NASA SP-7102

BIBLIOGRAPHY of GLOBAL CHANGE 1992

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Bibliography of Global Change

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This publication was prepared by the NASA Center for AeroSpace Information, 800 Elkridge Landing Road, Linthicum Heights, MD 21090-2934, (301) 621-0390.

INTRODUCTION

This bibliography contains citations to recent literature concerned with human-caused changes to the Earth's environment. The literature deals primarily with manifestations of such changes, such as global atmospheric and ocean warming, the "greenhouse effect," and alterations to atmospheric chemistry. Also included are literature items dealing with efforts to detect, verify, and monitor sources and effects of climate-altering activities and phenomena. This bibliography also lists items dealing with comparative studies of similar phenomena occurring on Mars and Venus.

USING THE BIBLIOGRAPHY

The first section of *Bibliography of Global Change* (NASA SP-7102) lists 585 reports, articles, and other documents originally announced in 1992 issues of *Scientific and Technical Aerospace Reports (STAR)*, and *International Aerospace Abstracts (IAA)*, including their original accession numbers. *STAR* and *IAA* are abstract journals produced for the NASA STI Program that announce aerospace-related, world wide technical reports and journal articles. Each entry in the publication consists of a standard bibliographic citation accompanied in most cases by an abstract. These citations/abstracts are categorized by 10 major subject divisions, broken down further into 76 specific subject categories, and one general division/category. The Table of Contents contains the complete list of divisions and categories, together with a note for each that defines its scope and provides any cross-references, and the corresponding page numbers. If there are no abstracts in a particular category, N.A. is noted. Following the abstract section, seven indexes are provided to further assist you. They are listed in the Table of Contents and include: subject, personal author, corporate source, foreign technology, contract number, report number, and accession number.

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ACCESS TO THE NASA STI DATABASE

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TABLE OF CONTENTS

N.A.—no abstracts were assigned to this category for this issue.

CHEMISTRY AND MATERIALS

ENGINEERING For related information see also *Physics.*

GEOSCIENCES For related information see also *Space Sciences.*

LIFE SCIENCES

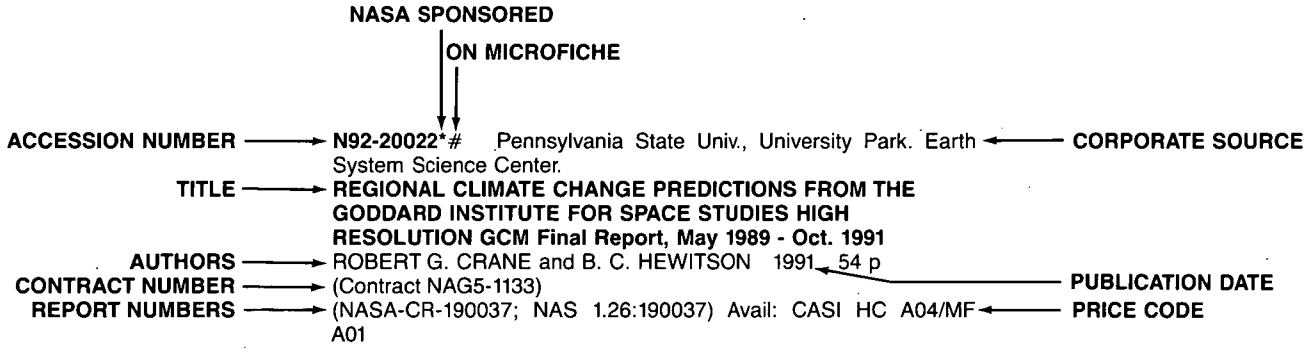
MATHEMATICAL AND COMPUTER SCIENCES

SPACE SCIENCES For related information see also *Geosciences.*

GENERAL

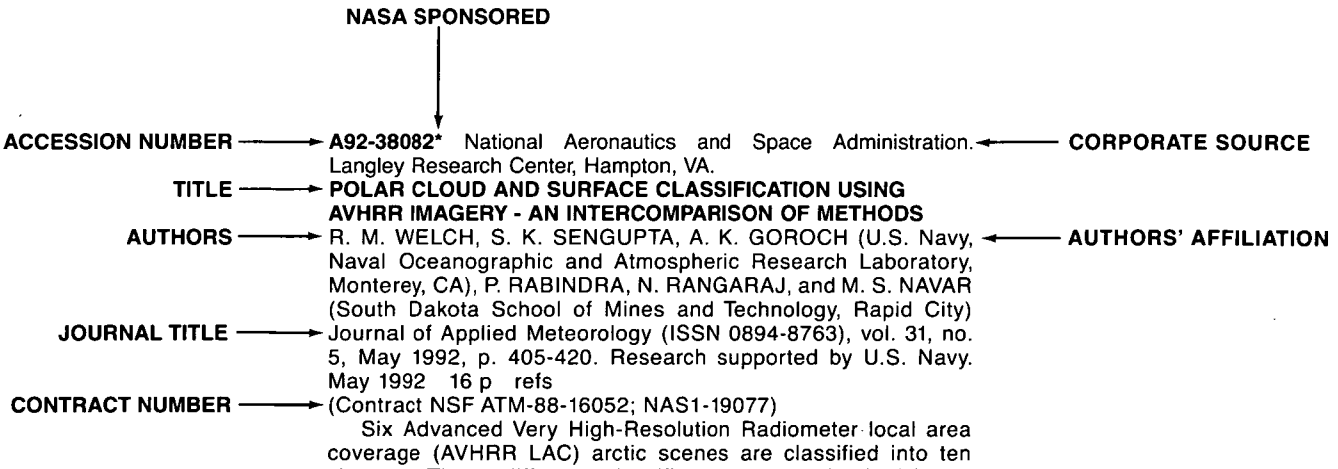
Includes aeronautical, astronautical, and space science related histories, biographies, and pertinent reports too broad for categorization; histories or broad overviews of NASA programs.

TYPICAL REPORT CITATION AND ABSTRACT



A new diagnostic tool is developed for examining relationships between the synoptic scale circulation and regional temperature distributions in GCMs. The 4 x 5 deg GISS GCM is shown to produce accurate simulations of the variance in the synoptic scale sea level pressure distribution over the U.S. An analysis of the observational data set from the National Meteorological Center (NMC) also shows a strong relationship between the synoptic circulation and grid point temperatures. This relationship is demonstrated by deriving transfer functions between a time-series of circulation parameters and temperatures at individual grid points. The circulation parameters are derived using rotated principal components analysis, and the temperature transfer functions are based on multivariate polynomial regression models. The application of these transfer functions to the GCM circulation indicates that there is considerable spatial bias present in the GCM temperature distributions. The transfer functions are also used to indicate the possible changes in U.S. regional temperatures that could result from differences in synoptic scale circulation between a 1XCO2 and a 2xCO2 climate, using a doubled CO2 version of the same GISS GCM. Author

TYPICAL JOURNAL ARTICLE CITATION AND ABSTRACT



Six Advanced Very High-Resolution Radiometer local area coverage (AVHRR LAC) arctic scenes are classified into ten classes. Three different classifiers are examined: (1) the traditional stepwise discriminant analysis (SDA) method; (2) the feed-forward back-propagation (FFBP) neural network; and (3) the probabilistic neural network (PNN). More than 200 spectral and textural measures are computed. These are reduced to 20 features using sequential forward selection. Theoretical accuracy of the classifiers is determined using the bootstrap approach. Overall accuracy is 85.6 percent, 87.6 percent, and 87.0 percent for the SDA, FFBP, and PNN classifiers, respectively, with standard deviations of approximately 1 percent. Author

BIBLIOGRAPHY OF GLOBAL CHANGE

February 1993

12

ASTRONAUTICS (GENERAL)

A92-12514* National Aeronautics and Space Administration, Washington, DC.
THE EARTH OBSERVING SYSTEM DATA AND INFORMATION SYSTEM
MARTHA E. MAIDEN, DIXON M. BUTLER, and JAMES C. DODGE (NASA, Washington, DC) IAF, International Astronautical Congress, 42nd, Montreal, Canada, Oct. 5-11, 1991. 8 p. Oct. 1991 8 p
(IAF PAPER 91-114) Copyright

The system is described in terms of the broad context of scientific cooperation and research which are facilitated by the architecture designed and the nature of the generated data. The Earth Observing System Data and Information System (EOSDIS) is composed of earth-science and applications data systems which archive global-change data and distribute the information to system users. Several archive centers catalogue selected Pathfinder data sets and generate new data products (such as maps of sea ice, cloud studies, etc.) with consistent calibration of all data. The schedule of three versions of EOSDIS is discussed with reference to the system architecture, programmatic plans, and data policy. The critical issue for EOSDIS is international cooperation to sponsor an infrastructure of global change data of this magnitude for public benefit and scientific research. C.C.S.

A92-12520
INDUSTRY-GOVERNMENT COOPERATIVE RESEARCH ON GLOBAL ENVIRONMENTAL CHANGE MANAGEMENT AND EARTH OBSERVATIONS APPLICATIONS
FREDERICK B. HENDERSON, III (Geosat Committee, Inc., Norman, OK) IAF, International Astronautical Congress, 42nd, Montreal, Canada, Oct. 5-11, 1991. 20 p. Oct. 1991 20 p refs
(IAF PAPER 91-124) Copyright

The study of global change is critically examined in terms of mutual efforts among industrial and governmental groups and global environmental monitoring with international satellites. Also examined is the extent to which policies based on global environmental change impact governments and private-sector economic development. Earth-observing systems are listed and discussed in terms of global resource development and environmental change management, and related issues of data management and access are examined. Industry-government cooperative research in the field includes such initiatives as the U.S. Committee on Earth and Environmental Sciences and the Global Change Research Plan. The lack of industry participation is underscored, and the Geosat Environmental Workshops of Industry-government Cooperation is identified as a step toward this type of effective collaboration. C.C.S.

A92-12529
PROPOSED CANADIAN EARTH-ENVIRONMENT SPACE INITIATIVE (EESI) PROGRAM
S. PARASHAR (Canadian Space Agency, Ottawa, Canada), H. ZWICK, N. HAMILTON (MacDonald Dettwiler, Richmond, Canada), D. THOMPSON, G. MCAVOY (Intera Technologies, Ltd., Calgary, Canada), D. EPP, D. MILLER (SED Systems, Inc., Saskatoon, Canada), A. STONES, and G. TYC (Bristol Aerospace, Ltd., Winnipeg, Canada) IAF, International Astronautical Congress, 42nd, Montreal, Canada, Oct. 5-11, 1991. 7 p. Oct. 1991 7 p refs
(IAF PAPER 91-134) Copyright

This paper describes a proposed Canadian program for earth observation. A Program Definition Study has defined a Canadian mission with vegetation and water quality related observables as a contribution toward improved management of the environment and resources and to contribute to the study of the implications of potential global change. The program requirements were developed based on broad consultation with users. The program design is responsive to these specific needs and is complementary to the Canadian Radarsat program as well as currently planned international earth observation missions. The program consists of a spacecraft bus with an optical sensor payload, and a ground segment for spacecraft control, data reception and information delivery to users. Author

A92-12585
PROJECT SPACE (SOLAR POWER AND CLIMATE EQUALIZER) - SPS USED FOR GLOBAL CLIMATE MODIFICATIONS
S. F. SINGER (National Air and Space Museum; Woodrow Wilson International Center for Scholars, Washington, DC) IAF, International Astronautical Congress, 42nd, Montreal, Canada, Oct. 5-11, 1991. 5 p. Oct. 1991 5 p refs
(IAF PAPER 91-232) Copyright

Applications of the Solar Power Satellite (SPS) to climate modification are proposed and discussed in terms of the greenhouse effect and the onset of a future ice age. Both concepts are based on changing the amount of solar radiation that reaches the earth's atmosphere with an SPS system to intercept or reflect the radiation. In the case of the SPS to intercept solar energy, a large surplus of energy is generated to be used in the most suitable way, and the typical radiation forcing by greenhouse gases is offset. Conversely, an SPS mirror can increase solar insolation, and a selective solar reflector can increase the thickness of the stratospheric ozone layer. The feasibility of the projects is discussed in terms of the design and engineering problems, and a small SPS to initiate the program is described. Preliminary optimization studies are required in order to select the proper orbit for the SPS in terms of the objectives of the SPACE program. C.C.S.

A92-17909
BEST - NEW SATELLITE MISSION DEDICATED TO TROPICAL SYSTEM ENERGY BUDGET
M. ORGERET (CNES, Toulouse, France) Journal of Aerospace Engineering (ISSN 0893-1321), vol. 5, Jan. 1992, p. 1-11. Jan. 1992 11 p refs
Copyright

BEST (Bilan Energetique du systeme Tropical) is a satellite project designed to provide simultaneous measurement of wind and precipitation fields in the tropical zone. The satellite would be placed in a 400 to 600 km height 28.5 deg inclination orbit with a three year lifespan. It is programmed to carry a wind Doppler lidar

with four fixed telescopes, a rain radar, and a microwave scanning radiometer. The BEST mission will contribute to the Global Energy and Water-Cycle Experiment and international global change programs. R.E.P.

A92-26821
LOGICA IN POLAR PLATFORM
British Interplanetary Society, Journal (ISSN 0007-094X), vol. 45, March 1992, p. 127, 128. Mar. 1992 2 p refs
Copyright

Specific developments by Logica for the ESA ERS-1 polar platform satellite are described in terms of the space-, ground-, and related-segment activities. The present contributions include computer modeling of the platform to support mission planning and standardizing communications specifications for software and some hardware. Also included are managing the technical and programmatic options of the ground-segment concept, the development of image-processing systems and archiving support, and the definition of the Data-Relay Satellite system. C.C.S.

A92-27274
SHUTTLE MISSION TO PROBE THE ATMOSPHERE
BEN EVANS Spaceflight (ISSN 0038-6340), vol. 34, March 1992, p. 90-92. Mar. 1992 3 p
Copyright

A series of Spacelab science missions called the Atmospheric Laboratory for Applications and Science (ATLAS) is described in terms of instrumentation and expected results. The ATLAS comprises two Spacelab platforms supporting a FUV space telescope and detectors for Lyman-alpha emissions, trace-molecule spectroscopy, grille spectrometry, imaging spectrometry, and mm-wave atmospheric sounding. The ATLAS project is expected to yield important data to advance the study of atmospheric molecular and atomic composition, changes in atmospheric ozone, solar physics, and space-plasma physics. C.C.S.

A92-38285
EARTH OBSERVING SYSTEM
W. S. WILSON IN: Space Congress, 27th, Cocoa Beach, FL, Apr. 24-27, 1990, Proceedings 1990 3 p
Copyright

The Earth Observing System (EOS) is described in terms of the space segment, the data and information system, and the areas of investigation in the field of earth-system science. The space segment includes two series of polar-orbiting platforms, existing environmental satellites, and earth probes. The EOS is expected to provide coordinated simultaneous measurements of hydrologic and biogeochemical cycles and descriptions of the interactions between the atmosphere, oceans, and solid earth. C.C.S.

A92-39360
LANDSAT 7 - A CHALLENGE TO AMERICA
ALDEN P. COLVOCORESSES (ASPRS, Bethesda, MD) IN: 1991 ACSM-ASPRS Annual Convention, Baltimore, MD, Mar. 25-29, 1991, Technical Papers. Vol. 3 1991 5 p refs
Copyright

Factors in favor of Landsat 7 are discussed; they include: reasonable cost, a base on which to examine global change, and the need for comprehensive and continuous satellite coverage of the earth at moderate (5-30 m) resolution, in view of various occurrences on the earth's surface, ranging from the Chernobyl disaster to deforestation to the Persian Gulf conflict. Attention is given to proposed parameters for Landsat 7 and suggested actions that should be taken by Congress, the Administration, and the public to implement this space program. C.A.B.

A92-40664
A DISK SHIELD AT THE POINT OF LIGHT-GRAVITY EQUILIBRIUM TO PREVENT THE OVERHEATING OF THE EARTH AND PLANETS [EKRANIRUIUSHCHII DISK V TOCHKE SVETOGRAVITATSIONNOGO RAVNOVESIIA PROTIV PEREGREVA ZEMLI I PLANET]
A. V. LUK'IANOV Kosmicheskie Issledovaniia (ISSN 0023-4206), vol. 30, no. 1, Jan.-Feb. 1992, p. 127-135. In Russian. Feb. 1992 9 p In RUSSIAN refs
Copyright

The use of a space-based solar shield as a possible method of preventing a dangerous increase in the global temperature of the biosphere is examined. It is suggested that the shield be placed at a large distance from the earth, between the libration point and the sun. The location of the shield, its size, and mass are calculated. The proposed material is nickel-containing iron, which is abundant on asteroids close to the earth. Methods for constructing the shield and controlling the shielding effect are discussed. V.L.

A92-43314* National Aeronautics and Space Administration, Washington, DC.
PROVIDING RELAY COMMUNICATIONS SUPPORT FOR THE MARS ENVIRONMENTAL SURVEY (MESUR) MISSION
BYRON L. SWENSON and ALAN L. FRIEDLANDER (Science Applications International Corp., Schaumburg, IL) IN: Astrodynamics 1991; Proceedings of the AAS/AIAA Astrodynamics Conference, Durango, CO, Aug. 19-22, 1991. Pt. 2 1992 24 p refs
(Contract NASW-4543)
(AAS PAPER 91-475) Copyright

The purpose of the Mars Environmental Survey (MESUR) mission is to put in place, over several launch opportunities, a constellation of Mars landers to make long-term surface observations of the circulation of the atmosphere and changes in climate, and to record the seismic activity of the planetary crust. Short-term objectives will also be addressed. An orbital communications infrastructure capable of providing regular high-rate data transfer to earth from the landers, which are scattered globally from pole to pole, is key to accomplishing the mission goals. A study is thereby presented of the orbit selection for the orbiter spacecraft, which will provide this support, and the relay communications operation. It is concluded that adequate communications support for the objectives of the MESUR mission can be provided by a single orbiter, provided care is taken in the selection of the size and orientation (i.e., inclination and apse line alignment) of the spacecraft orbit. S.A.V.

A92-45399* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
GEOSTATIONARY EARTH OBSERVATORIES - KEY ELEMENTS OF NASA'S 'MISSION TO PLANET EARTH'
WILLIAM C. SNODDY and VERNON W. KELLER (NASA, Marshall Space Flight Center, Huntsville, AL) IN: International Pacific Air and Space Technology Conference and Aircraft Symposium, 29th, Gifu, Japan, Oct. 7-11, 1991, Proceedings 1991 10 p refs
(SAE PAPER 911997) Copyright

The scientific rationale, required instrumentation, observatory configuration, and data system of the Geostationary Earth Observatory (GEO) element of NASA's Mission to Planet Earth program are discussed. Physical characteristics of GEO candidate instruments are listed. C.D.

A92-55577* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
MISSION TO PLANET EARTH'S GEOSTATIONARY EARTH OBSERVATORIES (GEO'S)
V. KELLER, R. BERANEK, M. HERRMANN, and R. KOCZOR (NASA, Marshall Space Flight Center, Huntsville, AL) IAF, International Astronautical Congress, 43rd, Washington, Aug. 28-Sept. 5, 1992. 9 p. Aug. 1992 9 p
(IAF PAPER 92-0088)

The Geostationary Earth Observatories (GEO's) are the space-based element of NASA's Mission to Planet Earth program which provide the excellent temporal resolution data required for a thorough understanding of earth processes and their role in global climate change. This paper discusses the scientific rationale, required instrumentation, observatory configuration, and data system of the GEO program. Author

A92-55603
GEWEX - A POTENTIAL CONTRIBUTION OF SPACE OBSERVATION
THIERRY BANOS, PAUL KAMOUN (Aerospatiale, Cannes, France), and CHRIS READINGS (ESA, Paris, France) IAF, International Astronautical Congress, 43rd, Washington, Aug. 28-Sept. 5, 1992. 12 p. Aug. 1992 12 p
(IAF PAPER 92-0133) Copyright

A coherent approach is proposed for the selection and deployment of the space segment of the Global Energy and Water Cycle Experiment (GEWEX). The general scientific requirements issued by various GEWEX working groups are presented, and needed measurements are identified along with a set of instruments for each measurement. Planned GEWEX missions are considered in terms of their time frames and expected contributions to GEWEX objectives, and those GEWEX objectives which remain to be fulfilled are identified. Finally, it is shown that GEWEX is technologically feasible for the 2000-2005 time frame, provided some realistic considerations are introduced into the reference scenario. C.D.

N92-30016*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
ATLAS 1: ENCOUNTERING PLANET EARTH
CHARLOTTE SHEA (Essex Corp., Huntsville, AL.), TRACY MCMAHAN (Essex Corp., Huntsville, AL.), DENISE ACCARDI (Essex Corp., Huntsville, AL.), MICHELE TYGIELSKI (Essex Corp., Huntsville, AL.), JEFF MIKATARIAN (Essex Corp., Huntsville, AL.), and MARGARET WIGINTON, ed. (Essex Corp., Huntsville, AL.) 1984 62 p LIMITED REPRODUCIBILITY: More than 20% of this document may be affected by color photographs original contains color illustrations
(NASA-TM-107956; NAS 1.15:107956) Avail: CASI HC A04/MF A01; 56 functional color pages

Several NASA science programs examine the dynamic balance of sunlight, atmosphere, water, land, and life that governs Earth's environment. Among these is a series of Space Shuttle-Spacelab missions, named the Atmospheric Laboratory for Applications and Science (ATLAS). During the ATLAS missions, international teams of scientists representing many disciplines combine their expertise to seek answers to complex questions about the atmospheric and solar conditions that sustain life on Earth. The ATLAS program specifically investigates how Earth's middle atmosphere and upper atmospheres and climate are affected by both the Sun and by products of industrial and agricultural activities on Earth. H.A.

13

ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbital and launching dynamics.

N92-15466*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
SATELLITE ORBIT CONSIDERATIONS FOR A GLOBAL CHANGE TECHNOLOGY ARCHITECTURE TRADE STUDY
EDWIN F. HARRISON (Lockheed Engineering and Sciences Co., Hampton, VA.), GARY G. GIBSON (Flight Mechanics and Control, Inc., Hampton, VA.), JOHN T. SUTTLES, JAMES J. BUGLIA, and ISRAEL TABACK (Bionetics Corp., Hampton, VA.) *In its* Global Change Technology Architecture Trade Study p 91-108 Sep. 1991 Previously announced as N91-25557
Avail: CASI HC A03/MF A04

A study was conducted to determine satellite orbits for Earth observation missions aimed at obtaining data for assessing global climate change. A multisatellite system is required to meet the scientific requirements for temporal coverage over the globe. The best system consists of four Sun-synchronous satellites equally spaced in local time of equatorial crossing. This system can obtain data every three hours for all regions. Several other satellite systems consisting of combinations of Sun-synchronous orbits and either the Space Station Freedom or a mid-latitude equatorial satellite can provide three to six hour temporal coverage, which is sufficient for measuring many of the parameters required for the global change monitoring mission. Geosynchronous satellites are required to study atmospheric and surface processes involving variations on the order of a few minutes to an hour. Two or more geosynchronous satellites can be relocated in longitude to study processes over selected regions of Earth. Author

14

GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and simulators.

A92-39368
THE ALASKA SAR FACILITY - PREPARING FOR ERS-1 DATA
P. F. FISHER (Kent State University, OH) and S. PATHIRANA (Toledo, University, OH) IN: 1991 ACSM-ASPRS Annual Convention, Baltimore, MD, Mar. 25-29, 1991, Technical Papers. Vol. 3 1991 8 p refs
Copyright

Attention is given to the capabilities and preparations of the Alaska SAR Facility (ASF) to enable the satellite remote-sensing community to obtain SAR data from new satellites in a timely fashion for research into many scientific disciplines related to global change. The systems that comprise the ASF are described, with emphasis on the methods for receiving data. Consideration is given to the receiving ground station, SAR processing system, archive and operations system, archive catalog subsystem, mission planning subsystem, and geophysical processor system. Due to the high-latitude location of the ASF, one of the most promising applications is the study of sea ice. Radar data from satellites will make it possible to quantify ice features and their extent of coverage. C.A.B.

18

SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes satellites; space platforms; space stations; spacecraft systems and components such as thermal and environmental controls; and attitude controls.

A92-55578* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
A SPACECRAFT FOR THE EARTH OBSERVING SYSTEM
RAYNOR L. TAYLOR (NASA, Goddard Space Flight Center, Greenbelt, MD) and FRANCESCO BORDI (Computer Sciences Corp., Seabrook, MD) IAF, International Astronautical Congress, 43rd, Washington, Aug. 28-Sept. 5, 1992. 20 p. Aug. 1992 20 p refs
(IAF PAPER 92-0089) Copyright

An overview is given of the scientific instruments on the Earth Observing System (EOS-AM) spacecraft. The parameters that most strongly affect the performance, system design, and cost of that spacecraft are discussed. Alternative design for EOS-AM are evaluated in order to produce a single consistent definition of the system that meets most or all of the mission objectives. C.D.

A92-57216
ADVANCED SMALL SATELLITE CONCEPTS TAKE MAXIMUM ADVANTAGE FROM ADVANCES IN TECHNOLOGY
ROBERT O. BARTLETT (Fairchild Space Co., Germantown, MD), CHRISTIAN VIALET, and DOMINIQUE PAWLAK (Matra Marconi Space, Toulouse, France) IAF, International Astronautical Congress, 43rd, Washington, Aug. 28-Sept. 5, 1992. 12 p. Aug. 1992 12 p
(IAF PAPER 92-0818) Copyright

Predicted future rises of the overall earth temperatures followed by rises of the ocean level will require corrective actions based on reliable predictions from accurate models of the effect of ocean circulation on the climate change. This paper describes the concept of a space-based ocean radar altimetry mission, called ECUMES, designed to measure the local slope of the ocean's surface accurately enough for the oceanographers to determine the patterns of ocean currents and large-scale eddies. Special attention is given to the ECUMES satellite, the power control system, the solar array design, the communications subsystems and data handling components, the attitude determination sensor, and the propulsion subsystem. I.S.

N92-15469*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
SUNSYNCHRONOUS LOW EARTH ORBIT SPACECRAFT CONCEPTS AND TECHNOLOGY REQUIREMENTS FOR GLOBAL CHANGE MONITORING
L. BERNARD GARRETT (Bionetics Corp., Hampton, VA.), ANSEL J. BUTTERFIELD (Bionetics Corp., Hampton, VA.), ISRAEL TABACK (Bionetics Corp., Hampton, VA.), PAUL A. GARN, and DONALD R. BURROWBRIDGE, JR. (Spartan Space Services, Glendale, AZ.) *In its* Global Change Technology Architecture Trade Study p 187-270 Sep. 1991
Avail: CASI HC A05/MF A04

The Global Change Technology Initiative listing of instruments for operation in low Earth, sunsynchronous orbits contain 21 entries, of which 20 are carried aboard multi-instrument spacecraft. This list identifies the temporal requirements for repetition of measurements and also includes groups of instruments that make complementing measurements. Definitions for individual spacecraft follows the temporal and grouping requirements to establish constellations which will provide the measurement data. The definitions of constellations for multi-instrument spacecraft show two alternatives: a constellation of 10 spacecraft, each compatible with launch by a Delta booster; a constellation of 4 spacecraft, each requiring a Titan booster. Operating subsystems for the individual spacecraft can use modular concepts that are adaptations based upon current plans for improving the performance of the NASA-Goddard Multimission Modular units. The descriptions of the spacecraft and constellations begins with a compilation of instrument related requirements that define the principal system performance parameters and operating capabilities. Author

N92-15470*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
HOOP COLUMN SOIL MOISTURE SPACECRAFT IN LOW EARTH ORBIT FOR GLOBAL CHANGE MONITORING
MELVIN J. FEREBEE, JR. *In its* Global Change Technology Architecture Trade Study p 271-280 Sep. 1991
Avail: CASI HC A02/MF A04

A subset of the total Global Change Technology Initiative instruments are required to be in low Earth, sunsynchronous orbits. There is one instrument, however, that requires its own specialized spacecraft; the Soil Moisture Microwave Radiometer (SMMR). The characteristic structure of the instrument is the 118 m hoop column support structure. The hoop is supported by an axially placed column. Tension cables support and shape an electromagnetically reflective mesh surface. The instrument is capable of detecting frequencies in the 1.4 GHz range (Soil Moisture and Sea Salinity). Three apertures are used to reduce the degree of paraboloid offset and improve the beam quality. The spacecraft configuration is determined by the instrument support requirements and the requirement that it can fit into the Titan IV cargo bay. The configuration is derived by cross referencing the instrument performance requirements with the performance of the spacecraft. The spacecraft design is similar with the Multi-mission Modular Spacecraft in terms of size and packaging. A description of the spacecraft's features will yield a summary of the technologies needed for the SMMR spacecraft. Author

N92-15471*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
GEOSTATIONARY ORBIT EARTH SCIENCE PLATFORM CONCEPTS FOR GLOBAL CHANGE MONITORING
JEFFERY T. FARMER (Bionetics Corp., Hampton, VA.), THOMAS G. CAMPBELL (Bionetics Corp., Hampton, VA.), WILLIAM T. DAVIS (Bionetics Corp., Hampton, VA.), PAUL A. GARN (Bionetics Corp., Hampton, VA.), CHARLES B. KING (Bionetics Corp., Hampton, VA.), and CHERYL C. JACKSON (Flight Mechanics and Control, Inc., Hampton, VA.) *In its* Global Change Technology Architecture Trade Study p 282-291 Sep. 1991
Avail: CASI HC A02/MF A04

Functionality of a geostationary spacecraft to support Earth science regional process research is identified. Most regional process studies require high spatial and temporal resolution. These high temporal resolutions are on the order of 30 minutes and may be achievable with instruments positioned in a geostationary orbit. A complement of typical existing or near term instruments are identified to take advantage of this altitude. This set of instruments is listed, and the requirements these instruments impose on a spacecraft are discussed. A brief description of the geostationary spacecraft concepts which support these instruments is presented. Author

N92-15472*# Bionetics Corp., Hampton, VA.
OPTIONS IN THE GLOBAL CHANGE FLEET ARCHITECTURE PROVIDED BY THE PRESENCE OF AN EOS-A AND -B
WARREN D. HYPES and ROGARD T. ROSS (Joint Inst. for Advancement of Flight Sciences, Hampton, VA.) *In* NASA. Langley Research Center, Global Change Technology Architecture Trade Study p 293-308 Sep. 1991
Avail: CASI HC A03/MF A04

The baseline architecture of the Global Change Technology Initiative (GCTI) fleet was established by selecting and designing spacecraft and instruments to meet the science requirements developed under the task 1 effort. While attempting to meet the temporal sampling portion of the science requirements, no consideration was given to the presence of the proposed Earth Observing System (EOS) Spacecraft that would be making many of the same measurements with many of the same instruments. After establishing the GCTI baseline independent of the EOS Spacecraft; however, it is now prudent to examine the impact of the presence of the EOS Spacecraft on the GCTI fleet. A small scope, GCTI study supplement was accomplished to assess the impact. The content and results of the supplementary study are presented. Author

N92-16009# National Oceanic and Atmospheric Administration, Washington, DC.
PRODUCT DEVELOPMENT PLANS FOR OPERATIONAL SATELLITE PRODUCTS FOR THE NOAA CLIMATE AND GLOBAL CHANGE PROGRAM: SPECIAL REPORT NO. 5
University Corp. for Atmospheric Research Oct. 1991 83 p
Avail: CASI HC A05/MF A01

The Product Development Plans (PDP's) developed for the Operational Measurements Project of NOAA's Climate and Global Change Program are presented. The objective of the Operational Measurements Project is to provide continuing climate and global change information products from operational observations. The operational measurement systems, satellite and in situ, generate a continuing stream of observations of the state of the Earth's climate. Author

N92-27388# Mitre Corp., McLean, VA.
SMALL SATELLITES AND RPAS IN GLOBAL-CHANGE RESEARCH, SUMMARY AND CONCLUSIONS

P. BANKS, J. M. CORNWALL, F. DYSON, N. FORTSON, and S. KOONIN Jan. 1992 29 p
(AD-A247855; JSR-91-330A) Avail: CASI HC A03/MF A01

JASON has now conducted two studies on the use of small satellites and remotely-piloted aircraft (RPA's) in global change research, with special reference to the DOE Atmospheric Radiation Measurement (ARM) Program and to DARPA's Small Satellite Program. The studies centered around meetings, one in January and the other in June, 1991, to which we invited representatives of all areas of the global change program and of the DOD satellite science and technology community. We have already issued a report on the January study. Here we summarize the main themes and results of our summer study. GRA

19

SPACECRAFT INSTRUMENTATION

A92-20376* National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
STRUCTURAL DYNAMIC PERFORMANCE OF A GEOSTATIONARY MICROWAVE RADIOMETER
DEBORAH M. WAHLS, JEFFERY T. FARMER (NASA, Langley Research Center, Hampton, VA), and DAVID W. SLEIGHT Dec. 1991 2 p refs
Copyright

A92-53729
STUDY ON EARTH GLOBAL CHANGE MONITORING SYSTEM FOR NEXT GENERATION
TAKASHI MORIYAMA, MASAKATSU NAKAJIMA (NASDA, Tsukuba Space Center, Japan), MAKOTO SUZUKI, and NOBUO TAKEUCHI (National Institute for Environmental Studies, Tsukuba, Japan) IN: International Symposium on Space Technology and Science, 17th, Tokyo, Japan, May 20-25, 1990, Proceedings. Vol. 2 1990 5 p refs
Copyright

Results are presented from the preliminary design studies for the Advanced Limb Atmospheric Spectrometer (A-LAS) and High-resolution Limb Atmospheric Spectrometer (H-LAS); these spaceborne instruments employ thermal-IR CCDs and grating spectrometer technologies. NASDA has developed two types of IR CCDs, respectively, using a heterobarrier detection mechanism and a Schottky barrier detection mechanism. An analysis is conducted of preliminary results obtained by these technologies for the vertical profiles of minor atmospheric constituents. O.C.

20

SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources.

A92-50640 National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
ADVANCED POWER SYSTEMS FOR EOS
SHEILA G. BAILEY, IRVING WEINBERG, and DENNIS J. FLOOD (NASA, Lewis Research Center, Cleveland, OH) IN: IECEC '91; Proceedings of the 26th Intersociety Energy Conversion Engineering Conference, Boston, MA, Aug. 4-9, 1991. Vol. 2 1991 6 p refs
(Contract RTOP 506-41-11)
Copyright

The Earth Observing System (EOS), which is part of the International Mission to Planet Earth, is NASA's main contribution to the Global Change Research Program. Five large platforms are to be launched into polar orbit: two by NASA, two by the European Space Agency, and one by the Japanese. In such an orbit the radiation resistance of indium phosphide solar cells combined with the potential of utilizing 5-micron cell structures yields an increase of 10 percent in the payload capability. If further combined with the Advanced Photovoltaic Solar Array, the total additional payload capability approaches 12 percent. Author

N92-13248*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
ENHANCED EOS PHOTOVOLTAIC POWER SYSTEM CAPABILITY WITH INP SOLAR CELLS
SHEILA G. BAILEY, IRVING WEINBERG, and DENNIS J. FLOOD *In* ESA, European Space Power Conference. Volume 2: Photovoltaic Generators p 641-645 Aug. 1991
Copyright Avail: CASI HC A01/MF A03; ESA, EPD, Noordwijk, Netherlands, HC 150 Dutch guilders (2 vols)

The Earth Observing System (EOS), which is part of the International Mission to Planet Earth, is NASA's main contribution to the Global Change Research Program which opens a new era in international cooperation to study the Earth's environment. Five large platforms are to be launched into polar orbit, two by NASA, two by ESA, and one by the Japanese. In such an orbit the radiation resistance of indium phosphide solar cells combined with the potential of utilizing five micron cell structures yields an increase of 10 percent in the payload capability. If further combined with the advanced photovoltaic solar array the payload savings approaches 12 percent. ESA

25

INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

N92-26812# National Oceanic and Atmospheric Administration, Boulder, CO. Climate Monitoring and Diagnostics Lab.
RULE-BASED EXPERT SYSTEM FOR EVALUATING THE QUALITY OF LONG-TERM, IN-SITU, GAS CHROMATOGRAPHIC MEASUREMENTS OF ATMOSPHERIC METHANE
K. A. MASARIE, L. P. STEELE, and P. M. LANG Nov. 1991 43 p
(PB92-128560; NOAA-TM-ERL-CMDL-3) Avail: CASI HC A03/MF A01

Methane is an important trace constituent of the earth's atmosphere because it is active both chemically and radiatively. The absorption of infrared radiation by atmospheric methane, and the rapid increase in the global atmospheric burden of methane over the past century combine to raise concerns that continued increases may contribute to global warming and climate change within the next century. The use of a rule-based expert system to assess the integrity of in situ gas chromatographic methane measurements made at the NOAA/CMDL Point Barrow, Alaska and Mauna Loa, Hawaii observatories is presented. The expert system flags ambient samples analyzed during chromatograph system instability and excludes them from further scientific analysis. The development and implementation of the expert system are described in detail. A comparison between data sets flagged by a human expert and by the expert system shows that the expert system can successfully reproduce the efforts of a human when evaluating gas chromatograph system stability. Advantages and limitations of the use of an expert system for the task are also discussed. GRA

31

ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; cryogenics; and fire prevention.

A92-17351
MODERN RADIO SCIENCE 1990
J. B. ANDERSEN, ED. (Aalborg, University, Denmark) Oxford, England and New York, Oxford University Press, 1990, 217 p. For individual items see A92-17352 to A92-17357. 1990 217 p
Copyright

This book discusses electromagnetic fields and the essence of living systems; scientific and technological research from manned space platforms; electromagnetic quantities, units, and standards in a changing International System of Units (SI); solution techniques for electromagnetic field problems; and the theory of electromagnetic interference control. Other topics discussed include satellite measurements of moisture variables and global change, the ionosphere from space, simulation methods for plasma wave research, new bioinformation from ultraweak photon emission in life and biological activities (biophoton), nonlinear networks and chaos, and polarization. I.S.

N92-15202# New Mexico Univ., Albuquerque. Engineering Research Inst.
HALOCARBONS AS HALON REPLACEMENTS. VOLUME 1: TECHNOLOGY REVIEW AND INITIATION Final Report, Dec. 1988 - May 1989
JONATHAN S. NIMITZ, ROBERT E. TAPSCOTT, STEPHANIE R. SKAGGS, and TED A. MOORE Mar. 1991 138 p
(Contract F29601-87-C-0001)
(AD-A242815; NMERI-SS-2-03-(1); AFESC/ESL-TR-90-38-VOL-1)
Avail: CASI HC A07/MF A02

The objective of this overall project is to develop one or more alternative clean halocarbon fire extinguishing streaming agents to replace Halon 1211. In this effort a technology review was conducted and an experimental plan was prepared. Screening criteria are presented with discussions and approaches to meeting the following criteria: cleanliness, toxicity, fire suppression, ozone depletion potentials (ODPs), global warming potentials (GWPs), physical properties, availability/manufacturability, cost, materials compatibility, and chemical stability. Lists of near-, medium-, and far-term candidate agents are presented. An algorithm was developed that enables prediction of atmospheric lifetimes of hydrogen-containing one- and two-carbon haloalkanes containing fluorine and/or chlorine. Relationships are examined among C-H bond strength, activation energy for hydrogen abstraction by OH, reaction rate constants, tropospheric lifetimes, and ODPs. A review of existing and emerging technologies for the destruction of halocarbons is included. GRA

N92-33501# National Inst. of Standards and Technology, Gaithersburg, MD.
PRELIMINARY SCREENING PROCEDURES AND CRITERIA FOR REPLACEMENTS FOR HALONS 1211 AND 1301 Final Report, Oct. 1989 - Sep. 1990
R. G. GANN, J. D. BARNES, S. DAVIS, J. S. HARRIS, and R. H. HARRIS Jul. 1991 326 p Sponsored by AFESC
(AD-A252912; NIST-TN-1278; ESL-TR-90-24) Avail: CASI HC A15/MF A03

Halons 1301 and 1211 are being restricted by the Montreal Protocol of 1987. This project facilitates identification of alternative chemicals by developing quick, inexpensive screening procedures for nine critical properties: fire suppression efficiency, ozone depletion potential, global warming potential, residue level, toxicity, long-term storage stability, metals corrosion, electrical conductivity, and compatibility with plastics. The procedures are straight forward to conduct, require about 5 moles of chemical, and can be performed in about 8 days for less than $15k. Concurrent testing of many chemicals would cost less. Sample purity is critical. The test results are reported in classes that relate to the performance of Halons 1211 and 1301. Examples of testing sequences are provided. Interpretation of the results requires expert judgment since weak performance in a test may not be the basis for rejecting a chemical. These methods and performance classes have been developed for screening purposes only and should not be used for final selection procurement regulation without more extensive evaluation. GRA

32

COMMUNICATIONS AND RADAR

Includes radar; land and global communications; communications theory; and optical communications.

A92-22964
THE UPGRADED WPL DUAL-POLARIZATION 8-MM WAVELENGTH DOPPLER RADAR FOR MICROPHYSICAL AND CLIMATE RESEARCH
R. A. KROPFLI, B. W. BARTRAM, and S. Y. MATROSOV (NOAA, Wave Propagation Laboratory, Boulder, CO) IN: 1990 Conference on Cloud Physics, San Francisco, CA, July 23-27, 1990, Preprints 1990 5 p refs
Copyright

The improvements made in the WPL dual-polarization 8-mm Doppler radar are summarized, and its operating characteristics are discussed. The scanning Doppler radar is capable of measuring not only the bulk properties of clouds such as cloud base, thickness, density, and small-scall structure, but also many other parameters for controlling the cloud formation and breakup. Particular attention is given to scattering calculations for ice crystals often found in cirrus clouds. It is suggested that the expected sensitivity and polarization discrimination of the Doppler radar will make it possible to observe the microphysical properties of cirrus clouds. O.G.

A92-53726
EVALUATION OF SURFACE CLUTTER FOR THE DESIGN OF SPACEBORNE RAIN RADAR
HIROSHI HANADO and TOSHIO IHARA (Kashima Space Research Center, Japan) IN: International Symposium on Space Technology and Science, 17th, Tokyo, Japan, May 20-25, 1990, Proceedings. Vol. 2 1990 6 p refs
Copyright

Effects of surface clutter interference through antenna sidelobe on rainfall measurements, which is one of the most important technological issues to realize spaceborne rain radar, are quantitatively examined in order to clarify the antenna design criteria. The received intensities of both rain echo and sea clutter are evaluated by numerically integrating both radar equations, assuming appropriate precipitation and sea surface scattering property models and realistic antenna pattern of phased array antenna, which is fed with the Taylor distribution of sidelobe level -30 dB with exciting currents errors being superimposed. The results illustrate that there exists a severely interfered region directly adjacent to the sea surface due to antenna mainlobe-sea clutter coupling. They also demonstrate the feasibility of quantitative measurements of rainfall, except the above region, with the planar array antenna fed according to the Taylor distribution of sidelobe level -30 dB. Author

N92-14236*# National Academy of Sciences - National Research Council, Washington, DC.
INTERNATIONAL GLOBAL NETWORK OF FIDUCIAL STATIONS: SCIENTIFIC AND IMPLEMENTATION ISSUES
1991 142 p Sponsored in part by NASA; AF; DMA; DOE; National Geodetic Survey; and NOAA
(NASA-CR-189525; NAS 1.26:189525; LC-91-62173; ISBN-0-309-04543-6) Avail: CASI HC A07/MF A02

In this report, an ad hoc panel of the National Research Council's Committee on Geodesy, Board of Earth Sciences and Resources (1) evaluates the scientific importance of a global network of fiducial sites, monitored very precisely, using a combination of surface- and space-geodetic techniques; (2) examines strategies for implementing and operating such a network; and (3) assesses whether such a network would provide a suitable global infrastructure for geodetic and other geophysical systems of the next century. The panel concludes that a global network of fiducial sites would be a valuable tool for addressing global change issues and play a critical role in providing a reference frame for scientific Earth missions. The panel suggests that existing global networks be integrated and anticipates that such a network would grow from about 30 to the ultimate size of about 200 fiducial sites. It is noted that such a global network will provide a long-term infrastructure for geodetic and geophysical studies. The panel expects that these fiducial sites would evolve into terrestrial observatories or laboratories that would permit more comprehensive studies of the Earth than those now possible. J.P.S.

35

INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

A92-24633* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A MULTI-APERTURE SPECTROMETER DESIGN FOR THE ATMOSPHERIC INFRARED SOUNDER (AIRS)
ROBERT PAGANO (JPL, Pasadena, CA) and MARCUS HATCH (Loral Infrared and Imaging Systems, Inc., Lexington, MA) IN: International Lens Design Conference, Monterey, CA, June 11-14, 1990, Proceedings 1990 12 p refs
Copyright

The baseline multiaperture echelle spectrometer for the Atmospheric IR Sounder (AIRS) is described in terms of design and applications. The functional requirements for the optical design are set forth including the 1-K measurement goal, the 3.4-15.4 spectral bandpass, and the full global coverage twice daily. The multiaperture spectrometer is compared to the cross-dispersed spectrometer, and the multiaperture model is found to permit specific adjustments to the signal-to-noise ratio. The optical design of the spectrometer is described in terms of the focal-plane constraints, the multiaperture pupil-imaging relay, the spectrometer collimator, and the grating format and efficiency. The multiaperture design is found to have a good spectral-response function, and a 1.2 percent signal change is noted for a 95-percent unpolarized scene. The AIRS instrument is illustrated in its deployment configuration and is concluded to be capable of fulfilling the performance requirements. C.C.S.

A92-38656#
SMALL SATELLITE RADIOMETRIC MEASUREMENT SYSTEM
PAUL G. WEBER (Los Alamos National Laboratory, NM) AIAA, Space Programs and Technologies Conference, Huntsville, AL, Mar. 24-27, 1992. 10 p. Mar. 1992 10 p refs
(AIAA PAPER 92-1563)

The Los Alamos Radiometric Instrument (LARI) is a compact, lightweight, adaptable radiometer for climate change-related measurements which could be carried by small satellites, manned aircraft, and RPVs for remote sensing. LARI can furnish both spectrally-integrated measurements and data in selected spectral bands. Attention is given to the benefits derived from the simultaneous operation of LARI with a compact spectrometer. The basic LARI package can be inserted into orbit with the Pegasus air-launched vehicle; well-chosen orbits facilitate the use of data from other satellites to enhance data products. O.C.

N92-15467*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
SELECTION OF REPRESENTATIVE INSTRUMENTS FOR A GLOBAL CHANGE TECHNOLOGY ARCHITECTURE TRADE STUDY
WARREN D. HYPES (Bionetics Corp., Hampton, VA.), LLOYD KEAFER (Bionetics Corp., Hampton, VA.), ROGARD T. ROSS (Joint Inst. for Advancement of Flight Sciences, Hampton, VA.), HEATHER R. KNIGHT (Joint Inst. for Advancement of Flight Sciences, Hampton, VA.), ANTHONY JALINK, and CHERYL L. ALLEN *In its* Global Change Technology Architecture Trade Study p 109-179 Sep. 1991
Avail: CASI HC A04/MF A04

The objectives of Task 2 of the Global Change Technology Initiative (GCTI) Architectural Trade Study were to select representative sets of instruments for making the science measurements specified in Task 1 and to identify instruments that, when flown together, form special complementary packages for measurement purposes. The list of representative instruments and their complementary relationships provide a payload manifest defined in terms of mass, power, size, viewing angles, data rates, etc. which can be used to focus spacecraft trade studies and the definition of a candidate GCTI fleet. Science requirements from Task 1 are given in tabular form. Numerous instruments are described, including visible-infrared radiometers, visible-infrared spectrometers, gas correction radiometers, active systems for Earth observation, Limb viewing instruments, visible-infrared and grating spectrometers, and microwave radiometers. Author

N92-15475*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
PHYSICAL AND PERFORMANCE CHARACTERISTICS OF INSTRUMENTS SELECTED FOR GLOBAL CHANGE MONITORING
CHERYL L. ALLEN *In its* Global Change Technology Architecture Trade Study p 351-379 Sep. 1991
Avail: CASI HC A03/MF A04

The following appendix (appendix B) lists the instruments chosen for the Global Change Monitoring program. The instruments are described according to the following categories: (1) Title; (2) Measurement; (3) Contact; (4) Instrument Type; (5) Dimensions; (6) Mass; (7) Average Operational Power; (8) Data Rate; (9) Spectral/Frequency Range; (10) Number of Channels/Frequencies; (11) Viewing Field; (12) Scanning Characteristics; (13) Resolution (Horizontal/Vertical); (14) Swath Width; (15) Satellite Application; and (16) Technology Status. A technical drawing of each instrument is also provided. D.R.D.

N92-29228*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
SIXTEENTH INTERNATIONAL LASER RADAR CONFERENCE, PART 1
M. PATRICK MCCORMICK, ed. Washington Jul. 1992 407 p Conference held in Cambridge, MA, 20-24 Jul. 1992; sponsored by NASA. Langley Research Center, AFOSR, AF Phillips Lab., American Meteorological Society, and the Optical Society of America
(Contract RTOP 665-45-20-21)
(NASA-CP-3158-PT-1; L-17126-PT-1; NAS 1.55:3158-PT-1)
Avail: CASI HC A18/MF A04

This publication contains extended abstracts of papers presented at the 16th International Laser Radar Conference. One-hundred ninety-five papers were presented in both oral and poster sessions. The topics of the conference sessions were: (1) Mt. Pinatubo Volcanic Dust Layer Observations; (2) Global Change/Ozone Measurements; (3) GLOBE/LAWS/LITE; (4) Mesospheric Measurements and Measurement Systems; (5) Middle Atmosphere; (6) Wind Measurements and Measurement Systems; (7) Imaging and Ranging; (8) Water Vapor Measurements; (9) Systems and Facilities; and (10) Laser Devices and Technology. This conference reflects the breadth of research activities being conducted in the lidar field. These abstracts address subjects from

lidar-based atmospheric investigations relating to global change to the development of new lidar systems and technology.

N92-31040*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
ADVANCED RAMAN WATER VAPOR LIDAR
DAVID N. WHITEMAN, S. HARVEY MELFI, RICHARD A. FERRARE (Universities Space Research Association, Columbia, MD.), KEITH A. EVANS (Hughes STX, Inc., Lanham, MD.), LUIS RAMOS-IZQUIERDO, O. GLENN STALEY, RAYMOND W. DISILVESTRE, INNA GORIN, KENNETH R. KIRKS (Science Systems and Applications, Inc., Greenbelt, MD.), WILLIAM A. MAMAKOS (Science Systems and Applications, Inc., Greenbelt, MD.) et al. *In* NASA. Langley Research Center, 16th International Laser Radar Conference, Part 2 p 483-484 Jul. 1992 Prepared in cooperation with Ressler Associates, Inc., Laurel, MD; University Research Foundation, Greenbelt, MD; and NYMA, Inc., Greenbelt, MD
Avail: CASI HC A01/MF A03

Water vapor and aerosols are important atmospheric constituents. Knowledge of the structure of water vapor is important in understanding convective development, atmospheric stability, the interaction of the atmosphere with the surface, and energy feedback mechanisms and how they relate to global warming calculations. The Raman Lidar group at the NASA Goddard Space Flight Center (GSFC) developed an advanced Raman Lidar for use in measuring water vapor and aerosols in the earth's atmosphere. Drawing on the experience gained through the development and use of our previous Nd:YAG based system, we have developed a completely new lidar system which uses a XeF excimer laser and a large scanning mirror. The additional power of the excimer and the considerably improved optical throughput of the system have resulted in approximately a factor of 25 improvement in system performance for nighttime measurements. Every component of the current system has new design concepts incorporated. The lidar system consists of two mobile trailers; the first (13m x 2.4m) houses the lidar instrument, the other (9.75m x 2.4m) is for system control, realtime data display, and analysis. The laser transmitter is a Lambda Physik LPX 240 iCC operating at 400 Hz with a XeF gas mixture (351 nm). The telescope is a .75m horizontally mounted Dall-Kirkham system which is bore sited with a .8m x 1.1m elliptical flat which has a full 180 degree scan capability - horizon to horizon within a plane perpendicular to the long axis of the trailer. The telescope and scan mirror assembly are mounted on a 3.65m x .9m optical table which deploys out the rear of the trailer through the use of a motor driven slide rail system. The Raman returns from water vapor (403 nm), nitrogen (383 nm) and oxygen (372 nm) are measured in addition to the direct Rayleigh/Mie backscatter (351). The signal from each of these is split at about a 5/95 ratio between two photomultiplier detectors. The 5 percent detector is used for measurements below about 4.0 km, while the 95 percent detector provides the information above this level. Author

36

LASERS AND MASERS

Includes parametric amplifiers.

A92-18246
LIDARS AND CLIMATE INVESTIGATION [LIDARY I ISSLEDOVANIE KLIMATA]
VLADIMIR M. ZAKHAROV, OLEG K. KOSTKO, and SERGEI S. KHMELEVTSOV Leningrad, Gidrometeoizdat, 1990, 320 p. In Russian. 1990 320 p In RUSSIAN refs
Copyright

The book discusses the potential of lidar observations for the monitoring of climate-related phenomena and presents experimental results of lidar measurements of stratospheric aerosol, ozone, cloud amount, atmospheric gases, and the thermodynamic parameters of the atmosphere. Special attention is given to the methods and instruments of a lidar network designed for monitoring these values. The feasibility of climate monitoring by lidars aboard satellites is discussed. I.S.

38

QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N92-17199*# National Aeronautics and Space Administration, Washington, DC.
NASA TOTAL QUALITY MANAGEMENT 1990 ACCOMPLISHMENTS REPORT Annual Report No. 8
Sep. 1991 200 p
(ISSN 1051-225X)
(NASA-TM-105465; NAS 1.15:105465) Avail: CASI HC A09/MF A03

NASA's efforts in Total Quality Management are based on continuous improvement and serve as a foundation for NASA's present and future endeavors. Given here are numerous examples of quality strategies that have proven effective and efficient in a time when cost reduction is critical. These accomplishment benefit our Agency and help to achieve our primary goal, keeping American in the forefront of the aerospace industry. Author

42

GEOSCIENCES (GENERAL)

A92-12519
THE MANAGEMENT OF EARTH OBSERVATION DATA FOR MONITORING GLOBAL CHANGE
JOHN S. MACDONALD (MacDonald Dettwiler, Richmond, Canada) IAF, International Astronautical Congress, 42nd, Montreal, Canada, Oct. 5-11, 1991. 6 p. Oct. 1991 6 p refs (IAF PAPER 91-123) Copyright

The paper presents an approach to the overall design of a global earth observation instrumental system and some of the technical requirements which must be met if the system is to achieve its desired objective. The focus of this system will be on the measurement of subtle long-term changes in the planetary system. Topics discussed include the quantitative measurement of geophysical parameters, the accurate placement of such measurements within the earth system, and the overall requirements for information management. I.S.

A92-13992
AEROSOLS, CLOUD PHYSICS AND RADIATION
S. TWOMEY (Arizona, University, Tucson) IN: Conference on Atmospheric Radiation, 7th, San Francisco, CA, July 23-27, 1990, Preprints 1990 4 p refs
Copyright

Some aspects of climate physics are discussed with special attention given to cases where cloud physics is relevant for the phase and microstructure of clouds and, therefore, in the optical properties of the planet. It is argued that aerosol particles, through their strong effect on cloud microphysics, influence the shortwave energy input to earth, and that cloud microphysics strongly influence rain formation. Therefore, through their influence on microphysics, the aerosols play a central role in the atmospheric water cycle and, thus, on the planet's outgoing radiation. I.S.

A92-18160* California Univ., Los Angeles.
NUCLEAR WINTER - PHYSICS AND PHYSICAL MECHANISMS
R. P. TURCO (California, University, Los Angeles), O. B. TOON, J. B. POLLACK (NASA, Ames Research Center, Moffett Field, CA), T. P. ACKERMAN (Pennsylvania State University, University Park), and C. SAGAN (Cornell University, Ithaca, NY) IN: Annual review of earth and planetary sciences. Vol. 19 1991 40 p refs
Copyright
The basic physics of the environmental perturbations caused by multiple nuclear detonations is explored, summarizing current knowledge of the possible physical, chemical, and biological impacts of nuclear war. Emphasis is given to the impact of the bomb-generated smoke (soot) particles. General classes of models that have been used to simulate nuclear winter are examined, using specific models as examples. C.D.

A92-25326
PRIORITIES OF GLOBAL ECOLOGY AND PROBLEMS OF REMOTE SENSING OF THE ENVIRONMENT AND THE BIOSPHERE [PRIORITETY GLOBAL'NOI EKOLOGII I ZADACHI DISTANTSIONNOGO ZONDIROVANIIA OKRUZHAIUSHCHEI SREDY I BIOSFERY]
K. IA. KONDRAT'EV (AN SSSR, Institut Ozerovedeniia, Leningrad, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), Sept.-Oct. 1991, p. 3-9. In Russian. Oct. 1991 7 p In RUSSIAN refs
Copyright
Remote sensing of the environment and the biosphere is discussed on the basis of an analysis of global ecological priorities. Approaches to substantiating the priorities in the Global Change programs elaborated in the U.S. and France are considered in this connection. The fundamental importance of investigating the dynamics of the biosphere and the need for cooperation among experts in the natural and social sciences are highlighted. P.D.

A92-27661* National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
GLOBAL BIOMASS BURNING - ATMOSPHERIC, CLIMATIC AND BIOSPHERIC IMPLICATIONS
JOEL S. LEVINE (NASA, Langley Research Center, Hampton, VA) EOS (ISSN 0096-3941), vol. 71, Sept. 11, 1990, p. 1075-1077. 11 Sep. 1990 3 p refs
Copyright
Changes in the trace gas composition of the atmosphere due to global biomass burning are examined. The environmental consequences of those changes which have become areas of international concern are discussed. C.D.

A92-33698
THE ROLE OF COUNTRIES AND REGIONS IN THE FORMATION OF THE GLOBAL ATMOSPHERIC CARBON DIOXIDE BUDGET [ROL' STRAN I REGIONOV V FORMIROVANII GLOBAL'NOGO BIUDZHETA DVUOKISI UGLERODA ATMOSFERY]
A. M. TARKO, B. G. BOGATYREV, and A. P. KIRILENKO (Rossiiskaia Akademiia Nauk, Vychislitel'nyi Tsentr, Moscow, Russia) Akademiia Nauk SSSR, Doklady (ISSN 0002-3264), vol. 322, no. 3, 1992, p. 610-613. In Russian. 1992 4 p In RUSSIAN refs
Copyright
A mathematical model is used to calculate the CO2 cycle parameters for a series of countries and regions (USSR, Europe, USA, Canada, tropical forests, and the whole world) with allowance for the effect of anthropogenic sources of atmospheric CO2. The model consists of 1500 ordinary differential equations and includes such variables as the amount of carbon in the biomass of living plants, the amount of carbon in the soil humus, and the amount of carbon in the atmosphere. The results indicate a significant decrease in the capacity of the land biota to absorb CO2 emissions after the year 2000. V.L.

A92-35000* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DATA PRINCIPLES FOR THE U.S. GLOBAL CHANGE RESEARCH PROGRAM
GEORGE H. LUDWIG (JPL, Pasadena, CA) and LISA R. SHAFFER (George Washington University, Washington, DC) IN: IGARSS '91; Proceedings of the 11th Annual International Geoscience and Remote Sensing Symposium, Espoo, Finland, June 3-6, 1991. Vol. 2 1991 3 p
Copyright
The U.S. Interagency Working Group on Data Management for Global Change has developed a set of data management and access principles. The overall purpose of these statements of principle is to stimulate responsible stewardship for data and related information and to facilitate full and open access to them. These statements have been accepted by the U.S. Agencies responsible for the Global Change Research Program. The statements of principle are presented and discussed. I.E.

A92-35924
CLIMATE CHANGE - THE IPCC SCIENTIFIC ASSESSMENT
JOHN T. HOUGHTON, ED., G. J. JENKINS, ED., and J. J. EPHRAUMS, ED. (Meteorological Office, Bracknell, England) Cambridge, England and New York, Cambridge University Press, 1990, 406 p. No individual items are abstracted in this volume. 1990 406 p
(ISBN 0-521-40720-6) Copyright
The present symposium on climate change encompasses available data on climate change, the environmental and socioeconomic impacts of climate change, as well as the formulation of response strategies. Specific issues addressed include greenhouse gases and aerosols, the radiative forcing of climate, processes and modeling, the validation of climate models, equilibrium climate change, and time-dependent greenhouse-gas-induced climate change. Also addressed are issues including the detection of the greenhouse effect in observational data, observed climate variations and change, sea-level rise, effects on the ecosystem, methods for narrowing the uncertainties related to the prediction of climate changes and their effects, and statistical scenarios for future emissions. C.C.S.

A92-36401
THE ECOS-A PROJECT - SCIENTIFIC SPACE INVESTIGATIONS AND MODELING OF GLOBAL ECOLOGICAL AND CLIMATIC PROCESSES AND NATURAL DISASTERS [PROEKT 'EKOS-A' - NAUCHNYE KOSMICHESKIE ISSLEDOVANIIA I POSTROENIE MODELEI GLOBAL'NYKH EKOLOGICHESKIKH I KLIMATICHESKIKH PROTSESSOV I PRIRODNYKH KRIZISNYKH SITUATSII]
G. A. AVANESOV, A. A. GALEEV, B. S. ZHUKOV, IA. L. ZIMAN, and I. G. MITROFANOV (Rossiiskaia Akademiia Nauk, Institut Kosmicheskikh Issledovanii, Moscow, Russia) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), no. 2, Mar.-Apr. 1992, p. 3-14. In Russian. Apr. 1992 12 p In RUSSIAN refs
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The concept of the ECOS-A project is outlined. Consideration is given to the basic areas of research, requirements for space-based and concomitant ground observations, the composition and specifications of onboard instrumentation, and the performance data of spacecraft and ground support systems. The interconnection of ECOS-A research fields is illustrated, and a diagram of ECOS-A space-based observations is given. P.D.

A92-37626* National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
GLOBAL BIOMASS BURNING - ATMOSPHERIC, CLIMATIC, AND BIOSPHERIC IMPLICATIONS
JOEL S. LEVINE, ED. (NASA, Langley Research Center, Hampton, VA) Cambridge, MA, MIT Press, 1991, 599 p. For individual items see A92-37627 to A92-37688. 1991 599 p
(ISBN 0-262-12159-X) Copyright
The present volume discusses the biomass burning (BMB)

studies of the International Global Atmospheric Chemistry project, GEO satellite estimation of Amazonian BMB, remote sensing of BMB in West Africa with NOAA-AVHRR, an orbital view of the great Chinese fire of 1987, BMB's role in tropical rainforest reduction, CO and O3 measurements of BMB in the Amazon, effects of vegetation burning on the atmospheric chemistry of the Venezuelan savanna, an assessment of annually-burned biomass in Africa, and light hydrocarbon emissions from African savanna burnings. Also discussed are BMB in India, trace gas and particulate emissions from BMB in temperate ecosystems, ammonia and nitric acid emissions from wetlands and boreal forest fires, combustion emissions and satellite imagery of BMB, BMB in the perspective of the global carbon cycle, modeling trace-gas emissions from BMB, NO(x) emissions from BMB, and cloud-condensation nuclei from BMB. O.C.

A92-37627* National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
GLOBAL BIOMASS BURNING - ATMOSPHERIC, CLIMATIC, AND BIOSPHERIC IMPLICATIONS
JOEL S. LEVINE (NASA, Langley Research Center, Hampton, VA) IN: Global biomass burning - Atmospheric, climatic, and biospheric implications 1991 6 p
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On a global scale, the total biomass consumed by annual burning is about 8680 million tons of dry material; the estimated total biomass consumed by the burning of savanna grasslands, at 3690 million tons/year, exceeds all other biomass burning (BMB) components. These components encompass agricultural wastes burning, forest burning, and fuel wood burning. BMB is not restricted to the tropics, and is largely anthropogenic. Satellite measurements indicate significantly increased tropospheric concentrations of CO and ozone associated with BMB. BMB significantly enhances the microbial production and emission of NO(x) from soils, and of methane from wetlands. O.C.

A92-37628
BIOMASS BURNING - ITS HISTORY, USE, AND DISTRIBUTION AND ITS IMPACT ON ENVIRONMENTAL QUALITY AND GLOBAL CLIMATE
MEINRAT O. ANDREAE (Max-Planck-Institut fuer Chemie, Mainz, Federal Republic of Germany) IN: Global biomass burning - Atmospheric, climatic, and biospheric implications 1991 19 p
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The present discussion of the historical development of biomass burning (BMB) and its role in agriculture and society furnishes current estimates of the types and quantities of pollutants emitted, as well as of their environmental effects. Attention is given to the clearing of forest and brushland, BMB in tropical savannas, the use of wood and charcoal as major fuels, the geographical distribution of BMB, and the seasonality of BMB. While CO2 is the primary atmospheric pollutant, CO, CH4, and various other hydrocarbons are also generated by BMB, in conjunction with the aerosol particles of 'smoke'. Accounts are given of the long-range transport and photochemistry of smoke plumes, ozone pollution of the stratosphere, the perturbation of tropospheric oxidant cycles, and the disruption of nutrient cycles and soil degradation by BMB. O.C.

A92-37629* National Aeronautics and Space Administration, Washington, DC.
BIOMASS BURNING STUDIES AND THE INTERNATIONAL GLOBAL ATMOSPHERIC CHEMISTRY (IGAC) PROJECT
RONALD G. PRINN (MIT, Cambridge, MA) IN: Global biomass burning - Atmospheric, climatic, and biospheric implications 1991 7 p
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IGAC is an ambitious, decade-long and global research initiative concerned with major research challenges in the field of atmospheric chemistry; its chemists and ecosystem biologists are addressing the problems associated with global biomass burning (BMB). Among IGAC's goals is the achievement of a fundamental understanding of the natural and anthropogenic processes determining changes in atmospheric composition and chemistry, in order to allow century-long predictions. IGAC's studies have been organized into 'foci', encompassing the marine, tropical, polar, boreal, and midlatitude areas, as well as their global composite interactions. Attention is to be given to the effects of BMB on biogeochemical cycles. O.C.

A92-37636
TROPICAL WILD-LAND FIRES AND GLOBAL CHANGES - PREHISTORIC EVIDENCE, PRESENT FIRE REGIMES, AND FUTURE TRENDS
JOHANN G. GOLDAMMER (Freiburg, Universitaet, Freiburg im Breisgau, Federal Republic of Germany) IN: Global biomass burning - Atmospheric, climatic, and biospheric implications 1991 9 p
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Wildfires are noted to have been an integral feature of the global environment for millions of years; on this geological time-scale, the role of such fires was interdependent with climate patterns and atmospheric characteristics. In the present and future, the negative atmospheric and ecological effects of such fires must be addressed by means of integrated fire-management systems. Wildfire-related policies must be targeted to safeguard vegetation cover for soil-productivity protection, as well as for the maintenance (and if possible, the enhancement) of land biomass carbon storage. O.C.

A92-37665
THE CONTRIBUTION OF BIOMASS BURNING TO THE CARBON BUDGET OF THE CANADIAN FOREST SECTOR - A CONCEPTUAL MODEL
WERNER A. KURZ (Environmental and Social Systems Analysts, Ltd., Vancouver, Canada), MICHAEL J. APPS (Forestry Canada, Edmonton), TIMOTHY M. WEBB, and PETER J. MCNAMEE (Environmental and Social Systems Analysts, Ltd., Vancouver, Canada) IN: Global biomass burning - Atmospheric, climatic, and biospheric implications 1991 6 p
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The present conceptual model for the Canadian Forest Sector carbon budget is undergoing computer implementation in order to quantitatively determine carbon-pool sizes and net fluxes in forest biomass, forest soils, and the forest products sector. Attention is given to policy questions concerning the possible role of the forest sector in sequestering and storing atmospheric carbon; such policy questions are pertinent to the reduction of the rate of the global atmospheric CO2 increase through reforestation, alterations in fire-protection strategies, the substitution of fossil fuels by bioenergy sources, and increased recycling of such forest products as pulp and paper. O.C.

A92-37672
THE ROLE OF BIOMASS BURNING IN THE BUDGET AND CYCLE OF CARBONACEOUS SOOT AEROSOLS AND THEIR CLIMATE IMPACT
JOYCE E. PENNER, STEVEN J. GHAN, and JOHN J. WALTON (Lawrence Livermore National Laboratory, Livermore, CA) IN: Global biomass burning - Atmospheric, climatic, and biospheric implications 1991 7 p
(Contract W-7405-ENG-48)
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The climatic impact of biomass burning in virtue of both direct smoke radiative effect and indirect cloud-albedo effects is presently estimated on the basis of the Walton et al. (1988) model, in conjunction with the NCAR Community Climate Model 1. Calculated soot content is compared with soot concentrations in the Southern Hemisphere; partial confirmation of the present modeling procedures is thus obtained. Predicted smoke optical depths are compared with those typically obtained by satellite observations. Attention is given to the estimated change in climate due to solar radiation that is reflected by biomass burning. O.C.

A92-37679
THE CONTRIBUTION OF BIOMASS BURNING TO GLOBAL WARMING - AN INTEGRATED ASSESSMENT
DANIEL A. LASHOF (Natural Resources Defense Council, Washington, DC) IN: Global biomass burning - Atmospheric, climatic, and biospheric implications 1991 4 p
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Biomass burning-related results are presented which suggest that, while biomass burning is less significant a contributor to greenhouse-gas buildup than fossil fuel consumption on a global basis, it remains a major source that is responsible for 10-15 percent of total forcing from current emissions. While uncertainties about both emissions and relative impact from different gases are large, biomass burning is probably the dominant source of greenhouse gases in some regions. O.C.

A92-37680
POLICY OPTIONS FOR MANAGING BIOMASS BURNING TO MITIGATE GLOBAL CLIMATE CHANGE
KENNETH J. ANDRASKO (EPA, Washington, DC), DILIP R. AHUJA (Bruce Co., Washington, DC), STEVEN M. WINNETT, and DENNIS A. TIRPAK (EPA, Washington, DC) IN: Global biomass burning - Atmospheric, climatic, and biospheric implications 1991 12 p
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An effort is made to systematically identify and assess the set of potential biomass-burning policy-response options needed for implementation of (1) silvicultural and grassland fire-management practices, (2) improved biomass-burning stove designs, and (3) integrated bioenergy production and utilization systems. Relative costs and benefits and environmental implications are evaluated. It is established that net gas-balance analysis of response options is needed to devise policy interventions that reduce emissions on a greenhouse-equivalent basis, and that there exists only a limited capability for intervening in burning practices. O.C.

A92-37681
AMAZONIA - BURNING AND GLOBAL CLIMATE IMPACTS
LUIZ C. B. MOLION (Instituto de Pesquisas Espaciais, Sao Jose dos Campos, Brazil) IN: Global biomass burning - Atmospheric, climatic, and biospheric implications 1991 6 p
Copyright

An assessment is made of the causes and extent of Amazonian deforestation, with a view to both its local and global environmental impacts. The evaluation of land-use transformation in the Brazilian Amazon on the basis of Landsat-TM images has led to an estimated deforested area of about 397,000 sq km, or nearly 11 percent of forest area, in conjunction with a deforestation rate of 21,000 sq km/year. Attention is given to two climate change-related hypotheses concerning Amazonia: the forest as controller of the greenhouse effect, and as the main heat-source for the extratropics. O.C.

A92-37889
THE CLIMATE INDUCED VARIATION OF THE CONTINENTAL BIOSPHERE - A MODEL SIMULATION OF THE LAST GLACIAL MAXIMUM
P. FRIEDLINGSTEIN (Bruxelles, Universite Libre; Institut d'Aeronomie Spatiale de Belgique, Brussels, Belgium), C. DELIRE (Liege, Institut d'Astrophysique, Belgium), J. F. MUELLER (Institut d'Aeronomie Spatiale de Belgique, Brussels, Belgium), and J. C. GERARD (Liege, Institut d'Astrophysique, Belgium) Geophysical Research Letters (ISSN 0094-8276), vol. 19, no. 9, May 4, 1992, p. 897-900. Research supported by Institut pour l'Encouragement de la Recherche Scientifique dans l'Industrie et l'Agriculture, FNRS, and Belgian National Impulse Programmes. 4 May 1992 4 p refs
Copyright

A simplified 3D global climate model was used to simulate the surface temperature and precipitation distributions for the Last Glacial Maximum (LGM), 18,000 years ago. These fields were applied to a bioclimatic scheme which parameterizes the distribution of eight vegetation types as a function of biotemperature and annual precipitation. The model predicts a decrease, for LGM compared to the present, in forested areas balanced by an increase in desert and tundra extent, in agreement with a reconstruction of the distribution of vegetation based on paleodata. However, the estimated biospheric carbon content (phytomass and soil carbon) at LGM is less reduced than in the reconstructed one. Possible reasons for this discrepancy are discussed. Author

A92-38082* National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
POLAR CLOUD AND SURFACE CLASSIFICATION USING AVHRR IMAGERY - AN INTERCOMPARISON OF METHODS
R. M. WELCH, S. K. SENGUPTA, A. K. GOROCH (U.S. Navy, Naval Oceanographic and Atmospheric Research Laboratory, Monterey, CA), P. RABINDRA, N. RANGARAJ, and M. S. NAVAR (South Dakota School of Mines and Technology, Rapid City) Journal of Applied Meteorology (ISSN 0894-8763), vol. 31, no. 5, May 1992, p. 405-420. Research supported by U.S. Navy. May 1992 16 p refs
(Contract NSF ATM-88-16052; NAS1-19077)

Six Advanced Very High-Resolution Radiometer local area coverage (AVHRR LAC) arctic scenes are classified into ten classes. Three different classifiers are examined: (1) the traditional stepwise discriminant analysis (SDA) method; (2) the feed-forward back-propagation (FFBP) neural network; and (3) the probabilistic neural network (PNN). More than 200 spectral and textural measures are computed. These are reduced to 20 features using sequential forward selection. Theoretical accuracy of the classifiers is determined using the bootstrap approach. Overall accuracy is 85.6 percent, 87.6 percent, and 87.0 percent for the SDA, FFBP, and PNN classifiers, respectively, with standard deviations of approximately 1 percent. Author

A92-38178* National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
ENERGY, ATMOSPHERIC CHEMISTRY, AND GLOBAL CLIMATE
JOEL S. LEVINE (NASA, Langley Research Center, Hampton, VA) 1991 International Symposium on Energy and Environment, Espoo, Finland, Aug. 25-28, 1991, Paper. 10 p. Aug. 1991 10 p refs

Global atmospheric changes due to ozone destruction and the greenhouse effect are discussed. The work of the Intergovernmental Panel on Climate Change is reviewed, including its judgements regarding global warming and its recommendations for improving predictive capability. The chemistry of ozone destruction and the global atmospheric budget of nitrous oxide are reviewed, and the global sources of nitrous oxide are described. C.D.

A92-47419 National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York, NY.
MODELLING THE HYDROLOGICAL CYCLE IN ASSESSMENTS OF CLIMATE CHANGE
D. RIND (NASA, Goddard Institute for Space Studies, New York), C. ROSENZWEIG, and R. GOLDBERG (Columbia University, New York) Nature (ISSN 0028-0836), vol. 358, no. 6382, July 9, 1992, p. 119-122. Research supported by EPA and NASA. 9 Jul. 1992 4 p refs
Copyright

The predictions of climate change studies depend crucially on the hydrological cycles embedded in the different models used. It is shown here that uncertainties in hydrological processes and inconsistencies in both climate and impact models limit confidence in current assessments of climate change. A future course of action to remedy this problem is suggested. C.D.

A92-52838
VEGETATION DYNAMICS, CO2 CYCLE AND EL NINO PHENOMENON
S. M. SINGH (NERC; Reading, University, United Kingdom) International Journal of Remote Sensing (ISSN 0143-1161), vol. 13, no. 11, July 20, 1992, p. 2069-2077. 20 Jul. 1992 9 p

refs
(Contract NERC-F60/G6/12)
Copyright

Attention is focused on important differences between raw global vegetation index (GVI) values and those values resulting after the application of solar zenith angle and atmospheric corrections. The northern hemispheric CO2 concentration cycle is compared with the GVI dynamics over the U.S.A. and the UK. It is shown that the GVI is a measure of the degree of photosynthetic activity in the terrestrial vegetation as shown by Tucker et al (1986). R.E.P.

A92-55563
GERMAN CONTRIBUTIONS TO THE INTERNATIONAL SPACE YEAR ISY 1992
W. STEINBORN (DARA, Bonn, Germany), H.-D. SCHLICHTER (DLR, Oberpfaffenhofen, Germany), and A. BLUDAU (DARA, Bonn, Germany) IAF, International Astronautical Congress, 43rd, Washington, Aug. 28-Sept. 5, 1992. 11 p. Aug. 1992 11 p refs
(IAF PAPER 92-0073) Copyright

German engagement in the International Space Year initiative is discussed demonstrating that the current and planned space research projects are relevant to the Mission to Planet Earth. Projects related to earth science and technology include: the Polar Ice Extent Project, World Forest Watch, and the Global Change Outreach Program. Projects characterized as education and application include a pedagogical link to Meteosat and NOAA satellites and a program for high school students to study the principles of remote sensing. Space science achievements during 1992 are reviewed such as the European Stratospheric Ozone Experiment, the Millimeter-wave Atmospheric Sounder, and a body of data regarding the use of space sciences for monitoring the changing earth. German activities for the ISY are based on multidisciplinary application projects, sensor development, and educational activities as well as ongoing space missions. C.C.S.

A92-57380
THE GEOSPHERE PROJECT
TOM VAN SANT (Eyes on Earth Corp., Santa Monica, CA) and RONALD S. GIRD (NOAA, National Weather Service, Washington) IAF, International Astronautical Congress, 43rd, Washington, Aug. 28-Sept. 5, 1992. 7 p. Aug. 1992 7 p
(IAF PAPER 92-0469) Copyright

A visually accurate 3D model of the earth is proposed as the basis of a program for monitoring climate changes and earth resources with satellite imagery. The GeoSphere Project is outlined in the context of a phased approach that begins by assembling satellite images of the earth, integrating earth databases, and developing the GeoSphere product and earth situation room. The project is expected to enhance public understanding of and access to global scientific findings regarding terrestrial climate and resources. C.C.S.

N92-22826# European Space Agency, Paris (France).
REPORT OF THE EARTH OBSERVATION USER CONSULTATION MEETING
C. BARRON, ed. and B. BATTRICK, ed. Oct. 1991 288 p Meeting held in Noordwijk, Netherlands, 29-31 May 1991 Original contains color illustrations
(ESA-SP-1143; ISBN-92-9092-148-X; ETN-92-91204) Copyright
Avail: CASI HC A13/MF A03; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 75 Dutch guilders

Earth observation is an important component of the Long Term Program being prepared by the European Space Agency for consideration by European Ministers at the meeting of the Agency's council in November 1991. As part of the preparations for this November Council Meeting, a meeting of users decided that the aims were to identify lists of topics that should be addressed by the Agency's Earth Observation programme; list the sets of parameters that need to be measured to attain these objectives; and specify the role of the Space based observations. To facilitate discussion, the various areas of interest were grouped under the four basic thrusts of the Agency's Earth Observation strategy, namely environment, resource management, solid Earth, and meteorology. A fifth division, atmospheric chemistry, was added to facilitate discussion. ESA

N92-28950*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
TOPEX/POSEIDON SCIENCE INVESTIGATIONS PLAN
1 Sep. 1991 184 p Original contains color illustrations
(Contract NAS7-918)
(NASA-CR-190456; NAS 1.26:190456; JPL-PUBL-91-27)

TOPEX/POSEIDON is a satellite mission that will use the technique of radar altimetry to make precise measurement of sea level with a primary goal of studying the global ocean circulation. The mission represents the culmination of the development of satellite altimetry over the past two decades. The major thrust of the mission is a commitment to measuring sea level with an unprecedented accuracy such that the small-amplitude, basinwide sea level changes that bear significant effects on global change can be detected. The mission will be conducted jointly by NASA and the French Space Agency. The 3 to 5 year mission will study the long-term mean and variability of ocean circulation. An international team of 38 principal investigators was established to conduct scientific investigations in ocean circulation, tides, and Marine geophysics using data from the mission. Brief descriptions of the planned investigations as well as a summary of the major elements of the mission are provided. Author

43

EARTH RESOURCES AND REMOTE SENSING

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

A92-12515
SPACE TECHNOLOGY FOR GLOBAL CHANGE MODELLING AND SUSTAINABLE DEVELOPMENT OF NATURAL RESOURCES
U. R. RAO, M. G. CHANDRASEKHAR, V. JAYARAMAN, P. P. N. RAO, B. MANIKIAM, and S. K. SRIVASTAVA (ISRO, Bangalore, India) IAF, International Astronautical Congress, 42nd, Montreal, Canada, Oct. 5-11, 1991. 9 p. Oct. 1991 9 p refs
(IAF PAPER 91-115) Copyright

The paper discusses the development of a detailed global change model encompassing fluxes of water, energy, and chemicals in the plant-soil-atmosphere continuum, which would be able to combine information on the local and regional ecological and hydrological characteristics of a region with that on global changes in natural resources. It is shown that satellite remote sensing, by virtue of its capability to transfer information across scales and processes provides an opportunity to develop individual modules of such an overall global-change model. The examples of such modules are the International Satellite Land Surface Climatology Project (Sellers et al., 1989), the Net Primary Productivity assessment of ecosystems (Goward, 1989), and the climate impact studies of oil fires by Rao et al. (1991). The major components of global changes amenable to spaceborne measurements are shown. I.S.

A92-12546* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
APPLICATIONS OF THE EOS SAR TO MONITORING GLOBAL CHANGE
MARGUERITE SCHIER, JOBEA WAY, and BENJAMIN HOLT (JPL, Pasadena, CA) IAF, International Astronautical Congress, 42nd, Montreal, Canada, Oct. 5-11, 1991. 9 p. Oct. 1991 9 p refs
(IAF PAPER 91-163) Copyright

The SAR employed by NASA's Earth Observing System (EOS)

is a multifrequency multipolarization radar which can conduct global monitoring of geophysical and biophysical parameters. The present discussion of the EOS SAR's role in global monitoring emphasizes geophysical product variables applicable to global hydrologic, biogeochemical, and energy cycle models. EOS SAR products encompass biomass, wetland areas, and phenologic and environmental states, in the field of ecosystem dynamics; soil moisture, snow moisture and extent, and glacier and ice sheet extent and velocity, in hydrologic cycle studies; surface-wave fields and sea ice properties, in ocean/atmosphere circulation; and the topography, erosion, and land forms of the solid earth. O.C.

A92-13173
POTENTIAL MAGNITUDE OF FUTURE VEGETATION CHANGE IN EASTERN NORTH AMERICA - COMPARISONS WITH THE PAST
JONATHAN T. OVERPECK (NOAA, National Geophysical Data Center, Boulder, CO; Lamont-Doherty Geological Observatory, Palisades, NY), PATRICK J. BARTLEIN (Oregon, University, Eugene), and THOMPSON WEBB, III (Brown University, Providence, RI) Science (ISSN 0036-8075), vol. 254, Nov. 1, 1991, p. 692-695. Research supported by NSF. 1 Nov. 1991 4 p refs
(Contract EPA-DW-80932629-01)
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Increase in atmospheric trace gas concentrations could warm the global average temperature 1.5 to 4.5 C by the end of the next century. Application of climate-pollen response surfaces to three climate model simulations of doubled preindustrial atmospheric CO2 levels shows that the change in the equilibrium distribution of natural vegetation over eastern North America over the next 200 to 500 years could be larger than the overall change during the past 7000 to 10,000 years and equivalent to the change that took place over the 1000- to 3000-year period of most rapid deglaciation. Some plant ranges and abundance maxima could shift as much as 500 to 1000 km during the next 200 to 500 years; such changes would have dramatic impacts on silvicultural and natural ecosystems. Although unprecedented vegetation change is likely if climate changes as predicted, forecasting the exact timing and patterns of change will be difficult. Author

A92-16151*
REMOTE SENSING SCIENCE FOR THE NINETIES; PROCEEDINGS OF IGARSS '90 - 10TH ANNUAL INTERNATIONAL GEOSCIENCE AND REMOTE SENSING SYMPOSIUM, UNIVERSITY OF MARYLAND, COLLEGE PARK, MAY 20-24, 1990. VOLS. 1, 2, & 3
Symposium sponsored by IEEE, URSI, NASA, et al. New York, Institute of Electrical and Electronics Engineers, Inc., 1990, p. Vol. 1, 1018 p.; vol. 2, 784 p.; vol. 3, 821 p. No individual items are abstracted in these volumes. 1990 2623 p
Copyright

Various papers on remote sensing (RS) for the nineties are presented. The general topics addressed include: subsurface methods, radar scattering, oceanography, microwave models, atmospheric correction, passive microwave systems, RS in tropical forests, moderate resolution land analysis, SAR geometry and SNR improvement, image analysis, inversion and signal processing for geoscience, surface scattering, rain measurements, sensor calibration, wind measurements, terrestrial ecology, agriculture, geometric registration, subsurface sediment geology, radar modulation mechanisms, radar ocean scattering, SAR calibration, airborne radar systems, water vapor retrieval, forest ecosystem dynamics, land analysis, multisensor data fusion. Also considered are: geologic RS, RS sensor optical measurements, RS of snow, temperature retrieval, vegetation structure, global change, artificial intelligence, SAR processing techniques, geologic RS field experiment, stochastic modeling, topography and Digital Elevation model, SAR ocean waves, spaceborne lidar and optical, sea ice field measurements, millimeter waves, advanced spectroscopy, spatial analysis and data compression, SAR polarimetry techniques. Also discussed are: plant canopy modeling, optical RS techniques, optical and IR oceanography, soil moisture, sea ice back scattering, lightning cloud measurements, spatial textural analysis, SAR systems and techniques, active microwave sensing, lidar and optical, radar scatterometry, RS of estuaries, vegetation modeling, RS systems, EOS/SAR Alaska, applications for developing countries, SAR speckle and texture. C.D.

A92-27268
ENHANCEMENT AND MENSURATION OF SPACE IMAGERY TO DOCUMENT ENVIRONMENTAL CHANGE - OMO DELTA, AFRICA
ROBERT R. J. MOHLER (Lockheed Engineering and Sciences Co., Houston, TX) and JOHN R. GIARDINO (Texas A & M University, College Station) Geocarto International (ISSN 1010-6049), vol. 6, Sept. 1991, p. 53-55. Sep. 1991 3 p refs
Copyright

Image-processing techniques including hand-held photography with digitization and registration are evaluated for studying and documenting global change. Directional and stretch image-enhancement techniques are applied to photographs of the African delta to improve the saturation, intensity, and hue components. The resulting images show the areas of Savanna, deltaic vegetation, and water which correspond to a 22 percent increase in the delta area. C.C.S.

A92-27758* National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York, NY.
THE IMPACT OF GLOBAL WARMING ON RIVER RUNOFF
JAMES R. MILLER (Rutgers University, New Brunswick, NJ) and GARY L. RUSSELL (NASA, Goddard Institute for Space Studies, New York) (Chapman Conference on the Hydrologic Aspects of Global Climate Change, Lake Chelan, WA, June 12-14, 1990, Selected Papers. A92-27751 10-47) Journal of Geophysical Research (ISSN 0148-0227), vol. 97, no. D3, Feb. 28, 1992, p. 2757-2764. 28 Feb. 1992 8 p refs
Copyright

A global atmospheric model is used to calculate the annual river runoff for 33 of the world's major rivers for the present climate and for a doubled CO2 climate. The model has a horizontal resolution of 4 x 5 deg, but the runoff from each model grid box is quartered and added to the appropriate river drainage basin on a 2 x 2.5 deg resolution. The computed runoff depends on the model's precipitation, evapotranspiration, and soil moisture storage. For the doubled CO2 climate, the runoff increased for 25 of the 33 rivers, and in most cases the increases coincide with increased rainfall within the drainage basins. There were runoff increases in all rivers in high northern latitudes, with a maximum increase of 47 percent. At low latitudes there were both increases and decreases ranging from a 96 increase to a 43 percent decrease. The effect of the simplified model assumptions of land-atmosphere interactions on the results is discussed. Author

A92-27763
POTENTIAL RESPONSE OF AN ARCTIC WATERSHED DURING A PERIOD OF GLOBAL WARMING
LARRY D. HINZMAN and DOUGLAS L. KANE (Alaska, University, Fairbanks) (Chapman Conference on the Hydrologic Aspects of Global Climate Change, Lake Chelan, WA, June 12-14, 1990, Selected Papers. A92-27751 10-47) Journal of Geophysical Research (ISSN 0148-0227), vol. 97, no. D3, Feb. 28, 1992, p. 2811-2820. Research supported by DOE. 28 Feb. 1992 10 p refs
Copyright

TDHC, a heat conduction model which incorporates phase change, was used to analyze the thermal impact of climatic warming on a permafrost environment. The response of the active layer to climatic warming is incorporated into HBV, a hydrologic mode, to elucidate the effects on the hydrologic regime. Several scenarios of climatic warming are examined to determine the impact on the active layer depth, with particular attention paid to the results of 4-C warming at a typical Arctic site. In the case of 4-C warming, three scenarios of precipitation are studied: no change, +15 percent, and -15 percent. The most significant response to climatic warming was an increase in active layer depth. Other changes

observed were warming of the entire soil profile, increased soil moisture storage, increased evaporation, and variable response in runoff, depending upon the scenario. P.D.

A92-27764
SENSITIVITY OF GROUNDWATER RECHARGE ESTIMATES TO CLIMATE VARIABILITY AND CHANGE, COLUMBIA PLATEAU, WASHINGTON
JOHN J. VACCARO (USGS, Water Resources Div., Tacoma, WA) (Chapman Conference on the Hydrologic Aspects of Global Climate Change, Lake Chelan, WA, June 12-14, 1990, Selected Papers. A92-27751 10-47) Journal of Geophysical Research (ISSN 0148-0227), vol. 97, no. D3, Feb. 28, 1992, p. 2821-2833. 28 Feb. 1992 13 p refs

The paper explores the sensitivity of recharge estimates for a selected groundwater basin to historical climate variability and to projected climate change. A synthetic daily weather generator was used to simulate lengthy sequences with parameters estimated from subsets of the historical record that were unusually wet or unusually dry. Comparison of recharge estimates corresponding to relatively wet and dry periods showed that recharge for predevelopment land use varies considerably within the range of climatic conditions observed in the 87-yr historical observation period. Recharge variations for present land use conditions were less sensitive to the same range of historical climatic conditions because of irrigation. For the average GCM scenario, predevelopment recharge increased, and current recharge decreased. Predevelopment and current recharge were less and more sensitive, respectively, to the climate variability for the average GCM scenario as compared to the variability within the historical record. P.D.

A92-34997* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE ROLE OF THE EOS SAR IN MISSION TO PLANET EARTH
BENJAMIN HOLT, JOBEA WAY, and MARGUERITE SCHIER (JPL, Pasadena, CA) IN: IGARSS '91; Proceedings of the 11th Annual International Geoscience and Remote Sensing Symposium, Espoo, Finland, June 3-6, 1991. Vol. 2 1991 3 p
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The Earth Observing System (EOS) synthetic aperture radar (SAR) is a multifrequency, multipolarization radar which will be capable of the global monitoring of key quantitative measurements of geophysical and biophysical parameters. Scheduled to fly on its own dedicated spacecraft, it is one of three platforms that will make up the space-based component to EOS. The role of the SAR in the EOS mission is discussed, wtih emphasis on the geophysical product variables which will be generated with the SAR and used in global hydrologic, biogeochemical and energy cycle models. The latest concepts for processing the data, including calibration and geophysical processing strategies, are presented. I.E.

A92-35083* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
MONITORING TEMPORAL CHANGE IN ALASKAN FORESTS USING AIRSAR DATA
JOBEA WAY, ERIC RIGNOT (JPL, Pasadena, CA), KYLE MCDONALD (Michigan, University, Ann Arbor), and GORDON BONAN (NCAR, Boulder, CO) IN: IGARSS '91; Proceedings of the 11th Annual International Geoscience and Remote Sensing Symposium, Espoo, Finland, June 3-6, 1991. Vol. 3 1991 3 p refs
Copyright

A92-35244* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
THE DATE OF SNOW DISAPPEARANCE ON THE ARCTIC TUNDRA AS DETERMINED FROM SATELLITE, METEOROLOGICAL STATION AND RADIOMETRIC IN-SITU OBSERVATIONS
J. L. FOSTER (NASA, Goddard Space Flight Center, Greenbelt, MD), J. W. WINCHESTER (Florida State University, Tallahassee), and E. G. DUTTON (NOAA, Climate Monitoring and Diagnostics Laboratory, Boulder, CO) IN: IGARSS '91; Proceedings of the 11th Annual International Geoscience and Remote Sensing Symposium, Espoo, Finland, June 3-6, 1991. Vol. 4 1991 4 p refs
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A92-35280* National Aeronautics and Space Administration. John C. Stennis Space Center, Bay Saint Louis, MS.
PEAT ANALYSES IN THE HUDSON BAY LOWLANDS USING GROUND PENETRATING RADAR
R. E. PELLETIER (NASA, Stennis Space Center, Bay Saint Louis, MS), J. L. DAVIS, and J. R. ROSSITER (Canpolar, Inc., Toronto, Canada) IN: IGARSS '91; Proceedings of the 11th Annual International Geoscience and Remote Sensing Symposium, Espoo, Finland, June 3-6, 1991. Vol. 4 1991 4 p refs
Copyright

The use of ground penetrating radar (GPR) as a means to determine peak thickness and estimate peat volume in the Hudson Bay Lowlands of Canada is examined. Ground-based and airborne GPR data were acquired so as to extrapolate measurements to larger scales. While the ground-based measurements did an excellent job in determining peat depth, the airborne techniques did a fair job a low altitudes and demonstrated great promise with additional system engineering changes. I.E.

A92-37163
WATER RESOURCES
H. HAEFNER (Zuerich, Universitaet, Zurich, Switzerland) and P. PAMPALONI (CNR, Istituto di Ricerca sulle Onde Elettromagnetiche, Florence, Italy) International Journal of Remote Sensing (ISSN 0143-1161), vol. 13, no. 6-7, Apr.-May 10, 1992, p. 1277-1303. 10 May 1992 27 p refs
Copyright

Satellite studies of water runoff assessment and prediction are reviewed. The technologies and methods involved in the estimation of precipitation, significance and determination of soil moisture, assessment and prediction of surface runoff, and assessment of the water equivalent are examined in detail. C.D.

A92-37630
ASTRONAUT OBSERVATIONS OF GLOBAL BIOMASS BURNING
CHARLES A. WOOD (North Dakota, University, Grand Forks) and RAYMOND NELSON (Lockheed Engineering Services Corp., Houston, TX) IN: Global biomass burning - Atmospheric, climatic, and biospheric implications 1991 12 p
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The examples of biomass burning (BMB) observations by astronauts during one year furnish a compelling perspective of BMB's widespread occurrence and the variety of materials thus consumed. These observations have focused on both such intermediate-term monitoring phenomena as smoke plumes and deforestation, but also such long-term phenomena as increases in erosion as a result of deforestation. The first global estimate of BMB was made in 1985, when the majority of observed fires occurred in Latin America. Climate model-based speculations on the relationship of BMB to weather and climate changes are noted. O.C.

A92-37655
FTIR REMOTE SENSING OF BIOMASS BURNING EMISSIONS OF CO2, CO, CH4, CH2O, NO, NO2, NH3, AND N2O
DAVID W. T. GRIFFITH (Wollongong, University, Australia), WILLIAM G. MANKIN, MICHAEL T. COFFEY (NCAR, Boulder, CO), DAROLD E. WARD (USDA, Forest Service, Missoula, MT), and ALLEN RIEBAU (Bureau of Land Management, Cheyenne, WY) IN: Global biomass burning - Atmospheric, climatic, and biospheric implications 1991 10 p
Copyright

High-resolution Fourier-transform IR (FTIR) absorption spectroscopy is presently used over open paths in biomass-fire smoke plumes to remotely sense emissions. FTIR can be employed

in simultaneous measurements of a wide range of gas-phase species. Measurements are integrated over a long path through the smoke plume, and are therefore not subject to small-scale local variations. The emissions of all nitrogen species from the four field fires studied can be compared to the nitrogen content of the fuels burned; valuable insight has been gained into the relationships between biomass burning emissions and fire parameters. O.C.

A92-37659* National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
BIOMASS BURNING - COMBUSTION EMISSIONS, SATELLITE IMAGERY, AND BIOGENIC EMISSIONS
JOEL S. LEVINE, WESLEY R. COFER, III (NASA, Langley Research Center, Hampton, VA), EDWARD L. WINSTEAD (ST Systems Corp., Hampton, VA), ROBERT P. RHINEHART, DONALD R. CAHOON, JR. (NASA, Langley Research Center, Hampton, VA), DANIEL I. SEBACHER, SHIRLEY SEBACHER (ST Systems Corp., Hampton, VA), and BRIAN J. STOCKS (Forestry Canada, Sault-Ste.-Marie) IN: Global biomass burning - Atmospheric, climatic, and biospheric implications 1991 8 p
Copyright
After detailing a technique for the estimation of the instantaneous emission of trace gases produced by biomass burning, using satellite imagery, attention is given to the recent discovery that burning results in significant enhancement of biogenic emissions of N2O, NO, and CH4. Biomass burning accordingly has an immediate and long-term impact on the production of atmospheric trace gases. It is presently demonstrated that satellite imagery of fires may be used to estimate combustion emissions, and could be used to estimate long-term postburn biogenic emission of trace gases to the atmosphere. O.C.

A92-37660 National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, FL.
CHANGES IN MARSH SOILS FOR SIX MONTHS AFTER A FIRE
PAUL A. SCHMALZER, C. R. HINKLE (Bionetics Corp., Cocoa Beach, FL), and ALBERT M. KOLLER, JR. (NASA, Kennedy Space Center, Cocoa Beach, FL) IN: Global biomass burning - Atmospheric, climatic, and biospheric implications 1991 15 p (Contract NAS10-10285; NAS10-11624)
Copyright
An examination is conducted of changes in soil-nutrient levels in marsh systems after a fire, in conjunction with studies of particulates and gases generated by such biomass combustion. Attention is given to data covering six months after the fire. It is noted that changes in soil property occur at different times after the fire, and persist for different intervals; this implies a need for long-term postfire observations. The marshes studied were representative of a variety of graminoid wetlands in the southeastern U.S. which periodically burn either naturally or upon prescription. Nitrogen transformations in flooded soils differ from those in well-drained ones. O.C.

A92-39392
DEVELOPMENT OF LAND DATA SETS FOR STUDIES OF GLOBAL CLIMATE CHANGE
FRANK G. SADOWSKI and ALLEN H. WATKINS (USGS, EROS Data Center, Sioux Falls, SD) IN: 1991 ACSM-ASPRS Annual Convention, Baltimore, MD, Mar. 25-29, 1991, Technical Papers. Vol. 3 1991 8 p
Copyright
The U.S. Geological Survey has begun a major initiative to organize, produce, and distribute land data sets that will support the land data requirements of the global change science community. Satellite image data sets, produced from the National Oceanic and Atmospheric Administration's Advanced Very High Resolution Radiometer sensors, will be developed to provide repetitive, synoptic coverage of regional, continental, and global land areas. These data sets, integrated with related land data and supplemented by coregistered Landsat data sets, will enable scientists to quantify the fundamental land surface attributes that are needed to model land surface processes, to detect and monitor land surface change, and to map land cover. These well-structured, consistent land data sets will form the historical record of land observations prior to the era of the National Aeronautics and Space Administration's Earth Observing System sensors. Author

A92-39405
SATELLITE REMOTE SENSING OF LIMNOLOGICAL INDICATORS OF GLOBAL CHANGE
RANDOLPH H. WYNNE and THOMAS M. LILLESAND (Wisconsin, University, Madison) IN: 1991 ACSM-ASPRS Annual Convention, Baltimore, MD, Mar. 25-29, 1991, Technical Papers. Vol. 3 1991 10 p refs
Copyright
The paper examines the general hypothesis that large-scale and long-term trends in lake ice formation and breakup, along with changes in the optical properties of lakes, can serve as robust integrated measures of regional and global climate change. Recent variation in the periodicity of lake ice formation and breakup is investigated using the AVHRR aboard the NOAA/TIROS series of polar orbiting satellites. The study area consists of 44 lakes and reservoirs with a surface area of greater than 1000 hectares in Wisconsin. The utility of AVHRR for lake ice detection with high temporal resolution is demonstrated, the relationship between ice phenology and periodicity with lake morphometry for the lakes in the study is elucidated, and remotely sensed measures of ice periodicity are correlated with local and regional temperature trends. P.D.

A92-40951
INTERNATIONAL SYMPOSIUM ON REMOTE SENSING OF ENVIRONMENT, 24TH, RIO DE JANEIRO, BRAZIL, MAY 27-31, 1991, PROCEEDINGS. VOLS. 1 & 2
Symposium sponsored by Environmental Research Institute of Michigan, INPE, Society of Latin American Remote Sensing Specialists, et al. Ann Arbor, MI, Environmental Research Institute of Michigan, 1992, p. Vol. 1, 471 p.; vol. 2, 591 p. For individual items see A92-40952, A92-40953, A92-40955 to A92-41030. 1992 1062 p
Copyright
Papers are presented on such topics as the emergence of ecological awareness in society, the need for expanded environmental measurement capabilities in geosynchronous orbit, national forest inventories in Uruguay, the determination of low water line on Brazilian coasts by remote sensing, and agricultural crop area estimation in Sweden. Attention is also given to environmental conditions and change on the Amazon flood plain, the use of remote sensing for the monitoring of forest resources in Thailand, a global change data base using TM data, and microwave remote sensing for hydrological and agricultural monitoring. L.M.

A92-40952
DATA AND INFORMATION ACCESS FOR ANALYSIS OF GLOBAL ENVIRONMENTAL CHANGE
RICHARD C. CICONE and THOMAS M. PARRIS (Consortium for International Earth Science Information Network, Saginaw, MI) IN: International Symposium on Remote Sensing of Environment, 24th, Rio de Janeiro, Brazil, May 27-31, 1991, Proceedings. Vol. 1 1992 11 p refs
Copyright
Changes detected in earth's biogeochemical processes in recent years have resulted in an international scientific endeavor to understand earth as a system. Recent technological developments enable research in understanding global change. Remote sensing systems such as Landsat, SPOT and AVHRR laid the groundwork for synoptic earth observation studies, while meteorological systems such as GOES provided vital information related to global climate systems. In addition to measurement devices, advanced computing and electronic networking tools establish an information technology capacity to pursue global change research and model development using the extensive data collected by remote sensing devices. In this paper, data and

informative access mechanisms being developed to facilitate scientific query and analysis of global environmental change are examined. Author

A92-40953
THE NEAR-TERM SUITE OF SATELLITE SENSORS TO SUPPORT DEVELOPING COUNTRIES' CLIMATE AND GLOBAL CHANGE PROGRAMS
JOHN W. SHERMAN, III (NOAA, NESDIS, Washington, DC) IN: International Symposium on Remote Sensing of Environment, 24th, Rio de Janeiro, Brazil, May 27-31, 1991, Proceedings. Vol. 1 1992 13 p refs
Copyright
Since the first observations of the earth's environment from space using the Very High Resolution Radiometer (VHRR) on the NOAA-2 polar satellite in 1972, an evolution of visible and infrared observations has been continued on an operational basis by the National Oceanic and Atmospheric Administration (NOAA). After a brief review of the NOAA history of data acquisition for environmental data and information, the paper will provide an overview of the numerous new and improved sensors being developed by many nations in support of both continuing improvement in environmental data for day-to-day planning and addressing the urgently needed information required to determine the nature and extent of climate and global change. Author

A92-40981
REMOTE SENSING EARTH SURFACES TO ADDRESS GLOBAL CHANGE ISSUES - A REVIEW OF THE RESEARCH PROGRAMME OF THE INSTITUTE FOR REMOTE SENSING APPLICATIONS
R. KLERSY, J. P. MALINGREAU, and M. M. VERSTRAETE (CEC, Joint Research Centre, Ispra, Italy) IN: International Symposium on Remote Sensing of Environment, 24th, Rio de Janeiro, Brazil, May 27-31, 1991, Proceedings. Vol. 1 1992 9 p refs
Copyright
This paper discusses some of the potential contributions of remote sensing to the analysis of global change issues, particularly with respect to terrestrial surfaces. Specifically, it reports on the research program currently developed by the Institute for Remote Sensing Applications of the CEC Joint Research Centre. Research plans in three major fields of application are outlined: (1) the use of remote sensing for the quantitative description of land and ocean surfaces in climate models, (2) the development of operational approaches to the monitoring of global tropical forests, and (3) the detection of tropical biomass burning and the assessment of its impact in terms of greenhouse gas emissions. Research on the role of the oceans in the climate system is also briefly mentioned. The paper also describes the current approaches adopted by IRSA in the implementation of the data banks.
Author

A92-40998
AN URBAN HEAT ISLAND IN TROPICAL AREA INVESTIGATED BY REMOTE SENSING - BELO HORIZONTE CITY
BERNARD C. R. J. GASTELOIS (Minas Gerais, Fundacao Centro Tecnologico, Belo Horizonte, Brazil) and ELEONORA SAD DE ASSIS (Sao Paulo, Universidade, Brazil) IN: International Symposium on Remote Sensing of Environment, 24th, Rio de Janeiro, Brazil, May 27-31, 1991, Proceedings. Vol. 2 1992 14 p refs
Copyright
In order to guide urban planning in the control of urban environmental quality, specifically, as regards thermal comfort, a method was developed to evaluate the thermal behavior of built-up and urban green areas. The mean maximum temperature of the principal heat nuclei exceeds, in summer, the limit value of diurnal thermal comfort of the city climate according to Givoni's (1978) Bioclimatic Chart. During the day period, areas with a lower vegetation index, more density, and predominating horizontal settlements were the warmest. P.D.

A92-41010
NORMALIZED DIFFERENCE VEGETATION INDEX FOR THE SOUTH AMERICAN CONTINENT USED AS A CLIMATIC VARIABILITY INDICATOR
WILLIAM T. LIU, OSWALDO MASSAMBANI, and MARIO FESTA (Sao Paulo, Universidade, Brazil) IN: International Symposium on Remote Sensing of Environment, 24th, Rio de Janeiro, Brazil, May 27-31, 1991, Proceedings. Vol. 2 1992 11 p refs
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A92-41030
MULTITEMPORAL COMPOSITING OF SATELLITE DATA FOR IMPROVED GLOBAL CHANGE DETECTION
ALFREDO HUETE (Arizona, University, Tucson), A. CHEHBOUNI (CNES, Laboratoire d'Etudes et de Recherches en Teledetection Spatiale, Toulouse, France), and JIAGUO QI (Arizona, University, Tucson) IN: International Symposium on Remote Sensing of Environment, 24th, Rio de Janeiro, Brazil, May 27-31, 1991, Proceedings. Vol. 2 1992 14 p refs
Copyright
The maximum value compositing approach in satellite-based vegetation monitoring studies was critically examined as to its potential and limitations for global change studies of terrestrial productivity. Ground- and satellite-based bidirectional reflectance data were measured throughout the monsoon period at the Walnut Gulch Experimental Watershed in Arizona in order to measure the vegetation dynamics of the surface following major rainfall storm events. Changes resulting from vegetation growth and dynamics were then compared with variations due to atmosphere, view angle, sun angle, and soil condition. The weekly compositing scheme, based on the maximum normalized difference vegetation index transformation minimized atmosphere influences but was unable to account for view and sun angle effects. A multidirectional vegetation index, capable of minimizing angular and soil effects, is presented here as a method of improving compositing of temporal satellite data for more accurate assessment of vegetation activity.
Author

A92-41930
THE 1990 CONTERMINOUS U.S. AVHRR DATA SET
JEFFERY C. EIDENSHINK (TGS Technology, Inc.; USGS, EROS Data Center, Sioux Falls, SD) Photogrammetric Engineering and Remote Sensing (ISSN 0099-1112), vol. 58, no. 6, June 1992, p. 809-813. Jun. 1992 5 p refs
(Contract USGS-14-08-0001-22521)
Copyright
The U.S. Geological Survey, using NOAA-11 Advanced Very High Resolution Radiometer (AVHRR) 1-km data, has produced a time series of 19 biweekly maximum normalized difference vegetation index (NDVI) composites of the conterminous United States for the 1990 growing season. Each biweekly composite included data from approximately 20 calibrated and georegistered daily overpasses. The output is a data set which includes all five calibrated AVHRR channels, NDVI values, three satellite/solar viewing angles, and date of observation pointer for each biweekly composite. The data set is intended for assessing seasonal variations in vegetation condition and provides a foundation for studying long-term changes in vegetation resulting from human interactions or global climate alterations. Author

A92-42287* National Aeronautics and Space Administration, Washington, DC.
UPSCALE INTEGRATION OF NORMALIZED DIFFERENCE VEGETATION INDEX - THE PROBLEM OF SPATIAL HETEROGENEITY
ANGORA AMAN (Universite Nationale de Cote d'Ivoire, Abidjan, Ivory Coast), HEREMINO P. RANDRIAMANANTENA (Laboratoire d'Etudes et de Recherches en Teledetection Spatiale, Toulouse, France), ALAIN PODAIRE (CNES, Toulouse, France), and ROBERT FROUIN (Scripps Institution of Oceanography, La Jolla, CA) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. 30, no. 2, March 1992, p. 326-338. Research supported by CNES, CNRS, University of California, and Ministere

de la Recherche Scientifique of Ivory Coast. Mar. 1992 13 p refs
(Contract NAGW-1968)
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An analysis is conducted of the correspondence between the normalized difference vegetation index (NDVI) calculated from average reflectances, or M(NDVI), and the I(NDVI) that is integrated from individual NDVIs, by simulating AVHRR data from high spatial resolution SPOT 1 radiometer and Landsat TM data. The West African and French sites analyzed at 300-1000 m scale show a strong correlation between the two types of index; the relationship is almost perfectly linear, with a slope that is somewhat dependent on vegetation cover. Effecting the scale change using M(NDVI) instead of I(NDVI) does not introduce significant errors. O.C.

A92-45869
ANALYZING VEGETATION DYNAMICS OF LAND SYSTEMS WITH SATELLITE DATA
JEFFREY C. EIDENSHINK and ROBERT H. HAAS (TGS Technology, Inc., Sioux Falls, SD) Geocarto International (ISSN 1010-6049), vol. 7, no. 1, March 1992, p. 53-61. Mar. 1992 9 p refs
(Contract USGS-14-08-0001-22521)
Copyright

National Oceanic and Atmospheric Administration weather satellite data were used to conduct a biweekly assessment of vegetation conditions in 17 western countries. The AVHRR data were acquired daily and geographically registered, and NDVI was computed for the western United States during the 1989 growing season. Major land resource areas (MLRAs) were evaluated as an appropriate stratification for monitoring vegetation conditions using biweekly NGVI data sets. Assessments of the NDVI are found to be adequate for monitoring seasonal growth patterns on MLRAs where rangelands, forests, or cultivated agriculture are the primary resource type. Descriptive statistics are indicators of the uniformity or diversity of land use and land cover within an MLRA. O.G.

A92-53732
APPLICATIONS OF MOS-1 DATA TO EARTH ENVIRONMENT MONITORING AND FUTURE GLOBAL CHANGE MONITORING SYSTEM
KOREHIRO MAEDA (NASDA, Earth Observation Center, Hatoyama, Japan) and HIDEO SATOH IN: International Symposium on Space Technology and Science, 17th, Tokyo, Japan, May 20-25, 1990, Proceedings. Vol. 2 1990 7 p refs
Copyright

The first Japanese earth observation satellite MOS-1 (Marine Observation satellite-1) was launched on Feb. 19, 1987 and MOS-1b was launched on Feb. 7, 1990. By using MOS-1 and MOS-1b, the MOS-1 observation system will contribute to the monitoring of the environment of the earth. In this paper, earth environment monitoring items are classified into three categories (ocean, land and atmosphere) and examples of applications are presented. A future earth monitoring system is presented in view of MOS-1 results. Author

A92-56719
DETERMINATION OF LAND SURFACE SPECTRAL REFLECTANCES USING METEOSAT AND NOAA/AVHRR SHORTWAVE CHANNEL DATA
O. ARINO, G. DEDIEU, and P. Y. DESCHAMPS (Laboratoire d'Etudes et de Recherches en Teledetection Spatiale, Toulouse, France) International Journal of Remote Sensing (ISSN 0143-1161), vol. 13, no. 12, Aug. 1992, p. 2263-2287. Research supported by CNES, CNRS, and Ministere de la Recherche et de la Technologie. Aug. 1992 25 p refs
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A method to derive surface spectral reflectances from currently available Meteosat geostationary and NOAA/AVHRR polar orbiting satellite data is described. Broadband reflectance was derived from Meteosat measurements while NOAA/AVHRR vegetation index provided a spectral weighting which enabled the spectral reflectances on either side of 0.7 micron to be estimated. The method takes into account satellite calibrations, viewing geometry, and correction of some atmospheric effects. Conversion from narrow-band to broad-band reflectances is discussed. The method was applied to a month of data to obtain the surface spectral reflectances of Africa which are compared with some data sets used by climate modelers, in order to assess them and to monitor their seasonal and interannual changes on a global scale. Author

N92-11393*# International Space Univ., Inc., Cambridge, MA.
INTERNATIONAL PROGRAM FOR EARTH OBSERVATIONS Final Report
1990 604 p Presented at the Summer Session of the Inst. for Space and Terrestrial Science, Toronto, Ontario, 1990
(Contract NAG5-1469)
(NASA-CR-188799; NAS 1.26:188799) Copyright

During the 1990 summer session of the International Space University, graduate students of many different countries and with various academic backgrounds carried out a design project that focused on how to meet the most pressing environmental information requirements of the 1990's. The International Program for Earth Observations (IPEO) is the result of the students labor. The IPEO report examines the legal and institutional, scientific, engineering and systems, financial and economic, and market development approaches needed to improve international earth observations and information systems to deal with environmental issues of global importance. The IPEO scenario is based on the production of a group of lightweight satellites to be used in global remote sensing programs. The design and function of the satellite is described in detail. M.G.

N92-11551# Colorado Univ., Boulder. Center for the Study of Earth from Space.
A CONCEPTUAL FRAMEWORK FOR ECOSYSTEM MODELING USING REMOTELY SENSED INPUTS
CAROL A. WESSMAN (Colorado Univ., Boulder.), BRIAN CURTISS (Colorado Univ., Boulder.), BO-CAI GAO (Colorado Univ., Boulder.), and SUSAN L. USTIN (California Univ., Davis.) *In* ESA, Physical *Measurements and Signatures in Remote Sensing, Volume 2* p 777-782 May 1991
Copyright Avail: CASI HC A02/MF A03; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 150 Dutch guilders (2 vols)

Ecosystem models utilizing input parameters obtained from remote sensing measurements will improve the simulation of ecosystem dynamics in ths spatial domain and provide the means to describe and monitor the state of the biosphere at regional to global scales. Landscape processes affecting remote sensing data occur at a range of spatial and temporal scales. Thus, ecosystem models utilizing remote sensing inputs must be parameterized not only on leaf scale properties, but also on canopy properties that are modulated at much larger scales. It is only through the modeling of both large and small scale canopy properties that ecosystem parameters can be accurately inferred. A conceptual framework that allows the analysis of ecosystem processes using models that rely on new physical parameters to be derived from the suite of instruments available on the Earth Observing System and other proposed remote sensing platforms is presented. ESA

N92-11555*# National Aeronautics and Space Administration, Washington, DC.
SPACE OBSERVATIONS FOR GLOBAL CHANGE Abstract Only
S. I. RASOOL *In* ESA, Physical Measurements and Signatures in Remote Sensing, Volume 2 p 805 May 1991
Copyright Avail: CASI HC A01/MF A03; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 150 Dutch guilders (2 vols)

There is now compelling evidence that man's activities are changing both the composition of the atmospheric and the global landscape quite drastically. The consequences of these changes on the global climate of the 21st century is currently a hotly debated subject. Global models of a coupled Earth-ocean-atmosphere system are still very primitive and progress in this area appears

largely data limited, specially over the global biosphere. A concerted effort on monitoring biospheric functions on scales from pixels to global and days to decades needs to be coordinated on an international scale in order to address the questions related to global change. An international program of space observations and ground research was described. ESA

N92-11556# California Univ., Santa Barbara. Center for Remote Sensing and Environmental Optics.
LOOKING AHEAD TO EOS: UPDATE ON NASA'S EARTH OBSERVING PROGRAM Abstract Only
JEFF DOZIER *In* ESA, Physical Measurements and Signatures in Remote Sensing, Volume 2 p 807 May 1991
Copyright Avail: CASI HC A01/MF A03; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 150 Dutch guilders (2 vols)

NASA's Earth Observing System (EOS) is a pivotal part of the U.S. Global Change Research Program, and hence of the international effort to understand global change and the increasing demands of human activity. EOS consists of a space based observing system, a Data and Information System (EOSDIS), and a scientific research program. The space component will consist of two series of polar orbiting platforms, the first scheduled for launch in late 1997 and followed by launches every 2 1/2 years, that will collect data for 15 years. EOS will be supplemented by European and Japanese platforms and continuing operational and commercial satellites. ESA

N92-15468*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
MICROWAVE SENSING TECHNOLOGY ISSUES RELATED TO A GLOBAL CHANGE TECHNOLOGY ARCHITECTURE TRADE STUDY
THOMAS G. CAMPBELL, JIM SHIUE, DENIS CONNOLLY, and KEN WOO (Jet Propulsion Lab., California Inst. of Tech., Pasadena.) *In its* Global Change Technology Architecture Trade Study p 181-186 Sep. 1991
Avail: CASI HC A01/MF A04

The objectives are to enable the development of lighter and less power consuming, high resolution microwave sensors which will operate at frequencies from 1 to 200 GHz. These systems will use large aperture antenna systems (both reflector and phased arrays) capable of wide scan angle, high polarization purity, and utilize sidelobe suppression techniques as required. Essentially, the success of this technology program will enable high resolution microwave radiometers from geostationary orbit, lightweight and more efficient radar systems from low Earth orbit, and eliminate mechanical scanning methods to the fullest extent possible; a main source of platform instability in large space systems. The Global Change Technology Initiative (GCTI) will develop technology which will enable the use of satellite systems for Earth observations on a global scale. Author

N92-15476*# Joint Inst. for Advancement of Flight Sciences, Hampton, VA.
PLOTS OF GROUND COVERAGE ACHIEVEABLE BY GLOBAL CHANGE MONITORING INSTRUMENTS AND SPACECRAFT
HEATHER R. KNIGHT and LYNDA FOERNSLER (Auburn Univ., AL.) *In* NASA. Langley Research Center, Global Change Technology Architecture Trade Study p 381-411 Sep. 1991
Avail: CASI HC A03/MF A04

Low Earth Orbit (LEO) and Geosynchronous Earth Orbit (GEO) satellite plots are given. All satellites are in an 800 km circular orbit at an inclination of 98.6 deg (sun synchronous). Specifics of the instrument package are given. Additionally, the time period of the plot and the percentage of the Earth covered during the time period are listed. Author

N92-16405 Waterloo Univ. (Ontario). Earth Observation Lab.
REMOTE SENSING AND HIGH-LATITUDE CLIMATE PROCESSES: STUDIES IN ATMOSPHERE-FLOATING ICE-OCEAN INTERACTION Abstract Only
DOUGLAS D. JOHNSON and ELLSWORTH F. LEDREW *In* New Brunswick Univ., Proceedings of the Thirteenth Canadian Symposium on Remote Sensing p 239 Jul. 1990
Avail: Canadian Aeronautics and Space Inst., 222 Somerset St. W., Suite 601, Ottawa, Ontario K2P 0J1 Canada

The Earth Observation Lab at the University of Waterloo has developed a sea ice monitoring site project in the Lancaster Sound Region of the Northwest Territories. The short term goal of this project is to validate the relationship between sea ice geophysical parameters and information contained within remotely sensed imagery. Potential applications include information extraction for ship navigation, atmospheric proxy indicators, and sub-ice primary production. The long term goal is to develop the ability to link sea ice parameters to atmospheric variables which are required for measurement and monitoring of climate change. Polar ice regime is of great importance to the study and understanding of synoptic-scale processes in the context of polar climatology and ice forecasts. Satellite remote sensing, available from various sources, has been used to derive quantitative sea ice concentrations. This paper examines the application of such sea ice data products derived from remotely sensed data in the investigation of climate processes which operate in the high-latitude floating ice regime. CISTI

N92-16441 Maine Univ., Orono. Dept. of Surveying Engineering.
THE USE OF DIGITAL SATELLITE IMAGES FOR THE DETERMINATION OF GLACIAL VELOCITIES IN ANTARCTICA
DAVID R. STEINER and MANFRED EHLERS *In* New Brunswick Univ., Proceedings of the Thirteenth Canadian Symposium on Remote Sensing p 439-442 Jul. 1990
Avail: Canadian Aeronautics and Space Inst., 222 Somerset St. W., Suite 601, Ottawa, Ontario K2P 0J1 Canada

The study of flow dynamics in polar ice sheets has become increasingly important as a monitor of climate change. One of the primary parameters in the determination of the mass discharge of an ice sheet is the velocities of the glaciers and ice streams that transport ice to adjacent ice shelves and oceans. This paper describes the establishment of a digital database based on satellite images, acquired over time, to be used for monitoring the velocities of the ice flow. The area of study for this project is Byrd Glacier in East Antarctica. The images, acquired over a 10 year period, are registered and georeferenced using established ground control points. The images are enhanced and used to measure the movement of prominent surface features. The resulting database of digitally processed, time lapsed images provides a valuable source of information about glacial flow and ice sheet mass balance for use in global climate modeling. CISTI

N92-19635# Los Alamos National Lab., NM.
SMALL SATELLITE RADIOMETRIC MEASUREMENT SYSTEM
P. G. WEBER 1992 10 p Presented at the AIAA Space Programs and Technologies Conference, Huntsville, AL, 24-27 Mar. 1992
(Contract W-7405-ENG-36)
(DE92-004572; LA-UR-91-4169; CONF-920373-1) Avail: CASI HC A02/MF A01

A critical need for the U.S. Global Change Research Program is to provide continuous, well-calibrated radiometric data for the earth's radiation budget. This paper describes a new, compact, relatively light-weight, adaptable radiometer which will provide both spectrally integrated measurements and data in selected spectral bands. The radiometer design is suitable for use on small satellites, aircraft, or remotely piloted aircraft (RPA's). An example of the implementation of this radiometer on a small satellite is given. Significant benefits derive from simultaneous measurements of specific narrow (in wavelength) spectral features; such data may be obtained by combining LARI with a compact spectrometer on the same platform. Well-chosen satellite orbits allow one to use data from other satellites (e.g., DMSP) to enhance the data product, or to provide superior coverage of specific locations. DOE

N92-22832# European Space Agency, Paris (France).
BACKGROUND MATERIAL: INTRODUCTION
P. GOLDSMITH *In its* Report of the Earth Observation User

Consultation Meeting p 61-68 Oct. 1991 Original contains color illustrations
Copyright Avail: CASI HC A02/MF A03; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 75 Dutch guilders

Through consulting the wider user/scientific community, progress made in the ESA's Long Term Program for Earth Observation is reviewed and an attempt to ensure that the program meets updated user requirements is made. The progress review covered ERS-1 and ERS-2, the Earth Observation Preparatory Program (EOPP), the Polar Platform Program, Artistoteles, the Solid Earth mission, and Metosat Second Generation. The modularity of the Polar Platform is discussed, and the candidate payload instruments for the first Polar Mission (EPOP-MI) are listed. The need to agree on topics that must be addressed and the role of spaceborne instrumentation within the fields of environment resource management, solid Earth, and meteorology was stressed. ESA

N92-22847# Ludwig-Maximilians-Univ., Munich (Germany). Inst. fuer Meteorologie.
LAND TRANSFORMATION, LAND USE AND CARTOGRAPHY: LAND-SURFACE TRANSFORMATION PROCESSES
H. J. BOLLE *In* ESA, Report of the Earth Observation User Consultation Meeting p 181-192 Oct. 1991
Copyright Avail: CASI HC A03/MF A03; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 75 Dutch guilders

The need for global data sets derived from observations in space is clearly apparent. Attempts have been made on a more or less experimental basis to compile global data sets which are generally not validated to the degree necessary to meet the very stringent specifications for global change studies. The production of these data sets needs to be confirmed, but with a more solid basis that guarantees continuity in time, validation, permanent quality control and easy accessibility. Steps that would help to reach this goal range from workshops (to compare and select algorithms), to mesoscale field experiments (to validate the information derived from the data), the establishment of research centers dealing with the controlled production and documentation of the final products. The International Geosphere Biosphere Program (IGBP) provides the framework for the very substantial effort that is necessary to reach this goal, and Europe should participate at an early stage at a level appropriate to its high scientific standards. ESA

N92-22851# Technische Univ., Delft (Netherlands).
SOLID EARTH FROM SPACE: GRAVITY FIELD, MARINE GEOID AND PRECISE POSITIONING. INTRODUCTION
R. RUMMEL *In* ESA, Report of the Earth Observation User Consultation Meeting p 214-219 Oct. 1991
Copyright Avail: CASI HC A02/MF A03; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 75 Dutch guilders

The ESA solid Earth program is considered. The necessity of research from space is discussed. The priorities of the solid Earth program of NASA (Earth's rotation, plate and intraplate tectonics) and the ESA (geopotential fields, and oceanic circulation and climate changes) are presented. The scientific rationale behind the following are considered: geopotential field, geodesy, geodynamics, oceanography, sea level rise and climatology, time variations of gravity field, and ice/ocean/land surface monitoring. The highest priority of the ESA short term is the improvement on current knowledge of the global geopotential fields, gravity and magnetism. This will be achieved by the Aristoteles mission of which details are given. The medium term program is directed towards the development of new sensors required for improved: global geopotential determination, determination of its variations with time, and monitoring of ocean/ice/land surface dynamics. The latter are discussed. ESA

N92-26746# Centre National d'Etudes Spatiales, Paris (France).
FRENCH SPACE PROGRAMMES RELATED TO GLOBAL CHANGE
A. RATIER and J. L. FELLOUS *In* NASDA, International Conference on Japanese Earth Observation Programs: Plenary Session p 65-78 29 Oct. 1990
Avail: CASI HC A03/MF A02

Presented in viewgraph format, current status and future plans of French national earth observation programs were outlined. Topics addressed include: outlines of CNES (Centre National d'Etudes Spatiales) Science Prospective Seminars; DORIS Tracking System; TOPEX/POSEIDON satellite; SPOT satellites; BEST (Tropical System Energy Budget) satellite; GLOBSAT satellite; ScaRaB; Balloon-borne instruments; and data systems.
Author (NASDA)

N92-26748# Canada Centre for Remote Sensing, Ottawa (Ontario).
ENVIRONMENTAL PROJECTS AT THE CANADA CENTRE FOR REMOTE SENSING
R. ONEIL *In* NASDA, International Conference on Japanese Earth Observation Programs: Plenary Session p 91-97 29 Oct. 1990
Avail: CASI HC A02/MF A02

Presented in viewgraph format, current status and future plans of environmental projects at the CCRS (Canada Centre for Remote Sensing) were outlined. Topics addressed include: land cover change project; global change encyclopedia; boreal forest experiment (BORIAS); Northern Biosphere Observation and Modelling Experiment (NBIOME); Cryospheric Systems (CRYSYS); GC (Global-Change) NET; ISY (International Space Year) project; Joint Global Oceans Flux Study (JGOFS); World Ocean Circulation Experiment (WOCE); Global Energy and Water Experiment (GEWEX); and Northern Wetlands Project. Author (NASDA)

N92-26781 Colorado Univ., Boulder.
THE EFFECT OF GLOBAL CHANGE AND LONG PERIOD TIDES ON THE EARTH'S ROTATION AND GRAVITATIONAL POTENTIAL Ph.D. Thesis
ANDREW SETH TRUPIN 1991 224 p
Avail: Univ. Microfilms Order No. DA9132625

The effects of a possible global warming, in particular the rising sea level and melting glaciers, has been a topic of great interest. The attempt here is to quantify the effect these changes and long period ocean tides have on the Earth's rotation and gravity. Global averages of tide gauge data, after correcting for the effects of post glacial rebound on individual station records, reveal an increase in sea level for the years 1900-1979, of between 1.5 and 2.0 mm/yr. The global response of sea level to atmospheric pressure is found to be inverted barometer at periods greater than two months. Tide gauge data are fitted to numerically generated tidal data to show that the 18.6 year lunar nodal tide and 14.3 month pole tide have amplitudes and phases that are consistent with a global equilibrium response. The large coherence at 437 days between pressure and sea level in the North Sea, Baltic Sea and the Gulf of Bothnia may be due to meteorological forcing. The effects on the Earth's rotation and gravitational potential due to changes in annual mass balance for 85 glaciers in 13 mountain glacier systems for the years 1965-1984 are generally at or below detectable limits, but the contribution to sea level rise for these glaciers is 0.14 mm/year. Gridded accumulation data for the Antarctic ice sheet and for the Greenland ice sheet are used along with estimates of the rate of discharge from the ice sheets to estimate the contributions these two regions make to the Earth's gravity and rotation. The Antarctic contribution to the gravitational signal and to the displacement of the solid earth are found to be within the limits of detection by satellites. The secular trends in the X and Y-components of observed polar motion excitation agree well with the Antarctic contributions, for a model where the interior portions of the ice sheet undergo thinning and the coastal regions thicken. Changes in polar or glacial ice do not agree well with observed changes in the length of day during the last 80 years. Dissert. Abstr.

N92-28834# Los Alamos National Lab., NM.
A NEW RADIOMETER FOR EARTH RADIATION BUDGET STUDIES

P. G. WEBER 1992 4 p Presented at the 1992 International Geoscience and Remote Sensing Symposium, Houston, TX, 26-29 May 1992
(Contract W-7405-ENG-36)
(DE92-011267; LA-UR-92-764; CONF-9205136-1) Avail: CASI HC A01/MF A01

A critical need for the US Global Change Research Program is to provide continuous, well-calibrated radiometric data for radiation balance studies. This paper describes a new, compact, relatively light-weight, adaptable radiometer which will provide both spectrally integrated measurements and data in selected spectral bands. The radiometer design is suitable for use on (small) satellites, aircraft, or Unmanned Aerospace Vehicles (UAVs). Some considerations for the implementation of this radiometer on a small satellite are given. DOE

N92-29442*# National Aeronautics and Space Administration, Washington, DC.
EOS DATA AND INFORMATION SYSTEM (EOSDIS)
May 1992 36 p Original contains color illustrations
(NASA-TM-107922; NAS 1.15:107922) Avail: CASI HC A03/MF A01; 4 functional color pages

In the past decade, science and technology have reached levels that permit assessments of global environmental change. Scientific success in understanding global environmental change depends on integration and management of numerous data sources. The Global Change Data and Information System (GCDIS) must provide for the management of data, information dissemination, and technology transfer. The Earth Observing System Data and Information System (EOSDIS) is NASA's portion of this global change information system. H.A.

N92-30017# Committee on Commerce, Science, and Transportation (U.S. Senate).
NASA'S EARTH OBSERVING SYSTEM
Washington GAO 1992 87 p
(S-HRG-102-647; GPO-55-802CC; ISBN-0-16-038754-X) Avail: CASI HCA05/MFA01; Subcommittee on Science, Technology, and Space, Senate, Washington DC 20515 HC

The U.S. Senate, Subcommittee on Science, Technology, and Space of the Committee on Commerce, Science, and Transportation met on February 26, 1992 to discuss NASA's Mission to Planet Earth and within that mission, the Earth Observing System (EOS). Questions were asked by Senators Gore and Pressler to various scientists about the EOS's mission capabilities, present status, and budgetary needs. H.A.

N92-33738# General Accounting Office, Washington, DC. National Security and International Affairs Div.
NASA: CHANGES TO THE SCOPE, SCHEDULE, AND ESTIMATED COST OF THE EARTH OBSERVING SYSTEM. REPORT TO THE CHAIR, GOVERNMENT ACTIVITIES AND TRANSPORTATION SUBCOMMITTEE, COMMITTEE ON GOVERNMENT OPERATIONS, HOUSE OF REPRESENTATIVES
22 Jul. 1992 24 p
(GAO/NSIAD-92-223; B-248634) Avail: CASI HC A03/MF A01; GAO, PO Box 6015, Gaithersburg, MD 20877 HC

Congress funded the Earth Observing System (EOS) as a new NASA program beginning in fiscal year 1991. NASA proposed to launch about 30 types of earth observing instruments beginning in 1998. These instruments were intended to improve satellite data about the earth and to provide new data to support interdisciplinary studies of the earth. EOS is seen by NASA as the first step toward a future period of space-based scientific observation of the earth. The program is directly linked to the objectives of the U.S. Global Change Research Program and international efforts to observe and study the earth. The U.S. Global Change Research Program, which is funded by 11 agencies, is an attempt to achieve these objectives and to improve predictions of climate and other forms of global change. Within that program, EOS is intended to significantly improve scientists' abilities to model, and thereby predict, broad natural relationships among the sea, land, and atmosphere; to observe how water, carbon, and other substances move on the planet or are affected by variations in the sun's radiation; and to assess the impact of human activities on the earth's climate. Ultimately, EOS is to help determine the extent to which human activities are affecting the earth's environment and to provide policymakers with the information they will need to preserve the earth. Author

44

ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells; global sources of energy; geophysical conversion; and windpower.

A92-20360
SOLAR POWER SATELLITES - ENERGY SOURCE FOR THE GREENHOUSE CENTURY?
MARTIN I. HOFFERT, SETH D. POTTER, MURALI N. KADIRAMANGALAM, and FRANCESCO TUBIELLO (New York University, NY) (Societe des Electriciens et des Electroniciens, Societe des Ingenieurs et Scientifiques de France, and AIAA, Meeting on Power from Space '91, Ecole Superieure d'Electricite, Gif-sur-Yvette, France, Apr. 11-13, 1991) Space Power - Resources, Manufacturing and Development (ISSN 0883-6272), vol. 10, no. 2, 1991, p. 131-151. 1991 21 p refs
Copyright

Energy is needed to produce wealth, and an increasing world population needs increasing amounts of energy to improve its standard of living. Through the use of a carbon-cycle model, it is shown that continued reliance on fossil fuels causes a global greenhouse warming. An energy-CO2-economics model is used to project future demand for fossil-fuel-generated energy. When this demand is compared with the fossil-fuel use that is permissible if a global warming is to be avoided, a shortfall in energy becomes evident. Terrestrial photovoltaics, nuclear fission, nuclear fusion, and the Solar Power Satellite (SPS) are examined as means of making up this energy shortfall. On comparing these technologies, the SPS appears to be the most feasible means of providing the required energy ad preventing a global warming. Laser, 2.45-GHz, and 35-GHz SPS technologies are intercompared, and results indicate that the 2.45-GHz technology remains the most feasible SPS option. Author

A92-20362
PROJECT PHOENIX - CONFRONTING GLOBAL WARMING WITH SOLAR POWER
CHARLES L. OWEN (Illinois Institute of Technology, Chicago) (Societe des Electriciens et des Electroniciens, Societe des Ingenieurs et Scientifiques de France, and AIAA, Meeting on Power from Space '91, Ecole Superieure d'Electricite, Gif-sur-Yvette, France, Apr. 11-13, 1991) Space Power - Resources, Manufacturing and Development (ISSN 0883-6272), vol. 10, no. 2, 1991, p. 157-184. 1991 28 p refs
Copyright

Project Phoenix is a design proposal for a combination of projects to combat global warming. In this paper, one of these is explained - a plan for solar power satellites to reduce dependence on fossil fuels. In the plan, the moon is the prime source of functional and structural materials. Large, 10-gigawatt, double-cone satellites 9.25 kilometers in diameter are constructed in lunar orbit and towed to geosynchronous orbit. Author

A92-27650
INTERNATIONAL PHOTOVOLTAIC SCIENCE AND ENGINEERING CONFERENCE, 5TH, KYOTO, JAPAN, NOV. 26-30, 1990, TECHNICAL DIGEST
Conference sponsored by Japan Society of Applied Physics, Institute of Electrical Engineers of Japan, Agency of Industrial Science and Technology, et al. Kyoto, Japan, International

PVSEC-5, 1990, 1072 p. No individual items are abstracted in this volume. 1990 1072 p

The present conference on photovoltaic science and engineering encompasses amorphous silicon materials, compound solar cells, a national photovoltaic project, solar cells fabricated from polycrystalline silicon and amorphous silicon, the use of solar cells in space systems, photovoltaic systems components, and experience from field use of the systems. Specific issues addressed include the status of the U.S. National Photovoltaic Program, a novel p-type window material for amorphous silicon solar cells, low dislocation-density GaAs on Si for solar cells, the spin-cast process for Si solar cells, advances in a-Si:H alloy multijunction devices, and n-ZnO/p-MoSe2 heterojunction solar cells. Also addressed are polycrystalline photovoltaic silicon-ingot production, cells with large areas and high efficiency, a vacuum-evaporated CdS/CdTe solar cell, proton-irradiation damage in thin-film GaAs solar cells fabricated on Si substrates, and advanced power systems for the Space Station Freedom. C.C.S.

A92-29940#
A GROWTH PATH FOR THE EVOLUTION OF THE SOLAR POWER SATELLITE
P. E. GLASER (Arthur D. Little, Inc., Cambridge, MA) IN: AIAA International Communication Satellite Systems Conference and Exhibit, 14th, Washington, DC, Mar. 22-26, 1992, Technical Papers. Pt. 3 1992 4 p refs
(AIAA PAPER 92-2022) Copyright

A brief assessment of the need for a solar power satellite (SPS) is presented. The technology options are indicated, the evolution of an SPS is outlined, and a growth path for development of an SPS is considered. C.D.

A92-40401
SPS 91 - POWER FROM SPACE; PROCEEDINGS OF THE 2ND INTERNATIONAL SYMPOSIUM, ECOLE SUPERIEURE D'ELECTRICITE, GIF-SUR-YVETTE, FRANCE, AUG. 27-30, 1991
Symposium supported by Alenia Spazio S.p.A., CNRS, AIAA, et al. Paris, Societe des Electriciens et des Electroniciens and Societe des Ingenieurs et Scientifiques de France, 1991, 641 p. In English and French. For individual items see A92-40402 to A92-40408, A92-40410 to A92-40422, A92-20424 to A92-40461, A92-40463 to A92-40481, A92-40483 to A92-40487. 1991 641 p
Copyright

Various papers on the concept of Solar Power Satellites (SPS) are presented. The general topics addressed include: global energy issues; SPS demonstration projects; extraterrestrial materials; power generation, conversion, and storage; environmental issues; development strategies. C.D.

A92-40402
SPS AND THE NEXT CENTURY
THIERRY GAUDIN (Ministere de la Recherche et de la Technologie, Paris, France) IN: SPS 91 - Power from space; Proceedings of the 2nd International Symposium, Gif-sur-Yvette, France, Aug. 27-30, 1991 1991 4 p

The main problems regarding demography, food supply, raw materials, and energy that the world will face in the 21st century are briefly discussed. The general approaches that need to be taken to address these challenges are summarized. The possible role played therein by Solar Power Satellites (SPS) is briefly considered. C.D.

A92-40407
SATELLITE POWER SYSTEMS - PROMISE AND PERSPECTIVE
A. R. MARTIN (AEA Technology, Culham Laboratory, Abingdon, England) IN: SPS 91 - Power from space; Proceedings of the 2nd International Symposium, Gif-sur-Yvette, France, Aug. 27-30, 1991 1991 6 p refs

The future energy requirements of the earth and the problems and possibilities associated with energy generation for the future are briefly discussed. The main trends and ultimate requirements are emphasized, and the use of satellite power systems with the potential to provide an inexhaustible source of clean safe energy is discussed in this context. C.D.

N92-10584# Helsinki Univ. of Technology, Espoo (Finland). Dept. of Technical Physics.
SOLAR ENERGY IN MITIGATING GLOBAL ENVIRONMENTAL PROBLEMS Abstract Only
P. D. LUND *In* Oulu Univ., Proceedings of the 25th Annual Conference of the Finnish Physical Society 1 p 1991
Avail: CASI HC A01/MF A03

The potential of solar energy is discussed. Solar energy is an inherently clean energy source and may thus have an important contribution in mitigating global environmental problems. For global climate change questions with a strong coupling with the growing energy demands of the less developed countries situated around the Sun belt region, solar energy offers also an interesting future possibility. ESA

N92-16476# Sandia National Labs., Albuquerque, NM.
WIND POWER: THE NEW ENERGY POLICY 1
Oct. 1991 51 p
(Contract DE-AC04-76DP-00789)
(DE92-002792; ALS/91-022) Avail: CASI HC A04/MF A01

Increasing use of renewable energy sources is an important aspect of the new energy policy of the State government of Schleswig-Holstein. Technical and industrial innovation are involved. By expanding and developing these regionally available inexhaustible energy sources to generate electricity and heat, we are contributing to environmental protection and helping to reduce adverse affects on the climate. We are also taking our limited resources into account and expanding energy generation in a logical manner. Wind energy is the most attractive renewable energy source for Schleswig-Holstein because our State is well known for its strong winds and constant fresh breeze. For this reason the State government has made expansion of wind energy one of its primary areas of emphasis. The goals of our promotion measures includes ongoing technical and engineering development of wind energy facilities, increasing the level of use of the wind, and increasing the percentage of wind energy used for power generation. This brochure is intended to demonstrate the significance and possibilities of wind energy for our State, to outline the legal requirements for erecting wind energy facilities, and to explain the many promotion measures. It represents a favorable breeze for wind. DOE

45

ENVIRONMENT POLLUTION

Includes atmospheric, noise, thermal, and water pollution.

A92-14175
CALCULATING FUTURE ATMOSPHERIC CO2 CONCENTRATIONS
I. G. ENTING (CSIRO, Div. of Atmospheric Research, Mordilloc, Australia) Mordialloc, Australia, Commonwealth Scientific and Industrial Research Organisation (CSIRO, Div. of Atmospheric Research, Technical Paper. No. 22), 1991, 34 p. 1991 34 p refs
Copyright

Current methods for calculating the future atmospheric CO2 concentrations to be expected from various possible patterns of future CO2 release are presented. Attention is given to the calculations in the International Panel on Climatic Change (IPCC, 1990) report that were obtained utilizing a modified box-diffusion model. Results showing the CO2 concentrations expected from an adoption of the 'Toronto' target of a 20 percent reduction in CO2 emissions by the year 2005 are described. R.E.P.

A92-14644* Environmental Protection Agency, Washington, DC.
METHANE ON THE GREENHOUSE AGENDA
KATHLEEN B. HOGAN, JOHN S. HOFFMAN (EPA, Office of Air and Radiation, Washington, DC), and ANNE M. THOMPSON (NASA, Goddard Space Flight Center, Greenbelt, MD) Nature (ISSN 0028-0836), vol. 354, Nov. 21, 1991, p. 181, 182. 21 Nov. 1991 2 p refs
Copyright

Options for reducing methane emissions, which could have a significant effect on global warming, are addressed. Emissions from landfills, coal mining, oil and natural gas systems, ruminants, animal wastes and wastewater, rice cultivation, and biomass burning are considered. Methods for implementing these emission reductions are discussed. C.D.

A92-17735
PRESENT AND FUTURE CFC AND OTHER TRACE GAS WARMING - RESULTS FROM A SEASONAL CLIMATE MODEL
D. A. HAUGLUSTAINE (CNRS, Service d'Aeronomie, Paris, France) and J.-C. GERARD (Liege, Universite, Belgium) Annales Geophysicae (ISSN 0939-4176), vol. 9, Sept. 1991, p. 571-587. Research supported by FNRS. Sep. 1991 17 p refs
(Contract CEC-B/87000569)
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Equilibrium and transient warming due to the accumulation of atmospheric trace gases is investigated and compared using a seasonal 1.5D energy-balance climate model. In particular, the relative importance of temperature increase due to CFCs during the next century is examined on the basis of estimated future emission. The capability of the model to simulate the present climate is illustrated. The response of the climatic system to the increase in greenhouse trace gases (CO2, CH4, N2O, and the eight major CFCs) since 1850 and projected to the year 2050 is simulated. Total surface temperature increases are 1.57 and 3.70 C, respectively, for transient and equilibrium warming in 2050. It is shown that CO2 makes and will continue to make a major contribution - more than 60 percent of the total warming. The contribution of CFCs may reach more than 10 percent in 2050, with minor CFCs accounting for an important part of this contribution. A reduction of CFC emissions may decrease the total warming by more than 5 percent in 2050. C.A.B.

A92-19193
IMPACT OF AIRCRAFT AND SURFACE EMISSIONS OF NITROGEN OXIDES ON TROPOSPHERIC OZONE AND GLOBAL WARMING
COLIN JOHNSON, JIM HENSHAW (Harwell Laboratory, Didcot, England), and GORDON MCINNES (Warren Spring Laboratory, Stevenage, England) Nature (ISSN 0028-0836), vol. 355, Jan. 2, 1992, p. 69-71. Research supported by CEC and Department of Environment of England. 2 Jan. 1992 3 p refs
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Tropospheric ozone, in addition to being toxic to living organisms, is a greenhouse gas. Radiative forcing of surface temperature is most sensitive to tropospheric ozone changes at about 12-km altitude, where aircraft NO(x) emissions are greatest and ozone model sensitivity to NO(x) is enhanced. The present model indicates that radiative forcing of surface temperature is of the order of 30 times more sensitive to aircraft NO(x) emissions than to surface emissions. The global warming impact of surface NO(x) emissions-induced increases in tropospheric ozone is judged to have been overestimated by a factor of 5. O.C.

A92-20361* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
COUNTERMEASURES FOR MITIGATING THE EFFECTS OF GLOBAL ENVIRONMENT CHANGES
LYLE M. JENKINS (NASA, Johnson Space Center, Houston, TX) (Societe des Electriciens et des Electroniciens, Societe des Ingenieurs et Scientifiques de France, and AIAA, Meeting on Power from Space '91, Ecole Superieure d'Electricite, Gif-sur-Yvette, France, Apr. 11-13, 1991) Space Power - Resources, Manufacturing and Development (ISSN 0883-6272), vol. 10, no. 2, 1991, p. 153-156. 1991 4 p refs
Copyright

Environmental countermeasures for preventing the negative effects of global climate change and ozone depletion are discussed with special emphasis on the possibilities of space-based actions. Among the programs addressed are the Mission to Planet Earth, the Solar Power Satellite (and linkage to the Space Exploration Initiative), and proposed projects such as a lunar-based power generator that utilizes He-3 as a fusion fuel when combined with deuterium. The concept of regional working groups is proposed for initiating the programs for effective countermeasures. C.C.S.

A92-20648* Lawrence Livermore National Lab., CA.
FUTURE AIRCRAFT AND POTENTIAL EFFECTS ON STRATOSPHERIC OZONE AND CLIMATE
DOUGLAS E. KINNISON and DONALD J. WUEBBLES (Lawrence Livermore National Laboratory, Livermore, CA) IAF, International Astronautical Congress, 42nd, Montreal, Canada, Oct. 5-11, 1991. *13 p. Research supported by NASA.* *Oct. 1991 13 p refs*
(Contract W-7405-ENG-48)
(IAF PAPER 91-736) Copyright

Initial studies with LLNL models of global atmospheric chemical, radiative, and transport processes have indicated that substantial decreases in stratospheric ozone concentrations could result from emissions of NO(x) from aircraft flying in the stratosphere, depending on fleet size and magnitude of the engine emissions. These studies used homogeneous chemical reaction rates (e.g., gas-phase chemistry). Recent evidence indicates that reactions on particles in the stratosphere may be important. Heterogeneous chemical reactions convert NO(x) (NO and NO2) molecules to HNO3. This decreases the odd oxygen loss from the NO(x) catalytic cycle and increases the odd oxygen loss from the Cl(x) catalytic cycle. By including these heterogeneous reactions in the LLNL model, the relative partitioning of odd oxygen loss between these two families changes, with the result that emissions of NO(x) from proposed aircraft fleets flying in the stratosphere now increase ozone. Having these heterogeneous processes present also increases ozone concentration in the troposphere relative to gas-phase only chemistry calculations for emissions of NO(x) from subsonic aircraft. Author

A92-22072
INDIRECT CHEMICAL EFFECTS OF METHANE ON CLIMATE WARMING
JOS LELIEVELD and PAUL J. CRUTZEN (Max-Planck-Institut fuer Chemie, Mainz, Federal Republic of Germany) Nature (ISSN 0028-0836), vol. 355, Jan. 23, 1992, p. 339-342. 23 Jan. 1992 4 p refs
Copyright

It is shown here that the climate effects of methane's atmospheric chemistry have previously been overestimated, notably by the Intergovernmental Panel on Climate Change (IPCC), largely due to neglect of the height dependence of certain atmospheric radiative processes. Available estimates of fossil fuel-related leaks of methane are used to show that switching from coal and oil to natural gas as an energy source would reduce climate warming. A significant fraction of methane emissions cannot, however, be accounted for by known sources; should leakages from gas production and distribution be underestimated for some countries, then it might be unwise to switch to using natural gas. C.D.

A92-22348* Washington Univ., Seattle.
CLIMATE FORCING BY ANTHROPOGENIC AEROSOLS
R. J. CHARLSON (Washington, University, Seattle), S. E. SCHWARTZ (Brookhaven National Laboratory, Upton, NY), J. M. HALES (Pacific Northwest Laboratory, Richland, WA), R. D. CESS (New York, State University, Stony Brook), J. A. COAKLEY, JR. (Oregon State University, Corvallis), J. E. HANSEN (NASA, Goddard Institute for Space Studies, New York), and D. J. HOFMANN (NOAA, Climate Monitoring and Diagnostics Laboratory, Boulder, CO) Science (ISSN 0036-8075), vol. 255, Jan. 24, 1992, p. 423-430. Research supported by NOAA. 24 Jan. 1992 8 p

refs
(Contract DE-FG02-85ER-60314; DE-AC06-76RL-01830; DE-AC02-76CH-00016; NSF ATM-88-13825; NSF ATM-89-12669)
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Although long considered to be of marginal importance to global climate change, tropospheric aerosol contributes substantially to radiative forcing, and anthropogenic sulfate aerosol, in particular, has imposed a major perturbation to this forcing. Both the direct scattering of short-wavelength solar radiation and the modification of the shortwave reflective properties of clouds by sulfate aerosol particles increase planetary albedo, thereby exerting a cooling influence on the planet. Current climate forcing due to anthropogenic sulfate is estimated to be -1 to -2 watts per square meter, globally averaged. This perturbation is comparable in magnitude to current anthropogenic greenhouse gas forcing but opposite in sign. Thus, the aerosol forcing has likely offset global greenhouse warming to a substantial degree. However, differences in geographical and seasonal distributions of these forcings preclude any simple compensation. Aerosol effects must be taken into account in evaluating anthropogenic influences on past, current, and projected future climate and in formulating policy regarding controls on emission of greenhouse gases and sulfur dioxide. Resolution of such policy issues requires integrated research on the magnitude and geographical distribution of aerosol climate forcing and on the controlling chemical and physical processes. Author

A92-26105
THE RELATIONSHIP BETWEEN CLOUD DROPLET NUMBER CONCENTRATIONS AND ANTHROPOGENIC POLLUTION - OBSERVATIONS AND CLIMATIC IMPLICATIONS
W. R. LEAITCH, G. A. ISAAC, J. W. STRAPP, C. M. BANIC, and H. A. WIEBE (Atmospheric Environment Service, Downsview, Canada) Journal of Geophysical Research (ISSN 0148-0227), vol. 97, Feb. 20, 1992, p. 2463-2474. 20 Feb. 1992 12 p refs
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Sulfate concentration data are studied and compared to the corresponding data regarding cloud-droplet number concentrations (CDNC) to assess the CDNC/anthropogenic pollution relation. A total of 92 samples - with 85 that include CDNC measurements - are used to develop positive linear correlations between log (CDNC) and log (cloud-water sulfate concentration) in cumuliform and stratiform clouds. Liquid water content is examined, and the CDNC are determined for 'clean-air' conditions as well. The median CDNC is found to be 250/cu cm for all clouds and 20-250/cu cm and 170-370/cu cm for stratiform and cumuliform clouds, respectively. Clean-air clouds have a CDNC value of 160/cu cm which is 56 percent lower than the median for all clouds. These data demonstrate that the clean-air CDNC is different from the median CDNC, and the observations demonstrate the interrelated quality of pollution, cloud microphysics, and cloud albedo. C.C.S.

A92-26830
RADIATIVE FORCING OF CLIMATE FROM HALOCARBON-INDUCED GLOBAL STRATOSPHERIC OZONE LOSS
V. RAMASWAMY (Princeton University, NJ), M. D. SCHWARZKOPF (NOAA, Geophysical Fluid Dynamics Laboratory, Princeton, NJ), and K. P. SHINE (Reading, University, England) Nature (ISSN 0028-0836), vol. 355, Feb. 27, 1992, p. 810-812. Research supported by U.K. Joint Environmental Program of National Power and Power Generation. 27 Feb. 1992 3 p refs
Copyright

The radiative forcing of the surface-troposphere system due to the observed decadal ozone losses are determined and compared with that due to the increased concentrations of the other main radiatively active gases over the same time period. The results indicate that a significant negative radiative forcing results from ozone losses in middle to high latitudes, in contrast to the positive forcing at all latitudes caused by the CFCs and other gases. As the anthropogenic emission of CFCs and other halocarbons are thought to be largely responsible for the observed ozone depletions, these results suggest that the net decadal contribution of CFCs to the greenhouse climate forcing is substantially less than previously estimated. C.D.

A92-37637
GREENHOUSE GAS CONTRIBUTIONS FROM DEFORESTATION IN BRAZILIAN AMAZONIA
PHILIP M. FEARNSIDE (National Institute for Research in the Amazon, Amazonas, Brazil) IN: Global biomass burning - Atmospheric, climatic, and biospheric implications 1991 14 p
(Contract NSF ATM-86-0921)
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Deforestation in Brazilian Amazonia is presently judged to be already making a significant contribution to the greenhouse effect. Uncertainties regarding forest clearing rates, biomass, etc., are shown to be insignificant in light of several hypothetical examples. The contrast between the costs and the benefits of biomass burning and fossil fuel combustion are very significant on a per capita basis; the gulf between the costs and benefits of deforestation, relative to fossil fuel use, renders the slowing of forest loss an ideal matter for Brazil to target as the basis of global greenhouse warming contribution-reduction. O.C.

A92-37642
BIOMASS BURNING IN WEST AFRICAN SAVANNAS
JEAN-CLAUDE MENAUT, LUC ABBADIE (Ecole Normale Superieure, Paris, France), FRANCOIS LAVENU, PHILIPPE LOUDJANI, and ALAIN PODAIRE (Laboratoire d'Etudes et de Recherches en Teledetection Spatiale, Toulouse, France) IN: Global biomass burning - Atmospheric, climatic, and biospheric implications 1991 10 p
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The present investigation of the influence of West African savanna ecosystems on the regional climate in view of the amounts of such volatilized elements as C, N, and S that are annually released by brush fires into the atmosphere gives attention to (1) the location and extent of the fire, (2) the type of fire, (3) its burning efficiency, (4) its seasonal and geographic variations, and (5) the total greenhouse gas emissions from West Africa. The results for all quantities presently obtained are significantly lower than those recently published by Hao et al. (1989) and Hall and Scurlock (1990). O.C.

A92-37653
PARTICULATE AND TRACE GAS EMISSIONS FROM LARGE BIOMASS FIRES IN NORTH AMERICA
LAWRENCE F. RADKE, DEAN A. HEGG, PETER V. HOBBS, J. D. NANCE, JAMIE H. LYONS, KRISTA K. LAURSEN (Washington, University, Seattle), RAYMOND E. WEISS (Radiance Research, Seattle, WA), PHILLIP J. RIGGAN (USDA, Forest Service, Riverside, CA), and DAROLD E. WARD (USDA, Forest Service, Missoula, MT) IN: Global biomass burning - Atmospheric, climatic, and biospheric implications 1991 16 p
(Contract N00014-86-C-2246)
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Field studies of biomass burning have suggested that different amounts of particles and trace gases are generated as a result of a complex interplay between fuel types and conditions (prominently including moisture content), and the effects of meteorology, fuel spatial distribution, and fire scale and character. With respect to implications for global climate change, it is found that large biomass fires are often capped by cumulus clouds; when the cloud depth exceeds 2 km, a large fraction of smoke particles are scavenged by the capping cloud. Biomass burning may account for as much as 50 percent of global emissions of NH3. O.C.

A92-37657
THE MEASUREMENT OF TRACE EMISSIONS AND COMBUSTION CHARACTERISTICS FOR A MASS FIRE
RONALD A. SUSOTT, DAROLD E. WARD, RONALD E. BABBITT, and DON J. LATHAM (USDA, Forest Service, Missoula, MT) IN: Global biomass burning - Atmospheric, climatic, and biospheric

implications 1991 13 p
Copyright

The Fire Atmosphere Sampling System (FASS) has furnished detailed measurements of fire emissions during an intense mass fire, allowing consideration of the flaming and smoldering phases of large fires and temporal variations of emissions. Vertical airflow measurements, in conjunction with CO and CO2 concentrations, accurately reflect the mass flux of carbon that is released. The computer system employed by FASS allows numerous modifications to be implemented in order to accommodate various requirements. FASS is highly self-contained and can easily be transported to fires throughout the world. O.C.

A92-41716
IMPLICATIONS FOR CLIMATE AND SEA LEVEL OF REVISED IPCC EMISSIONS SCENARIOS
T. M. L. WIGLEY and S. C. B. RAPER (East Anglia, University, Norwich, England) Nature (ISSN 0028-0836), vol. 357, no. 6376, May 28, 1992, p. 293-300. Research supported by DOE, CEC, and Department of the Environment of England. 28 May 1992 8 p refs
Copyright

A new set of greenhouse gas emissions scenarios has been produced by the Intergovernmental Panel on Climate Change (IPCC). Incorporating these into models that also include the effects of CO2 fertilization, feedback from stratospheric ozone depletion and the radiative effects of sulphate aerosols yields new projections for radiative forcing of climate and for changes in global-mean temperature and sea level. Changes in temperature and sea level are predicted to be less severe than those estimated previously, but are still far beyond the limits of natural variability. Author

A92-41720
A SEQUENTIAL-DECISION STRATEGY FOR ABATING CLIMATE CHANGE
JAMES K. HAMMITT, ROBERT J. LEMPERT (Rand Corp., Santa Monica, CA), and MICHAEL E. SCHLESINGER (Illinois, University, Urbana) Nature (ISSN 0028-0836), vol. 357, no. 6376, May 28, 1992, p. 315-318. Research supported by Rand Corp., NSF, and DOE. 28 May 1992 4 p refs
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The effects of a sequential decision strategy to limit greenhouse-gas emissions are considered. The strategy consists of a near-term period during which either moderate emissions reductions or aggressive reductions are begun, and a subsequent long-term period during which a least-cost abatement policy is followed to limit global mean temperature change to an optimal target. For each policy, the global mean surface temperature change is calculated using a simple climate/ocean model for climate sensitivities of 4.5, 2.5, 1.5, and 0.5 C. The policy beginning with moderate reductions is less expensive than that with aggressive reductions if the optimal targets are greater than 2.9, 2.1, 1.5, and 0.9 C, respectively; otherwise, the aggressive-reductions policy is cheaper. It is suggested that this approach should assist in choosing realistic targets and in determining how best to implement emissions reductions in the short and long term. C.D.

A92-43797* National Aeronautics and Space Administration, Washington, DC.
EFFECTS OF AEROSOL FROM BIOMASS BURNING ON THE GLOBAL RADIATION BUDGET
JOYCE E. PENNER (Lawrence Livermore National Laboratory, Livermore, CA), ROBERT E. DICKINSON, and CHRISTINE A. O'NEILL (Arizona, University, Tucson) Science (ISSN 0036-8075), vol. 256, no. 5062, June 5, 1992, p. 1432-1434. 5 Jun. 1992 3 p refs
(Contract DE-FG02-91ER-61216; W-7405-ENG-48; NSF ATM-91-13163; NAGW-1827)
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An analysis is made of the likely contribution of smoke particles from biomass burning to the global radiation balance. These particles act to reflect solar radiation directly; they also can act as cloud condensation nuclei, increasing the reflectivity of clouds. Together these effects, although uncertain, may add up globally to a cooling effect as large as 2 watts per square meter, comparable to the estimated contribution to sulfate aerosols. Anthropogenic increases of smoke emission thus may have helped weaken the net greenhouse warming from anthropogenic trace gases. Author

A92-44748
GREENHOUSE WARMING OVER INDIAN SUB-CONTINENT
M. LAL and B. BHASKARAN (Indian Institute of Technology, New Delhi, India) Indian Academy of Sciences, Proceedings (Earth and Planetary Sciences) (ISSN 0253-4126), vol. 101, no. 1, March 1992, p. 13-25. Mar. 1992 13 p refs
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The distributions of temperature, rainfall, and soil moisture over the Indian subcontinent are presented for control and double CO2 experiments performed with the NCAR GCM. Regional scenarios involving changes in these values are examined and discussed. The predicted surface temperature change due to doubling of CO2 is also applied to a simple thermal expansion ocean model in order to estimate the probable increase in sea level by 2030 AD as a result of greenhouse warming. C.D.

A92-44791
GLOBAL ECOLOGY PRIORITIES
K. IA. KONDRAT'EV (Russian Academy of Sciences, Research Center of Ecological Safety, St. Petersburg, Russia) Nuovo Cimento C, Serie 1 (ISSN 0390-5551), vol. 15 C, no. 2, Mar.-Apr. 1992, p. 123-132. Apr. 1992 10 p refs
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An attempt to substantiate priorities of global ecology has been undertaken with an emphasis on two principal aspects: (1) heat balance of the earth and anthropogenically induced redistribution of its components; (2) closed nature of global biogeochemical cycles. It has been shown that the ecological faith of the earth depends first of all on biosphere dynamics distributed by man's impact. The Global Change program worked out in the U.S. and France have been summarized to analyze their advantages and disadvantages. The principal conclusion is that further discussion is necessary, preferably at the UN level. The Second UN Conference on Environment and Development will open such a possibility. Author

A92-45786
A GLOBAL INVENTORY OF VOLATILE ORGANIC COMPOUND EMISSIONS FROM ANTHROPOGENIC SOURCES
STEPHEN D. PICCOT (Science Applications International Corp., Durham, NC), JOEL J. WATSON (Radian Corp., Research Triangle Park, NC), and JULIAN W. JONES (EPA, Air and Energy Engineering Research Laboratory, Research Triangle Park, NC) Journal of Geophysical Research (ISSN 0148-0227), vol. 97, no. D9, June 20, 1992, p. 9897-9912. 20 Jun. 1992 16 p refs
(Contract EPA-68-02-4274; EPA-68-D9-0173; EPA-68-02-4288)
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An investigation of global volatile organic compound (VOC) emissions is conducted to estimate the anthropogenic sources and the consequences in terms of climate change. A total of seven VOC classes are studied including aromatics, aldehydes, paraffins, and marginally reactive compounds by means of a source-group approach. The technique involves: (1) source determination and classification for VOC emission; (2) the development of emission factors for source groups and extrapolation for global estimates; and (3) the use of industrial-activity and population data to distribute the emissions data into grid cells. The most significant sources of VOC emissions are fuel-wood consumption, savanna burning, gasoline production, and chemical manufacturing. Total VOC emissions from anthropogenic sources is 110,000 Gg/yr globally, and the largest emitters include the U.S., China, Japan, and the former Soviet Union. C.C.S.

A92-51336
EXPECTED GLOBAL ANTHROPOGENIC CHANGES IN CLIMATE CAUSED BY JOINT EFFECTS OF CARBON DIOXIDE AND CARBONYL SULFIDE [OZHIDAEMYE GLOBAL'NYE ANTROPOGENNYE IZMENENIIA KLIMATA, OBUSLOVLENNYE SOVMESTNYM VOZDEISTVIEM UGLEKISLOGO GAZA I KARBONILSUL'FIDA]
A. S. KABANOV (Institut Eksperimental'noi Meteorologii, Obninsk, Russia) Rossiiskaia Akademiia Nauk, Izvestiia, Fizika Atmosfery i Okeana (ISSN 0002-3515), vol. 28, no. 3, March 1992, p. 227-233. In Russian. Mar. 1992 7 p In RUSSIAN refs
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Joint effects of increases of anthropogenic stratospheric carbon dioxide and sulfate aerosols on global temperature in the future are estimated for three scenarios of fossil-fuel combustion proposed by Bjorkstrom. It is noted that, up to the years 2100-2130, the countereffect of stratospheric aerosol to the increase of temperature due to the greenhouse effect will be significant. By year 2150 however, a rapid increase is predicted for scenarios with the greatest variations of the intensity of fuel combustion.
I.S.

A92-52044
ON GLOBAL CLIMATE CHANGE, CARBON DIOXIDE, AND FOSSIL FUEL COMBUSTION
CHARLES W. GARRETT (DOE, Office of Fossil Energy, Washington) Progress in Energy and Combustion Science (ISSN 0360-1285), vol. 18, no. 5, 1992, p. 369-407. 1992 39 p refs
Copyright

Global climate change (GCC), greenhouse (GH) gases and the uncertainties swirling about them are of considerable concern to the Congress and to the public. Although the uncertainties leave GCC and GH gas implications open, the only GH gas of significance that results from fossil fuel combustion, namely CO2, has drawn much attention. This review discusses the concerns in two parts. The first part covers in some detail the scientific and technical aspects of GCC and the relationships of CO2 and fossil fuels to it. The second part notes in more abbreviated form some economic, demographic and international considerations. Author

N92-10228# Resources for the Future, Inc., Washington, DC. Energy and Natural Resources Div.
GREENHOUSE WARMING: ABATEMENT AND ADAPTATION
NORMAN J. ROSENBERG, ed., WILLIAM E. EASTERLING, III, ed., PIERRE R. CROSSON, ed., and JOEL DARMSTADTER, ed. 1991 184 p Workshop held in Washington, DC, 14-15 Jun. 1988; sponsored by Resources for the Future, Inc., NOAA, DOE, Dept. of Agriculture, EPA, and the International Federation of Inst. for Advanced Studies
(ISBN-0-915707-50-0; LC-89-8483) Avail: CASI HC A09/MF A02

The papers presented herein grew out of a workshop organized by the Climate Resources Program at Resources for the Future. The workshop was held to study the prospects for future climate change and the far reaching physical and socioeconomic impacts that may follow in the wake of such change. The aim was to provide information on policies and practices that can be effective for government and the private sector in delaying and abating climate change and in coping with such change as may be unavoidable.

N92-10229# National Center for Atmospheric Research, Boulder, CO. Interdisciplinary Climate Systems Section.
THE GREENHOUSE EFFECT: ITS CAUSES, POSSIBLE IMPACTS, AND ASSOCIATED UNCERTAINTIES
STEPHEN H. SCHNEIDER and NORMAN J. ROSENBERG (Resources for the Future, Inc., Washington, DC.) *In* Resources for the Future, Inc., Greenhouse Warming: Abatement and Adaptation p 7-34 1991
Avail: CASI HC A03/MF A02

The Earth's climate changes. The climatic effects of having polluted the atmosphere with gases such as carbon dioxide (CO2) may already be felt. There is no doubt that the concentration of CO2 in the atmosphere has been rising. CO2 tends to trap heat near the Earth's surface. This is known as the greenhouse effect, and its existence and basic mechanisms are not questioned by atmospheric scientists. What is questioned is the precise amount of warming and the regional pattern of climatic change that can be expected on the Earth from the anthropogenic increase in the atmospheric concentration of CO2 and other greenhouse gases. It is the regional patterns of changes in temperature, precipitation, and soil moisture that will determine what impact the greenhouse effect will have on natural ecosystems, agriculture, and water supplies. These possible effects are discussed in detail. It is concluded, however, that a detailed assessment of the climatic, biological, and societal changes that are evolving and should continue to occur into the next century cannot reliably be made with available scientific capabilities. Nevertheless, enough is known to suggest a range of plausible futures with attendant impacts, both positive and negative, on natural resources and human well being. Author

N92-10230# Resources for the Future, Inc., Washington, DC.
HUMAN DEVELOPMENT AND CARBON DIOXIDE EMISSIONS: THE CURRENT PICTURE AND THE LONG-TERM PROSPECTS
JOEL DARMSTADTER and JAE EDMONDS (Pacific Northwest Lab., Washington, DC.) *In its* Greenhouse Warming: Abatement and Adaptation p 35-51 1991 Sponsored in part by DOE
Avail: CASI HC A03/MF A02

The scale of human activity has grown to the point that gaseous emissions produced by four areas of human endeavor (energy, agriculture, land use, and chemical manufacture) are changing the stock of gases in the atmosphere. That change, in turn, affects the global temperature and climate. Such gases are called greenhouse, or radiatively important, gases (RIGs). The nature and timing of future climate change depend on three things: the rate of emission of RIGs into the atmosphere, the capacity of removal mechanisms, and the interaction between atmospheric composition and the climate. Herein, the first of these is examined: the rate of emission of RIGs and its determinants. The broad diversity of RIGs is briefly reviewed, but particular emphasis is on the relationship between energy use and the release of carbon dioxide from fossil fuels. Author

N92-10231# Ministry of Housing, Physical Planning, and Environment, Leidschendam (Netherlands).
SEA-LEVEL RISE: REGIONAL CONSEQUENCES AND RESPONSES
GJERRIT P. HEKSTRA *In* Resources for the Future, Inc., Greenhouse Warming: Abatement and Adaptation p 53-67 1991
Avail: CASI HC A03/MF A02

Climatic change and its possible impact on sea level, hydrology, agriculture, and other dimensions of human development have concerned physical and social scientists for some time. Public authorities in nations with coastal lowlands have shown heightened worry about the foreseeable long term effects of accelerated sea level rise (SLR). By constrast with the last century, during which SLR amounted to approx. 0.12 to 0.15 m, assessments of prospective change over the next 100 years range from increases of around 0.6 to 4.0 m, though scenarios can be constructed that point to the possibility of a far greater rise. Such a circumstance could result from the disintegration and rapid melting of the West Antarctic ice sheet. But such global averages may mask both substantial variability among different coastal regions and the storm surges and other intensified perturbations which, in given localities, can greatly magnify SLR damage to human settlements, croplands, and ground water quality. A detailed analysis is made of region-specific SLR effects and adaptive and protective measures to counter them are discussed. Author

N92-10232# Resources for the Future, Inc., Washington, DC.
CLIMATE CHANGE: PROBLEMS OF LIMITS AND POLICY RESPONSES
PIERRE R. CROSSON *In its* Greenhouse Warming: Abatement and Adaptation p 69-82 1991
Avail: CASI HC A03/MF A02

Present emission rates of carbon dioxide (CO2) and the other principle greenhouse gases (radiatively important gases (RIG's)) - methane, nitrous oxide, and chlorofluorocarbons - exceed the capacity of the oceanic, terrestrial, and tropospheric sinks to absorb them. Consequently, their concentrations in the troposphere are increasing and will continue to increase so long as emissions exceed sink capacities. It is assumed that an indefinitely persistent gap between emissions and sinks of RIG's implies indefinite global warming and related changes in regional climates. The high monetary and environmental costs that would be imposed by global warming are discussed along with the changes in energy policy that are needed to insure that these high costs will not be past on to future generations. Author

N92-10233# Resources for the Future, Inc., Washington, DC. Center for Risk Management.
ASSESSING AND MANAGING THE RISKS OF CLIMATE CHANGE
PAUL R. PORTNEY *In its* Greenhouse Warming: Abatement and Adaptation p 83-104 1991
Avail: CASI HC A03/MF A02

Some similarities and differences between the assessment and management of climate problems are presented along with ordinary environmental regulatory problems. The applicability of a familiar rule often invoked in thinking about the management of traditional environmental risks, namely, that an once of prevention is worth a pound of cure, is addressed with respect to the optimal management of climate-related risks. Author

N92-10234# Resources for the Future, Inc., Washington, DC.
CLIMATE AND FORESTS
ROGER A. SEDJO and ALLEN M. SOLOMON (International Inst. for Applied Systems Analysis, Laxenburg, Austria) *In its* Greenhouse Warming: Abatement and Adaptation p 105-119 1991
Avail: CASI HC A03/MF A02

The effects of forests on climate change and the effects of climate change on forests are examined. In particular, the mechanisms whereby changing CO2 levels and global warming might affect forest growth and composition are examined. The economic cost required to establish plantation forests in temperate and tropical regions are estimated. In addition, the economic uses to which the newly established forest stock might be put are investigated. The possible effects of these higher stocking levels on world industrial wood markets and on investments in traditional industrial forestry activities are addressed, and the broad economic implications are examined. The question of the source of financing is addressed briefly and the possibility/necessity of foreign assistance is examined. Author

N92-10235# Virginia Polytechnic Inst. and State Univ., Blacksburg.
THE BIOLOGICAL CONSEQUENCES OF CLIMATE CHANGES: AN ECOLOGICAL AND ECONOMIC ASSESSMENT
SANDRA S. BATIE and HERMAN H. SHUGART (Virginia Univ., Charlottesville.) *In* Resources for the Future, Inc., Greenhouse Warming: Abatement and Adaptation p 121-131 1991
Avail: CASI HC A03/MF A02

The following subject areas are covered: (1) the level of climate change; (2) impacts of climate change on ecological systems (short-term (decadal), medium term (centenary), and long-term (millennial) effects); and (3) ecological consequences of climate change - evaluating the social costs (the problem of valuing consequences, intergenerational problem, and safe minimum standard strategies and policies). Author

N92-10236# Resources for the Future, Inc., Washington, DC.
WATER RESOURCES AND CLIMATE CHANGE
KENNETH D. FREDERICK and PETER H. GLEICK (California Univ., Berkeley.) *In its* Greenhouse Warming: Abatement and Adaptation p 133-143 1991
Avail: CASI HC A03/MF A02

The following subject areas are covered: (1) risks to water supplies associated with climate change; (2) coping with hydrologic change (infrastructure, managing the infrastructure for more water and greater security, demand management for urban and agricultural water use, and technological change); and (3) vulnerability to climate change. Author

N92-10237# International Centre for Integrated Mountain Development, Kathmandu (Nepal). Mountain Farming Systems Div.
POTENTIAL STRATEGIES FOR ADAPTING TO GREENHOUSE WARMING: PERSPECTIVES FROM THE DEVELOPING WORLD
N. S. JODHA *In* Resources for the Future, Inc., Greenhouse Warming: Abatement and Adaptation p 147-158 1991
Avail: CASI HC A03/MF A02

The following subject areas are covered: (1) the developing world and its high-risk sector; and (2) abatement and adaptation strategies (prevention of further warming, adaptation options, and impediments to adaptation). Adaptation options in the developing countries are discussed in the framework of the following components: (1) uncertainties with respect to the impact of the greenhouse warming; (2) indifference of public policies and programs to greenhouse warming issues; and (3) potential agroclimatic changes following greenhouse warming. Author

N92-10238# International Federation of Inst. for Advanced Study, Toronto (Ontario).
HUMAN DIMENSIONS OF GLOBAL CHANGE: TOWARD A RESEARCH AGENDA
IAN BURTON *In* Resources for the Future, Inc., Greenhouse Warming: Abatement and Adaptation p 159-174 1991
Avail: CASI HC A02/MF A02

The Earth's environment is being transformed by human activity. Human activity, in turn, is being affected by these transformations. This interaction is being studied under the aegis of global change in the geosphere-biosphere. The purpose here is to explore the basis for and the substance of a proposed research program focused on the human dimensions of global change. Global warming due to the greenhouse effect, CO2 reduction, environment impacts, land use management, and the removal of greenhouse gases from the atmosphere are among the topics covered. Author

N92-10240# Resources for the Future, Inc., Washington, DC.
EPILOGUE
CHESTER L. COOPER *In its* Greenhouse Warming: Abatement and Adaptation p 175-182 1991
Avail: CASI HC A02/MF A02

A general discussion of the issues raised during the conference is given. Global warming due to the greenhouse effect, climate change, agricultural, and forestry are discussed. General policy considerations, the improvement of energy efficiency, fuel switching as a way of reducing the rate of CO2 emissions, capturing of CO2 through forest management, water management, and adapting to sea level rises are covered. Author

N92-10242# Resources for the Future, Inc., Washington, DC.
PROCESSES FOR IDENTIFYING REGIONAL INFLUENCES OF AND RESPONSES TO INCREASING ATMOSPHERIC CO2 AND CLIMATE CHANGE: THE MINK PROJECT
PIERRE R. CROSSON, L. A. KATZ, and J. WINGARD Aug. 1991 123 p
(Contract DE-AC06-76RL-01830)
(DE91-018602; DOE/RL-01830T-H7) Avail: CASI HC A06/MF A02

The second report of a series contributing to the study Processes for Identifying Regional Influences of and Responses to Increasing Atmospheric CO2 and Climate Change. The MINK Project is composed of two parts. This Report (2A) treats agriculture in MINK in terms of state and region-wide production and resource use for the main crops and animals in the baseline periods of 1984/87 and 2030. The effects of the analog climate on the industry at this level of aggregation are considered in both baseline periods. DOE

N92-10243# Resources for the Future, Inc., Washington, DC.
PROCESSES FOR IDENTIFYING REGIONAL INFLUENCES OF AND RESPONSES TO INCREASING ATMOSPHERIC CO2 AND CLIMATE CHANGE: THE MINK PROJECT
WILLIAM E. EASTERLING, III, M. S. MCKENNEY, NORMAN J. ROSENBERG, and K. M. LEMON Aug. 1991 222 p
(Contract DE-AC06-76RL-01830)
(DE91-018603; DOE/RL-01830T-H8) Avail: CASI HC A10/MF A03

The second report of a series Processes for Identifying Regional Influences of and Responses to Increasing Atmospheric CO2 and Climate Change. The MINK Project is composed of two parts. This Report (2B) deals with agriculture at the level of farms and Major Land Resource Areas (MLRAs). The Erosion Productivity Impact Calculator (EPIC), a crop growth simulation model developed by scientists at the U.S. Department of Agriculture, is used to study the impacts of the analog climate on yields of main crops in both the 1984/87 and the 2030 baselines. The results of this work with EPIC are the basis for the analysis of the climate change impacts on agriculture at the region-wide level undertaken in this report. Report IIA treats agriculture in MINK in terms of state and region-wide production and resource use for the main crops and animals in the baseline periods of 1984/87 and 2030. The effects of the analog climate on the industry at this level of aggregation are considered in both baseline periods. DOE

N92-10587# Helsinki Univ. of Technology, Espoo (Finland). Dept. of Meteorology.
THE GREENHOUSE EFFECT Abstract Only
E. HOLOPAINEN *In* Oulu Univ., Proceedings of the 25th Annual Conference of the Finnish Physical Society 1 p 1991
Avail: CASI HC A01/MF A03

The atmospheric concentration of carbon dioxide has increased by about 25 since preindustrial times. During recent decades this increase has been primarily due to burning of fossil fuels. Concentrations of some other greenhouse gases such as the CFC's, methane and nitrous oxide are also increasing. Numerical climate models, based on laws of physics, predict that increase of atmopsheric greehouse gases will eventually warm the climate. Associated with the warming there will be other changes, such as the rise of the gobal mean sea level. Confidence on the predictions of regional climate changes is still low. Some of the regional features in the model results deserve attention, however. In high latitudes the wintertime increase of temperature and precipitation is expected to be much larger than on the average over the globe. There may be reduction in summertime precipitation and soil moisture e.g., in Southern Europe and central North America. According to recent model results, the Gulf Stream may weaken when the climate warms. If this happens, the wintertime warming in Scandinavia could be smaller than the average warming in the high northern latitudes. ESA

N92-11573# Agency for International Development, Washington, DC.
GREENHOUSE GAS EMISSIONS AND THE DEVELOPING COUNTRIES: STRATEGIC OPTIONS AND THE USAID RESPONSE
D. JHIRAD and S. PADMANABHAN Jul. 1990 162 p
(PB91-209882; AID-PN-ABG-833) Avail: CASI HC A08/MF A02

This report responds to the Fiscal Year 1990 Foreign Assistance Appropriations Act, which requested the Agency of International Development (AID) to prepare a report that: (1) examines the potential contributions of developing countries to future global emissions of greenhouse gases under different economic growth scenarios; (2) estimates the relative contributions of those countries to global greenhouse gas emissions; and (3) identifies specific key countries that stand to contribute significantly to global greenhouse gas emissions, and in which actions to promote energy efficiency, reliance on renewable resources, and conservation of forest resources could significantly reduce emissions of greenhouse gases. Ongoing programs and new initiatives being considered by AID to promote sustained economic growth in developing countries while minimizing green house gas emissions are presented. Estimates of present and projected emissions, including emission from AID-designated key countries, are based on the work of the Intergovernmental Panel on Climate Change (IPCC). Despite the uncertainties regarding the timing, magnitude, and impacts of global climate change, the issue has dramatized the daunting problems faced by developing countries in achieving sustained economic and social development. Responding to the policy imperative of managing the global commons while accelerating development in individual countries is one of the significant challenges of our time. GRA

N92-11575# Colorado State Univ., Fort Collins.
GRASSLAND/ATMOSPHERE RESPONSE TO CHANGING CLIMATE: COUPLING REGIONAL AND LOCAL SCALES
M. B. COUGHENOUR, T. KITTEL, R. A. PIELKEL, W. PARTON, J. EASTMAN, and J. CRAM 30 Jul. 1991 46 p
(Contract DE-FG02-90ER-60932)
(DE91-016906; DOE/ER-60932/T1) Avail: CASI HC A03/MF A01

This study is an interdisciplinary research designed to increase our understanding of the ecological impacts of changes in climate and atmospheric chemistry projected to occur over the next 50 to 100 years due to globally increasing levels of CO2 and other greenhouse gases. The project study area is the North American Central Grasslands. The objectives are (1) to develop multiscaled modeling systems linking extant state-of-the-art models from the ecological and atmospheric sciences with different spatial and temporal resolutions, and (2) to evaluate the response of grassland ecosystems to atmospheric change at regional and site scales. Responses are to be evaluated in terms of ecosystem function and potential biospheric impacts to climate. We report progress since the last progress report (July 1990), covering the last half of Year 1 and the first 7 months of Year 2. We have (1) refined the high resolution GRASS model, (2) completed parameterization of the GRASS model for three sites, (3) constructed a multi-scaled modeling user interface, (4) conducted preliminary modeling experiments to filter from fine to coarse scale models, (5) implemented a computer-based synoptic classification scheme (synoptic classification processor), a key step in the scale transition of GCM climate change scenarios, and (6) evaluated scale issues associated with linking models. We also used coarse and fine resolution ecosystem models, in a manually linked mode, to simulate ecosystem response to climate and CO2 change. DOE

N92-11579# Resources for the Future, Inc., Washington, DC.
PROCESSES FOR IDENTIFYING REGIONAL INFLUENCES OF AND RESPONSES TO INCREASING ATMOSPHERIC CO2 AND CLIMATE CHANGE: THE MINK PROJECT
Aug. 1991 113 p
(Contract DE-AC06-76RL-01830)
(DE91-018601; DOE/RL-01830T-H6) Avail: CASI HC A06/MF A02

This is the first of a series of reports of research contributing to the study Processes for Identifying Regional Influences of and Responses to Increasing Atmospheric CO2 and Climate Change, MINK (Missouri-Iowa-Nebraska-Kansas) Project. This Report is intended to provide background information on project organization and methodology. In Sections 2 and 3 the region chosen for study and the scenario of climate change applied to it are described. The remainder of the paper provides information on the current functioning of the region, its demography and macroeconomic characteristics, its major natural resource sectors, and way these sectors interlink among themselves and with other industries and the region's economic base. In the final section projections are made of the demographics and macroeconomic characteristics of the region 20 and 40 years into the future. DOE

N92-11580# Resources for the Future, Inc., Baltimore, MD.
PROCESSES FOR IDENTIFYING REGIONAL INFLUENCES OF AND RESPONSES TO INCREASING ATMOSPHERIC CO2 AND CLIMATE CHANGE: THE MINK PROJECT
M. D. BOWES and R. A. SEDJO Aug. 1991 123 p

(Contract DE-AC06-76RL-01830)
(DE91-018604; DOE/RL-01830T-H9) Avail: CASI HC A06/MF A02

This is the third of a series of reports of research contributing to the study Processes for Identifying Regional Influences of an Responses to Increasing Atmospheric CO2 and Climate Change, The MINK Project. This report is an analysis of the possible impacts of climatic change on forest resources in the Missouri-Iowa-Nebraska-Kansas (MINK) region. It follows a uniform methodological strategy that is applied to the four resource sectors most likely to be impacted by climate change, i.e., agriculture, forestry, water resources and energy. What makes the forests of this region interesting is their great vulnerability to climate warming. With their position on the fringe of the eastern hardwood forest, bordering the grasslands of the midwest, it might be expected that these forests would be among the first to be affected by a changing climate. The state of the current forest resource are examined as well as, using simulation models, the likely sensitivity of the Missouri forests to a climate warming. The future development of forestry and forest technology in the region is considered. It is concluded that the low productivity of these forests rules out active adaptation to climate change, such as might expected in the region's agricultural sector or in the more productive forest regions of the U.S. southeast or northwest. The forest sector is most likely to begin gradual and passive decline under a climate warming. DOE

N92-12342# Oak Ridge National Lab., TN.
GLOBAL CLIMATE CHANGE AND HUMAN HEALTH: INFORMATION NEEDS, RESEARCH PRIORITIES, AND STRATEGIC CONSIDERATIONS
MICHAEL P. FARRELL, PAUL KANCIRUK, and FREDERICK M. OHARA, JR. 1989 10 p Presented at the Global Atmospheric Change and Public Health Conference, Washington, DC, 5-6 Dec. 1989
(Contract DE-AC05-84OR-21400)
(DE90-012599; CONF-891292-1) Avail: CASI HC A02/MF A01

The U.S. Global Research Plan and the International Geosphere-Biosphere Program were created to assess the effects of global climate change but have not been able to devote much attention to the consequences climate change will have on human health and welfare. Although researchers and policy makers recognize that climate change will have complex effects on resources, in general, the social and medical sciences have not received appropriate international attention under the banner of global change. To address this imbalance, the public health research community needs to launch a international coordinated effort so that the social and medical sciences are as fully represented as other scientific disciplines. This document discusses the information needs, research priorities and strategic considerations of the global change and its impact on human health. DOE

N92-12344# Pacific Northwest Lab., Richland, WA.
VERTICAL INTEGRATION OF SCIENCE, TECHNOLOGY, AND APPLICATIONS
M. J. GRAHAM Jun. 1990 16 p
(Contract DE-AC06-76RL-01830)
(DE90-013552; PNL-7369) Avail: CASI HC A03/MF A01

The Vertical Integration of Science, Technology, and Applications (VISTA) is an initiative developed by the Pacific Northwest Laboratory (PNL) to employ modern information and communications technology for rapid and effective dissemination and use of research results, with emphasis on applying these results to environmental problems. VISTA is being supported at PNL by DOE. The goal of VISTA is to make research results (data, models, and advanced concepts) usable and available to users in the areas of hazardous waste management and global climate change to speed research and development applications and reduce the costs of solving the complex environmental problems facing DOE and the nation. DOE

N92-12350# Oak Ridge National Lab., TN.
MANAGING GLOBAL CLIMATE CHANGE THROUGH INTERNATIONAL COOPERATION: LESSONS FROM PRIOR RESOURCE MANAGEMENT EFFORTS
D. L. FELDMAN Jul. 1990 53 p
(Contract DE-AC05-84OR-21400)
(DE90-014699; ORNL/TM-10914) Avail: CASI HC A04/MF A01

This report addresses the availability of an incremental and iterative learning process for enhancing international cooperation in the management of global climate change. The process is iterative because carefully formulated agreements are replicated in increasingly larger and diverse contexts. Through an examination of three case studies concerning regional seas, ozone, and nuclear-materials regulation, models for global cooperation are identified that encompass concerns about the size and distribution of correction costs among countries, the uncertainties involved in identifying cause-effect relationships, the vulnerability of shared resources, and the divergent needs of developed and developing countries. The ability of these models to encompass such concerns comes from their emphasis on interactive learning among scientists, environmental groups, international organizations, and governments of nations. DOE

N92-12353# Resources for the Future, Inc., Washington, DC.
PROCESSES FOR IDENTIFYING REGIONAL INFLUENCES OF AND RESPONSES TO INCREASING ATMOSPHERIC CO2 AND CLIMATE CHANGE: THE MINK PROJECT
J. DARMSTADTER Aug. 1991 60 p
(Contract DE-AC06-76RL-01830)
(DE91-018606; DOE/RL-01830T-H11) Avail: CASI HC A04/MF A01

This is the fifth of a series of reports of research contributing to the study Processes for Identifying Regional Influences of and Responses to Increasing Atmospheric CO2 and Climate Change -- The MINK Project. This report is directed to an analysis of the possible impacts of climatic change on energy in the Missouri-Iowa-Nebraska-Kansas (MINK) region. It follows a uniform methodological strategy that is applied to the four resource sectors most likely to be impacted by climate change, i.e., agriculture, forestry, water resources and energy. The methodological strategy is fully explained in Report 1 of this series. DOE

N92-12354# Resources for the Future, Inc., Washington, DC.
PROCESSES FOR IDENTIFYING REGIONAL INFLUENCES OF AND RESPONSES TO INCREASING ATMOSPHERIC CO2 AND CLIMATE CHANGE: THE MINK PROJECT
M. D. BOWES and P. R. CROSSON Aug. 1991 58 p
(Contract DE-AC06-76RL-01830)
(DE91-018607; DOE/RL-01830T-H12) Avail: CASI HC A04/MF A01

This is the sixth of a series of reports of research contributing to the study Processes for Identifying Regional Influences of and Responses to Increasing Atmospheric CO2 and Climate Change -- The MINK Project. This report is directed to providing an integrated analysis of the possible economic impacts of climatic change on resources in the Missouri-Iowa-Nebraska-Kansas (MINK) region. It is based on a uniform methodological strategy that was applied to the four resource sectors most likely to be impacted by climate change, i.e., agriculture, forestry, water resources and energy. The methodological strategy is fully explained in Report 1 of this series. DOE

N92-12355# Resources for the Future, Inc., Washington, DC.
PROCESSES FOR IDENTIFYING REGIONAL INFLUENCES OF AND RESPONSES TO INCREASING ATMOSPHERIC CO2 AND CLIMATE CHANGE: THE MINK PROJECT
N. J. ROSENBERG and P. R. CROSSON Aug. 1991 35 p
(Contract DE-AC06-76RL-01830)
(DE91-018608; DOE/RL-01830T-H13) Avail: CASI HC A03/MF A01

This overview report explains the rationale for and the methodology used in conduct of the study Processes for Identifying Regional Influences of and Responses to Increasing Atmospheric

CO2 and Climate Change -- The MINK Project, commissioned by the U.S. Department of Energy. The MINK project includes four states -- Missouri, Iowa, Nebraska and Kansas. The major findings of the study are also presented in this overview, which accompanies a series of reports in which the requisite technical details on methodology, sectoral analyses and integrated analysis of climate change impacts and responses are provided in detail. The report topics in this analysis series of potential greenhouse effects are: (1) background and baseline; (2) agricultural production and resource use in the MINK region without and with climate change; (3) a farm-level simulation of the effects of climate change on crop productivity in the MINK region; (4) forest resources; (5) water resources; (6) energy; (7) consequences of climate change for the MINK economy: impacts and responses. DOE

N92-13492# Department of Energy, Washington, DC. Office of Environmental Analysis.

GLOBAL CLIMATE TRENDS AND GREENHOUSE GAS DATA: FEDERAL ACTIVITIES IN DATA COLLECTION, ARCHIVING, AND DISSEMINATION

Jun. 1990 401 p

(DE90-013545; DOE/PE-0094P) Avail: CASI HC A18/MF A04

This report examines current and emerging efforts of the U.S. Government to collect, manage, and disseminate data on the emissions of greenhouse gases, their atmospheric concentrations, and trends in the earth's climate. It reviews how data are used to estimate and project emissions, to infer climate trends, and to support assessment and policy analysis functions, as well as its use in scientific research. It examines coordination of Federal data activities among agencies. In addition to data needed for scientific research and identification of trends, this report considers the special data and information needs of government and the public for assessment and policy analysis purposes. The report concludes with recommendations for strengthening data collection and management efforts in light of anticipated large increases in collection and demand for such data over the next decade. DOE

N92-15430*# National Aeronautics and Space Administration, Washington, DC.

SCIENTIFIC ASSESSMENT OF STRATOSPHERIC OZONE: 1989, VOLUME 1

1990 494 p Prepared in cooperation with Department of the Environment, London, England; NOAA, Washington, DC; UN Environment Programme, Nairobi, Kenya; and WMO, Geneva, Switzerland Original contains color illustrations

(NASA-TM-105442; NAS 1.15:105442; GORMP-20-VOL-1; ISBN-92-807-1255-1) Avail: CASI MF A04; print copy available at WMO, Geneva, Switzerland; 5 functional color pages

A scientific review is presented of the current understanding of stratospheric ozone. There have been highly significant advances in the understanding of the impact of human activities on the Earth's protective ozone layer. There are four major findings that each heighten the concern that chlorine and bromine containing chemicals can lead to a significant depletion of stratospheric ozone: (1) Antarctic ozone hole (the weight of evidence indicates that chlorinated and brominated chemicals are responsible for the ozone hole; (2) Perturbed arctic chemistry (the same potentially ozone destroying processes were identified in the Arctic stratosphere); (3) Long term ozone decreases; and (4) Model limitations (gaps in theoretical models used for assessment studies).

N92-15432*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.

GLOBAL TRENDS

G. MEGIE, M.-L. CHANIN, D. EHHALT, P. FRASER, J. F. FREDERICK, J. C. GILLE, M. P. MCCORMICK, M. SCHOEBERT, L. BISHOP, R. D. BOJKOV (World Meteorological Organization, Geneva, Switzerland) et al. *In* NASA, Washington, Scientific Assessment of Stratospheric Ozone: 1989, Volume 1 p 163-281 1990

Avail: CASI MF A04; print copy available at WMO, Geneva, Switzerland; 5 functional color pages

Measuring trends in ozone, and most other geophysical variables, requires that a small systematic change with time be determined from signals that have large periodic and aperiodic variations. Their time scales range from the day-to-day changes due to atmospheric motions through seasonal and annual variations to 11 year cycles resulting from changes in the sun UV output. Because of the magnitude of all of these variations is not well known and highly variable, it is necessary to measure over more than one period of the variations to remove their effects. This means that at least 2 or more times the 11 year sunspot cycle. Thus, the first requirement is for a long term data record. The second related requirement is that the record be consistent. A third requirement is for reasonable global sampling, to ensure that the effects are representative of the entire Earth. The various observational methods relevant to trend detection are reviewed to characterize their quality and time and space coverage. Available data are then examined for long term trends or recent changes in ozone total content and vertical distribution, as well as related parameters such as stratospheric temperature, source gases and aerosols. Author

N92-15434*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

HALOCARBON OZONE DEPLETION AND GLOBAL WARMING POTENTIALS

RICHARD A. COX, D. WUEBBLES, R. ATKINSON, PETER S. CONNELL, H. P. DORN, A. DERUDDER, RICHARD G. DERWENT, F. C. FEHSENFELD, D. FISHER, IVAR S. A. ISAKSEN (Oslo Univ., Norway) et al. *In* NASA, Washington, Scientific Assessment of Stratospheric Ozone: 1989, Volume 1 p 401-466 1990

Avail: CASI MF A04; print copy available at WMO, Geneva, Switzerland; 5 functional color pages

Concern over the global environmental consequences of fully halogenated chlorofluorocarbons (CFCs) has created a need to determine the potential impacts of other halogenated organic compounds on stratospheric ozone and climate. The CFCs, which do not contain an H atom, are not oxidized or photolyzed in the troposphere. These compounds are transported into the stratosphere where they decompose and can lead to chlorine catalyzed ozone depletion. The hydrochlorofluorocarbons (HCFCs or HFCs), in particular those proposed as substitutes for CFCs, contain at least one hydrogen atom in the molecule, which confers on these compounds a much greater sensitivity toward oxidation by hydroxyl radicals in the troposphere, resulting in much shorter atmospheric lifetimes than CFCs, and consequently lower potential for depleting ozone. The available information is reviewed which relates to the lifetime of these compounds (HCFCs and HFCs) in the troposphere, and up-to-date assessments are reported of the potential relative effects of CFCs, HCFCs, HFCs, and halons on stratospheric ozone and global climate (through 'greenhouse' global warming). Author

N92-15435*# National Aeronautics and Space Administration, Washington, DC.

SCIENTIFIC ASSESSMENT OF STRATOSPHERIC OZONE: 1989, VOLUME 2. APPENDIX: AFEAS REPORT

1990 478 p Prepared in cooperation with Department of the Environment, London, England; NOAA, Washington, DC; UN Environment Programme, Nairobi, Kenya; and WMO, Geneva, Switzerland

(NASA-TM-105443; NAS 1.15:105443; GORMP-20-VOL-2) Avail: CASI MF A04; print copy available at WMO, Geneva, Switzerland

The results are presented of the Alternative Fluorocarbon Environmental Acceptability Study (AFEAS), which was organized to evaluate the potential effects on the environment of alternate compounds targeted to replace fully halogenated chlorofluorocarbons (CFCs). All relevant current scientific information to determine the environmental acceptability of the alternative fluorocarbons. Special emphasis was placed on: the potential of the compounds to affect stratospheric ozone; their

potential to affect tropospheric ozone; their potential to contribute to model calculated global warming; the atmospheric degradation mechanisms of the compounds, in order to identify their products; and the potential environmental effects of the decomposition products. The alternative compounds to be studied were hydrofluorocarbons (HFCs) with one or two carbon atoms and one or more each of fluorine and hydrogen.

N92-15442*# *United Kingdom Atomic Energy Authority, Harwell* (England). Engineering Science Div.

DEGRADATION MECHANISMS OF SELECTED HYDROCHLOROFLUOROCARBONS IN THE ATMOSPHERE: AN ASSESSMENT OF THE CURRENT KNOWLEDGE

RICHARD A. COX (United Kingdom Atomic Energy Authority, Harwell (England).) *and* ROBERT LESCLAUX (*Bordeaux Univ.*, France) *In* NASA, Washington, Scientific Assessment of Stratospheric Ozone: 1989, Volume 2. Appendix: AFEAS Report p 207-231 1990

Avail: CASI MF A04; print copy available at WMO, Geneva, Switzerland

Volatile organic compounds are mainly degraded in the troposphere by attack of OH with abstraction of H atoms or addition to unsaturated linkages. The chlorofluorocarbons (CFC's) do not contain these reactive sites and consequently cannot be degraded in this way in the lower atmosphere. This results in pollution of the stratosphere by these molecules and attendant problems for ozone. The proposed replacements for CFC's, the hydrochlorofluorocarbons (HCFC's), and hydrofluorocarbons (HFC's), contain at least one hydrogen atom in the molecule, which confers on these compounds a greater sensitivity toward oxidation by OH in the troposphere and in the lower stratosphere, resulting in much shorter atmospheric lifetimes than the CFC's. Consequently, the Ozone Depletion Potential and the Atmospheric Warming Potential are reduced substantially compared to the CFC's. All the possible degradation processes of the HCFC's and HFC's proposed to replace the CFC's are examined with the principal aim of identifying chlorine- and fluorine-containing products which are stable under tropospheric conditions. Author

N92-15447*# Du Pont de Nemours (E. I.) and Co., Wilmington, DE.

RELATIVE EFFECTS ON GLOBAL WARMING OF HALOGENATED METHANES AND ETHANES OF SOCIAL AND INDUSTRIAL INTEREST

DONALD A. FISHER (Du Pont de Nemours (E. I.) and Co., Wilmington, DE.), CHARLES H. HALES (Du Pont de Nemours (E. I.) and Co., Wilmington, DE.), WEI-CHYUNG WANG (Atmospheric and Environmental Research, Inc., Pasadena, CA.), MALCOLM K. W. KO (Atmospheric and Environmental Research, Inc., Pasadena, CA.), and N. DAK SZE (Atmospheric and Environmental Research, Inc., Cambridge, MA.) *In* NASA, Washington, Scientific Assessment of Stratospheric Ozone: 1989, Volume 2. Appendix: AFEAS Report p 383-401 1990

Avail: CASI MF A04; print copy available at WMO, Geneva, Switzerland

The relative potential global warming effects for several halocarbons (chlorofluorocarbons (CFC's)-11, 12, 113, 114, and 115; hydrochlorofluorocarbons (HCFC's) 22, 123, 124, 141b, and 142b; and hydrofluorocarbons (HFC's) 125, 134a, 143a, and 152a; carbon tetrachloride; and methyl chloroform) were calculated by two atmospheric modeling groups. These calculations were based on atmospheric chemistry and radiative convective models to determine the chemical profiles and the radiative processes. The resulting relative greenhouse warming when normalized to the effect of CFC-11 agree reasonably well as long as we account for differences between modeled lifetimes. Differences among results are discussed. Sensitivity of relative warming values is determined with respect to trace gas levels assumed. Transient relative global warming effects are analyzed. Author

N92-15457*# National Aeronautics and Space Administration, Washington, DC.

REPORT OF THE INTERNATIONAL OZONE TRENDS PANEL 1988, VOLUME 2

1989 404 p Prepared in cooperation with UN Environment Programme, Nairobi, Kenya; WMO, Geneva, Switzerland; NOAA, Washington, DC; and FAA, Washington, DC

(NASA-TM-105119; NAS 1.15:105119; GORMP-18-VOL-2) Avail: CASI HC A18/MF A04

Chapters on the following topics are presented: trends in stratospheric temperature; theory and observations- model simulations of the period 1955-1985; trends in source gases; trends in stratospheric minor constituents; trends in aerosol abundances and distribution; and observations and theories related to antarctic ozone.

N92-15464*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.

GLOBAL CHANGE TECHNOLOGY ARCHITECTURE TRADE STUDY

L. BERNARD GARRETT, ed. (Bionetics Corp., Hampton, VA.), WARREN D. HYPES, ed. (Bionetics Corp., Hampton, VA.), and ROBERT L. WRIGHT, ed. Sep. 1991 397 p

(Contract RTOP 506-49-31)

(NASA-TM-104128; NAS 1.15:104128) Avail: CASI HC A17/MF A04

Described here is an architecture trade study conducted by the Langley Research Center to develop a representative mix of advanced space science instrumentation, spacecraft, and mission orbits to assist in the technology selection processes. The analyses concentrated on the highest priority classes of global change measurements which are the global climate changes. Issues addressed in the tradeoffs includes assessments of the economics of scale of large platforms with multiple instruments relative to smaller spacecraft; the influences of current and possible future launch vehicles on payload sizes, and on-orbit assembly decisions; and the respective roles of low-Earth versus geostationary Earth orbiting systems.

N92-15465*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.

SCIENCE REQUIREMENTS FOR A GLOBAL CHANGE TECHNOLOGY INITIATIVE ARCHITECTURE TRADE STUDY

JOHN T. SUTTLES (Lockheed Engineering and Sciences Co., Hampton, VA.), EDWIN F. HARRISON, GARY G. GIBSON (Lockheed Engineering and Sciences Co., Hampton, VA.), and THOMAS G. CAMPBELL *In* NASA. Langley Research Center, Global Change Technology Architecture Trade Study p 73-89 Sep. 1991 Previously announced as N91-25558

Avail: CASI HC A03/MF A04

Science requirements for a Global Change Technology Initiative (GCTI) Architecture Trade Study were established by reviewing and synthesizing results from recent studies. A scientific rationale was adopted and used to identify a comprehensive set of measurables and their priorities. Spatial and temporal requirements for a number of measurement parameters were evaluated based on results from several working group studies. Science requirements were defined using these study results in conjunction with guidelines for investigating global changes over a time scale of decades to centuries. Requirements are given separately for global studies and regional process studies. For global studies, temporal requirements are for sampling every 1 to 12 hours for atmospheric and radiation parameters and 1 day or more for most Earth surface measurements. Therefore, the atmospheric measurables provide the most critical drivers for temporal sampling. Spatial sampling requirements vary from 1 km for land and ocean surface characteristics to 50 km for some atmospheric parameters. Thus, the land and ocean surface parameters have the more significant spatial variations and provide the most challenging spatial sampling requirements. Author

N92-15474*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
GLOBAL CHANGE TECHNOLOGY INITIATIVE ARCHITECTURE TRADE STUDY PLAN
In its Global Change Technology Architecture Trade Study p 341-349 Sep. 1991
Avail: CASI HC A02/MF A04

The overall objective of the trade study is to define the architectural mix of missions, spacecraft/platforms, and sensors to meet the science requirements of the Mission to Planet Earth/Global Change Technology Initiative (MPE/GCTI) beyond the early Earth Observing System (Eos) and Geosynchronous Earth Orbit (GEO) spacecraft missions. Within the overall objective, the study includes the following specific objectives: (1) Substantiate the selected mix of Low Earth Orbit (LEO), GEO, or intermediate orbit spacecraft/platforms; (2) Define the required number and size of spacecraft related to objective (1); (3) Define a generic sensor complement for the spacecraft/platforms; (4) Evaluate current spacecraft capabilities to meet the mission requirements and develop conceptual designs of spacecraft/platforms as required. (5) Identify advanced or new technology needed to most efficiently accomplish the MPE/GCTI Program. Author

N92-16395 Atmospheric Environment Service, Downsview (Ontario).
REMOTE SENSING OF THE OZONE LAYER FOR GLOBAL CHANGE Abstract Only
W. F. J. EVANS *In* New Brunswick Univ., Proceedings of the Thirteenth Canadian Symposium on Remote Sensing p 155 Jul. 1990
Avail: Canadian Aeronautics and Space Inst., 222 Somerset St. W., Suite 601, Ottawa, Ontario K2P 0J1 Canada

The technology for remote sensing of the ozone layer is reviewed. The ozone field is imaged on a daily basis by the Total Ozone Mapping Spectrometer (TOMS) instrument on the NIMBUS 7 satellite. Altitude profiles of the ozone layer are measured by the Stratographic Aerosol and Gas Experiment (SAGE) on the Earth Radiation Budget Satellite (ERBS). Ground-based remote sensing systems such as the Dobson, the Brewer, and ozone differential absorption lidar (DIAL) systems are described. The development of the Antarctic ozone hole is described. Progress in research on the crater in the Arctic ozone field is described. Global trends in ozone can also be mapped from the TOMS data. The global maps indicate that ozone may have declined by about 6 percent over the last decade at midlatitudes in the Southern Hemisphere and about 3 percent in the Northern Hemisphere due to the growth of the polar ozone sink. The generation of synthetic ozone fields from meteorological upper air maps is illustrated.
CISTI

N92-16488# Corvallis Environmental Research Lab., OR.
CLIMATE CHANGE AND GLOBAL ISOPRENE EMISSIONS
DAVID P. TURNER (Environmental Protection Agency, Corvallis, OR.), ANDREW G. WONES, mf287453 (Environmental Protection Agency, Corvallis, OR.), DEREK PROSS (Oregon State Univ., Corvallis.), and DONALD L. PHILLIPS 1991 19 p Submitted for publication
(PB91-226480; EPA/600/D-91/180) Avail: CASI HC A03/MF A01

Emission of isoprene from vegetation affects tropospheric chemistry at the regional and global scales. Projected global climate change will potentially alter emission rates, with corresponding influences on concentrations of ozone and other radiatively important trace gases. Progress has been made in surveying plant species for their baseline emission rates and in understanding the physiology of the response of emission to environmental factors such as temperature, light, and atmospheric CO2 concentration. However, few tree species of tropical environments have been studied nor have the details of isoprene biosynthesis or its functional significance been elucidated. Relatively simply emission models at regional to global scales have been developed using geographic databases for temperature and vegetation characteristics. Isoprene emissions are expected to rise in response to projected global climate change because of increases in temperature and an increased areal extent of high isoprene emitting forest types. There remains great uncertainty about such projections, however, considering the uncertainties in the emissions modeling (about a factor of 3), uncertainties in the climate modeling, the future influence of anthropogenic factors on vegetation change, and the unmodeled influence of high CO2 on isoprene biosynthesis. There is a need to improve the modeling of emissions as inputs to global atmospheric chemistry models which in turn can be used to evaluate the effects of changing emissions on concentrations of tropospheric ozone and other radiatively important gases.
GRA

N92-16490# National Governors Association/Council of State Planning Agencies, Washington, DC.
PROCEEDINGS: EPA/NGA WORKSHOP ON GLOBAL CLIMATE AND STATE ACTIONS
BARBARA WELLS, ed. Jul. 1991 16 p Workshop held in Research Triangle Park, NC, 3-4 Dec. 1990
(Contract EPA-R81-3853-02-1)
(PB91-219105; EPA/600/9-91/024) Avail: CASI HC A03/MF A01

The proceedings document state and federal efforts described at a December 3-4, 1990 workshop that explored how states have been responding to potential global climate change. Cosponsored by the National Governors' Association (NGA) and the U.S. Environmental Protection Agency (EPA), the proceedings present some of the finding that emerged from discussions among the participants. Despite uncertainty about the extent, rate, and timing of a temperature increase, many state governments are wasting no time in working to reduce their greenhouse gas emissions as research on the effects of these gases continues. Fortunately, nearly all methods to curb emissions of greenhouse gases produces other benefits as well, such as cleaner air, reduced energy costs, and natural resource conservation. Therefore, most programs to reduce emissions will reflect concern about environmental and energy issues as well as global climate change. Author

N92-16492# Los Alamos National Lab., NM.
SPATIALLY AVERAGED HEAT FLUX AND CONVERGENCE MEASUREMENTS AT THE ARM REGIONAL FLUX EXPERIMENT
W. PORCH (Los Alamos National Lab., NM.), F. BARNES (Los Alamos National Lab., NM.), M. BUCHWALD (Los Alamos National Lab., NM.), W. CLEMENTS (Los Alamos National Lab., NM.), D. COOPER (Los Alamos National Lab., NM.), D. HOARD (Los Alamos National Lab., NM.), C. DORAN (Pacific Northwest Lab., Richland, WA.), J. HUBBE (Pacific Northwest Lab., Richland, WA.), W. SHAW (Pacific Northwest Lab., Richland, WA.), R. COULTER et al. 1991 8 p Presented at the 72nd American Meteorological Society Conference, Atlanta, GA, 5-10 Jan. 1992
(Contract W-7405-ENG-36)
(DE92-000180; LA-UR-91-3089; CONF-920134-2) Avail: CASI HC A02/MF A01

Cloud formation and its relation to climate change is the greatest weakness in current numerical climate models. Surface heat flux in some cases causes clouds to form and in others to dissipate and the differences between these cases are subtle enough to make parameterization difficult in a numerical model. One of the goals of the DOE Atmospheric Radiation Measurement Program is to make long term measurements at representative sites to improve radiation and cloud formation parameterization. This paper compares spatially averaged optical measurements of heat flux and convergence with a goal of determining how point measurements of heat fluxes scale up to the larger scale used for climate modeling. It was found that the various optical techniques used in this paper compared well with each other and with independent measurements. These results add confidence that spatially averaging optical techniques can be applied to transform point measurements to the larger scales needed for mesoscale and climate modeling. DOE

N92-16493# Argonne National Lab., IL.
STRUCTURING ENERGY SUPPLY AND DEMAND NETWORKS IN A GENERAL EQUILIBRIUM MODEL TO SIMULATE GLOBAL WARMING CONTROL STRATEGIES
S. HAMILTON, T. D. VESELKA, and R. R. CIRILLO 1991 13 p Presented at the 13th Annual North American Conference on the International Association for Energy Economics, Chicago, IL, 18-20 Nov. 1991
(Contract W-31-109-ENG-38)
(DE92-001918; ANL/CP-74210; CONF-911184-1) Avail: CASI HC A03/MF A01

Global warming control strategies which mandate stringent caps on emissions of greenhouse forcing gases can substantially alter a country's demand, production, and imports of energy products. Although there is a large degree of uncertainty when attempting to estimate the potential impact of these strategies, insights into the problem can be acquired through computer model simulations. This paper presents one method of structuring a general equilibrium model, the ENergy and Power Evaluation Program/Global Climate Change (ENPEP/GCC), to simulate changes in a country's energy supply and demand balance in response to global warming control strategies. The equilibrium model presented in this study is based on the principle of decomposition, whereby a large complex problem is divided into a number of smaller submodules. Submodules simulate energy activities and conversion processes such as electricity production. These submodules are linked together to form an energy supply and demand network. Linkages identify energy and fuel flows among various activities. Since global warming control strategies can have wide reaching effects, a complex network was constructed. The network represents all energy production, conversion, transportation, distribution, and utilization activities. The structure of the network depicts interdependencies within and across economic sectors and was constructed such that energy prices and demand responses can be simulated. Global warming control alternatives represented in the network include: (1) conservation measures through increased efficiency; and (2) substitution of fuels that have high greenhouse gas emission rates with fuels that have lower emission rates. DOE

N92-16494# Oak Ridge National Lab., TN.
THE QUEST FOR GREENHOUSE-CONSTRAINED TECHNOLOGIES AMID OTHER CONCERNS FOR ENVIRONMENT AND ENERGY
R. N. MCGILL 1991 18 p Presented at the International Workshop on Motor Vehicle and Global-Environment Problem, Tokyo (Japan), 6 Nov. 1991
(Contract DE-AC05-84OR-21400)
(DE92-002333; CONF-9111113-1) Avail: CASI HC A03/MF A01

As we approach the 21st century, sentiments run high in the U.S. for improved air quality in our cities and for a more secure energy future, hopefully to be manifest in lesser dependence on foreign supplies of oil. These sentiments are reflected in intense political activity on both the federal and state levels to enact legislation that will help alleviate both problems. At the same time though, the recent emergence of awareness of a threat of global warming due to ever increasing emissions of greenhouse gases has only served as an additional complicating factor, one which has not been fully dealt with either socially or politically in the U.S. Much discussion and deliberation on the issue of the greenhouse effect is underway in the U.S. and aimed at understanding the size of the problem as well as identifying options for solutions. This paper will review the recent political climate on issues of environment and energy and will include brief descriptions of the recent U.S. Clean Air Act Amendments, the California Clean Air Act, the National Energy Strategy, and the Alternative Motor Fuels Act of 1988. These policies and programs form a backdrop for the additional and more recent challenges brought about by the issue of global warming. To integrate all of these concerns will require complex solutions. First an understanding and discussion of all the options must exist. It is that integration process that is currently underway in the U.S. The paper will also review the current understanding of greenhouse gas emissions as well as options for mitigating them, especially as related to the transportation sector. DOE

N92-16497# Department of Energy, Washington, DC. Office of Health and Environmental Research.
CARBON DIOXIDE AND CLIMATE
Oct. 1991 204 p
(DE92-002831; DOE/ER-0508T) Avail: CASI HC A10/MF A03

Global climate change is a serious environmental concern, and the U.S. has developed an action agenda to deal with it. At the heart of the U.S. effort is the U.S. Global Change Research Program (USGCRP), which has been developed by the Committee on Earth and Environmental Sciences (CEES) of the Federal Coordinating Council for Sciences, Engineering, and Technology (FCCSET). The USGCRP will provide the scientific basis for sound policy making on the climate-change issue. The DOE contribution to the USGCRP is the Carbon Dioxide Research Program, which now places particular emphasis on the rapid improvement of the capability to predict global and regional climate change. DOE's Carbon Dioxide Research Program has been addressing the carbon dioxide-climate change connection for more than twelve years and has provided a solid scientific foundation for the USGCRP. The expansion of the DOE effort reflects the increased attention that the DOE has placed on the issue and is reflected in the National Energy Strategy (NES) that was released in 1991. This program summary describes projects funded by the Carbon Dioxide Research Program during FY 1991 and gives a brief overview of objectives, organization, and accomplishments. The Environmental Sciences Division of the Office of Health and Environmental Research, Office of Energy Research supports a Carbon Dioxide Research Program to determine the scientific linkage between the rise of greenhouse gases in the atmosphere, especially carbon dioxide, and climate and vegetation change. One facet is the Core CO2 Program, a pioneering program that DOE established more than 10 years ago to understand and predict the ways that fossil-fuel burning could affect atmospheric CO2 concentration, global climate, and the Earth's biosphere. Major research areas are: global carbon cycle; climate detection and models of climate change; vegetation research; resource analysis; and information and integration. DOE

N92-16503# Brown Univ., Providence, RI.
SENSITIVITY OF CLIMATE MODELS: COMPARISON OF SIMULATED AND OBSERVED PATTERNS FOR PAST CLIMATES
W. L. PRELL, T. WEBB, III, and R. J. OGLESBY Oct. 1991 14 p
(Contract DE-FG02-85ER-60304)
(DE92-002820; DOE/ER-60304/6) Avail: CASI HC A03/MF A01

Predicting the potential climatic effects of increased concentrations of atmospheric carbon dioxide requires the continuing development of climate models. As one index of the magnitude of past climates change, the global mean temperature increase during the past 18,000 years is similar to that predicted for carbon dioxide doubling. Simulating the climate changes of the past 18,000 years, as well as the warmer-than-present climate of 6000 years ago and the climate of the last interglacial, around 126,000 years ago, provides an excellent opportunity to test the models that are being used in global climate change research. During the past several years, we have used paleoclimatic data to test the accuracy of the NCAR CCMO (National Center for Atmospheric Research, Community Climate Model, Version 0), after changing its boundary conditions to those appropriate for past climates. We have assembled near-global paleoclimatic data sets of pollen, lake level, and marine plankton data and calibrated many of the data in terms of climatic variables. We have also developed methods that permit direct quantitative comparisons between the data and model results. Our comparisons have shown both some of the strengths and weaknesses of the model. The research so far has shown the feasibility of our methods for comparing paleoclimatic data and model results. Our research has also shown that comparing the model results with the data is an

evolutionary process, because the models, the data, and the methods for comparison are continually being improved. During 1991, we have continued our studies and this Progress Report documents the results to date. During this year, we have completed new modeling experiments, compiled new data sets, made new comparisons between data and model results, and participated in workshops on paleoclimatic modeling. DOE

N92-16504# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
MONITORING THE RESPONSE OF THE UPPER TROPOSPHERE/LOWER STRATOSPHERE TO A GREENHOUSE GAS SCENARIO
J. M. DAVIS and S. K. COX 2 Nov. 1991 13 p
(Contract DE-FG02-90ER-60970)
(DE92-003037; DOE/ER-60970/2) Avail: CASI HC A03/MF A01

The emission interferometer system was deployed at a high elevation site in the foothills of the Rocky Mountains. Spectra and atmospheric soundings were collected under various sky conditions. Spectra were collected at different observation zenith angles to investigate those portions of the spectrum most sensitive to changes in atmospheric path. The stability of the 60 degrees/0 degrees radiance ratios have been evaluated for the small number of clear sky spectra collected to date. Initial results indicate that the ratio is constant to about 0.5 percent (excluding large variations in the temperature structure) for clear sky cases. The ratio also shows sensitivity even to thin cloudiness. Examination of the spectra in the atmospheric window region shows that the slope of the floor of the spectra is sensitive even to near subvisual cirrus conditions. A temperature and gaseous concentration retrieval algorithm has been acquired to investigate the more conventional inversion to the current problem. A high speed computer workstation has been acquired to facilitate this phase of the research. DOE

N92-17982# National Academy of Sciences - National Research Council, Washington, DC.
POLICY IMPLICATIONS OF GREENHOUSE WARMING: REPORT OF THE ADAPTATION PANEL
PAUL E. WAGGONER (Connecticut Agricultural Experiment Station, New Haven.), JESSE AUSUBEL (Rockefeller Univ., New York, NY.), CLARK BINKLEY (British Columbia Univ., Vancouver.), MARY M. KRITZ (Cornell Univ., Ithaca, NY.), JOSHUA LEDERBERG (Rockefeller Univ., New York, NY.), WILLIAM LEWIS (McKinsey and Co., Inc., Washington, DC.), JON C. LIEBMAN (A & B Design Engineering Co., Inc., West Acton, MA.), JANE LUBCHENCO (Oregon State Univ., Corvallis.), WILLIAM D. NORDHAUS (Yale Univ., New Haven, CT.), GORDON H. ORIANS (Washington Univ., Seattle.) et al. 1991 163 p Sponsored in part by EPA, NRC, Carnegie Corp. of NY, Charles E. Culpepper Foundation, William and Flora Hewlett Foundation, John D. and Catherine T. MacArthur Foundation, Andrew W. Mellon Foundation, Rockefeller Foundation, and Alfred P. Sloan Foundation, and the Academy Industry Program
Avail: CASI HC A08/MF A02

The HUD-Independent Agencies Appropriations Act of 1988 called for a National Academy of Sciences (NAS) study on global climate change. This study should establish the scientific consensus on the rate and magnitude of climate change, estimate the projected impacts, and evaluate policy options for mitigating and responding to such changes. According to subsequent advice received from members of Congress, the NAS study was to focus on radiatively active trace gases from human sources, or 'greenhouse warming.' The work of the study was conducted by four panels. This is the report of the Adaptation Panel. The Adaptation Panel assessed the impacts of possible climate change on humanity and nature and the policies that could help people and nature adapt to those changes. The panel began its work by reviewing the literature in the field of impacts and adaptation, stressing studies of the U.S. Environmental Protection Agency (EPA) and the work in progress of the Intergovernmental Panel on Climate Change (IPCC). D.R.D.

N92-18086# Argonne National Lab., IL.
GREENHOUSE GAS EMISSIONS CONTROL BY ECONOMIC INCENTIVES: SURVEY AND ANALYSIS
D. W. SOUTH, R. F. KOSOBUD, and K. G. QUINN 1991 13 p Presented at the 13th Annual North American Conference of the International Association for Energy Economics, Chicago, IL, 18-20 Nov. 1991
(Contract W-31-109-ENG-38)
(DE92-004125; ANL/CP-74787; CONF-911184-7) Avail: CASI HC A03/MF A01

This paper presents a survey of issues and concerns raised in recent literature on the application of market-based approaches to greenhouse effect policy with an emphasis on tradeable emission permits. The potential advantages of decentralized decision-making cost-effectiveness or allocation efficiency, stimulation of innovations, and political feasibility are discussed. The potential difficulties of data recording, monitoring, enforcement, and of creating viable emission permit contracts and markets are examined. Special attention is given to the problem of designing a greenhouse effect policy that is cost-effective over time: a problem that has been given little attention to date. Proposals to reduce or stabilize greenhouse gas emission (especially CO2) in the short run require high carbon tax rates or permit prices and impose heavy adjustment costs on the fossil fuel industry. A more cost-effective time path of permit prices is proposed that achieves the same long-run climate change stabilization goals. DOE

N92-18155# Argonne National Lab., IL.
TRADEABLE CO2 EMISSION PERMITS FOR COST-EFFECTIVE CONTROL OF GLOBAL WARMING
R. F. KOSOBUD, D. W. SOUTH, T. A. DALY, and K. G. QUINN 1991 14 p Presented at the 13th Annual North American Conference of the International Association for Energy Economics, Chicago, IL, 18-20 Nov. 1991
(Contract W-31-109-ENG-38)
(DE92-003519; ANL/CP-74713; CONF-911184-6) Avail: CASI HC A03/MF A01

Many current global warming mitigation policy proposals call for large, near-term reductions in CO2 emissions, thereby entailing high initial carbon emission tax rates or permit prices. This paper claims that these high initial tax rates or permit prices are not cost effective in achieving the desired degree of climate change control. A cost effective permit system is proposed and described that, under certain assumptions, would allow markets to optimally lead permit prices along a gradually increasing trajectory over time. This price path presents the Hotelling result and would ease the abrupt, inefficient, and costly adjustments imposed on the fossil fuel and other industries in current proposals. This finding is demonstrated using the Argonne Model, a linear programming 'energy environmental economic' model that allows for intertemporal optimization of consumer energy well being. DOE

N92-18604# Lawrence Livermore National Lab., CA.
GREENHOUSE GASES: SOURCES AND EMISSIONS
J. EDMONDS and D. J. WUEBBLES 30 Mar. 1991 30 p Presented at the World Coal Institute Conference and Exhibition on Coal in the Environment, London, England, 3-5 Apr. 1991
(Contract W-7405-ENG-48; DE-AC06-76RL-01830)
(DE92-004672; UCRL-JC-108318; CONF-910405-2) Avail: CASI HC A03/MF A01

The current interest in the 'greenhouse' issue stems from the observation that the concentrations of such gases as CO2, CH4, N2O, CFCl3, and CF2Cl2 have been increasing. Changes in the concentrations of these gases hold the potential for changing the Earth's climate. In the discussion that follows, we will examine recent and long-term trends in the atmosphere, and the current understanding of the sources of the most important radiatively important gases released as byproducts of human activities. These gases are: CO2, CH4, N2O, CFCs, and CO. In addition, we will discuss the current outlook for future emissions of these gases and the current understanding of the technical potential and economic costs of options to reduce emissions of these gases.

This suite of gases includes both the greenhouse gases as well as those gases which can either directly or indirectly affect the Earth's energy balance. DOE

N92-18725# Los Alamos National Lab., NM.
GLOBAL SIMULATIONS OF SMOKE FROM KUWAITI OIL FIRES AND POSSIBLE EFFECTS ON CLIMATE
G. A. GLATZMAIER, R. C. MALONE, and C. Y. J. KAO 1991 7 p Presented at the Conference on Global Climate Change: Its Mitigation Through Improved Production and Utilization of Energy, Los Alamos, NM, 21-24 Oct. 1991
(Contract W-7405-ENG-36)
(DE92-005068; LA-UR-91-3950; CONF-9110127-1) Avail: CASI HC A02/MF A01

The Los Alamos Global Climate Model has been used to simulate the global evolution of the Kuwaiti oil fire smoke and its potential effects on the climate. The initial simulations were done shortly before the fires were lit in January 1991. They indicated that such an event would not result in a 'Mini Nuclear Winter' as some people were suggesting. Further simulations during the year suggested that the smoke could be responsible for subtle regional climate changes in the spring such as a 5 degree centigrade decrease in the surface temperature in Kuwait, a 10 percent decrease in precipitation in Saudi Arabia and a 10 percent increase in precipitation in the Tibetan Plateau region. These results are in qualitative agreement with the observations this year. DOE

N92-19657# Department of Energy, New York, NY.
ENVIRONMENTAL MEASUREMENTS LABORATORY ANNUAL REPORT, 1990
N. A. CHIECO, ed. and J. HOPPEN, ed. Nov. 1991 111 p
(DE92-004856; EML-542) Avail: CASI HC A06/MF A02

This report summarizes the activities of the Environmental Measurements Laboratory (EML) for the calendar year 1990 and it serves as an annual report to the Director of the Office of Energy Research (OER), the Associate Director and staff of the Office of Health and Environmental Research (OHER), the manager and staff of the Field Office--Chicago, and our colleagues. The progress and accomplishments of the year are emphasized rather than future plans or expectations. The technical summaries are grouped according to the following six general program areas: environmental radiation and radioactivity; radiation transport and dosimetry; environmental radon, thoron, and related aerosols; atmospheric and surface pollutant studies related to global climate change; ecological and subsurface pollutant research; and metrology, consultation, and emergency response. DOE

N92-19791# Lawrence Livermore National Lab., CA.
THE COMPUTER HARDWARE ADVANCED MATHEMATICS AND MODEL PHYSICS (CHAMMP) CLIMATE MODELING PROGRAM
D. C. BADER (Pacific Northwest Lab., Richland, WA.), M. C. MACCRACKEN (Lawrence Livermore National Lab., CA.), and R. C. MALONE (Los Alamos National Lab., NM.) Nov. 1991 5 p Presented at the 3rd Symposium for Global Change Studies, Atlanta, GA, 5-10 Jan. 1991
(Contract W-7405-ENG-48)
(DE92-004671; UCRL-JC-108853; CONF-9101125-1) Avail: CASI HC A01/MF A01

Improved methods for predicting the world's future climate and the potential climate change caused by anthropogenic activities are needed to guide domestic and international energy policy formulation. Current general circulation models (GCM's) of the atmosphere and ocean that form the basis for climate projections are useful, but lack: treatment of interactions among the atmosphere, ocean, cryosphere, and land surface; the adequate representation of key processes such as radiative transfer and cloud development; and relatively coarse spatial resolution. The demands that must be met by future climate models have been established in the development of the U.S. Global Change Research Program (USGCRP) and their importance is evidenced by the designation of climate modeling and prediction as one of the four high priority integrating themes of the program. The U.S. DOE CHAMMP Program is a multiyear climate modeling research program designed to bring the computational power of emerging computer systems to further climate research. This requires true multidisciplinary collaboration among climate scientists, applied mathematicians, and computer scientists. Since the ultimate goal is to provide better scientific prediction, research is also directed toward estimating the limits of climate predictability and the uncertainty of model results. Through interactions with other programs of the USGCRP and US High Performance Computing and Communications Program (HPCC), it will contribute to more definitive projections of climate change to aid in the formulation of national and international energy policy. DOE

N92-19943# New York Univ., New York. Dept. of Applied Science.
THE ROLE OF CLOUDS AND OCEANS IN GLOBAL GREENHOUSE WARMING
M. I. HOFFERT Jan. 1992 15 p
(Contract DE-FG02-90ER-61014; W-7405-ENG-48)
(DE92-007018; DOE/ER-61014/2) Avail: CASI HC A03/MF A01

The overall objectives of this project has been to exploit empirical data from atmospheric measurements, satellite data and paleoclimatic reconstructions to derive the role of cloud radiative forcing on the historical global temperature record and on projections of global warming from greenhouse gases during the coming decades. Our work has involved data analysis and modelling tasks involving both atmospheric radiation and ocean modelling. A major accomplishment this past year has been the derivation of global climate sensitivity and the cloud radiative feedback from a new analysis of paleoclimatic data. A detailed discussion of this work and it implications is given as the appendix to this Progress Report. Some additional research planning considerations are discussed below. DOE

N92-20022*# Pennsylvania State Univ., University Park. Earth System Science Center.
REGIONAL CLIMATE CHANGE PREDICTIONS FROM THE GODDARD INSTITUTE FOR SPACE STUDIES HIGH RESOLUTION GCM Final Report, May 1989 - Oct. 1991
ROBERT G. CRANE and B. C. HEWITSON 1991 54 p
(Contract NAG5-1133)
(NASA-CR-190037; NAS 1.26:190037) Avail: CASI HC A04/MF A01 CSCL 13B

A new diagnostic tool is developed for examining relationships between the synoptic scale circulation and regional temperature distributions in GCMs. The 4 x 5 deg GISS GCM is shown to produce accurate simulations of the variance in the synoptic scale sea level pressure distribution over the U.S. An analysis of the observational data set from the National Meteorological Center (NMC) also shows a strong relationship between the synoptic circulation and grid point temperatures. This relationship is demonstrated by deriving transfer functions between a time-series of circulation parameters and temperatures at individual grid points. The circulation parameters are derived using rotated principal components analysis, and the temperature transfer functions are based on multivariate polynomial regression models. The application of these transfer functions to the GCM circulation indicates that there is considerable spatial bias present in the GCM temperature distributions. The transfer functions are also used to indicate the possible changes in U.S. regional temperatures that could result from differences in synoptic scale circulation between a 1XCO2 and a 2xCO2 climate, using a doubled CO2 version of the same GISS GCM. Author

N92-20099# Brookhaven National Lab., Upton, NY.
EXPLORING CO2 EMISSIONS REDUCTION STRATEGIES
S. C. MORRIS, D. HILL, J. LEE, G. GOLDSTEIN, and J. LYDICK Jan. 1991 6 p Presented at the International Conference on Energy in the 1990's, Pittsburgh, PA, 11-13 Mar. 1991
(Contract DE-AC02-76CH-00016)
(DE92-005393; BNL-46727; CONF-910306-2) Avail: CASI HC A02/MF A01

Concern for potential climate change resulting from the

greenhouse effect may be the biggest factor in energy planning in the 1990s. A 20 pct. reduction in CO2, the predominant greenhouse gas, has been proposed as a goal by several international and national groups. Its principal source is the combustion of fossil fuels. A substantial reduction in CO2 emissions in the first decade of the 21st century will require major shifts in energy planning and development in the 1990s. An energy systems model, MARKAL, is being used to meet specific CO2 reduction goals. This can provide a technological basis for economic and policy models designed to find the best policy instruments to induce technological and behavioral change. This report focuses on MARKAL results in the electric supply sector. DOE

N92-20260# Economic Research Service, Washington, DC. Resources and Technology Div.
CLIMATE CHANGE: ECONOMIC IMPLICATIONS FOR WORLD AGRICULTURE
S. KANE, J. REILLY, and J. TOBEY Oct. 1991 28 p
(PB92-128636; USDA/AER-647) Avail: CASI HC A03/MF A01

Agricultural activities contribute to global climate change, and crop production will be affected if and when climate changes. Despite substantial yield effects of climate change, the economic effect on national and world economies is estimated to be small, as reduced production potential in some areas is balanced by gains in others. A slight increase in world output and a decline in commodity prices are estimated under a moderate climate change impact scenario. There remain major uncertainties in estimating future emission of greenhouse gases that contribute to climate change, costs of controlling climate change, and the effects of climate change on society. GRA

N92-20540# International Bank for Reconstruction and Development, Washington, DC.
ENVIRONMENTAL CHALLENGE
B. CONABLE, J. WARFORD, Z. PARTOW, E. LUTZ, and M. MUNASINGHE Sep. 1991 33 p
(PB91-240267) Avail: CASI MF A01; HC available from World Bank Publications, PO Box 7247-8619, Philadelphia, PA

A collection of 11 articles on the environment is presented by the World Bank. Each article deals with a specific environmental problem and explains the World Bank's efforts and policies towards these problems. Also included is a history of the World Bank's environmental policies and how they have changed in recent years. The articles presented are titled: (1) Development and the Environment: A Global Balance; (2) Evolution of the World Bank's Environmental Policy; (3) Accounting for the Environment; (4) Public Policy and the Environment; (5) Managing Drylands; (6) Environmental Action Plans in Africa; (7) Agroforestry in Sub-Saharan Africa; (8) Irrigation and the Environmental Challenge; (9) Curbing Pollution in Developing Countries; (10) Global Warming and the Developing World; and (11) The Global Environment Facility. GRA

N92-20647# General Accounting Office, Washington, DC.
GREENHOUSE EFFECT: DOE'S PROGRAMS AND ACTIVITIES RELEVANT TO THE GLOBAL WARMING PHENOMENON
Mar. 1990 51 p
(GAO/RCED-90-74BR; B-237780) PO Box 6015, Gaithersburg, MD 20877 HC *first five copies free, additional copies $2.00*

Background information is given on the global warming issue as well as the Department of Energy's (DOE's) objectives, scope, and methodology in relation to the problem. Details are given on DOE's policies and research efforts. Examples of energy policy and program changes to mitigate the global warming phenomenon that have been suggested by various Federal and non-Federal authorities are provided. Appendices include descriptions of DOE program areas relevant to the global climate change issue, additional information on suggested energy policy and program changes to address global warming, and a list of major contributors to this briefing report. Information is given in tabular form on DOE's FY 1989 budget and 1990 budget request for direct and indirect programs relevant to global climate change. Author

N92-21339# Westinghouse Hanford Co., Richland, WA.
MODERN AND PLEISTOCENE CLIMATIC PATTERNS IN THE WEST
K. L. PETERSEN Dec. 1991 32 p
(Contract DE-AC06-87RL-10930)
(DE92-006437; WHC-EP-0523) Avail: CASI HC A03/MF A01

This document was prepared as a chapter entitled, 'Modern and Pleistocene Climatic Patterns in the West,' for the two volume book, The Biogeography of the Great Basin and Colorado Plateau, being edited by Dr. Wilford M. Hess (Brigham Young University, Provo, Utah) and is scheduled to be published in 1992 by Westview Press (Boulder, Colorado). It was prepared in support of the Climate Change Task of the Protective Barrier Program. This document shows that regional climate cannot be viewed in isolation, but must be viewed as part of a larger continental and global system to fully understand the underlying driving mechanism. This document is an attempt to provide the global and continental contexts. These contexts are necessary for the overall project of which this is a part. The overall object of this task is to obtain quantitative estimates of past, present, and especially future climate in the Pacific Northwest and the Western United States. These estimates which will be used in future papers are needed to aid in the development of a defensible Hanford Site Protective barrier design and Hanford Site Performance Assessment, and in proposals to help in the development of protective barriers at the Idaho National Engineering Laboratory and at the DOE's Monticello (Utah) Remedial Action Project for uranium mill tailings. The defensibility of estimates of potential future climate in the Pacific Northwest and the Western United States is greatly enhanced by demonstrating an understanding of the present climate system and the range of change that has occurred in the past. DOE

N92-21395# New Energy Development Organization, Tokyo (Japan).
SURVEY ON THE EFFECTIVE USE OF CARBON DIOXIDE RELATED TO THE GLOBAL ENVIRONMENTAL ISSUES (APPLICATION TO EOR TECHNOLOGY USING CARBON DIOXIDE)
Mar. 1991 168 p In JAPANESE; ENGLISH summary
(DE92-769373; NEDO-ITE-9001) Avail: CASI HC A08/MF A02

An effective method for using carbon dioxide injection into oil reservoirs for the fixation of carbon dioxide and its application to enhanced oil recovery (EOR) are presented. EOR using CO2 is widely used as a tertiary recovery technique, particularly in the U.S. In the oil recovery, some of the CO2 is generated as associated gas. The CO2 is separated from the associated gas and recovered for recycling. It is possible to make the carbon dioxide fixation a completely closed system. The CO2 volume required for EOR is estimated at 63 billion tons worldwide. The study introduces a total system for CO2 emission in Japan. The system covers CO2 recovery, liquefaction, and maritime transportation of the liquid CO2 to oil producing countries. The price of CO2 under the total system is higher than that of CO2 emitted from the ordinary carbon dioxide gas field. However, when deduction for a cost of the CO2 fixation to prevent the global warming is taken into consideration, the EOR system using CO2 is economically viable, if the CO2 cost for EOR operation in southeast Asia does not include the cost of CO2 recovery and liquefaction in the total system. However, it is necessary to consider economy and viability individually and check the response to the EOR at each oil field. DOE

N92-21439# National Geophysical Data Center, Boulder, CO.
GLOBAL ECOSYSTEMS DATABASE. VERSION 0.1 (BETA-TEST). EPA GLOBAL CLIMATE RESEARCH PROGRAM. NOAA/NGDC GLOBAL CHANGE DATABASE PROGRAM. PROTOTYPE 1: DATABASE DOCUMENTATION. NGDC KEY TO GEOPHYSICAL RECORDS DOCUMENTATION NO. 25. USER'S MANUAL
W. G. CAMPBELL and J. J. KINEMAN Nov. 1991 368 p

Prepared in cooperation with ManTech Environmental Technology, Inc., Corvallis, OR
(PB92-122803; EPA/600/8-91/216) Avail: CASI HC A16/MF A03

The primary objective of the cooperative research and development is to produce an integrated, quality controlled, global database (including time sequences) for spatially distributed modeling. The project concentrates on modern observational data, including remotely sensed data and data from other sources. The database includes complementary multi-thematic data sets on comparable grids, registered to a common origin and projection (latitude-longitude). The database has been structured to be operable with several existing geographic information systems (GIS), so that a complete analytical package could be provided to reviewers and other scientists for evaluation, experimentation, and further development. The software accompanying the CD-ROM (a subset of GIS known as Idrisi) was developed and adopted for the project at Clark University. Although compatible with Idrisi, the database is also designed to be easily up-loaded to the GIS known as GRASS, running on UNIX operating systems. Since the database structure is as system independent as possible, tt should also be easily usable in other systems. GRA

N92-22827# Meteorological Office, Bracknell (England).
REPORTS OF THE WORKING GROUPS: ENVIRONMENT. WHY OBSERVE THE EARTH'S ENVIRONMENT?
B. J. MASON *In* ESA, Report of the Earth Observation User Consultation Meeting p 9-14 Oct. 1991 Original contains color illustrations
Copyright Avail: CASI HC A02/MF A03; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 75 Dutch guilders

The European Space Agency's strategy concerning the environment is reviewed. The need for an integrated international global climate monitoring and prediction program was emphasized and the main components of this program are tabulated. The necessity of developing a Global Climate Observing System (GFOS), which would detect and monitor climate changes and hence reduce uncertainties in climate predictions and provide more reliable guidance for policy decisions on remedial action and adaptive strategies aimed at reducing the magnitude and impacts of future climate changes, is stressed. The basic structure of combining space measurements with surface based and airborne direct observations and indirect sounding techniques is underlined. The vital role Europe has to play in the observation and prediction of environmental changes in both global and regional scales and in influencing world opinion on practical and effective remedial action is discussed. In considering what environmental parameters are desirable to measure from space, the generic types of instruments to be used and the degree of accuracy are considered. ESA

N92-22828# Max-Planck-Inst. fuer Chemie, Mainz (Germany).
ATMOSPHERIC CHEMISTRY: INTRODUCTION. BRIEF INTRODUCTION TO ATMOSPHERIC CHEMISTRY
J. P. BURROWS *In* ESA, Report of the Earth Observation User Consultation Meeting p 15-23 Oct. 1991
Copyright Avail: CASI HC A02/MF A03; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 75 Dutch guilders

The European Space Agency's strategy concerning atmospheric chemistry is reviewed. In a brief introduction to atmospheric chemistry, the necessity of obtaining global measurements of ozone and the trace species that determine its concentration is clarified. The effect of atmospheric composition on the climate is considered and how man has adversely affected this composition is expressed. In order to make an accurate assessment of the importance of changes in the chemical composition of the atmosphere, a detailed understanding of the chemical and physical processes that determine the behavior of the atmosphere is needed. The need for models to predict the global consequences of changes in atmospheric composition is expressed. The role of ESA in the remote sensing of atmospheric constituents from space platforms is discussed and the types of instrumentation needed to measure these constituents are presented. ESA

N92-22833# Meteorological Office, Bracknell (England).
ENVIRONMENT: MONITORING AND PREDICTION OF THE GLOBAL ENVIRONMENT
B. J. MASON *In* ESA, Report of the Earth Observation User Consultation Meeting 71-73 Oct. 1991 Original contains color illustrations
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What the scientific community and end users will require of space technology in order to provide the observations necessary to implement a comprehensive and fully integrated Global Environment Monitoring and Prediction Program over the next decade and beyond is discussed and identified. Some parts of the global observing system are already in place, including the World Climate Research Program (WCRP), and the Tropical Ocean and Global Atmosphere (TOGA). A large component of the total system, the Global Climate Observing System (GCOS), is considered. Its major components and its relation to the research programs such as WCRP are diagrammatically illustrated. ESA

N92-22834# Meteorological Office, Bracknell (England).
MONITORING CLIMATE AND CLIMATE CHANGE: CLIMATE CHANGE CONCERNS
J. HOUGHTON *In* ESA, Report of the Earth Observation User Consultation Meeting p 74-81 Oct. 1991
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Increasing concern that human activities are inadvertently changing the global climate by the concentration of greenhouse gases and by means of other changes which can upset the complex chemical, dynamic and radiative balance of the atmosphere, ocean and land system resulted in the establishment of an Intergovernmental Panel on Climate Change (IPCC) and the organization of the Second World Climate Conference (SWCC). These resulted in the proposal for a Global Climate Observing System (GCOS) which needs to encompass all components of the climate system: atmosphere, biosphere, ergosphere and oceans. Specific developments required to provide an effective GCOS in the areas of the atmosphere, oceans and land are outlined. The role of space observations in the GCOS is discussed together with data handling, assimilation and interpretation. ESA

N92-22835# Max-Planck-Inst. fuer Chemie, Mainz (Germany).
ATMOSPHERIC CHEMISTRY AND THE BIOSPHERE
P. CRUTZEN (Saab Aircraft Co., Linkoping (Sweden).) and G. MEGIE (Centre National de la Recherche Scientifique, Verrieres-Le Buisson, France) *In* ESA, Report of the Earth Observation User Consultation Meeting p 82-89 Oct. 1991
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The impact of human activities on the Earth's environment has reached such proportions that effects are clearly observed on a global scale. These effects have led to steady growth in the atmospheric abundance of several radiatively and chemically active trace gases. These emissions influence tropospheric and stratospheric ozone and the Earth's climate, and modify the oxidizing properties and the self-cleaning power of the atmosphere. Scientific details of processes occurring in the stratosphere and troposphere are discussed together with important measurements that must be made to answer certain scientific questions which need to be documented as a prerequisite to a consensus definition of the optimum course of action by the greatest number of nations. A coherent instrument package for atmospheric chemistry is discussed, and ESA's program is reviewed. ESA

N92-22840# Reading Univ. (England). Unit for Thematic Information Systems.
LAND-SURFACE PROCESSES: INTRODUCTION
J. GURNEY *In* ESA, Report of the Earth Observation User Consultation Meeting p 119-122 Oct. 1991
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The study of the land surface as part of the climate system

is important because of the role it plays in radiation interception, partitioning of energy and water fluxes, and because it is part of the climate system with the best and most established data records. The land surface is also important for economic reasons because of the impact of possible changes in climate. A summary of radiation and energy budget studies for climate purposes is given, from which the following conclusions are drawn: simultaneous nadir and off nadir observations are needed at visible and near infrared wavelengths to characterize bidirectional reflectance distribution functions, with simultaneous observations for atmospheric correction; a higher spectral resolution thermal infrared radiometer is needed to make atmospheric moisture and temperature observations, but also to make estimates of surface emittance and temperature; passive microwave observations at 1.4 GHz are needed to estimate near surface soil moisture; passive microwave observations at approximately 18 and 37 GHz are needed estimate snow volume; simple visible and near infrared spectral observations at a few wavelengths are needed to map vegetation, with simultaneous atmospheric correction being required; experiments to study scaling up of energy budget relationships to large spatial scale are required for definition of satellite radiometer requirements as well as for algorithm development. ESA

N92-22841# Alfred-Wegener-Inst. for Polar Research, Bremerhaven (Germany).
ICE PROCESSES: INTRODUCTION
E. AUGUSTEIN, P. LEMKE, and T. VIEHOFF *In* ESA, Report of the Earth Observation User Consultation Meeting p 123-129 Oct. 1991 Original contains color illustrations
Copyright Avail: CASI HC A02/MF A03; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 75 Dutch guilders

Th effects of sea ice, ice shelves and the polar ice sheets are treated. The parameters that need to be measured in order to determine the effects of ice process on the environment and climate change are listed. The measuring instruments required are also listed. These include spaceborne, airborne and ground based instruments together with those in the oceanic water column. It is revealed that various techniques must be applied in order to determine the surface heat and radiation balances in the polar regions. In the framework of the various observation methods, satellite remote sensing occupies a rather important role which may grow in the future when more refined instruments can be applied to space platforms. ESA

N92-23123# Lawrence Livermore National Lab., CA.
SCIENTIFIC DEVELOPMENT OF THE ADVANCED PARALLEL CHEMISTRY (APACHE) CLIMATE MODEL
D. J. WUEBBLES and D. A. ROTMAN 16 Dec. 1991 7 p
(Contract W-7405-ENG-48)
(DE92-006657; UCRL-ID-109264) Avail: CASI HC A02/MF A01

Modeling of atmospheric chemistry and constituent transport is an important requirement for meeting the CHAMMP goal of exploring the limits of climate predictability and of simulating the time-dependent behavior of climatic changes on scales from regional to global. This report discusses the results obtained by the CHAMMP Pilot Project on atmospheric chemistry started at Lawrence Livermore National Laboratory (LLNL) in Apr. 1990. This project had the long-term goal of contributing to the development of the chemical-transport modeling capabilities for CHAMMP with the initial efforts aimed at defining some of the important design criteria for the modeling development needed for the advanced climate model. Primary efforts have branched into three distinct areas. First, to gain the necessary understanding of the challenges and opportunities of computing on a massively parallel computer an existing version of the LLNL two-dimensional chemical-radiative-transport code was transferred to a massively parallel computer. Second, the present LLNL two-dimensional chemical-radiative-transport code was used as a test bed in the study of advanced numerical methods needed to solve the stiff equations associated with chemistry, atmospheric dynamics, and higher order transport algorithms. Third, in order to prepare for development of the future three-dimensional chemical-transport model, an existing state-of-the-art three-dimensional tracer transport code was obtained and evaluated. This code has helped us push the model development forward by providing a head start on the three-dimensional model structure and formulation. DOE

N92-23593# Council on Environmental Quality, Washington, DC.
NATIONAL ACID PRECIPITATION ASSESSMENT PROGRAM: 1990 INTEGRATED ASSESSMENT REPORT
Nov. 1991 546 p
(PB92-100346) Avail: CASI HC A23/MF A04

A summary is presented of the causes and effects of acidic deposition and a comparison of the costs and effectiveness of alternative emission control scenarios. In developing the Integrated Assessment (IA), it was NAPAP's goal to produce a structured compilation of policy relevant technical information. The IA is based on findings and data from a series of 27 State-of-Science Technology Reports (SOST) on acidic deposition published by NAPAP in 1990. The scope includes: (1) emissions, atmospheric processes, and deposition; (2) effects on surface waters, forests, agricultural crops, exposed materials, human health, and visibility; and (3) control technologies, future emissions, and effects valuation. GRA

N92-23740# Lawrence Livermore National Lab., CA.
ON THE GLOBAL WARMING POTENTIALS OF CANDIDATE GASEOUS DIFFUSION PLANT COOLANTS
D. J. WUEBBLES 21 Nov. 1991 6 p
(Contract W-7405-ENG-48)
(DE92-006640; UCRL-ID-109227) Avail: CASI HC A02/MF A01

CFC-114 has been used in large quantities as a coolant in gaseous diffusion plants for some time. International and national policy actions related to protection of the ozone layer now call for the elimination of the production of several chlorofluorocarbons, including CF2ClCF2Cl, termed CFC-114, by the end of this decade. Atmospheric researchers have played major roles in the research and atmospheric modeling studies that led to the development of these policies. In a recent 1991 report for the U.S. Department of Energy (DOE), Lee Trowbridge of the Uranium Enrichment Organization makes a preliminary analysis of the potential environmental effects of compounds being considered as replacements for CFC-114 as coolants in the processing of uranium in gaseous diffusion plants. This report evaluates the findings of the Trowbridge report in relationship to the current understanding of atmospheric chemical, physical and climatic processes. DOE

N92-24256# State Univ. of New York, Stony Brook.
FIRST YEAR PROGRESS REPORT ON RESEARCH PROJECT ON CO2-INDUCED CLIMATE CHANGE
R. D. CESS and S. HAMEED 1991 6 p
(Contract DE-FG02-85ER-60314)
(DE92-007589; DOE/ER-60314/4) Avail: CASI HC A02/MF A01

The three major areas of study are discussed separately in this report of the first year of the Research Project on CO2 Induced Climate Change. The first task deals with an intercomparison of general circulation model capabilities with the aim of improving their parameterizations of important physical processes, so that model predictions of CO2 induced climate change become more reliable. The second task encompasses analysis of climate data for the purpose of understanding climate change and climate variability. The third task is concerned with analyzing climatic variability in General Circulation Models and its comparison with observations. DOE

N92-24671# Laser Applications Research Center, The Woodlands, TX.
THE 1991 WOODLANDS CONFERENCE: THE REGIONS AND GLOBAL WARMING: IMPACTS AND RESPONSE STRATEGIES
1991 24 p Conference held in Woodlands, TX, 3-6 Mar. 1991
(Contract DE-AC05-84OR-21400)
(DE92-003221; CONF-9103221-SUMM) Avail: CASI HC A03/MF A01

To date, much of the attention given to global warming in scientific research as well as in policy development has focused

on the global picture. International negotiations and agreements to stabilize, and eventually reduce, greenhouse gas emissions are very important. By themselves, however, they are not sufficient to address global warming. Regional strategies are also needed. They can help reduce greenhouse gas emissions, and they will be the most effective way to mitigate the consequences of global warming. Adaptive strategies must respond to local and regional conditions. In many countries, subnational jurisdictions such as states and provinces or community organizations can already take effective actions without direction from their national government or waiting for international agreements. An important factor in defining regional approaches is the disparate consequences of climate change for developed and developing areas. Different strategies will also be needed for industrial and agricultural regions. Wealthy industrial regions may be better able to develop capital-intensive, adaptive infrastructure than regions with fewer discretionary resources where people are more vulnerable to the vagaries of weather patterns. On the other hand, regions that rely on indigenous knowledge and local resources may be better equipped to make incremental adaptations and more willing to modify life-styles. Ultimately, all climate change effects are experienced in specific places and effective response depends upon local action. We recognize that individual localities cannot solve a problem of global proportions by acting alone. However, a regional strategy can supplement international and national action and be the focal point for addressing risks in the unique social and economic context of a particular area. These meetings discussions dealt with the impacts and implications of climate change on such things as agriculture, forestry, and policy. DOE

N92-24904# Corvallis Environmental Research Lab., OR.
GLOBAL CARBON CYCLE AND CLIMATE CHANGE: BOOK CHAPTER
R. K. DIXON 1992 11 p Submitted for publication
(PB92-153741; EPA/600/A-92/048) Avail: CASI HC A03/MF A01

The production of greenhouse gases due to anthropogenic activities may have begun to change the global climate. The global carbon cycle plays a significant role in projected climate change. However, considerable uncertainty exists regarding pools and flux in the global cycle. Given the author's present understanding of current global carbon sources and sinks, feedbacks from the biosphere are likely to influence the process of climate change. Opportunities may exist to manage the biosphere and reduce the accumulation of greenhouse gases in the atmosphere. The role of the global carbon cycle in projected climate change is surveyed. Author

N92-25062# Department of Energy, Washington, DC.
CLIMATE CHANGE AND RELATED ACTIVITIES
1992 17 p
(DE92-008012; DOE/PE-0102P) Avail: CASI HC A03/MF A01

The 'greenhouse' process regulates the Earth's climate at a level to sustain life, making our planet unique. The term 'climate' refers not only to temperature, but also to the entire system of precipitation, cloudiness, and winds, as well as to the distribution of these features in space and time. The production and consumption of energy contributes to the concentration of greenhouse gases in the atmosphere and is the focus of other environmental concerns as well. Yet the use of energy contributes to worldwide economic growth and development. If we are to achieve sound environmental economic growth, we must develop and deploy energy technologies that contribute to global stewardship. Global climate change is a significant issue for the U.S. Department of Energy (DOE) because greenhouse gases are emitted from the production and use of fossil fuels. Energy use and production now contribute more than half of the total manmade emissions on a global basis. DOE carries out an aggressive scientific research program to address some of the key uncertainties associated with the climate change issue. Of course, research simply to study the science of global climate change is not enough. At the heart of any regime of cost effective actions to address the possibility of global climate change will be a panoply of new technologies; technologies both to provide the services we demand and to use energy more efficiently than in the past. These, too, are important areas of responsibility for DOE. This report is a brief description of DOE's activities in scientific research, technology development, policy studies, and international cooperation that are directly related to or have some bearing on the issue of global climate change. DOE

N92-25118# Mitre Corp., McLean, VA. Jason Program Office.
ISSUES IN PREDICTABILITY
H. ABARBANEL, S. KOONIN, H. LEVINE, G. MACDONALD, and O. ROTHAUS Dec. 1991 58 p
(Contract DE-AI05-90ER-30174)
(DE92-008514; JSR-90-320) Avail: CASI HC A04/MF A01

Since the beginning of the greenhouse debate, policy makers have demanded from the scientific community predictions of future climate in limited geographical areas (e.g., Congressional Districts) and limited time intervals (e.g., Convention Time, 2000). Current climate models clearly do not have such capabilities, as is demonstrated by large disagreements among the models of continental size regions. Government and private groups have proposed programs such as DOE's CHAMMP and UCAR's CSMP to remedy the situation. Largely lost in the debate are fundamental questions such as: What is meant by predictability; What can be predicted and over what time and length scale; What errors can be expected from predictions. This report explores some of the issues by analyzing toy models of climate and existing data sets of global annual average surface air temperature. DOE

N92-25170# Colorado Univ., Boulder. Cooperative Inst. for Research in Environmental Sciences.
THERMOHALINE CIRCULATIONS AND GLOBAL CLIMATE CHANGE
H. P. HANSON 1992 4 p
(Contract DE-FG02-90ER-61019)
(DE92-008796; DOE/ER-61019/2) Avail: CASI HC A01/MF A01

'Thermohaline Circulations and Global Climate Change' is concerned with investigating the hypothesis that changes in surface thermal and hydrological forcing of the North Atlantic, changes that might be expected to accompany CO2 induced global warming, could result in ocean-atmosphere interactions' exerting a positive feedback on the climate system. Because the North Atlantic is the source of much of the global ocean's reservoir of deep water, and because this deep water could sequester large amounts of anthropogenically produced CO2, changes in the rate of deep-water production are important to future climates. Since deep-water production is controlled, in part, by the annual cycle of the atmospheric forcing of the North Atlantic, and since this forcing depends strongly on both hydrological and thermal processes as well as the windstress, there is the potential for feedback between the relatively short-term response of the atmosphere to changing radiative forcing and the longer-term processes in the oceans. DOE

N92-25226# European Space Agency, Paris (France).
EURISY SYMPOSIUM ON THE EARTH'S ENVIRONMENT: AN ASSESSMENT FROM SPACE
T. D. GUYENNE, ed. Oct. 1991 136 p In ENGLISH and FRENCH Symposium held in Venice, Italy, 10-11 Apr. 1991; sponsored by ESA, CEC, ASI, BNSC, CNES, DARA, CICYT/INTA
(ESA-SP-337; ISBN-92-9092-190-0; ETN-92-91275) Copyright Avail: CASI HC A07/MF A02

The use of space technology to better monitor and assess the state of the Earth's environment is discussed. Natural factors and human effects on climate are considered. The consequences of ozone layer evolution are discussed. The use of remote sensing in monitoring the environment is described. Models of global climate change are presented. The policies of various European governments in developing environmental space programs are described. Space technologies used in atmospheric and environmental monitoring are summarized. Threats of desertification and their appraisal are discussed. ESA

N92-25227# Copenhagen Univ. (Denmark). Inst. of Geography.
IS THERE A THREAT?
AKSEL WIIN-NIELSEN *In* ESA, EURISY Symposium on the Earth's Environment: An Assessment from Space p 17-18 Oct. 1991
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A brief analysis of other various threats to environmental systems is presented. Requirements for observations and monitoring are reviewed. The nature of models of natural systems are discussed with the climate system as an example. The need to develop climate models such that they be more realistic both in the description of the internal processes in the atmosphere and in incorporating all other components of the climate systems is stressed. ESA

N92-25228# Universite Catholique de Louvain (Belgium). Inst. d'Astronomie et de Geophysique G. Lemaitre.
NATURAL FACTORS AND/OR HUMAN EFFECTS ON CLIMATE
ANDRE BERGER *In* ESA, EURISY Symposium on the Earth's Environment: An Assessment from Space p 19-29 Oct. 1991
Copyright Avail: CASI HC A03/MF A02

Interactions between man's activity, greenhouse effects and cyclical climatic fluctuations on the Earth are discussed. Simulation of climatic systems over a geological time scale is discussed. The time scale of such research is beyond most climatic models developed to date. Validation and sensitivity analysis of such climatic models is stressed as being crucial to better understand man's impact on climate. It is concluded that the greenhouse warming of the next century is unavoidable, possibly rivaling the temperature change between the last glacial maximum 20,000 years ago and today. ESA

N92-25231# Meteorology Bureau, Boulogne (France). Etablissement d'Etudes et de Recherches Meteorologiques.
THE THREAT OF DESERTIFICATION: SCIENTIFIC APPRAISAL AND SOME PROPOSALS FOR ACTION
JEAN-CLAUDE ANDRE *In* ESA, EURISY Symposium on the Earth's Environment: An Assessment from Space p 39 Oct. 1991
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The problem of climatic desertification and desertification threatened areas is discussed. The reason for this threat, the areas in danger, and what should be done is considered. Uncertainty about possible modifications of the hydrological cycle in response to increased greenhouse warming is discussed. It is known, for example, if precipitation will either decrease, or if precipitation distribution throughout the year will change. It is however clear that the temperature increase will be significant enough to affect water availability, through increased evaporation and evapotranspiration early in the season. It is likely that there will be a noticeable decrease in water availability in the upper soil layers. Pooling scientific resources from interested countries, to increase monitoring efforts, conduct special observational in situ programs and develop improved modeling and forecasting capacities is called for. ESA

N92-25232# Telespazio, S.p.A., Rome (Italy).
REMOTE SENSING AND THE ENVIRONMENT
RAFFAELE MINICUCCI *In* ESA, EURISY Symposium on the Earth's Environment: An Assessment from Space p 41-42 Oct. 1991
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Monitoring of the environment is a main issue where all available technology should be used in a very synergic and efficient way. Space remote sensing, a valuable tool for Earth observation and evaluation of several environmental processes such as climatological changes, sea water pollution, desertification, and other such processes is described. An overview of remote sensing application related to these topics is presented. Various Italian initiatives in setting up a Mediterranean Remote Sensing Center (MRSC) as well as an agrometeorology and environmental information network are described. The issue of training remote sensing network users is addressed. ESA

N92-25233# Imperial Coll. of Science and Technology, London (England). Center for Environmental Technology.
MODELS OF GLOBAL CLIMATE CHANGE
JOHN MASON *In* ESA, EURISY Symposium on the Earth's Environment: An Assessment from Space p 47-56 Oct. 1991
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Increases in carbon dioxide and the other greenhouse gases are together likely to approximate to a doubling of the present concentrations of CO2 by the year 2050. Current best estimates based on large, complex coupled atmosphere-ocean models, indicate that this would produce an average global surface temperature rise of 2.5 degrees centigrade and a sea level rise of 540 cm. However, the model predictions are sensitive to the treatment of clouds and their influence in radiation, so that improved understanding of these and other feedback mechanisms is necessary to reduce uncertainties in current predictions and provide firmer scientific guidance for remedial action. ESA

N92-25234# World Climate Programme, Geneva (Switzerland).
SPACE OBSERVATION REQUIREMENTS FOR GLOBAL CLIMATE SCIENCE AND PREDICTION
PAUL MOREL *In* ESA, EURISY Symposium on the Earth's Environment: An Assessment from Space p 57-59 Oct. 1991
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Predicting global climate change requires understanding the mechanisms of transient climate variations to an unprecedented level of accuracy. Climatological research is basically dependent upon the information inferred from global weather analyses so that the requirements of climate science are, firstly, for improved temperature, moisture and wind measurements from space. Global measurements of radiation fluxes at the top of the atmosphere, cloud extent and properties, and rainfall are called for. Global measurements of sea surface temperature, wind and geopotential altitude or topography, ocean color and extent of sea ice are also of importance. The time dependence properties of the land surface vegetation and soil moisture are important data to be expected from the future space based Earth Observing System (EOS). ESA

N92-25235# European Organization for the Exploitation of Meteorological Satellites, Darmstadt (Germany).
OPERATIONAL OBSERVATION OF THE EARTH FROM SPACE METEOROLOGY, CLIMATOLOGY, EARTH RESOURCES, ENVIRONMENT
JOHN MORGAN *In* ESA, EURISY Symposium on the Earth's Environment: An Assessment from Space p 61-65 Oct. 1991
Copyright Avail: CASI HC A01/MF A02

The classes of operational Earth observation satellites and some examples of their principle uses are discussed. Emphasis is given to the operational meteorological satellites, which have already provided data for more than thirty years. Commercial remote sensing satellites are also discussed. Geostationary meteorological satellites and typical missions of such satellites are described. Polar orbiting meteorological satellites and their typical missions are outlined. Different commercially oriented Earth resource satellites are described. The role of these different types of satellites on developing a picture of global change is discussed. ESA

N92-25236# Rutherford High Energy Lab., Chilton (England). Space Science Dept.
SPACE DATA FROM SCIENTIFIC PROJECTS
J. E. HARRIES *In* ESA, EURISY Symposium on the Earth's Environment: An Assessment from Space p 67-76 Oct. 1991
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A brief review of the use of Earth observation from space for scientific studies of the global environment is presented. Examples are given of observations of the atmosphere, oceans, and other components of the climate system, which illustrate the power of global data sets which are uniquely available from space. Some lessons for future research are discussed. ESA

N92-25237# European Space Agency, Paris (France).
THE EUROPEAN SPACE AGENCY'S CONTRIBUTION TO EARTH OBSERVATION FROM SPACE
JEAN-MARIE LUTON *In its* EURISY Symposium on the Earth's Environment: An Assessment from Space p 77-81 Oct. 1991
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The major Earth observation activities carried out by ESA are outlined. The role of space technology in providing a better understanding of the forces that shape the Earth's environment is stressed. The Meteosat program is summarized. The ERS satellite missions are discussed. The polar orbit Earth observation mission is described. The contributions these various missions have made to better understanding environmental factors are outlined. The Applications and Research Involving Space Techniques for the Observation of The Earth's fields from Low Earth orbit Spacecraft (Aristoteles) mission is discussed. ESA

N92-25238# Aerospatiale, Les Mureaux (France).
EUROPEAN INDUSTRIAL CAPABILITIES TO PROVIDE METEOROLOGICAL SPACE SYSTEMS
MICHEL DELAYE *In* ESA, EURISY Symposium on the Earth's Environment: An Assessment from Space p 83-87 Oct. 1991
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Avoidance of technological gambles and determination to arrive simple specific actions are identified as being key aspects of Meteosat's success. As the first European operational space program, Meteosat has proven how a well conceived system, developed and maintained in a close knit collaboration between space agencies and European industries, can stay alive from the early seventies to the year 2000. European industrial companies extend their action in the framework of the ESA-Eumetsat collaboration on second generation Meteosat as well as in the framework of the Eumetsat-NOAA potential collaboration for meteorological polar satellites. European industrial capabilities in design and development of spaceborne sensors for advanced meteorological and environmental instruments, are described. Meteosat speaks for the ability of European industry to contribute to the development and operation of a spaceborne operational system for the observation and study of the Earth's environment. ESA

N92-25239# MATRA Espace, Paris-Velizy (France).
MATRA MARCONI SPACE AND THE EARTH'S ENVIRONMENT MONITORING SYSTEMS
CLAUDE GOUMY *In* ESA, EURISY Symposium on the Earth's Environment: An Assessment from Space p 89-91 Oct. 1991
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The involvement of Matra Marconi Space in Earth observation from space is summarized. Involvement of the company on the SPOT, Helios, Meteosat and ERS programs is discussed. Atmos and Globsat mission concepts are outlined. The instruments aboard Globsat are described as is the total payload mass. A diagram of the general configuration of Globsat is presented. A general architecture for the Atmos, Globsat, ERS, SPOT network is shown in diagrammatic form. Ways to achieve cost savings and improvement in quality are suggested. ESA

N92-25245# State Secretary of Science Policy, Brussels (Belgium).
THE ROLE OF BELGIUM IN EARTH OBSERVATION FROM SPACE PROGRAMS [LA BELGIQUE ET LES PROGRAMMES D'OBSERVATION DE LA TERRE A PARTIR DE L'ESPACE]
ERIC DERYCKE *In* ESA, EURISY Symposium on the Earth's Environment: An Assessment from Space p 121-123 Oct. 1991
In FRENCH
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The role played by Belgium in Earth observation from space programs is outlined. The role of Belgium in the SPOT program, the Mir Infra Red Atmosphere Spectrometer (MIRAS), the space teledetection program and the global change program is described. The need for including considerations of life quality, starting with a concern for the environment in the politics of scientific research is stressed. The consequences of such an approach to scientific research in general and space research in particular are considered. ESA

N92-25247# Commission of the European Communities, Brussels (Belgium).
PANEL DISCUSSION ON ASSESSMENT OF THE EFFECTIVENESS OF CURRENT POLICIES, ACTIONS AND ORGANISATIONS
JEAN-PIERRE CONTZEN *In* ESA, EURISY Symposium on the Earth's Environment: An Assessment from Space p 129-130 Oct. 1991
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The position taken by the European Community at the second world climate conference is described. The unprecedented rate of climate change predicted by the Intergovernmental Panel on Climate Change (IPCC) indicates that action must be taken immediately. The economic impact of measure to be taken is considered to be less apocalyptic than many predictions. The need for increased further research to monitor the effectiveness and impact of adaptive actions and to provide a basis for policy adjustment is stressed. Three immediate main areas of action are identified. These are a ban or limitation in chlorofluorocarbons (CFS's), protection of the tropical forest and stabilization of CO2 emissions. ESA

N92-25313# Department of Energy, Washington, DC. Office of Environmental Analysis.
LIMITING NET GREENHOUSE GAS EMISSIONS IN THE UNITED STATES
R. A. BRADLEY, ed., E. C. WATTS, ed., and E. R. WILLIAMS, ed. Sep. 1991 529 p
(DE92-007267; DOE/PE-0101) Avil: NTIS HC/MF A23

Over the past decade, global climate change has been a subject of growing concern. The United States government in general, and the US Department of Energy in particular, have increased their level of activity in this area in recent years; since the 1970's, the DOE has sponsored scientific research programs in global climate change. These programs have sought to define the issues, reduce uncertainties, and quantify the interaction of global human and natural systems. Understanding the relationship between the production and use of energy and the accumulation of radiatively active gases in the atmosphere, as well as the consequences of this relationship for global climate systems, has been of particular interest, because constructive policy cannot be formulated without a firm scientific grasp of these issues. The National Energy Strategy was developed to address all of the nation's energy concerns, taking into account related environmental issues such as global climate change. Actions included in the National Energy Strategy are projected to hold US energy-related emissions of greenhouse important gases, weighted by IPCC-estimated global warming potential (GWP) coefficients, at or below 1990 levels through the year 2030. DOE

N92-25330# California Univ., Berkeley. Lawrence Berkeley Lab.
CO2 EMISSIONS FROM DEVELOPING COUNTRIES: BETTER UNDERSTANDING THE ROLE OF ENERGY IN THE LONG TERM
J. SATHAYE, ed. and N. GOLDMAN, ed. Jul. 1991 82 p
(Contract DE-AC03-76SF-00098)
(DE92-009504; LBL-30060) Avail: CASI HC A05/MF A01

Recent years have witnessed a growing recognition of the link between emissions of CO2 and changes in the global climate. Of all anthropogenic activities, energy production, and use generate the single largest portion of these greenhouse gases. Although developing countries currently account for a small share of global carbon emissions, their contribution is increasing rapidly. Due to the rapid expansion of energy demand in these nations, the developing world's share in global modern energy use rose from 16 to 27 percent between 1970 and 1990. If the growth rates observed over the past 20 years persist, energy demand in developing nations will surpass that in the countries of the

Organization for Economic Cooperation and Development (OECD) early in the 21st century. The study seeks to examine the forces that galvanize the growth of energy use and carbon emissions, to assess the likely future levels of energy and CO2 n selected developing nations and to identify opportunities for restraining this growth. The purpose of this report is to provide the quantitative information needed to develop effective policy options, not to identify the options themselves. These individual studies were conducted for China, India, Indonesia, and South Korea. DOE

N92-25415# General Accounting Office, Washington, DC.
GLOBAL WARMING. EMISSION REDUCTIONS POSSIBLE AS SCIENTIFIC UNCERTAINTIES ARE RESOLVED
Sep. 1990 74 p
(GAO/RCED-90-58; B-240222) PO Box 6015, Gaithersburg, MD 20877 HC first five copies free, additional copies $2.00

It was concluded that industrial and agricultural activities are causing the atmospheric concentrations of greenhouse gases to exceed historic levels. Without action now, these concentrations are likely to grow, although the rate of increase is uncertain. From their review of computer modeling results, most climate scientists agree that the climate's response to this growth will be an increased average temperature over the next 100 years. They do not concur, however, on the timing and magnitude of this change or on the associated regional climate changes. While research should reduce these scientific uncertainties, quick fixes or easy answers are unlikely to emerge. Rather, research results are expected to continue pointing to the need for a comprehensive, multinational, multidecade response strategy. In the meantime, many agree that certain actions can be justified because they have benefits in addition to reducing greenhouse gases. Reducing CFC's is an example of one such activity already under way, and more can be done in other areas, such as improving energy efficiency.
Author

N92-25745# Lawrence Livermore National Lab., CA.
CHAMMP PROGRAM OVERVIEW
M. C. MACCRACKEN Oct. 1991 6 p Presented at the ARM Science Team Conference, Denver, CO, 26-30 Oct. 1991
(Contract W-7405-ENG-48)
(DE92-008063; UCRL-JC-109518; CONF-9110336-1) Avail: CASI HC A02/MF A01

CHAMMP is an integral part of the ESD climate modeling program and its objectives are highly complementary to the modeling activities being conducted as part of the Program for Climate Model Diagnosis and Intercomparison. CHAMMP is also closely linked to the US Global Change Research Program, especially through its interactions with the major climate modeling centers of the other agencies. Because of its need for and focus on use of forefront supercomputers, CHAMMP is also a contributing program in the High Performance Computing Program, which is a new Presidential Initiative dedicated to the 'grand challenge' computational problems. Just as the ARM program was formed in recognition of the inability of present general circulation models (GCMs) to satisfactorily represent cloud formation, convection, and radiative processes, the CHAMMP program was organized in response to the need to harness greater computational power in the pursuit of regionally resolved projections of climate change. The goal of the CHAMMP Climate Modeling Program is to develop, verify, and apply a new generation of climate models within a coordinated framework that incorporates the best available scientific and numerical approaches to represent physical, biogeochemical, and ecological processes, that fully utilizes the hardware and software capabilities of new computer architectures, that probes the limits of climate predictability, and finally that can be used to address the challenging problem of understanding the greenhouse climate issue through the ability of the models to simulate time-dependent climatic changes over extended times and with regional resolution. DOE

N92-26000# Lawrence Livermore National Lab., CA.
GLACIAL TERMINATIONS AND THE GLOBAL WATER BUDGET
W. S. BROECKER (Lamont-Doherty Geological Inst., Palisades, NY.) Jan. 1992 50 p
(Contract W-7405-ENG-48)
(DE92-008939; UCRL-CR-109709) Avail: CASI HC A03/MF A01

Evidence suggests that the last glacial period came to an abrupt close about 13,500 years ago. This evidence indicates: (1) that the melting of the North American ice sheet commenced abruptly at this time; (2) that surface temperatures in the northern Atlantic rose sharply at this time; (3) that surface water conditions in the Antarctic changed abruptly at this time; (4) that the salinity of the Red Sea dropped abruptly at this time; and (5) that accumulation rate of planktonic foraminifera in the South China Sea underwent an abrupt five-fold increase at this time. This project was directed toward better developing and documenting our explanation for the abruptness of these changes. This project has supported investigation of several aspects of this hypothesis. We suggest that the Greenland climate changes are driven by oscillations in salt content which modulate the strength of the Atlantic's conveyor circulation. DOE

N92-26121*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
THE FUTURE OF SPACEBORNE ALTIMETRY. OCEANS AND CLIMATE CHANGE: A LONG-TERM STRATEGY
C. J. KOBLINSKY, ed. (CLS Argos, Toulouse (France).), P. GASPAR, ed., and G. LAGERLOEF, ed. (Science Applications International Corp., Bellevue, WA.) Mar. 1992 82 p Original contains color illustrations
(NASA-TM-105087; NAS 1.15:105087)

The ocean circulation and polar ice sheet volumes provide important memory and control functions in the global climate. Their long term variations are unknown and need to be understood before meaningful appraisals of climate change can be made. Satellite altimetry is the only method for providing global information on the ocean circulation and ice sheet volume. A robust altimeter measurement program is planned which will initiate global observations of the ocean circulation and polar ice sheets. In order to provide useful data about the climate, these measurements must be continued with unbroken coverage into the next century. Herein, past results of the role of the ocean in the climate system is summarized, near term goals are outlined, and requirements and options are presented for future altimeter missions. There are three basic scientific objectives for the program: ocean circulation; polar ice sheets; and mean sea level change. The greatest scientific benefit will be achieved with a series of dedicated high precision altimeter spacecraft, for which the choice of orbit parameters and system accuracy are unencumbered by requirements of companion instruments. Author

N92-26140# California Univ., Berkeley.
CO2 EMISSIONS FROM DEVELOPING COUNTRIES: BETTER UNDERSTANDING THE ROLE OF ENERGY IN THE LONG TERM
A. KETOFF, ed., J. SATHAYE, ed., and N. GOLDMAN, ed. Jul. 1991 77 p
(Contract DE-AC03-76SF-00098)
(DE92-009503; LBL-30059) Avail: CASI HC A05/MF A01

Recent years have witnessed a growing recognition of the link between emissions of carbon dioxide (CO2) and changes in the global climate. Of all anthropogenic activities, energy production and use generate the single largest portion of these greenhouse gases. Although developing countries currently account for a small share of global carbon emissions, their contribution is increasing rapidly. Due to the rapid expansion of energy demand in these nations, the developing world's share in global modern energy use rose from 16 to 27 percent between 1970 and 1990. If the growth rates observed over the past 20 years persist energy demand in developing nations will surpass that in the countries of the Organization for Economic Cooperation and Development (OECD) early in the 21st century. The study seeks to examine the forces that galvanize the growth of energy use and carbon emissions, to assess the likely future levels of energy and CO2 in selected developing nations and to identify opportunities for

restraining this growth. The purpose of this report is to provide the quantitative information needed to develop effective policy options, not to identify the options themselves. These individual studies were conducted for Argentina, Brazil, Mexico and Venezuela in Latin America. DOE

N92-26509# ManTech Environmental Technology, Inc., Corvallis, OR.

EQUILIBRIUM-ANALYSIS OF PROJECTED CLIMATE CHANGE EFFECTS ON THE GLOBAL SOIL ORGANIC MATTER POOL

D. P. TURNER and R. LEEMANS 1992 14 p Presented at the Carbon Cycling in Boreal Forest and Subarctic Ecosystems Workshop, Corvallis, OR, 9-12 Sep. 1991 Submitted for publication

(Contract EPA-68-C8-0006)

(PB92-153022; EPA/600/A-92/039) Avail: CASI HC A03/MF A01

Increased rates of soil organic matter decomposition may represent a significant positive feedback to global warming. As a step towards assessing the potential magnitude of this response, an equilibrium analysis was performed in which representative carbon pools were associated with each vegetation type and the Holdridge vegetation/climate correlation system was used to compare distributions of the vegetation types under the current climate and doubled-CO2 climate scenarios from four general circulation models (GCMs). Two of the GCMs predicted a net loss of below ground carbon (55-101 Pg) because of large decreases in the areal extent of tundra and boreal ecosystems with high levels of below ground carbon storage. Vegetation redistribution projected under the other two GCMs would result in the accumulation of carbon (5-41 Pg) in the biosphere. However, this accumulation was driven primarily by an increase in the areal extent of tropical rain forests, which is unlikely given the constraints imposed by anthropogenic factors. Other considerations not treated by the equilibrium approach also support the likelihood of a transient pulse of carbon from the soil to the atmosphere. GRA

N92-26878*# National Center for Atmospheric Research, Boulder, CO. Climate and Global Dynamics Div.

MONTHLY MEAN GLOBAL SATELLITE DATA SETS AVAILABLE IN CCM HISTORY TAPE FORMAT

JAMES W. HURRELL and G. GARRETT CAMPBELL Apr. 1992 105 p Original contains color illustrations

(Contract NASW-17214; RTOP 578-41-29-03)

(NASA-CR-190344; NAS 1.26:190344; NCAR/TN-371+STR; PB92-186121) Avail: CASI HC A06/MF A02; 1 functional color page

Satellite data for climate monitoring have become increasingly important over the past decade, especially with increasing concern for inadvertent antropogenic climate change. Although most satellite based data are of short record, satellites can provide the global coverage that traditional meteorological observations network lack. In addition, satellite data are invaluable for the validation of climate models, and they are useful for many diagnostic studies. Herein, several satellite data sets were processed and transposed into 'history tape' format for use with the Community Climate Model (CCM) modular processor. Only a few of the most widely used and best documented data sets were selected at this point, although future work will expand the number of data sets examined as well as update the archived data sets. An attempt was made to include data of longer record and only monthly averaged data were processed. For studies using satellite data over an extended period, it is important to recognize the impact of changes in instrumentation, drift in instrument calibration, errors introduced by retrieval algorithms and other sources of errors such as those resulting from insufficient space and/or time sampling. GRA

N92-27082 International Council of Scientific Unions, Stockholm (Sweden).

PAGES. PAST GLOBAL CHANGES PROJECT: PROPOSED IMPLEMENTATION PLANS FOR RESEARCH ACTIVITIES

JOHN A. EDDY, ed. 1992 108 p Sponsored in part by ICSU; IGBP; UNEP; Unesco; Commission of the European Communities; Swedish Council for Planning and Coordination of Research, NSF, Shell Netherlands, Dutch Electricity Generating Board; Canon Sweden; and Hewlett Packard Sweden

(ISSN 0284-8015)

(IGBP-REPT-19-ATTACH-10) Copyright Avail: Issuing Activity

The Past Global Changes (PAGES) project is directed at securing a better understanding of the natural and human induced variations of the Earth system in the past, through the organization of coordinated national and international endeavors to obtain and interpret a variety of natural and written records. To understand global changes of the past, or to predict the changes expected in the future, one needs to know a detailed history of environmental changes throughout the past, for every region of the globe. Among the research themes considered are: solar and orbital forcing and response; fundamental Earth system processes; rapid and abrupt global changes; multi-proxy mapping; palaeoclimate and environment modeling; and management of palaeodata. H.A.

N92-27343# McGill Univ., Montreal (Quebec). Climate Research Group.

NSERC/AES INDUSTRIAL RESEARCH CHAIRS IN CLIMATE RESEARCH, MCGILL UNIVERSITY Annual Progress Report No. 3

LAWRENCE A. MYSAK and CHARLES A. LIN Mar. 1989 14 p

(CRG-89-4; CTN-92-60536) Avail: CASI HC A03/MF A01

The unifying theme of most of the work carried out at McGill University's Industrial Research Chair program in climate research is the role of oceans in climate. A major task of the program has been the development of a global upper-ocean circulation model which will be coupled to an atmospheric general circulation model (GCM) in order to yield a fully interactive atmosphere-ocean GCM suitable for conducting various numerical climate experiments and producing climate scenarios. Other research projects include those concerning various aspects of climate and atmospheric dynamics, including large scale air-ice-ocean interactions, long-term climatic fluctuations, heat transport by planetary waves, and isopycnal diffusion in the oceans. The program is also contributing toward manpower training to research associates, postdoctoral fellows, and graduate students. Research during 1988-89 is reviewed and a list of relevant publications is included. CISTI

N92-27359# McGill Univ., Montreal (Quebec). Centre for Climate and Global Change Research.

THE OCEANS' ROLE IN CLIMATE VARIABILITY AND CLIMATE CHANGE

LAWRENCE A. MYSAK and CHARLES A. LIN May 1989 43 p Sponsored by Natural Sciences and Engineering Research Council; Atmospheric Environment Service; and FCAR

(CGCR-89-9; CTN-92-60540) Avail: CASI HC A03/MF A01

In view of the significant impacts of climate change, the question of whether the warming trend induced by the greenhouse effect has actually been detected is addressed. Natural climatic variability over various time scales is first illustrated, such as those coinciding with El Nino events or with large atmospheric pressure gradients. The impacts of natural climatic variability on fisheries are reviewed. The long-term increase in atmospheric CO2 due to fossil fuel burning is noted along with the problems of forecasting atmospheric CO2 concentrations in the future. The modeling of greenhouse effect induced climatic change is discussed along with some results from coupled ocean-atmosphere models and their uncertainties. The detection of CO2 greenhouse warming requires a comparison of the temperature increase calculated by a climate model with the observed temperature trend. The observed global temperature changes indicated by meteorological records do show an upward trend but also show variations which cannot be explained by CO2 alone. Models have limitations such as their reliance on equilibrium conditions and their way of treating the time-dependent transient responses of the climate system. Some models show an increase due to greenhouse warming of between 0.2 and 0.6 C for the period up to 1980, which is too small to be able to distinguish the greenhouse warming trend from natural climatic fluctuations. CISTI

N92-27417# Lawrence Livermore National Lab., CA.
SENSITIVITY OF GLOBAL WARMING POTENTIALS TO THE ASSUMED BACKGROUND ATMOSPHERE
D. J. WUEBBLES and K. O. PATTEN Mar. 1992 9 p
(Contract W-7405-ENG-48)
(DE92-011072; UCRL-ID-109847) Avail: CASI HC A02/MF A01

This is the first in a series of papers in which we will examine various aspects of the Global Warming Potential (GWP) concept and the sensitivity and uncertainties associated with the GWP values derived for the 1992 updated scientific assessment report of the Intergovernmental Panel on Climate Change (IPCC). One of the authors of this report helped formulate the GWP concept for the first IPCC report in 1990. The Global Warming Potential concept was developed for that report as an attempt to fulfill the request from policymakers for a way of relating the potential effects on climate from various greenhouse gases, in much the same way as the Ozone Depletion Potential (ODP) concept is used in policy analyses related to concerns about the relative effects of CFCs and other compounds on stratospheric ozone destruction. We are also coauthors of the section on radiative forcing and Global Warming Potentials for the 1992 IPCC update; however, there was too little time to prepare much in the way of new research material for that report. Nonetheless, we have recognized for some time that there are a number of uncertainties and limitations associated with the definition of GWPs used in both the original and new IPCC reports. In this paper, we examine one of those uncertainties, namely, the effect of the assumed background atmospheric concentrations on the derived GWPs. Later papers will examine the sensitivity of GWPs to other uncertainties and limitations in the current concept. DOE

N92-27511# Mitre Corp., McLean, VA.
ARM REVIEW, 1991
G. MACDONALD 20 Jan. 1992 41 p Sponsored by DOE
(AD-A247629; JSR-91-300) Avail: CASI HC A03/MF A01

The Department of Energy's Atmospheric Radiation Measurement Program (ARM) is a major component of the U.S. research program in global change. ARM's goals of quantifying the effect of clouds on the earth's radiation budget is a key element in improving global circulation models (GCM) through enhancing understanding of the fast physics of the atmosphere. ARM is a well organized and managed program. A major concern for the programs future is the availability of adequate resources to establish and maintain observation sites in the western tropical Pacific and on the north slope of Alaska. GRA

N92-27641# McGill Univ., Montreal (Quebec). Centre for Climate and Global Change Research.
ACTIVITIES OF THE CENTRE FOR CLIMATE AND GLOBAL CHANGE RESEARCH Annual Report No. 1, 1 Jun. 1990 - 31 May 1991
LAWRENCE A. MYSAK Jun. 1991 26 p
(CGCR-91-10; CTN-92-60458) Avail: CASI HC A03/MF A01

The Center for Climate and Global Change Research (C2GCR) at McGill University brings together faculty and graduate students from the departments of meteorology, geography, economics and renewable resources to collaborate in various interdisciplinary research activities. Fields in which C2GCR is strong include air-sea interaction and ocean climate studies, especially at high latitudes; cloud-climate interactions; air-land and land-ocean interactions, including hydrological and biogeochemical cycles; and impacts of climate change and climate variability on biological and socio-economic systems. Activities during 1990-91, C2GCR's first year of operation, are summarized. A list of C2GCR reports is included. CISTI

N92-28056# Argonne National Lab., IL.
GLOBAL CLIMATE CHANGE AND INTERNATIONAL SECURITY
M. RICE 1991 32 p
(Contract W-31-109-ENG-38)
(DE92-010868; ANL/RP-75587) Avail: CASI HC A03/MF A01

On May 8 to 10, 1991, the Midwest Consortium of International Security Studies (MCISS) and Argonne National Laboratory cosponsored a conference on Global Climate Change and International Security. The aim was to bring together natural and social scientists to examine the economic, sociopolitical, and security implications of the climate changes predicted by the general circulation models developed by natural scientists. Five themes emerged from the papers and discussions: (1) general circulation models and predicted climate change; (2) the effects of climate change on agriculture, especially in the Third World; (3) economic implications of policies to reduce greenhouse gas emissions; (4) the sociopolitical consequences of climate change; and (5) the effect of climate change on global security. DOE

N92-28200# McGill Univ., Montreal (Quebec). Centre for Climate and Global Change Research.
AES/NSERC INDUSTRIAL RESEARCH CHAIRS (IRC) IN CLIMATE RESEARCH Progress Report
LAWRENCE A. MYSAK and CHARLES A. LIN May 1991 25 p
(CGCR-91-9; CTN-92-60530) Avail: CASI HC A03/MF A01

The Industrial Research Chairs program in climate research at McGill University focuses on the role of the oceans in climatic variability and climate change. A major accomplishment of the program has been the development of a global upper-ocean circulation model, which is now being coupled to an atmospheric climate model. Other research projects in the dynamics of ocean, climate, and atmosphere are being conducted. Specific subjects of study include the nature and causes of interannual and decadal to century scale climatic fluctuations at high latitudes, global impacts of Arctic climatic variability, thermally forced mesoscale circulations, and tropospheric planetary waves. The program has been successful in training graduate students, postdoctoral fellows, and research associates in modern climate studies and air-sea interaction. A bibliography of publications and presentations by some program personnel is included, along with a financial report. CISTI

N92-28222*# National Aeronautics and Space Administration, Washington, DC.
TECHNOLOGY FOR THE MISSION TO PLANET EARTH
AMY GRAHAM, ed. (TRW Space Technology Labs., Redondo Beach, CA.) 1989 53 p Prepared in cooperation with TRW Space Technology Labs., Redondo Beach, CA
(NASA-TM-107952; NAS 1.15:107952; R11-1681) Avail: CASI HC A04/MF A01

Mission to Planet Earth is a concept referring to the endeavor of making long term, space based global observations for the purpose of understanding earth system processes. The Ad Hoc Review Team on Space Technology was formed to determine what technologies must be developed in the near term to support this endeavor. The review team's central finding is that the Office of Aeronautics and Space Technology has identified all the correct technologies to pursue, but that the mission and system architecture has not been developed sufficiently to permit determination of meaningful priorities. Some of the specific recommendations of the review team are as follows: (1) long term, space based investigation of global changes and the earth's systems; (2) studies should begin that include the performance of relative cost-benefit trade-off analyses and development of operations concepts; (3) funding should be increased, especially in research and development; (4) pursue new technology in information processing; (5) improve interagency integration and coordination; and (6) after architecture studies are complete, another team should meet to consider questions of technology priorities, development schedules, and funding allocation. H.A.

N92-29234*# Meteorological Research Inst., Tsukuba (Japan).
LIDAR OBSERVATIONS OF STRATOSPHERIC AEROSOL LAYER AFTER THE MT. PINATUBO VOLCANIC ERUPTION
TOMOHIRO NAGAI, OSAMU UCHINO, and TOSHIFUMI FUJIMOTO *In* NASA. Langley Research Center, Sixteenth International Laser Radar Conference, Part 1 p 17-20 Jul. 1992
Avail: CASI HC A01/MF A04

The volcano Mt. Pinatubo located on the Luzon Island,

Philippines, had explosively erupted on June 15, 1991. The volcanic eruptions such as volcanic ash, SO2 and H2O reached into the stratosphere over 30 km altitude by the NOAA-11 satellite observation and this is considered one of the biggest volcanic eruptions in this century. A grandiose volcanic eruption influences the atmosphere seriously and causes many climatic effects globally. There had been many impacts on radiation, atmospheric temperature and stratospheric ozone after some past volcanic eruptions. The main cause of volcanic influence depends on stratospheric aerosol, that stay long enough to change climate and other meteorological conditions. Therefore it is very important to watch stratospheric aerosol layers carefully and continuously. Standing on this respect, we do not only continue stratospheric aerosol observation at Tsukuba but also have urgently developed another lidar observational point at Naha in Okinawa Island. This observational station could be thought valuable since there is no lidar observational station in this latitudinal zone and it is much nearer to Mt. Pinatubo. Especially, there is advantage to link up these two stations on studying the transportation mechanism in the stratosphere. In this paper, we present the results of lidar observations at Tsukuba and Naha by lidar systems with Nd:YAG laser. Author

N92-29235*# Massachusetts Inst. of Tech., Cambridge. Center for Global Change Science.
THE ROLE OF LIDARS IN GLOBAL CHANGE RESEARCH
RONALD G. PRINN *In* NASA. Langley Research Center, Sixteenth International Laser Radar Conference, Part 1 p 21-22 Jul. 1992
Avail: CASI HC A01/MF A04

Recent research has solidified a view of the Earth as a global scale interactive system with complex chemical, physical, biological, and dynamical processes that link the ocean, atmosphere, land, and marine terrestrial living organisms. An important aspect of Earth System Science studies in the future is the need to observe simultaneously the physical, chemical, biological, and dynamical processes involved in highly coupled phenomena such as those mentioned. Lidars operating from the surface, aircraft, and satellites provide a powerful observational technique to study the processes and observe trends important to global change. Lidar observations have already played important roles in helping understand processes controlling stratospheric ozone and aerosols, tropospheric clouds, water vapor, ozone, gaseous pollutants, and aerosols, and winds and temperatures throughout the atmosphere. In this paper the author reviews the science of global change and highlights the potential roles for lidar in studying the Earth system. H.A.

N92-29416# Office of Technology Assessment, Washington, DC.
COMBINED SUMMARIES: TECHNOLOGIES TO SUSTAIN TROPICAL FOREST RESOURCES AND BIOLOGICAL DIVERSITY
May 1992 89 p Original contains color illustrations
(OTA-F-515) Avail: CASI HC A05/MF A01

Loss of tropical forests and reduction in the Earth's biological diversity have grown from development assistance concerns to themes of global debate during the last decade. Loss of tropical forests is still associated with poverty in tropical developing nations, but it is now juxtaposed with potential disruption of global weather patterns. In the years since the Office of Technology Assessment published 'Technologies to Sustain Tropical Forest Resources' (1984) and 'Technologies to Maintain Biological Diversity' (1987), new issues have arisen, new approaches have been devised, and new policies have been adopted. Yet the technologies underlying the efforts to manage the resources sustainably have changed little. Thus, in a continuing service to Congress, we are reprinting the summaries of the two earlier assessments and are providing an introduction to the changes that have occurred since their publication. Author

N92-29597# California Univ., Davis.
NATIONAL INSTITUTE FOR GLOBAL ENVIRONMENTAL CHANGE Semiannual Report, 1 Jul. - 31 Dec. 1991
G. C. WERTH 1 Apr. 1992 160 p
(Contract DE-FC03-90ER-61010)
(DE92-013487; DOE/ER-61010/T1) Avail: CASI HC A08/MF A02

This document is the Semi-Annual Report of the National Institute for Global Environmental Change for the reporting period July 1 to December 31, 1991. The report is in two parts. Part 1 presents the mission of the institute, examples of progress toward that mission, a brief description of the revised management plan, and the financial report. Part 2 presents the statements of the Regional Center Directors along with progress reports of the projects written by the researchers themselves. DOE

N92-30021# ManTech Environmental Technology, Inc., Corvallis, OR.
POTENTIAL IMPACTS OF CLIMATE CHANGE ON PACIFIC NORTHWEST FOREST VEGETATION
G. A. KING and D. T. TINGEY May 1992 45 p
(Contract EPA-68-C8-0006)
(PB92-184985; EPA/600/R-92/095) Avail: CASI HC A03/MF A01

Despite the limitations of the models used in the climate change analyses, some overall conclusions can be made concerning climate change impacts on Northwest forests. The foremost of these is that the distribution and composition of forests in Washington and Oregon could change substantially under the GCM scenarios of regional climate change. The Holdridge, climate/forest correlations, and forest gap models (except for the CLIMACS results) all forecast shifts to forests better adapted to warmer and drier conditions. Temperate forests in the Holdridge scenarios are generally restricted to upper elevations and total forest acreage decreases by 5 to 25 percent depending on the climate scenario used. In central Oregon, total forested area is projected to decrease by almost half under a 5C warming. Oak woodlands and dry Douglas-fir dominated forests are likely to increase in areal extent, while the more productive western hemlock - Douglas-fir forest will undergo significant contraction. Subalpine and alpine vegetation are likely to be reduced substantially. Declines in moisture availability would decrease forest productivity and long-term timber production. GRA

N92-30425 Ecological Society of America.
THE SUSTAINABLE BIOSPHERE INITIATIVE: AN ECOLOGICAL RESEARCH AGENDA
JANE LUBCHENCO, ANNETTE M. OLSON, LINDA B. BRUBAKER, STEPHEN R. CARPENTER, MARJORIE M. HOLLAND, STEPHEN P. HUBBELL, SIMON A. LEVIN, JAMES A. MACMAHON, PAMELA A. MATSON, JERRY M. MELILLO et al. 1991 43 p Repr. from Ecology, v. 72, no. 2, Apr. 1991 p 371-412
Copyright Avail: Issuing Activity

In this document, the Ecological Society of America proposes the Sustainable Biosphere Initiative (SBI), an initiative that focuses on the necessary role of ecological science in the wise management of Earth's resources and the maintenance of Earth's life support systems. This document is intended as a call to arms for all ecologists, but it will also serve as a means to communicate with individuals in other disciplines with whom ecologists must join forces to address a common predicament. This document focuses primarily on the acquisition of ecological knowledge. It identifies the ecological research programs of highest priority and recommends steps required to pursue research objectives. The document also lays the groundwork for improving the communication and application of ecological knowledge. The SBI proposes three research priorities: global change; biological diversity; and sustainable ecological systems. H.A.

N92-31121# Lawrence Livermore National Lab., CA.
THE ENVIRONMENTAL DILEMMA OF FOSSIL FUELS
M. C. MACCRACKEN Apr. 1992 11 p Presented at the 6th International Conference on Emerging Nuclear Energy Systems, Monterey, CA, 16-21 Jun. 1991
(Contract W-7405-ENG-48)

(DE92-014887; UCRL-JC-106406; CONF-910626-16) Avail: CASI HC A03/MF A01

The increasing atmospheric concentration of carbon dioxide poses an environmental dilemma for fossil fuel energy generation that, unlike other related emissions, cannot be resolved by control technologies alone. Although fossil fuels presently provide the most cost-effective global energy source, and model projections suggest that their use is initiating climatic changes which, while quite uncertain, may induce significant, counter-balancing impacts to water resources, coastal resources, ecological systems, and possibly agricultural production. The climate models indicate that the warming should have begun, and there is some evidence for this occurring, but at a less rapid and more uneven rate than projected. In addition, different climate models are not yet in agreement in their latitudinal or regional predictions, and it will likely require a decade or more for such agreement to develop as high performance computers become available for addressing this 'grand challenge' problem. Thus, in addition to the prospect for climatic change, the uncertainties of the changes and associated impacts contribute to the dilemma of dealing with the issue. Further, the problem is pervasive and international in scope, with different countries and peoples having differing perspectives of technology, development, and environmental responsibility. Dealing with this issue will thus require creativity, commitment, and flexibility. DOE

N92-31153*# Virginia Univ., Charlottesville. Dept. of Environmental Sciences.

TRACE GAS AND AEROSOL TRANSPORTS INTO AND OUT OF THE AMAZON BASIN Semiannual Report, 1 Sep. 1991 - 31 May 1992

MICHAEL GARSTANG Jul. 1992 165 p

(Contract NCC1-106)

(NASA-CR-190624; NAS 1.26:190624) Avail: CASI HC A08/MF A02

Research under Agreement NCC1-106 during the interim period Oct. 1, 1991 to May 31, 1992 has continued to use the data collected during all three ABLE missions. The work reported on in this interim period includes published papers that cover the topic of global interactions between the rain forest of the Amazon Basin and local regional processes interior to the Basin itself. Author

N92-31258*# National Aeronautics and Space Administration, Washington, DC.

THE DETECTION OF CLIMATE CHANGE DUE TO THE ENHANCED GREENHOUSE EFFECT

ROBERT A. SCHIFFER and SUSHEL UNNINAYAR 1991 60 p Presented at the GEDEX Atmospheric Temperature Workshop, Columbia, MD, 9-11 Jul. 1991

(NASA-TM-107965; NAS 1.15:107965) Avail: CASI HC A04/MF A01

The greenhouse effect is accepted as an undisputed fact from both theoretical and observational considerations. In Earth's atmosphere, the primary greenhouse gas is water vapor. The specific concern today is that increasing concentrations of anthropogenically introduced greenhouse gases will, sooner or later, irreversibly alter the climate of Earth. Detecting climate change has been complicated by uncertainties in historical observations and measurements. Thus, the primary concern for the GEDEX project is how can climate change and enhanced greenhouse effects be unambiguously detected and quantified. Specifically examined are the areas of: Earth surface temperature; the free atmosphere (850 millibars and above); space-based measurements; measurement uncertainties; and modeling the observed temperature record. H.A.

N92-31259*# National Science Foundation, Washington, DC. Committee on Earth and Environmental Sciences.

OUR CHANGING PLANET: THE FY 1993 US GLOBAL CHANGE RESEARCH PROGRAM. A SUPPLEMENT TO THE US PRESIDENT'S FISCAL YEAR 1993 BUDGET

1992 89 p Revised Sponsored in part by NASA, Washington; NOAA; DOE; and EPA Original contains color illustrations

(NASA-CR-190675; NAS 1.26:190675) Avail: CASI HC A05/MF A01; 2 functional color pages

An improved predictive understanding of the integrated Earth system, including human interactions, will provide direct benefits by anticipating and planning for possible impacts on commerce, agriculture, energy, resource utilization, human safety, and environmental quality. The central goal of the U.S. Global Change Research Program (USGCRP) is to help establish the scientific understanding and the basis for national and international policymaking related to natural and human-induced changes in the global Earth system. This will be accomplished through: (1) establishing an integrated, comprehensive, long-term program of documenting the Earth system on a global scale; (2) conducting a program of focused studies to improve our understanding of the physical, geological, chemical, biological, and social processes that influence the Earth system processes; and (3) developing integrated conceptual and predictive Earth system models. H.A.

N92-31297# Lawrence Livermore National Lab., CA.

EFFECTS OF ANTHROPOGENIC SULFUR AEROSOLS ON CLIMATE

C. C. CHUANG and J. E. PENNER May 1992 4 p Presented at the 13th International Conference on Nucleation and Atmospheric Aerosols and Nucleation Symposium, Salt Lake City, UT, 24-28 Aug. 1992

(Contract W-7405-ENG-48)

(DE92-016158; UCRL-JC-108521; CONF-9208100-1) Avail: CASI HC A01/MF A01

The potential effect of atmospheric aerosols from anthropogenic sulfur emissions on climate has received a considerable amount of attention recently. Concerns are expressed regarding a possible change in the global energy budget of variations in the clear sky albedo as well as variations in the cloud optical properties. A climate model is coupled with a 3-D global chemistry model to investigate the climate response to anthropogenic sulfur aerosols. Our preliminary study indicates that the global change in the reflected solar radiation due to the increase of sulfate particles offsets part of the warming resulting from the increase of greenhouse gases. DOE

N92-31324# Lawrence Livermore National Lab., CA.

THE VALIDATION OF ATMOSPHERIC MODELS

W. L. GATES Mar. 1992 17 p Presented at the 1st Demetra Conference on the Dilemmas of Global Warming, Chianciano Terme, Italy, 28 Oct. - 1 Nov. 1991

(Contract W-7405-ENG-48)

(DE92-013254; UCRL-ID-109810; CONF-9110374-1) Avail: CASI HC A03/MF A01

The validation of atmospheric models is a key part of the modeling enterprise, but one to which increased attention needs to be given if systematic progress is to be made in the development of predictive climate models. The validation of current AGCM's in terms of the mean seasonal distribution of primary variables such as pressure, temperature, and wind shows a reasonable ability to simulate the observed large-scale features, while at the same time identifying a number of systematic errors. More recent validations have included the simulation of variability, which reveals a modest level of skill but with further systematic errors. Recent results from mesoscale models nested within AGCM's, however, have shown substantial skill in the simulation of regional climate. In addition to conventional data sources of various resolutions, current model validation is enriched by the use of satellite observations and other special data sets, as well as by the analyses from operational models. A comprehensive atmospheric model validation program includes examination of not only the mean and variance, but of the complete frequency distribution. Moreover, in addition to the primary dynamical and physical variables, the various derived quantities associated with fluxes and processes and the occurrence of specific events should also be evaluated. A complete validation would also include evaluation of a model's ability to simulate more than just the present climate and/or its ability to simulate observed

climate change (the latter aspect necessarily including the oceans). DOE

N92-31422# Brookhaven National Lab., Upton, NY.
APPLICATION OF FREE-AIR CO2 ENRICHMENT (FACE) TECHNOLOGY TO A FOREST CANOPY: A SIMULATION STUDY
F. W. LIPFERT, G. R. HENDREY, K. L. LEWIN, and Y. ALEXANDER (Israel Inst. for Biological Research, Ness-Ziona.) Mar. 1992 12 p Presented at the 9th World Clean Air Congress and Exhibition: Towards the Year 2000 - Critical Issues in the Global Environment, Montreal (Canada), 30 Aug. - 4 Sep. 1992
(Contract DE-AC02-76CH-00016)
(DE92-013308; BNL-47392; CONF-920814-4) Avail: CASI HC A03/MF A01

Forest ecosystems constitute an important part of the planet's land cover. Understanding their exchanges of carbon with the atmosphere is crucial in projecting future net atmospheric CO2 increases. It is also important that experimental studies of these processes be performed under conditions which are as realistic as possible, particularly with respect to photosynthesis and evapotranspiration. New technology and experimental protocols now exist which can facilitate studying an undisturbed forest canopy under long-term enriched CO2 conditions. The International Geosphere Biosphere Program of the International Council of Scientific Unions has established a subprogram on Global Change and Terrestrial Ecosystems (GCTE). This program is driven by two major concerns: to be able to predict the effects of global change on the structure and function of ecosystems, and to predict how these changes will control both atmospheric CO2 and climate, through various feedback pathways. Brookhaven National Laboratory (BNL) has developed a system for exposing field-grown plants to controlled elevated concentrations of atmospheric gases, without use of confining chambers that alter important atmospheric exchange processes. This system is called FACE (Free Air CO2 Enrichment). This paper focuses on the fluid mechanics of free-air fumigation and uses a numerical simulation model based on superposed gaussian plumes to project how the present ground-based system could be used to fumigate an elevated forest canopy. DOE

N92-31620# Federal Coordinating Council for Science, Engineering and Technology, Washington, DC. Committee on Earth and Environmental Sciences.
OUR CHANGING PLANET: THE FY 1993 US GLOBAL CHANGE RESEARCH PROGRAM. A REPORT BY THE COMMITTEE ON EARTH AND ENVIRONMENTAL SCIENCES, A SUPPLEMENT TO THE US PRESIDENT'S FISCAL YEAR 1993 BUDGET
Jan. 1992 90 p
(PB92-156892) Avail: CASI HC A05/MF A01

The U.S. Global Change Reasearch Program (USGCRP) was established as a Presidential initiative in the FY-1990 Budget to help develop sound national and international policies related to global environmental issues, particularly global climate change. The USGCRP is implemented through a priority-driven scientific research agenda that is designed to be integrated, comprehensive, and multidisciplinary. It is designed explicitly to address scientific uncertainties in such areas as climate change, ozone depletion, changes in terrestrial and marine productivity, global water and energy cycles, sea level changes, the impact of global changes on human health and activities, and the impact of anthropogenic activities on the Earth system. The USGCRP addresses three parallel but interconnected streams of activity: documenting global change (observations); enhancing understanding of key processes (process research); and predicting global and regional environmental change (integrated modeling and prediction). GRA

N92-31626# San Diego State Univ., CA.
RESPONSE OF A TUNDRA ECOSYSTEM TO ELEVATED ATMOSPHERIC CARBON DIOXIDE AND CO2-INDUCED CLIMATE CHANGE
W. C. OECHEL Apr. 1992 18 p
(Contract DE-FG03-86ER-60479)
(DE92-013925; DOE/ER-60479/T1) Avail: CASI HC A03/MF A01

This report presents the progress on the DOE funded project: 'Response of a Tundra Ecosystem to Elevated Atmospheric Carbon Dioxide and CO2 Induced Climate Change.' The current funding cycle was initiated on September 1, 1989, to run through August 31, 1992. There was an initial reduction in scope dictated by budget availabilities, primarily manipulations of CO2, temperature, and nutrients at a wet tundra located at Barrow, Alaska. These experiments still need to be done over the mid- to longer term in order to accurately predict, apriori, the effects of climate change on the arctic tundra as well as possible feedbacks. Coordination and cooperation with other agencies was initiated in 1990 and formally proposed in our 1991 renewal at the national and international level and has become an important aspect of the research. To accurately and precisely scale, plot, and transect measurements to the circumpolar tundra is beyond the scope of the current DOE project. It is possible, however to determine the patterns and controls of CO2 flux from the current circumpolar arctic tundra with the involvement of additional agencies and governments. Results from the past two years of this project confirm that the arctic has become a source of CO2 to the atmosphere. This change coincides with recent climatic variation in the arctic, and suggests a positive feedback of arctic ecosystems on atmospheric CO2 and global change. Measurements along a latitudinal gradient across the north slope of Alaska indicate a loss of carbon from tussock tundra and wet tundra, decreasing in magnitude along a decreasing gradient of temperature, but an increasing gradient in soil moisture. These data are in agreement with work done on tussock tundra in 1983-85, and 1987. DOE

N92-31896# Oak Ridge National Lab., TN.
ITERATIVE FUNCTIONALISM AND CLIMATE MANAGEMENT REGIMES: FROM INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE TO INTERGOVERNMENTAL NEGOTIATING COMMITTEE
D. L. FELDMAN (Tennessee Univ., Knoxville.) 1992 27 p Presented at the 4th North American Symposium on Society and Resource Management, Madison, WI, 17-20 May 1992
(Contract DE-AC05-84OR-21400)
(DE92-014798; CONF-9205167-1) Avail: CASI HC A03/MF A01

This paper contends that an iterative functionalist regime -- comprised of international organizations that monitor the global climate and perform scientific and policy research on prevention, mitigation, and adaptation strategies for response to possible global warming -- has developed over the past decade. A common global effort by scientists, diplomats, and others to negotiate a framework convention that would reduce emissions of carbon dioxide and other greenhouse gases has been brought about by this regime. Individuals that participate in this regime are engaged in several cooperative activities including: (1) international research on the causes and consequences of global change; (2) global environmental monitoring and standard-setting for analyses of climate data; and (3) negotiating a framework convention that places limits on greenhouse gas emissions by countries. The implications of this iterative approach for successful implementation of a treaty to forestall global climate change are discussed. DOE

N92-31907# Oak Ridge National Lab., TN. Carbon Dioxide Information Analysis Center.
TRENDS 1991: A COMPENDIUM OF DATA ON GLOBAL CHANGE
T. A. BODEN, ed., R. J. SEPANSKI, ed., and F. W. STOSS, ed. Dec. 1991 694 p
(Contract DE-AC05-84OR-21400)
(DE92-011733; ORNL/CDIAC-46; ESD-3746) Avail: CASI HC A99/MF A06

This document is a source of frequently used global change data. This second issue of the Trends series expands the coverage of sites recording atmospheric concentrations of carbon dioxide

(CO2) and methane, (CH4), and it updates records reported in the first issue. New data for other trace atmospheric gases have been included in this issue; historical data on nitrous oxide (N2) from ice cores, modern records of atmospheric concentrations of chlorofluorocarbons (CFC-11 and CFC-12) and N2O and estimates of global estimates of CFC-11 and CFC-12. The estimates for global and national CO2 emissions from the burning of fossil fuels, the production of cement, and gas flaring have been revised and updated. Regional CO2 emission estimates have been added, and long-term temperature records have been updated and expanded. Data records are presented in four- to six-page formats, each dealing with a specific site, region, or emissions species. The data records include tables and graphs; discussion of methods for collecting, measuring, and reporting the data; trends in the data; and references to literature that provides further information. All data appearing in the document are available on digital media from the Carbon Dioxide Information Analysis Center. DOE

N92-32014 Alabama Univ., Huntsville. Atmospheric Science Program.
THE UNCERTAINTIES OF GLOBAL TEMPERATURES IN THE GLOBAL WARMING CONTEXT
JOHN R. CHRISTY *In* Huntsville Association of Technical Societies, TABES 92: 8th Annual Technical and Business Exhibition and Symposium. Executive Summaries and Submitted Papers 7 p 1992
(TABES PAPER 92-447) Copyright Avail: Issuing Activity

Long-term surface temperature records have large enough uncertainties and contain enough uncertainties and contain enough natural variability that conclusions about global warming due to greenhouse gas emissions are not possible based on these data. Comparison with newly developed data from satellites indicates the surface temperatures measured today do not provide the accuracy necessary for assessing climate trends for over half of the globe. Though warm and cool years generally coincide between satellite and surface measurements, the subtle differences are sufficient to cause one to rethink the conclusions of excessive warmth of the past two years (1990-91) and decade. Author

N92-32147*# Lawrence Livermore National Lab., CA.
NASA HIGH SPEED RESEARCH PROGRAM, EMISSIONS SCENARIOS COMMITTEE REPORT OF MEETINGS ON 26 SEPTEMBER 1991 AND 9 JANUARY 1992
D. J. WUEBBLES 23 Mar. 1992 11 p Sponsored by NASA, Washington
(Contract W-7405-ENG-48)
(NASA-CR-190379; NAS 1.26:190379; DE92-012409; UCRL-ID-109860) Avail: CASI HC A03/MF A01

An important step in the process of assessing the environmental effects of possible future High-Speed Civil Transports (HSCTs) is the definition of scenarios for the emissions from a fleet of such aircraft. These scenarios are then used in numerical models of the chemistry and physics of the global atmosphere to determine potential environmental effects, including concerns about changes in ozone and in climate. The Emissions Scenarios Committee was formed to provide a forum for meeting the combined needs of the atmospheric science community, the aircraft industry, NASA and the federal government in undertaking the development of scenarios for such assessments. DOE

N92-32609# Environmental Protection Agency, Research Triangle Park, NC. Air and Energy Engineering Research Lab.
US EPA'S GLOBAL CLIMATE CHANGE PROGRAM: LANDFILL EMISSIONS AND MITIGATION RESEARCH Report, Aug. 1990 - May 1991
S. A. THORNELOE 14 Oct. 1991 20 p Presented at the 3rd Sardinia 1991 International Landfill Symposium, Cagliari, Italy, 14 Oct. 1991
(PB92-180215; EPA/600/A-92/102) Avail: CASI HC A03/MF A01

The paper discusses the U.S. Environmental Protection Agency's (EPA) global climate change program, concentrating on global landfill methane (CH4) emissions and mitigation research. The EPA's Air and Energy Engineering Research Laboratory (AEERL) has begun research on developing more reliable emission estimates of the key greenhouse gas sources that are amenable to cost-effective control. Research was initiated on biomass and CH4 utilization, tropospheric ozone, and evaluation of potential mitigation opportunities for emissions contributing to global climate change. The emissions program has begun to identify and quantify emission sources of greenhouse gases for anthropogenic sources including landfills, coal mines, natural gas production/distribution, cookstoves, and biomass burning. Development of enhanced emission estimates will improve the understanding of atmospheric chemistry and feedback effects, target mitigation opportunities, and ensure cost-effective mitigation strategies. GRA

N92-32619# Maryland Univ., College Park.
EXPLOITATION OF PARALLELISM IN CLIMATE MODELS
F. BAER, J. J. TRIBBIA, and D. L. WILLIAMSON 1992 9 p
(Contract DE-FG05-91ER-61219)
(DE92-012595; DOE/ER-61219/1) Avail: CASI HC A02/MF A01

The US Department of Energy (DOE) through its CHAMMP initiative, hopes to develop the capability to make meaningful regional climate forecasts on time scales exceeding a decade. Such a capability is to be based on numerical prediction type models. We propose research to contribute to each of the specific items enumerated in the CHAMMP announcement (Notice 9103): to consider theoretical limits to prediction of climate and climate change on appropriate time scales; to develop new mathematical techniques to utilize massively parallel processors (MPP); to actually utilize MPP's as a research tool; and to develop improved representations of some processes essential to climate prediction. To explore these initiatives, we will exploit all available computing technology, and in particular MPP machines. We anticipate that significant improvements in modeling of climate on the decadal and longer time scales for regional space scales will result from our efforts. This report summarizes the activities of our group during a part of the first year's effort to meet the objectives stated in our proposal. We will comment on three research foci, time compression studies, subgrid scale model studies, and distributed climate ensemble studies, and additional significant technical matters. DOE

N92-33523# Southern Methodist Univ., Dallas, TX. Dept. of Statistical Science.
STATISTICAL EXAMINATION OF CLIMATOLOGICAL DATA RELEVANT TO GLOBAL TEMPERATURE VARIATION
H. L. GRAY, R. F. GUNST, and W. A. WOODWARD Jan. 1992 12 p
(Contract DE-FG05-90ER-61015)
(DE92-013654; DOE/ER-61015/T1) Avail: CASI HC A03/MF A01

The research group at Southern Methodist University has been involved in the examination of climatological data as specified in the proposal. Our efforts have resulted in three papers which have been submitted to scholarly journals, as well as several other projects which should be completed either during the next six months or next year. In the following, we discuss our results to date along with projected progress within the next six months. Major topics discussed in this progress report include: testing for trend in the global temperature data; defining and estimating mean global temperature change; and the effect of initial conditions on autoregressive models for global temperature data. DOE

N92-33578# Alaska Univ., Fairbanks. Geophysical Inst.
PROCEEDINGS OF INTERNATIONAL CONFERENCE ON THE ROLE OF THE POLAR REGIONS IN GLOBAL CHANGE, VOLUME 1 Final Report, 1 May 1990 - 30 Apr. 1991
GUNTER WELLER Mar. 1992 361 p Proceedings held in Fairbanks, AK, 11-15 Jun. 1990
(Contract DAAL03-90-G-0126)
(AD-A253027; ARO-27859.1-GS-CF-VOL-1) Avail: CASI HC A16/MF A03

The goal of the conference was to define and summarize the state of knowledge on the role of the polar regions in global

change, and to identify gaps in knowledge. To this purpose experts in a wide variety of relevant disciplines were invited to present papers and hold panel discussions. While there are numerous conferences on global change, this conference dealt specifically with the polar regions which occupy key positions in the global system. Over 400 scientists from 15 different countries attended and presented 200 papers on research in the Arctic and Antarctic. The papers were distributed among seven major themes and sessions, each having about three invited papers, a dozen contributed papers, and 15-20 poster papers. These papers, or their abstracts, are contained in the two proceedings volumes. In publishing the papers we did not distinguish between invited, contributed, or poster papers, but gave them all equal weight. On the final day of the conference three panels met to discuss problems and priorities in polar research. A summary of their recommendations follows the final section of papers. GRA

N92-33579# Alaska Univ., Fairbanks. Geophysical Inst.
PROCEEDINGS OF INTERNATIONAL CONFERENCE ON THE ROLE OF THE POLAR REGIONS IN GLOBAL CHANGE, VOLUME 2 Final Report, 1 May 1990 - 30 Apr. 1991
GUNTER WELLER Mar. 1992 492 p Proceedings held in Fairbanks, AK, 11-15 Jun. 1990
(Contract DAAL03-90-G-0126)
(AD-A253028; ARO-27859.2-GS-CF-VOL-2) Avail: CASI HC A21/MF A04

The International Conference on the Role of the Polar Regions in Global Change took place on the campus of the University of Alaska Fairbanks on June 11-15, 1990. It was cosponsored by several national and international scientific organizations, as listed on the preceding page. The host institutions were the Geophysical Institute and the Center for Global Change and Arctic System Research, both at the University of Alaska Fairbanks. The goal of the conference was to define and summarize the state of knowledge on the role of the polar regions in global change, and to identify gaps in knowledge. To this purpose experts in a wide variety of relevant disciplines were invited to present papers and hold panel discussions. While there are numerous conferences on global change, this conference dealt specifically with the polar regions which occupy key positions in the global system. Conference,--Global Change, Polar Regions, Global System Over 400 scientists from 15 different countries attended and presented 200 papers on research in the Arctic and Antarctic. The papers were distributed among seven major themes and sessions, each having about three invited papers, a dozen contributed papers, and 15-20 poster papers. These papers, or their abstracts, are contained in the two proceedings volumes. In publishing the papers we did not distinguish between invited, contributed, or poster papers, but gave them all equal weight. On the final day of the conference three panels met to discuss problems and priorities in polar research. A summary of their recommendations follows the final section of papers. GRA

N92-33843 New York Univ., New York.
CARBONATE-SILICATE CYCLE MODELS OF THE LONG-TERM CARBON CYCLE, CARBONATE ACCUMULATION IN THE OCEANS, AND CLIMATE Ph.D. Thesis
KENNETH GEORGE CALDEIRA 1991 261 p
Avail: Univ. Microfilms Order No. DA9134648

Several models of the long-term carbon cycle, incorporating models of the carbonate-silicate cycle, were developed and utilized to investigate issues relating to global climate and the causes and consequences of changes in calcium carbonate accumulation in the oceans. Model results indicate that the marked mid-Cretaceous (120 Ma) global warming could be explained by increased rates of release of carbon dioxide from subduction-zone metamorphism and mid-ocean-ridges, in conjunction with paleogeographic factors. Since the mid-Cretaceous, the primary setting for calcium carbonate accumulation in the oceans has shifted from shallow-water to deep-water environments. Model results suggest that this shift could have major consequences for the carbonate-silicate cycle and climate, and lead to significant increases in the flux of metamorphic carbon dioxide to the atmosphere. Increases in pelagic carbonate productivity, and decreases in tropical shallow-water area available for neritic carbonate accumulation, have both been proposed as the primary cause of this shift. Two lines of evidence developed here (one involving a statistical analysis of Tertiary carbonate-accumulation and oxygen-isotope data, and another based on modeling the carbonate-silicate cycle and ocean chemistry) suggest that a decrease in tropical shallow-water area was more important than increased pelagic productivity in explaining this shift. Model investigations of changes in ocean chemistry at the Cretaceous/Tertiary (K/T) boundary (66 Ma) indicate that variations in deep-water carbonate productivity may affect shallow-water carbonate accumulation rates through a mechanism involving surface-water carbonate-ion concentration. In the aftermath of the K/T boundary event, deep-water carbonate production and accumulation were significantly reduced as a result of the extinction of calcareous plankton. Results of a carbonate-silicate cycle model incorporating a shallow-water carbonate-accumulation parameterization indicate that increases in shallow-water carbonate accumulation associated with changes in carbonate-ion concentration may have partially compensated for decreases in deep-water carbonate accumulation. Dissert. Abstr.

N92-34027 California Univ., Berkeley.
FOREST SUCCESSION AND CLIMATE CHANGE: COUPLING LAND-SURFACE PROCESSES AND ECOLOGICAL DYNAMICS Ph.D. Thesis
PHILIPPE MARTIN 1990 358 p
Avail: Univ. Microfilms Order No. DA9126692

Growing evidence supports the hypothesis that humans are in the process of inadvertently modifying the Earth's climate by increasing the atmospheric concentrations of carbon dioxide and other radiatively active trace gas. The present man-induced climate change, often referred to as the greenhouse effect, is different from natural changes because of its unprecedented pace and our incomplete knowledge of its consequences. As some scientists put it, humanity is performing on itself a 'global experiment' which may entail a number of surprises. The potential changes in the behavior of atmosphere/biosphere interactions are of particular importance. Such changes could affect atmospheric dynamics, the local and regional hydrology, the global bio-geochemistry, and therefore, human societies. Five distinct aspects of climate/vegetation interactions are examined. First, the climatically and physiologically mediated impacts of increases in the concentration of carbon dioxide on the evaporation from agricultural crops, grassland, and forests are investigated using the Penman-Monteith combination equation. Second, the degree of coupling between the vegetation and the atmosphere, as defined by Jarvis and McNaughton, is reexamined taking radiative losses from the vegetation to the atmosphere into account. Third, the effects of changes in the mean vs. the variance of climatic variables are investigated using a modified version of the forest dynamics model developed by Pastor and Post, LINK-AGES. Fourth, using the same model, changes in the production of non-methane hydrocarbons are estimated as climate and/or vegetation change. Finally, the main focus is on the response of forests to climatic changes using a model treating the physics of energy and water exchange in detail. Because the Energy, Water, and Momentum Exchange, and Ecological Dynamics Model (EXE), couples the land-surface processes and the ecological dynamics of forests of Northeast America, new insights are gained into the behavior of forests, in general, and into the possible consequences of a greenhouse effect on forest hydrology and vegetation succession, in particular. Dissert. Abstr.

N92-34028*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
GLOBAL CHANGE DATA SETS: EXCERPTS FROM THE MASTER DIRECTORY, VERSION 2.0
JOY BEIER Feb. 1992 220 p
(NASA-TM-107994; NAS 1.15:107994;
NSSDC/WDC-A-R/S-91-34) Avail: CASI HC A10/MF A03

The recent awakening to the reality of human-induced changes

to the environment has resulted in an organized effort to promote global change research. The goal of this research as outlined by NASA's Earth System Science Committee (Earth System Science: A closer View, 1988) is to understand the entire Earth system on a global scale by describing how its component parts and their interactions have evolved, how they function, and how they may be expected to evolve on all timescales. The practical result is the capacity to predict that evolution over the next decade to century. Key variables important for the study of global change include external forcing factors (solar radiance, UV flux), radiatively and chemically important trace species (CO2, CH4, N2O, etc.), atmospheric response variables (temperature, pressure, winds), landsurface properties (river run-off, snow cover, albedo, soil moisture, vegetation cover), and oceanic variables (sea surface temperature, sea ice extent, sea level ocean wind stress, currents, chlorophyll, biogeochemical fluxes). The purpose of this document is to identify existing data sets available (both remotely sensed and in situ data) covering some of these variables. This is not intended to be a complete list of global change data, but merely a highlight of what is available. The information was extracted from the Master Directory (MD), an on-line scientific data information service which may be used by any researcher. This report contains the coverage dates for the data sets, sources (satellites, instruments) of the data and where they are archived.
Author

N92-34058*# Consortium for International Earth Science Information Network, University Center, MI.
PATHWAYS OF UNDERSTANDING: THE INTERACTIONS OF HUMANITY AND GLOBAL ENVIRONMENTAL CHANGE
HAROLD K. JACOBSON, JOHN KATZENBERGER, JACK LOUSMA, HAROLD A. MOONEY, RICHARD H. MOSS, WILLIAM KUHN, URS LUTERBACHER, and ELLEN WIEGANDT 1992 62 p Original contains color illustrations
(Contract NAGW-2010; NAGW-2901)
(NASA-CR-190678; NAS 1.26:190678) Copyright Avail: CASI HC A04/MF A01; 35 functional color pages

How humans, interacting within social systems, affect and are affected by global change is explored. Recognizing the impact human activities have on the environment and responding to the need to document the interactions among human activities, the Consortium for International Earth Science Information Network (CIESIN) commissioned a group of 12 scientists to develop a framework illustrating the key human systems that contribute to global change. This framework, called the Social Process Diagram, will help natural and social scientists, educators, resource managers and policy makers envision and analyze how human systems interact among themselves and with the natural system. The Social Process Diagram consists of the following blocks that constitute the Diagram's structural framework: (1) fund of knowledge and experience; (2) preferences and expectations; (3) factors of production and technology; (4) population and social structure; (5) economic systems; (6) political systems and institutions; and (7) global scale environmental processes. To demonstrate potential ways the Diagram can be used, this document includes 3 hypothetical scenarios of global change issues: global warming and sea level rise; the environmental impact of human population migration; and energy and the environment. These scenarios demonstrate the Diagram's usefulness for visualizing specific processes that might be studied to evaluate a particular global change issues. The scenario also shows that interesting and unanticipated questions may emerge as links are explored between categories on the Diagram.
Author

N92-34068# Oak Ridge National Lab., TN.
ENERGY AND GLOBAL WARMING IMPACTS OF CFC ALTERNATIVE TECHNOLOGIES
S. K. FISCHER, P. D. FAIRCHILD, and P. J. HUGHES 1992 8 p Presented at the International Inst. of Refrigeration Meeting on Refrigeration, Energy and Environment, Trondheim (Norway), 22-24 Jun. 1992
(Contract DE-AC05-84OR-21400)
(DE92-015128; CONF-9206130-1) Avail: CASI HC A02/MF A01

Chlorofluorocarbons (CFCs) are used in a number of applications, and volumes of CFCs used grew at a tremendous pace during the 1960s and 1970s. However, in the mid-1980s, it was confirmed that these extremely useful chemicals contribute to the destruction of stratospheric ozone. These chemicals are being phased out of use rapidly to protect the ozone layer and it is very important that the replacements for CFCs do not result in a net increase in global warming by introducing less efficient processes that lead to higher energy use and increased carbon dioxide emissions. A study was conducted to identify those alternative chemicals and technologies that could replace CFCs in energy related applications before the year 2000, and to assess the total potential impact of these alternatives on global warming. The analysis for this project included an estimate of the direct effects from the release of blowing agents, refrigerants, and solvents into the atmosphere and the indirect effects in the form of carbon dioxide emissions resulting from energy use for commercial and residential heating and cooling, household and commercial refrigeration, building and automobile air-conditioning, and general metal and electronics solvent cleaning. The discussion in this paper focuses on those aspects of the study relevant to refrigeration and air-conditioning. In general the use of hydrofluorocarbon (HFC) and hydrochlorofluorocarbon (HCFC) alternatives for CFCs lead to large and sometimes dramatic reductions in total equivalent warming impact (TEWI), lifetime equivalent CO2 emissions. Most of the reductions result from decreased direct effects without significant changes in energy use.
DOE

46

GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

A92-10293
RAPID FORMATION OF ONTONG JAVA PLATEAU BY APTIAN MANTLE PLUME VOLCANISM
J. A. TARDUNO, H. MAYER, E. L. WINTERER (Scripps Institution of Oceanography, La Jolla, CA), W. V. SLITER (USGS, Menlo Park, CA), L. KROENKE, J. J. MAHONEY (Hawaii, University, Honolulu), M. LECKIE (Massachusetts, University, Amherst), R. MUSGRAVE (Tasmania, University, Hobart, Australia), and M. STOREY (Leicester, University, England) Science (ISSN 0036-8075), vol. 254, Oct. 18, 1991, p. 399-403. Research supported by U.S. Science Support Program and NSF. 18 Oct. 1991 5 p refs
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The timing of flood basalt volcanism associated with formation of the Ontong Java Plateau (OJP) is estimated from paleomagnetic and paleontologic data. Much of OJP formed rapidly in less than 3 million years during the early Aptial, at the beginning of the Cretaceous Normal Polarity Superchron. Crustal emplacement rates are inferred to have been several times those of the Deccan Traps. These estimates are consistent with an origin of the OJP by impingement at the base of the oceanic lithosphere by the head of a large mantle plume. Formation of the OJP may have led to a rise in sea level that induced global oceanic anoxia. Carbon dioxide emissions likely contributed to the mid-Cretaceous greenhouse climate but did not provoke major biologic extinctions.
Author

A92-10633
MODELLING OF COMPOSITION CHANGES DURING F-REGION STORMS - A REASSESSMENT
T. J. FULLER-ROWELL, D. REES (University College, London, England), H. RISHBETH (Southampton, University, England), A. G. BURNS, T. L. KILLEEN (Michigan, University, Ann Arbor), and R. G. ROBLE (NCAR, Boulder, CO) (Thermospheric and

ionospheric dynamics; Symposium, Exeter, England, July 1989, Selected Papers. A92-10626 01-46) Journal of Atmospheric and Terrestrial Physics (ISSN 0021-9169), vol. 53, June-July 1991, p. 541-550. Jul. 1991 10 p refs
(Contract SERC-GR/E/58007; SERC-GR/E/73956)
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A recalculation of the global changes of thermospheric gas composition, resulting from strong heat inputs in the auroral ovals, shows that (contrary to some previous suggestions) widespread increases of mean molecular mass are produced at mid-latitudes, in summer and at equinox. Decreases of mean molecular mass occur at mid-latitudes in winter. Similar results are given by both the 'UCL' and 'NCAR TIGCM' three-dimensional models. The computed composition changes now seem consistent with the local time and seasonal response observed by satellites, and can broadly account for 'negative storm effects' in the ionospheric F2-layer at mid-latitudes. Author

A92-11475
CHEMISTRY OF ATMOSPHERES - AN INTRODUCTION TO THE CHEMISTRY OF THE ATMOSPHERES OF EARTH, THE PLANETS, AND THEIR SATELLITES (2ND REVISED AND ENLARGED EDITION)
RICHARD P. WAYNE (Oxford, University, England) Oxford, England and New York, Oxford University Press, 1991, 460 p. 1991 460 p refs
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An introduction to the chemistry of the atmospheres of the earth, the planets, and their satellites is presented, with particular attention given to the application of photochemistry and kinetics to atmospheres, ozone in the earth's stratosphere, the earth's troposphere, ions in the atmosphere, the airglow, and evolution and change in atmospheres and climates. This book presents the principles of atmospheric chemistry and provides the necessary background for more detailed study. New developments are covered, including the discovery of the Antarctic ozone hole. Information gathered by the Voyager 2 and other space missions is also discussed. B.J.

A92-11694
ON THE OZONE MINIMUM OVER THE EQUATORIAL PACIFIC OCEAN
STEPHEN R. PIOTROWICZ, HUGO F. BEZDEK, GEORGE R. HARVEY, MARGIE SPRINGER-YOUNG (NOAA, Atlantic Oceanographic and Meteorological Laboratory, Miami, FL), and KIRBY J. HANSON (NOAA, Air Resources Laboratory, Miami, FL) Journal of Geophysical Research (ISSN 0148-0227), vol. 96, Oct. 20, 1991, p. 18,679-18,687. 20 Oct. 1991 9 p refs

Study results are reviewed which indicate that the boundary layer of the equatorial Pacific Ocean is a spatially and temporally variable region of net ozone destruction. Mesoscale and synoptic circulation patterns can influence the observed O3 mixing ratios at any site by transporting air relatively high in O3 from the free troposphere and from midlatitudes of both hemispheres into this region. This suggests that large-scale meridional and zonal circulation patterns will determine the general characteristics of the equatorial O3 minimum, including both the boundaries of the region and the magnitude of the minimum. Under conditions of equatorial warming the ozone minimum is broad and intense, encompassing the entire eastern and central equatorial Pacific and reflects a decreased flux of free tropospheric and midlatitude air into the region. Under more normal conditions of equatorial cooling the minimum is located mostly in the central equatorial Pacific and is of variable intensity. C.D.

A92-11695
DIFFERENT METHODS OF MODELING THE VARIABILITY IN THE MONTHLY MEAN CONCENTRATIONS OF ATMOSPHERIC CO2 AT MAUNA LOA
F. MARTIN (Madrid, Universidad Complutense, Spain) and A. DIAZ (La Laguna, Universidad, Spain) Journal of Geophysical Research (ISSN 0148-0227), vol. 96, Oct. 20, 1991, p. 18,689-18,704. 20 Oct. 1991 16 p refs
Copyright

A detailed analysis of the time series of the monthly average atmospheric CO2 concentrations from March 1958 to December 1985 has been carried out. Seasonal decomposition of the CO2 time series has been done in order to obtain estimations of the trend, seasonal, and irregular components. The seasonal variation includes a cycle of 6-month period superimposed to the strong annual cycle. These two harmonic explain more than 95 percent of the seasonal variation of the CO2 concentration. Three different models for the atmospheric CO2 concentrations have been analyzed: univarite stochastic model, curve fitting, and a model with exogenous variables. The model with exogenous variables offered the closest fit to the measured data and seems to be the best model in forecasting the monthly average atmospheric CO2 concentration during the years 1986-1989. Author

A92-11776
THE STABILITY OF TROPOSPHERIC OH DURING ICE AGES, INTER-GLACIAL EPOCHS AND MODERN TIMES
J. P. PINTO (EPA, Atmospheric Research and Exposure Assessment Laboratory, Research Triangle Park, NC) and M. A. K. KHALIL (Oregon Graduate Institute, Beaverton) Tellus, Series B - Chemical and Physical Meteorology (ISSN 0280-6509), vol. 43B, Nov. 1991, p. 347-352. Research supported by Andarz Co. and EPA. Nov. 1991 6 p refs
(Contract DE-FG06-85ER-60313; NSF ATM-88-11059; NSF DPP-87-17023; NSF DPP-88-20632; NSF DPP-88-21320)
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Hydroxyl (OH) radicals remove many man-made and natural gases from the atmosphere and therefore play a key role in global tropospheric chemistry. Recent increases in CH4 and CO have caused concern that the levels of OH may decrease, thus reducing the capacity of the atmosphere to remove and control man-made pollutants. Here, OH concentrations were calculated over a wide range of climatic conditions to examine its long-term stability and to determine the major factors that may cause changes in its levels. A one-dimensional photochemical model was used, the concentrations of CH4 and N2O from polar ice cores, and the current understanding of the sources and sinks of CO, NO(y) and other gases involved in OH chemistry. It is found that mean OH concentrations are stabilized against changes even though the climatic conditions and atmospheric trace gas composition change considerably between ice-ages, inter-glacial periods, and the present. In these transitions, the more rapid destruction of OH from increased CH4 and CO is compensated by increases in the production processes. The calculations indicate that only a small part of the 5-fold increase of methane between the present and the peak of the last ice age, is due to changes in OH levels. Author

A92-12518
ROLE OF SATELLITE OBSERVATIONS IN CLIMATE AND GLOBAL CHANGE STUDIES
P. K. RAO (NOAA, National Environmental Satellite, Data, and Information Service, Washington, DC) IAF, International Astronautical Congress, 42nd, Montreal, Canada, Oct. 5-11, 1991. 8 p. Oct. 1991 8 p
(IAF PAPER 91-121)

The geophysical parameters measured by operational U.S. satellites are discussed with specific attention given to how particular parameters contribute to the study of climate and global change. The list of satellite-derived products include sea-surface and land-surface temperatures, monthly averaged total-ozone data, stratospheric temperatures, and the vegetation index. Other measurements discussed include radiation-budget parameters, outgoing longwave radiation and albedo, polar ice distributions, and lower tropospheric temperature anomalies. The sources of the measurements are mentioned with reference to type of remote sensor and typical variabilities. With specific references to some mechanisms, the parameters are described as important indicators of global change; temporal and spatial distributions of the quantities are useful for model validation and climate monitoring. C.C.S.

A92-13148
ANHYDRITE-BEARING PUMICES FROM MOUNT PINATUBO - FURTHER EVIDENCE FOR THE EXISTENCE OF SULPHUR-RICH SILICIC MAGMAS
A. BERNARD, D. DEMAIFFE, N. MATTIELLI (Bruxelles, Universite Libre, Brussels, Belgium), and R. S. PUNONGBAYAN (Philippine Institute of Volcanology and Seismology, Quezon City, Republic of the Philippines) Nature (ISSN 0028-0836), vol. 354, Nov. 14, 1991, p. 139, 140. Research supported by FNRS. 14 Nov. 1991 2 p refs
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The presence of primary anhydrite (CaSO4) phenocrysts in dacitic pumice clasts from the June 14-15 eruption of Mount Pinatubo, which clearly shows that the Mount Pinatubo magma is also rich in sulfur, is reported. The posteruptive sulfur content of the pumices ranges from 0.37 to 0.48 wt pct SO3. The considerable amount of sulfate aerosol should lead to a measurable cooling of the earth's surface over the next few years, and could also trigger heterogeneous chemical reactions leading to stratospheric ozone depletion. This new eruption of a sulfur-rich silicic magma thus shows that the El Chichon eruption is not unique, and that climate-modifying eruptions of this type may be more common than previously believed. C.D.

A92-13944
GREENHOUSE POTENTIALS OF OTHER TRACE GASES RELATIVE TO CO2
KEITH E. GRANT, LEONARD C. ROSEN, and DONALD J. WUEBBLES (Lawrence Livermore National Laboratory, Livermore, CA) IN: Conference on Atmospheric Radiation, 7th, San Francisco, CA, July 23-27, 1990, Preprints 1990 2 p refs
(Contract W-7405-ENG-48)
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The direct radiative and indirect chemical effects of increasing trace gas concentrations are investigated via application of the LLNL Chemical-Radiative-Transport Models of the Stratosphere and Troposphere to several trace gas emission scenarios. Several relative global warming potentials for greenhouse effects on the climate of other trace gases, such as CH4, N2O, and CFCs, relative to those for CO2 are developed and compared. R.E.P.

A92-15212
CHANGES IN THE WEST ANTARCTIC ICE SHEET
R. B. ALLEY (Pennsylvania State University, University Park) and I. M. WHILLANS (Ohio State University, Columbus) Science (ISSN 0036-8075), vol. 254, Nov. 15, 1991, p. 959-963. 15 Nov. 1991 5 p refs
(Contract NSF DPP-87-16016; NSF DPP-87-16447; NSF DPP-89-15995)
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Th portion of the West Antarctic ice sheet that flows into the Ross Sea is thinning in some places and thickening in others. These changes are not caused by any current climatic change, but by the combination of a delayed response to the end of the last global glacial cycle and an internal instability. The near-future impact of the ice sheet on global sea level is largely due to processes internal to the movement of the ice sheet, and not so much to the threat of a possible greenhouse warming. Thus, the near-term future of the ice sheet is already determined. However, too little of the ice sheet has been surveyed to predict its overall future behavior. Author

A92-15774
MESOSPHERIC CLOUDS AND THE PHYSICS OF THE MESOPAUSE REGION
GARY E. THOMAS (Colorado, University, Boulder) Reviews of Geophysics (ISSN 8755-1209), vol. 29, Nov. 1991, p. 553-575. Research supported by NSF. Nov. 1991 23 p refs
(Contract N00014-86-K-0535)
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This review contains a brief historical account of early mesospheric cloud studies with an emphasis on the two main theories: cosmic dust and ice condensation models. Current topics are described, including wave-cloud interactions, the dynamics and momentum budget of the high-latitude polar mesosphere, new satellite observations, polar mesospheric summer radar echoes, heterogeneous chemistry, and implications of apparent secular changes in cloud brightness for global change of the atmosphere as a whole. Author

A92-15775
THE MODELLION CONCEPT
W. J. SHUTTLEWORTH (Institute of Hydrology, Wallingford, England) Reviews of Geophysics (ISSN 8755-1209), vol. 29, Nov. 1991, p. 585-606. Nov. 1991 22 p refs
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A model planet, Modellion, with much simpler terrestrial surfaces, have been conceived to carry out numerical experiments on the planet earth. Over the last decade, there have been observational studies to better define this model planet and to aid its evolution toward the earth system. This paper reviews these studies, their purpose, and the insight they have given; it then goes on to preview elements of the observational program proposed to occur under the Global Energy and Water Cycle Experiment and International Geosphere-Biosphere Programme in the 1990s. Author

A92-17138 Hawaii Univ., Honolulu.
ANALYSIS OF ACTIVE VOLCANOES FROM THE EARTH OBSERVING SYSTEM
PETER MOUGINIS-MARK, SCOTT ROWLAND (Hawaii, University, Honolulu), JOY CRISP, LORI GLAZE, KENNETH JONES, ANNE KAHLE, DAVID PIERI, HOWARD ZEBKER (JPL, Pasadena, CA), ARLIN KRUEGER, LOU WALTER (NASA, Goddard Space Flight Center, Greenbelt, MD) et al. Remote Sensing of Environment (ISSN 0034-4257), vol. 36, April 1991, p. 1-12. Apr. 1991 12 p refs
(Contract NAS5-33012)
Copyright

The Earth Observing System (EOS) scheduled for launch in 1997 and 1999 is briefly described, and the EOS volcanology investigation objectives are discussed. The volcanology investigation will include long- and short-term monitoring of selected volcanoes, the detection of precursor activity associated with unanticipated eruptions, and a detailed study of on-going eruptions. A variety of instruments on the EOS platforms will enable the study of local- and regional-scale thermal and deformational features of volcanoes, and the chemical and structural features of volcanic eruption plumes and aerosols. O.G.

A92-22341
WILL GREENHOUSE WARMING LEAD TO NORTHERN HEMISPHERE ICE-SHEET GROWTH?
GIFFORD H. MILLER (Colorado, University, Boulder) and ANNE DE VERNAL (Quebec, Universite, Montreal, Canada) Nature (ISSN 0028-0836), vol. 355, Jan. 16, 1992, p. 244-246. Research sponsored by NSF, NSERC, and Ministere de l'Education du Quebec. 16 Jan. 1992 3 p refs
Copyright

The recent geological record is examined here to obtain an independent assessment of ice-sheet response to climate change. The age and distribution of glacial sediments, coupled with marine and terrestrial proxy records of climate, support arguments that initial ice-sheet growth at the beginning of the last glacial cycle occurred at high northern latitudes under climate conditions rather similar to present. In particular, the conditions most favorable for glacier inception are warm high-latitude oceans, low terrestrial summer temperature, and elevated winter temperature. It is found that the geological data support the idea that greenhouse warming, which is expected to be most pronounced in the Arctic and in the winter months, coupled with decreasing summer insolation may lead to more snow deposition than melting at high northern latitudes and thus to ice-sheet growth. C.D.

A92-23539
TOTAL-OZONE AND NITROGEN-DIOXIDE MEASUREMENTS AT THE MOLODEZHNAYA AND MIRNYI ANTARCTIC STATIONS DURING SPRING 1987-AUTUMN 1988 [IZMERENIIA OBSHCHEGO SODERZHANIIA OZONA I DVUOKISI AZOTA NA ANTARKTICHESKIKH STANTSIIAKH MOLODEZHNAIA I MIRNYI VESNOI 1987-OSEN'IU 1988 GG.]
A. S. ELOKHOV and A. N. GRUZDEV (AN SSSR, Institut Fiziki Atmosfery, Moscow, USSR) Optika Atmosfery (ISSN 0235-277X), vol. 4, Sept. 1991, p. 1006-1009. In Russian. Sep. 1991 4 p In RUSSIAN refs
Copyright
Results of measurements of the total-ozone and NO2 content during November-December (Molodezhnaya) and February-April 1988 (Mirnyi) are reported. During the November-December period an irregular total ozone increase was observed, which characterized the filling up of the ozone hole. Stratospheric warming and the total NO2 increase occurred simultaneously. During the summer-autumn period the total NO2 content decreased gradually. The evening total NO2 content was systematically greater than the morning one, which reflects changes in the NO2 abundance from day to night. P.D.

A92-24220* National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
INITIAL ASSESSMENT OF THE STRATOSPHERIC AND CLIMATIC IMPACT OF THE 1991 MOUNT PINATUBO ERUPTION - PROLOGUE
M. P. MCCORMICK (NASA, Langley Research Center, Hampton, VA) Geophysical Research Letters (ISSN 0094-8276), vol. 19, Jan. 24, 1992, p. 149. 24 Jan. 1992 1 p
An overview is given of the techniques employed to evaluate the early effects of the volcanic eruption on the stratosphere and climate, and data are given on the initial eruption yield. Global satellite measurements were taken by TOMS, SAGE II, AVHRR, and other devices, and the initial results indicate an eruption yield of 20 megatons of SO2 and 20-30 megatons of H2SO4/H2O aerosol mass. The predicted effects of the eruption - accelerated global ozone depletion and surface cooling - can be compared to meteorological data to test the validity of present climate models based on these data. C.C.S.

A92-25118
TROPICAL STRATOSPHERIC CIRCULATION DEDUCED FROM SATELLITE AEROSOL DATA
CHARLES R. TREPTE and MATTHEW H. HITCHMAN (Wisconsin, University, Madison) Nature (ISSN 0028-0836), vol. 355, Feb. 13, 1992, p. 626-628. 13 Feb. 1992 3 p refs
Copyright
By examining the stratospheric aerosol distribution following volcanic eruptions in the tropics, it is found that poleward transport occurs readily at altitudes within a few km above the tropopause, whereas in the altitude range of 21-28 km, aerosols tend to remain within 20 deg of the equator. It is further deduced that the aerosol distribution in this upper regime is controlled by the phase of the quasi-biennial oscillation. When the easterly shear is present, aerosols are lofted over the equator, whereas when the westerly shear is present, descent relative to the mean stratospheric circulation occurs over the equator. From the aerosol distributions, it is suggested that the tropical stratosphere may be regarded as a temporary reservoir for trace constituents entering the stratosphere through the tropical tropopause. C.D.

A92-25524
THE 10-12 YEAR STRATOSPHERIC OSCILLATION [DIE 10-BIS 12JAEHRIGE SCHWINGUNG IN DER STRATOSPHAERE]
KARIN LABITZKE (Berlin, Freie Universitaet, Federal Republic of Germany) and H. VAN LOON Sterne und Weltraum (ISSN 0039-1263), vol. 31, Feb. 1992, p. 98-102. In German. Feb. 1992 5 p In GERMAN refs
The relationship of the solar sunspot cycle with the 10-12-year stratospheric oscillation on earth is examined. The effect of cyclic variations in solar energy arriving at earth on the stratosphere is discussed. The stratospheric quasi-biennial oscillation and its relationship to the solar cycle is addressed in some detail. C.D.

A92-26096* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
MODELING 100,000-YEAR CLIMATE FLUCTUATIONS IN PRE-PLEISTOCENE TIME SERIES
THOMAS J. CROWLEY, KWANG-YUL KIM (Applied Research Corp., College Station, TX), JOHN G. MENGEL (Applied Research Corp., Landover, MD), and DAVID A. SHORT (NASA, Goddard Space Flight Center, Greenbelt, MD) Science (ISSN 0036-8075), vol. 255, Feb. 7, 1992, p. 705-707. 7 Feb. 1992 3 p refs
(Contract NSF ATM-90-02808)
Copyright
A number of pre-Pleistocene climate records exhibit significant fluctuations at the 100,000-year (100-ky) eccentricity period, before the time of such fluctuations in global ice volume. The origin of these fluctuations has been obscure. Results reported here from a modeling study suggest that such a response can occur over low-altitude land areas involved in monsoon fluctuations. The twice yearly passage of the sun across the equator and the seasonal timing of perihelion interact to increase both 100-ky and 400-ky power in the modeled temperature field. The magnitude of the temperature response is sufficiently large to leave an imprint on the geologic record, and simulated fluctuations resemble those found in records of Triassic lake levels. Author

A92-26751
LIDAR MEASUREMENTS OF OZONE [MESURES D'OZONE PAR LIDAR]
S. GODIN (CNRS, Service d'Aeronomie; Paris VI, Universite, France) IN: The middle atmosphere and space observations; International Summer School on Space Physics, Marseille, France, Aug. 1990, Proceedings 1991 19 p In FRENCH refs
Copyright
The principles underlying the use of lidar to measure stratospheric ozone are presented. The experimental lidar system of the Haute-Provence Observatory is then described. A study of seasonal variations of ozone is presented, and Haute-Provence data are compared with OHP Umkehr measurements and with SAGE II data. It is concluded that the Haute-Provence measurements confirm the ability of lidar systems to monitor continuously the concentration of stratospheric ozone. L.M.

A92-27467
ANALYTICAL STUDIES ON THE VARIATIONS OF THE ANTARCTIC OZONE LAYER
SHAOHOU QU (Chinese Academy of Sciences, Institute of Atmospheric Physics, Beijing, People's Republic of China) Advances in Atmospheric Sciences (ISSN 0256-1530), vol. 9, Feb. 1992, p. 46-62. Feb. 1992 17 p refs
Copyright
Statistical data regarding solar activity and ozone are employed to analyze Antarctic ozone depletion in terms of the effects of CFCs vs natural electrochemical-dynamic causes. Data taken from 1962-89 relating to Antarctic total ozone and solar radio flux are examined by means of a correlation analysis based on monthly statistics. Attention is also given to the key role of the circumpolar vortex in the formation of the Antarctic ozone hole. The correlation calculation demonstrates a coefficient of 0.70 and 0.66 in October 1965-76 and October 1976-86 respectively at the Syowa station and of 0.73 and 0.68 respectively at the South Pole station. The February correlations are as low as 0.28 and 0.30 at the Syowa and South Pole stations respectively for the full period 1962-86, but the data support the electrochemistry-dynamics theory by Wei (1990). The present analysis does not deny the contribution of anthropogenic activity to ozone depletion in the Antarctic. C.C.S.

A92-27694
A LONG-TERM TREND IN THE HEIGHT OF THE ATMOSPHERIC SODIUM LAYER - POSSIBLE EVIDENCE FOR GLOBAL CHANGE

B. R. CLEMESHA, D. M. SIMONICH, and P. P. BATISTA (Instituto de Pesquisas Espaciais, Sao Jose dos Campos, Brazil) Geophysical Research Letters (ISSN 0094-8276), vol. 19, March 3, 1992, p. 457-460. Research supported by FINEP. 3 Mar. 1992 4 p refs
Copyright

An analysis of a long series of lidar measurements of the vertical distribution of atmospheric sodium shows the existence of a long-term trend in the centroid height of the layer. After making allowances for the sampling effects of the mean seasonal and diurnal variations in centroid height, it is found that the height of the layer fell by approximately 700 meters between 1972 and 1987. A regression analysis indicates a mean rate of fall of 49 +/- 12 m/yr, with a correlation coefficient of -0.33, significant at the 99.99 percent level. The observed change is consistent with long term trends in mesospheric temperatures detected by other techniques. Author

A92-28471 National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
CHANGES IN ICE COVER THICKNESS AND LAKE LEVEL OF LAKE HOARE, ANTARCTICA - IMPLICATIONS FOR LOCAL CLIMATIC CHANGE
ROBERT A. WHARTON, JR. (Nevada, University, Reno), CHRISTOPHER P. MCKAY (NASA, Ames Research Center, Moffett Field, CA), GARY D. CLOW (USGS, Menlo Park, CA), DALE T. ANDERSEN (Lockheed Engineering and Sciences Co., Washington, DC), GEORGE M. SIMMONS, JR. (Virginia Polytechnic Institute and State University, Blacksburg), and F. G. LOVE (Radford University, VA) Journal of Geophysical Research (ISSN 0148-0227), vol. 97, no. C3, March 15, 1992, p. 3503-3513. Research supported by NSF and NASA. 15 Mar. 1992 11 p refs
Copyright

Results are reported from 10 years of ice-thickness measurements at perennially ice-covered Lake Hoare in southern Victoria Land, Antarctica. The ice cover of this lake had been thinning steadily at a rate exceeding 20 cm/yr during the last decade but seems to have recently stabilized at a thickness of 3.3 m. Data concerning lake level and degree-days above freezing are presented to show the relationship between peak summer temperatures and the volume of glacier-derived meltwater entering Lake Hoare each summer. From these latter data it is inferred that peak summer temperatures have been above 0 C for a progressively longer period of time each year since 1972. Possible explanations for the thinning of the lake ice are considered. The thickness of the ice cover is determined by the balance between freezing during the winter and ablation that occurs all year but maximizes in summer. It is suggested that the term most likely responsible for the change in the ice cover thickness at Lake Hoare is the extent of summer melting, consistent with the rising lake levels. Author

A92-31616
ENVIRONMENTAL INFORMATION FROM ICE CORES
ROBERT J. DELMAS (CNRS, Laboratoire de Glaciologie et Geophysique de l'Environnement, Saint-Martin-d'Heres, France) Reviews of Geophysics (ISSN 8755-1209), vol. 30, Feb. 1992, p. 1-21. Feb. 1992 21 p refs
Copyright

Information from snow and ice core studies which is useful for documenting the interplay between the climate and the chemistry of the natural atmosphere is reviewed. Particular attention is given to the formation and interpretation of the ice records for the present conditions and the data obtained from the analysis of the Vostok ice core. It is concluded that the deep ice core data provide precise information on the ice-age environmental conditions. When polar temperatures were approximately 10 C lower than now, atmospheric CO2 and CH4 contents were factors of 2 and 4 lower, respectively, than the present conditions. At this time, sea salt and overall crustal dust depositions were significantly higher. According to modifications in source intensity and transport of gaseous precursors the biogeochemical cycles of S and N were also disturbed. O.G.

A92-33859
GLOBAL CARBON DIOXIDE EMISSION TO THE ATMOSPHERE BY VOLCANOES
STANLEY N. WILLIAMS, STEPHEN J. SCHAEFFER (Arizona State University, Tempe), MARTA L. CALVACHE (Arizona State University, Tempe; Observatorio Vulcanologico de Colombia, Pasto), and DINA LOPEZ (British Columbia, University, Vancouver, Canada) Geochimica et Cosmochimica Acta (ISSN 0016-7037), vol. 56, April 1992, p. 1765-1770. Research supported by NSF. Apr. 1992 6 p refs
Copyright

Global emission of carbon dioxide by subaerial volcanoes is calculated, using CO2/SO2 from volcanic gas analyses and SO2 flux, to be 34 +/- 24 x 10 exp 12 g CO2/yr from passive degassing and 31 +/- 22 x 10 exp 12 g CO2/yr from eruptions. Volcanic CO2 presently represents only 0.22 percent of anthropogenic emissions but may have contributed to significant 'greenhouse' effects at times in earth history. Models of climate response of CO2 increases may be tested against geological data. Author

A92-34965* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE MICROWAVE LIMB SOUNDER (MLS) EXPERIMENTS FOR UARS AND EOS
JOE W. WATERS (JPL, Pasadena, CA) and GORDON E. PECKHAM (Heriot-Watt University, Edinburgh, Scotland) IN: IGARSS '91; Proceedings of the 11th Annual International Geoscience and Remote Sensing Symposium, Espoo, Finland, June 3-6, 1991. Vol. 2 1991 4 p refs
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Microwave limb sounding can provide important measurements for understanding global change and processes in earth's stratosphere, mesosphere, and lower thermosphere. An experiment for this purpose operating at millimeter wavelengths is now ready for launch on the NASA Upper Atmosphere Research Satellite (UARS). An enhanced experiment at submillimeter wavelengths is also being studied for the future NASA Earth Observing System (EOS). I.E.

A92-35262
APPLICATION OF A SPECTRAL ESTIMATION SYSTEM FOR THE DETERMINATION OF CYCLICITIES IN CONTINENTAL SEDIMENTATION PROCESSES
ELFI VAN OVERLOOP and LEO P. VAN BIESEN (Brussel, Vrije Universiteit, Brussels, Belgium) IN: IGARSS '91; Proceedings of the 11th Annual International Geoscience and Remote Sensing Symposium, Espoo, Finland, June 3-6, 1991. Vol. 4 1991 6 p refs
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A92-37671
THE PARTICULATE MATTER FROM BIOMASS BURNING - A TUTORIAL AND CRITICAL REVIEW OF ITS RADIATIVE IMPACT
JACQUELINE LENOBLE (Lille I, Universite, Villeneuve-d'Ascq, France) IN: Global biomass burning - Atmospheric, climatic, and biospheric implications 1991 6 p
Copyright

Smoke particles from biomass burning can modify cloud characteristics by acting as condensation nuclei; cloud albedo is also decreased, and cloud absorption increased. Attention is presently given to particles' radiative characteristics, in view of the preeminently important smoke plume parameters of average optical depth at solar wavelengths and average single-scattering albedo. Additional parameters discussed, in order of decreasing importance, are the asymmetry factor and the vertical profile of the extinction coefficient. O.C.

A92-37682
SURFACE COOLING DUE TO SMOKE FROM BIOMASS BURNING
ALAN ROBOCK (Maryland, University, College Park) IN: Global biomass burning - Atmospheric, climatic, and biospheric implications 1991 14 p
(Contract NOAA-NA-87AADCP003; NOAA-NA-84AAH00026)
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Accounts are given of five different forest fires which are illustrative of the surface-temperature effects of this type of smoke, involving daytime cooling but no nighttime effects. These results correspond to theoretical estimates of the effects of smoke, and they serve as observational confirmations of an aspect of the nuclear-winter hypothesis. The results obtained imply that smoke from biomass burning can have a daytime cooling effect of a few degrees over seasonal time-scales; in order to accurately simulate the current climate with a numerical climate model, in regions where burning regularly occurs, the inclusion of this smoke effect may be required. O.C.

A92-37685
IMPACT WINTER IN THE GLOBAL K/T EXTINCTIONS - NO DEFINITIVE EVIDENCES
DEWEY M. MCLEAN (Virginia Polytechnic Institute and State University, Blacksburg) IN: Global biomass burning - Atmospheric, climatic, and biospheric implications 1991 11 p
Copyright

It is presently suggested that if a Cretaceous/Tertiary (K/T) boundary impact winter occurred, it was too transitory, or feeble, to be recorded in the geological record; it is also likely to have been of insufficient magnitude to trigger the catastrophic species-extinction event associated with the K/T boundary. Nevertheless, a major, long-duration K/T transition carbon-cycle perturbation associated with coeval climatic warming is indicated in the record. Little definitive evidence is found in support of a bolide-induced K/T boundary impact winter. O.C.

A92-37888
TESTING FOR CAUSAL RELATIONSHIPS BETWEEN LARGE PYROCLASTIC VOLCANIC ERUPTIONS AND MASS EXTINCTIONS
DOUGLAS H. ERWIN (National Museum of Natural History, Washington, DC) and THOMAS A. VOGEL (Michigan State University, East Lansing) Geophysical Research Letters (ISSN 0094-8276), vol. 19, no. 9, May 4, 1992, p. 893-896. Research supported by NSF. 4 May 1992 4 p refs
Copyright

To study the connection between volcanism and mass extinction, an approach is employed to identify large pyroclastic eruptions with well-constrained age determinations, and evaluate the fossil record for evidence of significant regional or global extinctions. The largest, best constrained pyroclastic events known, i.e., Toba Tuff, Huckleberry Ridge Tuff, Tuff of Blacktail and the Elkhorn Mountain volcanics are selected for this evaluation. Neither global or regional terrestrial vertebrate diversity nor global marine diversity exhibit any biological effect from these extremely massive pyroclastic eruptions. It is concluded that massive pyroclastic eruptions are unlikely to have been an effective cause of mass extinctions. R.E.P.

A92-37919
MILANKOVITCH FLUCTUATIONS ON SUPERCONTINENTS
THOMAS J. CROWLEY, STEVEN K. BAUM (Applied Research Corp., College Station, TX), and WILLIAM T. HYDE (Dalhousie University, Halifax, Canada) Geophysical Research Letters (ISSN 0094-8276), vol. 19, no. 8, April 24, 1992, p. 793-796. 24 Apr. 1992 4 p refs
(Contract NSF ATM-90-02808)
Copyright

A two-dimensional energy balance climate model is used to examine the potential effects of Milankovitch fluctuations for a supercontinent configuration. It is calculated that Milankovitch variations can modulate the magnitude of summer warming by as much as 14-16 deg on Pangaea, with large changes occurring in both the Northern and Southern Hemispheres. However, lower topography in the Jurassic may have reduced the magnitude of precipitation variations associated with these changes. Altered geography and CO2 levels may have caused summer temperatures of 25 C in high latitudes during peak precession half cycles of hot summer orbits. This result suggests that evidence for high-latitude warmth needs to consider the potential influence of Milankovitch forcing. V.L.

A92-38150 National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
THE BIOSPHERE AS A DRIVER OF GLOBAL ATMOSPHERIC CHANGE
JOEL S. LEVINE (NASA, Langley Research Center, Hampton, VA) IN: Scientists on Gaia. Cambridge, MA, MIT Press, 1991, p. 353-361. Research supported by NASA. 1991 9 p refs
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The effects of the biosphere on the evolution of atmospheric oxygen and ozone, and the consequences of that development for global atmospheric change, are discussed. Attention is given to the impact of oxygen and ozone on atmospheric photolysis rates, the effect of oxygen on the biogenic production of nitrous oxide and nitric oxide, and the effects of the evolution of atmospheric oxygen on fires and biomass burning. The influence of the latter on atmospheric processes, particularly the production of methane, carbon dioxide, and carbon monoxide, is considered. C.D.

A92-38176* National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
EARTH, ATMOSPHERE
JOEL S. LEVINE (NASA, Langley Research Center, Hampton, VA) IN: The astronomy and astrophysics encyclopedia. New York, Van Nostrand Reinhold, 1991, p. 176-178. 1991 3 p refs
Copyright

Present understanding of the earth's atmosphere is briefly reviewed. The structure and composition of the atmosphere are described. The origin of the atmosphere and the factors involved in global atmospheric change are addressed. C.D.

A92-38945
THE GLOBAL CARBON DIOXIDE FLUX IN SOIL RESPIRATION AND ITS RELATIONSHIP TO VEGETATION AND CLIMATE
J. W. RAICH (Iowa State University of Science and Technology, Ames) and W. H. SCHLESINGER (Duke University, Durham, NC) Tellus, Series B - Chemical and Physical Meteorology (ISSN 0280-6509), vol. 44B, no. 2, April 1992, p. 81-99. Apr. 1992 19 p refs
(Contract NSF BSR-89-18382)
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Measured rates of soil respiration from terrestrial and wetland ecosystems are reviewed to define the annual global CO2 flux from soils, identify uncertainties in the global flux estimates, and to investigate the influences of temperature, precipitation, and vegetation on soil respiration rates. The annual global CO2 flux from soils is estimated to average 68 +/- 4 PgC/yr, based on extrapolations from biome land areas. On a global scale, soil-respiration rates are positively correlated with mean annual air temperatures and mean annual precipitation. There is a chosen correlation between mean annual net primary productivity of different vegetation biomes and their mean annual soil respiration rates. Estimates of soil C turnover rates range from 500 years in tundra and peaty wetlands to 10 years in tropical savannas. The impacts of human activities on soil-respiration rates are poorly documented, and vary among sites. Of particular importance are potential changes in temperatures and precipitation. Based on a review of in situ measurements, the Q10 value for total soil respiration has a median value of 2.4. Increased soil respiration with global warming is likely to provide a positive feedback to the greenhouse effect. Author

A92-38946
NORTHERN FENS - METHANE FLUX AND CLIMATIC CHANGE
NIGEL ROULET (York University, North York, Canada), TIM MOORE, JILL BUBIER (McGill University, Montreal, Canada), and PETER LAFLEUR (Trent University, Peterborough, Canada) Tellus, Series B - Chemical and Physical Meteorology (ISSN 0280-6509), vol. 44B, no. 2, April 1992, p. 100-105. Research supported by NSERC and Atmospheric Environment Service of Canada. Apr. 1992 6 p refs
Copyright

Methane flux from northern peatlands is believed to be an important contribution to the global methane budget. High latitude regions are predicted to experience significant changes in surface temperature and precipitation associated with the 2 x CO2 climate scenarios, but the effects of these changes on methane emission are poorly understood. A peatland hydrologic model predicted June-August decreases in water storage of between 82 and 144 mm, using as inputs increases in temperatures of 3 C and rainfall of 1 mm/d. These changes translate into a water table drop, relative to the peat surface, of between 14 and 22 cm, depending on whether the fen has a floating or nonfloating surface. The 3 C air temperature increase was predicted to raise peat temperature at 10 cm depth by 0.8 C. These changes were then applied to relationships derived at a subarctic fen for water table: methane flux: temperature at 10 cm depth. Increased temperatures raise the methane flux by between 5 and 40 percent, but the lowered water table decreases methane flux by 74 and 81 percent, at the floating and nonfloating fen sites, respectively. These results suggest that methane emissions from northern peatlands are more sensitive to changes in moisture regime than temperature within the range of changes predicted for 2 x CO2 scenarios. Author

A92-40508
COMMENTS ON THE ORIGIN OF DUST IN EAST ANTARCTICA FOR PRESENT AND ICE AGE CONDITIONS
A. GAUDICHET (Paris XII, Universite, Creteil, France), M. DE ANGELIS (CNRS, Laboratoire de Glaciologie et Geophysique de l'Environnement, Saint-Martin-d'Heres, France), S. JOUSSAUME (CNRS, Laboratoire de Meteorologie Dynamique, Paris, France), J. R. PETIT (CNRS, Laboratoire de Glaciologie et Gephysique de l'Environnement, Saint-Martin-d'Heres, France), Y. S. KOROTKEVICH, and V. N. PETROV (Arctic and Antarctic Research Institute, St. Petersburg, Russia) (The chemistry of the global atmosphere; International Symposium of the Commission for Atmospheric Chemistry and Global Pollution of IAMAP, 7th, Chamrousse, France, Sept. 5-11, 1990, Selected Papers. A92-40501 16-46) Journal of Atmospheric Chemistry (ISSN 0167-7764), vol. 14, no. 1-4, April 1992, p. 129-142. Research supported by Expeditions Polaires Francaises, Programme National d'Etude de la Dynamique du Climat, France, NSF, et al. Apr. 1992 14 p refs
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The distribution of 327 clay mineral particles retrieved from four Antarctic ice samples corresponding to present and last glacial maximum (LGM) climate conditions is studied. Chlorite, illite, kaolinite and smectite are identified in all samples. Concentrating on kaolinite, (because of its utilization as a possible tracer of low latitude soils), a significantly smaller amount is found for LGM samples, while the dust concentration in snow during the LGM is about 30 times greater than for present climate conditions.
R.E.P.

A92-40515
SPATIAL AND TEMPORAL VARIATIONS OF METHANESULFONIC ACID AND NON SEA SALT SULFATE IN ANTARCTIC ICE
M. LEGRAND, C. FENIET-SAIGNE (CNRS, Laboratoire de Glaciologie et Geophysique de l'Environnement, Saint-Martin-d'Heres, France), E. S. SALTZMAN, and C. GERMAIN (Miami, University, FL) (The chemistry of the global atmosphere; International Symposium of the Commission for Atmospheric Chemistry and Global Pollution of IAMAP, 7th, Chamrousse, France, Sept. 5-11, 1990, Selected Papers. A92-40501 16-46) Journal of Atmospheric Chemistry (ISSN 0167-7764), vol. 14, no. 1-4, April 1992, p. 245-260. Research supported by Terres Australes et Antarctiques Francaises, NSF, CNRS, et al. Apr. 1992 16 p refs
Copyright

A simultaneous glaciochemical study of methanesulfonic acid (MSA) and non-sea-salt sulfate (nss-SO4) is conducted on the Antarctic plateau to investigate marine sulfur emissions in very remote areas. The data suggest that MSA and nss-SO4 present in Antarctic ice are mainly marine in origin and that DMS emissions were significantly modulated by short-term (e.g., ENSO) events as well as long term climatic changes in the past. A study of spatial variations of these two sulfur species indicates that the atmosphere of coastal Antarctic regions are mainly supplied by local DMS emissions whereas the atmosphere of the high plateau is also influenced by DMS emissions from more temperature marine latitudes. The partitioning between MSA and nss-SO4 suggest that the temperature could have been an important parameter controlling the final composition of the high southern latitude atmosphere over the last climatic cycle. Author

A92-41722
POSSIBLE METHANE-INDUCED POLAR WARMING IN THE EARLY EOCENE
L. C. SLOAN, JAMES C. G. WALKER, T. C. MOORE, JR., DAVID K. REA, and JAMES C. ZACHOS (Michigan, University, Ann Arbor) Nature (ISSN 0028-0836), vol. 357, no. 6376, May 28, 1992, p. 320-322. 28 May 1992 3 p refs
Copyright

Estimates of Eocene wetland areas are considered and it is suggested that the flux of methane may have been substantially greater during the Eocene than at present. Elevated methane concentrations would have enhanced early Eocene global warming and also might have prevented severe winter cooling of polar regions because of the potential of atmospheric methane to promote the formation of optically thick polar stratospheric ice clouds. C.D.

A92-41862
PINNING DOWN THE BRUNHES/MATUYAMA AND UPPER JARAMILLO BOUNDARIES - A RECONCILIATION OF ORBITAL AND ISOTOPIC TIME SCALES
L. TAUXE (Scripps Institution of Oceanography, La Jolla, CA), A. D. DEINO (Institute for Human Origins, Berkeley, CA), A. K. BEHRENSMEYER, and R. POTTS (Smithsonian Institution, Washington, DC) Earth and Planetary Science Letters (ISSN 0012-821X), vol. 109, no. 3-4, April 1992, p. 561-572. Research supported by NSF and Smithsonian Institution. Apr. 1992 12 p refs
Copyright

The two reported estimates of the age of the Brunhes/Matuyama boundary (namely, 0.73 Ma, derived by Mankinen and Dalrymple (1979) using the 'chronogram technique' and 0.78 Ma obtained by Shackleton et al. (1990) using the 'astronomical technique') are reconciled by using new magnetostratigraphic data tied to high-quality Ar-40/Ar-39 dates, and a date of 0.992 for the upper Jaramillo boundary, which is considerably older than the estimate of 0.91 Ma in the chronomogram-based scale. An age of 0.746 +/-0.039 Ma is obtained for the sediment immediately overlying the Brunhes/Matuyama boundary, which is consistent with the astronomical estimates of 0.78 Ma and 0.99 Ma for the Brunhes/Matuyama and the upper Jaramillo boundaries, respectively. A new method is presented for estimating the uncertainties of the ages calculated using the chronogram technique, which uses a simple bootstrap resampling scheme.
I.S.

A92-42292* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ESTIMATES OF SURFACE ROUGHNESS DERIVED FROM SYNTHETIC APERTURE RADAR (SAR) DATA
DIANE L. EVANS, TOM G. FARR, and JAKOB J. VAN ZYL (JPL,

Pasadena, CA) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. 30, no. 2, March 1992, p. 382-389. Mar. 1992 8 p refs
Copyright

Radar remote sensing data provide a unique perspective of the earth's crust and the processes that have influenced its evolution. Physically based models are required, however, to relate the geophysical quantities being measured by the radar sensor to useful geologic information. In this study, synthetic aperture radar (SAR) data over the Cima volcanic field in the Mojave Desert of California are quantitatively connected with microtopography through inversion of a radar backscatter model. Changes in surface roughness inferred from the derived microtopography are modeled and found to be consistent with aeolian mantling as surfaces age. Estimated rates of aeolian deposition for the Cima area are compared to the Lunar Crater volcanic field in Nevada. Rates of deposition appear to be higher at Cima volcanic field, most likely because of its proximity to Soda Lake, the main source of the aeolian material. Author

A92-46577
ESTIMATES OF THE RADIATIVE AND THERMAL CONSEQUENCES OF VARIATIONS OF THE OZONE CONTENT IN THE GLOBAL ATMOSPHERE FOR 1980-1990 [OTSENKI RADIATSIONNYKH I TEMPERATURNYKH POSLEDSTVII IZMENENII SODERZHANIIA OZONA V GLOBAL'NOI ATMOSFERE ZA 1980-1990 GG.]
I. L. KAROL' and V. A. FROL'KIS (Glavnaia Geofizicheskaia Observatoriia, St. Petersburg, Russia) Rossiiskaia Akademiia Nauk, Doklady (ISSN 0002-3264), vol. 323, no. 1, 1992, p. 66-69. In Russian. 1992 4 p In RUSSIAN refs
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A 2D radiative-convective energy-balance model is used to evaluate variations of mean zonal, mean yearly fluxes of solar and thermal radiation and the associated temperature variations of different layers of the atmosphere. This study of variations of the radiative and thermal regimes is based on data concerning concentration variations of ozone and other greenhouse gases in the atmosphere from 1979-1980 to 1990. It is found that the radiation influence on the increasing greenhouse effect of the other greenhouse gases associated with variations of the ozone content can occur only in polar zones (especially the southern one) and at southern midlatitudes, where the Antarctic ozone hole plays a significant role. The observed difference in snow area variations on continents and sea polar ice might have been the consequence of the ozone 'compensation' of the greenhouse warming of the southern polar zone in the 1980s: the total areas were reduced in the Arctic but remained roughly constant in the Antarctic. L.M.

A92-46686
LONG-TERM HISTORY OF CLIMATE ICE AGES AND MILANKOVITCH PERIODICITY
A. BERGER (Louvain, Universite Catholique, Louvain-la-Neuve, Belgium) IN: The sun in time 1991 13 p
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A92-46687
QUATERNARY GLACIATIONS - THEORY AND OBSERVATIONS
MICHAEL GHIL (California, University, Los Angeles) IN: The sun in time 1991 32 p
(Contract NSF ATM-86-15424; NSF ATM-90-13217)
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The components of the climate system active on Quaternary time scales are described and modeled along with their nonlinear interactions. The discovery of geologic evidence for past glaciations is sketched, geochemical methods for the study of deep-sea cores are reviewed, and the phenomenology of glaciation cycles as deduced from these cores is described. A near-periodicity of roughly 100,000 yr dominates continuous records of isotopic proxy data for ice volume, with smaller spectral peaks near 40,000 and 20,000 yr. The equations for radiation balance and ice flow are derived, analyzed, and coupled with an equation for bedrock response to yield a system of differential equations governing stable, self-sustained, periodic oscillations. The power spectra of these oscillations show the above mentioned peaks with periodicities near 100 kyr, 40 kyr, and 20 kyr. A few novel methods for the study of nonlinear, quasi-periodic, and aperiodic phenomena in theoretical climate dynamics are discussed. C.D.

A92-46688
SOLAR VARIABILITY CAPTURED IN CLIMATIC AND HIGH-RESOLUTION PALEOCLIMATIC RECORDS - A GEOLOGIC PERSPECTIVE
ROGER Y. ANDERSON (New Mexico, University, Albuquerque) IN: The sun in time 1991 19 p
(Contract NSF ATM-87-07462)
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A92-49218
POSSIBILITY OF THE COMETARY ORIGIN OF THE BACKGROUND SULFATE LAYER IN THE STRATOSPHERE [O VOZMOZHNOSTI KOMETNOGO PROISKHOZHDENIIA FONOVOGO SUL'FATNOGO SLOIA V STRATOSFERE]
V. N. LEBEDINETS (NPO Taifun, Obninsk, Russia) Astronomicheskii Vestnik (ISSN 0320-930X), vol. 26, no. 3, May-June 1992, p. 61-64. In Russian. Jun. 1992 4 p In RUSSIAN refs
Copyright

The paper develops a global balance model of sulfur introduced into the middle atmosphere by minicomets. It is shown that in intervals between powerful vocanic eruptions the Junge sulfate aerosol layer may be formed from minicometary sulfur. The required influx of cometary sulfur corresponds to a sulfur depletion relative to oxygen (as compared with their space abundances) by a factor of 30. L.M.

A92-49817
ANTARCTIC (DOME C) ICE-CORE DUST AT 18 K.Y. B.P. - ISOTOPIC CONSTRAINTS ON ORIGINS
FRANCIS E. GROUSSET (Bordeaux I, Universite, Talence, France; Lamont-Doherty Geological Observatory, Palisades, NY), PIERRE E. BISCAYE (Lamont-Doherty Geological Observatory, Palisades, NY), MARIE REVEL (Bordeaux I, Universite, Talence, France), JEAN-ROBERT PETIT (CNRS, Laboratoire de Glaciologie et Geophysique de l'Environnement, Saint-Martin-d'Heres, France), KENNETH PYE (Reading, University, England), SYLVIE JOUSSAUME (CEA, Laboratoire de Modelisation du Climat et de l'Environnement, Gif-sur-Yvette; Paris VI, Universite, France), and JEAN JOUZEL (CEA, Laboratoire de Modelisation du Climat et de l'Environnement, Gif-sur-Yvette; CNRS, Laboratoire de Glaciologie et Geophysique de l'Environnement, Saint-Martin-d'Heres, France) Earth and Planetary Science Letters (ISSN 0012-821X), vol. 111, no. 1, June 1992, p. 175-182. Research supported by Programme National d'Etude Dynamique des Climats. Jun. 1992 8 p refs
(Contract DE-FG02-87ER-60555)
Copyright

The source area from which dusts from the Last Glacial Maximum (LGM) section of the Dome C ice core were derived was determined by comparing their strontium and neodymium isotopic ratios with those of samples from potential source areas. The Sr-87/Sr-86 and Nd-143/Nd-144 isotope ratios of the dusts deposited about 18 k.y. B.P. at the East Antarctic Dome C site were compared with potential Antarctic, Australian, southern African and South American sources. The isotope ratios clearly define the Patagonian provenance of the dust, with the other potential source areas being, at most, minor contributors. Contributions by volcanic ash and tephra to the dust sample were also determined to be minimal, based on the patterns of rare earth elements. Knowing the source of the dusts places constraints on the aeolian trajectory by which it was transported to Antarctica, and this serves as a test of the simulation of southern hemispheric circulation by atmospheric global circulation models during the LGM. Author

A92-51222* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
FREQUENCY VARIATIONS OF THE EARTH'S OBLIQUITY AND THE 100-KYR ICE-AGE CYCLES
HAN-SHOU LIU (NASA, Goddard Space Flight Center, Greenbelt, MD) Nature (ISSN 0028-0836), vol. 358, no. 6385, July 30, 1992, p. 397-399. 30 Jul. 1992 3 p refs
Copyright

Changes in the earth's climate are induced by variations in the earth's orbital parameters which modulate the seasonal distribution of solar radiation. Periodicities in the geological climate record with cycles of 100, 41, and 23 kyr have been linked with changes in obliquity, eccentricity, and precession of the equinoxes. The effect of variations of eccentricity during a 100 kyr period is weak relative to the signals from obliquity and precession variations and it may therefore be expected that the 100 kyr signal in the climate record would be of low intensity. However, this signal dominates the climate record and internal nonlinear processes within the climate system have previously been proposed to account for this fact. The author shows that variations in the frequency of the obliquity cycle can give rise to strong 100-kyr forcing of climate. A.O.

A92-52586
A DETAILED CHRONOLOGY OF THE AUSTRALASIAN IMPACT EVENT, THE BRUHES-MATUYAMA GEOMAGNETIC POLARITY REVERSAL, AND GLOBAL CLIMATE CHANGE
DAVID A. SCHNEIDER (Woods Hole Oceanographic Institution, MA), DENNIS V. KENT, and GILBERTO A. MELLO (Lamont-Doherty Geological Observatory, Palisades, NY) Earth and Planetary Science Letters (ISSN 0012-821X), vol. 111, no. 2-4, July 1992, p. 395-405. Research supported by ARCO and Woods Hole Oceanographic Institution. Jul. 1992 11 p refs
(Contract NSF EAR-88-17773)
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A92-55061
CLIMATE CHANGE INFERRED FROM ANALYSIS OF BOREHOLE TEMPERATURES - AN EXAMPLE FROM WESTERN UTAH
TIMOTHY J. CHISHOLM and DAVID S. CHAPMAN (Utah, University, Salt Lake City) Journal of Geophysical Research (ISSN 0148-0227), vol. 97, no. B10, Sept. 10, 1992, p. 14,155-14,175. Research supported by University of Utah. 10 Sep. 1992 21 p refs
(Contract NSF EAR-90-15357)
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The paper employs temperature-depth profiles measured in a suite of boreholes in western Utah to infer climate change in the region over the past century and to document how effectively the solid earth records secular changes in surface air temperature. Deviations from linear temperature-depth profiles in the boreholes, interpreted in terms of a linear change of surface temperature with time, suggest changes of -0.8 to +0.6 C in surface temperature for western Utah over the last several decades. Up to 50 percent of the temperature increase seen in the 100-yr record constitutes recovery from a cold period toward the end of the last century. P.D.

A92-55095
BLACK CARBON CONCENTRATION IN BYRD STATION ICE CORE - FROM 13,000 TO 700 YEARS BEFORE PRESENT
P. CHYLEK (Dalhousie University, Halifax, Canada; New York, State University, Albany), B. JOHNSON, and H. WU (Dalhousie University, Halifax, Canada) Annales Geophysicae (ISSN 0992-7689), vol. 10, no. 8, Aug. 1992, p. 625-629. Aug. 1992 5 p refs
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The concentration of black carbon in 22 ice core samples from Byrd Station (West Antarctica) covering the time period from about 13,000 to 700 years before present has been determined. For the first time, black carbon concentrations were obtained in an ice core which included a part of the last climatic transition. An average black carbon concentration of 0.1 micrograms/kg during the Wisconsin-Holocene climatic transition. After the transition the black carbon concentration in the ice core oscillated between 0.1 and 0.95 micrograms/kg, with an average concentration of 0.5 micrograms/kg. The increase in black carbon concentration occurred several hundred years after changes in delta-O-18, CO2 and CH4 characterizing the end of the last (Wisconsin) ice age. Expansion of the land biomass during the early Holocene was responsible for the observed increase of black carbon concentration in the Byrd Station ice core. Author

A92-55896
IRREGULAR OSCILLATIONS OF THE WEST ANTARCTIC ICE SHEET
DOUGLAS R. MACAYEAL (Chicago, University, IL) Nature (ISSN 0028-0836), vol. 359, no. 6390, Sept. 3, 1992, p. 29-32. 3 Sep. 1992 4 p refs
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Model simulations of the West Antarctic ice sheet suggest that sporadic, perhaps chaotic, collapse (complete mobilization) of the ice sheet occurred throughout the past one million years. The irregular behavior is due to the slow equilibration time of the distribution of basal till, which lubricates ice-sheet motion. This nonlinear response means that predictions of future collapse of the ice sheet in response to global warming must take into account its past history, and in particular whether the present basal till distribution predisposes the ice sheet towards rapid change. Author

A92-55901* National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York, NY.
VOLCANIC WINTER AND ACCELERATED GLACIATION FOLLOWING THE TOBA SUPER-ERUPTION
MICHAEL R. RAMPINO (New York University; NASA, Goddard Institute for Space Studies, New York) and STEPHEN SELF (Hawaii, University, Honolulu) Nature (ISSN 0028-0836), vol. 359, no. 6390, Sept. 3, 1992, p. 50-52. Research supported by DOE, National Institutes for Global Environmental Change, Columbia University, and NATO. 3 Sep. 1992 3 p refs
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Model calculations that investigate the possible climatic effects of the Toba volcanic cloud are presented. The increase in atmospheric opacity might have produced a 'volcanic winter', followed by a few years with maximum estimated annual hemispheric surface-temperature decreases of 3-5 C. The eruption occurred during the stage 5a-4 transition of the oxygen isotope record, a time of rapid ice growth and falling sea level. It is suggested that the Toba eruption may have greatly accelerated the shift to glacial conditions that was already under way, by inducing perennial snow cover and increased sea-ice extent at sensitive northern latitudes. As the onset of climate change may have helped to trigger the eruption itself, it is proposed that the Toba event may exemplify a more general climate-volcano feedback mechanism. C.A.B.

A92-56711
THE CRETACEOUS-TERTIARY EXTINCTION - A LETHAL MECHANISM INVOLVING ANHYDRITE TARGET ROCKS
ROBIN BRETT (USGS, Reston, VA) Geochimica et Cosmochimica Acta (ISSN 0016-7037), vol. 56, no. 9, Sept. 1992, p. 3603-3606. Sep. 1992 4 p refs
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The Chicxulub Crater, Yucatan, Mexico, is a leading contender as the site for the impact event that caused the Cretaceous-Tertiary (K-T) extinctions. A considerable thickness of anhydrite (CaSO4) forms part of the target rock. High temperatures resulting from impact would drive SO2 off from the anhydrite. Hundreds of billions of tonnes of sulfuric acid aerosol would thus enter the stratosphere and cause considerable cooling of the earth's surface, decrease photosynthesis by orders of magnitude, deplete the ozone layer, and permit increased UV radiation to reach the earth's surface. Finally, the aerosol would fall back to earth as acid rain and devastate land and some lacustrine biota and near-surface marine

creatures. The presence of anhydrite in the Chicxulub target rock may thus help explain the many extinctions observed at the K-T boundary. Author

A92-56996
TECTONIC FORCING OF LATE CENOZOIC CLIMATE
M. E. RAYMO (MIT, Cambridge, MA) and W. F. RUDDIMAN (Virginia, University, Charlottesville) Nature (ISSN 0028-0836), vol. 359, no. 6391, Sept. 10, 1992, p. 117-122. Research supported by NSF. 10 Sep. 1992 6 p refs
Copyright
Global cooling in the Cenozoic, which led to the growth of large continental ice sheets in both hemispheres, may have been caused by the uplift of the Tibetan plateau and the positive feedbacks initiated by this event. In particular, tectonically driven increases in chemical weathering may have resulted in a decrease of atmospheric CO2 concentration over the past 40 Myr. Author

N92-14529*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
HIGH RESOLUTION SPECTROSCOPY TO SUPPORT ATMOSPHERIC MEASUREMENTS
MARY ANN H. SMITH (College of William and Mary, Williamsburg, VA.), V. MALATHY DEVI (College of William and Mary, Williamsburg, VA.), CURTIS P. RINSLAND, D. CHRIS BENNER (College of William and Mary, Williamsburg, VA.), and GALE A. HARVEY *In* NASA, Washington, NASA Upper Atmosphere Research Program: Research Summaries 1988-1989 p 168-169 Jan. 1990
Avail: CASI HC A01/MF A03
Detailed knowledge of the molecular spectra of ozone and other infrared-active atmospheric species is needed for accurate calculation of atmospheric heating and cooling rates in climate models. Remote sensing experiments on the Nimbus-7 satellites and the Spacelab-3 Space Shuttle Mission have shown that space-based measurements of infrared absorption or emission can be used to accurately determine the concentrations and distributions of stratospheric species on a global scale. The objective of this research task is to improve knowledge of the spectroscopic line parameters (positions, intensities, assignments, halfwidths, and pressure-induced shifts) of key atmospheric constituents through laboratory measurements. Author

N92-14543*# National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York, NY.
CLIMATOLOGICAL STRATOSPHERIC MODELING
DAVID RIND *In* NASA, Washington, NASA Upper Atmosphere Research Program: Research Summaries 1988-1989 p 262 Jan. 1990
(Contract RTOP 673-61-07-30)
Avail: CASI HC A01/MF A03
The Goddard Institute for Space Studies (GISS) Three dimensional Global Climate/Middle Atmosphere Model was used to investigate the effect of doubled carbon dioxide on the middle atmosphere. Carbon dioxide was doubled in both the troposphere and stratosphere, and the sea surface temperatures were increased in accordance with results from the GISS climate model. Additional experiments were run with different sea surface temperature distributions, and doubling the carbon dioxide only in the troposphere or stratosphere. Author

N92-15497# Interagency Arctic Research Policy Committee, Washington, DC.
ARCTIC RESEARCH OF THE UNITED STATES, SPRING 1990, VOLUME 4
JERRY BROWN, ed. (NSF, Washington, DC.) and STEPHEN BOWEN, ed. (Army Cold Regions Research and Engineering Lab., Hanover, NH.) NSF 1990 124 p Original contains color illustrations
(NSF-90-72)
This is a journal for national and international audiences of government officials, scientists, engineers, educators, Arctic residents, and other people interested in Arctic-related topics. Reports cover a broad spectrum of life in the Arctic including such topics as fish, game, health, social services, science, engineering, environment, oceanography, international activities, international cooperation, global change, conferences, polar libraries, data, policies, research, and history. The emphasis in this issue is on the importance of the Arctic Ocean and its marginal seas to U.S. national interests, including fisheries, the oil and gas industries, and global climate change processes. J.P.S.

N92-15498# Interagency Arctic Research Policy Committee, Washington, DC.
ARCTIC RESEARCH OF THE UNITED STATES, FALL 1990, VOLUME 4
JERRY BROWN, ed. (NSF, Washington, DC.) and STEPHEN BOWEN, ed. (Army Cold Regions Research and Engineering Lab., Hanover, NH.) NSF 1990 110 p
(NSF-90-151) Avail: CASI HC A06/MF A02
This is a journal for national and international audiences of government officials, scientists, engineers, educators, Arctic residents, and other people interested in Arctic-related topics. Reports cover a broad spectrum of life in the Arctic including such topics as fish, game, health, social services, science, engineering, environment, oceanography, international activities, international cooperation, global change, conferences, polar libraries, data, policies, research, and history. The emphasis in this issue is on international activities, including the environment, research ships, and the Bering Sea region's history and resources. J.P.S.

N92-15506# Los Alamos National Lab., NM.
VARIABILITY OF SURFACE FLUXES OVER A HETEROGENEOUS SEMI-ARID GRASSLAND
F. J. BARNES (Los Alamos National Lab., NM.), W. PORCH (Los Alamos National Lab., NM.), D. COOPER (Los Alamos National Lab., NM.), K. E. KUNKEL (Illinois Univ., Champaign.), L. HIPPS (Utah State Univ., Logan.), and E. SWIATEK (Utah State Univ., Logan.) 1991 10 p Presented at the 72d American Meteorological Society Conference, Atlanta, GA, 5-10 Jan. 1992
(Contract W-7405-ENG-36)
(DE92-002449; LA-UR-91-3140; CONF-920134-4) Avail: CASI HC A02/MF A01
Efforts are increasing throughout the research community to improve the predictive capabilities of general circulation models (GCM's). The US Department of Energy's Atmospheric Radiation Measurement (ARM) program has stated its goals as improving the representation and parameterization of cloud radiative forcing and feedbacks in GCM's by a combined modeling and experimental approach. Along with ambient atmospheric conditions, including advection of water vapor and cloud nuclei from other regions, cloud dynamics depend on surface fluxes of heat and water vapor. The lower boundary of the GCM modeling domain, the earth's surface, exerts a strong influence on regional dynamics of heat and water vapor, and the heterogeneity in the surface features can be responsible for generating regional mesoscale circulation patterns. Changes in the surface vegetation due to anthropogenic activity can cause substantial changes in the ratio of sensible to latent heat flux and result in climate changes that may be irreversible. A broad variety of models for representing energy fluxes are in use, from individual leaf and canopy models to mesoscale atmospheric models and GCM's. Scaling-up a model is likely to result in significant errors, since biophysical responses often have nonlinear dependence on the abiotic environment. Thus, accurate and defensible methods for selecting measurement scales and modeling strategies are needed in the effort to improve GCM's. DOE

N92-22830# Belgian Royal Observatory, Brussels.
SOLID EARTH: THE PRIORITIES
P. PAQUET *In* ESA, Report of the Earth Observation User Consultation Meeting p 34-39 Oct. 1991
Copyright Avail: CASI HC A02/MF A03; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 75 Dutch guilders
The European Space Agency's strategy concerning the solid

Earth program is reviewed. Improvement of current knowledge of the global geopotential fields, both gravity and magnetic, was stressed as the highest priority. It was agreed that the objectives and goals of the planned Aristoteles mission correspond to this priority, and the need to realize this part of the program was stated. The interdisciplinary links of the program were identified, and it was decided that this program could make substantial contributions to research of oceans, climate and global change, atmosphere, ice and land surfaces. ESA

N92-22850# Technische Univ., Delft (Netherlands).
SOLID EARTH: INTRODUCTION
R. RUMMEL *In* ESA, Report of the Earth Observation User Consultation Meeting p 209-213 Oct. 1991 Original contains color illustrations
Copyright Avail: CASI HC A01/MF A03; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 75 Dutch guilders

The principles of the solid Earth program are introduced. When considering the study of solid Earth from space, satellites are used as beacons, inertial references, free fall probes and carrying platforms. The phenomenon measured by these satellites and the processes which can be studied as a result of these measurements are tabulated. The NASA solid Earth program focusses on research into surface kinematics, Earth rotation, land, ice, and ocean monitoring. The ESA solid Earth program identifies as its priority the Aristoteles mission for determining the gravity and magnetic field globally, with high spatial resolution and high accuracy. The Aristoteles mission characteristics and goals are listed. The benefits of the improved gravity information that will be provided by this mission are highlighted. This information will help in the following research: geodesy, orbit mechanics, geodynamics, oceanography, climate sea level, and the atmosphere. ESA

N92-23540*# Texas Univ., Austin. Center for Space Research.
DETERMINATION OF CRUSTAL MOTIONS USING SATELLITE LASER RANGING Final Report, 15 Feb. 1989 - 31 Dec. 1991
31 Dec. 1991 55 p
(Contract NAG5-1118)
(NASA-CR-190246; NAS 1.26:190246) Avail: CASI HC A04/MF A01

Satellite laser ranging has matured over the last decade into one of the essential space geodesy techniques. It has demonstrated centimeter site positioning and millimeter per year velocity determinations in a frame tied dynamically to the mass center of the solid Earth hydrosphere atmosphere system. Such a coordinate system is a requirement for studying long term eustatic sea level rise and other global change phenomena. Earth orientation parameters determined with the coordinate system have been produced in near real time operationally since 1983, at a relatively modest cost. The SLR ranging to Lageos has also provided a rich spectrum of results based upon the analysis of Lageos orbital dynamics. These include significant improvements in the knowledge of the mean and variable components of the Earth's gravity field and the Earth's gravitational parameter. The ability to measure the time variations of the Earth's gravity field has opened as exciting area of study in relating global processes, including meteorologically derived mass transport through changes in the satellite dynamics. New confirmation of general relativity was obtained using the Lageos SLR data. Author

N92-31008# Los Alamos National Lab., NM.
SMALL SATELLITE RADIATION BUDGET INSTRUMENTATION
P. G. WEBER 1992 11 p Presented at the 2nd Small Satellite Technology and Applications Conference, Orlando, FL, 20-24 Apr. 1992
(Contract W-7405-ENG-36)
(DE92-011134; LA-UR-92-949; CONF-9204112-1) Avail: CASI HC A03/MF A01

A major diagnostic in understanding the response of the Earth's climate to natural or anthropogenic changes is the radiative balance at the top of the atmosphere. Two classes of measurements may be undertaken: (1) a monitoring of the radiation balance over decade-long long-time scales; and (2) measurements designed to provide a sufficiently complete data set to validate or improve models. This paper discusses some of the important ingredients in obtaining such data and presents a description of some candidate instrumentation for use on a small satellite. DOE

N92-31084*# Illinois Univ., Urbana-Champaign. Dept. of Electrical and Computer Engineering.
MEASUREMENT CAPABILITIES OF GIANT LIDARS FOR MIDDLE AND UPPER ATMOSPHERIC APPLICATIONS Abstract Only
CHESTER S. GARDNER *In* NASA. Langley Research Center, 16th International Laser Radar Conference, Part 2 p 647 Jul. 1992
Avail: CASI HC A01/MF A03

The development and refinement of sophisticated remote sensing techniques during the past three decades have contributed enormously to our knowledge of the atmosphere. Lidar technologies have developed rapidly since the invention of the laser in 1961. Today, sophisticated systems are used to probe composition and structure throughout the atmosphere from the troposphere into the lower thermosphere and are making important contributions to several global change studies. While the recent advances in lidar technology have been impressive, the accuracy, resolution, and sensitivity of many systems are still limited by signal levels. We review the scientific rationale for developing a major new lidar facility to study the chemistry and dynamics of the Earth's atmosphere. The centerpiece of the facility is to be a 10-meter telescope which serves as the receiving system for several very large lidar systems. We discuss the observational capabilities of the proposed facility with particular emphasis on measurements of temperature, winds, water vapor, and ozone. Author

N92-31636# Lamont-Doherty Geological Observatory, Palisades, NY.
LAMONT-DOHERTY GEOLOGICAL OBSERVATORY Report, 1990 - 1991
M. LANGSETH and R. JELLINECK 1992 157 p
(PB92-185040) Avail: CASI HC A08/MF A02

This report features a series of articles whose titles are: Topography and Faulting in the Western U.S. - An example of digital map making; Profile of the Hudson River; Responses to Impending Continent-Continent Collision in the Mediterranean; Ocean Ridges as Active Volcanoes; The Role of Thermohaline Circulation in Global Climate Change; El Nino and Natural Short-Term Climate Variability; The El Nino/Southern Oscillation System and the Record of Past Climate Change; Sedimentary Basins as Thermochemical Reactors; Modeling the Stratigraphy of Continental Margins; The Role of Late-Stage Sedimentation in the Generation of GAs, Gulf of Mexico; and Conjuring Up the Red Planet. H.A.

N92-33097*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
SAGE 1 DATA USER'S GUIDE
LEONARD R. MCMASTER, WILLIAM P. CHU, and MICHAEL W. ROWLAND (ST Systems Corp., Hampton, VA.) Aug. 1992 26 p
(Contract RTOP 665-45-30-21)
(NASA-RP-1275; L-16879; NAS 1.61:1275) Avail: CASI HC A03/MF A01

A guide for using the data products from the Stratospheric Aerosol and Gas Experiment 1 (SAGE 1) for scientific investigations of stratospheric chemistry related to aerosol, ozone, nitrogen dioxide, dynamics, and climate change is presented. A detailed description of the aerosol profile tape, the ozone profile tape, and the nitrogen dioxide profile tape is included. These tapes are the SAGE 1 data products containing aerosol extinction data and ozone and nitrogen dioxide concentration data for use in the different scientific investigations. Brief descriptions of the instrument operation, data collection, processing, and validation, and some of the scientific analyses that were conducted are also included. Author

47

METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

A92-10646
FORCING MECHANISMS OF THE INDIAN OCEAN MONSOON
STEVEN CLEMENS, WARREN PRELL, DAVID MURRAY (Brown University, Providence, RI), GRAHAM SHIMMIELD (Edinburgh, University, Scotland), and GRAHAM WEEDON (Cambridge, University, England) Nature (ISSN 0028-0836), vol. 353, Oct. 24, 1991, p. 720-725. Research supported by NSF and Joint Oceanographic Institutions. 24 Oct. 1991 6 p refs
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Sediments in the Arabian Sea provide biological, biogeochemical and lithogenic evidence of past changes in the Indian Ocean summer monsoon winds. For the past 350,000 years, this system has been externally forced by cyclical changes in solar radiation, and internally phase-locked to the transport of latent heat from the southern subtropical Indian Ocean to the Tibetan Plateau. In contrast to the results of general circulation models, these geological data suggests that the climate change associated with variability in global ice volume is not a primary factor in determining the strength and timing of the monsoon winds. Author

A92-10827
MODELING OF A GLOBAL STRUCTURE OF STATIONARY PLANETARY WAVES AND THEIR PENETRATION ACROSS THE EQUATOR [MODELIROVANIE GLOBAL'NOI STRUKTURY I PRONIKNOVENIE CHEREZ EKVATOR STATSIONARNYKH PLANETARNYKH VOLN]
A. S. MEDVEDEV, A. I. POGOREL'TSEV, and S. A. SUKHANOVA (Leningradskii Gidrometeorologicheskii Institut, Leningrad, USSR; AN KSSR, Institut Ionosfery, Alma-Ata, Kazakh SSR) Akademiia Nauk SSSR, Izvestiia, Fizika Atmosfery i Okeana (ISSN 0002-3515), vol. 27, Aug. 1991, p. 813-824. In Russian. Aug. 1991 12 p In RUSSIAN refs
Copyright

A novel method based on the latitudinal operator inversion of stationary planetary waves (SPWs) is proposed for eliminating the difficulties arising from the simulation of stationary large-scale disturbances at low latitudes. A global structure of SPWs with a zonal wave number of 1 is calculated for the model mean zonal wind which qualitatively reflects the climatic picture of the Northern-Hemisphere winter. SPW penetration across the equator is found to occur in the region of the mean zonal westerlies. P.D.

A92-11273
COMMENTS ON 'CORRECTION OF ERRORS ASSOCIATED WITH MEASUREMENT OF NET ALL-WAVE RADIATION WITH DOUBLE-DOMED RADIOMETERS' BY OLIVER AND WRIGHT (1990)
SVEN HALLDIN (Uppsala University, Sweden) Boundary-Layer Meteorology (ISSN 0006-8314), vol. 57, no. 1-2, Oct. 1991, p. 195-201. Oct. 1991 7 p refs
Copyright

A92-11684
USING SPARSE RAINGAGES TO TEST SATELLITE-BASED RAINFALL ALGORITHMS
MARK L. MORRISSEY (Hawaii, University, Honolulu) Journal of Geophysical Research (ISSN 0148-0227), vol. 96, Oct. 20, 1991, p. 18,561-18,571. 20 Oct. 1991 11 p refs
(Contract NOAA-NA-90RAH00074)
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A statistical method is presented which uses sparsely distributed raingages to obtain calibrations for satellite-based rainfall algorithms. The method can also be used for the development and verification of these algorithms. It is assumed that the distributions of areal rainfall, given a value of a satellite areal rainfall estimate, are homogeneous and stationary over a region encompassing a network of sparse raingages. The method may best be applied over open ocean regions to supplement the limited number of dense raingage/radar networks there. A description of the method is given, followed by an illustration of the method using simulated rain fields. Finally, the method is used to calibrate a simple satellite rainfall algorithm using Pacific atoll monthly raingage data. Author

A92-11696
MEASUREMENTS OF AITKEN NUCLEI AND CLOUD CONDENSATION NUCLEI IN THE MARINE ATMOSPHERE AND THEIR RELATION TO THE DMS-CLOUD-CLIMATE HYPOTHESIS
DEAN A. HEGG, LAWRENCE F. RADKE, and PETER V. HOBBS (Washington, University, Seattle) Journal of Geophysical Research (ISSN 0148-0227), vol. 96, Oct. 20, 1991, p. 18,727-18,733. 20 Oct. 1991 7 p refs
(Contract NSF ATM-90-08639)
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New airborne measurements provide support for the hypothesis that layers of high concentrations of Aitken nuclei near the tops of marine clouds are due to photochemical nucleation. They also reveal a significant correlation between cloud condensation nucleus (CCN) concentrations in the boundary layer and mean cloud droplet concentration in stratus clouds topping a marine boundary layer. Nonsea salt sulfate mass and the concentration of CCN active at 1 percent supersaturation are also significantly correlated. These results provide quantitative support for some facets of the DMS-cloud-climate hypothesis. Author

A92-12376
THE GREENHOUSE EFFECT AND ITS CLIMATIC CONSEQUENCES - SCIENTIFIC EVALUATION [L'EFFET DE SERRE ET SES CONSEQUENCES CLIMATIQUES - EVALUATION SCIENTIFIQUE]
Academie des Sciences (Paris), Comptes Rendus, Serie Generale, La Vie des Sciences (ISSN 0762-0969), vol. 8, no. 2, 1991, p. 89-106. In French. 1991 18 p In FRENCH
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The consequences of the intensification of the greenhouse effect on climate are examined. Theoretical considerations concerning the intensities and time lags of the phenomena involved are presented. The budget of factors that can have an effect on climate is examined; natural variability is separated from modifications due to human activity. Some predictions concerning the response of the terrestrial systems to these factors on a time scale extending to the end of the 21st century are then made. L.M.

A92-12377
CLIMATE AND GREENHOUSE-EFFECT GASES - DATA FROM GLACIAL ARCHIVES [CLIMAT ET GAZ A EFFET DE SERRE - LES DONNEES DES ARCHIVES GLACIAIRES]
CLAUDE LORIUS (CNRS, Laboratoire de Glaciologie et Geophysique de l'Environnement, Saint-Martin-d'Heres, France) Academie des Sciences (Paris), Comptes Rendus, Serie Generale, La Vie des Sciences (ISSN 0762-0969), vol. 8, no. 2, 1991, p. 107-124. In French. 1991 18 p In FRENCH refs
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It is pointed out that polar-cap ice has registered the impact of man on the atmospheric composition and particularly on concentrations of greenhouse-effect gases, e.g., CO2 and methane. The data examined indicate that, in the course of the last 150,000 years the warm and cold periods of ice ages and the intervals between ice ages have been governed by the periodic characteristics of the motion of the earth around the sun as well as by atmospheric concentrations of greenhouse-effect gases. Data that concern the possible effect of anthropogenic emissions on the climate in the next century are also considered. L.M.

A92-12694
EFFECTS OF SATURATED AND DRY LAND SURFACES ON THE TROPICAL CIRCULATION AND PRECIPITATION IN A GENERAL CIRCULATION MODEL
KERRY H. COOK (NOAA, Geophysical Fluid Dynamics Laboratory, Princeton, NJ) and ANAND GNANADESIKAN (Princeton University, NJ) Journal of Climate (ISSN 0894-8755), vol. 4, Sept. 1991, p. 873-889. Sep. 1991 17 p refs

The effects of interactions between tropical circulation and dry or saturated land surfaces on the precipitation distribution are investigated using a comprehensive rhomboidal-15 GCM with idealized boundary conditions. Results show that, when the surface is dry, the maximum summer hemisphere warming is 4 times larger than in the saturated surface case and extends into the winter hemisphere. The ITCZ is shifted farther into the summer hemisphere and enhanced near the coasts over the saturated continent, but it is interrupted in crossing the dry surface. The extreme dryness of the surface and the atmosphere below 830 mb eliminates condensation in the lower troposphere, and condensation in the middle troposphere over the western half of the continent also decreases. I.S.

A92-12695* Yale Univ., New Haven, CT.
SPRINGTIME SOIL MOISTURE, NATURAL CLIMATIC VARIABILITY, AND NORTH AMERICAN DROUGHT AS SIMULATED BY THE NCAR COMMUNITY CLIMATE MODEL 1
ROBERT J. OGLESBY (Yale University, New Haven, CT) Journal of Climate (ISSN 0894-8755), vol. 4, Sept. 1991, p. 890-897. Sep. 1991 8 p refs
(Contract NAG8-785)

Previous results concerning the role that summertime soil moisture reductions can play in amplifying or maintaining North American droughts are extended to include the role of springtime soil moisture reductions and the role that natural climatic variability, as expressed in soil moisture, can play. General circulation model (GCM) simulations with the NCAR Community Climate Model have been made with initial desert-like soil moisture anomalies imposed on 1 May and on 1 March. The May simulation maintained the imposed anomaly throughout the summer, while in the March simulation the anomaly was ameliorated within one month. Thus, the timing of soil moisture reductions may be crucial. A 10-year model control integration with prescribed sea surface temperatures yielded 1 year with late spring and summer soil moisture values similar to those of the 1 May anomaly simulation. This suggests that occasional widespread North American droughts may be an inherent feature of at least the GCM employed for this study. The results also demonstrate the important role played by moisture transport from the Gulf of Mexico in modulating or ameliorating drought conditions for much of the south-central United States, a topic that requires considerable further investigation. Author

A92-12696
AN EVALUATION OF PROPOSED REPRESENTATIONS OF SUBGRID HYDROLOGIC PROCESSES IN CLIMATE MODELS
G. THOMAS (British Columbia, University, Vancouver, Canada) and A. HENDERSON-SELLERS (Macquarie University, North Ryde, Australia) Journal of Climate (ISSN 0894-8755), vol. 4, Sept. 1991, p. 898-910. Research supported by NSERC, Atmospheric Environment Service of Canada, and Australian Research Council. Sep. 1991 13 p refs

The temporal and spatial scales that characterize surface hydrologic processes provide conceptual and practical difficulties to the development of parameterization schemes for incorporation into climate models. In particular, there is a requirement to develop process descriptions applicable to large areas but that can model (capture) day-to-day and even hour-to-hour temporal changes. The paper compares two recently proposed methods of simulating subgrid-scale heterogeneity in precipitation distribution. These schemes diverge significantly when the fractional areal extent of the precipitation falls below about 0.2. In addition, two recently proposed parameterizations of surface hydrologic processes are examined in the context of basin-scale data from the Hunter Valley in southeastern Australia. It is found that, although both models capture the predominant characteristics of the annual and monthly surface runoff adequately, the day-to-day variability in the observed flow requires a more explicit identification and treatment of the predominant runoff-generating processes. Author

A92-12698
EVIDENCE OF SECULAR VARIATIONS IN INDIAN MONSOON RAINFALL-CIRCULATION RELATIONSHIPS
B. PARTHASARATHY, K. R. KUMAR, and A. A. MUNOT (Indian Institute of Tropical Meteorology, Poona, India) Journal of Climate (ISSN 0894-8755), vol. 4, Sept. 1991, p. 927-938. Sep. 1991 12 p refs

Detailed correlation analysis of the all-India monsoom rainfall and mean sea-level seasonal pressure at Bombay up to three lags on either side of the monsoon season during the last 30 years (1951-80) indicates a systematic relationship. The winter-to-premonsoon seasonal pressure tendency at Bombay shows a correlation coefficient (CC) of -0.70 with the Indian monsoon rainfall. Further examination of this relationship over a long period of 144 years (1847-1990), using sliding correlation analysis, reveals some interesting features. The sliding CCs were positive before 1870, negative during 1871-1900, positive in the years 1901-40, and again negative later on, showing systematic turning points around the years 1870, 1900, and 1940. In light of other corroborative evidence, these climatic regimes can be identified as 'meridional monsoon' periods during 1871-1900 and after 1940, and as 'zonal monsoon' periods before 1870 and during 1901-40, similar to the observation of Fu and Fletcher (1988). It is also observed that the relationship between Bombay pressure and Indian monsoon rainfall becomes dominant when the ENSO variance in Bombay pressure is high and falls apart when the ENSO variance is small. The paper contains a listing of the long homogeneous data series on all-India monsoon rainfall and monthly MSL pressure at Bombay for the period 1847-1990. Author

A92-12842
THE EFFECT OF URBANIZATION ON GLOBAL WARMING ESTIMATES [O VLIIANII PROTSESSA URBANIZATSII NA OTSENKI GLOBAL'NOGO POTEPLENIIA]
P. IA. GROISMAN and V. V. KOKNAEVA (Gosudarstvennyi Gidrologicheskii Institut, St. Petersburg, USSR) Meteorologiia i Gidrologiia (ISSN 0130-2906), Sept. 1991, p. 5-11. In Russian. Sep. 1991 7 p In RUSSIAN refs

Estimates of the spatially averaged annual mean air temperature for four large continental areas are presented. They were obtained by a standard network and from a specially selected network of rural stations. It is concluded that the contribution of urbanization to the increase in the average air temperature that has been taking place during this century is insignificant (less than 10 percent). P.D.

A92-13175
LENGTH OF THE SOLAR CYCLE - AN INDICATOR OF SOLAR ACTIVITY CLOSELY ASSOCIATED WITH CLIMATE
E. FRIIS-CHRISTENSEN and K. LASSEN (Danish Meteorological Institute, Copenhagen, Denmark) Science (ISSN 0036-8075), vol. 254, Nov. 1, 1991, p. 698-700. 1 Nov. 1991 3 p refs

Observational data are presented which suggest that long-term variations in terrestrial temperature are closely associated with solar cycle length variations; the solar cycle therefore appears to be a possible indicator of long-term changes in the sun's total energy output. If this result can be related to a suitable physical mechanism, it may be possible to ascertain the greenhouse warming signal and predict long-term climate changes by appropriate modeling of solar dynamics. The natural variability of the earth climate and its causes must be determined before anthropogenic changes can be properly characterized. O.C.

A92-13913* Columbia Univ., New York, NY.
GLOBAL PATTERNS OF CLOUD OPTICAL THICKNESS VARIATION WITH TEMPERATURE
GEORGE TSELIOUDIS (Columbia University, New York), DAVID RIND, and WILLIAM B. ROSSOW (NASA, Goddard Institute for Space Studies, New York) IN: Conference on Atmospheric Radiation, 7th, San Francisco, CA, July 23-27, 1990, Preprints 1990 6 p refs
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A global cloud climatology dataset is used to study patterns of cloud optical thickness variation with temperature. The data, which cover the period from July 1983 through June 1995, contain detailed information on the distribution of cloud radiative properties and their diurnal and seasonal variations, as well as information on the vertical distribution of temperature and humidity in the troposphere. For cold low clouds over land, the temperature coefficient of change in optical thickness has a value of about 0.04, which is similar to that deduced from Soviet aircraft observations and derived from thermodynamic considerations for the change of cloud liquid water with temperature. It is suggested that, in this cold-temperature range, cloud optical thickness variations are dominated by changes in the liquid water content of the cloud and that the liquid water content changes in accordance with the thermodynamic theory. P.D.

A92-13928* National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
A SATELLITE RETRIEVAL OF THE SHORTWAVE HEATING OF THE ATMOSPHERE AND THE SURFACE - RELATIONSHIP TO THE GENERAL CIRCULATION, INTERANNUAL CLIMATE VARIABILITY, AND THE CRYOSPHERE
THOMAS P. CHARLOCK, G. L. SMITH (NASA, Langley Research Center, Hampton, VA), and FRED G. ROSE (Lockheed Engineering and Sciences Co., Hampton, VA) IN: Conference on Atmospheric Radiation, 7th, San Francisco, CA, July 23-27, 1990, Preprints 1990 4 p refs
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Data from several Nimbus-7 instruments and monthly averaged, multilayer delta-Eddington radiative transfer calculations are used to estimate the full vertical profile of the SW heating in the surface and the atmosphere. The noontime physical profile of clouds, water vapor, and surface albedo is used to compute a daily, monthly averaged top-of-atmosphere albedo (TOA), which was produced with noontime Nimbus-7 data, and a profile of SW heating for the atmosphere and surface. The daily, monthly averaged TOA albedo for July 1983 is compared with the ERBE daily, monthly averaged TOA albedo for July 1985. The sensitivity of the vertical SW heating profiles to the retrieval input assumptions is shown. P.D.

A92-13969
PRELIMINARY COMPARISON OF LIDAR AND RADAR BACKSCATTER AS A MEANS OF ASSESSING CIRRUS RADIATIVE PROPERTIES
JANET M. INTRIERI (Cooperative Institute for Research in the Environmental Sciences, Boulder, CO), WYNN L. EBERHARD (NOAA, Wave Propagation Laboratory, Boulder, CO), and GRAEME L. STEPHENS (Colorado State University, Fort Collins) IN: Conference on Atmospheric Radiation, 7th, San Francisco, CA, July 23-27, 1990, Preprints 1990 3 p refs
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A92-13973
THE DEPARTMENT OF ENERGY INITIATIVE ON ATMOSPHERIC RADIATION MEASUREMENTS - A STUDY OF RADIATION FORCING AND FEEDBACKS
ARISTIDES A. PATRINOS (DOE, Washington, DC), ROBERT G. ELLINGSON (Maryland, University, College Park), GERALD M. STOKES (Pacific Northwest Laboratories, Richland, WA), and DAVID SOWLE (Mission Research Corp., Santa Barbara, CA) IN: Conference on Atmospheric Radiation, 7th, San Francisco, CA, July 23-27, 1990, Preprints 1990 5 p refs
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An overview of the DOE's Atmospheric Radiation Measurement (ARM) program to address global climate change is presented. The program is a direct continuation of DOE's effort to enhance GCMs and provide reliable simulations of long-term and regional climate change in response to increasing greenhouse gases. The goal of the ARM program is to provide a testbed to study important atmospheric effects, especially cloud and radiative processes, and to test parameterizations of these processes for utilization in atmospheric models. R.E.P.

A92-13985
LINE-BY-LINE CHARACTERIZATION OF THE RADIATIVE EFFECTS AND THE 'GREENHOUSE' WARMING POTENTIAL DUE TO VARIOUS HALOGENATED COMPOUNDS
V. RAMASWAMY, M. D. SCHWARZKOPF, and D. L. TRUEMAN (NOAA, Geophysical Fluid Dynamics Laboratory, Princeton, NJ) IN: Conference on Atmospheric Radiation, 7th, San Francisco, CA, July 23-27, 1990, Preprints 1990 4 p refs
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A92-14005* Utah Univ., Salt Lake City.
IS THERE A CIRRUS SMALL PARTICLE RADIATIVE ANOMALY?
KENNETH SASSEN (Utah, University, Salt Lake City), ANDREW J. HEYMSFIELD (NCAR, Boulder, CO), and DAVID O'C. STARR (NASA, Goddard Space Flight Center, Greenbelt, MD) IN: Conference on Atmospheric Radiation, 7th, San Francisco, CA, July 23-27, 1990, Preprints 1990 5 p refs
(Contract NSF ATM-85-13975; NSF ATM-89-14348)
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Earlier studies of fundamental radiative properties of cirrus clouds suggest the presence of a significant radiative effect produced by small ice crystals of sizes below the detection thresholds of currently available in situ probes. This paper examines visible versus IR radiation relationships to explain the nature and implications of the cirrus small-particle radiative anomaly. It is concluded that the apparent phenomenon of cirrus small particle radiative anomaly is likely due to the approximate treatment of the radiative properties of actual cirrus particles. I.S.

A92-14006
MODELING OF MICROPHYSICAL AND RADIATIVE PROPERTIES OF CIRRUS CLOUDS
DAVID L. MITCHELL (Nevada, University, Reno) IN: Conference on Atmospheric Radiation, 7th, San Francisco, CA, July 23-27, 1990, Preprints 1990 8 p refs
(Contract NOAA-NA-89RAH09087)
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A 1D analytical/numerical model based on growth processes of diffusion and aggregation is developed to predict the evolution of ice-size spectra in cirrus clouds. When compared with a vertical distribution of measured ice-size spectra from cirrus, the predicted and measured spectra compared favorably in the upper and mid-regions of the cirrus deck, but differed significantly in the lower cloud regions. The reasons for this discrepancy are discussed. I.S.

A92-14063
THE MISSING PART OF THE GREENHOUSE EFFECT
A. ZECCA and R. S. BRUSA (Trento, Universita, Italy) Nuovo Cimento C, Serie 1 (ISSN 0390-5551), vol. 14 C, Sept.-Oct. 1991, p. 523-532. Oct. 1991 10 p refs
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Global average temperatures from 1860 to 1989 were analyzed with a simple fitting procedure. The temperature records can be fitted with a rising exponential up to 1946 and with the same exponential minus an increasing cooling action from 1946 to 1989. It is shown that the results are compatible with the hypothesis of an albedo increase caused by SO2 emissions. This hypothesis gives satisfactory explanations of the temperature drop in the years 1940-1970, of the different warming of the Northern and Southern Hemispheres and of the slower warming observed over North America. The results give an indication that the greenhouse

warming in the next years could be faster than predicted until now. Author

A92-14187* State Univ. of New York, Stony Brook.
INTERPRETATION OF SNOW-CLIMATE FEEDBACK AS PRODUCED BY 17 GENERAL CIRCULATION MODELS
R. D. CESS, M.-H. ZHANG (New York, State University, Stony Brook), G. L. POTTER (Lawrence Livermore National Laboratory, Livermore, CA), J.-P. BLANCHET (Canadian Climate Centre, Downsview, Canada), S. CHALITA (CNRS, Laboratoire de Meteorologie Dynamique, Paris, France), R. COLMAN (Bureau of Meteorology, Research Centre, Melbourne, Australia), D. A. DAZLICH (Colorado State University, Fort Collins), A. D. DEL GENIO, A. A. LACIS (NASA, Goddard Institute for Space Studies, New York), V. DYMNIKOV (AN SSSR, Otdel Vychislitel'noi Matematiki, Moscow, USSR) et al. Science (ISSN 0036-8075), vol. 253, Aug. 23, 1991, p. 888-892. Research supported by French Climate Program. 23 Aug. 1991 5 p refs
(Contract DE-FG02-85ER-60314; W-7405-ENG-48; DE-FG02-89ER-69027; DE-AI01-80EV-10220; EEC-EV4C-0066-F; BMFT-KFT-05/6; NAG5-1058)
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Snow feedback is expected to amplify global warming caused by increasing concentrations of atmospheric greenhouse gases. The conventional explanation is that a warmer earth will have less snow cover, resulting in a darker planet that absorbs more solar radiation. An intercomparison of 17 general circulation models, for which perturbations of sea surface temperature were used as a surrogate climate change, suggests that this explanation is overly simplistic. The results instead indicate that additional amplification or moderation may be caused both by cloud interactions and longwave radiation. One measure of this net effect of snow feedback was found to differ markedly among the 17 climate models, ranging from weak negative feedback in some models to strong positive feedback in others. Author

A92-14271
STUDIES OF VARIATIONS OF CLIMATE AND HYDROLOGIC CYCLE [ISSLEDOVANIE IZMENENII KLIMATA I VLAGOOBOROTA]
M. I. BUDYKO, ED. Leningrad, Gidrometeoizdat (Gosudarstvennyi Gidrologicheskii Institut, Trudy, No. 348), 1990, 128 p. In Russian. No individual items are abstracted in this volume. 1990 128 p In RUSSIAN
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Results are presented on studies in the area of physical climatology with emphasis on the processing and analysis of data on air temperature and precipitation over the continents and oceans, in modern times and in the past including the Holocene. Consideration is given to a multidimensional autoregressive model of monthly SST anomalies in the Northern Hemisphere, averaged over 10-deg latitude zones; new data on the ocean-atmosphere moisture exchange; the ocean carbonate system under different conditions for the formation of bottom residue; and the effect of radiation-regime changes on climate. Attention is also given to climatic changes in the late Wuerm-Holocene, the basic characteristics of the oxygen regime formation in the surface layer of the bottom deposits in the Neva inlet, and the effect of environmental changes on the productivity of natural phytocenoses. I.S.

A92-14272
PHYSICAL-STATISTICAL METHODS IN METEOROLOGY [FIZIKO-STATISTICHESKIE METODY V METEOROLOGII]
G. M. VINOGRADOVA, ED. and N. N. ZAVALISHIN, ED. Moscow, Gidrometeoizdat (Zapadno-Sibirskii Regional'nyi Nauchno-Issledovatel'skii Gidrometeorologicheskii Institut, Trudy, No. 93), 1990, 140 p. In Russian. No individual items are abstracted in this volume. 1990 140 p In RUSSIAN
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Reports are presented regarding the development and application of physical-statistical prediction methods in meteorology. Attention is given to the choice of statistical prediction models, a solar-energy theory of climatic changes and the cosmic future of the planet earth, the effect of the gravitation factor on the cycle of changes of meteorological parameters and atmospheric microprocesses, and the statistical correlation between some meteorological phenomena and the lunar phases. Special consideration is given to a study of the information content of predictors used in the official monthly weather-forecasting method, the large-scale air-temperature anomalies in western Siberia, an automated method for predicting the motions of air masses and cloud systems, and the process of rapid replenishment of hydrometeorological information using the ILO data-processing center data base. I.S.

A92-15051
THEORY AND PREDICTION OF CLIMATE CHANGE [TEORIIA I PROGNOZ IZMENENIIA KLIMATA]
I. L. KAROL', ED., B. I. SAZONOV, ED., and V. F. LOGINOV, ED. Leningrad, Gidrometeoizdat (Glavnaia Geofizicheskaia Observatoriia, Trudy, No. 531), 1990, 159 p. In Russian. For individual items see A92-15052 to A92-15057. 1990 159 p In RUSSIAN
Copyright

This book discusses climatic anomalies on various temporal and spatial scales. Attention is given to the use of information from moderate latitudes to forecast an Indian monsoon, the relationship between Indian monsoons and upper-atmosphere processes, changes in the temperature of the water surface and the air over the world ocean, and seasonal and interannual variations of the total ozone content in the major air masses of the Northern Hemisphere in various phases of quasi-biennial oscillation. Consideration is also given to estimating the effects of changes in the insolation and the polar-zone boundary on the thermal regime, using an energy-balance model; modeling of changes in the thermal regime of the Northern Hemisphere during the last century; variations in the climatic signal induced by an increase of atmospheric CO2 concentration; the characteristics of the formation of extreme winters in the Northern Hemisphere; and the rhythm in the warming of the Eurasian climate. I.S.

A92-15056
VARIATIONS IN A CLIMATIC SIGNAL INDUCED BY AN INCREASE OF CO2 CONCENTRATION IN THE ATMOSPHERE [VARIATSII KLIMATICHESKOGO SIGNALA, INDUTSIROVANNOGO ROSTOM KONTSENTRATSII CO2 V ATMOSFERE]
I. V. ALTUNIN IN: Theory and prediction of climate change 1990 8 p In RUSSIAN refs
Copyright

The uncertainty of the climatic signal due to increased concentrations of CO2 in the atmosphere is estimated on the basis of numerical experiments using a zero-order climatic model. Results obtained using CO2 concentrations for 1980 and those estimated for 2010 showed a significant scatter of the surface temperature increases and a perceptible increase in the delay of atmospheric warming as compared with equilibrium warming. I.S.

A92-15101
GENERAL AND APPLIED CLIMATOLOGY [OBSHCHAIA I PRIKLADNAIA KLIMATOLOGIIA]
N. V. KOBYSHEVA, ED. and I. D. KOPANEV, ED. Leningrad, Gidrometeoizdat (Glavnaia Geofizicheskaia Observatoriia imeni A.I. Voeikova, Trudy, No. 532), 1990, 231 p. In Russian. For individual items see A92-15102 to A92-15118. 1990 231 p In RUSSIAN
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Papers are presented on such topics as absorbed radiation on the territory of the USSR, the use of solar-radiation values for devising the standard year for one of the climatic zones of Kazakhstan, and the estimation of the error of spatial averaging for essentially inhomogeneous meteorological fields. Consideration is also given to the effect of mesoclimatic conditions on thunderstroms and hail on the territory of the USSR, the

anthropogenic effect on the nonuniformity of interaweek variations of precipitation in cities, and the effect of meteorological visibiltiy range on air safety. L.M.

A92-15114
ANTHROPOGENIC INFLUENCE ON THE NONUNIFORMITY OF INTRAWEEK VARIATIONS OF PRECIPITATION IN CITIES [ANTROPOGENNOE VLIIANIE NA NERAVNOMERNOST' VNUTRINEDEL'NOGO KHODA OSADKOV V GORODAKH]
P. B. BERNSHTEIN and TS. A. SHVER IN: General and applied climatology 1990 9 p In RUSSIAN refs
Copyright

Variations of the nonuniformity of the intraweek trends of precipitation in periods of low (before 1929) and high (after 1946) industrial potential are evaluated on the basis of daily meteorological observations in 16 large cities of the European part of the USSR. The intraweek nonuniformity is shown to depend significantly on the wind direction. L.M.

A92-15122
ADVECTIVE-RADIATIVE CLIMATE FLUCTUATIONS IN THE OCEAN-ATMOSPHERE-LAND SYSTEM [ADVEKTIVNO-RADIATSIONNYE KOLEBANIIA KLIMATA V SISTEME ATMOSFERA-OKEAN-SUSHA]
G. V. ALEKSEEV and I. A. PODGORNYI (Arkticheskii i Antarkticheskii Nauchno-Issledovatel'skii Institut, Leningrad, USSR) Akademiia Nauk SSSR, Izvestiia, Fizika Atmosfery i Okeana (ISSN 0002-3515), vol. 27, Oct. 1991, p. 1120-1129. In Russian. Oct. 1991 10 p In RUSSIAN refs
Copyright

Results of archive data and GCMs are presented which indicate a reverse dependence of mean hemispheric or global surface air temperature and characteristics of the spatial inhomogeneity of the temperature field. It is shown that this connection is due to a nonlinear relation between temperature and outgoing infrared radiation. The changes and fluctuations of mean hemispheric and global temperatures under the influence of the intensity of meridional and zonal heat fluxes, the amplitude of annual variations of the absorbed solar radiation, and the thermal inertia of the upper ocean are evaluated using energy-balance climate models. P.D.

A92-16184
GLOBAL WARMING AND CHANGE IN MEAN AIR PRESSURE AT THE EARTH'S SURFACE [GLOBALE ERWAERMUNG UND AENDERUNG DES MITTLEREN LUFTDRUCKES AN DER ERDOBERFLAECHE]
K. BERNHARDT (Berlin, Humboldt-Universitaet, Federal Republic of Germany) Zeitschrift fuer Meteorologie (ISSN 0084-5361), vol. 41, no. 5, 1991, p. 325-332. In German. 1991 8 p In GERMAN refs
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It is shown that global warming involving increased atmospheric CO2 and water vapor content is the factor mainly responsible for increasing global mean atmospheric pressure at the earth's surface. This increase is partly reduced by growing atmospheric potential energy due to tropospheric warming. The increase in total average surface pressure is found to be 1.0-1.5 hPa. The mean sea level pressure is influenced also by the surface temperature increase, resulting in a decrease in the difference between sea level pressure and surface pressure. This diminishes the sea level pressure increase considerably compared with that of the mean atmospheric surface pressure. C.D.

A92-16186
CLIMATE VARIATIONS AND AEROSOL TRANSPORT IN THE ANTARCTIC AND ARCTIC [KLIMASCHWANKUNGEN UND AEROSOLTRANSPORT IN DER ANTARKTIS UND ARKTIS]
U. LEITERER (Aerologisches Observatorium, Lindenberg, Federal Republic of Germany) Zeitschrift fuer Meteorologie (ISSN 0084-5361), vol. 41, no. 5, 1991, p. 343-349. In German. 1991 7 p In GERMAN refs
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Data from the 2083 m ice core discovered at Vostok in East Antarctica is used to discuss possible reasons for climatic changes during the last 160,000 yrs. The peculiarities of the large-scale Antarctic circulation and its effect on the transport of aerosol are addressed. Finally, some aspects of recent climate changes in the Arctic region are discussed. C.D.

A92-16235
SENSITIVITY OF THE EARTH'S CLIMATE TO HEIGHT-DEPENDENT CHANGES IN THE WATER VAPOUR MIXING RATIO
KEITH P. SHINE and ASHOK SINHA (Reading, University, England) Nature (ISSN 0028-0836), vol. 354, Dec. 5, 1991, p. 382-384. 5 Dec. 1991 3 p refs
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Lindzen has argued that only changes in the upper tropospheric water vapor can alter the radiative budget of the atmosphere significantly and hence contribute to the atmospheric water vapor feedback. Here, radiative transfer calculations are used to show that this seems to be true if the water vapor concentration is perturbed by a constant absolute amount at all heights. But observations of the seasonal change in water vapor concentrations suggest that the climate response to increased concentrations of greenhouse gases may be closer to a constant relative change at all heights, corresponding to much larger absolute changes in the lower troposphere. It is found that the earth's radiation budget is most sensitive to changes in lower tropospheric water vapor concentrations when such relative perturbations are considered. C.D.

A92-17041 Maryland Univ., College Park.
AMAZONIAN DEFORESTATION AND REGIONAL CLIMATE CHANGE
CARLOS A. NOBRE, PIERS J. SELLERS, and JAGADISH SHUKLA (Maryland, University, College Park) Journal of Climate (ISSN 0894-8755), vol. 4, Oct. 1991, p. 957-988. Research supported by Instituto de Pesquisas Espaciais. Oct. 1991 32 p refs
(Contract NSF ATM-87-13567; NAGW-1269; NAG5-892; NAGW-557)
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A coupled numerical model of the global atmosphere and biosphere (center for ocean-land-atmosphere GCM) is used to assess the effects of Amazonian deforestation on the regional and global climate. It is found that when the Amazonian tropical forests were replaced by degraded grass (pasture) in the model, there was a significant increase in the mean surface temperature (about 2.5 C) and a decrease in the annual evapotranspiration (30 percent reduction), precipitation (25 percent reduction), and runoff (20 percent reduction) in the region. The differences between the two simulations were greatest during the dry season. The deforested case was associated with larger diurnal fluctuations of surface temperature and vapor pressure deficit; such effects have been observed in existing deforested areas in Amazonia. The calculated reduction in precipitation was larger than the calculated decrease in evapotranspiration, indicating a reduction in the regional moisture convergence. There was also an increase in the length of the dry season in the southern half of the Amazon Basin, which could have serious implications for the reestablishment of the tropical forests following massive deforestation. An empirical bioclimatic scheme based on an integrated soil moisture stress index was used to derive the movement of the savanna-forest boundary in response to the simulated climate change produced by large-scale deforestation. Author

A92-17044 Jet Propulsion Lab., California Inst. of Tech., Pasadena.
HUMIDITY PROFILES OVER THE OCEAN
W. T. LIU, WENQING TANG, and PEARN P. NIILER (JPL, Pasadena, CA) Journal of Climate (ISSN 0894-8755), vol. 4, Oct. 1991, p. 1023-1034. Research supported by NASA. Oct. 1991 12 p refs
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The variabilities of atmospheric humidity profile over oceans

from daily to interannual time scales were examined using 9 years of daily and semidaily radiosonde soundings at island stations extending from the Arctic to the South Pacific. The relative humidity profiles were found to have considerable temporal and geographic variabilities, contrary to the prevalent assumption. Principal component analysis on the profiles of specific humidity were used to examine the applicability of a relation between the surface-level humidity and the integrated water vapor; this relation has been used to estimate large-scale evaporation from satellite data. The first principal component was found to correlate almost perfectly with the integrated water vapor. The fractional variance represented by this mode increases with increasing period. It reaches approximately 90 percent at two weeks and decreases sharply, below one week, down to approximately 60 percent at the daily period. At low frequencies, the integrated water vapor appeared to be an adequate estimator of the humidity profile and the surface-level humidity. At periods shorter than a week, more than one independent estimator is needed. Author

A92-17355
SATELLITE MEASUREMENTS OF MOISTURE VARIABLES AND GLOBAL CHANGE
GERALD R. NORTH (Texas A & M University, College Station) IN: Modern radio science 1990 1990 10 p refs
Copyright

Use of satellite measurements for determining variables of airborne moisture in the process of climatic changes is discussed. Special attention is given to the methods suitable for space measurements (including the IR methods and the passive microwave methods) and to space systems that are presently in operation or being developed. The former include systems aboard the geosynchronous satellites, the polar orbiting sun-synchronous satellites, and the Defense Meteorological Satellites. The latter include the Tropical Rainfall Measuring Mission scheduled for a launch in 1996 and the Earth Observing System of polar orbiting satellites. I.S.

A92-18322
FLUCTUATIONS OF THE WARMING EFFECT OF OCEANS ON THE GLOBAL CLIMATE [KOLEBANIIA OTEPLIAIUSHCHEGO VLIIANIIA OKEANOV NA GLOBAL'NYI KLIMAT]
G. V. ALEKSEEV, I. A. PODGORNYI, and P. N. SVIASHCHENNIKOV (Arkticheskii i Antarkticheskii NII, Leningrad, USSR) Akademiia Nauk SSSR, Doklady (ISSN 0002-3264), vol. 320, no. 1, 1991, p. 70-73. In Russian. 1991 4 p In RUSSIAN refs
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Correlation coefficients of anomalies of mean temperature and anomalies of thermal contrasts between land and ocean in the Northern Hemisphere in different months over the 1891-1986 time period are examined. The data indicate that observed changes of the current climate have a substantial internal 'oceanic' component. L.M.

A92-18737* Colorado State Univ., Fort Collins.
NONLINEAR INFLUENCE OF MESOSCALE LAND USE ON WEATHER AND CLIMATE
R. A. PIELKE, T. J. LEE (Colorado State University, Fort Collins), G. A. DALU (Cooperative Institute for Research in the Atmosphere, Fort Collins; CNR, Istituto di Fisica dell'Atmosfera, Rome, Italy), J. S. SNOOK (NOAA, Forecast Systems Laboratory, Boulder, CO), and T. G. F. KITTEL (Cooperative Institute for Research in the Atmosphere; Colorado State University, Fort Collins) Journal of Climate (ISSN 0894-8755), vol. 4, Nov. 1991, p. 1053-1069. Research supported by ENEL. Nov. 1991 17 p refs
(Contract NSF ATM-89-15265; NAG5-910; NSF BSR-88-05390; N00014-88-K-0029; DE-FG02-90ER-60932)
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It is shown that the influence of mesoscale landscape spatial variability on the atmosphere must be parameterized or explicitly modeled in larger-scale atmospheric model simulations including general circulation models. The mesoscale fluxes of heat that result from this variability are shown to be of the same order of magnitude but with a different vertical structure than found for the turbulent fluxes. These conclusions are based on experiments in which no phase changes of water were permitted. To parameterize surface thermal inhomogeneities, the influence of landscape must be evaluated using spectral analysis or an equivalent procedure. To include the nonlinear contribution of each scale, numerical model simulations for the range of observed surface and overlying atmospheric conditions must be performed. P.D.

A92-18906
SENSITIVITY OF THE SOUTHERN HEMISPHERE CIRCULATION TO LEADS IN THE ANTARCTIC PACK ICE
IAN SIMMONDS and W. F. BUDD (Melbourne, University, Parkville, Australia) Royal Meteorological Society, Quarterly Journal (ISSN 0035-9009), vol. 117, pt. B, July 1991, p. 1003-1024. Research supported by Australian Research Council. Jul. 1991 22 p refs

The sensitivity of the Southern Hemisphere circulation to changes in the fraction of open water in the sea ice is assessed by means of four experiments with a 21-wave GCM with this fraction set to 5, 50, 80, and 100 percent. The mean surface temperatures and the surface atmospheric temperatures over the sea ice increased as the water fraction increased and the largest changes were simulated adjacent to the coast. Significant anomalies in the surface heat fluxes, particularly those of sensitive heat, accompanied the decrease in the sea ice concentration. Substantial atmospheric warming was simulated over and in the vicinity of areas in which leads were considered. In all but one experiment there were anomalous easterlies between about 40 and 60 deg S with westerly anomalies further to the south. It is found that the surface pressure at high latitudes appears to change in a consistent fashion with the fraction of open water, with the greatest changes occurring in the Weddel Sea and near the Ross Sea. C.A.B.

A92-19509 Delaware Univ., Newark.
INFLUENCE OF SPATIALLY VARIABLE INSTRUMENT NETWORKS ON CLIMATIC AVERAGES
C. J. WILLMOTT, S. M. ROBESON (Delaware, University, Newark), and J. J. FEDDEMA (California, University, Los Angeles) Geophysical Research Letters (ISSN 0094-8276), vol. 18, Dec. 1991, p. 2249-2251. Dec. 1991 3 p refs
(Contract NAG5-853; NAGW-1884)
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New high-resolution climatologies are intensively sampled and integrated to illustrate the effects of sampling biases. Attention is given to problems associated with instrumental bias, namely, measurement error, instrument exposure changes, temporal sampling bias, and urban heating effects. It is shown that the uneven spatial coverage of temperature and precipitation networks has introduced marked variability and bias into the large-scale climatic record. C.A.B.

A92-19510
GLOBAL WARMING - EVIDENCE FOR ASYMMETRIC DIURNAL TEMPERATURE CHANGE
THOMAS R. KARL, MICHAEL J. CHANGERY, ROBERT G. QUAYLE, RICHARD R. HEIM, JR., DAVID R. EASTERLING (NOAA, Global Climate Laboratory, Asheville, NC), GEORGE KUKLA (Lamont Doherty Geological Observatory, Palisades, NY), VIACHESLAV N. RAZUVAEV (VNII Gidrometeorologicheskoi Informatsii, Obninsk, USSR), and CONG B. FU (Beijing University, People's Republic of China) Geophysical Research Letters (ISSN 0094-8276), vol. 18, Dec. 1991, p. 2253-2256. Dec. 1991 4 p refs
(Contract DE-A105-90ER-60952; DE-FG02-85ER-60372)
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This paper discusses analyses of the year-month mean maximum and minimum surface thermometric record, which was updated and expanded to cover the contiguous U.S., Russia, and China. They indicate that most of the warming which has occurred in these regions over the past four decades can be attributed to an increase of mean minimum (mostly nighttime temperatures.

Mean maximum (mostly daytime) temperatures display little or no warming. In the U.S. and Russia, similar characteristics are also reflected in the changes of extreme seasonal temperatures, e.g., increase of extreme minimum temperatures and little or no change in extreme maximum temperatures. The continuation of increasing minimum temperatures and little overall change of the maximum leads to a decrease of the mean temperature range, an important measure of climate variability. It is suggested that changes in cloud cover plays a direct role where increases in cloudiness result in reduced maximum and higher minimum temperatures. C.A.B.

A92-19652
SOLAR AND GEOMAGNETIC VARIABILITY AND CHANGES OF WEATHER AND CLIMATE

V. BUCHA (Czechoslovak Academy of Sciences, Geophysical Institute, Prague, Czechoslovakia) (Solar-terrestrial physics; International SCOSTEP Symposium, 7th, The Hague, Netherlands, June 25-30, 1990, Selected Papers. A92-19628 06-46) Journal of Atmospheric and Terrestrial Physics (ISSN 0021-9169), vol. 53, Nov.-Dec. 1991, p. 1161-1172. Dec. 1991 12 p refs

Previous results substantiated by statistical tests are used to investigate the hypothesis that the changes in solar activity can influence processes in the auroral oval which modulate the alternation of the meridional and zonal types of atmospheric circulation, leading to changes in temperature and pressure. Long-term climate fluctuations are explained as being due to the wandering of the geomagnetic poles influenced by processes in the earth's interior. These poles represent a center of the auroral zone, the shift of which could lead to crucial changes of atmospheric flow and thus to the occurrence of glacial and interglacial periods. The increase of global temperature in the past may also participate in the changes in the CO2 concentration. The findings can contribute to the solution of the problem of how responses to anthropogenic impacts on the earth can be distinguished from the variability of the natural system, mainly of the natural forcing mechanisms and of the climate. P.D.

A92-19671
EFFECT OF OCEAN THERMAL DIFFUSIVITY ON GLOBAL WARMING INDUCED BY INCREASING ATMOSPHERIC CO2

NING BAO and XUEHONG ZHANG (Chinese Academy of Sciences, Institute of Atmospheric Physics, Beijing, People's Republic of China) Advances in Atmospheric Sciences (ISSN 0256-1530), vol. 8, Nov. 1991, p. 421-430. Nov. 1991 10 p refs

A global mean ocean model including atmospheric heating, heat capacity of the mixed layer ocean, and vertical thermal diffusivity in the lower ocean, proposed by Cess and Goldenberg (1981), is used in this paper to study the sensitivity of global warming to the vertical diffusivity. The results suggest that the behavior of upper ocean temperature is mainly determined by the magnitude of upper layer diffusivity and an ocean with a larger diffusivity leads to a less increase of sea surface temperature and a longer time delay for the global warming induced by increasing CO2 than that with smaller one. The global warming relative to four scenarios of CO2 emission assumed by Intergovernmental Panel of Climate Change is also estimated by using the model with two kinds of thermal diffusivities. The result shows that, for various combinations of the CO2 emission scenarios and the diffusivities, the oceanic time delay to the global warming varies from 15 to 70 years. Author

A92-19673
A NUMERICAL STUDY OF THE MECHANISM FOR THE EFFECT OF NORTHERN WINTER ARCTIC ICE COVER OF THE GLOBAL SHORT-RANGE CLIMATE EVOLUTION

YUNQI NI, YUEDONG LI (Nanjing University, People's Republic of China), and QIN ZHANG (Nanjing Institute of Meteorology, People's Republic of China) Advances in Atmospheric Sciences (ISSN 0256-1530), vol. 8, Nov. 1991, p. 489-498. Nov. 1991 10 p refs

A nine-layer global spectral model involving fuller parameterization of physical processes, with a rhomboidal truncation at wavenumber 15 is used to perform experiments in terms of two numerical schemes, one with long-term mean coverage of Arctic ice (Exp. 1), and the other without the ice (Exp. 2). Results indicate that the Arctic region is a heat source in Exp. 2 relative to the case in Exp. 1. Under the influence of the simulated polar heat source, there are still stationary wavetrains that produce WA-EUP and weak PNA patterns in the northern winter. That either the Arctic or the tropical heat source can cause identical climatic effects is due to the fact that the anomaly of the Arctic ice cover will directly induce a south-propagating wavetrain and bring about the redistribution of the tropical heat source/sink. The redistribution is responsible for new wavetrains that will exert an impact on the global climate. The simulation results confirm that the polar region in Exp. 2 as a heat source can produce, by local forcing, a pair of positive and negative difference centers which circle the Arctic, moving eastward. P.D.

A92-21031
A COMPARISON OF GCM SIMULATIONS OF ARCTIC CLIMATE

JOHN E. WALSH (Illinois, University, Urbana) and ROBERT G. CRANE (Pennsylvania State University, University Park) Geophysical Research Letters (ISSN 0094-8276), vol. 19, Jan. 3, 1992, p. 29-32. 3 Jan. 1992 4 p refs
(Contract NSF ATM-89-13039; NSF ATM-89-12911)

The Arctic performance of five atmospheric GCMs (GFDL, GISS, NCAR, OSU, and UKMO) is compared to illustrate key differences in the fields most relevant to sea ice/ocean forcing: surface air temperature and sea level pressure (surface wind stress). While the amplitude of the seasonal cycle of simulated air temperature is generally realistic, biases of up to 5-10 C relative to observations are apparent over much of the Arctic. The simulated sea-level pressure pattern varies widely from model to model, and in some cases is incompatible with the observed wind-forcing of sea ice from the Arctic Basin to the North Atlantic via Fram Strait. The implications that these differences have for transports of salinity are significant. P.D.

A92-21715
THE WORLD CLIMATE RESEARCH PROGRAMME

M. J. MANTON (Australian Meteorological and Oceanographic Society; Bureau of Meteorology, Research Centre, Melbourne, Australia) Australian Meteorological Magazine (ISSN 0004-9743), vol. 39, Dec. 1991, p. 247-253. Dec. 1991 7 p refs

The World Climate Research Programme (WCRP) was established in 1979 as a joint activity of the World Meteorological Organization and the International Council of Scientific Unions. In recognition of the primary contribution of the oceans to the climate system, the Intergovernmental Oceanographic Commission is now expected to share the formal responsibility for the WCRP. The WCRP consists of a number of programs that focus international research on major problems of the climate system, including the development and application of climate models, the hydrologic cycle, and the causes of low-frequency variability in the climate system. Author

A92-22111
LOW-FREQUENCY CHANGES IN EL NINO-SOUTHERN OSCILLATION

DAVID B. ENFIELD (NOAA, Atlantic Oceanographic and Meteorological Laboratory, Miami, FL) and LUIS CID S. (Concepcion, Universidad, Chile) Journal of Climate (ISSN 0894-8755), vol. 4, Dec. 1991, p. 1137-1146. Research supported by NOAA and FONDECYT. Dec. 1991 10 p refs

Although there are indications from numerical models that ENSO

may be an internal mode of the coupled Pacific ocean-atmosphere system, sensitive to climatic background parameters, it has not yet been possible to find significant changes in ENSO variability between the Little Ice Age and the present. Yet a number of authors have found qualitative indications in anecdotal and proxy records of shorter, century-scale variations in the return-internal statistics for ENSO episodes. To objectively determine what nonstationarities exist, the ENSO occurrences since 1525 are statistically examined. The return intervals both for strong events and for all events are stratified according to two null hypotheses: (1) return intervals are stationary over periods of 200-500 years, and (2) the intervals are stationary on a centenary time scale, between epochs of contrasting solar variability. At the 95-percent significance level, only the null hypothesis for high/low solar levels and strong ENSO events can be rejected. Author

A92-22534
GLOBAL ANALYSIS OF AEROSOL-CLOUD INTERACTIONS - IMPLICATIONS FOR CLIMATE CHANGE PROCESSES
PHILIP A. DURKEE (U.S. Naval Postgraduate School, Monterey, CA) IN: Conference on Satellite Meteorology and Oceanography, 5th, London, England, Sept. 3-7, 1990, Preprints 1990 3 p refs
Copyright

An analysis of cloud and aerosol properties using regional and global AVHRR data sets is presented. The zonal average of estimated aerosol optical depth from April 1983 over the global oceans is shown; the most apparent feature of the distribution is the distant hemispheric difference. The zonal average of low cloud reflectance from April 1983 is shown; the zonal variation discovered is consistent with a hemispheric difference in concentrations of cloud condensation nuclei. C.A.B.

A92-22574
REMOVING URBAN BIAS FROM GLOBAL TEMPERATURE RECORDS PHASE I - DETERMINATION OF RURAL SURFACE TEMPERATURE USING TOVS DATA
GREGORY L. JOHNSON, JERRY M. DAVIS (North Carolina State University, Raleigh), THOMAS R. KARL, ALAN L. MCNAB (NOAA, National Climatic Data Center, Asheville, NC), and J. D. TARPLEY (NOAA, Satellite Research Laboratory, Camp Springs, MD) IN: Conference on Satellite Meteorology and Oceanography, 5th, London, England, Sept. 3-7, 1990, Preprints 1990 2 p refs
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A92-22589
VERIFYING SATELLITE-BASED RAINFALL ESTIMATES USING SPARSE RAINGAUGES
MARK L. MORRISSEY (Hawaii, University, Honolulu) IN: Conference on Satellite Meteorology and Oceanography, 5th, London, England, Sept. 3-7, 1990, Preprints 1990 6 p refs
Copyright

The paper introduces a novel statistical method, termed noncontiguous raingauge (NCR) procedure, that makes it possible to utilize widely separated raingauges to obtain comparative ground-truth area-averaged rain rate (AAR) measurements. The NCR method uses standard geostatistical techniques to generate AAR samples from the theoretical pdf of ground-truth AAR. The generated AAR values can then be statistically compared to discrete values of satellite bulk quantities. The NCR procedure can be used for the development, calibration, and testing of all satellite-based rainfall algorithms and for the verification of rain-rate estimates made from these algorithms. I.S.

A92-22956
THE STRUCTURE OF TURBULENCE IN CIRRUS CLOUDS
M. QUANTE, P. SCHEIDGEN, M. LAUBE, and E. RASCHKE (Koeln, Universitaet, Cologne, Federal Republic of Germany) IN: 1990 Conference on Cloud Physics, San Francisco, CA, July 23-27, 1990, Preprints 1990 8 p refs
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Numerical studies and observations of cirrus cloud systems are summarized. Results from measurements obtained during the 1987 experiment are presented, focusing on the role of turbulence in cirrus clouds. Attention is also given to the numerical study of a marine cirrus cloud system with emphasis placed on microphysical processes, particularly, the ice phase and its impact on the dynamics. O.G.

A92-22975 National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York, NY.
PREDICTING CLOUD WATER VARIATIONS IN THE GISS GCM
ANTHONY D. DEL GENIO (NASA, Goddard Institute for Space Studies, New York) and MAO-SUNG YAO (NASA, Goddard Institute for Space Studies; ST Systems Corp., New York) IN: 1990 Conference on Cloud Physics, San Francisco, CA, July 23-27, 1990, Preprints 1990 8 p refs
Copyright

A cloud water parameterization under development for the NASA Goddard Institute for Space Studies (GISS) global climate model (GCM) is described. The scheme is based on the studies of Sundqvist (1978) and Sundqvist et al. (1989), with a number of additional features designed to mimic the effects of important microphysical and dynamic processes in clouds. Preliminary results on geographical and seasonal variations from simulations of the current climate are presented. R.E.P.

A92-23546
DETERMINATION OF THE AEROSOL OPTICAL THICKNESS OF THE ATMOSPHERE FROM GROUND-BASED MEASUREMENTS OF DIRECT INTEGRAL SOLAR RADIATION [OPREDELENIE AEROZOL'NOI OPTICHESKOI TOLSHCHINY ATMOSFERY PO NAZEMNYM IZMERENIIAM PRIAMOI INTEGRAL'NOI SOLNECHNOI RADIATSII]
T. A. TARASOVA and E. V. IARKHO (Tsentral'naia Aerologicheskaia Observatoriia, Dolgoprudny, USSR) Meteorologiia i Gidrologiia (ISSN 0130-2906), Dec. 1991, p. 66-71. In Russian. Dec. 1991 6 p In RUSSIAN refs
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Simple formulas are proposed for calculating the aerosol optical thickness of the atmosphere at a wavelength of 0.55 micron on the basis of values of direct integral solar radiation measured with an actinometer. Possible computational errors of the method and errors due to insufficient data on the moisture content of the atmosphere and on spectral variations of the aerosol extinction coefficient are estimated. P.D.

A92-23548
HEAT ACCUMULATION IN THE NORTHERN PART OF THE ATLANTIC OCEAN AND ITS MULTIYEAR VARIABILITY [AKKUMULIATSIIA TEPLA V SEVERNOI CHASTI ATLANTICHESKOGO OKEANA I EE MNOGOLETNIAIA IZMENCHIVOST']
B. A. BIRMAN and E. V. BALASHOVA (Gidrometeorologicheskii Nauchno-Issledovatel'skii Tsentr SSSR, Moscow, USSR) Meteorologiia i Gidrologiia (ISSN 0130-2906), Dec. 1991, p. 77-83. In Russian. Dec. 1991 7 p In RUSSIAN refs
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Data on heat accumulation in the upper quasi-homogeneous layer of the northern Atlantic Ocean are analyzed. Alternating meridionally situated regions in which the annual heat accumulation balance has been disturbed are revealed. Operating in these regions are compensation mechanisms which manifest themselves as positive trends of heat content where the annual amounts of dQ/dt are less than 0, and as negative trends for dQ/dt greater than 0. The main features of seasonal and interannual heat-accumulation variability are presented. P.D.

A92-24237* National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York, NY.
POTENTIAL CLIMATE IMPACT OF MOUNT PINATUBO ERUPTION
JAMES HANSEN, ANDREW LACIS, RETO RUEDY, and MAKIKO SATO (NASA, Goddard Institute for Space Studies, New York) Geophysical Research Letters (ISSN 0094-8276), vol. 19, Jan. 24,

1992, p. 215-218. 24 Jan. 1992 4 p refs
Copyright

The GISS global-climate model is used to make a preliminary estimate of Mount Pinatubo's climate impact. Assuming the aerosol optical depth is nearly twice as great as for the 1982 El Chichon eruption, the model forecasts a dramatic but temporary break in recent global warming trends. The simulations indicate that Pinatubo occurred too late in the year to prevent 1991 from becoming one of the warmest years in instrumental records, but intense aerosol cooling is predicted to begin late in 1991 and to maximize late in 1992. The predicted cooling is sufficiently large that by mid 1992 it should even overwhelm global warming associated with an El Nino that appears to be developing, but the El Nino could shift the time of minimum global temperature into 1993. The model predicts a return to record warm levels in the later 1990s. The effect is estimated of the predicted global cooling on such practical matters as the severity of the coming Soviet winter and the dates of cherry blossoming next spring. Author

A92-26841* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
TROPICAL RAINFALL MEASURING MISSION (TRMM) PROJECT. V - SCIENTIFIC BACKGROUND AND GOALS OF TRMM
JOANNE SIMPSON (NASA, Goddard Space Flight Center, Greenbelt, MD), KENJI NAKAMURA, TSUYOSHI NITTA, and TAROH MATSUNO Communications Research Laboratory, Review (ISSN 0914-9279), vol. 36, no. 11, June 1990, p. 57-70. In *Japanese.* Jun. 1990 14 p In JAPANESE refs

The scientific goals of TRMM are described. TRMM provides quantitative measurements of tropical rain which can improve the understanding of the global climate. TRMM can also help to improve techniques for measuring rainfall from space. Author

A92-27470
AN OVERVIEW OF THE MADDEN-JULIAN OSCILLATION AND ITS RELATION TO MONSOON AND MID-LATITUDE CIRCULATION
BIN WANG (Hawaii, University, Honolulu) and YIHUI DING (Chinese Academy of Meteorological Sciences; State Meteorological Administration, Beijing, People's Republic of China) Advances in Atmospheric Sciences (ISSN 0256-1530), vol. 9, Feb. 1992, p. 93-111. Feb. 1992 19 p refs
(Contract NSF ATM-88-14626; NSF ATM-90-19315)
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A92-27751* National Aeronautics and Space Administration, Washington, DC.
CHAPMAN CONFERENCE ON THE HYDROLOGIC ASPECTS OF GLOBAL CLIMATE CHANGE, LAKE CHELAN, WA, JUNE 12-14, 1990, SELECTED PAPERS
DENNIS P. LETTENMAIER, ED. (Washington, University, Seattle) and D. RIND, ED. Conference sponsored by NASA, NOAA, USGS, et al. Journal of Geophysical Research (ISSN 0148-0227), vol. 97, no. D3, Feb. 28, 1992, 159 p. For individual items see A92-27752 to A92-27764. 28 Feb. 1992 159 p
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The present conference on the hydrological aspects of global climate change discusses land-surface schemes for future climate models, modeling of the land-surface boundary in climate models as a composite of independent vegetation, a land-surface hydrology parameterizaton with subgrid variability for general circulation models, and conceptual aspects of a statistical-dynamical approach to represent landscape subgrid-scale heterogeneities in atmospheric models. Attention is given to the impact of global warming on river runoff, the influence of atmospheric moisture transport on the fresh water balance of the Atlantic drainage basin, a comparison of observations and model simulations of tropospheric water vapor, and the use of weather types to disaggregate the prediction of general circulation models. Topics addressed include the potential response of an Arctic watershed during a period of global warming and the sensitivity of groundwater recharge estimates to climate variability and change. P.D.

A92-27752
HYDROLOGIC MODELS AND CLIMATE CHANGE
J. C. I. DOOGE (University College, Dublin, Republic of Ireland) (Chapman Conference on the Hydrologic Aspects of Global Climate Change, Lake Chelan, WA, June 12-14, 1990, Selected Papers. A92-27751 10-47) Journal of Geophysical Research (ISSN 0148-0227), vol. 97, no. D3, Feb. 28, 1992, p. 2677-2686. 28 Feb. 1992 10 p refs
Copyright

A discussion of the gaps in the relationship between theory and practice in hydrologic modeling and between hydrologic modeling and climate modeling is presented. Attention is given to topics that are important in connection with closing these gaps, such as the difficulty of estimating actual evaporation in the water balance at catchment and regional scale, the uncertainty about the role of vegetation in relation to changes in runoff following climate change, and the link that nonlinear system theory may provide between theoretical hydrology and climate theory. A complementary approach to regional evaporation, statistical dynamics and system approaches, chaos and strange attractors, and catastrophe theory and the climate are also discussed. P.D.

A92-27756* National Aeronautics and Space Administration, Washington, DC.
CONCEPTUAL ASPECTS OF A STATISTICAL-DYNAMICAL APPROACH TO REPRESENT LANDSCAPE SUBGRID-SCALE HETEROGENEITIES IN ATMOSPHERIC MODELS
RONI AVISSAR (Rutgers University, New Brunswick, NJ) (*Chapman Conference on the Hydrologic Aspects of Global Climate* Change, Lake Chelan, WA, June 12-14, 1990, Selected Papers. A92-27751 10-47) Journal of Geophysical Research (ISSN 0148-0227), vol. 97, no. D3, Feb. 28, 1992, p. 2729-2742. Research supported by New Jersey Agricultural Experiment Station and NASA. 28 Feb. 1992 14 p refs
(Contract NSF ATM-90-16562; NSF EAR-91-05059)
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A parameterization of land surfaces based on a statistical-dynamical approach is presented. With this approach, the most important characteristics of the soil-plant-atmosphere system that affect the partition of energy (e.g., plant stomatal conductance, soil humidity, and surface roughness) are represented by a pdf rather than by a single 'representative' value. A primary simplified version of this parameterization is used to estimate the land-surface energy fluxes that are produced at the grid scale by various distributions of stomatal conductance under a broad range of environmental conditions. To demonstrate the approach's potential, results are compared with the same fluxes calculated with a big leaf model using the mean stomatal conductance that corresponds to the distributions. Large absolute and relative differences are obtained between the two schemes for many *combinations of stomatal conductance pdfs and environmental* conditions. P.D.

A92-27759
THE INFLUENCE OF ATMOSPHERIC MOISTURE TRANSPORT ON THE FRESH WATER BALANCE OF THE ATLANTIC DRAINAGE BASIN - GENERAL CIRCULATION MODEL SIMULATIONS AND OBSERVATIONS
FRITZ ZAUCKER and WALLACE S. BROECKER (Lamont-Doherty Geological Observatory, Palisades, NY) (Chapman Conference on the Hydrologic Aspects of Global Climate Change, Lake Chelan, WA, June 12-14, 1990, Selected Papers. A92-27751 10-47) Journal of Geophysical Research (ISSN 0148-0227), vol. 97, no. D3, Feb. 28, 1992, p. 2765-2773. Research supported by EPRI, Lawrence Livermore National Laboratory, and Gottlieb-Daimler and Karl-Benz Stiftung. 28 Feb. 1992 9 p refs
Copyright

The reliability of water transport estimates from atmospheric GCMs is evaluated by comparing the vapor export from the Atlantic basin obtained by the GISS 4 x 5-deg grid GCM with that obtained from observations of wind velocity and humidity performed by Oort (1983). Substantial differences are found. The model gives an export of 0.13 Sv from the Atlantic basin compared to 0.32 Sv

from the Oort data set. The GCM is found to produce far stronger easterly winds and correspondingly larger tropical vapor transports. Because of the model's low orography, steering of the winds and drying of air masses by mountain chains are not adequately represented, which leads to a dramatic overestimation of water vapor transport across mountain ranges. The water vapor transport in a double-CO2 scenario are calculated. Atmospheric freshwater loss from the Atlantic basin is increased to 0.30 Sv compared to 0.13 Sv in the control run. P.D.

A92-27761
USE OF WEATHER TYPES TO DISAGGREGATE GENERAL CIRCULATION MODEL PREDICTIONS
LAUREN E. HAY, GREGORY J. MCCABE, JR. (USGS, Water Resources Div., Denver, CO), DAVID M. WOLOCK (USGS, Water Resources Div., Lawrence, KS), and MARK A. AYERS (USGS, Water Resources Div., Reston, VA) (Chapman Conference on the Hydrologic Aspects of Global Climate Change, Lake Chelan, WA, June 12-14, 1990, Selected Papers. A92-27751 10-47) Journal of Geophysical Research (ISSN 0148-0227), vol. 97, no. D3, Feb. 28, 1992, p. 2781-2790. 28 Feb. 1992 10 p refs

A method has been developed that uses weather-type analysis as a tool to spatially disaggregate GCM predictions to make them useful for water resource studies. The method has been applied to the Delaware River basin to predict the effects of doubling atmospheric carbon dioxide on precipitation patterns in the region. An application of the technique to the Delaware River basin indicates that future climatic conditions will show minimal changes in weather-type frequency, implying that air circulation patterns will remain unchanged. Results of this study indicate that changes in regional precipitation patterns under a doubling of atmospheric carbon dioxide will be a result of within-type changes in weather characteristics. Author

A92-27986* National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York, NY.
THE EFFECT OF GLOBAL WARMING ON LIGHTNING FREQUENCIES
COLIN PRICE (NASA, Goddard Institute for Space Studies, New York) and DAVID RIND (Columbia University, New York) IN: Conference on Severe Local Storms, 16th and Conference on Atmospheric Electricity, Kananaskis Park, Canada, Oct. 22-26, 1990, Preprints 1990 4 p refs
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The first attempt to model global lightning distributions by using the Goddard Institute for Space Studies (GISS) GCM is reported. Three sets of observations showing the relationship between lightning frequency and cloud top height are shown. Zonally averaged lightning frequency observed by satellite are compared with those calculated using the GISS GCM, and fair agreement is found. The change in lightning frequency for a double CO2 climate is calculated and found to be nearly 2.23 x 10 exp 6 extra lightning flashes per day. C.D.

A92-28440
CARBON DIOXIDE AND CLIMATE - MECHANISMS OF CHANGES IN CLOUD
J. F. B. MITCHELL and W. J. INGRAM (Meteorological Office, Hadley Centre for Climate Prediction and Research, Bracknell, England) Journal of Climate (ISSN 0894-8755), vol. 5, Jan. 1992, p. 5-21. Jan. 1992 17 p refs

Changes in cloud distribution may provide a major feedback on climate change. General circulation model simulations show an upward shift of high cloud and a general reduction of free-tropospheric cloud when climate warms. The shift of high cloud seems due to an upward shift of the tropopause. It is argued that the reduction in relative humidity and cloud cover below can be attributed to the increased depth of vertical motions in the warmer climate, which in turn follows from the upward shift of atmospheric radiative cooling as specific humidities increase. A diagnostic study of the response of a general circulation model is consistent with this mechanism. Author

A92-28443* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
GLOBAL DISTRIBUTION OF PHOTOSYNTHETICALLY ACTIVE RADIATION AS OBSERVED FROM SATELLITES
R. T. PINKER and I. LASZLO (Maryland, University, College Park) Journal of Climate (ISSN 0894-8755), vol. 5, Jan. 1992, p. 56-65. Jan. 1992 10 p refs
(Contract NOAA-NA-16RC0113-01; NAG5-914)
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In this study the feasibility to derive photosynthetically active radiation (PAR) on a global scale is demonstrated. In the past, information on PAR was obtained from local ground measurements in the 0.4-0.7-micron spectral interval. In the absence of such measurements, PAR was estimated from measured total solar irradiance, using empirical 'conversion factors'. It is demonstrated that this important biogeophysical parameter can now be derived from satellite observations. The inference model is implemented with global satellite data that are available from the International Satellite Cloud Climatology Project to produce for the first time global fields of PAR and corresponding 'conversion factors'. Author

A92-28444
EQUILIBRIUM CLIMATE STATISTICS OF A GENERAL CIRCULATION MODEL AS A FUNCTION OF ATMOSPHERIC CARBON DIOXIDE. I - GEOGRAPHIC DISTRIBUTIONS OF PRIMARY VARIABLES
ROBERT J. OGLESBY (Brown University, Providence, RI) and BARRY SALTZMAN (Yale University, New Haven, CT) Journal of Climate (ISSN 0894-8755), vol. 5, Jan. 1992, p. 66-92. Research supported by EPRI and Brown University. Jan. 1992 27 p refs
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In order to estimate quantitatively the climatic response as a continuous function of CO2 (for plausible earth values), an extended series of simulations with a general circulation model, the NCAR CCM1 is performed. A set of six 'primary' simulations has been made, with 100 ppm, 200 ppm, 330 ppm, 460 ppm, 660 ppm, and 1000 ppm CO2. From these simulations, logarithmic sensitivity coefficients are computed for primary climatic variables. Variables considered include surface temperature, sea level pressure, the 500-mb winds, specific humidity, precipitation, and sea-ice cover. Two measures of the uncertainties of these coefficients, the least-squares log misfits and the jackknife standard deviations, have also been computed. Model climatic variables can be broadly classified into two groups: those with a large sensitivity to CO2 changes (surface temperature, specific humidity, and sea-ice cover) and those with less sensitivity to CO2 changes (the winds and surface pressure). Much of the large surface temperature sensitivity can be explained in terms of changing specific humidity (water vapor feedback) at low and midlatitudes and in terms of changing sea-ice cover (albedo feedback) at high latitudes. Author

A92-29477 National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York, NY.
INTERCOMPARISON AND INTERPRETATION OF SURFACE ENERGY FLUXES IN ATMOSPHERIC GENERAL CIRCULATION MODELS
D. A. RANDALL (Colorado State University, Fort Collins), R. D. CESS (New York, State University, Stony Brook), J. P. BLANCHET, G. J. BOER (Atmospheric Environment Service, Downsview, Canada), D. A. DAZLICH (Colorado State University, Fort Collins), A. D. DEL GENIO (NASA, Goddard Institute for Space Studies, New York), M. DEQUE (Centre National de Recherches Meteorologiques, Toulouse, France), V. DYMNIKOV, V. GALIN (Akademiia Nauk, Otdel Vychislitel'noi Matematiki, Moscow, Russia), S. J. GHAN (Lawrence Livermore National Laboratory, Livermore, CA) et al. Journal of Geophysical Research (ISSN 0148-0227), vol. 97, March 20, 1992, p. 3711-3724. 20 Mar. 1992 14 p refs
(Contract DE-FG02-89ER-69027; DE-FG02-85ER-60314; DE-AI05-90ER-61068; W-7405-ENG-48; DE-AI01-80EV-10220;

BMFT-KF-20128; CEC-EV4C-066-F7; NAG1-1266)
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Responses of the surface energy budgets and hydrologic cycles of 19 atmospheric general circulation models to an imposed, globally uniform sea surface temperature perturbation of 4 K were analyzed. The responses of the simulated surface energy budgets are extremely diverse and are closely linked to the responses of the simulated hydrologic cycles. The response of the net surface energy flux is not controlled by cloud effects; instead, it is determined primarily by the response of the latent heat flux. The prescribed warming of the oceans leads to major increases in the atmospheric water vapor content and the rates of evaporation and precipitation. The increased water vapor amount drastically increases the downwelling IR radiation at the earth's surface, but the amount of the change varies dramatically from one model to another. Author

A92-30486 National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York, NY.
CLIMATE CHANGE AND THE MIDDLE ATMOSPHERE. II - THE IMPACT OF VOLCANIC AEROSOLS
D. RIND, N. K. BALACHANDRAN, and R. SUOZZO (NASA, Goddard Institute for Space Studies, New York) Journal of Climate (ISSN 0894-8755), vol. 5, March 1992, p. 189-208. Research supported by NASA. Mar. 1992 20 p refs
Copyright

The response of the middle atmosphere to an increase in stratospheric aerosols, normally associated with increased volcanic activity, is investigated. The aerosols are found to induce a direct stratospheric response, with warming in the tropical lower stratosphere, and cooling at higher latitudes. On the shorter time scales, this radiative effect increases tropospheric static stability at low- to midlatitudes, which reduces the intensity of the Hadley cell and Ferrel cell. There is an associated increase in tropospheric standing wave energy and a decrease in midlatitude west winds, which result in additional wave energy propagation into the stratosphere at lower midlatitudes in both hemispheres. On the longer time scale, a strong hemispheric asymmetry arises. In the Northern Hemisphere eddy energy decreases, as does the middle-atmosphere residual circulation, and widespread stratospheric cooling results. In the Southern Hemisphere, the large increase in sea ice increases the tropospheric latitudinal temperature gradient, leading to increased eddy energy, an increased middle-atmosphere residual circulation, and some high-latitude stratospheric warming. C.A.B.

A92-32028
AEROSOL IN THE RADIATION PROCESSES IN THE ATMOSPHERE-CASPIAN SEA SYSTEM [AEROZOL' V RADIATSIONNYKH PROTSESSAKH SISTEMY ATMOSFERA-KASPIISKOE MORE]
V. V. KOZODEROV, SH. A. AKHMEDOV, N. A. AGAEV, S. A. VEISOVA, and N. A. AKHMEDOV (Rossiiskaia Akademiia Nauk, Otdel Vychislitel'noi Matematiki, Moscow, Russia; NPO Kosmicheskikh Issledovanii, Baku, Azerbaijan) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), Jan.-Feb. 1992, p. 17-20. In Russian. Feb. 1992 4 p In RUSSIAN refs
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A92-32051
SYMPOSIUM ON METEOROLOGICAL OBSERVATIONS AND INSTRUMENTATIONS, 7TH, NEW ORLEANS, LA, JAN. 14-18, 1991, PREPRINTS
Symposium sponsored by AMS and World Meteorological Organization. Boston, MA, American Meteorological Society, 1991, 746 p. For individual items see A92-32052 to A92-32158. 1991 746 p
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Various papers on laser atmospheric studies are presented. The general topics addressed include: atmospheric flux measurements over land and oceans, radio acoustic sounding systems, calibration and intercomparison methods, measurements and instrumentation, satellite measurement programs, precipitation, automated surface observing systems, radiosonde measurements, aircraft measurements, radiosonde systems and intercomparisons. Also discussed are: humidity instrumentation and measurements, optical techniques for determining present weather and visibility, new instrumentation, active and passive profilers, sodar intercomparisons and applications, cloud detection by satellite, measurements and archiving methods for very long trend monitoring, atmospheric boundary layer measurements for the 1990s, Lidar Global Backscatter Experiment. C.D.

A92-32067* National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
SHORTWAVE WIDE-FIELD-OF-VIEW RESULTS FROM THE EARTH RADIATION BUDGET EXPERIMENT
DAVID RUTAN (Lockheed Engineering and Sciences Co., Hampton, VA) and G. L. SMITH (NASA, Langley Research Center, Hampton, VA) IN: Symposium on Meteorological Observations and Instrumentations, 7th, New Orleans, LA, Jan. 14-18, 1991, Preprints 1991 6 p refs
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The deconvolution (DCN) and numerical filter (NF) techniques of analyzing nonscanning radiometer measurements are evaluated by comparison with scanning radiometer results for monthly mean maps of albedo and absorbed solar radiation. Both techniques successfully enhance the resolution of the monthly mean product. The numerical filter albedo adheres closer to the scanning radiometer in the zonal average than does the DCN albedo. Zonal rms's, however, show that the DCN albedo is about 1 percent better than the NF in the Southern Hemisphere, but in the Northern Hemisphere the NF is better by up to 2 percent. C.D.

A92-32120
PECULIARITIES OF THE PROCESSED NASA AND UK-EAST ANGLIA GLOBAL SURFACE TEMPERATURE DATA SETS
CHRISTOPHER ARDEEL, ERNEST AGEE (Purdue University, West Lafayette, IN), and LAWRENCE BUJA (NCAR, Boulder, CO) IN: Symposium on Meteorological Observations and Instrumentations, 7th, New Orleans, LA, Jan. 14-18, 1991, Preprints 1991 6 p refs
(Contract NSF ATM-87-11611; N00014-86-K-0179)
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The paper describes the two most widely used data sets compiling the world temperature records: the NASA data set and the University of East Anglia, UK, data set. The abilities of the finely processed data of the two sets to accurately represent the 'true' climatic record free of bias which might favor a particular temperature trend are assessed. The results show that the trends exhibited by both data sets (cold last century, then warming the first part of this century, then cooling from 1940 through the mid-1970s, and subsequent warming through the 1980) may be largely attributable to spatial biases that are present in the processed temperature data sets. However, this is much less so in the University of East Anglia data analysis. I.S.

A92-32121
BUILDING A SATELLITE CLIMATE DIAGNOSTICS DATA BASE FOR REAL-TIME CLIMATE MONITORING
CHESTER F. ROPELEWSKI (NOAA, Climate Analysis Center, Washington, DC) IN: Symposium on Meteorological Observations and Instrumentations, 7th, New Orleans, LA, Jan. 14-18, 1991, Preprints 1991 6 p refs
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The paper discusses the development of a data base, the Satellite Climate Diagnostic Data Base (SCDDB), for real time operational climate monitoring utilizing current satellite data. Special attention is given to the satellite-derived quantities useful for monitoring global climate changes, the requirements of SCDDB, and the use of conventional meteorological data and model assimilated data in developing the SCDDB. Examples of prototype SCDDB products are presented. I.S.

A92-32137
THE AUTOMATED SURFACE OBSERVING SYSTEM - A PROGRAM OVERVIEW
STEVE E. SHORT and JAMES A. MCNITT (NOAA, National Weather Service, Silver Spring, MD) IN: Symposium on Meteorological Observations and Instrumentations, 7th, New Orleans, LA, Jan. 14-18, 1991, Preprints 1991 4 p refs
Copyright

The Automated Surface Observing System (ASOS), a major systems acquisition managed by the National Weather Service and designed to increase the temporal and spatial coverage of surface weather observations, is reviewed. When fully deployed, ASOS is to more than double the number of full-time surface weather observing locations and provide nearly continuous observations of elements critical for hydrometeorological forecasting, weather warning, aviation operations, and climate services. Attention is given to system characteristics, implementation plans, and sensor development. P.D.

A92-34269
COMPARISON OF GENERAL CIRCULATION MODEL AND OBSERVED REGIONAL CLIMATES - DAILY AND SEASONAL VARIABILITY
DAVID A. PORTMAN (Atmospheric and Environmental Research, Inc., Cambridge, MA), WEI-CHYUNG WANG (New York, State University, Albany), and THOMAS R. KARL (NOAA, NESDIS, Asheville, NC) Journal of Climate (ISSN 0894-8755), vol. 5, April 1992, p. 343-353. Apr. 1992 11 p refs
(Contract DE-FG02-86ER-60422)
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Validation of general circulation model (GCM) current climate simulations is important for further GCM development and application to climate change studies. So far, studies that compare GCM output with observations have focused primarily on large-scale spatial averages of the surface climate variables. Two approaches to compare output of individual GCM grid boxes with local station observations near the surface and in the free troposphere are discussed. The first approach involves the application of standard parametric statistical analysis and hypothesis testing procedures. The second approach is nonparametric; instead, station observations are first subjected to a bootstrap technique and then used to define a unique set of distributions and confidence limits for each GCM grid box. To demonstrate the usefulness of the two approaches, daily and seasonal gridbox temperatures simulated by the NCAR Community Climate Model (CCM1) are compared with station temperatures at the surface, 850-mb, 500-mb, and 300-mb levels for three different areas in the United States. Although CCM1 gridbox temperatures are mostly cooler than station temperatures, they are equally variable. For all grid boxes, gridbox-to-station differences decrease with height and vary with time of year. The techniques presented here can provide useful comparisons of GCM regional and local observed temperatures. Application to other variables and GCM is also discussed.
Author

A92-34272
IMPACT OF BOUNDARY-LAYER CLOUDS - A CASE STUDY OF COVER HOURS
ROLAND B. STULL (Wisconsin, University, Madison) Journal of Climate (ISSN 0894-8755), vol. 5, April 1992, p. 390-394. Apr. 1992 5 p
(Contract NSF ATM-88-22214)
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Cover hours are defined as the cloud-cover fraction times the number of hours those clouds are observed. Case study statistics of cover hours during 1990 for nonprecipitating low clouds at Madison, Wisconsin, indicate the potential for climatic impact by boundary-layer clouds. A total of 1476.6 cover hours by all low clouds are observed, of which the subset of scattered boundary-layer clouds contributes 33 percent. The subset of low clouds that are turbulently coupled to the ground contributes 1199.1 cover hours, which is 81 percent of the total observed and 13.7 percent of the total possible 8760 hours per year. Author

A92-34719
INTERNAL AND EXTERNAL CAUSES OF THE RECENT CLIMATIC CHANGE - A NUMERICAL STUDY WITH AN ENERGY BALANCE MODEL
HIROYOSHI HATAZAWA and TATSUYA IWASHIMA (Kyoto University, Japan) Meteorological Society of Japan, Journal (ISSN 0026-1165), vol. 68, June 1990, p. 371-383. Jun. 1990 13 p refs
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A92-34862
CHANGES IN SOLAR RADIATION, CLOUDINESS AND ATMOSPHERIC TRANSPARENCY DURING RECENT DECADES
VIIVI RUSSAK (Estonian Academy of Sciences, Institute of Astrophysics and Atmospheric Physics, Toravere, Estonia) IN: IGARSS '91; Proceedings of the 11th Annual International Geoscience and Remote Sensing Symposium, Espoo, Finland, June 3-6, 1991. Vol. 1 1991 3 p refs
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Data obtained from 1955-1989 at the Toravere actinometric station (Estonia) are used to study long-term variations in solar radiation. In this period a certain decreasing tendency was observed in direct and global solar radiation, and in reflected radiation. Decreasing trends have been observed in the data of global radiation in Helsinki, Stockholm, and Kaunas. Both the increase in the amount of low cloudiness and in atmospheric turbidity are discussed as the main reasons for the decrease in radiation. The observed growing tendency of long-wave net radiation is probably caused by the increased cloudiness and the greenhouse effect.
I.E.

A92-34888 National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
THE TROPICAL RAINFALL MEASURING MISSION (TRMM) AND ITS ROLE IN STUDIES OF CLIMATE VARIATIONS
JOANNE SIMPSON (NASA, Goddard Space Flight Center, Greenbelt, MD) and JOHN S. THEON (NASA, Washington, DC) IN: IGARSS '91; Proceedings of the 11th Annual International Geoscience and Remote Sensing Symposium, Espoo, Finland, June 3-6, 1991. Vol. 1 1991 4 p refs
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Adequate measurement of rainfall over the global tropics can only be made from space, using an inclined low orbit and a combination of sensors. A relatively low-budget earth probe satellite called the tropical rainfall measuring mission (TRMM) is described. It is an approved joint project between the United States and Japan, with an intended launch by the Japanese in 1996. It will fly at an orbit elevation of 350 km and an inclination of 35 deg. Radiation instruments were added to the payload in late 1990. The TRMM rain package, its instruments, expected products, and some results of prelaunch research on the orbit sampling, rain retrievals, and ground validation procedures are discussed. I.E.

A92-35046
INFRARED REMOTE SENSING OF THE ATMOSPHERE AT THE JUNGFRAUJOCH STATION - EVIDENCE FOR GLOBAL CHANGES
R. ZANDER and PH. DEMOULIN (Liege, Universite, Belgium) IN: IGARSS '91; Proceedings of the 11th Annual International Geoscience and Remote Sensing Symposium, Espoo, Finland, June 3-6, 1991. Vol. 2 1991 4 p refs
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The threat imposed on the earth's atmosphere by anthropogenic activities is becoming well documented. Analyses of infrared solar observations carried out at the International Scientific Station of the Jungfraujoch, Switzerland, in 1950-51 and more intensively since the late 1970s have contributed to that documentation. A summary is presented of original findings arrived at so far, and the need for intensive and coordinated observational programs during the 1990s is discussed. I.E.

A92-35585
NUMERICAL SIMULATIONS OF TEMPERATURE AND MOISTURE CHANGES IN LAND-AIR COUPLED SYSTEM
YONGFU QIAN (Nanjing University, People's Republic of China) Acta Meteorologica Sinica (ISSN 0577-6619), vol. 49, no. 4, Nov. 1991, p. 538-547. In Chinese. Nov. 1991 10 p In CHINESE refs

A one-dimensional numerical model is developed to calculate changes of temperature and moisture in the land-air coupled system. The model uses heat and water balance principles in computation of the soil temperature and moisture. In the atmosphere, the effects of longwave and shortwave radiations, cloudiness, condensation and other factors on variations of the atmospheric temperature and moisture are taken into account. The model is tested on a representative soil sample. Results show that the model can fairly simulate the diurnal variations of many physical quantities. The principles can be used for parameterizations of the land-air interaction in general circulation models. Author

A92-35586
INTERANNUAL CHANGE IN TELECONNECTIONS OF GENERAL CIRCULATION IN SUMMER DURING 1980'S OVER THE NORTHERN HEMISPHERE
ANJIAN SUN, LIANCHUN SONG, SULAN HE, and GUOLI TANG (State Meteorological Administration, National Meteorological Centre, People's Republic of China) Acta Meteorologica Sinica (ISSN 0577-6619), vol. 49, no. 4, Nov. 1991, p. 559-563. In Chinese. Nov. 1991 5 p In CHINESE refs

The present study of northern summer teleconnection changes in general circulation uses 5 x 10 deg latitude-longitude grid point data of daily 500 hPa geopotential height. A summer source anomaly in the tropical western Pacific causes a general circulation summer anomaly over the Northern Hemisphere. During a period-peak ENSO year, the western Pacific's subtropical high was significantly enhanced during summer. In the peak year of a counter-ENSO event, the intensity of the western Pacific's subtropical high caused severe summer droughts along two Chinese river basins. O.C.

A92-35798
ON AN INTERNATIONAL FRAMEWORK CONVENTION ON CLIMATE CHANGE - GLOBAL CLIMATE CHANGE IN THE CONTEXT OF GLOBAL CHANGE
K. IA. KONDRAT'EV (Rossiiskaia Akademiia Nauk, Institut Ozerovedeniia, St. Petersburg, Russia) Nuovo Cimento C, Serie 1 (ISSN 0390-5551), vol. 15 C, no. 1, Jan.-Feb. 1992, p. 87-97. Feb. 1992 11 p refs
Copyright

The paper discusses the key components of the Second World Climate Conference (SWCC) held in Geneva in 1990, which resulted in a published IPCC report (Houghton et al., ed., 1990) containing an assessment of the present-day state of climate research. Special attention is given to the future development of climate research, especially in the field of numerical modeling; the substantiation and implementation of Global Climate Observing System for climate monitoring, climate change detection, and response monitoring; and an analysis of socioeconomic aspects of the problem of climate change. I.S.

A92-36427
THE EFFECT OF GLOBAL CLIMATE CHANGES ON THE VORTEX ACTIVITY IN THE ATMOSPHERE [VLIIANIE GLOBAL'NYKH KLIMATICHESKIKH IZMENENII NA VIKHREVUIU AKTIVNOST' V ATMOSFERE]
I. I. MOKHOV, O. I. MOKHOV, V. K. PETUKHOV, and R. R. KHAIRULLIN (Rossiiskaia Akademiia Nauk, Institut Fiziki Atmosfery; VNII Fiziko-Tekhnicheskikh i Radiotekhnicheskikh Izmerenii, Moscow; Kazanskii Gosudarstvennyi Universitet, Kazan, Russia) Rossiiskaia Akademiia Nauk, Izvestiia, Fizika Atmosfery i Okeana (ISSN 0002-3515), vol. 28, no. 1, Jan. 1992, p. 11-26. In Russian. Jan. 1992 16 p In RUSSIAN refs
Copyright

The effect of global temperature changes on trends of the atmospheric vortex generation is investigated using empirical data for the 1962-1986 period on the interannual variability and intraannual evolution of these trends and by examining distinctive features of cyclone and anticyclone genesis at different altitudes over ocean and land. The model calculations are compared to empirical data. Equations are also obtained for meridional vortex heat fluxes. I.S.

A92-36450
QUALITATIVE VARIATIONS CAUSED BY PARAMETRIZATION IN SIMPLE CLIMATE MODELS [O KACHESTVENNYKH IZMENENIIAKH V PROSTYKH MODELIAKH KLIMATA, VNOSIMYKH PARAMETRIZATSIEI]
O. B. RODIMOVA (Rossiiskaia Akademiia Nauk, Institut Optiki Atmosfery, Tomsk, Russia) Optika Atmosfery (ISSN 0235-277X), vol. 4, no. 11, Nov. 1991, p. 1231, 1232. In Russian. Nov. 1991 2 p In RUSSIAN refs
Copyright

The equilibrium states in the finite part of the plane are found for a simple climate model with two temperatures. It is shown that, for different parametrizations of the outgoing infrared radiation, the position and character of the equilibrium states can vary up to their complete disappearance. O.G.

A92-36604
PHYSICAL ASPECTS OF CLIMATE THEORY [FIZICHESKIE ASPEKTY TEORII KLIMATA]
A. M. OBUKHOV, ED., G. S. GOLITSYN, ED., IU. A. IZRAEL', ED., V. M. VOLOSHCHUK, ED., and A. S. GINZBURG, ED. Leningrad, Gidrometeoizdat, 1990, 224 p. In Russian. No individual items are abstracted in this volume. 1990 224 p In RUSSIAN
(ISBN 5-286-00508-X) Copyright

The book contains the proceedings of the Third All-Union Symposium on the Physical Aspects of Climate Theory (Obninsk, October 1987). Special attention is given to problems related to climate changes and climate monitoring, the factors and substances responsible for climate changes and to their monitoring, the effects of radioactive gases in the atmosphere on climate and their monitoring, physical mechanisms responsible for the formation of quasi-stationary regimes, and an analytical method for calculating the regime of radiation-convection equilibrium in the atmosphere. Consideration is also given to climatic features of cyclones and anticyclones in the Northern Hemisphere, numerical experiments on modeling general ocean circulation, modeling the distribution of precipitation between ocean and continent, the extrapolation of index series of droughts and severe winters, and the effect of changes in the global atmospheric temperature on the atmospheric precipitation field. I.S.

A92-37678
CLOUD CONDENSATION NUCLEI FROM BIOMASS BURNING
C. F. ROGERS, JAMES G. HUDSON, BARBARA ZIELINSKA, ROGER L. TANNER, JOHN HALLETT, and JOHN G. WATSON (Nevada, University, Reno) IN: Global biomass burning - Atmospheric, climatic, and biospheric implications 1991 8 p
Copyright

The probability of the generation of cloud condensation nuclei (CCN) by tropical biomass burning is presently discussed in light of (1) whether tropical biomass smoke particles are active as CNN, and, in the event that they are thus active, (2) the deducibility of their estimated source strength and potential influence on global cloud reflectivity from existing data. It is found that smoke particles from the burning of Northern Hemisphere biomass fuels are enriched in water-soluble ions and with polar organic species, by comparison with crude-oil smoke particles. These ionic species are present in sufficient concentrations to allow the smoke particles to be active as CNNs. O.C.

A92-37683* National Aeronautics and Space Administration, Washington, DC.
A STUDY OF CLIMATE CHANGE RELATED TO DEFORESTATION IN THE XISHUANGBANNA AREA, YUNAN, CHINA
CHUNGCHENG LI (Yunnan School of Meteorology, Kunming, People's Republic of China) and CONG LAI (New York University, Tuxedo) IN: Global biomass burning - Atmospheric, climatic, and biospheric implications 1991 6 p
(Contract NAGW-1697)
Copyright

A92-37920
THE IMPACT OF SNOW COVER ON DIURNAL TEMPERATURE RANGE
RANDALL S. CERVENY and ROBERT C. BALLING, JR. (Arizona State University, Tempe) Geophysical Research Letters (ISSN 0094-8276), vol. 19, no. 8, April 24, 1992, p. 797-800. 24 Apr. 1992 4 p refs
Copyright
A statistically significant, inverse correlation between the area of North American snow cover and the United States diurnal temperature range is demonstrated. Because global warming is expected to reduce the areal extent of snow cover, the results reveal snow cover should act to increase the diurnal temperature range in the years to come. This climate variable appears therefore to be influencing the daily temperature range counter to other feedbacks discussed in previous studies. It is demonstrated that the direct linkage between the diurnal temperature range and greenhouse gases may be complicated by feedbacks associated with other geophysical variables. Author

A92-38177* National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
CLIMATE
JOEL S. LEVINE (NASA, Langley Research Center, Hampton, VA) IN: Encyclopedia of earth system science. Vol. 1. San Diego, CA, Academic Press, Inc., 1992, p. 503-515. 1992 13 p refs
Copyright
A general discussion of the influence of the greenhouse effect on the earth's climate is given. The sources and sinks of the various greenhouse gases are discussed. C.D.

A92-38179* National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
GLOBAL CLIMATE CHANGE
JOEL S. LEVINE (NASA, Langley Research Center, Hampton, VA) IN: Global climate change and freshwater ecosystems. New York, Springer-Verlag, 1991, p. 1-25. 1991 25 p refs
Copyright
Present processes of global climate change are reviewed. The processes determining global temperature are briefly described and the concept of effective temperature is elucidated. The greenhouse effect is examined, including the sources and sinks of greenhouse gases. C.D.

A92-39249 National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
THE SIGNIFICANCE OF CLOUD-RADIATIVE FORCING TO THE GENERAL CIRCULATION ON CLIMATE TIME SCALES - A SATELLITE INTERPRETATION
BYUNG-JU SOHN (Florida State University, Tallahassee; NASA, Marshall Space Flight Center, Huntsville, AL) and ERIC A. SMITH (Florida State University, Tallahassee) Journal of the Atmospheric Sciences (ISSN 0022-4928), vol. 49, no. 10, May 15, 1992, p. 845-860. 15 May 1992 16 p refs
(Contract NAG5-849; NAGW-1840; DE-FC05-85ER-25000)
Copyright
This paper focuses on the role of cloud- and surface-atmosphere forcing on the net radiation balance and their potential impact on the general circulation at climate time scales. The globally averaged cloud-forcing estimates and cloud sensitivity values taken from various recent studies are summarized. It is shown that the net radiative heating over the tropics is principally due to high clouds, while the net cooling in mid- and high latitudes is dominated by low and middle clouds. R.E.P.

A92-40626
EFFECT OF CLOUDINESS ON THE VORTEX ACTIVITY IN THE ATMOSPHERE DURING CLIMATE CHANGES [O VLIIANII OBLACHNOSTI NA VIKHREVUIU AKTIVNOST' ATMOSFERY PRI IZMENENIIAKH KLIMATA]
I. I. MOKHOV, O. I. MOKHOV, V. K. PETUKHOV, and R. R. KHAIRULLIN (Rossiiskaia Akademiia Nauk, Institut Fiziki Atmosfery; VNII Fiziko-Tekhnicheskikh i Radiotekhnicheskikh Izmerenii, Moscow; Kazanskii Gosudarstvennyi Universitet, Kazan, Russia) Meteorologiia i Gidrologiia (ISSN 0130-2906), no. 1, Jan. 1992, p. 5-11. In Russian. Jan. 1992 7 p In RUSSIAN refs
Copyright
Trends in the generation of vorticity in the atmosphere are examined in relation to cloudiness. A physical interpretation of the characteristics of cyclogenesis and anticyclogenesis at different latitudes of the Northern Hemisphere is proposed which is based on empirical data on their annual variability and a model of baroclinic vorticity generation with allowance for the effect of cumulus and stratus cloudiness. It is noted that the thermodynamic properties of cloudiness have a noticeable effect on the characteristics of vortex activity in the atmosphere. V.L.

A92-41122
DIAGNOSIS OF REGIONAL MONTHLY ANOMALIES USING THE ADJOINT METHOD. I - TEMPERATURE. II - POTENTIAL VORTICITY
ANDREW W. ROBERTSON (Muenchen, Universitaet, Munich, Federal Republic of Germany) Journal of the Atmospheric Sciences (ISSN 0022-4928), vol. 49, no. 11, June 1, 1992, p. 885-918. Research supported by Bavarian Climate Program Bay FORKLIM. 1 Jun. 1992 34 p refs
Copyright
The paper examines observed midlatitude regional anomalies in terms of horizontal advection, and the effects of adiabatic and diabatic heat sources by means of a one-layer tropospherically averaged tracer model and its adjoint. Large January temperature anomalies are found to be primarily accounted for by the horizontal advection of air masses already presented on January 1, with anomalous heating/cooling during the month playing a secondary role. Quasi-geostrophic theory suggests that the small heating effects implied by the one-layer model are often associated with compensation between diabatic and adiabatic heating effects, the latter accompanying vertical motions. These compensating heat sources and sinks are interpreted in terms of the positions of the storm tracks. Observed central European anomalies of potential vorticity are examined in terms of advection and diabatic effects. P.D.

A92-41376
A ONE-DIMENSIONAL SIMULATION OF THE INTERACTION BETWEEN LAND SURFACE PROCESSES AND THE ATMOSPHERE
J. SIEBERT, U. SIEVERS, and W. ZDUNKOWSKI (Mainz, Universitaet, Federal Republic of Germany) Boundary-Layer Meteorology (ISSN 0006-8314), vol. 59, no. 1-2, April 1992, p. 1-34. Apr. 1992 34 p refs
Copyright
A one-dimensional soil-vegetation model is developed for future incorporation into a mesoscale model. The interaction of land surface processes with the overlying atmosphere is treated in terms of three coupled balance equations describing the energy and moisture transfer at the ground and the energy state of the vegetation layer. For a complete description of the interaction, the coupled processes of heat and moisture transport within the soil are included as a multilayer soil model. As model verification, successful reproductions of the observed energy fluxes over vegetated surfaces from the HAPEX-MOBILHY experiment in southwestern France and from the LOTREX-10E/HIBE88 field experiment in Germany are presented. Finally, some sensitivity

studies are performed and discussed in order to investigate the influence of different soil and vegetation types on the energy state of the atmosphere. Author

A92-41886 National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
INTERPRETATION OF SEASONAL CLOUD-CLIMATE INTERACTIONS USING EARTH RADIATION BUDGET EXPERIMENT DATA
R. D. CESS (New York, State University, Stony Brook), E. F. HARRISON, P. MINNIS, B. R. BARKSTROM (NASA, Langley Research Center, Hampton, VA), V. RAMANATHAN (Scripps Institution of Oceanography; California, University, La Jolla), and T. Y. KWON (New York, State University, Stony Brook) Journal of Geophysical Research (ISSN 0148-0227), vol. 97, no. D7, May 20, 1992, p. 7613-7617. Research supported by NASA. 20 May 1992 5 p refs
(Contract NSF ATM-88-15885)
Copyright

A92-41891
COMMENT ON 'MEASUREMENTS OF AITKEN NUCLEI AND CLOUD CONDENSATION NUCLEI IN THE MARINE ATMOSPHERE AND THEIR RELATION TO THE DMS-CLOUD-CLIMATE HYPOTHESIS' BY D.A. HEGG, L.F. RADKE, AND P.V. HOBBS
I. R. PALUCH and D. H. LENSCHOW (NCAR, Boulder, CO) Journal of Geophysical Research (ISSN 0148-0227), vol. 97, no. D7, May 20, 1992, p. 7657, 7658; Author's Reply, p. 7659, 7660. 20 May 1992 4 p refs
Copyright

A92-42549
COMPARISON OF SYNOPTIC AND CLIMATOLOGICALLY MAPPED SECTIONS IN THE SOUTH PACIFIC OCEAN
N. L. BINDOFF and C. WUNSCH (MIT, Cambridge, MA) Journal of Climate (ISSN 0894-8755), vol. 5, no. 6, June 1992, p. 631-645. Jun. 1992 15 p refs
(Contract NSF OCE-88-23043)
Copyright

To understand the extent to which oceanic climate shifts could be detected, a South Pacific climatology has been used to create pseudosections of temperature, salinity, and other tracers along a zonal and meridional lines at 15 deg S and 90 deg W, respectively. Interpolations from the climatology were made using combined empirical orthogonal functions and objective mapping. Comparisons are made with independent measurements, taken in 1987, of temperature and salinity at 15 deg S. Temperature and salinity fields between the surface and 300 db along the 15-deg S section are predicted with an uncertainty sufficiently small to display significant differences in temperature and salinity related to ENSO of 1987. The 90-deg W pseudosection is a forecast of a synoptic section to be obtained as part of WOCE in 1992. Explicit values for the smallest temperature shift with depth that could be detected are produced. Author

A92-44075
APPLIED CLIMATOLOGY [PRIKLADNAIA KLIMATOLOGIIA]
E. P. BORISENKOV, ED., I. D. KOPANEV, ED., and M. N. MYTAREV, ED. Leningrad, Gidrometeoizdat, 1990, 272 p. In Russian. No individual items are abstracted in this volume. 1990 272 p In RUSSIAN
(ISBN 5-286-00598-5) Copyright

This book presents papers delivered at the 1988 All-Union Conference on Applied Climatology. Attention is given to problems of climatology applicable in the fields of construction, agriculture, medicine, and health resorts. Other aspects discussed include the application of climatic resources to the task of energy generation and to methods for calculating the characteristics of the regimes of input, transformation, and optimal utilization of the wind and solar energies. I.S.

A92-44093
CURRENT TRENDS OF CLIMATE CHANGES IN THE ARCTIC [SOVREMENNYE TENDENTSII IZMENENIIA KLIMATA ARKTIKI]
E. I. ALEKSANDROV and A. P. NAGURNYI (Arkticheskii i Antarkticheskii NII, St. Petersburg, Russia) Rossiiskaia Akademiia Nauk, Doklady (ISSN 0002-3264), vol. 322, no. 5, 1992, p. 865-868. In Russian. 1992 4 p In RUSSIAN refs
Copyright

An analysis of annual changes in the normalized anomalies of the surface air temperature in the region 85-60 deg NL over the periods 1951-90, 1966-90, and 1981-90 indicates that the warming trend in the Arctic has sharply decreased over the past decade, with negative changes in the mean latitudinal temperatures observed during the winter and fall periods. This contradicts the expected warming scenario at high latitudes due to anthropogenic greenhouse effects. The polar latitudes are also characterized by abrupt reversals of the trend sign. It is suggested that climate changes at high latitudes are discontinuous and difficult to predict because of the stochastic nature of the processes responsible for these changes. V.L.

A92-45098
CLIMATE CHANGES [KLIMAVERAENDERUNGEN]
GUENTER EBERT Sterne und Weltraum (ISSN 0039-1263), vol. 31, no. 6, June 1992, p. 367-371. In German. Jun. 1992 5 p In GERMAN refs

Past and present causes of climatic variations are reviewed. The influence of human activities on the world's climate is examined. Prospects for climatic changes over the next 200 years are addressed. C.D.

A92-45793
A 2XCO2 CLIMATE CHANGE SCENARIO OVER EUROPE GENERATED USING A LIMITED AREA MODEL NESTED IN A GENERAL CIRCULATION MODEL. I - PRESENT-DAY SEASONAL CLIMATE SIMULATION
M. R. MARINUCCI (L'Aquila, Universita, Italy) and F. GIORGI (NCAR, Boulder, CO) Journal of Geophysical Research (ISSN 0148-0227), vol. 97, no. D9, June 20, 1992, p. 9989-10,009. Research supported by Fondazione Scientifica San Paolo of Italy and ENEL. 20 Jun. 1992 21 p refs
Copyright

The existing seasonal climatology of the western Mediterranean is studied with a model developed to evaluate the effects of doubling the CO2 concentrations. The model incorporates a limited-area model nested into a general-circulation model, and the study compares present-day climatic conditions with those generated by the model. The models are based on the community climate model (CCM) and the mesoscale model MM4. Comparisons between the CCM and the MM4 show the relative performance of each in terms of large-scale circulation and inherent biases. The CCM shows significant biases including a weakening southward shift of the North Atlantic jet during the winter and a low tropospheric relative humidity bias. The nested MM4 provides improved spatial distributions for precipitation and surface air temperature, and biases are noted for precipitation and temperature. C.C.S.

A92-45794
A 2XCO2 CLIMATE CHANGE SCENARIO OVER EUROPE GENERATED USING A LIMITED AREA MODEL NESTED IN A GENERAL CIRCULATION MODEL. II - CLIMATE CHANGE SCENARIO
F. GIORGI (NCAR, Boulder, CO), M. R. MARINUCCI, and G. VISCONTI (L'Aquila, Universita, Italy) Journal of Geophysical Research (ISSN 0148-0227), vol. 97, no. D9, June 20, 1992, p. 10,011-10,028. Research supported by Fondazione Scientifica San Paolo of Italy and ENEL. 20 Jun. 1992 18 p refs
Copyright

A regional climate-change scenario is developed based on a simulation involving a limited-area model nested in a general circulation model to evaluate the impact of a doubling of the CO2

concentration. Versions of the community climate model (CCM) and the mesoscale model MM4 are employed, and doubled-CO2 warming is predicted in general with seasonal variations in large-scale circulation patterns. Regional precipitation changes vary from -20 percent to +177 percent depending on the season. The two models predict modifications in average temperature induced by the doubled CO2 that differ locally, and predicted precipitation differ for both models in magnitude and sign. The nested MM4 model provides sub-GCM-grid-scale detail on components of the surface hydrology. The coarse-resolution GCM output is shown to be inferior to the MM4 in estimating local changes in surface climatic variables. C.C.S.

A92-45795
A STUDY OF THE ASTRONOMICAL THEORY OF ICE AGES IN A TWO-DIMENSIONAL NONLINEAR CLIMATE MODEL
R. Q. LIN (Johns Hopkins University, Laurel, MD), R. X. HUANG (Woods Hole Oceanographic Institution, MA), and J. R. APEL (Johns Hopkins University, Laurel, MD) Journal of Geophysical Research (ISSN 0148-0227), vol. 97, no. D9, June 20, 1992, p. 10,029-10,036. 20 Jun. 1992 8 p refs
Copyright

A new one-level nonlinear seasonal energy balance climate model with a 2D land-sea geography to study the astronomical theory of ice ages is introduced. The new model is more physically consistent and mathematically reliable than those previously reported. The model reproduces the current climate state and explains how the earth's orbit causes ice ages. A set of bifurcation points of warm and cold orbit is found for both backward and forward processes. Moreover, it is found that because the earth's orbit varies slowly, gradual increases (or decreases) in the concentration of CO2 will also cause sudden climate transitions. Thus, variations in the earth's orbit and the concentration of CO2 appear to be the two major mechanisms that cause ice ages or climate changes; furthermore, these changes are usually sudden. Finally, the near-future climate resulting from a continual increase in CO2 concentration is predicted. The model does not yet include slower components such as the deep-ocean circulation. Therefore, variations occur more rapidly than in the real world. Author

A92-45798
ON THE TRANSIENT RESPONSE OF A SIMPLE COUPLED CLIMATE SYSTEM
KWANG-YUL KIM (Applied Research Corp., College Station, TX), GERALD R. NORTH, and JIANPING HUANG (Texas A & M University, College Station) Journal of Geophysical Research (ISSN 0148-0227), vol. 97, no. D9, June 20, 1992, p. 10,069-10,081. 20 Jun. 1992 13 p refs
(Contract DE-FG05-91ER-61221)
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This paper presents quasi-analytical solutions to a class of coupled atmosphere-ocean models for time-dependent ramp- and step-forced climate changes. The model consists of a conventional 2D energy balance model of the atmosphere with an oceanic mixed layer coupled to a deep ocean having vertical heat transports due to horizontally uniform vertical diffusion and upwelling. The solution is partitioned into the particular or asymptotic part and the homogeneous or transient part. The lag behind the 'no inertia' warming is a few decades, while the adjustment time to the asymptotic curve is several hundred years due to the restructuring of the thermal profile near the main thermocline. This is in strong contrast to the step-forcing scenario where the adjustment time to the new constant steady state is only a few decades. The latter experiment suggests that step-forcing scenarios are not very similar to ramp-forcing scenarios. The model produces a warming of about 0.5 C over the last hundred years provided the simulation is started 200 years ago. An interesting feature of the solutions is that the land surface areas lead the ocean surface areas in heating up by O(0.1 C). This may lead eventually to a fairly robust signature of the greenhouse forcing. Future models of this type probably need more horizontal dependence on the vertical heat transport parameters as well as horizontal transport mechanisms. Author

A92-46195
INADEQUACY OF EFFECTIVE CO2 AS A PROXY IN ASSESSING THE REGIONAL CLIMATE CHANGE DUE TO OTHER RADIATIVELY ACTIVE GASES
WEI-CHYUNG WANG, MICHAEL P. DUDEK, and XIN-ZHONG LIANG (New York, State University, Albany) Geophysical Research Letters (ISSN 0094-8276), vol. 19, no. 13, July 6, 1992, p. 1375-1378. Research supported by DOE and NSF. 6 Jul. 1992 4 p refs
Copyright

Recent GCM studies suggest that CO2 maintains the present regional climate differently than trace gases CH4, N2O, CFC-11 and CFC-12, thus raising the question of the adequacy of using 'effective' CO2 to assess future climate changes due to the greenhouse effect of these other radiatively active gases. The present GCM simulations indicate that, although the effective CO2 can provide global mean surface temperature responses in good agreement with that when these other trace gases are explicitly considered, it calculates smaller surface warming in several continental regions, notably in northwestern North America by 20-30 percent during winter and 10-15 percent during summer. Author

A92-47750
WATER VAPOUR AS AN AMPLIFIER OF THE GREENHOUSE EFFECT - NEW ASPECTS
H. FLOHN, ALICE KAPALA, H. R. KNOCHE, and H. MAECHEL (Bonn, Universitaet, Federal Republic of Germany) Meteorologische Zeitschrift (ISSN 0941-2948), vol. 1, no. 2, April 1992, p. 122-138. Research supported by Rheinisch-Westfaelische Akademie der Wissenschaften. Apr. 1992 17 p refs
Copyright

In view of the wide-spread negligence concerning water vapor as the most efficient greenhouse gas, its role in the recent climatic evolution is investigated. Increase of tropospheric water vapor content and rising evaporation (by about 15 percent) from tropical oceans have been found in recent decades. Evidence for an accelerated hydrologic cycle is given, leading simultaneously to a remarkable intensification of the tropospheric circulation in the Northern Hemisphere. Average geostrophic wind speed at the surface and in the troposphere have increased by 6-9 percent between 1967 and 1989. This internal feedback through water vapor amplifies the 'dry' greenhouse effect of CO2 and other trace gases by a factor of about 5, spreading poleward from tropical oceans. Author

A92-49230
LONGWAVE BAND MODEL FOR THERMAL RADIATION IN CLIMATE STUDIES
B. P. BRIEGLEB (NCAR, Boulder, CO) Journal of Geophysical Research (ISSN 0148-0227), vol. 97, no. D11, July 20, 1992, p. 11,475-11,485. 20 Jul. 1992 11 p refs
Copyright

To accurately simulate the present earth climate requires an atmospheric longwave radiation model whose computed fluxes agree to within +/- 1 percent of the only presently available standard, line by line (LBL) calculations. To model potential future climate change requires an atmospheric longwave radiation model that can easily incorporate many trace gases. To meet these requirements, a longwave band model of 100/cm resolution is presented. Random band model transmissions are modified to account for overabsorption compared to LBL calculations, with empirical coefficients chosen to give good agreement with LBL spectral fluxes. The longwave-band-model (LWBM) integrated fluxes agree to within +/- 1 percent of LBL fluxes, while heating rates agree to within +/- 5 percent. The LWBM is used in the NCAR Community Climate Model Version 1 to compute longwave radiation. It is demonstrated that, by not including minor bands of CO2 and O3, other trace gases (CH4, N2O, CFCl3, CF2Cl2), or nonblack surface emissivity effects result in a significant bias in tropical clear-sky outgoing longwave radiation of 8-10 W/sq m over oceans and up to 15 W/sq m over sandy deserts. Author

A92-49630
COMPUTATIONALLY EFFICIENT APPROXIMATIONS TO STRATIFORM CLOUD MICROPHYSICS PARAMETERIZATION
STEVEN J. GHAN and RICHARD C. EASTER (Pacific Northwest Laboratory, Richland, WA) Monthly Weather Review (ISSN 0027-0644), vol. 120, no. 8, Aug. 1992, p. 1572-1582. Aug. 1992 11 p refs
(Contract DE-AC06-76RL-01830)
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Bulk cloud microphysics parameterizations typically employ time steps of a few tens of seconds. Although the computational burden of these parameterizations is acceptable for the 1-day mesoscale cloud simulations for which they were designed, the time steps are unacceptably short for direct application of these parameterizations to global-climate simulation. To increase the computational efficiency of bulk cloud microphysics parameterizations, two approximations that are appropriate for stratiform clouds are introduced. By diagnosing rather than predicting rain and snow concentrations and by assuming instantaneous melting of snow, it is found that the permissible time step is increased tenfold (to 2-6 min) with little loss in accuracy for vertical motions and time scales characteristic of those resolved by general circulation models (GCMs). Such time steps are sufficiently long to permit application of bulk cloud microphysical parameterizations to GCMs for multiyear global simulations. However, it is also found that the vertical resolution must be considerably finer (100-200 m) than that currently employed in GCMs. Author

A92-50339
INFRARED EMITTANCE OF WATER CLOUDS
PETR CHYLEK, PETER DAMIANO (Dalhousie University, Halifax, Canada), and ERIC P. SHETTLE (U.S. Navy, Naval Research Laboratory, Washington, DC) Journal of the Atmospheric Sciences (ISSN 0022-4928), vol. 49, no. 16, Aug. 15, 1992, p. 1459-1472. Research supported by Atmospheric Environment Service of Canada, NSERC, and U.S. Navy. 15 Aug. 1992 14 p refs
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A simple approximation has been developed for the infrared emittance of clouds composed of water spheres based on the absorption approximation for the emittance and on the polynomial approximation to the Mie absorption efficiency. The expression for the IR emittance is obtained in a simple analytical form as a function of the liquid water content and two size distribution parameters, namely, the effective radius and effective variance. The approximation is suitable for numerical weather prediction, climate modeling, and radiative transfer calculations. The accuracy, when compared to the exact Mie calculation and integration over the size distribution, is within a few percent, while the required computer time is reduced by several orders of magnitude. In the limit of small droplet sizes, the derived IR emittance reduces to a term proportional to the liquid water content. Author

A92-51443
INVESTIGATION OF A LONG GERMAN TEMPERATURE SERIES [UNTERSUCHUNG EINIGER LANGER DEUTSCHER TEMPERATURREIHEN]
GERHARD MUELLER-WESTERMEIER (German Meteorological Service, Offenbach am Main, Federal Republic of Germany) Meteorologische Zeitschrift (ISSN 0941-2948), vol. 1, no. 3, June 1992, p. 155-171. In German. Jun. 1992 17 p In GERMAN refs
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Central European temperature records from before 1800 are used here to investigate whether an anthropogenic increase in temperature can be deduced from these time series. The records mostly show a rise in temperature of about 0.5 K from the second half of the 19th century similar to global records. This agrees well with the trend expected to result from an anthropogenic increase in the concentration of greenhouse gases. Yearly mean temperatures, however, were as high at the beginning of the 19th century as today, so there must be natural causes which produce climatic fluctuations over a period of decades to centuries which are at least as strong as the anthropogenic effects. Thus, the predicted warming trend is not demonstrated. C.D.

A92-51455* National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
EVIDENCE FOR LIQUID-PHASE CIRRUS CLOUD FORMATION FROM VOLCANIC AEROSOLS - CLIMATIC IMPLICATIONS
KENNETH SASSEN (Utah, University, Salt Lake City) Science (ISSN 0036-8075), vol. 257, no. 5069, July 24, 1992, p. 516-519. Research supported by DOE. 24 Jul. 1992 4 p refs
(Contract NAG1-868; NSF ATM-89-14348)
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Supercooled droplets in cirrus uncinus cell heads between -40 and -50 C are identified from the First International Satellite Cloud Climatology Project Regional Experiment polarization lidar measurements. Although short-lived, complexes of these small liquid cells seem to have contributed importantly to the formation of the cirrus. Freezing-point depression effects in solution droplets, apparently resulting from relatively large cloud condensation nuclei of volcanic origin, can be used to explain this rare phenomenon. An unrecognized volcano-cirrus cloud climate feedback mechanism is implied by these findings. Author

A92-51587 National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
THE INFLUENCE OF CONCENTRATED HEATING ON THE HADLEY CIRCULATION
ARTHUR Y. HOU (NASA, Goddard Space Flight Center, Greenbelt, MD) and RICHARD S. LINDZEN (MIT, Cambridge, MA) Journal of the Atmospheric Sciences (ISSN 0022-4928), vol. 49, no. 14, July 15, 1992, p. 1233-1241. 15 Jul. 1992 9 p refs
(Contract NSF ATM-83-42482; NAGW-525)

The studies of Lindzen and Hou (1988) of Hadley circulation forced by global heating distributions are extended to situations where heating is latitudinally concentrated. The qualitative effect of narrow heating is examined by means of simple 'equal area' arguments of the type developed by Held and Hou (1980). Numerical calculations for a continuous fluid are carried out, showing that the intensity of the resulting Hadley circulation depends on how the heating is concentrated. It is shown that only a mild concentration is needed to achieve agreement with observations. I.S.

A92-51589
NUCLEATION SCAVENGING OF SMOKE PARTICLES AND SIMULATED DROP SIZE DISTRIBUTIONS OVER LARGE BIOMASS FIRES
CATHERINE C. CHUANG, JOYCE E. PENNER, and LESLIE L. EDWARDS (Lawrence Livermore National Laboratory, Livermore, CA) Journal of the Atmospheric Sciences (ISSN 0022-4928), vol. 49, no. 14, July 15, 1992, p. 1264-1275. 15 Jul. 1992 12 p refs
(Contract W-7405-ENG-48)
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A microphysical entraining parcel model of nucleation and condensation is used to develop a parameterization for nucleation scavenging for use in dynamical models that simulate the formation of cumulus clouds above fire. The model was used to investigate the changes of parcel characteristics caused by the effect of entrainment, as well as the sensitivity of nucleation scavenging and drop number concentration to the different background environmental aerosol distributions. It is shown that the fraction of smoke particles nucleated depends on the chemical nature of the particles, their size distribution, the quantitiy of smoke present at the cloud base, the updraft velocity, and the environmental conditions. The predicted drop-size distribution agrees well with data measured for an experimental fire observed using ground and airborne instruments. I.S.

A92-52292
CLIMATIC VARIABILITY OF TEMPERATURE AND HUMIDITY OVER THE TROPICAL WESTERN PACIFIC

DAVID S. GUTZLER (Atmospheric and Environmental Research, Inc., Cambridge, MA) Geophysical Research Letters (ISSN 0094-8534), vol. 19, no. 15, Aug. 3, 1992, p. 1595-1598. 3 Aug. 1992 4 p refs
(Contract NOAA-NA-88AADAC038)
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Data from four radiosonde stations are used to define indices of temperature and humidity over the tropical western Pacific. Both temperature and specific humidity have increased throughout the troposphere since the mid-1970's; relative humidity also shows positive trends at all tropospheric levels above the surface despite the warming trend. Examination of the vertical structure of decade-scale trends reveals that long-term changes in humidity occur principally within the boundary layer, whereas the annual cycle and interannual variability of humidity are seated primarily in the free atmosphere above the boundary layer. Implications of the results for climate change detection are discussed. V.L.

A92-52294
POSSIBLE REGIONAL CLIMATE CONSEQUENCES OF THE PINATUBO ERUPTION - AN EMPIRICAL APPROACH
PAVEL IA. GROISMAN (State Hydrological Institute, St. Petersburg, Russia) Geophysical Research Letters (ISSN 0094-8534), vol. 19, no. 15, Aug. 3, 1992, p. 1603-1606. 3 Aug. 1992 4 p refs
Copyright

The regional climate consequences of the greatest volcanic eruptions of the last two centuries are discussed. The pattern of changes of seasonal temperature after such eruptions is compared to these changes after the Pinatubo eruption (in June 1991). The unusually warm winter of 1991-92 in Eastern Europe coincides with the pattern following earlier eruptions. According to this pattern cool summers in Eastern Europe and the northeastern USA are probable in the next two or three years. Author

A92-52295* National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York, NY.
CLIMATE FORCING BY STRATOSPHERIC AEROSOLS
ANDREW LACIS, JAMES HANSEN, and MAKIKO SATO (NASA, Goddard Institute for Space Studies, New York) Geophysical Research Letters (ISSN 0094-8534), vol. 19, no. 15, Aug. 3, 1992, p. 1607-1610. 3 Aug. 1992 4 p refs
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It is illustrated how climate forcing by stratospheric aerosols depends on aerosol properties. The climate forcing is a function of aerosols size distribution, but the size dependence can be described well by a single parameter: the area-weighted mean radius, r(eff). If r(eff) is greater than about 2 microns, the global average greenhouse effect of the aerosols exceeds the albedo effect, causing a surface heating. The aerosol climate forcing is less sensitive to other characteristics of the size distribution, the aerosol composition, and the altitude of the aerosols. Thus stratospheric aerosol forcing can be defined accurately from measurements of aerosol extinction over a broad wavelength range. Author

A92-52354
SULFUR EMISSION, CCN, CLOUDS AND CLIMATE - A REVIEW
Y. FOUQUART (Lille I, Universite, Villeneuve d'Ascq, France) and H. ISAKA (Clermont-Ferrand II, Universite, Aubiere, France) Annales Geophysicae (ISSN 0992-7689), vol. 10, no. 7, July 1992, p. 462-471. Research supported by EEC. Jul. 1992 10 p refs
Copyright

Attention is given to the relationship between atmospheric sulfur concentration and cloud condensation nuclei (CCN) concentration, the extent to which CCN concentration and the number of cloud droplets are related, and the magnitude of the expected effect on the planetary albedo. The physical basis for the climatic effect of CCN variations, i.e., the variations in radiative properties directly or indirectly associated with variations in droplet size, is considered. Satellite and aircraft observations of enhanced cloud reflectivities in the tracks of ships' exhausts confirm that, at least in some cases, changes in CCN concentration do have a significant impact on cloud albedos. Under some conditions, more CCN lead to more droplets, to smaller droplets, and to increased cloud reflectivity. It is suggested that cloud liquid water may vary in relation to droplet number. With regard to the causes of variation of CCN number over oceanic areas, the relative importance of biogenic and anthropogenic sulfur sources is geographically dependent; sulfur constituents are essentially anthropogenic. C.A.B.

A92-52377
A ZONALLY AVERAGED, COUPLED OCEAN-ATMOSPHERE MODEL FOR PALEOCLIMATE STUDIES
THOMAS F. STOCKER (McGill University, Montreal, Canada), DANIEL G. WRIGHT (Bedford Institute of Oceanography, Dartmouth, Canada), and LAWRENCE A. MYSAK (McGill University, Montreal, Canada) Journal of Climate (ISSN 0894-8755), vol. 5, no. 8, Aug. 1992, p. 773-797. Research supported by SNSF, NSERC, U.S. Navy, et al. Aug. 1992 25 p refs
Copyright

A latitude-depth climate model is developed by coupling the three-basin ocean model of Wright and Stocker (1991) to a zonally averaged energy balance model of the atmosphere. Parameter values are determined objectively using the steady state of the ocean model and necessary observational data from the atmosphere. The effect of excess freshwater discharge into the North Atlantic is investigated, and the influence of the parameterization of precipitation is tested. The Atlantic thermohaline flow is sensitive to anomalous freshwater input. Reversals of the deep circulation can occur in the Atlantic, leading to a state where deep water is formed only in the Southern Ocean. Depending on the zonality of precipitation, a feedback mechanism is identified that may also trigger the reversal of the Pacific thermohaline circulation yielding the inverse conveyor belt as an additional steady state. A total of four different stable equilibria of the coupled model are realized. C.A.B.

A92-52379
EFFECTS OF CLOUD OPTICAL PROPERTY FEEDBACKS ON THE GREENHOUSE WARMING
GYULA MOLNAR (Atmospheric and Environmental Research, Inc., Cambridge, MA) and WEI-CHYUNG WANG (New York, State University, Albany) Journal of Climate (ISSN 0894-8755), vol. 5, no. 8, Aug. 1992, p. 814-821. Research supported by DOE and NSF. Aug. 1992 8 p refs
Copyright

A 1D radiative-convective model is used to illustrate that the difference in the vertical distribution of the radiative forcing between CO2 increase and changes of solar constant can result in a different optical thickness (tau) feedback. Because of the different changes in the tau vertical distributions, the tau feedback is calculated to be a small negative value for a CO2 increase, but much larger negative values for increases of trace gases. The strongest negative feedback is found for CFCs. Similar experiments using a revised version of the Somerville and Remer (1984) scheme, which relates tau to cloud liquid water content through cloud temperature, indicate that the negative feedback for CO2 increases for a single cloud layer becomes much smaller when multiple-layer clouds are used. The tau feedback is also found to be sensitive to model dimensionality. C.A.B.

A92-52380
TEMPERATURE-PRECIPITATION RELATIONSHIPS FOR CANADIAN STATIONS
G. A. ISAAC (Atmospheric Environment Service, Downsview, Canada) and R. A. STUART (Weather Research House, Downsview, Canada) Journal of Climate (ISSN 0894-8755), vol. 5, no. 8, Aug. 1992, p. 822-830. Aug. 1992 9 p refs
Copyright

The dependence of daily precipitation upon average daily temperature has been examined for all seasons using climatological data from 56 stations across Canada. For east and west coast

sites, and the north, more precipitation occurs with warm and cold temperatures during January and July, respectively. In the middle of the country, the temperature dependence tends to increase toward the Arctic, with strong dependencies in the Northwest Territories and weaker dependencies on the Prairies. Southern Ontario and Quebec show almost no dependence of precipitation upon temperature during July, but more precipitation falls during warm weather during the winter. For stations within and immediately downwind of the Rockies, for all seasons, more precipitation occurs when the temperature is colder. These temperature-precipitation relationships can provide information on precipitation formation processes, as well as assistance in weather and climate forecasting. Author

A92-52382* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
PRECISION AND RADIOSONDE VALIDATION OF SATELLITE GRIDPOINT TEMPERATURE ANOMALIES. I - MSU CHANNEL 2. II - A TROPOSPHERIC RETRIEVAL AND TRENDS DURING 1979-90
ROY W. SPENCER (NASA, Marshall Space Flight Center, Huntsville, AL) and JOHN R. CHRISTY (Alabama, University, Huntsville) Journal of Climate (ISSN 0894-8755), vol. 5, no. 8, Aug. 1992, p. 847-866. Aug. 1992 20 p refs
Copyright

Monthly 2.5-deg gridpoint anomalies in the Tiros-N satellite series Microwave Sounding Unit channel 2 brightness temperatures during 1979-1988 are evaluated with multiple satellites and radiosonde data for their climate temperature monitoring capability. The MSU anomalies are computed about a 10-yr mean annual cycle at each gridpoint, with the MSUs intercalibrated to a common arbitrary level. The monthly gridpoint anomaly agreement between concurrently operating satellites reveals single-satellite precision generally better than 0.07 C in the tropics and better than 0.15 C at higher latitudes. The removal from channel 2 of the temperature influence above the 30-kPa level is addressed, providing a sharper and thus potentially more useful weighting function for monitoring lower tropospheric temperatures. C.A.B.

A92-52384
EVALUATION OF PROTOTYPICAL CLIMATE FORECASTS - THE SUFFICIENCY RELATION
MARTIN EHRENDORFER (Wien, Universitaet, Vienna, Austria) and ALLAN H. MURPHY (NOAA, National Meteorological Center, Washington) Journal of Climate (ISSN 0894-8755), vol. 5, no. 8, Aug. 1992, p. 876-887. Aug. 1992 12 p refs
(Contract NSF ATM-87-14108; NSF SES-91-06440)
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The sufficiency relation is applied to the problem of comparative evaluation of prototypical climate forecasting systems in order to assess the basic applicability of the sufficiency relation in this context and to investigate the implications of this approach for the relationships among the performance characteristics of such forecasting systems. The results confirm that forecasting system A is sufficient for forecasting system B when the former uses more extreme probabilities more frequently than the latter. In terms of the relatively simple forecasting systems under consideration, it is found that system A may be sufficient for system B even if the former uses extreme forecasts less frequently, provided A's forecasts are, to a certain degree, more extreme than B's forecasts. Conversely, system A cannot be shown to be sufficient for system B if the former uses less extreme forecasts more frequently than the latter. The advantages of the sufficiency relation over traditional performance measures in this context are also demonstrated. Several issues related to the general applicability of the sufficiency relation to the comparative evaluation of climate forecasts are discussed. C.A.B.

A92-52537
OBSERVATIONAL SIGNS OF GREENHOUSE-GAS-INDUCED CLIMATE CHANGE, WITH SPECIAL REFERENCE TO NORTHERN LATITUDES
C.-D. SCHOENWIESE (Frankfurt, Universitaet, Frankfurt am Main, Germany) Journal of Atmospheric and Terrestrial Physics (ISSN 0021-9169), vol. 54, no. 9, Sept. 1992, p. 1101-1106. Sep. 1992 6 p refs
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Northern Hemisphere surface air temperature and precipitation records covering the recent 100-130 yr are analyzed on an interannual and seasonal time scale using statistical techniques. In particular, the linear trends in different latitude zones are presented. In addition to these, a multiple (multiforced) statistical approach is used which correlates the observed climate fluctuations and trends simultaneously with volcanic, solar, ENSO, NAO, and greenhouse gases forcing. On the basis of these results it is attempted to separate hypothetically the anthropogenic greenhouse-gas-induced climate signals from natural variability (noise reduction strategy). Author

A92-53725
TROPICAL RAINFALL MEASURING MISSION (TRMM)
KEN'ICHI OKAMOTO (Communications Research Laboratory, Koganei, Japan) and TASUKU TANAKA (NASDA, Tokyo, Japan) IN: International Symposium on Space Technology and Science, 17th, Tokyo, Japan, May 20-25, 1990, Proceedings. Vol. 2 1990 6 p
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The TRMM project is outlined. The TRMM will provide quantitative measurements of rainfall over all land and ocean areas of the tropics. Tropical rainfall data are essential for understanding the global atmospheric structure, because tropical rain activity produces one of the major energy sources for the global atmospheric circulation. The major data product is monthly averaged rain rate over an area of 5 x 5 deg grid boxes between 37 deg N and 37 deg S for three-year mission life. To accomplish the objectives, the TRMM will carry three sensors to observe rain: AVHRR, microwave radiometers (ESMR,SSM/I), and a rain radar which will be the first spaceborne rain radar in history. The inclination of the satellite orbit will be 35 deg and the altitude will be 350 km, which is suitable to measure the tropical rain in detail. The data will be processed to provide various levels of products according to the processing level. Author

A92-53921
LONG-TERM VARIABILITY OF ATMOSPHERIC CIRCULATION AND CLIMATE OSCILLATIONS IN THE FIRST NATURAL SYNOPTIC REGION [MNOGOLETNIE IZMENENIIA ATMOSFERNOI TSIRKULIATSII I KOLEBANIIA KLIMATA V PERVOM ESTESTVENNOM SINOPTICHESKOM RAIONE]
N. S. SIDORENKOV and P. I. SVIRENKO IN: Planetary atmosphere processes 1991 13 p In RUSSIAN refs
Copyright

The annual variability of the frequency of the westerly (W), easterly (E), and meridional (C) forms of atmospheric circulation over the first natural synoptic region is analyzed for the period 1891-1984. Over the period studied, the frequency of W circulation has been continuously decreasing, whereas the frequency of E circulation has been continuously increasing, suggesting important irreversible changes in atmospheric circulation. Anomalies in the frequency of C circulation are correlated with changes in the earth rotation velocity. The results obtained are used to forecast certain climatic characteristics in the first natural synoptic region for the next 20 years. V.L.

A92-54626
SOME RESULTS FROM AN INTERCOMPARISON OF THE CLIMATES SIMULATED BY 14 ATMOSPHERIC GENERAL CIRCULATION MODELS
G. J. BOER (Canadian Climate Centre, Downsview, Canada), K. ARPE (Max-Planck-Institut fuer Meteorologie, Hamburg, Germany), M. BLACKBURN (Reading, University, United Kingdom), M. DEQUE (Meteo-France, Centre National de Recherches Meteorologiques, Toulouse), W. L. GATES (Lawrence Livermore National Laboratory, Livermore, CA), T. L. HART (Bureau of Meteorology, Research Centre, Melbourne, Australia), H. LE TREUT (CNRS, Laboratoire de Meteorologie Dynamique, Paris, France), E. ROECKNER

(Max-Planck-Institut fuer Meteorologie, Hamburg, Germany), D. A. SHEININ (Main Geophysical Observatory, St. Petersburg, Russia), I. SIMMONDS (Melbourne, University, Parkville, Australia) et al. Journal of Geophysical Research (ISSN 0148-0227), vol. 97, no. D12, Aug. 20, 1992, p. 12,771-12,786. 20 Aug. 1992 16 p refs

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Some climatological information from 14 atmospheric general circulation models is presented and compared in order to assess the ability of a broad group of models to simulate current climate. The quantities considered are cross sections of temperature, zonal wind, and meridional stream function together with latitudinal distributions of mean sea level pressure and precipitation rate. The nature of the deficiencies in the simulated climates that are common to all models and those which differ among models is investigated; the general improvement in the ability of models to simulate certain aspects of the climate is shown; consideration is given to the effect of increasing resolution on simulated climate; and approaches to understanding and reducing model deficiencies are discussed. The information presented here is a subset of a more voluminous compilation which is available in report form (Boer et al., 1991). This report contains essentially the same text, but results from all 14 models are presented together with additional results in the form of geographical distributions of surface variables and certain difference statistics. Author

A92-55443

INFLUENCE OF THE STARTING DATE OF MODEL INTEGRATION ON PROJECTIONS OF GREENHOUSE-GAS-INDUCED CLIMATIC CHANGE

THIERRY FICHEFET and CHRISTIAN TRICOT (Louvain, Universite Catholique, Louvain-la-Neuve, Belgium) Geophysical Research Letters (ISSN 0094-8276), vol. 19, no. 17, Sept. 4, 1992, p. 1771-1774. Research sponsored by FNRS. 4 Sep. 1992 4 p refs

(Contract CEC-EPOC-0003-C)

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Numerical experiments were carried out using a simple coupled atmosphere-ocean model in order to evaluate the effect of the starting date of model integration on time-dependent projections of greenhouse-gas-induced climatic change. The effect of the starting date is shown to depend on the rate of forcing change and on the thermal inertia of the ocean model. The results suggest that starting the model integration in or before 1960 leads to reliable projections of greenhouse-gas-induced climatic change over the next century. The results also show that the simulated warming rates are significantly underestimated when model integration starts after 1975. V.L.

A92-55605

MODELLING OF DOWNWARD SURFACE LONGWAVE FLUX DENSITY FOR GLOBAL CHANGE APPLICATIONS

F. MISKOLCZI (Maryland, University, College Park) IAF, International Astronautical Congress, 43rd, Washington, Aug. 28-Sept. 5, 1992. 7 p. Aug. 1992 7 p refs

(Contract NSF INT-90-15325)

(IAF PAPER 92-0137) Copyright

In this paper selected longwave surface irradiance measurements are tested against high-resolution radiative-transfer computations. The differences between the modeled IR flux density using a line-by-line code and pyrgeometer measurements are within the required accuracy for ground observations. Author

N92-10266# Lamont-Doherty Geological Observatory, Palisades, NY.

RECENT CHANGES OF WEATHER PATTERNS IN NORTH AMERICA

1991 7 p

(Contract DE-FG02-85ER-60372)

(DE91-017706; DOE/ER-60372/6) Avail: CASI HC A02/MF A01

Much effort in the last several years has been spent in the preparation of digitized quality controlled and homogenized data basis suitable for the time series analysis. This work has taken considerably more time than originally expected due to many serious and unexpected problems in the data. It has been necessary to balance the quality requirements with the needs of uniform geographic coverage, the uncertainty due to the data gaps with the uncertainties involved in the applied corrections. In general we prefer to end up with less data of higher quality than with more data of low quality. Today most of the work on the preparation of the necessary data sets is completed. Other research groups within NOAA-NCDC or cooperating with NOAA are currently working on the addition of quality controlled data sets which will become available for the study. Thus the bulk of our effort may be oriented toward the analysis. This will be done by similar statistical procedures as those used in our earlier work. The bulk of the analysis is done using Monte Carlo techniques. DOE

N92-12370# Colorado State Univ., Fort Collins. Dept. of *Atmospheric Science.*

NUMERICAL STUDIES OF THE ROLE OF CLOUDS IN THE PRESENT CLIMATE

D. A. RANDALL Aug. 1990 13 p Presented at the Beijing International Symposium on Climate Change, Beijing (China), 9-12 Aug. 1990

(Contract DE-FG02-89ER-69027)

(DE90-014345; CONF-9008126-1) Avail: CASI HC A03/MF A01

Until recently there has been lingering skepticism, in the general circulation modeling community, that the radiative effects of clouds significantly influence the atmospheric general circulation. Zonally uniform observed cloud amounts were, in some cases, prescribed by modelers who preferred to avoid confronting the complex physics of cloud formation. Ironically, GCMs have provided the proof that the radiative effects of clouds are important for the general circulation of the atmosphere. An important concept in analysis of the effects of clouds on climate is the cloud radiative forcing, which is defined as the difference between the radiative flux which actually occurs in the presence of clouds, and that which would occur if the clouds were removed but the atmospheric state were otherwise unchanged. We also use the term CRF to denote warming or cooling tendencies due to cloud-radiation interactions. Cloud feedback is the change in CRF that accompanies a climate change. It is useful to distinguish among three aspects of the CRF: the planetary CRF acting at the top of the atmosphere, the surface CRF at the Earth's surface, and the atmospheric CRF, which acts on the atmospheric itself and is the difference between the planetary and surface CRFs. This paper reviews the magnitudes, distribution causes, and consequences of the CRF, as they relate to climate modeling. A review of some earlier studies is combined with a brief presentation of new, previously unpublished results. DOE

N92-14567# International Centre for Theoretical Physics, Trieste (Italy).

A NEW PROCESS BY WHICH THE GENERAL CIRCULATION SYSTEM IS MAINTAINED

E. C. NJAU Dec. 1990 8 p

(DE91-635154; IC-90/402) Avail: CASI HC A02/MF A01

According to the author's theory of climatic change (Nuovo Cimento C, 12, 597-611 (1989)), heat energy or temperature variations at any location on the earth may be expressed as a power series of some specific functions. These functions represent amplitude modulation processes in which the complex carrier signals are generated by interactions between the earth and its spinning motion on one hand and the constant component of extraterrestrial insolation on the other hand, while the modulating signals are formed by the variable components of extraterrestrial insolation. It is shown here that the latitudinal variation of the modulation indices involved in the above-mentioned processes leads to the establishment and maintenance of atmospheric stability along the intertropical as well as polar high pressure belts. Besides, a high level of atmospheric instability is permanently enforced along the subpolar low pressure belts. All the modulation indices attain minimum values along the equatorial low pressure belt and maximum values along the subpolar low pressure belts. Our

analysis reflects and explains quite well the salient characteristics of the general circulation system already deduced from observations. DOE

N92-14569# International Centre for Theoretical Physics, Trieste (Italy).
PHYSICAL PROCESSES RESPONSIBLE FOR ENSO EVENTS
E. C. NJAU Dec. 1990 13 p
(DE91-635166; IC-90/432) Avail: CASI HC A03/MF A01

We use the author's theory of sun-weather/climate links and climatic change to develop and explain the physical processes which give rise to El Nino and Southern Oscillation (ENSO) events. Our analysis apparently accounts well for all major characteristics of ENSO events already established from past observations. Finally we propose possible ways by which future ENSO events may be predicted. DOE

N92-15507# World Meteorological Organization, Geneva (Switzerland).
REPORT OF MEETING OF EXPERTS ON CLIMATE CHANGE DETECTION PROJECT World Climate Data Programme
Nov. 1990 107 p Meeting held in Niagara-on-the-Lake, 26-30 Nov. 1990
(WCDP-13; WMO/TD-418) Avail: CASI HC A06/MF A02; print copy available at WMO, Geneva, Switzerland

An account is given of research on climate change detection that was presented at a meeting of experts. Topics covered included climate prediction model validation, the importance of using more remote sensing data in model validations and climate change detection, current modeling activities at the Canadian Climate Center (CCC), the coupling of an upper ocean circulation model to the CCC general circulation model (GCM), the coupling of a version of the Cox-Byran ocean GCM to the CCC GCM, the monitoring of sea surface temperature and salinity at 18 sites around the Canadian coast, a statistical study of the 95 year record of in-situ meteorological data in the northern mid-west of the United States, and the use of proxy data records for climate change detection. Author

N92-16523*# Columbia Univ., New York, NY.
SEMIANNUAL PROGRESS REPORT, APRIL - SEPTEMBER 1991
Sep. 1991 21 p
(Contract NCC5-29)
(NASA-CR-189775; NAS 1.26:189775) Avail: CASI HC A03/MF A01

Research conducted during the past year in the climate and modeling programs has concentrated on the development of appropriate atmospheric and upper ocean models, and preliminary applications of these models. Principal models are a one-dimensional radiative-convective model, a three dimensional global climate model, and an upper ocean model. Principal applications have been the study of the impact of CO2, aerosols, and the solar constant on climate. Progress was made in the 3-D model development towards physically realistic treatment of these processes. In particular, a map of soil classifications on 1 degree by 1 degree resolution has now been digitized, and soil properties have been assigned to each soil type. Using this information about soil properties, a method has been developed to simulate the hydraulic behavior of the soils of the world. This improved treatment of soil hydrology, together with the seasonally varying vegetation cover, will provide a more realistic study of the role of the terrestrial biota in climate change. A new version of the climate model was created which follows the isotopes of water and sources of water throughout the planet. Author

N92-18912# World Meteorological Organization, Geneva (Switzerland).
ACTIVITIES REPORT OF THE WORLD METEOROLOGICAL ORGANIZATION Annual Report, 1990
1991 74 p
(WMO-746; ISBN-92-63-10746-7; ETN-92-90661) Copyright Avail: CASI MF A01; HC availaible from WMO, Case Postale No. 5, CH-1211 Geneva 20, Switzerland

The activities, conferences, research projects, and publications of the World Meteorological Organization (WMO) during the course of 1990 are described. The organization structure and funding of the organization are presented. The World Climate Program and the World Weather Watch Program are described. The global climate system and significant climate anomalies and events during 1990 are described. One of these anomalies is the El Nino Southern Oscillation. Other more localized anomalies and events are reported. All six of the warmest years in global record have occurred since 1980. ESA

N92-19251# International Meteorological Inst., Stockholm (Sweden). Arrhenius Lab.
ACTIVITIES REPORT OF THE INTERNATIONAL METEOROLOGICAL INSTITUTE IN STOCKHOLM (SWEDEN) Annual Report, Jul. 1990 - Jun. 1991
Aug. 1991 77 p
(ISSN 0349-0068)
(ETN-92-90725) Avail: CASI HC A05/MF A01

International collaborative activities, including participation in the Intergovernmental Geosphere-Biosphere Program (OGBP) and the European Chemistry Program (EUROTRAC), are outlined. Research work organized in the sections of dynamic meteorology, chemical meteorology, atmospheric physics, and atmospheric aerosol science is described. The most important function of the institute is to provide opportunites for foreign scientists to work in collaboration for varying periods of time. These visits by scientists are detailed. ESA

N92-19819# Oak Ridge National Lab., TN. Carbon Dioxide Information Analysis Center.
AN UPDATED GLOBAL GRID POINT SURFACE AIR TEMPERATURE ANOMALY DATA SET: 1851-1990
R. J. SEPANSKI, T. A. BODEN, and R. C. DANIELS Oct. 1991 5225 p
(Contract DE-AC05-84OR-21400)
(DE92-004582; ORNL/CDIAC-37; NDP-020/R1) Avail: CASI HC A99/MF A10

This document presents land-based monthly surface air temperature anomalies (departures from a 1951-1970 reference period mean) on a 5 degree latitude by 10 degree longitude global grid. Monthly surface air temperature anomalies (departures from a 1957-1975 reference period mean) for the Antarctic (grid points from 65 degrees S to 85 degrees S) are presented in a similar way as a separate data set. The data were derived primarily from the World Weather Records and the archives of the United Kingdom Meteorological Office. This long-term record of temperature anomalies may be used in studies addressing possible greenhouse-gas-induced climate changes. To date, the data have been employed in generating regional, hemispheric, and global time series for determining whether recent (i.e., post-1900) warming trends have taken place. This document also presents the monthly mean temperature records for the individual stations that were used to generate the set of gridded anomalies. The periods of record vary by station. Northern Hemisphere station data have been corrected for inhomogeneities, while Southern Hemisphere data are presented in uncorrected form. DOE

N92-21539 Pennsylvania State Univ., University Park.
REGIONAL CLIMATE CHANGES IN THE GODDARD INSTITUTE FOR SPACE STUDIES GENERAL CIRCULATION MODEL Ph.D. Thesis
BRUCE CHARLES HEWITSON 1991 121 p
Avail: Univ. Microfilms Order No. DA9204213

Anthropogenic increases of infrared reactive gases in the atmosphere are leading to changes in the global system. These changes will be manifest in the climate to different degrees from region to region. Consequently there is a pressing need for regional climate change predictions, which has not been met by traditional analog or computer modeling prediction techniques. An alternative approach is developed here which combines elements of General

Circulation Models (GCM) with analogs of relationships derived from observed data. This approach provides both a powerful diagnostic tool for GCMs as well as information about possible regional climate change. Using the Goddard Institute for Space Studies (GISS) GCM, the surface synoptic circulation is analyzed with Principal Components Analysis (PCA), and shows that the GCM accurately represents the primary modes of variance in the circulation field. Furthermore, the same modes of variance are present in the 1 x CO2 and 2 x CO2 simulations. Transfer functions based on observed data are then derived for these regions to relate surface climate to synoptic circulation patterns, and are applied to the circulation patterns in 1 x CO2 2 x CO2 GCM simulations. The results demonstrate that while GISS GCM has an accurate representation of the surface synoptic circulation features, the model derived temperature field has strong spatial biases when compared to the field derived from circulation. Furthermore, the temperature field derived from circulation is far more representative of observed data than is the model field itself. When differencing the temperature fields derived from the 1 x CO2 and 2 x CO2 simulations, the regional climate change shows marked differences to that derived by the model. Dissert. Abstr.

N92-22837# Meteorological Office, Bracknell (England).
PRECIPITATION AND THE WATER CYCLE
K. BROWNING *In* ESA, Report of the Earth Observation User Consultation Meeting p 94-99 Oct. 1991
Copyright Avail: CASI HC A02/MF A03; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 75 Dutch guilders

Details of the hydrological cycle are considered together with the Global Energy and Water Cycle Experiment (GEWEX) established to observe, understand, model and eventually predict variations of the global hydrological regimes, including changes in regional trends of water resources and their response to change in the environment due to increasing greenhouse gases. The full range of global data needed for GEWEX are given. This includes information on meteorological parameters, irradiation and clouds, ocean surface parameters, and land surface data. Three of the highest priorities for improving global observations for GEWEX are temperature and humidity profiles with high vertical resolution, upper air wind profiles, and precipitation profiles. A table of space-based measurements and instruments especially important to climate related studies of precipitation and the water cycle is presented. ESA

N92-22838# Centre National de la Recherche Scientifique, Verrieres-Le Buisson (France). Lab. de Meteorologie Dynamique.
RADIATION AND THE ENERGY BALANCE: THE ROLE OF RADIATION
R. KANDEL *In* ESA, Report of the Earth Observation User Consultation Meeting p 100-114 Oct. 1991
Copyright Avail: CASI HC A03/MF A03; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 75 Dutch guilders

The role of radiation, cloud radiation interactions in the climate, and radiation processes in climate change are discussed. The geometrical constraints, calibration issues, and time sampling issues of measuring radiation fluxes, done from space, are considered. Radiation parameters to be measured, including solar radiation, reflected SW flux, emitted LW flux, and cloud radiation forcing, are discussed. Radiative fluxes at the sea surface and in the atmosphere are considered. Projected and necessary spaceborne instrumentation for the next twenty years is considered. ESA

N92-22854# Paris VI Univ. (France).
CONTRIBUTIONS TO CLIMATE RESEARCH: STUDY OF THE SOLID EARTH IS OF IMPORTANCE TO CLIMATE RESEARCH IN THREE AREAS
J.-F. MINSTER *In* ESA, Report of the Earth Observation User Consultation Meeting p 240-241 Oct. 1991
Copyright Avail: CASI HC A01/MF A03; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 75 Dutch guilders

The study of the solid Earth is of importance to climate research in three areas: determination of the Earth's potential field; polar motion and Earth rotation; and absolute mean sea level rise. Each of these are discussed. ESA

N92-22974# Sandia National Labs., Albuquerque, NM.
AN OVERVIEW OF THE YUCCA MOUNTAIN GLOBAL/REGIONAL CLIMATE MODELING PROGRAM
R. P. SANDOVAL, Y. K. BEHL, and S. L. THOMPSON 10 Jan. 1992 8 p Presented at the International High Level Radioactive Waste Management (IHLRWM) Conference: Promoting Understanding Through Education and Communication, Las Vegas, NV, 12-16 Apr. 1992
(Contract DE-AC04-76DP-00789)
(DE92-006807; SAND-91-1927C; CONF-920430-40) Avail: CASI HC A02/MF A01

The US Department of Energy (DOE) has developed a site characterization plan (SCP) to collect detailed information on geology, geohydrology, geochemistry, geoengineering, hydrology, climate, and meteorology (collectively referred to as 'geologic information') of the Yucca Mountain site. This information will be used to determine if a mined geologic disposal system (MGDS) capable of isolating high-level radioactive waste without adverse effects to public health and safety over 10,000 years, as required by regulations 40 CFR Part 191 and 10 CFR Part 60, could be constructed at the Yucca Mountain site. Forecasts of future climate conditions for the Yucca Mountain area will be based on both empirical and numerical techniques. The empirical modeling is based on the assumption that future climate change will follow past patterns. In this approach, paleclimate records will be analyzed to estimate the nature, timing, and probability of occurrence of certain climate states such as glacials and interglacials over the next 10,000 years. For a given state, key climate parameters such as precipitation and temperature will be assumed to be the same as determined from the paleoclimate data. The numerical approach, which is the primary focus of this paper, involves the numerical solution of basic equations associated with atmospheric motions. This paper describes these equations and the strategy for solving them to predict future climate conditions around Yucca Mountain. DOE

N92-23677# World Meteorological Organization, Geneva (Switzerland). World Climate Data and Monitoring Program.
CLIMATE SYSTEM MONITORING (CSM). EL NINO/SOUTHERN OSCILLATION (ENSO) DIAGNOSTIC ADVISORY, SPECIAL ISSUE
Jan. 1992 16 p
Avail: CASI MF A01; print copy available at WMO, Geneva, Switzerland

In this special issue of the Climate System Monitoring Bulletin analyses from three climate centers have been compiled under a single cover. The first analysis is from the Climate Analysis Center, National Weather Service of the U.S.A., the second is from the Darwin Regional/Specialized Meteorological Center (RSMC), Australia and the third includes a portion of the first issue of the South Pacific Climate Monitor, from New Zealand, National Climate Center. H.A.

N92-23771 Delaware Univ., Newark.
EVALUATION OF TERRESTRIAL CLIMATE VARIABILITY USING A MOISTURE INDEX Ph.D. Thesis
JOHANNES JAN FEDDEMA 1990 163 p
Avail: Univ. Microfilms Order No. DA9206297

A geographically dense station network of precipitation and temperature observations is used to evaluate global patterns of climate variation over the twenty-year period from Jan. 1951 to Dec. 1970. Selection of this particular time period is based on an analysis of the spatial representativeness of available monthly climate records from 1880 to 1987. This analysis illustrates the errors associated with varying station distributions through time. However, neither temperature nor precipitation alone is adequate for a comprehensive analysis of climate change. A modified form of Thornthwaite's moisture index, showing the relative moistness or dryness of a climate, is therefore evaluated since it represents

a more active or integrative factor in climate. The twenty-year time series of mean terrestrial moisture index values shows that moisture demand exceeds moisture supply by about 20 percent. There does not seem to be a consistent relationship between annual values of the mean moisture index values of the two hemispheres. Analysis of climate variation included the mapping and analysis of moisture indices on a 2 deg of latitude by 2 deg of longitude grid. A composite scenario of El Nino events was created from the six years of known El Nino events in the Pacific Ocean. Further spatial analysis involved the clustering of similar yearly moisture index distributions into six composites.
Dissert. Abstr.

N92-25476# New Mexico State Univ., Las Cruces. Water Resources Research Inst.
RIO GRANDE BASIN GLOBAL CLIMATE CHANGE SCENARIOS: PROCEEDINGS OF WORKSHOPS AND CONFERENCE
W. STONE, M. MINNIS, and E. TROTTER Jun. 1991 127 p Workshops and Conference held in Albuquerque, NM, 1-2 Jun. 1990 Sponsored in part by Sandia National Labs, Albuquerque, NM; and Bureau of Land Management, Albuquerque, NM
(PB92-106293; WRRI-M24) Avail: CASI HC A07/MF A02

Conference topics discussed include regional aspects of climate change, approaches to the problem, information and research needs, organizational and political perspectives, and funding.
GRA

N92-25493*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
ATMOSPHERIC WATER VAPOR MEASUREMENTS DURING THE SPECTRE CAMPAIGN USING AN ADVANCED RAMAN LIDAR
S. H. MELFI, D. N. WHITEMAN, R. A. FERRARE, S. E. BISSON, J. E. M. GOLDSMITH, and M. LAPP (Sandia National Labs., Albuquerque, NM.) 1991 6 p Presented at the CLEO/QELS '92, Anaheim, CA, 10-17 May 1992
(Contract DE-AC04-76DR-00789)
(NASA-TM-107822; NAS 1.15:107822; DE92-006703; SAND-91-8751; CONF-920573-5) Avail: CASI HC A02/MF A01

Water vapor is an important atmospheric state variable. From a dynamics stand point its distribution with height determines convective stability, which in turn controls storm development. From a radiative perspective, current global warming scenarios suggest that water vapor may contribute as much as twice the anticipated atmospheric temperature increase that would be caused by anthropogenic carbon dioxide along via a thermally induced feedback mechanism. Because atmospheric water vapor is radiatively active, accurate measurements with high spatial and temporal resolution are required to fully understand it's impact on future global surface temperature. An advanced Raman lidar has been designed to operate in both daylight and darkness. Details of the instrument will be presented. Results from operating during the SPECTRE Field Campaign will be discussed. DOE

N92-26822# National Meteorological Center, Washington, DC. Climate Analysis Center.
CLIMATE RESEARCH AT REGIONAL CLIMATE CENTERS IN 1991
Oct. 1991 101 p Presented at the 1991 Conferences of the American Meteorological Society on Applied Climatology, Agricultural and Forest Meteorology, and Biometeorology and Aerobiology, Salt Lake City, UT, 10-13 Sep. 1991
(PB92-160399) Avail: CASI HC A06/MF A02

The climate service mission of the National Oceanic and Atmospheric Administration (NOAA) is to supply high quality climate data and information to a diverse user community through a program of data acquisition, monitoring, and product development. The mission also includes determining the impacts of climate on the environment, commerce, and the economy of the U.S. To meet these goals of a nation wide system of climate services on the regional and local scale, NOAA sponsors a group of six Regional Climate Centers (RCCs) located throughout the contiguous U.S. The primary purpose of the assemblage of papers is to provide a resource for applied research performed either by personnel at RCCs or by scientists who have received support from the RCCs, and to furnish an example of the climate services rendered by the centers. The 14 papers presented on applied research can be grouped into four general categories. Six of the papers deal with information that can be used in design applications, three address climate change or impacts, three deal with climate records, and two address soil moisture related subjects. In addition, three papers on RCC operations and climate services are presented.
GRA

N92-26923# World Meteorological Organization, Geneva (Switzerland). World Climate Data and Monitoring Program.
REPORT OF THE CC1 WORKING GROUP ON CLIMATE CHANGE DETECTION
Oct. 1991 73 p First Session held in Geneva, Switzerland, 21-25 Oct. 1991
(WCDMP-14; WMO-TD-466) Avail: CASI MF A01; print copy available at WMO, Geneva, Switzerland

A number of topics were discussed, including the problem of detection of the greenhouse effect, climate normals datasets, the importance of the interdisciplinary approach to the detection problem, the sources of uncertainties in the climate record, the status of climate sets for climate change detection, the Climate Change Detection Project (CCDP), and working group recommendations.
Author

N92-29320*# Commonwealth Scientific and Industrial Research Organization, Mordialoc (Australia). Div. of Atmospheric Research.
LIDAR STUDIES OF EXTINCTION IN CLOUDS IN THE ECLIPS PROJECT
C. MARTIN, R. PLATT, STUART A. YOUNG, and GRAEME P. PATTERSON *In* NASA. Langley Research Center, Sixteenth International Laser Radar Conference, Part 1 p 345-348 Jul. 1992
Avail: CASI HC A01/MF A04

The Experimental Cloud Lidar Pilot Study (ECLIPS) project has now had two active phases in 1989 and 1991. A number of laboratories around the world have taken part in the study. The observations have yielded new data on cloud height and structure, and have yielded some useful new information on the retrieval of cloud optical properties, together with the uncertainties involved. Clouds have a major impact on the climate of the earth. They have the effect of reducing the mean surface temperature from 30 C for a cloudless planet to a value of about 15 C for present cloud conditions. However, it is not at all certain how clouds would react to a change in the planetary temperature in the event of climate change due to a radiative forcing from greenhouse gases. Clouds both reflect out sunlight (negative feedback) and enhance the greenhouse effect (positive feedback), but the ultimate sign of cloud feedback is unknown. Because of these uncertainties, campaigns to study clouds intensely were initiated. The International Satellite Cloud Climatology (ISCPP) and the FIRE Campaigns (cirrus and stratocumulus) are examples. The ECLIPS was set up similarly to the above experiments to obtain information specifically on cloud base, but also cloud top (where possible), optical properties, and cloud structure. ECLIPS was designed to allow as many laboratories as possible globally to take part to get the largest range of clouds. It involves observations with elastic backscatter lidar, supported by infrared fluxes at the ground and radiosonde data, as basic instrumentation. More complex experiments using beam filter radiometers, solar pyranometers, and satellite data and often associated with other campaigns were also encouraged to join ECLIPS. Two periods for observation were chosen, Sep. - Dec. 1989 and Apr. - Jul. 1992 into which investigators were requested to fit 30 days of observations. These would be either continuous, or arranged to coincide with NOAA satellite overpasses to obtain AVHRR data. The distribution of the ECLIPS international effort as in 1991 is shown. The main gaps in the global distribution are in the tropics and the Southern Hemisphere.
Author

N92-29653*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
MONTHLY MEANS OF SELECTED CLIMATE VARIABLES FOR 1985 - 1989
S. SCHUBERT, C.-Y. WU (General Sciences Corp., Laurel, MD.), J. ZERO (General Sciences Corp., Laurel, MD.), J.-K. SCHEMM (General Sciences Corp., Laurel, MD.), C.-K. PARK (Universities Space Research Association, Columbia, MD.), and M. SUAREZ Jun. 1992 390 p
(Contract RTOP 578-41-07-20)
(NASA-TM-104565; NAS 1.15:104565; REPT-92B00088) Avail: CASI HC A17/MF A04

Meteorologists are accustomed to viewing instantaneous weather maps, since these contain the most relevant information for the task of producing short-range weather forecasts. Climatologists, on the other hand, tend to deal with long-term means, which portray the average climate. The recent emphasis on dynamical extended-range forecasting and, in particular measuring and predicting short term climate change makes it important that we become accustomed to looking at variations on monthly and longer time scales. A convenient toll for researchers to familiarize themselves with the variability which occurs in selected parameters on these time scales is provided. The format of the document was chosen to help facilitate the intercomparison of various parameters and highlight the year-to-year variability in monthly means. Author

N92-29801# National Weather Service, Washington, DC. Climate Analysis Center.
PROCEEDINGS OF THE 16TH ANNUAL CLIMATE DIAGNOSTICS WORKSHOP
Mar. 1992 476 p Workshop held in Los Angeles, CA, 28 Oct. - 28 Nov. 1991
(PB92-167378) Avail: CASI HC A21/MF A04

The Sixteenth Annual Climate Diagnostics Workshop was hosted by the Department of Atmospheric Sciences at the University of California in Los Angeles. The workshop consisted of 10 sessions, entitled: ENSO; low frequency variability; stratosphere; ocean circulations; ocean-atmosphere interaction; special section on contemporary climate-variations, problems, and issues; global climate change; hydrology and precipitation; ENSO and seasonal forecasts; and climate prediction. GRA

N92-31089*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
RAMAN LIDAR MEASUREMENTS OF WATER VAPOR AND AEROSOL/CLOUDS DURING THE FIRE/SPECTRE FIELD CAMPAIGN
S. H. MELFI, D. WHITEMAN, R. FERRARE, K. EVANS, J. E. M. GOLDSMITH (Sandia National Labs., Livermore, CA.), M. LAPP (Sandia National Labs., Livermore, CA.), and S. E. BISSON (Sandia National Labs., Livermore, CA.) *In* NASA. Langley Research Center, 16th International Laser Radar Conference, Part 2 p 663-666 Jul. 1992 Prepared in cooperation with Universities Space Research Association, Columbia, MD; and Hughes STX, Inc., Lanham, MD
Avail: CASI HC A01/MF A03

Water vapor is one of the most important constituents of the earth's atmosphere. It has a major impact on both atmospheric dynamics and radiative transfer. From a dynamic standpoint, the distribution of water vapor with height determines convective stability which is the major indicator of destructive storm development. Also, water vapor stored in the planetary boundary layer acts as the fuel to intensify severe weather. In regards to radiative transfer, water vapor is the most active IR molecule in the atmosphere. It is more effective in absorbing and emitting IR radiation than either carbon dioxide or methane, and thus plays an important role in global change. The main objective of FIRE (First ISSCCP (International Satellite Cloud Climatology Project) Regional Experiment) was to study the development and radiative characteristics of cirrus clouds. The SPECTRE (Spectral Radiation Experiment) project was designed to acquire the necessary atmospheric observations to compare radiative measurements with radiative transfer theory, with special emphasis on understanding the water vapor spectral continuum. The FIRE/SPECTRE field campaign was conducted during Nov. - Dec. 1991 in Coffeyville, Kansas. A complete understanding of water vapor, its distribution with height, and its temporal variation was important for both experiments. Author

N92-31734# National Climatic Data Center, Asheville, NC.
COMPREHENSIVE AEROLOGICAL REFERENCE DATA SET (CARDS)
R. E. ESKRIDGE 1992 79 p
(Contract DE-AI05-90ER-61011)
(DE92-016469; DOE/ER-61011/T2) Avail: CASI HC A05/MF A01

Under the CO2 doubling scenario, the current numerical climate models are robust in predicting that surface temperatures will rise markedly in the polar regions and that stratospheric temperatures will decrease markedly. The goal of the CARDS project is to produce an upper air data set based on radiosonde and pibal observations suitable for use in evaluating climate models and detecting climate change. We are taking a number of steps to achieve this goal: we have begun collecting upper air data from various sources, we are developing plans to digitize (key) selected older data, we are developing station histories, we have developed version 1.0 of a quality control (QC) program, and we are developing methods for removing biases (systematic errors) from these data. A final step to ensure data integrity will consist of an analysis of these data in the context of greenhouse-gas induced climate modification. DOE

N92-32431# Oak Ridge National Lab., TN. Carbon Dioxide Information Analysis Center.
US HISTORICAL CLIMATOLOGY NETWORK DAILY TEMPERATURE AND PRECIPITATION DATA
D. P. KAISER, P. Y. HUGHES (National Oceanic and Atmospheric Administration, Asheville, NC.), E. H. MASON (National Oceanic and Atmospheric Administration, Asheville, NC.), T. R. KARL (National Oceanic and Atmospheric Administration, Asheville, NC.), and W. A. BROWER (National Oceanic and Atmospheric Administration, Asheville, NC.) Feb. 1992 138 p
(Contract DE-AC05-84OR-21400)
(DE92-014920; ORNL/CDIAC-50; NDP-042) Avail: CASI HC A07/MF A02

This document describes a data base containing daily observations of maximum and minimum temperature and precipitation amounts from 138 US stations. These stations are a specially chosen subset of the 1219-station US Historical Climatology Network (HCN), compiled by the National Climatic Data Center (Asheville, North Carolina). The daily data network (herein referred to as the HCN/D) consists of stations considered to be the best of those from the HCN, selected to provide reasonably homogeneous spatial coverage of the contiguous US after considering the temporal homogeneity of each station's observing times, instrument types/positions, and surroundings. The data for each station extend through 1987, and most station records are complete for at least 80 years. The daily resolution of these data lends maximum flexibility for studies attempting to detect and monitor long-term climatic changes on a regional scale. Studies using daily data may be able to detect changes in regional climate that would not be apparent from analysis of the more commonly used monthly temperature and precipitation data. Such studies may include analyses of trends in maximum/minimum temperatures, temperature extremes, daily temperature range, precipitation 'event size' frequency, and the magnitude and duration of wet and dry periods. Other applications of the data include planning and risk assessment in areas such as agriculture, natural resource exploration, and construction. This document describes how the stations in the HCN/D were selected, defines limitations and restrictions of the data, describes the format and contents of the magnetic tape, and provides reprints of literature pertinent to the collection and application of daily climate data. DOE

N92-33173# Illinois State Water Survey, Champaign. Office of Applied Climatology.
APPLICATIONS OF STATISTICAL METHODS TO THE STUDY OF CLIMATE AND FLOODING FLUCTUATIONS IN THE CENTRAL US Final Report
K. E. KUNKEL, S. A. CHANGNON, and R. T. SHEALY Mar. 1992 182 p Sponsored by Geological Survey
(Contract USGS-14-08-0001-G1731)
(PB92-205137; USGS/G-1731) Avail: CASI HC A09/MF A02

Because of concern about the potential hydrologic impacts of potential future climate change, historical streamflow and precipitation data were analyzed to determine whether significant temporal fluctuations in flooding and heavy precipitation event frequencies have occurred in the 20th century. The study encompasses 80 streamgaging stations and 230 precipitation stations located in a 9-state region (IL, IN, IA, KY, MI, MN, MO, OH, and WI) in the central U.S. The time period for the study was 1921-1985. Partial duration series analysis of the daily data were used to identify extreme events using a threshold for a 1-year recurrence event. The warm season and cold season were analyzed separately. Statistical techniques, including the Kolmogorov-Smirnov test and robust regression with Huber-weighting of the residuals, were used to identify significant temporal fluctuations in event frequencies, magnitudes, and durations. Many stations did not exhibit significant fluctuations. However, upward trends in flood frequencies were found in MN, IA, and northern IL in the warm season, and IA, southwestern IL, and OH in the cold season. Trends were less noticeable in duration and magnitude. Analysis of the precipitation data indicated that the occurrence of heavy rainfall events is not well correlated with overall climate anomalies. GRA

N92-34046 Pennsylvania State Univ., University Park.
VARIABILITY OF 500-MB GEOPOTENTIAL HEIGHTS IN A GENERAL CIRCULATION MODEL AND THE PROJECTION OF REGIONAL GREENHOUSE EFFECT CLIMATE CHANGE Ph.D. Thesis
MICHAEL ANTHONY PALECKI 1991 256 p
Avail: Univ. Microfilms Order No. DA9127396

Many researchers have utilized general circulation models (GCM's) in establishing climate change scenarios for specific regions or locations, despite the mismatch of spatial scales involved. A major underlying assumption involved in utilizing model output in this manner is that the GCM contains mid-tropospheric dynamics that are internally consistent with those of the real climate system. The main purpose of this study is to examine the forms and processes of mid-tropospheric variability in the Goddard Institute for Space Studies (GISS) GCM, with the hope of shedding light on this model-analog strategy. The response of mean 500 mb and surface air temperature fields in the GISS GCM to a doubling of CO2 indicates a substantial relationship between the two. Unfortunately, the GISS GCM demonstrates systematic flaws in its simulation of mid-tropospheric dynamics. These are revealed in an examination of high-frequency and low-frequency 500-mb teleconnections in the model. The shapes and amplitudes of known teleconnection patterns are not simulated well. This is likely due to the weak stationary wave structure found in the control run of the model. More importantly, several model teleconnections appear to coincide geographically with the patterns of mean climate change. This may indicate a direct relationship between the modeled mid-tropospheric dynamics and the spatial patterns of mean climate change. This finding has two important implications. First, it is necessary to further study the influence of GCM mid-tropospheric dynamics on the spatial distribution of climate changes being modeled. Second, and more fundamentally, spatially specific climate system feedbacks may be substantially affected by variations in teleconnection strength and frequency, potentially impacting the global climate far beyond the regional scale.
Dissert. Abstr.

N92-34100# Lawrence Livermore National Lab., CA.
ATMOSPHERIC CHEMISTRY AND CLIMATE PREDICTABILITY: TOWARDS AN ADVANCED CLIMATE MODEL
D. J. WUEBBLES, J. E. PENNER, and D. A. ROTMAN Apr. 1992 4 p Presented at the Computer Hardward Advanced Mathematics and Model Physics (CHAMMP) Science Meeting, Las Vegas, NV, 17 Mar. 1992
(Contract W-7405-ENG-48)
(DE92-017437; UCRL-JC-110812; CONF-9203118-2) Avail: CASI HC A01/MF A01

The goal of this project is to emphasize the role of atmospheric chemistry and tracer transport in determining the predictability of climate change and to develop the chemical-transport modeling capability needed for advanced climate modeling through accurate and efficient calculations of global climate phenomena affected by atmospheric chemistry, radiation, and transport processes. The interactions between these processes are of major importance to the large questions of global climate change, and in general, to global climates. This study has four main objectives: (1) to show and investigate the strong interaction between chemistry and global climate and global climate change, with the purpose of determining how these interactions affect climate predictability and the accuracy with which climate projections can be made; (2) to study and develop new model physics and numerical algorithms for atmospheric chemical, radiative, microphysical, and transport processes which are needed for a more accurate prediction of global climate and climate change; (3) to develop a next generation three dimensional chemistry-transport model that can fully interface (or be run stand alone when appropriate) with a GCM within the advanced climate modeling framework to accurately calculate these interactions on a regional to global scale; and (4) to design and implement this new chemistry-transport model on a massively parallel machine for high resolution large-scale application to global change questions. DOE

48

OCEANOGRAPHY

Includes biological, dynamic, and physical oceanography; and marine resources.

A92-14650
OCEAN CIRCULATION BENEATH THE RONNE ICE SHELF
K. W. NICHOLLS, K. MAKINSON, and A. V. ROBINSON (NERC, British Antarctic Survey, Cambridge, England) Nature (ISSN 0028-0836), vol. 354, Nov. 21, 1991, p. 221-223. 21 Nov. 1991 3 p refs
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Oceanographic data have been obtained from beneath the largest Antarctic ice shelf, the Ronne-Filcher shelf in the southern Weddell Sea. The data agree well with predictions of a relatively simple oceanographic plume model of sub-ice-shelf circulation. This model can be used with some confidence to investigate the links between climate changes, ice-shelf melting, and bottom-water production. C.D.

A92-14894
EVALUATION OF MULTICHANNEL SEA SURFACE TEMPERATURE PRODUCT QUALITY FOR CLIMATE MONITORING - 1982-1988
JOHN J. BATES and HENRY F. DIAZ (NOAA, Climate Monitoring and Diagnostics Laboratory, Boulder, CO) Journal of Geophysical Research (ISSN 0148-0227), vol. 96, Nov. 15, 1991, p. 20,613-20,622. 15 Nov. 1991 10 p refs

This study presents satellite-derived multichannel sea surface temperature (MCSST) data evaluated for the period 1982-1988 relative to in situ data from the comprehensive ocean-atmosphere data set (COADS). Statistical methods are used to assess the quality of the MCSST data. Temporal anomaly cross correlations are significant at the 95-percent confidence level for all basins and subregions examined, except for the North Atlantic Ocean. Signal-to-noise variance ratios range from 0.49 in the North Atlantic

Ocean to above 4 in the equatorial Pacific. Mean differences between MCSST and COADS show that the MCSST values are lower than COADS by 0.19 to 0.64 C. The mean differences are found to have an annual cycle that varies with latitude and season. The mean MCSST standard deviations are almost always lower than those of COADS, ranging from 0.03 to 0.45 C. C.A.B.

A92-15053
LONG-PERIOD OSCILLATIONS OF THE TEMPERATURES OF THE SEA SURFACE AND THE AIR OVER THE OCEAN [DOLGOPERIODNYE KOLEBANIIA TEMPERATURY VODY POVERKHNOSTI MIROVOGO OKEANA I TEMPERATURY VOZDUKHA NAD OKEANOM]
A. V. TSVETKOV and V. F. LOGINOV IN: Theory and prediction of climate change 1990 7 p In RUSSIAN refs
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Results are presented on an analysis of data on long-period oscillations of midseasonal sea-surface temperature (SST) and of the near-surface air temperature (AT), averaged over 14 zones of the Northern and the Southern Hemispheres for the time period 1870-1979. The analysis of SST and AT fields indicated that the temperature minimum at moderate latitudes of the Northern Hemisphere arrived 5-10 years earlier than in the Southern Hemisphere. This delay is explained by the thermal inertia of the ocean to the effects of global-scale phenomena, such as volcanic activity. I.S.

A92-15119
MONITORING OF VARIATIONS OF THE WORLD-OCEAN CLIMATE [MONITORING KLIMATICHESKIKH IZMENENII MIROVOGO OKEANA]
S. K. GULEV, S. S. LAPPO, and V. P. TERESHCHENKOV (Gosudarstvennyi Okeanograficheskii Institut, Moscow, USSR) Akademiia Nauk SSSR, Izvestiia, Fizika Atmosfery i Okeana (ISSN 0002-3515), vol. 27, Oct. 1991, p. 1043-1053. In Russian. Oct. 1991 11 p In RUSSIAN refs
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The possibilities of forecasting short-period climatic oscillations by monitoring the energy-active ocean zones within the framework of the Razrezy program are considered. It is shown that the energy-active zones are characterized by extreme magnitudes of heat fluxes at the ocean-atmosphere boundary and by their maximum variability. An analysis is presented of the effectiveness of the energy-active zone concept for identifying climatically significant variations in the ocean that are regulated by global ocean circulation. The main elements of monitoring this process are discussed. P.D.

A92-17683
NUMERICAL EXPERIMENTS ON THE SIMULATION OF SEA SURFACE TEMPERATURE FOR THE LAST 18,000 YEARS
JULIAN ADEM (Universidad Nacional Autonoma de Mexico, Coyoacan, Mexico) Annales Geophysicae (ISSN 0939-4176), vol. 9, Jan. 1991, p. 42-49. Jan. 1991 8 p refs
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A92-20116* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
EVAPORATION OVER GLOBAL OCEANS DERIVED FROM SATELLITE DATA AND AGCM
W. T. LIU (JPL, Pasadena, CA) IN: Symposium on Global Change Studies, 2nd, New Orleans, LA, Jan. 14-18, 1991, Preprints. Boston, MA, American Meteorological Society, 1991, p. 33-36. 1991 4 p refs
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Evaporation over ocean at 100 km has been estimated using operational satellite data. Recent satellite results are compared to data obtained through atmospheric general circulation models (AGCMs). A large systematic error is found in AGCM data which is considered to be due to overestimation of atmospheric moisture. It is suggested that the discrepancy may be caused by errors in operational infrared sounder data assimilated into the model. The error may also be caused by interpolation of very sparse in situ data in areas of sharp gradients. O.G.

A92-22396
EVIDENCE FROM SOUTHERN OCEAN SEDIMENTS FOR THE EFFECT OF NORTH ATLANTIC DEEP-WATER FLUX ON CLIMATE
CHRISTOPHER D. CHARLES and RICHARD G. FAIRBANKS (Lamont-Doherty Geological Observatory, Palisades; Columbia University, New York) Nature (ISSN 0028-0836), vol. 355, Jan. 30, 1992, p. 416-419. Research supported by NSF. 30 Jan. 1992 4 p refs
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The Southern Ocean is perhaps the only region where fluctuations in the global influence of North Atlantic Deep Water (NADW) can be monitored unambiguously in single deep-sea cores. A carbon isotope record from benthic foraminifera in a Southern Ocean core reveals large and rapid changes in the flux of NADW during the last deglaciation, and an abrupt increase in the NADW production rate which immediately preceded large-scale melting of the Northern Hemisphere ice sheets. This sudden strengthening of the NADW thermohaline cell provides strong evidence for the importance of NADW in glacial-interglacial climate change. Author

A92-22549* National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
SEA SURFACE TEMPERATURE-CLOUD RELATIONSHIP
THOMAS C. PETERSON and THOMAS H. VONDER HAAR (Colorado State University, Fort Collins) IN: Conference on Satellite Meteorology and Oceanography, 5th, London, England, Sept. 3-7, 1990, Preprints 1990 2 p refs
(Contract NAG1-865)
Copyright

Initial results are reported from an observational study which determines how clouds change when the surface warms. Strong regional variation which highlights many features of the atmosphere is found. Analysis of high cloud-SST least absolute deviation indicates that high clouds tend to increase with increasing SST. The idea that the cloud radiative feedback loop in global warming is positive is validated. C.A.B.

A92-24972
AN ENERGY-SALINITY BALANCE CLIMATE MODEL - WATER VAPOR TRANSPORT AS A CAUSE OF CHANGES IN THE GLOBAL THERMOHALINE CIRCULATION
HUAXIAO WANG and G. E. BIRCHFIELD (Northwestern University, Evanston, IL) Journal of Geophysical Research (ISSN 0148-0227), vol. 97, Feb. 15, 1992, p. 2335-2346. 15 Feb. 1992 12 p refs
(Contract NSF ATM-89-12967)
Copyright

A92-34165 National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
INTERANNUAL VARIABILITY OF MONTHLY SOUTHERN OCEAN SEA ICE DISTRIBUTIONS
CLAIRE L. PARKINSON (NASA, Goddard Space Flight Center, Greenbelt, MD) Journal of Geophysical Research (ISSN 0148-0227), vol. 97, no. C4, April 15, 1992, p. 5349-5363. Research supported by NASA. 15 Apr. 1992 15 p refs

The interannual variability of the Southern-Ocean sea-ice distributions was mapped and analyzed using data from Nimbus-5 ESMR and Nimbus-7 SMMR, collected from 1973 to 1987. The set of 12 monthly maps obtained reveals many details on spatial variability that are unobtainable from time series of ice extents. These maps can be used as baseline maps for comparisons against future Southern Ocean sea ice distributions. The maps are supplemented by more detailed maps of the frequency of ice coverage, presented in this paper for one month within each of the four seasons, and by the breakdown of these results to the periods covered individually by each of the two passive-microwave imagers. I.S.

A92-38036
SUDDEN CHANGES IN NORTH ATLANTIC CIRCULATION DURING THE LAST DEGLACIATION
SCOTT J. LEHMAN and LLOYD D. KEIGWIN (Woods Hole Oceanographic Institution, MA) Nature (ISSN 0028-0836), vol. 356, no. 6372, April 30, 1992, p. 757-762. Research supported by NSF and NOAA. 30 Apr. 1992 6 p refs
Copyright

Sudden changes in the flow of warm Atlantic surface waters into the Norwegian Sea occurred frequently during the last deglaciation, typically involving shifts in sea surface temperature of 5 C or more in fewer than 40 years. These led to equally large and rapid changes in atmospheric temperatures, and to shifts in Atlantic deep thermohaline circulation and ice-sheet melting rates. Author

A92-38039
WATER MASS EXCHANGE BETWEEN THE NORTH ATLANTIC AND THE NORWEGIAN SEA DURING THE PAST 28,000 YEARS
TERJE VEUM, EYSTEIN JANSEN (Bergen, University, Norway), MAURICE ARNOLD (Centre des Faibles Radioactivites, Gif-sur-Yvette, France), IDA BEYER (Bergen, University, Norway), and JEAN-CLAUDE DUPLESSY (Centre des Faibles Radioactivites, Gif-sur-Yvette, France) Nature (ISSN 0028-0836), vol. 356, no. 6372, April 30, 1992, p. 783-785. Research supported by NAF, CNRS, and EEC. 30 Apr. 1992 3 p refs
Copyright

Carbon and oxygen isotope data are presented that provide a record of circulation changes in the Greenland, Iceland, and Norwegian (GIN) seas during and at the termination of the Last Glacial Maximum (LGM). Inflow of nutrient-depleted waters from the GIN seas to form intermediate waters of the North Atlantic resulted in nutrient enrichment of North Atlantic deep water and consequent enhanced drawdown of atmospheric CO2, contributing to the lower atmospheric p(CO2) during the LGM. The onset of deglaciation occurred at a time of low salinity in the GIN seas and thus of reduced thermohaline circulation. Although strong thermohaline circulation was later reinitiated in the North Atlantic as deglaciation proceeded, it cannot therefore have caused the onset of warming. Similarly, it is found that rapid changes in thermohaline circulation cannot account for the transient return to a cooler climate during the Younger Dryas episode. C.D.

A92-38084
SATELLITE-DERIVED SEA SURFACE TEMPERATURES - A COMPARISON BETWEEN OPERATIONAL, THEORETICAL, AND EXPERIMENTAL ALGORITHMS
IAN J. BARTON (CSIRO, Div. of Atmospheric Research, Aspendale, Australia) Journal of Applied Meteorology (ISSN 0894-8763), vol. 31, no. 5, May 1992, p. 433-442. May 1992 10 p refs
Copyright

The performance of prelaunch algorithms for deriving sea surface temperature (SST) is evaluated using data from operational satellites (the AVHRR on the NOAA satellites) and surface-based SST measurements combined with simultaneous radiosonde profile measurements of atmospheric temperature and water vapor content. Also, AVHRR data are used to derive experimental multipath SST algorithms that are compared with those derived theoretically. The results obtained indicate that computer models of infrared transmission through the atmosphere are not yet capable of reproducing the observed satellite measurements. V.L.

A92-38095
WARMING OF THE WATER COLUMN IN THE SOUTHWEST PACIFIC OCEAN
NATHANIEL L. BINDOFF (CSIRO, Div. of Oceanography, Hobart, Australia) and JOHN A. CHURCH (CSIRO, Div. of Oceanography; Cooperative Research Center for Antarctic and Southern Ocean Studies, Hobart, Australia) Nature (ISSN 0028-0836), vol. 357, no. 6373, May 7, 1992, p. 59-62. 7 May 1992 4 p refs
Copyright

On the basis of measurements made 22 yrs apart of full-depth temperature sections in the Pacific Ocean between Australia and New Zealand, it is shown here that there has been a depth-averaged warming of 0.04 C and 0.03 C at 43 deg S and 28 deg S, respectively, throughout most of the water column below the mixed layer. The sea-level rise caused by expansion between a depth of 300 m and the ocean floor is 2-3 cm, consistent with the observed rate of global sea-level rise. In the main thermocline there is a coherent cooling and freshening on density surfaces consistent with surface warming in the southern ocean where these waters originate. C.D.

A92-41025
GLOBAL CHANGE EFFECTS ON EARLY HOLOCENE SEDIMENTATION OF THE BRAZILIAN CONTINENTAL SHELF DETERMINED FROM TM-LANDSAT 5 DATA OF THE SEAFLOOR
A. P. CABRAL, M. L. VIANNA, and D. F. M. GHERARDI (INPE, Sao Jose dos Campos, Brazil) IN: International Symposium on Remote Sensing of Environment, 24th, Rio de Janeiro, Brazil, May 27-31, 1991, Proceedings. Vol. 2 1992 11 p refs
Copyright

A92-44794
SOME FACTORS CONTROLLING THE CLIMATOLOGICAL EVOLUTION OF THE UPPER-LAYER SEA TEMPERATURE AT TRIESTE
F. CRISCIANI, S. FERRARO, and F. RAICICH (CNR, Istituto Sperimentale Talassografico, Trieste, Italy) Nuovo Cimento C, Serie 1 (ISSN 0390-5551), vol. 15 C, no. 2, Mar.-Apr. 1992, p. 173-179. Apr. 1992 7 p refs
Copyright

A92-44827
LOW-FREQUENCY INTERNAL OCEANIC VARIABILITY UNDER SEASONAL FORCING
PAUL G. MYERS and ANDREW J. WEAVER (McGill University, Montreal, Canada) Journal of Geophysical Research (ISSN 0148-0227), vol. 97, no. C6, June 15, 1992, p. 9541-9563. Research supported by NSERC, Atmospheric Environment Service, and Ministere de l'Education du Quebec. 15 Jun. 1992 23 p refs
Copyright

A series of numerical experiments are conducted using the Bryan-Cox ocean general circulation model to investigate the potential existence of low-frequency variability of the thermohaline circulation under seasonal forcing. Experiments are performed with different combinations of a seasonal cycle being present or not on the restoring temperature, the surface freshwater flux fields (mixed boundary conditions), and the surface wind forcing. Despite the presence of forcing on the dominant seasonal time scale, it is found that the system may oscillate at the decadal period or longer. The decadal variability is excited by changes in the net surface density flux which are due to the advection of temperature and salinity anomalies in the model domain. The magnitude of the seasonal cycle also plays an important role in determining the time scale of variability. Violent overturning events may occur on the century time scale under seasonal forcing. The magnitudes of the flushes are reduced compared with those found in similar experiments without the presence of a seasonal cycle. Author

A92-48659
ON THE RESPONSE OF THE EQUILIBRIUM THICKNESS DISTRIBUTION OF SEA ICE TO ICE EXPORT, MECHANICAL DEFORMATION, AND THERMAL FORCING WITH APPLICATION TO THE ARCTIC OCEAN
GORAN BJORK (Goteborg, University, Sweden) Journal of Geophysical Research (ISSN 0148-0227), vol. 97, no. C7, July 15, 1992, p. 11,287-11,298. Research supported by NFR. 15 Jul. 1992 12 p refs
Copyright

A92-49377
OCEAN WARMING AND SEA LEVEL RISE ALONG THE SOUTHWEST U.S. COAST

DEAN ROEMMICH (Scripps Institution of Oceanography, La Jolla, CA) Science (ISSN 0036-8075), vol. 257, no. 5068, July 17, 1992, p. 373-375. Research supported by Scripps Institution of Oceanography and NSF. 17 Jul. 1992 3 p refs
Copyright

Hydrographic time-series data recorded during the past 42 years in the upper 500 meters off the coast of southern California indicate that temperatures have increased by 0.8 C uniformly in the upper 100 meters and that temperatures have risen significantly to depths of about 300 meters. The effect of warming the surface layer of the ocean and thereby expanding the water column has been to raise sea level by 0.9 +/- 0.2 mm/yr. Tide gauge records along the coast are coherent with steric height and show upward trends in sea level that vary from about 1 to 3 mm/yr. Author

A92-51418
VARIABILITY IN SEA-ICE THICKNESS OVER THE NORTH POLE FROM 1977 TO 1990
A. S. MCLAREN (Lamont-Doherty Geological Observatory, Palisades, NY), J. E. WALSH (Illinois, University, Urbana), R. H. BOURKE (U.S. Naval Postgraduate School, Monterey, CA), R. L. WEAVER (Cooperative Institute for Research in Environmental Sciences, Boulder, CO), and W. WITTMANN Nature (ISSN 0028-0836), vol. 358, no. 6383, July 16, 1992, p. 224-226. Research supported by NSF. 16 Jul. 1992 3 p refs
Copyright

An analysis is presented of measurements of the subsurface ice thickness of sea ice around the North Pole made from 1977 to 1990. These data represent the most extensive data set so far for ice draft in the central Arctic at the same season and location. The results reveal considerable interannual variability both in mean ice draft and in open water extent. This variability limits the confidence that can be placed in any apparent trends observed for sea-ice thickness or type since the late 1970s and illustrates the need for a reliable baseline against which to assess future trends. C.D.

A92-52867
GLOBAL SEA LEVEL ACCELERATION
BRUCE C. DOUGLAS (NOAA, National Oceanographic Data Center, Washington) Journal of Geophysical Research (ISSN 0148-0227), vol. 97, no. C8, Aug. 15, 1992, p. 12,699-12,706. Research sponsored by NOAA. 15 Aug. 1992 8 p refs

For the 1905-1985 period, 23 essentially complete tide gage records in 10 geographic groups show an apparent global acceleration of sea-level rise of -0.011 +/- 0.012 mm/yr-squared. There is on this basis judged to be no evidence for an acceleration in the last century which is significant either statistically or in light of values associated with global warming. Tide gages alone, however, cannot serve as a leading indicator of climate change in less than at least several decades; confirming the prediction of a particular model at the 95-percent confidence level or differentiating between model predictions will take much longer. O.C.

A92-53838
ANALYSIS OF THE SURFACE TEMPERATURE IN THE WORLD OCEAN [ANALIZ TEMPERATURY POVERKHNOSTI MIROVOGO OKEANA]
D. A. LARIN (Institut Global'nogo Klimata I Ekologii, Moscow, Russia) Meteorologiia i Gidrologiia (ISSN 0130-2906), no. 2, Feb. 1992, p. 60-65. In Russian. Feb. 1992 6 p In RUSSIAN refs
Copyright

A method is presented for analyzing the sea surface temperature (SST), which was developed in the Department of Climate Dynamics of the Institute of Global Climate and Ecology (IGCE). It is shown that the IGCE method makes it possible to determine the surface temperature of any region of the world ocean as well as of world ocean as a whole. Excellent agreement was obtained between the results predicted by the IGCE method and observations. I.S.

A92-53846
CHANGES OF THE CHARACTERISTICS OF THE ARCTIC-SEA ICE DUE TO THE DOUBLING OF THE CO2 CONCENTRATION [IZMENENIE KHARAKTERISTIK ARKTICHESKOGO MORSKOGO L'DA PRI UDVOENII KONTSENTRATSII UGLEKISLOGO GAZA]
M. P. KOLOMEEV and S. L. MALYSHEV (NPO Taifun, Obninsk, Russia) Meteorologiia i Gidrologiia (ISSN 0130-2906), no. 4, April 1992, p. 45-52. In Russian. Apr. 1992 8 p In RUSSIAN refs
Copyright

A 3D energy-balanced climatic model developed for simulating seasonal variations in ice characteristics in the Northern Hemisphere was used to study the response of sea ice to the doubling of atmospheric CO2. It was found that, under conditions of CO2 doubling, the summertime ice cover decreases from 6.2 million sq km under normal conditions to 1.1 million sq; ice is preserved only north of Greenland. In the wintertime, the ice-covered area decreases by 18 percent. Compared with the undisturbed state, the average ice thickness within the zone between 80 deg N and 90 deg N decreases twofold. The relationship between the ice distribution and global warming is discussed. I.S.

N92-11602# Joint Oceanographic Inst., Inc., Washington, DC.
THEORY AND MODELING IN GLOBEC: A FIRST STEP
E. HOFMANN, T. OSBORN, T. POWELL, J. PRICE, B. ROTHSCHILD, and J. ROUGHGARDEN Feb. 1991 14 p
Avail: CASI HC A03/MF A01

Evidence continues to accumulate that the environment of Earth is changing. The changes involve physical, geological, chemical, and biological processes. A great challenge is to assess the direction and magnitude of the response of the planet's environment to these changes. GLOBEC (GLOBal ocean ECosystems dynamics) is an initiative proposed by the oceanographic and fisheries communities to determine the impact of the changes in our global environment on the populations and communities of marine animals. The GLOBEC approach is to develop fundamental information about the basic mechanisms that determine the abundance and distribution of marine animal populations and, most importantly, the variability of these populations about their average values. Through understanding of these fundamental mechanisms reliable predictions of population changes in the face of a shifting global environment can be obtained. The GLOBEC program is detailed. Author

N92-11603*# National Aeronautics and Space Administration, Washington, DC.
GLOBEC: GLOBAL OCEAN ECOSYSTEMS DYNAMICS: A COMPONENT OF THE US GLOBAL CHANGE RESEARCH PROGRAM Initial Science Plan Report No. 1
Feb. 1991 91 p Prepared in cooperation with Joint Oceanographic Inst., Inc., Washington, DC
(NASA-TM-105121; NAS 1.15:105121) Avail: CASI HC A05/MF A01

GLOBEC (GLOBal ocean ECosystems dynamics) is a research initiative proposed by the oceanographic and fisheries communities to address the question of how changes in global environment are expected to affect the abundance and production of animals in the sea. The approach to this problem is to develop a fundamental understanding of the mechanisms that determine both the abundance of key marine animal populations and their variances in space and time. The assumption is that the physical environment is a major contributor to patterns of abundance and production of marine animals, in large part because the planktonic life stages typical of most marine animals are intrinsically at the mercy of the fluid motions of the medium in which they live. Consequently, the authors reason that a logical approach to predicting the potential impact of a globally changing environment is to understand how the physical environment, both directly and indirectly, contributes to animal abundance and its variability in marine ecosystems. The plans for this coordinated study of of the potential impact of global change on ocean ecosystems dynamics are discussed. Author

N92-15514*# National Aeronautics and Space Administration, Washington, DC.
GLOBEC (GLOBAL OCEAN ECOSYSTEMS DYNAMICS: NORTHWEST ATLANTIC PROGRAM GLOBEC Report No. 2
Feb. 1991 113 p Presented at the GLOBEC Canada/US Meeting on NW Atlantic Fisheries and Climate, Dartmouth, Nova Scotia, 19-21 Jun. 1990 Prepared in cooperation with Joint Oceanographic Inst., Inc., Washington, DC
(NASA-TM-105122; NAS 1.15:105122) Avail: CASI HC A06/MF A02 CSCL 08C

The specific objective of the meeting was to plan an experiment in the Northwestern Atlantic to study the marine ecosystem and its role, together with that of climate and physical dynamics, in determining fisheries recruitment. The underlying focus of the GLOBEC initiative is to understand the marine ecosystem as it related to marine living resources and to understand how fluctuation in these resources are driven by climate change and exploitation. In this sense the goal is a solid scientific program to provide basic information concerning major fisheries stocks and the environment that sustains them. The plan is to attempt to reach this understanding through a multidisciplinary program that brings to bear new techniques as disparate as numerical fluid dynamic models of ocean circulation, molecular biology and modern acoustic imaging. The effort will also make use of the massive historical data sets on fisheries and the state of the climate in a coordinated manner. Author

N92-22839# Max-Planck-Inst. fuer Chemie, Mainz (Germany).
AIR-SEA INTERACTION
K. HASSELMANN *In* ESA, Report of the Earth Observation User Consultation Meeting p 115-118 Oct. 1991 Original contains color illustrations
Copyright Avail: CASI HC A01/MF A03; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 75 Dutch guilders

Since the atmosphere and the ocean are the two most important parts of the climate system, it is expected that a major thrust in climate research will be directed in the future towards a better understanding and modeling of the coupled ocean-atmosphere system. This coupling occurs at the air/sea interface. In the large scale, the two systems interact by means of the fluxes of solar and infrared radiation and by exchange of momentum, latent and sensible heat, and fresh water (precipitation minus evaporation). On the smaller scale, these fluxes are governed by complex turbulent interaction processes at the moving sea surface. They can be determined reliably only through a proper understanding of the dynamics of the interface and the interactions of the turbulent atmospheric and oceanic boundary layers in which it is embedded. Air sea fluxes are normally represented in large scale ocean, atmosphere or coupled models by highly simplified bulk formulae. Improved descriptions of these fluxes are looked for; the benefits that these would have for climate studies are stated. A table of the sea surface and near sea surface variables that can be measured from space is presented. Reasons for implementing an end to end data assimilation system, including sensor algorithms, data quality control, first guess forecasts, and model initialization are given. ESA

N92-24357# Observatorium Hoher List, Daun (Germany).
EARTH ROTATION AND OCEANS: EFFECTS OF TIDES AND OCEAN FLOWS ON THE POSITION OF THE EARTH IN SPACE [ERDROTATION UND OZEANE: EINFLUESSE VON GEZEITEN UND OZEANISCHEN STROEMUNGEN AUF DIE STELLUNG DER ERDE IM RAUM]
In Minister fuer Wissenschaft und Forschung des Landes Nordrhein-Westfalen, Subject Space 2: A Documentation on Space Research in North-Rhineland-Westphalia in the Period 1985-1990 p 29-30 Dec. 1990 In GERMAN
Avail: CASI HC A01/MF A02

The effects of oceanic geophysical processes on the Earth's rotation were investigated using highly precise VLBI (Very Long Base Interferometry) data. Global changes of the total angular momentum and hence of the Earth's position were determined from the changes of the ocean level provided by hydrodynamical models, and from the velocities of the water masses. The small signals in the VLBI data which are due to ocean holes were determined. ESA

N92-27340# McGill Univ., Montreal (Quebec). Centre for Climate and Global Change Research.
CURRENT AND FUTURE TRENDS IN ARCTIC CLIMATE RESEARCH: CAN CHANGES OF THE ARCTIC SEA ICE BE USED AS AN EARLY INDICATOR OF GLOBAL WARMING?
LAWRENCE A. MYSAK Jan. 1991 35 p Presented at the Role of Sea Ice in Climate Change Studies Workshop, Montreal, Quebec, 29-30 Nov. 1990 Sponsored by Natural Sciences and Engineering Research Council; Atmospheric Environment Service; and ONR
(CGCR-91-1; CTN-92-60523) Avail: CASI HC A03/MF A01

The response of recently developed coupled atmosphere-ocean general circulation models to an increase of atmospheric CO2 concentration is reviewed, with special emphasis given to the Arctic region. Because these models neglect many important air-ice-ocean interactions and therefore cannot simulate the full range of high-latitude climatic variability, the changes predicted for the Arctic (much higher surface air temperatures and hence considerably less sea ice coverage) under a CO2-enriched atmosphere are open to question. Consistent with this assessment is the fact that recent high-resolution Arctic sea ice cover data do not show evidence of a global warming signal that rises above the background noise of interannual climatic variability. Also, to assess whether future changes in the Arctic ice pack are due at least in part to CO2-induced climatic change, a better understanding of the nature and causes of interannual and interdecadal climate fluctuations in the Arctic are required. From an analysis of nearly 90 years of sea ice extents, as well as oceanic, atmospheric, and hydrological data, it appears that Arctic climate cycles with roughly a 20-year period are common. Clearly, such natural interdecadal variability needs to be taken into account when looking for signs of CO2-induced climate change during the next century. Author (CISTI)

N92-28199# McGill Univ., Montreal (Quebec). Centre for Climate and Global Change Research.
THE OCEAN'S THERMOHALINE CIRCULATION: ITS STABILITY, VARIABILITY, AND ROLE IN CLIMATE
TERTIA M. C. HUGHES Aug. 1991 52 p
(CGCR-91-12; CTN-92-60529) Avail: CASI HC A04/MF A01

A review is presented to summarize some of the results from the hierarchy of models of the uniqueness of the present-day thermohaline circulation in the world oceans. The factors governing the stability or variability of the thermohaline circulation are explored and its role in regulating the global climate is evaluated. The Strommel-Arons theory of the deep circulation is discussed and the process of deep water formation is identified as the driving force in the thermohaline circulation. A number of box-type models are then reviewed, which indicate that several distinct equilibria are possible under the same boundary conditions. The main limitation of these models is their emphasis on the steady state. General circulation models take into account non-steady state effects and two important aspects of thermohaline circulation are made evident: the interaction with the wind-driven circulation and the importance of vertical stratification. Coupled models which introduce a link to climate and indicate that temperature anomalies as well as salinity anomalies may have a significant effect on the stability of the thermohaline circulation. CISTI

N92-29686*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
SEAWIFS TECHNICAL REPORT SERIES. VOLUME 1: AN OVERVIEW OF SEAWIFS AND OCEAN COLOR
STANFORD B. HOOKER, ed., ELAINE R. FIRESTONE, ed. (General Sciences Corp., Laurel, MD.), WAYNE E. ESAIAS, GENE C. FELDMAN, WATSON W. GREGG, and CHARLES R. MCCLAIN Jul. 1992 28 p
(NASA-TM-104566-VOL-1; REPT-92B00089; NAS 1.15:104566-VOL-1) Avail: CASI HC A03/MF A01

The purpose of this series of technical reports is to provide current documentation of the Sea-viewing Wide Field-of-view Sensor (SeaWiFS) Project activities, instrument performance, algorithms, and operations. This documentation is necessary to ensure that critical information related to the quality and calibration of the satellite data is available to the scientific community. SeaWiFS will bring to the ocean community a welcomed and improved renewal of the ocean color remote sensing capability lost when the Nimbus-7 Coastal Zone Color Scanner (CZCS) ceased operating in 1986. The goal of SeaWiFS, scheduled to be launched in August 1993, is to examine oceanic factors that affect global change. Because of the role of phytoplankton in the global carbon cycle, data obtained from SeaWiFS will be used to assess the ocean's role in this cycle, as well as other biogeochemical cycles. SeaWiFS data will be used to help elucidate the magnitude and variability of the annual cycle of primary production by marine phytoplankton and to determine the distribution and timing of spring blooms. The observations will help to visualize the dynamics of ocean and costal currents, the physics of mixing, and the relationships between ocean physics and large-scale patterns of productivity. The data will help fill the gap in ocean biological observations between those of the CZCS and the upcoming Moderate Resolution Imaging Spectrometer (MODIS) on the Earth Observing System-A (EOS-A) satellite. Author

51

LIFE SCIENCES (GENERAL)

A92-13040
SUDDEN EXTINCTION OF THE DINOSAURS - LATEST CRETACEOUS, UPPER GREAT PLAINS, U.S.A
PETER M. SHEEHAN (Milwaukee Public Museum, WI), DAVID E. FASTOVSKY (Rhode Island, University, Kingston), RAYMOND G. HOFFMANN (Wisconsin, Medical College, Milwaukee), CLAUDIA B. BERGHAUS (Wisconsin, University, Madison), and DIANE L. GABRIEL (Montana State University, Bozeman) Science (ISSN 0036-8075), vol. 254, Nov. 8, 1991, p. 835-839. Research supported by University of Rhode Island, Marquette Electronics Foundation, Igloo Corp., et al. 8 Nov. 1991 5 p refs
Copyright

Results of a three-year field study of family-level patterns of ecological diversity of dinosaurs in the Hell Creek Formation of Montana and North Dakota show no evidence of a gradual decline of dinosaurs at the end of the Cretaceous. Stratigraphic reliability was maintained through a tripartite division of the Hell Creek, and preservational biases were corrected for by comparison of results only from similar facies as well as through the use of large-scale, statistically rigorous survey and collection procedures. The findings are in agreement with an abrupt extinction event such as one caused by an asteroid impact. Author

A92-28998
END OF THE PROTEROZOIC EON
ANDREW H. KNOLL (Harvard University, Cambridge, MA) Scientific American (ISSN 0036-8733), vol. 265, Oct. 1991, p. 64-67, 70-73. Oct. 1991 8 p refs
Copyright

It is argued that at the end of the Proterozoic eon a net production of oxygen occurred when organic remains from photosynthetic organisms were buried in sediments and not respired back to CO2 and water by nonphotosynthetic organisms. Some of this buried oxygen found its way to the atmosphere, and atmospheric oxygen eventually accumulated to the point when it fueled the rapid evolution of multicellular animals. C.D.

A92-36299* National Aeronautics and Space Administration, Washington, DC.
THE EARLY EVOLUTION OF EUKARYOTES - A GEOLOGICAL PERSPECTIVE
ANDREW H. KNOLL (Harvard University, Cambridge, MA) Science (ISSN 0036-8075), vol. 256, no. 5057, May 1, 1992, p. 622-627. Research supported by NASA and NSF. 1 May 1992 6 p refs
Copyright

This paper examines the goodness of fit between patterns of biological and environmental history implied by molecular phylogenies of eukaryotic organisms and the geological records of early eukaryote evolution. It was found that Precambrian geological records show evidence that episodic increases in biological diversity roughly coincided with episodic environmental changes and by sharp increases in atmospheric oxygen concentrations which significantly changed the earth surface environments. Although the goodness of fit among physical and biological changes is gratifyingly high, the records of these changes do not always coincide in time. The additional information in these fields that is needed for complete integration of geological and phylogenic records is suggested. I.S.

59

MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

A92-57199
EFFECTIVE ACCESS TO GLOBAL CHANGE DATA
B. K. RICHARD and GEORGE SPADARO (TRW, Inc., Redondo Beach, CA) IAF, International Astronautical Congress, 43rd, Washington, Aug. 28-Sept. 5, 1992. 11 p. Aug. 1992 11 p refs
(IAF PAPER 92-0795) Copyright

The paper discusses the ways in which new advances in information technologies can support the Global Change scientists in effectively utilizing masses of the earth observation data. The individual steps involved in the process for accessing and selecting data of interest are discussed, with special attention given to the Fast Data Finder technology, designed for processing multispectral data for purposes of rapidly characterizing locations by their spectral signature, neural networks, and the satellite data access methods. I.S.

61

COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms, and specific applications, e.g., CAD/CAM.

N92-21180# National Academy of Sciences - National Research Council, Washington, DC.
MATHEMATICAL FOUNDATIONS OF HIGH-PERFORMANCE COMPUTING AND COMMUNICATIONS
1991 40 p Sponsored by NSF
Avail: CASI HC A03/MF A01

The National Research Council's Panel on the Mathematical Sciences in High Performance Computing and Communication (HPCC) examines the elements of the Federal Government's HPCC Program and explicitly identifies the role of the mathematical sciences community in that effort. Furthermore, it identifies the role of mathematical sciences research in an illustrative subset of challenges of computational sciences. Recent contributions of

mathematical sciences to HPCC includes hardware and software improvements, and a National Research and Education Network that will increase computer performance and communication by a thousandfold. For future success and development, it is crucial that ongoing research and development continue on hardware, software, networks, and human resources. Among the challenges that need to be met are improvements in computational fluid dynamics, computational biology, dynamics of cardiac models, global changes, material science, geophysical modeling, machine vision, and human-machine communication. Finally, the report notes a number of specific areas where new mathematical sciences research is needed, including algorithms, dynamic graphics, pattern matching, and nonlinear modeling. H.A.

62

COMPUTER SYSTEMS

Includes computer networks and special application computer systems.

A92-38559#
SYSTEM AND OPERATIONS CONCEPT FOR THE GEOSTATIONARY EARTH OBSERVATORY DATA AND INFORMATION SYSTEM
FRANK C. WEINSTEIN, FREDRIC MESSING, and ANGELA ARMSTEAD (Computer Sciences Corp., Beltsville, MD) AIAA, Space Programs and Technologies Conference, Huntsville, AL, Mar. 24-27, 1992. 11 p. Mar. 1992 11 p refs
(AIAA PAPER 92-1405) Copyright

The Geostationary Earth Observatory (GEO) Data and Information System (GEODIS) is a critical element in achieving GEO program goals. GEODIS must collect, process, and disseminate scientific data to meet the challenges of NASA's Mission to Planet Earth. The system and operations concept for GEODIS described here summarizes its principal functional elements and external interfaces. GEODIS operations include mission support (of the GEO platform and instruments), data production (of multiple levels of products derived from GEO sensor data), user support (in accessing this data both from archives and directly via satellite rebroadcast links), and institutional support (for communications, management, development, and testing). This concept is part of a baseline generated for Marshall Space Flight Center to define the preliminary architecture of GEODIS. After validation by scientists, managers, operators, and developers, these concepts may be used to guide future work in defining detailed requirements and designs for GEODIS. Author

A92-39383
IMAGE BROWSE IN THE GLOBAL LAND INFORMATION SYSTEM
LYNDON R. OLESON, STUART W. DOESCHER, and THOMAS M. HOLM (USGS, EROS Data Center, Sioux Falls, SD) IN: 1991 ACSM-ASPRS Annual Convention, Baltimore, MD, Mar. 25-29, 1991, Technical Papers. Vol. 3 1991 8 p refs
Copyright

The Global Land Information System (GLIS) is an online directory, guide, and inventory system being developed by the U.S. Geological Survey to respond to the land data information needs of the global change science community. In addition to providing temporal, spatial, and discipline-oriented data query and product request capabilities, GLIS will also provide online digital browse services for satellite image data sets. Two Advanced Very High Resolution Radiometer (AVHRR) image browse prototypes are being developed on IBM PC-compatible and 32-bit, UNIX-based graphics workstation platforms as precursors to operational capabilities planned for 1992. These activities will also serve as precursors to similar capabilities planned for Landsat data available through GLIS and for Earth Observing System (EOS) data sets that will be available through the EOS Data and Information System. Author

64

NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

A92-18905
A CONSERVATIVE SPLIT-EXPLICIT INTEGRATION SCHEME WITH FOURTH-ORDER HORIZONTAL ADVECTION
M. J. P. CULLEN (Meteorological Office, Bracknell, England) and T. DAVIES (European Centre for Medium Range Weather Forecasts, Reading, England) Royal Meteorological Society, Quarterly Journal (ISSN 0035-9009), vol. 117, pt. B, July 1991, p. 993-1002. Jul. 1991 10 p refs

This study presents a split-explicit finite difference scheme which combines the accuracy and economy required for numerical weather prediction with the conservation properties required for climate-change experiments. It is shown that a model including the proposed finite-difference scheme yields comparable figures. Checks on the conservation properties showed that the temperature error amounted to about 1 K in 15 years, with comparable results for the other variables. C.A.B.

71

ACOUSTICS

Includes sound generation, transmission, and attenuation.

N92-27532# Naval Postgraduate School, Monterey, CA.
MONITORING OF GLOBAL ACOUSTIC TRANSMISSIONS: SIGNAL PROCESSING AND PRELIMINARY DATA ANALYSIS M.S. Thesis
GARY R. FROGNER Sep. 1991 137 p
(AD-A246572) Avail: CASI HC A07/MF A02

A great deal of controversy exists concerning the possible global warming trend which may occur as a result of a documented increase in atmospheric greenhouse gasses. The 1991 Heard Island Feasibility Experiment tested the feasibility of using transmissions of acoustic energy through major ocean basins of the world to monitor spatially averaged global temperature trends. This thesis documents the Naval Postgraduate School's reception of the phase encoded signal transmitted from the Southern Indian Ocean, development of real-time signal processing software, and preliminary data analysis. Data, received from a 32-channel vertical array suspended in the deep sound channel off the coast of Monterey, CA, was processed using real-time capable software. Data processing to reduce noise, determine SNR, and remove the m-sequence coding was found to be quite sensitive to Doppler frequency shifts. Although the SNR of the raw data was only about -27.5 dB for individual hydrophones, the transmitted signal was detected in both the frequency and time domains. However, the maximum processed signal peak in the time domain had an SNR of only +9 dB which is insufficient for use in a long term global temperature monitoring project. The hydrophone provides inadequate arrival time resolution. GRA

72

ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure, electron properties, and molecular spectra.

A92-52581* National Aeronautics and Space Administration, Washington, DC.
ABSORPTION COEFFICIENTS OF CFC-11 AND CFC-12 NEEDED FOR ATMOSPHERIC REMOTE SENSING AND GLOBAL WARMING STUDIES
PRASAD VARANASI (New York, State University, Stony Brook) Journal of Quantitative Spectroscopy and Radiative Transfer (ISSN 0022-4073), vol. 48, no. 2, Aug. 1992, p. 205-219. Research supported by NASA and DOE. Aug. 1992 15 p refs
Copyright

Spectral absorption coefficients k(v) in the atmospheric window are reported for CFC-11 and CFC-12. Data obtained with a grating spectrometer are compared with NCAR cross sections and measurements of k(v) made with a tunable diode laser spectrometer at various temperature-pressure combinations representing tangent heights or layers in the atmosphere are presented. The results are suitable for atmospheric remote sensing and global warming studies. C.D.

80

SOCIAL SCIENCES (GENERAL)

Includes educational matters.

A92-18522
MISSION TO PLANET EARTH DAY - A STATUS REPORT
LORI B. GARVER (National Space Society, Washington, DC) IAF, International Astronautical Congress, 42nd, Montreal, Canada, Oct. 5-11, 1991. 8 p. Oct. 1991 8 p refs
(IAF PAPER 91-514) Copyright

The plans to monitor global change as envisaged in the Mission to Planet Earth (MTPE) are described in terms of priorities, methodology, and support activities. The MPTE program is intended to address issues such as chlorofluorocarbon and CO2 issues, the greenhouse effect, and ozone-hole detection by means of spacecraft observation. The additional activities suggested for the MPTE program are founded on the need for outreach to the environmental community. C.C.S.

A92-41027* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
A GLOBAL CHANGE DATA BASE USING THEMATIC MAPPER DATA - EARTH MONITORING EDUCATIONAL SYSTEM (EMES)
HECTOR L. D'ANTONI and DAVID L. PETERSON (NASA, Ames Research Center, Moffett Field, CA) IN: International Symposium on Remote Sensing of Environment, 24th, Rio de Janeiro, Brazil, May 27-31, 1991, Proceedings. Vol. 2 1992 14 p refs
Copyright

Some of the main directions in creating an education program in earth system science aimed at combining top science and technology with high academic performance are presented. The creation of an Earth Monitoring Educational System (EMES) integrated with the research interests of the NASA Ames Research Center and one or more universities is proposed. Based on the integration of a global network of cooperators to build a global data base for assessments of global change, EMES would promote degrees at all levels in global ecology at associated universities and colleges, and extracurricular courses for multilevel audiences. EMES objectives are to: train specialists; establish a tradition of solving regional problems concerning global change in a systemic manner, using remote sensing technology as the monitoring tool; and transfer knowledge on global change to the national and world communities. South America is proposed as the pilot continent for the project. P.D.

A92-55809* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
GROUND TRUTH STUDIES - A HANDS-ON ENVIRONMENTAL SCIENCE PROGRAM FOR STUDENTS, GRADES K-12
JOHN KATZENBERGER (Aspen Global Change Institute, CO) and CHARLES R. CHAPPELL (NASA, Marshall Space Flight Center, Huntsville, AL) IAF, International Astronautical Congress, 43rd, Washington, Aug. 28-Sept. 5, 1992. 11 p. Aug. 1992 11 p refs
(IAF PAPER 92-0471) Copyright

The paper discusses the background and the objectives of the Ground Truth Studies (GTSs), an activity-based teaching program which integrates local environmental studies with global change topics, utilizing remotely sensed earth imagery. Special attention is given to the five key concepts around which the GTS programs are organized, the pilot program, the initial pilot study evaluation, and the GTS Handbook. The GTS Handbook contains a primer on global change and remote sensing, aerial and satellite images, student activities, glossary, and an appendix of reference material. Also described is a K-12 teacher training model. International participation in the program is to be initiated during the 1992-1993 school year. I.S.

82

DOCUMENTATION AND INFORMATION SCIENCE

Includes information management; information storage and retrieval technology; technical writing; graphic arts; and micrography.

A92-27080*# National Aeronautics and Space Administration, Washington, DC.
DATA AND INFORMATION SYSTEM REQUIREMENTS FOR GLOBAL CHANGE RESEARCH
DAVID L. SKOLE, WALTER H. CHOMENTOWSKI, BINBIN DING, and BERRIEN MOORE, III (New Hampshire, University, Durham) AIAA, Aerospace Sciences Meeting and Exhibit, 30th, Reno, NV, Jan. 6-9, 1992. 12 p. Jan. 1992 12 p refs
(Contract NAGW-2294; NAGW-980)
(AIAA PAPER 92-0723) Copyright

Efforts to develop local information systems for supporting interdisciplinary Global Change Research are described. A prototype system, the Interdisciplinary Science Data and Information System (IDS-DIS), designed to interface the larger archives centers of EOS-DIS is presented. Particular attention is given to a data query information management system (IMS), which has been used to tabulate information of Landsat data worldwide. The use of these data in a modeling analysis of deforestation and carbon dioxide emissions is demonstrated. The development of distributed local information systems is considered to be complementary to the development of central data archives. Global Change Research under the EOS program is likely to result in proliferation of data centers. It is concluded that a distributed system is a feasible and natural way to manage data and information for global change research. O.G.

A92-27081#
GLOBAL LAND OBSERVATION DATA SETS - THEIR CHARACTERISTICS AND AVAILABILITY
R. J. THOMPSON (USGS, Eros Data Center, Sioux Falls, SD) AIAA, Aerospace Sciences Meeting and Exhibit, 30th, Reno, NV, Jan. 6-9, 1992. 12 p. Jan. 1992 12 p refs
(AIAA PAPER 92-0728)

Activities of the U.S. Geological Survey's EROS Data Center

(EDC) responsible for managing land observation data collected by both satellite land remote sensing data programs and the EOS program are described. The primary role of these programs is to archive, process, and distribute pre-EOS and EOS land processes data and related products. The EDC represents an important link in the interagency network of facilities that archive and distribute data for many disciplines and exploits the expertise developed during years of processing Landsat and AVHRR data to support the U.S. Global Change Research program. O.G.

A92-34999 Jet Propulsion Lab., California Inst. of Tech., Pasadena.
EARLY-EOS DATA AND INFORMATION SYSTEM
GEORGE H. LUDWIG (JPL, Pasadena, CA) and GREGORY W. HUNOLT (NASA, Washington, DC) IN: IGARSS '91; Proceedings of the 11th Annual International Geoscience and Remote Sensing Symposium, Espoo, Finland, June 3-6, 1991. Vol. 2 1991 3 p refs
Copyright

NASA's Earth Observing System (EOS), an integral part of the U.S. Global Change Research Program, will provide simultaneous observations from a suite of instruments in low-earth orbit. The EOS Data and Information System (EOSDIS) will handle the data from those instruments, as well as provide access to observations and related information from other earth science missions. The Early-EOSDIS Program will provide initial improved support for global change research by building upon present capabilities and data, and will establish a working prototype EOSDIS for selected archiving, distribution, and information management functions by mid-1994. I.E.

A92-35001
A DATA MANAGEMENT SYSTEM FOR HANDLING HETEROGENEOUS DATA SETS FOR GLOBAL CHANGE STUDIES
D. CLEDEN, M. D. ELKINGTON, R. K. FREAN (Earth Observation Sciences, Ltd., Fleet, England), and M. S. HUTCHINS (Royal Aerospace Establishment, Earth Observation Data Centre, Farnborough, England) IN: IGARSS '91; Proceedings of the 11th Annual International Geoscience and Remote Sensing Symposium, Espoo, Finland, June 3-6, 1991. Vol. 2 1991 4 p refs
Copyright

A new data management system designed to support the UK's Earth Observation Data Centre (EODC) is described. One of the main features of this system is its ability to handle many heterogeneous data sets within a single architectural framework. The system incorporates the emerging Committee on Earth Observation Satellites (CEOS) recommendations for earth observation catalog systems. The system will be used as a platform for interoperability experiments. I.E.

A92-38513*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
THE FUNCTION OF THE EARTH OBSERVING SYSTEM - DATA INFORMATION SYSTEM DISTRIBUTED ACTIVE ARCHIVE CENTERS
C. C. LAPENTA (NASA, Marshall Space Flight Center, Huntsville, AL) AIAA, Space Programs and Technologies Conference, Huntsville, AL, Mar. 24-27, 1992. 4 p. Mar. 1992 4 p refs
(AIAA PAPER 92-1330) Copyright

The functionality of the Distributed Active Archive Centers (DAACs) which are significant elements of the Earth Observing System Data and Information System (EOSDIS) is discussed. Each DAAC encompasses the information management system, the data archival and distribution system, and the product generation system. The EOSDIS DAACs are expected to improve the access to earth science data set needed for global change research. O.G.

A92-39388
EARLY-EOS ACTIVITIES AT THE LAND PROCESSES DISTRIBUTED ACTIVE ARCHIVE CENTER
BRUCE K. QUIRK and R. J. THOMPSON (USGS, EROS Data Center, Sioux Falls, SD) IN: 1991 ACSM-ASPRS Annual Convention, Baltimore, MD, Mar. 25-29, 1991, Technical Papers. Vol. 3 1991 13 p refs
Copyright

The Land Processes Distributed Active Archive Center (LPDAAC), one of several centers that will be included in the EOSDIS (Earth Observing System Data and Information System) component of the EOS program, is discussed. While its primary role will be to archive, process, and distribute pre-EOS and EOS land processes data and related products, the LPDAAC will also be an important link in the network of facilities that archive and distribute data for many disciplines. The interdisciplinary element of LPDAAC is of particular importance in light of the global emphasis that surrounds the EOS Program and the requirement for integration of many different types of pre-EOS and EOS data into complex models for research, analysis, and applications to global change investigations. The LPDAAC is to exploit the experience and expertise gained during years of managing Landsat, AVHRR, and other satellite and aircraft remote sensing data, including the development of the systems necessary to process these data, and the scientific research performed with these data. P.D.

N92-12784*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
CONTENTS OF THE JPL DISTRIBUTED ACTIVE ARCHIVE CENTER (DAAC) ARCHIVE, VERSION 2-91
ELIZABETH A. SMITH, ed. and RUBY A. LASSANYI, ed. 1 Feb. 1991 28 p Revised
(Contract NAS7-918)
(NASA-CR-189027; JPL-PUBL-90-49-REV-1; NAS 1.26:189027)
Avail: CASI HC A03/MF A01

The Distributed Active Archive Center (DAAC) archive at the Jet Propulsion Laboratory (JPL) includes satellite data sets for the ocean sciences and global change research to facilitate multidisciplinary use of satellite ocean data. Parameters include sea surface height, surface wind vector, sea surface temperature, atmospheric liquid water, and surface pigment concentration. The Jet Propulsion Laboratory DAAC is an element of the Earth Observing System Data and Information System (EOSDIS) and will be the United States distribution site for the Ocean Topography Experiment (TOPEX)/POSEIDON data and metadata. Author

N92-15473*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
INFORMATION DATA SYSTEMS FOR A GLOBAL CHANGE TECHNOLOGY INITIATIVE ARCHITECTURE TRADE STUDY
NICHOLAS D. MURRAY *In its* Global Change Technology Architecture Trade Study p 309-338 Sep. 1991
Avail: CASI HC A03/MF A04

The Global Change Technology Initiative (GCTI) was established to develop technology which will enable use of satellite systems of Earth observations on a global scale, enable use of the observations to predictively model Earth's changes, and provide scientists, government, business, and industry with quick access to the resulting information. At LaRC, a GCTI Architecture Trade Study was undertaken to develop and evaluate the architectural implications to meet the requirements of the global change studies and the eventual implementation of a global change system. The output of the trade study are recommended technologies for the GCTI. That portion of the study concerned with the information data system is documented. The information data system for an earth global change modeling system can be very extensive and beyond affordability in terms of today's costs. Therefore, an incremental approach to gaining a system is most likely. An options approach to levels of capability versus needed technologies was developed. The primary drivers of the requirements for the information data system evaluation were the needed science products, the science measurements, the spacecraft orbits, the instruments configurations, and the spacecraft configurations and their attendant architectures. The science products requirements were not studied here; however, some consideration of the product needs were included in the evaluation results. The information data system technology items were identified from the viewpoint

of the desirable overall information system characteristics.
Author

83

ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

A92-40412
A DIFFERENT RACE: GLOBAL RURAL ELECTRIFICATION, MARKET NICHES, THE THIRD WORLD AS A STARTING PLACE FOR SPS
R. S. LEONARD (Ad Astra, Ltd., Santa Fe, NM) IN: SPS 91 - Power from space; Proceedings of the 2nd International Symposium, Gif-sur-Yvette, France, Aug. 27-30, 1991 1991 8 p refs

This paper addresses the possibility of implementing a program of global rural electrification using power from space from Solar Power Satellites (SPS). This power would be given to the third world in order to combat global warming and preserve the environment. The characteristics of the market for such electrical power and the time needed for such a market to develop are examined. The main problems in developing the market, including bureaucracy and the mercantile system, are addressed. The needed financing for developing a global rural electrification system is briefly examined. C.D.

84

LAW, POLITICAL SCIENCE AND SPACE POLICY

Includes NASA appropriation hearings; aviation law; space law and policy; international law; international cooperation; and patent policy.

A92-20581
THE NEW WORLD ORDER, GLOBAL CHANGE, AND SPACE
TOM CREMINS (Institute for Security and Cooperation in Outer Space, Washington, DC) IAF, International Astronautical Congress, 42nd, Montreal, Canada, Oct. 5-11, 1991. 9 p. Oct. 1991 9 p refs
(IAF PAPER 91-620) Copyright

A review is presented of current national and international programs dealing with the environment, which are centered around the utilization of information systems, especially data derived from space systems, as providing a starting point to develop international security frameworks that match the challenges of a new era. Very real transnational and integrated challenges are emerging that will test nations' and individuals' abilities to activate these broader principles in policies, strategies, and programs. Much more ground must be covered in terms of crafting strategies and policies which take advantage of the explosion of information capabilities, and uses of space for global security and development. R.E.P.

A92-28773
PRIORITIES FOR GLOBAL ECOLOGY NOW AND IN THE NEXT CENTURY
KIRILL IA. KONDRAT'EV (AN SSSR, Institut Ozerovedeniia, St. Petersburg, USSR), JOHANNES ORTNER (Oesterreichische Gesellschaft fuer Weltraumfragen mbH, Vienna, Austria), and OTHMAR PREINING (Wien, Universitaet, Vienna, Austria) Space Policy (ISSN 0265-9646), vol. 8, Feb. 1992, p. 39-48. Feb. 1992 10 p refs
Copyright

An attempt is made to establish priorities for global ecology with emphasis on two main aspects: (1) the earth's heat budget and the anthropogenically induced redistribution of its components; and (2) biosphere dynamics and the closed nature of global biogeochemical cycles. It is shown that the ecological future of the earth depends first of all on biosphere dynamics disturbed by human impact. The U.S. space-based Global Change Program is selected as one of the most comprehensive projects and is summarized in order to analyze its advantages and disadvantages. The general conclusion is that further discussion of global ecological priorities is necessary, preferably at United Nations level. The UN Conference on Environment and Development in June 1992 offers such an opportunity. Author

A92-36676
CFCS AND STRATOSPHERIC OZONE - LEGAL AND POLITICAL MEASURES
SYLVIA M. WILLIAMS (International Law Association, London, England) IN: Colloquium on the Law of Outer Space, 33rd, Dresden, Federal Republic of Germany, Oct. 6-12, 1990, Proceedings 1991 9 p refs
Copyright

An overview is presented detailing the scientific, historical, legal, and political issues related to the use of CFCs that deplete the stratospheric ozone. Particular references are made to the 1985 Vienna Convention on the Protection of the Ozone Layer and the Protocol on Substances that Deplete the Ozone Layer developed in Montreal and London. Both industrialized and developing countries are shown to be committed to some degree to the concept of 'sustainable development' that does not compromise the activities of future generations. It is suggested that a combination of research and regulation is needed to protect the environment in a way compatible with industrial development.
C.C.S.

85

URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

N92-19950# National Science Foundation, Washington, DC.
SCIENCE AND TECHNOLOGY INTEGRATION IN EUROPE AND INFLUENCES ON US-EUROPEAN COOPERATION: A REPORT OF THE NATIONAL SCIENCE BOARD COMMITTEE ON EUROPE IN 1992 Final Report
F. K. WILLENBROCK, R. E. BRADSHAW, D. N. LANGENBERG, J. H. MOORE, and J. W. LYONS Nov. 1990 41 p
(PB92-100676; NSB-90-172) Avail: CASI HC A03/MF A01

Science and Technology (S&T) in Western Europe is quickly evolving toward an umbrella structure for strategic policy planning, research coordination, and resources development and allocation. The EC Commission is becoming the largest source of funding and administrative and planning resources for such cooperation. It is assuming a growing but contentious role in stimulating, guiding, and making this cooperative paradigm operational. The Commission is also moving quickly to develop EC policies and activities for international cooperation in S&T, particularly in fields such as environmental protection and global warming. However, the EC member nations' primary responsibility for research support, facilities and human resources remains paramount; the EC superstructure is to be integrative, and supplementary of member state S&T activity. This implies challenges for U.S. decision makers, by way of: assessing the pace and directions of European S&T integration; achieving U.S. interagency consensus on exercising U.S. influence on that process; and allocating resources among bilateral and multilateral cooperative activities. Policy and operational recommendations are provided for appropriate U.S. government responses. Author

89

ASTRONOMY

Includes radio, gamma-ray, and infrared astronomy; and *astrometry.*

A92-24763
STABILITY OF THE ASTRONOMICAL FREQUENCIES OVER THE EARTH'S HISTORY FOR PALEOCLIMATE STUDIES
A. BERGER, M. F. LOUTRE (Louvain, Universite Catholique, Louvain-la-Neuve, Belgium), and J. LASKAR (Bureau des Longitudes, Paris, France) Science (ISSN 0036-8075), vol. 255, Jan. 31, 1992, p. 560-566. 31 Jan. 1992 7 p refs
Copyright

The expected changes over the past 500 million years in the principal astronomical frequencies influencing the earth's climate may be strong enough to be detectable in the geological records, and such effects have been inferred in several cases. Calculations suggest that the shortening of the earth-moon distance and of the length of the day back in time induced a shortening of the fundamental periods for the obliquity and climatic precession, from 54 to 35, 41 to 29, 23 to 19, and 19 to 16 thousand years over the last half-billion years. At the same time, the precessional constant increased from 50 to 61 arc seconds per year. The changes in the frequencies of the planetary system due to its chaotic motion are much smaller; their influence on the changes of the periods of climatic precession, obliquity, and eccentricity of the earth's orbit around the sun can be neglected. Eccentricity periods used for Quaternary climate studies may therefore be considered to have been more or less constant for pre-Quaternary times. Author

91

LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

N92-10782*# Geological Survey, Flagstaff, AZ.
GEOLOGIC HISTORY AND CHANNELING EPISODES OF THE CHRYSE PLANITIA REGION OF MARS
SUSAN L. ROTTO and KENNETH L. TANAKA *In* NASA, Washington, Reports of Planetary Geology and Geophysics Program, 1990 p 146-148 Jun. 1991
Avail: CASI HC A01/MF A06

The study of the Chryse Planitia region of Mars is based on geologic mapping on a 1:5,000,000 scale shaded relief map. The map area includes Chryse and southern Acidalia Planitiae; the circum Chryse channels and chaotic terrains; Xanthe, southern Tempe, and western Arabia Terrae; Lunae Planum; and northeastern Valles Marineris. The aim of the study is twofold: (1) to obtain relative ages of the outflow channels by performing and compiling detailed stratigraphic analyses; and (2) to correlate channeling episodes with causative mechanisms (such as volcanism and tectonism) and resulting effects (such as climate change). The geologic history given based on this mapping, includes the documentation of a previously unproposed channeling episode in the region as well as the presently favored hypotheses concerning the nature and origin of the channeling events. It is concluded that the history of the Chryse region suggests that two major periods of tectonic activity resulted in two episodes of channeling in the highlands surrounding Chryse Planitia. Author

N92-28503*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
ASTRONOMICAL VARIATION EXPERIMENTS WITH A MARS GENERAL CIRCULATION MODEL Abstract Only
J. B. POLLACK, R. M. HABERLE, J. R. MURPHY, J. SCHAEFFER, and H. LEE *In* Lunar and Planetary Inst., Papers Presented to the Workshop on the Evolution of the Martian Atmosphere p 24 1992
Avail: CASI HC A01/MF A01

In time scales of a hundred thousand to a million years, the eccentricity of Mars orbit varies in a quasi-periodic manner between extremes as large as 0.14 and as small as 0 and the tilt of its axis of rotation with respect to the orbit normal also varies quasi-periodically between extremes as large as 35 deg and as small as 15 deg. In addition, the orientation of the axis precesses on comparable time scales. These astronomical variations are much more extreme than those experienced by the Earth. These variations are thought to have strongly modulated the seasonal cycles of dust, carbon dioxide, and water. One manifestation of the induced quasiperiodic climate changes may be the layered terrain of the polar regions, with individual layers perhaps recording variations in the absolute and/or relative deposition rates of dust and water in the polar regions, most likely in association with the winter time deposition of carbon dioxide ice. In an attempt to understand the manner in which atmospheric temperatures and winds respond to the astronomical forcings, we have initiated a series of numerical experiments with the NASA/Ames general circulation model of the Martian Atmosphere. Author

N92-29024*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Geology and Planetology Section.
DARK MATERIAL IN THE POLAR LAYERED DEPOSITS ON MARS
KEN HERKENHOFF *In* Lunar and Planetary Inst., Workshop on the Martian Surface and Atmosphere Through Time p 72-73 1992
Avail: CASI HC A01/MF A03

The Martian polar layered deposits probably record periodic variations in the deposition of dust and ice caused by climate changes over the past 10 to 100 million years. The polar layered deposits appear to be the source of dark, saltating material that has been distributed over the surface of Mars, but the mechanisms by which this material is incorporated and eroded from the layered deposits is unknown. These mechanisms must be understood before the processes that formed and modified the layered deposits can be inferred and related to Martian climate changes. In summary, weathering of the Martian layered deposits by sublimation of water ice may account for the geologic relationships observed in the Martian polar regions. The non-volatile components of the layered deposits appears to consist mainly of bright red dust, with small amounts of dark dust or sand. Alternatively, dark sand-sized basaltic particles may occasionally be transported onto the layered deposits, forming thin layers. Once eroded, particles of either type may saltate to form the dark dunes found in both polar regions. H.A.

N92-29029*# Arizona Univ., Tucson. Lunar and Planetary Lab.
GLACIAL GEOMORPHIC EVIDENCE FOR A LATE CLIMATIC CHANGE ON MARS
J. S. KARGEL and R. G. STROM *In* Lunar and Planetary Inst., Workshop on the Martian Surface and Atmosphere Through Time p 82-83 1992
Avail: CASI HC A01/MF A03

In a series of preliminary reports, we documented evidence of former glacial epochs on Mars. Apparent glacial landforms seemed to be concentrated primarily at middle to high southern latitudes. We now have additional evidence supporting the view that Martian glaciation appears to have been more extensive than previously recognized. The growth and collapse of ice sheets on Mars seems closely analogous to the growth and decline of Earth's great Pleistocene ice sheets. This implies that climate change was probably somewhat comparable on the two planets, although in the case of Mars the entire planet seems to have changed rapidly to a cold, dry present-day environment after the collapse of the ice sheets. Author

N92-29035*# California Univ., Los Angeles. Inst. of Geophysics and Planetary Physics.
DISCOVERY CONCEPTS FOR MARS
J. G. LUHMANN, C. T. RUSSELL, L. H. BRACE (Michigan Univ., Ann Arbor.), A. F. NAGY (Michigan Univ., Ann Arbor.), B. M. JAKOSKY (Colorado Univ., Boulder.), C. A. BARTH (Colorado Univ., Boulder.), and J. H. WAITE (Southwest Research Inst., San Antonio, TX.) *In* Lunar and Planetary Inst., Workshop on the Martian Surface and Atmosphere Through Time p 93 1992
Avail: CASI HC A01/MF A03

Two focused Mars missions that would fit within the guidelines for the proposed Discovery line are discussed. The first mission would deal with the issue of the escape of the atmosphere (Mars') to space. A complete understanding of this topic is crucial to deciphering the evolution of the atmosphere, climate change, and volatile inventories. The second mission concerns the investigation of remanent magnetization of the crust and its relationship to the ionosphere and the atmosphere. Author

N92-29051*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
SHORT- AND LONG-TERM CLIMATE CHANGES ON MARS
JAMES B. POLLACK *In* Lunar and Planetary Inst., Workshop on the Martian Surface and Atmosphere Through Time p 120 1992
Avail: CASI HC A01/MF A03

The present climate of Mars is dominated by the seasonal cycles of dust, water vapor, and carbon dioxide. Understanding these cycles represents a first step towards interpreting climate changes in the past. Past climates on Mars were probably different from the present one due to astronomical variations of orbital and axial properties, to major changes in atmospheric pressure and/or composition, and to long-term changes in solar luminosity. Author

N92-29052*# Hawaii Univ., Honolulu. Planetary Geosciences.
INFLUENCE OF HEAT FLOW ON EARLY MARTIAN CLIMATE
SUSAN POSTAWKO and FRASER P. FANALE *In* Lunar and Planetary Inst., Workshop on the Martian Surface and Atmosphere Through Time p 121 1992
Avail: CASI HC A01/MF A03

Previous arguments have suggested that the formation of the valley networks on Mars may be explained by higher internal regolith temperatures associated with a much higher heat flow early in the planet's history. It is possible that this higher heat flow could cause groundwater to be closer to the martian surface 3.8 billion years ago, and thus allow the formation of the valley networks by groundwater sapping, without having to invoke surface warming due to an atmospheric greenhouse effect. It was previously shown that, in fact, it may not be possible to completely separate the effects of higher heat flow and atmospheric greenhouse on early Mars. We have more fully explored the parametric space of our set of equations to better determine the sensitivity of the system to variations in any of the factors. The limiting factor in the effectiveness of an atmospheric greenhouse is the total CO2 available in the system. We find that a combination of higher heat flow and atmospheric greenhouse effect on early Mars may more easily explain valley network formation and distribution, even for a cool early sun, than either of these mechanisms separately. Author

N92-29073*# California Univ., Los Angeles. Dept. of Earth and Space Science.
MICROCRATERS ON MARS: EVIDENCE OF PAST CLIMATIC VARIATIONS
A. R. VASAVADA, T. J. MILAVEC, and D. A. PAIGE *In* Lunar and Planetary Inst., Workshop on the Martian Surface and Atmosphere Through Time p 162-163 1992
Avail: CASI HC A01/MF A03

On Mars, we do not expect to see the full spectrum of crater sizes that we see on the Moon, because the Martian atmosphere decelerates smaller incoming meteorites. Mars climate models predict thirty-fold variations in Mars' atmospheric pressure due to large amplitude quasi-periodic variations in Mars' obliquity. More recent studies have shown that uncertainties in Mars' moment of inertia may have resulted in an underestimation of this range. In this study, we find that potential variations in the mass of the Martian atmosphere should have dramatic effects on the production rates of centimeter sized craters on the surface of Mars, and suggest that observations of the densities of Martian microcraters would provide an important validation of the astronomical theory for Martian climate change. Author

N92-29079*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
CLIMATIC IMPLICATIONS OF THE SIMULTANEOUS PRESENCE OF CO2 AND H2O IN THE MARTIAN REGOLITH
A. P. ZENT *In* Lunar and Planetary Inst., Workshop on the Martian Surface and Atmosphere Through Time p 173-174 1992
Avail: CASI HC A01/MF A03

The current paradigm for quasi-periodic climate change on Mars holds that perhaps a few hundred millibars of CO2 are available for exchange between the atmosphere and regolith, and that a vast majority of that CO2 is presently absorbed into the regolith. The CO2 is partitioned between the regolith and atmosphere according to an equilibrium adsorptive relationship. If the atmospheric pressure exceeds the frost point at or near the poles, then quasi-permanent polar caps form and buffer the atmospheric pressure. This model was developed based upon laboratory studies of CO2 adsorption where no other adsorbates are present. We will conduct laboratory measurements of the simultaneous adsorption of H2O and CO2 under Mars-like conditions, and develop numerical expressions for use in climate modeling based upon our results. Author

N92-33720*# Atmospheric and Environmental Research, Inc., Cambridge, MA.
REANALYSIS OF MARINER 9 UV SPECTROMETER DATA FOR OZONE, CLOUD, AND DUST ABUNDANCES, AND THEIR INTERACTION OVER CLIMATE TIMESCALES Annual Progress Report, 1 May 1991 - 1 Aug. 1992
BERNHARD LEE LINDNER 10 Aug. 1992 54 p
(Contract NASW-4614)
(NASA-CR-190657; NAS 1.15:190657) Avail: CASI HC A04/MF A01

Research activities to date are discussed. Selected Mariner 9 UV spectra were obtained. Radiative transfer models were updated and then exercised to simulate spectra. Simulated and observed spectra compare favorably. It is noted that large amounts of ozone are currently not retrieved with reflectance spectroscopy, raising large doubts about earlier published ozone abundances. As these published abundances have been used as a benchmark for all theoretical photochemical models of Mars, this deserves further exploration. Three manuscripts were published, and one is in review. Papers were presented and published at three conferences, and are planned for five more conferences in the next six months. The research plan for the next reporting period is discussed and involves continuing studies of reflectance spectroscopy, further examination of Mariner 9 data, and climate change studies of ozone.

92

SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

A92-22484
SOLAR FLARES DETECTION AND WARNING BY SPACE NETWORK
G. MELKONIAN, J. BOSCHAT (Dassault Aviation, Saint-Cloud, France), P. LANTOS (Meudon, Observatoire, France), and J.

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ATMOSPHERIC EFFECTS

ATMOSPHERIC GENERAL CIRCULATION MODELS

B

C

CLIMATOLOGY

D

E

F

G

H

I

J

K

L

M

N

O

P

Q

R

S

T

U

V

W

X

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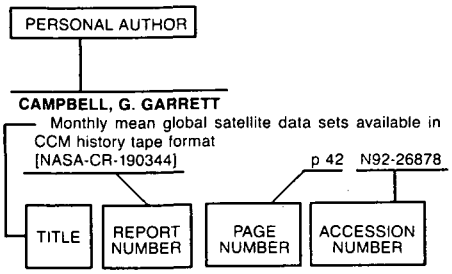

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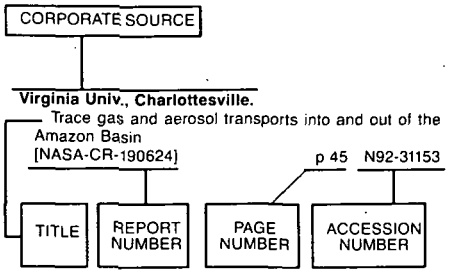

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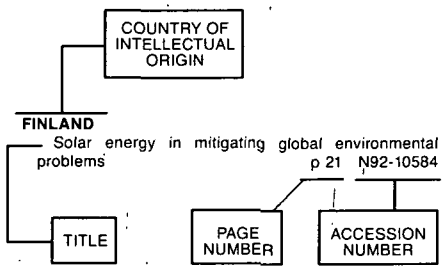

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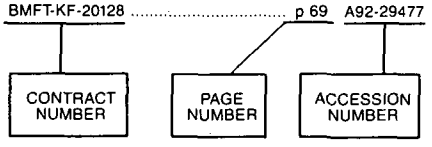

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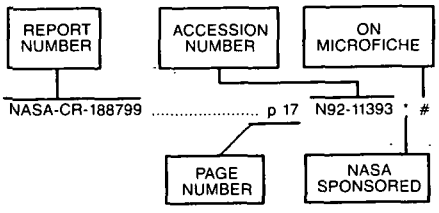

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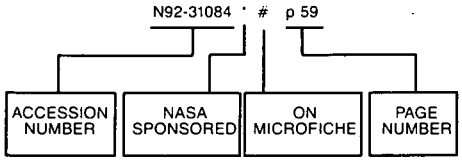

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