p. 40

NASA Technical Memorandum 104566, Vol. 24

# SeaWiFS Technical Report Series

Stanford B. Hooker and Elaine R. Firestone, Editors

# Volume 24, SeaWiFS Technical Report Series Cumulative Index: Volumes 1–23

Elaine R. Firestone and Stanford B. Hooker

June 1995

(NASA-TM-104566-Vol-24) SeaWiFS TECHNICAL REPORT SERIES. VOLUME 24: SeaWiFS TECHNICAL REPORT SERIES CUMULATIVE INDEX, VOLUMES 1-23 (NASA. Goddard Space Flight Center) 40 p

N95-32122

Unclas

G3/48 0062509

NASA Technical Memorandum 104566, Vol. 24

# SeaWiFS Technical Report Series

**Stanford B. Hooker, Editor**
*Goddard Space Flight Center*
*Greenbelt, Maryland*

**Elaine R. Firestone, Technical Editor**
*General Sciences Corporation*
*Laurel, Maryland*

# Volume 24, SeaWiFS Technical Report Series Cumulative Index: Volumes 1–23

**Elaine R. Firestone**
*General Sciences Corporation*
*Laurel, Maryland*

**Stanford B. Hooker**
*NASA Goddard Space Flight Center*
*Greenbelt, Maryland*

National Aeronautics and
Space Administration

**Goddard Space Flight Center**
Greenbelt, Maryland 20771

**1995**

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

ABSTRACT

The Sea-viewing Wide Field-of-view Sensor (SeaWiFS) is the follow-on ocean color instrument to the Coastal Zone Color Scanner (CZCS), which ceased operations in 1986, after an eight-year mission. SeaWiFS is expected to be launched in 1995, on the SeaStar satellite, being built by Orbital Sciences Corporation (OSC). The SeaWiFS Project at the National Aeronautics and Space Administration's (NASA) Goddard Space Flight Center (GSFC), has undertaken the responsibility of documenting all aspects of this mission, which is critical to the ocean color and marine science communities. This documentation, entitled the *SeaWiFS Technical Report Series,* is in the form of NASA Technical Memorandum Number 104566. All reports published are volumes within the series. This particular volume serves as a reference, or guidebook, to the previous 23 volumes and consists of 6 sections including: an errata, an addendum (summaries of various SeaWiFS Working Group Bio-optical Algorithm and Protocols Subgroups Workshops, and other auxiliary information), an index to key words and phrases, a list of all references cited, and lists of acronyms and symbols used. It is the editors' intention to publish a cumulative index of this type after every five volumes in the series. Each index covers the topics published in all previous editions, that is, each new index will include all of the information contained in the preceeding indices.

# 1. INTRODUCTION

This is the fourth in a series of indices, published as a separate volume in the Sea-viewing Wide Field-of-view (SeaWiFS) Technical Report Series, and covers information found in the first 23 volumes of the series. The Report Series is written under the National Aeronautics and Space Administration's (NASA) Technical Memorandum (TM) Number 104566. The volume numbers, authors, and titles are as follows:

Vol. 1: S.B. Hooker, W.E. Esaias, G.C. Feldman, W.W. Gregg, and C.R. McClain, *An Overview of SeaWiFS and Ocean Color.*

Vol. 2: W.W. Gregg, *Analysis of Orbit Selection for SeaWiFS: Ascending vs. Descending Node.*

Vol. 3: C.R. McClain, W.E. Esaias, W. Barnes, B. Guenther, D. Endres, S.B. Hooker, B.G. Mitchell, and R. Barnes, *SeaWiFS Calibration and Validation Plan.*

Vol. 4: C.R. McClain, E. Yeh, and G. Fu, *An Analysis of GAC Sampling Algorithms: A Case Study.*

Vol. 5: J.L. Mueller and R.W. Austin, *Ocean Optics Protocols for SeaWiFS Validation.*

Vol. 6: E.R. Firestone and S.B. Hooker, *SeaWiFS Technical Report Series Cumulative Index: Volumes 1–5.*

Vol. 7: M. Darzi, *Cloud Screening for Polar Orbiting Visible and IR Satellite Sensors.*

Vol. 8: S.B. Hooker, W.E. Esaias, and L.A. Rexrode, *Proceedings of the First SeaWiFS Science Team Meeting.*

Vol. 9: W.W. Gregg, F. Chen, A. Mezaache, J. Chen, and J. Whiting, *The Simulated SeaWiFS Data Set.*

Vol. 10: R.H. Woodward, R.A. Barnes, W.E. Esaias, W.L. Barnes, A.T. Mecherikunnel, *Modeling of the SeaWiFS Solar and Lunar Observations.*

Vol. 11: F.S. Patt, C.M. Hoisington, W.W. Gregg, and P.L. Coronado, *Analysis of Selected Orbit Propagation Models.*

Vol. 12: E.R. Firestone and S.B. Hooker, *SeaWiFS Technical Report Series Cumulative Index: Volumes 1–11.*

Vol. 13: C.R. McClain, J.C. Comiso, R.S. Fraser, J.K. Firestone, B.D. Schieber, E-n. Yeh, K.R. Arrigo, and C.W. Sullivan, *Case Studies for SeaWiFS Calibration and Validation, Part 1.*

Vol. 14: J.L. Mueller, *The First SeaWiFS Intercalibration Round-Robin Experiment, SIRREX-1, July 1992.*

Vol. 15: W.W. Gregg, F.S. Patt, and R.H. Woodward, *The Simulated SeaWiFS Data Set, Version 2.*

Vol. 16: Mueller, J.L., B.C. Johnson, C.L. Cromer, J.W. Cooper, J.T. McLean, S.B. Hooker, and T.L. Westphal, *The Second SeaWiFS Intercalibration Round-Robin Experiment, SIRREX-2, June 1993.*

Vol. 17: Abbott, M.R., O.B. Brown, H.R. Gordon, K.L. Carder, R.E. Evans, F.E. Muller-Karger, and W.E. Esaias, *Ocean Color in the 21st Century: A Strategy for a 20-Year Time Series.*

Vol. 18: Firestone, E.R., and S.B. Hooker, *SeaWiFS Technical Report Series Summary Index: Volumes 1–17.*

Vol. 19: McClain, C.R., R.S. Fraser, J.T. McLean, M. Darzi, J.K. Firestone, F.S. Patt, B.D. Schieber, R.H. Woodward, E-n. Yeh, S. Mattoo, S.F. Biggar, P.N. Slater, K.J. Thome, A.W. Holmes, R.A. Barnes, and K.J. Voss, *Case Studies for SeaWiFS Calibration and Validation, Part 2.*

Vol. 20: Hooker, S.B., C.R. McClain, J.K. Firestone, T.L. Westphal, E-n. Yeh, and Y. Ge, *The SeaWiFS Bio-Optical Archive and Storage System (SeaBASS), Part 1.*

Vol. 21: Acker, J.G., *The Heritage of SeaWiFS: A Retrospective on the CZCS NIMBUS Experiment Team (NET) Program.*

Vol. 22: Barnes, R.A., W.L. Barnes, W.E. Esaias, and C.R. McClain, *Prelaunch Acceptance Report for the SeaWiFS Radiometer.*

Vol. 23: Barnes, R.A., A.W. Holmes, W.L. Barnes, W.E. Esaias, C.R. McClain, and T. Svitek, *SeaWiFS Prelaunch Radiometric Calibration and Spectral Characterization.*

This volume within the series serves as a reference, or guidebook, to the aforementioned volumes. It consists of the four main sections included with the first two indices published, Volumes 6 and 12, in the series: a cumulative index to key words and phrases, a glossary of acronyms, a list of symbols used, and a bibliography of all references cited in the series. In addition, as in Volumes 12 and 18, errata and addenda sections have been added to address issues and needed corrections that have come to the editors' attention since the volumes were first published.

The nomenclature of the index is a familiar one, in the sense that it is a sequence of alphabetical entries, but it utilizes a unique format since multiple volumes are involved. Unless indicated otherwise, the index entries refer to some aspect of the SeaWiFS instrument or project, for example, the *mission overview* index entry refers to an overview of the SeaWiFS mission. An index entry is composed of a keyword or phrase followed by an entry field that directs the reader to the possible locations where a discussion of the keyword can be found. The entry field is normally made up of a volume identifier shown in bold face, followed by a pages identifier, which is always enclosed in parentheses:

keyword, **volume**(pages).

If an entry is the subject of an entire volume, the volume field is shown in slanted type without a page field:

keyword, *Vol. #.*

An entry can also be the subject of a complete chapter, as in Volumes 13 and 19 (to name a few). In this instance, both the volume number and chapter number appear without a page field:

keyword, *Vol. # ch. #.*

Figures or tables that provide particularly important summary information are also indicated as separate entries in the page field. In this case, the figure or table number is given with the page number on which it appears.

## 2. ERRATA

1. In Volume 23, Table 19, the headers entitled *Radiance* and *Counts* should be switched.

## 3. ADDENDA

This section presents a summary of the Fifth SeaWIFS Bio-optical Algorithm and Optical Protocols Workshop (BAOPW-5) held on 21 February 1995 at the Rosenstiel School of Marine and Atmospheric Sciences in Miami, Florida; submitted by C. McClain.

The primary workshop objectives were to:

1) finalize the initial operational SeaWiFS pigment, $K(490)$, and chlorophyll $a$ algorithms;
2) review the field programs and bio-optical data sets; and
3) discuss proposed changes in standard data products.

The team members and invited guests are listed in Table 1.

**Table 1.** Team members and invited guests to the BAOPW-5, held 21 February, 1995 at the Rosenstiel School of Marine and Atmospheric Sciences (RSMAS) in Miami, Florida. The subgroup memberships are as listed in Hooker et al. (1993). Attendees are identified with a checkmark (✓ ).

| *Team Members* | *Present* | *Team Members* | *Present* |
|---|---|---|---|
| J. Aiken | | O. Kopelevich | |
| (G. Moore) | ✓ | M. Lewis | ✓ |
| W. Balch | ✓ | C. McClain | ✓ |
| K. Carder | ✓ | G. Mitchell | ✓ |
| D. Clark | ✓ | A. Morel | |
| G. Cota | ✓ | J. Mueller | ✓ |
| C. Davis | ✓ | F. Muller-Karger | ✓ |
| R. Doerffer | ✓ | | |
| W. Esaias | ✓ | D. Siegel | ✓ |
| H. Gordon | ✓ | R. Smith | |
| F. Hoge | ✓ | C. Trees | ✓ |
| S. Hooker | ✓ | C. Yentsch | |
| D. Kamykowski | | J. Yoder | ✓ |
| M. Kishino | ✓ | R. Zaneveld | ✓ |
| *Other Attendees* | | | |
| R. Arnone | | S. Gallegos | |
| J. Campbell | | S. Hawes | |
| R. Evans | | N. Maynard | |
| R. Frouin | | J. Morrow | |
| H. Fukushima | | | |

## 3.1 BAOPW-5

1. *Introduction* (C. McClain):
   A. Workshop Objectives and Agenda
   B. Review of Action Items from the November Workshop
   C. SeaStar/SeaWiFS Update
2. *Data Set Development for Algorithm Evaluation* (J. Campbell): At the last bio-optical algorithm workshop in November, it was agreed that investigators would submit data for the verification of certain components of the operational chlorophyll algorithm, as well as evaluate the final chlorophyll retrievals. Campbell agreed to be the point of contact for the data submissions and will provide a status report. She gave a brief summary of what she personally has received [others have sent data directly to the SeaWiFS Bio-Optical Archive and Storage System (SeaBASS)]. She received data from A. Bricaud, C. Yentsch, and M. Kishino. She will provide these data to the SeaWiFS Project after some editing and reformatting. Also, permission is being sought to release Bricaud's data to the SeaBASS archive.
3. *Operational Chlorophyll a Algorithm* (K. Carder): Only minor modifications have been made to the algorithm since the November 1994 meeting. Preliminary analyses of Arabian Sea data and results from airborne oceanographic lidar (AOL) data obtained from the Mid-Atlantic Bight compare well with the algorithm. Initial analyses of California Cooperative Fisheries Institute (CalCoFI) data, by G. Mitchell, indicate that the algorithm underestimates chlorophyll by a factor of 2–5. Mitchell's analysis, however, was based on the ratios of subsurface upwelling radiance to subsurface downwelling irradiance and not remote sensing reflectances. D. Siegel made a recommendation that should improve the chlorophyll retrieval at low concentrations and will provide the details to Carder later.
4. *CZCS Pigment Algorithm* (G. Moore): At the November workshop, G. Moore presented a draft document for the bio-optics group to review and made a recommendation on a radiance ratio algorithm. The group suggested that the algorithm should include a band ratio in the green. Moore has incorporated this suggestion and others and has submitted a revised version of the document to the SeaWiFS Project for publication in the *SeaWiFS Technical Report Series.*
5. *K(490) Algorithm* (J. Mueller): The results of Mueller's analysis of the effect of the 5 nm shift in the 555 nm SeaWiFS band from the 550 nm CZCS band indicates the effect is small and that no change in the prelaunch algorithm [the Austin-Petzold CZCS $K(490)$ algorithm] is required. The analysis was based on 44 optical profiles provided by C. Trees, D. Siegel, and G. Mitchell.
6. *Final Results from the First Data Analysis Round-Robin (DARR-1)* (D. Siegel): Siegel reviewed the results of the first data analysis round-robin, which had not changed since the November meeting. For Case-1 water, all the methods worked equally well below 600 nm, but diverged in the near-infrared. Turbid water cases were not considered. The summary document has also been submitted to the SeaWiFS Project for publication in the series.
7. *Second Data Analysis Round-Robin (DARR-2) Planning* (D. Siegel): Two topics of interest were discussed, turbid water and the extrapolation of values to the surface from observations at discrete levels only as is the case for moorings and drifters. C. Davis volunteered to hold a workshop to discuss measurement protocols for Case-2 waters, but thought it was premature to hold a data analysis round-robin. D. Clark volunteered to host DARR-2 to evaluate the analysis issue associated with moorings and drifters. The dates for these events will not be scheduled until the SeaWiFS launch schedule is clarified in April.
8. *18-Month Time Series of MER-2040/2041 Calibration* (G. Mitchell): The time series of the Scripps Photobiology Group's MER-2040/2041 instrument calibration for 18 months was presented. During this time, radiometric calibrations at Biospherical Instruments, Inc. (BSI) and the San Diego State University (SDSU) Center for Hydro-Optics and Remote Sensing (CHORS) have been completed with both integrating spheres and reflectance plaques at each facility (total of three separate spheres and three separate plaques). Immersion coefficients have been determined as well. The CHORS and BSI calibrations are in good agreement for most wavelengths. The calibrations are particularly consistent over the past three calibrations, the UV bands being a notable exception. These results are tangible evidence that the calibration round-robins are helping to improve the reliability, consistency, and traceability of the ocean color community's instrument calibrations.
9. *Protocol for Determining Algorithm Accuracy* (J. Campbell): In reporting the accuracy of a model or algorithm, it is important to distinguish between systematic errors and random errors. A statement such as "This algorithm is accurate to within 30%," is very ambiguous. It says nothing about whether errors are random or systematic, and whether the range is $1\,\sigma$ or $3\,\sigma$. A protocol is presented here for determining the accuracy of an algorithm, and for testing and reporting both systematic and random errors. Campbell distributed a document describing the protocol and analysis based on the CZCS NET algorithm data set.
10. *Band-to-Band Correlation Analysis* (J. Mueller): The issue of instrumental band center wavelength differences was discussed at the May 1994 workshop (Firestone and Hooker 1995) and remains unresolved. Mueller has performed further empirical orthogonal function

(EOF) analyses on the NET data from D. Clark. The analysis showed that in order to obtain a meaningful result, the radiances had to be extrapolated to a common depth, e.g., the surface. For the irradiance fields, the variance was contained in the first few EOFs, but for upwelling radiance, a large number were required. His conclusion was that the data was too noisy for this analysis and that more recent data from higher quality spectrometers should be used. Such data exists from a number of sources and he will pursue this work further.

11. *Field Program Reports:* The intent of these reports is not to present results, but activities. Updates should review recent and future cruise plans, numbers of stations, data collected, status of analysis and data delivery to the SeaWiFS Project, etc. Each presentation should be no longer than 15 minutes.
    A. Bermuda Bio-Optical Time Series (D. Siegel): The bio-optical data collection will continue until at least December 1995. After that time, Siegel is unclear how the time-series will be supported. It appears unlikely, at this time, that the National Science Foundation (NSF) will support the program in fiscal year (FY) 1996 and he is not optimistic about NSF support in FY97.
    B. CalCoFI Bio-Optical Data Set (G. Mitchell): Mitchell has cruises planned in April, July, and October 1995. During each cruise, about 70 bio-optical stations will be taken.
    C. Navy Field Program Update (C. Davis): The Navy, NASA, and NSF will support a total of eight cruises with optics in the Arabian Sea. During the last cruise, much of the time was spent towing an instrument array. Nonetheless, 20 bio-optical stations were collected. Their bio-optical measurement suite included radiometer profiles, remote sensing reflectance measurements, and $Q$ measurements.
    D. United Kingdom Field Program Update (G. Moore): The British have a fair number of cruises scheduled for 1995 and 1996. Of particular interest is the Antarctic Survey's transects of the Atlantic during May and September of each year. These cruises have many berths available and will stop daily for bio-optical casts (2 hours maximum station time). The Falkland Islands would be the point of departure for the September leg and the point of embarkation for the May leg.
    E. Japanese Field Program Update (M. Kishino): The Japanese have an impressive manifest of bio-optical cruises scheduled in the Pacific (from the Bering Sea to Antarctica) during 1995 and 1996. (The manifest is too long to recite here.) The Yamato Bank Optical Mooring (YBOM) will be deployed during April–July 1996 [Ocean Color Temperature Sensor (OCTS) check-out] and again in September 1996 after refurbishment. YBOM will be in a year-long cycle whereby it will be in the water for nine months, and then out of the water for three months, for refurbishment.
    F. German Field Program Update (R. Doerffer): The Germans will be in the Arabian Sea during July and will collect in-water bio-optical and remote sensing reflectance data. Doerffer described the Picasso Program proposal to put four optical platforms in place. Picasso participants include the Joint Research Center (JRC) and the British. The platform sites are the northern Adriatic, Baltic, and North Seas.
12. *Proposed Scheme for Variable Quality Level-3 Products* (R. Evans): Evans described his proposal for incorporating variable quality data into the level-3 products. The scheme allows for level-2 data, which is deemed less accurate or reliable, to be binned when no higher quality data is available for a particular binning cell. The scheme can be applied in either space or time binning. Before the scheme can be accepted, the Science Working Group (SWG) must approve it. The bio-optics group voice general support for the concept. A more detailed description will be circulated to the SWG for comment.
13. *Proposed Revisions in the Level-3 Products* (C. McClain): The present set of quality masks and flags used as exclusion criteria in the level-3 binning process are defined so as to yield high quality pigment and $K(490)$ level-3 products; all other parameters binned in the level-3 product are subject to the same criteria. At the present time, there is only one level-3 product containing several binned quantities. As a result, the level-3 product eliminates useful information on some quantities of interest, e.g., coccolithophore blooms and high aerosol radiances. Defining additional level-3 products, using exclusion criteria appropriate to each product while eliminating parameters of limited utility from the present level-3 product, would extend the applications for SeaWiFS, but not substantially increase the number of data granules or volumes submitted to the Goddard Space Flight Center (GSFC) Distributed Active Archive Center (DAAC). Examples of this might be a pigment product, a coccolithophore product, or an aerosol product. The bio-optics group endorsed the idea of smaller, but more numerous level-3 products and McClain will circulate a strawman to the SWG for comment.

### 3.1.1 Action Items

The following are the action items, and people responsible for them, that arose from the meeting.

1. J. Campbell will submit the Bricaud and Morel absorption data and the Yentsch pigment data to the SeaWiFS Project for inclusion in the SeaBASS database.
2. K. Carder will submit the data set he is using for the chlorophyll algorithm.
3. D. Clark will organize and host DARR-2.
4. C. Davis will organize and host a workshop on turbid Case-2 data collection and analysis.
5. D. Siegel will work with K. Carder on a modification to the chlorophyll *a* algorithm to improve estimates at low values.
6. J. Mueller will pursue higher quality spectral data for the EOF analysis. Possible sources of this are D. Clark and C. Davis.
7. C. McClain and R. Evans will draft strawmen proposals for revisions in the level-3 products. These will be circulated together for comment by the SWG.

## Cumulative Index

Unless indicated otherwise, the index entries that follow refer to some aspect of the SeaWiFS instrument or project. For example, the *mission overview* index entry refers to an overview of the SeaWiFS mission.

### – A –



### – B –

## Glossary

### – A –

- A/D Analog-to-Digital; also written as: AD
- A&M (Texas) Agriculture and Mechanics (University)
- AC Alternating Current
- ACC Antarctic Circumpolar Current
- ACRIM Active Cavity Radiometer Irradiance Monitor
- ACS Attitude Control System
- ADC Analog-to-Digital Converter
- ADEOS Advanced Earth Observation Satellite (Japan)
- AE Ångström Exponent
- ALSCAT ALPHA and Scattering Meter (Note: the symbol $\alpha$ corresponds to $c(\lambda)$, the beam attenuation coefficient, in present usage).
- AM-1 Not an acronym, used to designate the morning platform of EOS.
- AMC Angular Momentum Compensation
- AOCI Airborne Ocean Color Imager
- AOL Airborne Oceanographic Lidar
- AOP Apparent Optical Property
- AOS/LOS Acquisition of Signal/Loss of Signal
- APL Applied Physics Laboratory
- ARGOS Not an acronym, but the name given to the data collection and location system on the NOAA Operational Satellites.
- ARI Accelerated Research Initiative
- ASCII American Standard Code for Information Interchange
- ASI Italian Space Agency
- ASR Absolute Spectral Response
- AT Along-Track
- AU Astronomical Unit
- AVHRR Advanced Very High Resolution Radiometer
- AVIRIS Advanced Visible and Infrared Imaging Spectrometer
- AXBT Airborne Expendable Bathythermograph

### – B –

- BAOPW-1 First Bio-optical Algorithm and Optical Protocols Workshop
- BAOPW-2 Second Bio-optical Algorithm and Optical Protocols Workshop
- BAOPW-3 Third Bio-optical Algorithm and Optical Protocols Workshop
- BAOPW-4 Fourth Bio-optical Algorithm and Optical Protocols Workshop
- BAOPW-5 Fifth Bio-optical Algorithm and Optical Protocols Workshop
- BAS British Antarctic Survey
- BATS Bermuda Atlantic Time-Series Station
- BBOP Bermuda Bio-Optical Profiler
- BBR Band-to-Band Registration
- BCRS Dutch Remote Sensing Board
- BEP Benguela Ecology Programme
- BER Bit Error Rate
- BMFT Minister for Research and Technology (Germany)
- BOFS British Ocean Flux Study
- BOMS Bio-Optical Moored Systems
- bpi bits per inch
- BRDF Bidirectional Reflectance Distribution Function
- BSI Biospherical Instruments, Incorporated
- BSIXR BSI's Transfer Radiometer
- BTR Bright Target Recovery
- BUV Backscatter Ultraviolet Spectrometer
- BWI Baltimore-Washington International (airport)

### – C –

- CalCoFI California Cooperative Fisheries Institute
- Cal/Val Calibration and Validation
- CALVAL Calibration and Validation
- Case-1 Water whose reflectance is determined solely by absorption.
- Case-2 Water whose reflectance is significantly influenced by scattering.
- CCD Charge Coupled Device
- CCPO Center for Coastal Physical Oceanography (Old Dominion University)
- CDF (NASA) Common Data Format
- CDOM Colored Dissolved Organic Material
- CD-ROM Compact Disk-Read Only Memory
- CDR Critial Design Review
- CEC Commission of the European Communities
- CENR Committee on Environment and Natural Resources
- CHORS Center for Hydro-Optics and Remote Sensing (San Diego State University)
- CICESE *Centro de Investigación Científica y de Educación Superior de Ensenada* (Mexico)
- CIRES Cooperative Institute for Research in Environmental Sciences
- COADS Comprehensive Ocean-Atmosphere Data Set
- COOP Coastal Ocean Optics Program
- COTS Commercial Off-The-Shelf (software)
- CPR Continuous Plankton Recorder
- cpu Central Processing Unit
- CRM Contrast Reduction Meter
- CRN Italian Research Council
- CRSEO Center for Remote Sensing and Environmental Optics (University of California at Santa Barbara)
- CRT Calibrated Radiance Tapes; or Cathode Ray Tube.
- CRTT CZCS Radiation and Temperature Tape
- CSIRO Commonwealth Scientific and Industrial Research Organization (of Australia)
- CSC Computer Sciences Corporation
- CSL Computer Systems Laboratory
- CT Cross-Track
- CTD Conductivity, Temperature, and Depth
- CVT Calibration and Validation Team
- CW Continuous Wave
- CWR Clear Water Radiance
- CZCS Coastal Zone Color Scanner

### – D –

- DAAC Distributed Active Archive Center
- DAO Data Assimilation Office
- DARR-1 First Data Analysis Round-Robin
- DARR-2 Second Data Analysis Round-Robin
- DAT Digital Audio Tape
- DC Direct Current
- DCF Data Capture Facility
- DCOM Dissolved Colored Organic Material
- DCP Data Collection Platform

DEC Digital Equipment Corporation
DMS dimethyl sulfide
DOC Dissolved Organic Carbon
DoD Department of Defense
DOM Dissolved Organic Matter
DOS Disk Operating System
DSP Not an acronym, but an image display and analysis package developed at RSMAS University of Miami.
DU Dobson Units
DXW Not an acronym, but a lamp designator.

– E –

E-mail Electronic Mail
EAFB Edwards Air Force Base
ECEF Earth-Centered Earth-Fixed
ECMWF European Centre for Medium Range Weather Forecasts
ECT Equator Crossing Time
EDT Eastern Daylight Time
EEZ Exclusive Economic Zone
ENSO El Niño Southern Oscillation
ENVISAT Environmental Satellite
EOF Empirical Orthogonal Function
EOS Earth Observing System
EOSAT Earth Observation Satellite Company
EOSDIS EOS Data Information System
EPA Environmental Protection Agency
EP-TOMS Earth Probe-Total Ozone Mapping Spectroradiometer
EqPac Equatorial Pacific (Process Study)
ER-2 Earth Resources-2
ERBE Earth Radiation Budget Experiment
ERBS Earth Radiation Budget Sensor
ERL (NOAA) Environmental Research Laboratories
ERS Earth Resources Satellite
ESA European Space Agency
EST Eastern Standard Time
EURASEP European Association of Scientists in Environmental Pollution
EUVE Extreme Ultraviolet Explorer

– F –

FASCAL Fast Calibration (Facility)
FDDI Fiber Data Distribution Interface
FEL Not an acronym, but a lamp designator.
FGGE First GARP Global Experiment
FLUPAC (Geochemical) Fluxes in the Pacific (Ocean)
FNOC Fleet Numerical Oceanography Center
FORTRAN Formula Translation (computer language)
FOV Field-of-View
FPA Focal Point Assembly
FRD Federal Republic of Deutschland (Germany)
FTP File Transfer Protocol
FWHM Full-Width at Half-Maximum
FY Fiscal Year

– G –

GAC Global Area Coverage, coarse resolution satellite data with a nominal ground resolution at nadir of approximately 4 km.
GARP Global Atmospheric Research Program
GASM General Angle Scattering Meter
GF/F Not an acronym; a specific type of glass fiber filter manufactured by Whatman
GIN Greenland, Iceland, and Norwegian Seas
GISS Goddard Institute for Space Studies
GLI Global Imager
GLOBEC Global Ocean Ecosystems dynamics
GMT Greenwich Mean Time
GOES Geostationary Operational Environmental Satellite
GOFS Global Ocean Flux Study
GOMEX Gulf of Mexico Experiment
GP Global Processing (algorithm)
GPM General Perturbations Model
GPS Global Positioning System
GRGS Groupe de Recherche de Geodesie Spatial
GRIB Gridded Binary
GRIDTOMS Gridded TOMS (data set)
GSFC Goddard Space Flight Center
GSO Graduate School of Oceanography (University of Rhode Island)
G/T System Gain/Total System Noise Temperature
GUI Graphical User Interface

– H –

HDF Hierarchical Data Format
HEI Hoffman Engineering, Incorporated
HeNe Helium-Neon
HHCRM Hand-Held Contrast Reduction Meter
HIRIS High Resolution Imaging Spectrometer
HN (Polaroid) Not an acronym; a linear sheet polarizer used to check the polarization sensitivity of bands 7 and 8.
HOTS Hawaiian Optical Time Series
HP Hewlett Packard
HPGL Hewlett Packard Graphics Language
HPLC High Performance Liquid Chromatography
HQ Headquarters
HR (Polaroid) Not an acronym; a linear sheet polarizer used to check the polarization sensitivity of bands 1–6.
HRPT High Resolution Picture Transmission
HST Hawaii Standard Time
HYDRA Hydrographic Data Reduction and Analysis

– I –

I/O Input/Output
IAPSO International Association for the Physical Sciences of the Ocean
IAU International Astrophysical Union
IBM International Business Machines
ICD Interface Control Document
ICES International Council on Exploration of the Seas
IDL Interactive Data Language
IFOV Instantaneous Field-of-View
IMS Information Management System
IOP Inherent Optical Property
IP Internet Protocol
IPD Image Processing Division
IR Infrared
ISCCP International Satellite Cloud Climatology Project
ISIC Integrating Sphere Irradiance Collector
ISTP International Solar Terrestrial Program
IUCRM Inter-Union Commission on Radio Meteorology
IUE International Ultraviolet Explorer

– J –

JAM JYACC Application Manager
JARE Japanese Antarctic Research Expedition
JGOFS Joint Global Ocean Flux Study
JHU Johns Hopkins University
JOI Joint Oceanographic Institute
JPL Jet Propulsion Laboratory
JRC Joint Research Center

– K, L –

L&N Leeds & Northrup
LAC Local Area Coverage, fine resolution satellite data with a nominal ground resolution at nadir of approximately 1 km.
LANDSAT Land Resources Satellite
LDEO Lamont-Doherty Earth Observatory (Columbia University)
LDGO Lamon-Doherty Geological Observatory (Columbia University)
LDTNLR Local Dynamic Threshold Nonlinear Raleigh
Level-0 Raw data.
Level-1 Calibrated radiances.
Level-2 Derived products.
Level-3 Gridded and averaged derived products.
LMCE *Laboratoire de Modelisation du climat et de l'Environment* (France)
LOC Local Time
LODYC *Laboratoire d'Océanographie et de Dynamique du climat* (France)
LOICZ Land Ocean Interaction in the Coastal Zone
LPCM *Laboratoire de Physique et Chimie Marines* (France)
LRER Long-Range Ecological Research
LSB Least Significant Bits
LSF Line Spread Function

– M –

MAREX Marine Resources Experiment Program
MARS Multispectral Airborne Radiometer System
MASSS Multi-Agency Ship-Scheduling for SeaWiFS
MBARI Monterey Bay Aquarium Research Institute
MEM Maximum Entropy Method
MER Marine Environmental Radiometer
MERIS Medium Resolution Imaging Spectrometer
METEOSAT Meteorological Satellite
MF Major Frame
mF Minor Frame
MIPS Millions of Instructions Per Second
MIT Massachusetts Institute of Technology
MIZ Marginal Ice Zone
MLE Maximum Likelihood Estimator
MLML Moss Landing Marine Laboratory (San Jose State University)
MO Magneto-Optical
MOBY Marine Optical Buoy
MOCE Marine Optical Characterization Experiment
MODARCH MODIS Document Archive
MODIS Moderate Resolution Imaging Spectroradiometer
MODIS-N Nadir-viewing MODIS instrument
MODIS-T Tilted MODIS instrument to minimize sun glint
MOS Marine Optical Spectroradiometer
MOU Memorandum of Understanding
MSB Most Significant Bits
MS/DOS MicroSoft/Disk Operating System
MTF Modulation Transfer Function

– N –

NABE North Atlantic Bloom Experiment
NAS National Academy of Science
NASA National Aeronautics and Space Administration
NASCOM NASA Communications
NASDA National Space Development Agency (Japan)
NASIC NASA Aircraft/Satellite Instrument Calibration
NAVSPASUR Naval Space Surface Surveillance
NCAR National Center for Atmospheric Research
NCCOSC Navy Command, Control, and Ocean Surveillance Center
NCDC (NOAA) National Climatic Data Center
NCDS NASA Climate Data System
NCSA National Center for Supercomputing Applications
NCSU North Carolina State University
NDBC National Data Buoy Center
NDVI Normalized Difference Vegetation Index
NEdL Noise Equivalent Differential Spectral Radiance
NE$\Delta$T Noise Equivalent Delta Temperature
NE$\delta$L Noise Equivalent delta Radiance
NER Noise Equivalent Radiance
NERC Natural Environment Research Council
NESDIS National Environmental Satellite Data Information Service
NESS National Environmental Satellite Service
NET NIMBUS Experiment Team
netCDF (NASA) Network Common Data Format
NFS Network File System
NGDC National Geophysical Data Center
NIMBUS Not an acronym, but a series of NASA experimental weather satellites containing a wide variety of atmosphere, ice, and ocean sensors.
NIST National Institute of Standards and Technology
NMC National Meteorological Center
NMFS National Marine Fisheries Service
NOAA National Oceanic and Atmospheric Administration
NOARL Naval Oceanographic and Atmospheric Research Laboratory
NODC National Oceanographic Data Center
NORAD North American Air Defense (Command)
NOPS NIMBUS Observation Processing System
NOS National Ocean Service
NRA NASA Research Announcement
NRaD Naval Research and Development
NRIFSF National Research Institute of Far Seas Fisheries (Japan)
NRL Naval Research Laboratory
NRT Near-Real Time
NSCAT NASA Scatterometer
NSF National Science Foundation
NSSDC National Space Science Data Center

– O –

OAM Optically Active Materials
OCDM Ocean Color Data Mission
OCEAN Ocean Colour European Archive Network
OCS Ocean Color Scanner
OCTS Ocean Color Temperature Sensor (Japan)

ODAS Ocean Data Acquisition System
ODEX Optical Dynamics Experiment
ODU Old Dominion University
OFFI Optical Free-Fall Instrument
OI Original Irradiance
OLIPAC Oligotrophy in the Pacific (Ocean)
OMEX Ocean Marine Exchange
ONR Office of Naval Research
OPT Ozone Processing Team
OS Operating System
OSC Orbital Sciences Corporation
OSFI Optical Surface Floating Instrument
OSSA Office of Space Science and Applications
OSU Oregon State University

– P –

PAR Photosynthetically Available Radiation
PC (IBM) Personal Computer
PDR Preliminary Design Review
PDT Pacific Daylight Time
PFF Programmable Frame Formatter
PI Principal Investigator
PIKE Phased Illuminated Knife Edge
PM-1 Not an acronym, used to designate the afternoon.
PMEL Pacific Marine Environmental Laboratory
PML Plymouth Marine Laboratory
POC Particulate Organic Carbon
POLDER Polarization Detecting Environmental Radiometer (France) or Polarization and Directionality of the Earth's Reflectances (depending on usage).
PON Particulate Organic Nitrogen
PR Photo Research
PRIME Plankton Reactivity in the Marine Environment
PST Pacific Standard Time
PSU Practical Salinity Units
PTFE Polytetrafluoroethylene
PUR Photosynthetically Usable Radiation

– Q –

QC Quality Control
QED Quantum Efficient Device

– R –

R&A Research and Applications
R&D Research and Development
R/V Research Vessel
RACER Research on Antarctic Coastal Ecosystem Rates
RDBMS Relational Database Management System
RDF Radio Direction Finder
RF Radio Frequency
RFP Request for Proposals
RISC Reduced Instruction Set Computer
rms root mean squared
ROSIS Remote Sensing Imaging Spectrometer, also known as the Reflective Optics System Imaging Spectrometer (Germany)
RR Round-Robin
RSMAS Rosenstiel School for Marine and Atmospheric Sciences (University of Miami)
RSS Remote Sensing Systems (Inc.)
RTOP Research and Technology Operation Plan

– S –

S/C Spacecraft
S/N Serial Number
SAC Satellite Applications Centre
SARSAT Search and Rescue Satellite
SBRC (Hughes) Santa Barbara Research Center
SBUV Solar Backscatter Ultraviolet Radiometer
SBUV-2 Solar Backscatter Ultraviolet Radiometer–2
SCADP SeaWiFS Calibration and Acceptance Data Package
SCOR Scientific Committee on Oceanographic Research
SDPS SeaWiFS Data Processing System
SDS Scientific Data Set
SDSU San Diego State University
SeaBASS SeaWiFS Bio-Optical Archive and Storage System
SEAPAK Not an acronym, but an image display and analysis package developed at GSFC.
SeaSCOPE SeaWiFS Study of Climate, Ocean Productivity, and Environmental Change
SeaWiFS Sea-viewing Wide Field-of-view Sensor
SES Shelf Edge Study
SGI Silicon Graphics, Incorporated
SI *Système International d' Unités* or International System of Units
SIG Special Interest Group
SIO Scripps Institution of Oceanography
SIO/MPL Scripps Institution of Oceanography/Marine Physical Laboratory
SIRREX SeaWiFS Intercalibration Round-Robin Experiment
SIRREX-1 The First SIRREX (July 1992)
SIRREX-2 The Second SIRREX (June 1993)
SIRREX-3 The Third SIRREX (September 1994)
SIS Spherical Integrating Source
SISSR Submerged *In Situ* Spectral Radiometer
SJSU San Jose State University
SMM Solar Maximum Mission
SNR Signal-to-Noise Ratio
SO Southern Ocean (algorithm)
SOC Simulation Operations Center
SOGS SeaStar Operations Ground Subsystem
SOH State of Health
SOW Statement of Work
SPM Suspended Particulate Material or Special Perturbations Model (depending on usage).
SPO SeaWiFS Project Office
SPOT *Satellite Pour l'Observation de la Terre* (France)
SPSWG SeaWiFS Prelaunch Science Working Group
SQL Sequential Query Language
SRC Satellite Receiving Station (NERC)
SRT Sigma Research Technology, Incorporated
SSM/I Special Sensor for Microwave/Imaging
SST Sea Surface Temperature or SeaWiFS Science Team (depending on usage).
ST Science Team
STM Science Team Member
SUN Sun Microsystems
SWAP Sylter Wattenmeer Austausch-prozesse
SWG Science Working Group
SXR SeaWiFS Transfer Radiometer

–T–

T-S Temperature-Salinity
TAE Transportable Applications Executive
TAO Thermal Array for the Ocean or more recently, Tropical Atmosphere-Ocean
TBD To Be Determined
TBUS Not an acronym, but a NOAA orbit prediction
TDI Time-Delay and Integration
TDRSS Tracking and Data Relay Satellite System
TIROS Television Infrared Observation Satellite
TLM Telemetry
TM Technical Memorandum
TOA Top of the Atmosphere
TOGA Tropical Ocean Global Atmosphere program
TOMS Total Ozone Mapping Spectrometer
TOPEX Topography Experiment
TOVS TIROS Operational Vertical Sounder
TRMM Tropical Rainfall Measuring Mission
TSM Total Suspended Material
TV Thermal Vacuum

–U–

UA University of Arizona
UARS Upper Atmosphere Research Satellite
UAXR University of Arizona's Transfer Radiometer
UCAR University Consortium for Atmospheric Research
UCMBO University of California Marine Bio-Optics
UCSB University of California at Santa Barbara
UCSD University of California at San Diego
UH University of Hawaii
UIM/X User Interface Management/X-Windows
UM University of Miami
UNESCO United Nations Educational, Scientific, and Cultural Organizations
UNIX Not an acronym, a computer operating system.
UPS Uninterruptable Power System
URI University of Rhode Island
USC University of Southern California
USF University of South Florida
UTM Universal Transverse Mercator (projection)
UV Ultraviolet
UVB Ultraviolet-B
UWG User Working Group

–V–

V0 Version 0
V1 Version 1
VAX Virtual Address Extension
VCS Version Control Software
VDC Volts Direct Current
VHF Very High Frequency
VI Virtual Instrument
VISLAB Visibility Laboratory (Scripps Institution of Oceanography)
VISNIR Visible and Near Infrared
VMS Virtual Memory System
VSF Volume Scattering Function

–W–

WFF Wallops Flight Facility
WHOI Woods Hole Oceanographic Institute
WMO World Meteorological Organization
WOCE World Ocean Circulation Experiment
WORM Write-Once Read-Many (times)
WVS World Vector Shoreline

–X–

XDR External Data Representation

–Y, Z–

YBOM Yamato Bank Optical Mooring

## Symbols

### – A –

$a$ The semi-major axis of the Earth's orbit, a formulation constant, a constant equal to 0.983, a constant equal to $-20/\tanh(2)$ or an exponential value in the expression relating the radiance of scattered light to wavelength (depending on usage).

$a(z,\lambda)$ Spectral absorption coefficient.

$a_{\le}$ Oxygen absorption coefficient.

$a_{ox}$ Coefficient for oxygen absorption.

$a_{oz}$ Coefficient for ozone absorption.

$a_{wv}$ Coefficient for water vapor absorption.

$A_0$ Coefficient for the linear term in the scan modulation correction equation.

$A_d$ The detector aperture.

$A_f$ The foam reflectance.

$A_i$ The intersection area.

$A(k)$ Absorptivity.

$A(\lambda)$ Coefficient for calculating $b_b(\lambda)$.

### – B –

$b$ Formulation coefficient or a constant equal to 1/3 (depending on usage).

$b(z,\lambda)$ Total scattering coefficient.

$b(\theta,z,\lambda_0)$ Volume scattering coefficient.

$b_b(z,\lambda)$ Spectral backscattering coefficient.

$b_{bc}(\lambda)$ Spectral backscattering coefficient for phytoplankton.

$b_r(\lambda)$ Total Raman scattering coefficient.

$b_w(\lambda)$ Total scattering coefficient for pure seawater.

$b1(k)$ Input data for polarization calculations for SeaWiFS band 1.

$b7(k)$ Input data for polarization calculations for SeaWiFS band 7.

$B$ Excess target radiance.

$B_0$ Coefficient for the power term in the scan modulation correction equation.

$B(\lambda)$ Coefficient for calculating $b_b(\lambda)$.

### – C –

$c(z,\lambda)$ Spectral beam attenuation coefficient .

$c(z,660)$ Red beam attenuation (at 660 nm).

$[chl.\ a]/K$ Concentration of chlorophyll $a$ over $K$, the diffuse attenuation coefficient.

$C$ Chlorophyll $a$ pigment, or just pigment concentration.

$C_1$ Measured value for the flight diffuser on a given scan line, in counts.

$C_{13}$ Pigment concentration derived using CZCS bands 1 and 3.

$C_2$ Measured value of the flight diffuser for the scan line immediately sequential to the first scan line used to measure the flight diffuser, i.e., $S_1$, in counts.

$C_{23}$ Pigment concentration derived using CZCS bands 2 and 3.

$C_{dark}$ Instrument dark restore value, in counts.

$C_{ext}$ Average total extinction cross-section of a particle.

$C_F$ The calibration factor.

$C_{out}$ Instrument output, in counts.

$C_{ref}$ Reference chlorophyll value (0.5).

$C_{temp}$ Temperature sensor output, in counts, represented by an 8-bit digital word in the SeaStar telemetry.

$[C+P]$ Pigment concentration defined as mg chlorophyll $a$ plus phaeopigments $m^{-3}$.

### – D –

$d$ The distance between source and detector apertures.

$d_i$ Distance from the $i$th observation point to the point of interest.

$d_j$ Distance from the $j$th observation point to the point of interest.

$d(I(\lambda))$ An increment in detector current.

$d\lambda$ An increment in wavelength.

$ds$ Detector configuration datum.

$D$ Sequential day of the year.

$\vec{D}$ Orbit position difference vector.

$D_{at}$ Along-track position difference.

$D_{ct}$ Cross-track position difference.

$D_{rad}$ Radial position difference.

$DC$ Digital count (value) or direct current (depending on usage).

$DC_{10}$ Digital counts at 10-bit digitization.

$DC_{meas}$ The digital counts measured unshadowed.

$DC_{scat}$ The digital counts due to scattered sunlight.

$DC_{TOA}$ The digital counts measured at the top of the atmosphere.

### – E –

$e$ Orbit eccentricity of the Earth.

$E(\lambda)$ Spectral irradiance.

$E_a(\lambda)$ Irradiance in air.

$E_{beg}$ Beginning irradiance value.

$E_{cal}$ Calibration source irradiance.

$E_d$ Incident downwelling irradiance.

$E_d(0^-,\lambda)$ Incident spectral irradiance.

$E_d(z,\lambda)$ Downwelled spectral irradiance.

$E_{end}$ Ending irradiance value.

$E_{meas}(\lambda)$ Measured radiance.

$E_{ref}(\lambda)$ Reference radiance.

$E_s(\lambda)$ Surface irradiance.

$E_{rem}$ Percentage of energy removed from a wavelength band.

$E_{sky}(\lambda)$ Spectral sky irradiance distribution.

$E_{sun}(z,\lambda)$ Spectral sun irradiance distribution.

$E_u(z,\lambda)$ Upwelled spectral irradiance.

$E_w(z,\lambda)$ Irradiance in water.

### – F –

$f$ The fraction of the surface covered by foam.

$f_i$ Filter number, $i$=0–11.

$f$-ratio The ratio of new to total production.

$\bar{F}$ Arithmetic average.

$\overline{F}(\lambda)$ A mean conversion factor.

$F(\lambda)$ Calibration factor.

$F(\lambda)$ A conversion factor to convert PR714 readings to the GSFC sphere radiance scale.

$\bar{F}(\lambda)$ Average of calibration factors.

$F_0$ Extraterrestrial irradiance corrected for Earth-sun distance.

$\mathbb{F}_0$ The scalar value of the solar spectral irradiance at the top of the atmosphere, multiplied by a columnar matrix of the four Stokes parameters (1/2, 1/2, 0, 0).

$\overline{F}_0$ Mean solar irradiance.

$F_0'$ Extraterrestrial irradiance corrected for the atmosphere.

$\bar{F}_0(\lambda)$ Mean extraterrestrial spectral irradiance.

$\overline{F}_0(\lambda)$ Mean extraterrestrial irradiance.

$F_a$ Forward scattering probability of the aerosol.
$F_d$ The total flux incident on the surface if it did not reflect light.
$F'_d$ The total flux incident on the surface, corrected for surface reflection.
$\mathbb{F}'_d$ The scalar value of the total flux incident on the surface, corrected for surface reflection, multiplied by a columnar matrix of the four Stokes parameters.
$F_i$ A correction factor.

– G –

$g_1$ A constant equal to 0.82.
$g_2$ A constant equal to −0.55.
$gs$ Gain selection datum.
$G$ Gain factor.
$G_1$ Gain setting 1.
$G_2$ Gain setting 2.
$G_3$ Gain setting 3.
$G_4$ Gain setting 4.
$G(\lambda)$ $\acute{R}_a(\lambda_i)/\acute{R}_a(670) = (670/\lambda)^\gamma\ T_{2r}(670)/T_{2r}(\lambda_i)$.
$G_e$ Gravitational constant of the Earth (398,600.5 km$^3$ s$^{-2}$).
$G_n$ Gain factor at gain setting $n$.

– H –

$h(k)$ Residual values without the calculated sinusoidal response.
$H_{\rm GMT}$ GMT in hours.
$H_M$ The measured moon irradiance.
$H_s$ Altitude of the spacecraft (for SeaStar 705 km).

– I –

$i$ Inclination angle or interval index (depending on usage).
$i'$ Inclination angle minus 90°.
$I$ Rayleigh intensity.
$I_0$ Surface downwelling irradiance.
$I_1$ Radiant intensity after traversing through an absorbing medium.
$I_2$ Reflected radiant energy received by the satellite sensor.
$I_{\rm max}$ Recorded maximum instrument output in response to linearly polarized light.
$I_{\rm min}$ Recorded minimum instrument output in response to linearly polarized light.
$I(\lambda)$ Detector current.
$ICS$ Current from the current source diode.

– J –

$j$ Interval index.
$J2$ The $J2$ gravity field term (0.0010863).
$J3$ The $J3$ gravity field term (−0.0000254).
$J4$ The $J4$ gravity field term (−0.0000161).
$J5$ The $J5$ gravity field term.

– K –

$\bar{k}$ Wavenumber of light ($1/\lambda$).
$k_1$ Beginning wavenumber.
$k_2$ Ending wavenumber.
$k_c(\lambda)$ Spectral fit coefficient weighted over the SeaWiFS bands; $k'_c(\lambda)$ also used.
$K(z,\lambda)$ Diffuse attenuation coefficient.
$K(490)$ Diffuse attenuation coefficient of seawater measured at 490 nm.
$K_0(\lambda)$ Diffuse attenuation coefficient at $z = 0$.
$K_1$ Primary instrument sensitivity factor.
$K_2$ Gain factor.
$K_3$ Temperature dependence of detector output.
$K_4$ Scan modulation correction factor.
$K_5$ Spacecraft analog to digital conversion factor.
$K_6$ Analog-to-digital offset in spacecraft conversion.
$K_7$ Current from the diode at 20°C.
$K_c(\lambda)$ Attenuation coefficients for phytoplankton.
$K_E(\lambda)$ Attenuation coefficient downwelled irradiance.
$K_g(\lambda)$ Attenuation coefficients for Gelbstoff.
$K_L(z,\lambda)$ Attenuation coefficient upwelled radiance.
$K_w(\lambda)$ Attenuation coefficients for pure seawater.

– L –

$L(\lambda)$ Spectral radiance.
$L(\lambda_m)$ The radiance of a calibration sphere at the nominal peak wavelength of a filter.
$L(z,\theta,\phi)$ Submerged upwelled radiance distribution.
$L_0$ The radiance of the atmosphere.
$L_a$ Aerosol radiance.
$L_c(\lambda)$ Cloud radiance threshold.
$L_{\rm cal}$ Calibration source radiance.
$\mathbb{L}_d$ A matrix of the four Stokes parameters for radiance incident on the surface.
$L_{\rm cloud}$ Maximum radiance from reflected light off of clouds.
$L_g(\lambda)$ Sun glint radiance.
$L_i(\lambda)$ Spectral radiance for run number $i$, or radiance, where $i$ may represent any of the following: $m$ for measured; $LU$ for look-up table; 0 for light scattered by the atmosphere; sfc for reflection from the sea surface; and $w$ for water-leaving radiance.
$L_{LU}$ The radiance calculated for the look-up tables.
$L_m$ The radiance of the ocean-atmosphere system measured at a satellite.
$L_M$ The radiance of the moon.
$L_{\rm max}$ Maximum saturation radiance.
$L_{\rm nadir}$ Measured radiance at nadir.
$L_{\rm NER}\lambda)$ Noise equivalent radiance.
$L_r(\lambda)$ Rayleigh radiance.
$L_{r0}(\lambda)$ Rayleigh radiance at standard atmospheric pressure, $P_0$.
$L_s(\lambda)$ Subsurface water radiance.
$L_{sa}$ $L_0 + L_{\rm sfc}$.
$L_{\rm sat}(\lambda)$ Saturation radiance for the sensor.
$L_{\rm scan}$ Measured radiance at any pixel in a scan.
$L_{\rm sfc}$ The radiance of the light reflected from the sea surface.
$\mathbb{L}_{\rm sfc}$ The columnar matrix of the four Stokes parameters ($L_{u,1}$, $L_{u,2}$, $L_{u,3}$, $L_{u,4}$).
$L_{\rm sky}(\lambda)$ Spectral sky radiance distribution.
$L_t(\lambda)$ Total radiance at the sensor.
$L_{\rm typical}$ Expected radiance from the ocean measured on orbit.
$L_u(z,\lambda)$ Upwelled spectral radiance.
$\mathbb{L}_{\rm up}$ The columnar matrix of light leaving the surface containing the values $L_{{\rm up},1}$, $L_{{\rm up},2}$, $L_{{\rm up},3}$, and $L_{{\rm up},4}$.
$L_{{\rm up},i}$ The **RADTRAN** radiance parameters (for $i = 1,4$).
$L_W$ The water-leaving radiance of light scattered from beneath the surface and penetrating it.
$L_W(443)$ Water-leaving radiance at 443 nm.

$L_W(520)$ Water-leaving radiance at 520 nm.
$L_W(550)$ Water-leaving radiance at 550 nm.
$L_W(670)$ Water-leaving radiance at 670 nm.
$\mathbb{L}_w$ The scalar value of the water-leaving radiance multiplied by a columnar matrix of the four Stokes parameters.
$L_{WN}(\lambda)$ Normalized water-leaving radiance.
$LS_1$ Measured radiance for mirror side 1.
$LS_2$ Measured radiance for mirror side 2.

– M –

$m$ Index of refraction.
$M$ Path length through the atmosphere.
$M'_m$ The corrected mean orbit anomaly of the Earth, which is a function of date, and refers to an imaginary moon in a circular orbit.
$M_{oz}$ Path length for ozone transmittance.

– N –

$n$ The index of refraction, the mean orbital motion in revolutions per day, or the gain setting (depending on usage).
$n(\lambda)$ An exponent conceptually similar to the Ångström exponent.
$n_w(\lambda)$ Index of refraction of water.
$N$ The total number of something.
$N_D$ The compensation factor for a 4 log neutral density filter.
$N$ Total number density.
$N_i$ Total number density of either the first or second aerosol model when $i = 1$ or 2, respectively.

– O –

$\vec{O}$ $\vec{P} \times \vec{V}$.

– P –

$p_a$ A factor to account for the probability of scattering to the spacecraft for three different paths from the sun.
$p_a/(4\pi)$ Aerosol albedo of the scattering phase function.
$p_w$ The probability of seeing sun glitter in the direction $\theta, \Phi$ given the sun in position $\theta_0, \Phi_0$ as a function of wind speed ($W$).
$P$ Nodal period, phaeopigment concentration or local surface pressure (depending on usage).
$\vec{P}$ Orbit position vector.
$P(\theta^+)$ Phase function for forward scattering.
$P(\theta^-)$ Phase function for backward scattering.
$P_0$ Standard atmospheric pressure (1,013.25 mb).
$P_a$ Probability of scattering to the spacecraft.
$P_i$ PR714 raw radiance.
$P_\sigma$ Phaeopigment concentration.
$PF$ Polarization factor.
Pxl Pixel number, i.e., the numerical designation of a pixel in a scan line.

– Q –

$q$ Water transmittance factor.
$Q(\lambda)$ $L_u(0^-,\lambda)$ to $E_u(0^-,\lambda)$ relation factor (theoretically equal to $\pi$).

– R –

$r$ Water-air reflectance for totally diffuse irradiance.
$r_1$ The radius of circle one or source aperture (depending on usage).
$r_2$ The radius of circle two or detector aperture (depending on usage).
$r_i$ The geometric mean radii of either the first or second aerosol model when $i = 1$ or 2, respectively.
$R$ Reflectance.
$\mathbb{R}$ The reflection matrix.
$R^2$ The square of the linear correlation coefficient.
$R(0^-,\lambda)$ Irradiance reflectance just below the sea surface.
$R_1$ Multiplier for mirror side 1.
$R_2$ Multiplier for mirror side 2.
$R_a$ Aerosol reflectance.
$\grave{R}_a$ $R_a/(qT_{2r})$.
$R_e$ Mean Earth radius (6,378.137 km).
$R_E$ Effective resistance for the thermistor-resistor pair.
$R_L(z,\lambda)$ Spectral reflectance.
$R_r$ Rayleigh reflectance.
$R_{rs}$ Remote sensing reflectance.
$R_s$ Subsurface reflectance.
$R_t$ Total reflectance at the sensor.
$\grave{R}_t$ $(R_t - R_r)/(qT_{2r})$.
$R_T$ Resistance of the thermistor.
$R_z$ Sunspot number.

– S –

$s$ The reflectance of the atmosphere for isotropic radiance incident at its base.
$s(\lambda)$ Slope for the range 0–1,023.
$S$ Solar constant.
$S_i$ Initial detector signal.
$S_n$ Detector signal with gain.
$S(\lambda)$ $L_a(\lambda)/L_a(670)$.

– T, U –

$t$ Time variable or the transmission of $L_{sfc}$ through the atmosphere (depending on usage).
$t'$ The transmission of $L_W$ through the atmosphere.
$t(k)$ Spectral transmission as a function of wavenumber.
$t(\lambda)$ Diffuse transmittance of the atmosphere.
$t_0$ The sum of the direct and diffuse transmission of sunlight through the atmosphere.
$t_1$ First observation time.
$t_2$ Second observation time.
$t_0$ Initial time.
$t_{aa}$ Aerosol transmittance after absorption.
$t_{as}$ Aerosol transmittance after scattering.
$t_d$ Direct component of transmittance after absorption by the gaseous components of the atmosphere, scattering and absorption by aerosols, and scattering by Rayleigh.
$t_e$ Time difference in hours between present position and most recent equator crossing.
$t_{EC}$ Equator crossing time.
$t_{oz}$ Transmittance after absorption by ozone.
$t_r$ Transmittance after Rayleigh scattering.
$t_s$ Diffuse component of transmittance after absorption by the gaseous components of the atmosphere, scattering and absorption by aerosols, and scattering by Rayleigh.
$t_{wv}$ Transmittance after absorption by water vapor.

$T$ Tilt position.
$T(\lambda)$ The transmittance along the slant path to the sun.
$T_s(\lambda)$ Transmittance through the surface.
$T(\lambda,\theta)$ Total transmittance (direct plus diffuse) from the ocean through the atmosphere to the spacecraft along the path determined by the spacecraft zenith angle $\theta$.
$T_{2r}$ Two-way diffuse transmittance for Rayleigh attenuation.
$T_0(\lambda,\theta_0)$ Total downward transmittance of irradiance.
$T_e$ Equation of time.
$T_{ox}$ Transmittance of oxygen ($O_2$).
$T_{oz}$ Transmittance of ozone ($O_3$).
$T_s(\lambda)$ Transmittance through the surface.
$T_w(\lambda)$ Transmittance through a water path.
$T_{wv}$ Transmittance of water vapor ($H_2O$).

– V –

$\vec{V}$ Orbit velocity vector.
$V_i(t_j)$ The $i$th spatial location at observation time $t_j$.
$V_M$ The radiance detector voltage while viewing the moon.
$V_S$ The irradiance detector voltage while viewing the sun.
$V_T$ Focal plane temperature sensor voltage output.

– W –

$W$ Wind speed.
$W_d$ Direct irradiance divided by the total irradiance at the surface.
$W_s$ Diffuse irradiance divided by the total irradiance.

– X –

$x$ Abscissa or longitudinal coordinate, or the pixel number within a scan line (depending on usage).
$X$ ECEF $x$ component of orbit position.
$\dot{X}$ ECEF $X$ component of orbit velocity.

– Y –

$y$ Ordinate or meridional coordinate.
$Y$ ECEF $y$ component of orbit position.
$\dot{Y}$ ECEF $Y$ component of orbit velocity.

– Z –

$Z$ ECEF $z$ component of orbit position.
$\dot{Z}$ ECEF $Z$ component of orbit velocity.

– Greek –

$\alpha$ Percent albedo, tilt angle, formulation coefficient (intercept), the power constant in the Ångström formulation, or the exponential value in the expression relating the extinction coefficient to wavelength (depending on usage).

$\beta$ A formulation coefficent (slope) or a constant in the Ångström formulation (depending on usage).
$\beta_i$ The extinction coefficient of either the first or second aerosol model when $i=1$ or 2, respectively.
$\beta(z,\lambda,\theta)$ Spectral volume scattering function.

$\gamma$ The Ångström exponent.
$\gamma(\lambda)$ The ratio of the aerosol optical thickness at wavelength $\lambda$ to the aerosol optical thickness at 670 nm.

$\delta$ The great circle distance from $\Psi_s(t_0)$ to $\Psi_s(t-t_0)$, the departure of each individual conversion factor from the mean, a relative difference, or the absorption coefficient (depending on usage).
$\Delta k$ Equivalent bandwidth.
$\Delta L_W(670)$ The error in the water-leaving radiance for the red channel.
$\Delta pCO_2$ Partial pressure difference of $CO_2$ between air and sea water.
$\Delta P$ The difference in successive pixels or the pressure deviation from standard pressure, $P_0$ (depending on usage).
$\Delta t$ Time difference.
$\Delta T(\lambda)$ The error in transmittance.
$\Delta\theta_s$ The error (in radians) in the knowledge of $\theta_s$.
$\Delta\lambda$ An interval in wavelength.
$\Delta\rho_w(\lambda)$ The error in the water-leaving reflectance for the red channel.
$\Delta\sigma(\lambda)$ The absolute error in spectral optical depth.
$\Delta\tau_a$ The error in the aerosol optical thickness.
$\Delta\omega$ The longitude difference from the sub-satellite point to the pixel.
$\Delta\omega_s$ Longitude difference.

$\eta$ Bearing from the sub-satellite point to the pixel along the direction of motion of the satellite.

$\theta$ Spacecraft zenith angle, spacecraft pitch, or polar angle of the line-of-sight at a spacecraft (depending on usage).
$\dot{\theta}$ Pitch rate.
$\theta_0$ Polar angle of the direct sunlight.
$\theta_1$ The intersection angle of circle one.
$\theta_2$ The intersection angle of circle two.
$\theta_0$ Solar zenith angle.
$\theta_n$ The zenith angle of the vector normal to the surface vector for which glint will be observed.
$\theta_N$ The angle with respect to nadir that the sea surface slopes to produce a reflection angle to the spacecraft.
$\theta_s$ Scan angle of sensor or the solar zenith angle (depending on usage).
$\theta'_s$ Scan angle of sensor adjusted for tilt.

$\kappa$ An integration constant: $\kappa = A_d\pi r_1^2(r_1^2+r_2^2+d^2)^{-1}$.

$\lambda$ Wavelength of light.
$\lambda_1$ Starting wavelength.
$\lambda_2$ Ending wavelength.
$\lambda_m$ Nominal center wavelength.

$\mu$ Mean value or cosine of the satellite zenith angle (depending on usage).
$\mu_0$ Cosine of the solar zenith angle.
$\overline{\mu}_d(0^+,\lambda)$ Spectral mean cosine for downwelling radiance at the sea surface.
$\mu_s$ The reciprocal of the effective optical length to the top of the atmosphere, along the line of sight to the sun.

$\nu_j$ The $j$th temporal weighting factor.

$\xi_{EM}$ The distance between the Earth and the moon.

$\rho$ The Fresnel reflectivity, the weighted direct plus diffuse reflectance, or the average reflectance of the sea (depending on usage).
$\rho(\theta)$ Fresnel reflectance for viewing geometry.
$\rho(\theta_0)$ Fresnel reflectance for solar geometry.
$\rho_{c,i}$ Reflectance of clouds and ice.
$\rho_n$ Sea surface reflectance for direct irradiance at normal incidence for a flat sea.
$\rho_i$ The reflectance of the sea of either the first or second aerosol model when $i = 1$ or 2, respectively.
$\rho_i(\lambda)$ The reflectance where $i$ may represent any of the following: $m$ for measured; $LU$ for look-up table; $o$ for light scattered by the atmosphere; sfc for reflection from the sea surface; and $w$ for water-leaving radiance.
$\rho_N$ Reflectance for diffuse irradiance.

$\sigma$ One standard deviation of a set of data values.
$\sigma^2$ The mean square surface slope distribution.
$\sigma(\lambda)$ The spectral optical depth.
$\sigma_i^2$ $\sigma_i^2 = \langle(\log r - \log r_i)^2\rangle$.

$\tau(z,\lambda)$ Spectral optical depth.
$\tau_a$ Aerosol optical thickness.
$\tau_{\rm ox}$ Oxygen optical thickness at 750 nm.
$\tau_{\rm oz}$ The optical thickness of ozone.
$\tau_r$ Rayleigh optical thickness (due to scattering by the standard molecular atmosphere).
$\tau_r'$ Pressure corrected Rayleigh optical thickness.
$\tau_{r0}$ Rayleigh optical thickness at standard atmospheric pressure, $P_0$.
$\tau_{ro}$ Rayleigh optical thickness weighted by the SeaWiFS spectral response.
$\tau_s(\lambda)$ Spectral solar atmospheric transmission.
$\tau_{\rm wv}$ The absorption optical thickness of water vapor.

$\phi$ Azimuth angle of the line-of-sight at a spacecraft.
$\phi_0$ Azimuth angle of the direct sunlight.
$\Phi$ Spacecraft azimuth angle or roll (depending on usage).
$\dot{\Phi}$ Roll rate.
$\Phi_D$ The detector solid angle.
$\Phi_M$ The solid angle subtended by the moon at the measuring instrument.
$\Phi_0$ Solar azimuth angle.

$\Psi$ Pixel latitude or yaw (depending on usage).
$\dot{\Psi}$ Yaw rate.
$\Psi_d$ Solar declination latitude.
$\Psi_s(t)$ Sub-satellite latitude as a function of time.

$\omega$ Longitude variable or the surface reflection angle (depending on usage).
$\omega_0$ Old longitude value.
$\omega_a$ Single scattering albedo of the aerosol.
$\omega_e$ Equator crossing longitude.
$\omega_i$ Spatial weighting factor.
$\omega_s$ Longitude variable.
$\Omega$ Solar hour angle or the amount of ozone in Dobson units (depending on usage).

## References

–A–


Abbott, M.R., and P.M. Zion, 1985: Satellite observations of phytoplankton variability during an upwelling event. *Cont. Shelf Res.,* **4,** 661–680.

——, and D.B. Chelton, 1991: Advances in passive remote sensing of the ocean. *U. S. National Report to the International Union of Geodesy and Geophysics 1987–1990, Contributions in Oceanography,* Am. Geophys. Union, Washington, DC, 571–589.

Abel, P., G.R. Smith, R.H. Levin, and H. Jacobowitz, 1988: Results from aircraft measurements over White Sands, New Mexico, to calibrate the visible channels of spacecraft instruments. *SPIE,* **924,** 208–214.

——, B. Guenther, R. Galimore, and J. Cooper, 1993: Calibration results for NOAA-11 AVHRR channels 1 and 2 from congruent aircraft observations. *J. Atmos. and Ocean. Technol.,* **10,** 493–508.

Ahmad, Z., and R.S. Fraser, 1982: An iterative radiative transfer code for ocean-atmosphere systems. *J. Atmos. Sci.,* **39,** 656–665.

Allen, C.W., 1973: *Astrophysical Quantities, 3rd Edition.* Athalone Press London, 310 pp.

Andersen J.H., 1991: CZCS level-2 generation. *OCEAN Technical Series, Nos. 1–8, Ocean Colour European Archive Network,* 49 pp.

Anderson, R.F., 1992: Southern Ocean processes study. *U.S. JGOFS Planning Report Number 16,* Woods Hole Oceanographic Institution, Woods Hole, Massachusetts, 114 pp.

André, J.-M. and A. Morel, 1989: Simulated effects of barometric pressure and ozone content upon the estimate of marine phytoplankton from space. *J. Geophys. Res.,* **94,** 1,029–1,037.

——, and ——, 1991: Atmospheric corrections and interpretation of marine radiances in CZCS imagery, revisited. *Oceanol. Acta,* **14,** 3–22.

Ångström , A., 1964: The parameters of atmospheric turbidity. *Tellus,* **16,** 64–75.

Arking, A., and J.D. Childs, 1985: Retrieval of cloud cover parameters from multispectral satellite images. *J. Climate Appl. Meteor.,* **24,** 322–333.

Austin, R.W., 1974: The remote sensing of spectral radiance from below the ocean surface. *Optical Aspects of Oceanography,* N.G. Jerlov and E. Steemann-Nielsen, Eds., Academic Press, 317–344.

——, 1976: Air-Water Radiance Calibration Factor. *Tech. Memo. ML-76-004t,* Vis. Lab., Scripps Inst. of Oceanogr., La Jolla, California, 8 pp.

——, 1980: Gulf of Mexico, ocean-color surface-truth measurements. *Bound.-Layer Meteor.,* **18,** 269–285.

——, 1993: Optical remote sensing of the oceans: BC (Before CZCS) and AC (After CZCS). *Ocean Colour: Theory and Applications in a Decade of CZCS Experience,* V. Barale and P. Schlittenhardt, Eds., ECSC, EEC, EAEC, Brussels and Luxembourg, Kluwer Academic Publishers, Norwell, Massachusetts, 1–15.

——, and T.J. Petzold, 1975: An instrument for the measurement of spectral attenuation coefficient and narrow-angle volume scattering function of ocean waters. *Visibility Laboratory of the Scripps Institution of Oceanography Report, SIO Ref. 75-25,* 12 pp.

——, and G. Halikas, 1976: The index of refraction of seawater. *SIO Ref. 76-1,* Vis. Lab., Scripps Inst. of Oceanogr., La Jolla, California, 64 pp.

——, and T.J. Petzold, 1981: The determination of diffuse attenuation coefficient of sea water using the Coastal Zone Color Scanner. *Oceanography from Space,* J.F.R. Gower, Ed., Plenum Press, 239–256.

——, and B.L. McGlamery, 1983: Passive remote sensing of ocean optical propagation parameters. *32nd Symp., AGARD Electromagnetic Wave Propagation Panel on Propagation Factors Affecting Remote Sensing by Radio Waves,* Oberammergau, Germany, 45-1–45-10.


–B–


Baker, K.S., and R.C. Smith, 1982: Bio-optical classification and model of natural waters, 2. *Limnol. Oceanogr.,* **27,** 500–509.

——, and ——, 1990: Irradiance transmittance through the air/water interface. *Ocean Optics X,* R.W. Spinrad, Ed., SPIE, **1302,** 556–565.

Balch, W.M., 1993: Reply. *J. Geophys. Res.,* **98,** 16,585-16,587.

——, R. Evans, J. Brown, G. Feldman, C. McClain, and W. Esaias, 1992: The remote sensing of ocean primary productivity–use of a new data compilation to test satellite algorithms. *J. Geophys. Res.,* **97,** 2,279–2,293.

Ball Aerospace Systems Division, 1979: Development of the Coastal Zone Color Scanner for Nimbus-7, Test and Performance Data. *Final Report F78-11, Rev. A, Vol. 2,* Boulder, Colorado, 94 pp.

Barale, V., C.R. McClain, and P. Malanotte-Rizzoli, 1986: Space and time variability of the surface color field in the northern Adriatic Sea. *J. Geophys. Res.,* **91,** 12,957–12,974.

——, and R. Wittenburg-Fay, 1986: Variability of the ocean surface color field in central California near-coastal waters as observed in seasonal analysis of CZCS imagery. *J. Mar. Res.,* **44,** 291–316.

——, and P. Schlittenhardt, 1993: *Ocean Colour: Theory and Applications in a Decade of CZCS Experience,* ECSC, EEC, EAEC, Brussels and Luxembourg, Kluwer Academic Publishers, Norwell, Massachusetts, 367 pp.

Barnes, R.A., and A.W. Holmes, 1993: Overview of the SeaWiFS Ocean Sensor. *Proc. SPIE,* **1,939,** 224–232.

——, W.L. Barnes, W.E. Esaias, and C.L. McClain, 1994a: Prelaunch Acceptance Report for the SeaWiFS Radiometer. *NASA Tech. Memo. 104566, Vol. 22,* S.B. Hooker, E.R. Firestone, and J.G. Acker, Eds., NASA Goddard Space Flight Center, Greenbelt, Maryland, 32 pp.

——, A.W. Holmes, W.L. Barnes, W.E. Esaias, and C.R. McClain, 1994b: The SeaWiFS Prelaunch Radiometeric Calibration and Spectral Characterization. *NASA Tech. Memo. 104566, Vol. 23,* S.B. Hooker and E.R. Firestone, Eds., NASA Goddard Space Flight Center, Greenbelt, Maryland, 55 pp.

Berger, W.H., 1989: *Productivity of the Ocean: Present and Past.* V.S. Smetacek and G. Wefer, Eds., John Wiley & Sons, 471 pp.

Berk, A., L.S. Bernstein, and D.C. Robertson, 1989: MODTRAN: A moderate resolution model for LOWTRAN 7. *GL-TR-89-0122,* Geophysics Laboratory, Air Force Systems Command, 38 pp.

Bernstein, R.L., 1982: Sea surface temperature estimation using the NOAA-6 satellite Advanced Very High Resolution Radiometer. *J. Geophys. Res.,* **87,** 9,455–9,465.

Biggar, S.F., D.I. Gellman, and P.N. Slater, 1990: Improved evaluation of optical depth components from Langley plot data. *Remote Sens. Environ.,* **32,** 91–101.

——, P.N. Slater, K.J. Thome, A.W. Holmes, and R.A. Barnes, 1993: Preflight solar-based calibration of SeaWiFS. *Proc. SPIE, Vol. 1,939,* 233–242.

Bird, R.E., and C. Riordan, 1986: Simple solar spectral model for direct and diffuse irradiance on horizontal and tilted planes at the Earth's surface for cloudless atmospheres. *J. of Climate and Appl. Meteor.,* **25,** 87–97.

Booth, C.R.B. and R.C. Smith, 1988: Moorable spectroradiometer in the Biowatt Experiment. *Ocean Optics IX,* SPIE **925,** 176–188.

Bowman, K.P., and A.J. Krueger, 1985: A global climatology of total ozone from the Nimbus 7 Total Ozone Mapping Spectrometer. *J. Geophys. Res.,* **90,** 7,967–7,976.

Boyd, R.A., 1951: The development of prismatic glass block and the daylight laboratory. *Eng. Res. Bull. No. 32,* Eng. Res. Inst., Univ. of Mich., Ann Arbor, Michigan, 88 pp.

Bricaud, A., A. Morel, and L. Prieur, 1981: Absorption by dissolved organic matter of the sea (yellow substance) in the UV and visible domains. *Limnol. Oceanogr.,* **26,** 43–53.

——, and ——, 1987: Atmospheric corrections and interpretation of marine radiances in CZCS imagery: use of a reflectance model. *Oceanol. Acta,* **7,** 33–50.

Brock, J.C., C.R. McClain, M.E. Luther, and W.W. Hay, 1991: The phytoplankton bloom in the northwest Arabian Sea during the southwest monsoon of 1979. *J. Geophys. Res.,* **96,** 20,623–20,642.

——, and ——, 1992: Interannual variability in phytoplankton blooms observed in the northwestern Arabian Sea during the southwest monsoon. *J. Geophys. Res.,* **97,** 733–750.

Brouwer, D., 1959: Solution of the problem of artificial satellite theory without drag. *Astron. J.,* **64**(1274), 378–397.

Brown, C.W., and J.A. Yoder, 1994: Coccolithophorid blooms in the global ocean. *J. Geophys. Res.,* **99(C4),** 7,467–7,482.

Brown, O.B., and R.H. Evans, 1985: Calibration of Advanced Very High Resolution Radiometer infrared observations. *J. Geophys. Res.,* **90,** 11,667–11,677.

Bruegge, C.J., V.G. Duval, N.L. Chrien, and D.J. Diner, 1993: Calibration plans for the Multi-angle Imaging Spectroradiometer (MISR). *Metrologia,* **30(4),** 213–221.

Bruening, R.J., 1987: Spectral irradiance scales based on filtered absolute silicon photodetectors. *Appl. Opt.,* **26,** 1,051–1,057.

Burlov-Vasiljev, K.A., E.A. Gurtovenko, and Y.B. Matvejev, 1992: The Solar Radiation Between 310–680 nm. *Proceedings of the Workshop on the Solar Electromagnetic Radiation Study for Solar Cycle 22,* R.E. Donnelly, Ed., U.S. DOC NOAA Environmental Research Laboratory, Boulder, Colorado, 49–53.

– C –

Campbell, J.W., and J.E. O'Reilly, 1988: Role of satellites in estimating primary productivity on the northwest Atlantic continental shelf. *Cont. Shelf Res.,* **8,** 179–204.

Capellari, J.O., C.E. Velez, and A.J. Fuchs, 1976: Mathematical Theory of the Goddard Trajectory Determination System. *GSFC X-582-76-77,* NASA Goddard Space Flight Center, Greenbelt, Maryland, 596 pp.

Caraux, D., and R.W. Austin, 1983: Delineation of Seasonal Changes of Chlorophyll Frontal Boundaries in Mediterranean Coastal Waters with NIMBUS-7 Coastal Zone Color Scanner Data. *Rem. Sens. Environ.,* **13,** 239–249.

Carder, K.L., G.R. Harvey, R.G. Steward, and P.B. Ortner, 1989: Marine humic and fulvic acids: their effects on remote sensing of ocean chlorophyll. *Limnol. Oceanogr.,* **34,** 68–81.

——, W.W. Gregg, D.K. Costello, K. Haddad, and J.M. Prospero, 1991: Determination of Saharan dust radiance and chlorophyll *a* from CZCS imagery. *J. Geophys. Res.,* **96,** 5,369–5,378.

——, P. Reinersman, R.F. Chen, F. Müller-Karger, C.O. Davis, and M. Hamilton, 1993a: AVIRIS calibration and application in coastal oceanic environments. *Remote Sens. Environ.,* **44,** 205–216.

——, R.G. Steward, R.F. Chen, S. Hawes, Z. Lee, and C.O. Davis, 1993b: AVIRIS calibration and application in coastal oceanic environments: Tracers of soluble and particulate constituents of the Tampa Bay coastal plume. *Photogramm. Eng. Remote Sens,* **59(3),** 339–344.

Cardone, V.J., J.G. Greenwood, and M.A. Cane, 1990: On trends in historical marine wind data. *J. Climate,* **3,** 113–127.

Cebula, R.P., H. Park, and D.F. Heath, 1988: Characterization of the Nimbus-7 SBUV radiometer for the long term monitoring of stratospheric ozone. *J. Atmos. Ocean. Technol.,* **5,** 215–227.

Chamberlin, W.S., C.R. Booth, D.A. Kiefer, J.H. Morrow, and R.C. Murphy, 1989: Evidence for a simple relationship between natural fluorescence, photosynthesis, and chlorophyll *a* in the sea. *Deep Sea Res.,* **37,** 951–973.

Chelton, D.B., and M.G. Schlax, 1991: Estimation of time averages from irregularly spaced observations: With application to coastal zone color scanner estimates of chlorophyll *a* concentrations. *J. Geophys. Res.,* **96,** 14,669–14,692.

Chin, R.T., C. Jau, and J.A. Weinman, 1987: The application of time series models to cloud field morphology analysis. *J. Climate Appl. Meteor.*, **26**, 363–373.

Clark, D.K., 1981: Phytoplankton pigment algorithms for the Nimbus-7 CZCS. *Oceanography from Space,* J.F.R. Gower, Ed., Plenum Press, 227–238.

——, E.T. Baker, and A.E. Strong, 1980: Upwelled spectral radiance distributions in relation to particulate matter in sea water. *Bound.-Layer Meteor.*, **18**, 287-298.

Coakley, J.A., Jr., and F.P. Bretherton, 1982: Cloud cover from high resolution scanner data: Detecting and allowing for partially filled fields of view. *J. Geophys. Res.*, **87**, 4,917–4,932.

Comiso, J.C., N.G. Maynard, W.O. Smith, Jr., and C.W. Sullivan, 1990: Satellite ocean color studies of Antarctic ice edges in summer and autumn. *J. Geophys. Res.*, **95**, 9,481–9,496.

——, C.R. McClain, C.W. Sullivan, J.P. Ryan, and C.L. Leonard, 1993: Coastal zone color scanner pigment concentrations in the Southern Ocean and relationships to geophysical surface features. *J. Geophys. Res.*, **98**, 2,419–2,451.

Corredera, P., A. Corróns, A. Pons, and J. Campos, 1990: Absolute spectral Irradiance scale in the 700–2400 nm spectral range. *Appl. Opt.*, **29**, 3,530–3,534.

Cox, C., and W. Munk, 1954a: Measurement of the roughness of the sea surface from photographs of the sun's glitter. *J. Opt. Soc. Am.*, **44**, 838–850.

——, and ——, 1954b: Statistics of the sea surface derived from sun glitter. *J. Mar. Res.*, **13**, 198–277.

——, and ——, 1955: *Some Problems in Optical Oceanography.* Scripps Institution of Oceanography, LaJolla, California, 63–77.

Crane, R.J., and M.R. Anderson, 1984: Satellite discrimination of snow/cloud surfaces. *Int. J. Remote Sens.*, **5**, 213–223.

Curran, R.J., 1972: Ocean color determination through a scattering atmosphere. *Appl. Opt.*, **11**, 1,857–1,866.

——, H.L. Kyle, L.R. Blaine, J. Smith, and T.D. Clem, 1981: Multichannel scanning radiometer for remote sensing cloud physical parameters. *Rev. Sci. Instrum.*, **52**, 1,546–1,555.

– D –

Darzi, M., 1992: Cloud Screening for Polar Orbiting Visible and IR Satellite Sensors. *NASA Tech. Memo. 104566, Vol. 7*, S.B. Hooker and E.R. Firestone, Eds., NASA Goddard Space Flight Center, Greenbelt, Maryland, 7 pp.

——, J. Chen, J. Firestone, and C.R. McClain, 1989: SEAPAK: A satellite image analysis system for oceanographic research. *Proc. Fifth Intl. Conf. Interactive Information Processing Systems for Meteorol., Oceanogr., and Hydrol.*, Am. Meteorol. Soc., Atlanta, Georgia, 26–32.

Dave, J.V., 1972a: Development of programs for computing characteristics of ultraviolet radiation. *Technical Report—Vector Case, Program IV,* FSC-72-0013, IBM Federal Systems Division, Gaithersburg, Maryland, 138 pp.

——, 1972b: Development of programs for computing characteristics of ultraviolet radiation. *Technical Report—Scalar Case, Program II,* FSC-72-0011, IBM Federal Systems Division, Gaithersburg, Maryland, 38 pp.

Denman, K.L., and M.R. Abbott, 1988: Time evolution of surface chlorophyll patterns from cross spectrum analysis of satellite color images. *J. Geophys. Res.*, **93**, 6,789–6,798.

Detwiler, A., 1990: Analysis of cloud imagery using box counting. *Int. J. Remote Sens.*, **11**, 887–898.

Deuser, W.G., F.E. Muller-Karger, and C. Hemleben, 1988: Temporal variations of particle fluxes in the deep subtropical and tropical North Atlantic: Eulerian versus Lagrangian effects. *J. Geophys. Res.*, **93**, 6,857–6,862.

——, ——, R.H. Evans, O.B. Brown, W.E. Esaias, and G.C. Feldman, 1990: Surface-ocean color and deep-sea carbon flux: how close a connection? *Deep-Sea Res.*, **37**, 1,331–1,343.

Dickey, T., J. Marra, T. Granata, C. Langdon, M. Hamilton, J. Wiggert, D. Siegel, and A. Bratkovich, 1991: Concurrent high-resolution bio-optical and physical time series observations in the Sargasso Sea during the spring of 1987. *J. Geophys. Res.*, **96**, 8,643–8,663.

Duffett-Smith, P., 1979: *Practical Astronomy With Your Calculator.* Cambridge University Press, 129 pp.

– E –

Ebert, E.E., 1992: Pattern recognition analysis of polar clouds during summer and winter. *Int. J. Remote Sens.*, **13**, 97–109.

Eck, T.F., and V.L. Kalb, 1991: Cloud-screening for Africa using a geographically and seasonally variable infrared threshold. *Int. J. Remote Sens.*, **12**, 1,205–1,221.

Eckstein, B.A., and J.J. Simpson, 1991: Cloud screening Coastal Zone Color Scanner images using channel 5. *Int. J. Remote Sens.*, **12**, 2,359–2,377.

England, C.F., and G.E. Hunt, 1985: A bispectral method for the automatic determination of parameters for use in imaging satellite cloud retrievals. *Int. J. Remote Sens.*, **6**, 1,545–1,553.

Eppley, R.W., 1984: Relations between primary productivity and ocean chlorophyll determined by satellites. *Global Ocean Flux Study: Proceedings of a Workshop,* National Academy Press, Washington, DC, 85–102.

Esaias, W., G. Feldman, C.R. McClain, and J. Elrod, 1986: Satellite observations of oceanic primary productivity. *Eos, Trans. AGU,* **67**, 835–837.

Evans, R.H., and H.R. Gordon, 1994: CZCS "system calibration:" A retrospective examination. *J. Geophys. Res.*, **99**, 7,293–7,307.

– F –

Feldman, G., 1986: Variability of the productive habitat in the eastern equatorial Pacific. *Eos, Trans. AGU,* **67**, 106–108.

——, D. Clark, and D. Halpern, 1984: Satellite color observations of the phytoplankton distribution in the eastern equatorial Pacific during the 1982–1983 El Niño. *Science,* **226**, 1,069–1,071.

——, N. Kuring, C. Ng, W. Esaias, C. McClain, J. Elrod, N. Maynard, D. Endres, R. Evans, J. Brown, S. Walsh, M. Carle, and G. Podesta, 1989: Ocean Color: Availability of the global data set. *Eos, Trans. AGU,* **70,** 634.

Firestone, E.R., and S.B. Hooker 1992: SeaWiFS Technical Report Series Cumulative Index: Volumes 1–5. *NASA Tech. Memo. 104566, Vol. 6,* S.B. Hooker and E.R. Firestone, Eds., NASA Goddard Space Flight Center, Greenbelt, Maryland, 9 pp.

——, and S.B. Hooker 1993: SeaWiFS Technical Report Series Cumulative Index: Volumes 1–11. *NASA Tech. Memo. 104566, Vol. 12,* S.B. Hooker and E.R. Firestone, Eds., NASA Goddard Space Flight Center, Greenbelt, Maryland, 28 pp.

——, and S.B. Hooker 1995: SeaWiFS Technical Report Series Cumulative Index: Volumes 1–17. *NASA Tech. Memo. 104566, Vol. 18,* S.B. Hooker and E.R. Firestone, Eds., NASA Goddard Space Flight Center, Greenbelt, Maryland, 47 pp.

Firestone, J.K., G. Fu, M. Darzi, and C.R. McClain, 1990: NASA's SEAPAK software for oceanographic data analysis: An update. *Proc. Sixth Int. Conf. Interactive Information Processing Systems for Meteor., Oceanogr., and Hydrol.,* Am. Meteor. Soc., Anaheim, California, 260–267.

——, and B.D. Scheiber, 1994: "The Generation of Ancillary Data Climatologies." In: McClain, C.R., K.R. Arrigo, J. Comiso, R. Fraser, M. Darzi, J.K. Firestone, B. Schieber, E-n. Yeh, and C.W. Sullivan, 1994: Case Studies for SeaWiFS Calibration and Validation, Part 1. *NASA Tech. Memo. 104566, Vol. 13,* S.B. Hooker and E.R. Firestone, Eds., NASA Goddard Space Flight Center, Greenbelt, Maryland, 35–42.

Flierl, G., D. Glover, J. Bishop, and S. Paranjpe, 1993: *The JGOFS Distributed Object Oriented Data System User Guide.* Massachusetts Institute of Technology, Cambridge, Massachusetts, 90 pp.

Flittner, D.E., and P.N. Slater, 1991: Stability of narrow-band filter radiometers in the solar-reflective range. *Photogramm. Eng. Remote Sens.,* **57,** 165–171.

Fofonoff, N.P., and R.C. Millard, Jr., 1983: Algorithms for Computation of Fundamental Properties of Seawater. *UNESCO Tech. Papers in Mar. Sci.,* **44,** UNESCO, 53 pp.

Fraser, R.S., 1993: Optical thickness of atmospheric dust over Tadjhikistan. *Atmos. Envir.,* **27A,** 2,533–2,538.

——, R.A. Ferrare, Y.J. Kaufman, B.L. Markham, and S. Mattoo, 1992: Algorithm for atmospheric corrections of aircraft and satellite imagery. *Int. J. Remote Sens.,* **13,** 541–557.

Frederick, J.E., R.P. Cebula, and D.F. Heath, 1986: Instrument characterization for detection of long-term changes in stratospheric ozone: An analysis of the SBUV/2 radiometer. *J. Atmos. Ocean. Technol.,* **3,** 472–480.

Frohlich, C., 1979: WMO/PMOD Sunphotometer: Instructions for Manufacture. *World Meteor. Org.,* Geneva, Switzerland, 3 pp., (plus tables and drawings).

Frost, B.W., 1991: The role of grazing in nutrient rich areas of the open seas. *Limnol. Oceanogr.,* **36,** 1,616–1,630.

Fukuchi, M., 1980: Phytoplankton chlorophyll stocks in the Antarctic ocean. *J. Oceanogr. Soc. Japan,* **36,** 73–84.

– G –

Gallaudet, T.C., and J.J. Simpson, 1991: Automated cloud screening of AVHRR imagery using split-and-merge clustering. *Remote Sens. Environ.,* **38,** 77–121.

Garand, L., 1986: *Automated Recognition of Oceanic Cloud Patterns and Its Application to Remote Sensing of Meteorological Parameters.* Doctoral dissertation, Dept. of Meteorology, Univ. of Wisconsin-Madison.

General Sciences Corp., 1991: SeaWiFS Science Data and Information System Architecture Report. *GSC-TR-21-91-006,* General Sciences Corp., Laurel, Maryland, 133 pp.

Gieskes, W.W.C., and G.W. Kraay, 1986: Analysis of phytoplankton pigments by HPLC before, during, and after mass occurrence of the microflagellate corymbellus during the spring bloom in the open north North Sea in 1983. *Mar. Biol.,* **92,** 45–52.

Gleason, J.F., P.K. Bhartia, J.R. Herman, R. McPeters, P. Newman, R.S. Stolarski, L. Flynn, G. Labow, D. Larko, C. Seftor, C. Wellemeyer, W.D. Komhyr, A.J. Miller, and W. Planet, 1993: Record low global ozone in 1992. *Science,* **260,** 523–526.

Gordon, H.R., 1978: Removal of atmospheric effects from satellite imagery of the oceans. *Appl. Opt.,* **17,** 1,631–1,636.

——, 1981a: Reduction of error introduced in the processing of coastal zone color scanner-type imagery resulting from sensor calibration and solar irradiance uncertainty. *Appl. Opt.,* **20,** 207–210.

——, 1981b: A preliminary assessment of the Nimbus-7 CZCS atmospheric correction algorithm in a horizontally inhomogeneous atmosphere. *Oceanography from Space,* J.F.R. Gower, Ed., Plenum Press, 257–266.

——, 1985: Ship perturbations of irradiance measurements at sea, 1: Monte Carlo simulations. *Appl. Opt.,* **24,** 4,172–4,182.

——, 1987a: Calibration requirements and methodology for remote sensors viewing the ocean in the visible. *Remote Sens. Environ.,* **22,** 103–126.

——, 1987b: Visible calibration of ocean-viewing sensors. *Remote Sens. of Environ.,* **22,** 103–126.

——, 1988: Ocean color remote sensing systems: radiometric requirements. *Recent Advances in Sensors, Radiometry, and Data Processing for Remote Sensing,* P.N. Slater, Ed., SPIE, **924,** 151–167.

——, 1989: Can the Lambert-Beer law be applied to the diffuse attenuation coefficient of ocean water? *Limnol. Oceanogr.,* **34,** 1,389–1,409.

——, 1990: Radiometric considerations for ocean color remote sensors. *Appl. Opt.,* **29,** 3,228–3,236.

——, 1991: Absorption and scattering estimates from irradiance measurements: Monte Carlo simulations. *Limnol. Oceanogr.,* **36,** 769–777.

——, and D.K. Clark, 1980: Remote sensing optical properties of a stratified ocean: an improved interpretation. *Appl. Opt.,* **19,** 3,428–3,430.

——, ——, J.L. Mueller, and W.A. Hovis, 1980: Phytoplankton pigments from the NIMBUS-7 Coastal Zone Color Scanner: Comparisons with surface measurements. *Science,* **210,** 63–66.

——, and ——, 1981: Clear water radiances for atmospheric correction of coastal zone color scanner imagery. *Appl. Opt.,* **20,** 4,175–4,180.

——, ——, J.W. Brown, O.B. Brown, and R.H. Evans, 1982: Satellite measurements of phytoplankton pigment concentration in the surface waters of a warm core Gulf Stream ring. *J. Mar. Res.,* **40,** 491–502.

——, ——, ——, ——, ——, and W.W. Broenkow, 1983a: Phytoplankton pigment concentrations in the Middle Atlantic Bight: Comparison of ship determinations and CZCS estimates. *Appl. Opt.,* **22,** 20–36.

——, J.W. Brown, O.B. Brown, R.H. Evans, and D.K. Clark, 1983b: Nimbus 7 CZCS: reduction of its radiometric sensitivity with time. *Appl. Opt.,* **24,** 3,929–3,931.

——, and D.J. Castaño, 1987: Coastal Zone Color Scanner atmospheric correction algorithm: multiple scattering effects. *Appl. Opt.,* **26,** 2,111–2,122.

——, O.B. Brown, R.H. Evans, J.W. Brown, R.C. Smith, K.S. Baker, and D.K. Clark, 1988a. A semianalytic radiance model of ocean color. *J. of Geophys. Res.,* **93,** 10,909–10,924.

——, J.W. Brown, and R.H. Evans, 1988b: Exact Rayleigh scattering calculations for use with the Nimbus-7 Coastal Zone Color Scanner. *Appl. Opt., 27,* **5,** 862–871.

——, and D.J. Castaño, 1989: Aerosol analysis with Coastal Zone Color Scanner: A simple method for including multiple scattering effects. *Appl. Opt.,* **28,** 1,320–1,326.

——, and K. Ding, 1991: Self shading of in-water optical instruments. *Limnol. Oceanogr.,* **37,** 491–500.

——, and M. Wang, 1994: Retrieval of water-leaving radiances and aerosol optical thickness over the oceans with SeaWiFS: a preliminary algorithm, *Appl. Opt.,* **33,** 443–452.

Gower, J.F.R., 1985: Reduction of the effect of clouds on satellite thermal imagery. *Int. J. Remote Sens.,* **6,** 1,419–1,434.

Gregg, W.W., 1992: Analysis of Orbit Selection for SeaWiFS: Ascending vs. Descending Node. *NASA Tech. Memo. 104566, Vol. 2,* S.B. Hooker and E.R. Firestone, Eds., NASA Goddard Space Flight Center, Greenbelt, Maryland, 16 pp.

——, 1993: The Simulated SeaWiFS Data Set, Version 1. *NASA Tech. Memo. 104566, Vol. 9,* S.B. Hooker and E.R. Firestone, Eds., NASA Goddard Space Flight Center, Greenbelt, Maryland, 17 pp.

——, and K.L. Carder, 1990: A simple spectral solar irradiance model for cloudless maritime atmospheres. *Limnol. Oceanogr.,* **35,** 1,657–1,675.

——, and F.S. Patt, 1994: Assessment of tilt capability for spaceborne global ocean color sensors. *IEEE Trans. Geosci. Remote Sens.,* **32,** 866–877.

Griggs, M., 1968: Absorption coefficients of ozone in the ultraviolet and visible regions. *J. Chem. Phys.,* **49,** 857.

Groom, S.B., and P.M. Holligan, 1987: Remote sensing of coccolithophorid blooms. *Adv. Space Res.,* **7,** 73–78.

Guenther, B., 1991: Accuracy and precisions actually achieved for large aperture sources for aircraft and space investigations. *Metrologia,* **28,** 229–232.

Gutman, G., D. Tarpley, and G. Ohring, 1987: Cloud screening for determination of land surface characteristics in a reduced resolution satellite data set. *Int. J. Remote Sens.,* **8,** 859–870.

– H –

Habermann, T., 1991: Freeform—A Flexible System of Format Specifications For Data Access. National Geophysical Data Center, NOAA, 37 pp.

Haury, L.R., J.J. Simpson, J. Pelaez, C. Koblinsky, and D. Wiesenhahn, 1986: Biological consequences of a recurrent eddy off Point Conception, California. *J. Geophys. Res.,* **91,** 12,937–12,956.

Hay, B.J., C.R. McClain, and M. Petzold, 1993: An assessment of the NIMBUS-7 CZCS calibration for May 1986 using satellite and *in situ* data from the Arabian Sea. *Remote Sens. Environ.,* **43,** 35–46.

Hayes, S.P., L.J. Mangum, J. Picaut, A. Sumi, and K. Takeuchi, 1991: TOGA-TAO: A moored array for real-time measurements in the tropical Pacific Ocean. *Bull. Am. Meteor. Soc.,* **72,** 339–347.

Helliwell, W.S., G.N. Sullivan, B. MacDonald, and K.J. Voss, 1990: Ship shadowing: model and data comparison. *Ocean Optics X,* R.W. Spinrad, Ed., SPIE, **1302,** 55–71.

Herman, J.R., R.D. Hudson, and G.N. Serafino, 1990: An analysis of the 8 year trend in ozone depletion from alternate models of SBUV instrument degradation. *J. Geophys. Res.,* **95,** 7,403–7,416.

Hoge, F.E., and R.N. Swift, 1990: Phytoplankton accessory pigments: Evidence for the influence of phycoerythrin on the submarine light field. *Remote Sens. Environ.,* **34,** 19–25.

Holm-Hansen, O., C.J. Lorenzen, R.W. Holmes, and J.D.H. Strickland, 1965: Fluorometric determination of chlorophyll. *J. du Cons. Int'l. pour l'Explor. de la Mer,* **30,** 3–15.

Hooker, S.B., P.L. Coronado, W.E. Esaias, G.C. Feldman, W.W. Gregg, C.R. McClain, B.W. Meeson, L.M. Olsen, R.A. Barnes, and E.F. Del-Colle, 1992a: *Baselines and Background Documentation,* SeaWiFS Science Team Meeting, January, 1993, Volume 1, S.B. Hooker and W.E. Esaias, Eds., SeaWiFS Proj. Office, NASA Goddard Space Flight Center, Greenbelt, Maryland, 244 pp.

——, W.E. Esaias, G.C. Feldman, W.W. Gregg, and C.R. McClain, 1992b: An Overview of SeaWiFS and Ocean Color. *NASA Tech. Memo. 104566, Vol. 1,* S.B. Hooker and E.R. Firestone, Eds., NASA Goddard Space Flight Center, Greenbelt, Maryland, 24 pp., plus color plates.

——, W.L. Barnes W.E. Esaias, G.C. Feldman, W.W. Gregg, R.G. Kirk, C.R. McClain, C.H. Vermillion, D.J. Zukor, R.A. Barnes, 1993a: *SeaWiFS Project Presentations,* SeaWiFS Science Team Meeting, January, 1993, Volume 2. S.B. Hooker and W.E. Esaias, Eds., SeaWiFS Proj. Office, NASA Goddard Space Flight Center, Greenbelt, Maryland, 235 pp.

——, W.E. Esaias, and L.A. Rexrode, 1993b: Proceedings of the First SeaWiFS Science Team Meeting. *NASA Tech. Memo. 104566, Vol. 8,* S.B. Hooker and E.R. Firestone, Eds., NASA Goddard Space Flight Center, Greenbelt, Maryland, 61 pp.

——, C.R. McClain, and A. Holmes, 1993c: Ocean color imaging: CZCS to SeaWiFS. *Mar. Tech. Soc. J.,* **27,** 3–15.

Hoots, F.R., and R.L. Roehrich, 1980: Models for Propagation of NORAD Element Sets. *Project Spacetrack Report No. 3,* 100 pp.

Hoppel, W.A., J.W. Fitzgerald, G.M. Frick, and R.E. Larson, 1990: Aerosol size distributions and optical properties found in the marine boundary layer over the Atlantic Ocean. *J. Geophys. Res.,* **95,** 3,659–3,686.

Hovis, W.A., 1981: The Nimbus-7 Coastal Zone Color Scanner (CZCS) program. *Oceanography from Space,* J.F.R. Gower, Ed., Plenum Press, 213–225.

——, and K.C. Leung, 1977: Remote sensing of ocean color. *Optical Eng.,* **16,** 158–166.

——, D.K. Clark, F. Anderson, R.W. Austin, W.H. Wilson, E.T. Baker, D. Ball, H.R. Gordon, J.L. Mueller, S. El-Sayed, B. Sturm, R.C. Wrigley, and C.S. Yentsch, 1980: NIMBUS-7 Coastal Zone Color Scanner: System description and initial imagery. *Science,* **210,** 60–63.

——, J.S. Knoll, and G.R. Smith, 1985: Aircraft measurements for calibration of an orbiting spacecraft sensor. *Appl. Opt.* **24,** 407–410.

Hughes, C.G., III, 1982: Silicon photodiode absolute spectral self-calibration using a filtered tungsten source. *Appl. Opt.,* **21,** 2,129–2,132.

– I –

Inn, E.C.Y., and Y. Tanaka, 1953: Absorption coefficient of ozone in the ultraviolet and visible regions. *J. Opt. Soc. Amer.,* **43,** 870–873.

Iqbal, M., 1983: *An Introduction to Solar Radiation.* Academic Press, 390 pp.

Ishizaka, J., 1990a: Coupling of Coastal Zone Color Scanner data to physical-biological model of the southeastern U.S. continental shelf ecosystem, 1. CZCS data description and Lagrangian particle tracing experiments. *J. Geophys. Res.,* **95,** 10,167–10,181.

——, 1990b: Coupling of Coastal Zone Color Scanner data to physical-biological model of the southeastern U.S. continental shelf ecosystem, 2. an Eulerian model. *J. Geophys. Res.,* **95,** 10,183–10,199.

——, 1990c: Coupling of Coastal Zone Color Scanner data to physical-biological model of the southeastern U.S. continental shelf ecosystem, 3. nutrient and phytoplankton fluxes and CZCS data assimilation. *J. Geophys. Res.,* **95,** 10,201–10,212.

– J –

Jerlov, N.G., 1976: *Marine Optics,* Elsevier Scientific Publishing Co., 231 pp.

Joint EOSAT–NASA SeaWiFS Working Group, 1987: System concept for wide-field-of-view observations of ocean phenomena from space. *Report of the Joint EOSAT/NASA SeaWiFS Working Group,* Earth Observation Satellite Co., Lanham, Maryland, 92 pp.

Joint Global Ocean Flux Study, 1991: JGOFS Core Measurements Protocols. *JGOFS Report No. 6,* Scientific Committee on Oceanic Research, 40 pp.

Joseph, J.H., 1985: The morphology of fair weather cumulus cloud fields as remotely sensed from satellites and some applications. *Adv. Space Res.,* **5,** 213–216.

Jursa, A.S., 1985: *Handbook of Geophysics and the Space Environment.* Air Force Geophysics Laboratory, 18-11–18-24.

Justice, J.O., B.L. Markham, J.R.G. Townshend, and R.L. Kennard, 1989: Spatial degradation of satellite data. *Int. J. Remote Sens.,* **10,** 1,539–1,561.

Justus, C.G., and M.V. Paris, 1985: A model for solar spectral irradiance and radiance at the bottom and top of a cloudless atmosphere, *J. Climate Appl. Meteor.,* **24,** 193–205.

– K –

Kasten, F., 1966: A new table and approximate formula for relative optical air mass. *Geophys. Biokimatol.,* **B14,** 206–223.

Kaufman, Y.J., 1987: The effect of subpixel clouds on remote sensing. *Int. J. Remote Sens.,* **8,** 839–857.

Kelly, K.A., 1985: Separating clouds from ocean in infrared images. *Remote Sensing Environ.,* **17,** 67–83.

Kerr, R.A., 1993: Ozone takes a nose dive after the eruption of Mt. Pinatubo. *Science,* **260,** 490–491.

Key, J.R., and R.G. Barry, 1989: Cloud cover analysis with Arctic AVHRR data. 1. Cloud detection. *J. Geophys. Res.,* **94,** 18,521–18,535.

——, J.A. Maslanik, and R.G. Barry, 1989: Cloud classification from satellite data using a fuzzy sets algorithm: A polar example. *Int. J. Remote Sens.,* **10,** 1,823–1,842.

Kidwell, K.B., 1991: NOAA Polar Orbiter User's Guide. NOAA NESDIS, Washington D.C., 279 pp.

Kiefer, D.A., and R.A. Reynolds, 1992: Advances in understanding phytoplankton fluorescence and photosynthesis. *Primary Productivity and Biogeochemical Cycles in the Sea,* P.G. Falkowski and A.D. Woodhead, Eds., Plenum Press, 155–174.

King, M.D., Y.J. Kaufman, W.P. Menzel, and D. Tanre, 1992: Remote sensing of cloud, aerosol, and water vapor properties from the Moderate Resolution Imaging Spectrometer (MODIS). *IEEE Trans. Geosci. Remote Sens.,* **30,** 2–27.

Kneizys, F.X., E.P. Shettle, W.O. Gallery, J.H. Chetwynd, L.W. Abreu, J.E.A. Selby, S.A. Clough, and R.W. Fenn, 1983: *Atmospheric transmittance/radiance: computer code LOWTRAN 6.* AFGL-TR-83-0187, Air Force Geophysics Lab, Hanscom AFB, Massachusetts, 200 pp.

Koepke, P., 1985: The reflectance factors of a rough ocean with foam. Comment on "Remote sensing of sea state using the 0.8–1.1 m spectral band" by L. Wald and M. Monget. *Int. J. Remote Sens.,* **6,** 787–799.

Kohler, R., R. Pello, and J. Bonhoure, 1990: Temperature dependent nonlinearity effects of a QED-200 detector in the visible. *Appl. Opt.*, **29**, 4,212–4,215.

Kuring, N., M.R. Lewis, T. Platt, and J.E. O'Reilly, 1990: Satellite-derived estimates of primary production on the northwest Atlantic continental shelf. *Cont. Shelf Res.*, **10**, 461–484.

– L –

Lee, Z., K.L. Carder, S.K. Hawes, R.G. Steward, T.G. Peacock and C.O. Davis, 1992: An interpretation of high spectral resolution remote sensing reflectance. *Optics of the Air-Sea Interface: Theory and Measurement,* L. Estep, Ed., SPIE, **1749**, 49–64.

Lyddane, R.H., 1963: Small eccentricities or inclinations in the Brouwer theory of the artificial satellite. *Astron. J.*, **68**, 555–558.

Lynnes, C., B. Vollmer, H. Griffioen, and P. King, 1992: *Metadata Submission Guide, version 0.9.* NASA Goddard Space Flight Center DAAC, Oct. 2, 1992, NASA GSFC, Greenbelt, Maryland, 11 pp.

– M –

Mantoura, R.F.C., and C.A. Llewellyn, 1983: The rapid determination of algal chlorophyll and carotenoid pigments and their breakdown products in natural waters by reverse-phase high-performance liquid chromatography. *Anal. Chim. Acta,* **151,** 297–314.

Marshall, B.R., and R.C. Smith, 1990: Raman scattering and in-water optical properties. *Appl. Opt.*, **29,** 71–84.

McClain, C.R., and L.P. Atkinson, 1985: A note on the Charleston Gyre. *J. Geophys. Res.*, **90,** 11,857–11,861.

——, S.-Y. Chao, L. Atkinson, J. Blanton, and F. de Castillejo, 1986: Wind-driven upwelling in the vicinity of Cape Finisterre, Spain. *J. Geophys. Res.*, **91,** 8,470–8,486.

——, J.A. Yoder, L.P. Atkinson, J.O. Blanton, T.N. Lee, J.J. Singer, and F. Muller-Karger, 1988: Variability of Surface Pigment Concentrations in the South Atlantic Bight. *J. Geophys. Res.*, **93,** 10,675–10,697.

——, J. Ishizaka, and E. Hofmann, 1990a: Estimation of phytoplankton pigment changes on the Southeastern U.S. continental shelf from a sequence of CZCS images and a coupled physical-biological model. *J. Geophys. Res.*, **95,** 20,213–20,235.

——, W.E. Esaias, G.C. Feldman, J. Elrod, D. Endres, J. Firestone, M. Darzi, R. Evans, and J. Brown, 1990b: Physical and biological processes in the North Atlantic during the First Global GARP Experiment. *J. Geophys. Res.*, **95,** 18,027–18,048.

——, M. Darzi, J. Firestone, E.-n. Yeh, G. Fu, and D. Endres, 1991a: SEAPAK Users Guide, Version 2.0, Vol. I—System Description. *NASA Tech. Mem. 100728,* NASA Goddard Space Flight Center, Greenbelt, Maryland, 158 pp.

——, ——, ——, ——, ——, and ——, 1991b: SEAPAK Users Guide, Version 2.0, Vol. II—Descriptions of Programs. *NASA Tech. Mem. 100728,* NASA Goddard Space Flight Center, Greenbelt, Maryland, 586 pp.

——, C.J. Koblinsky, J. Firestone, M. Darzi, E-n. Yeh, and B. Beckley, 1991c: An examination of some Southern Ocean data sets, *EOS Trans. AGU,* **72,** 345–351.

——, W.E. Esaias, W. Barnes, B. Guenther, D. Endres, S.B. Hooker, G. Mitchell, and R. Barnes, 1992a: Calibration and Validation Plan for SeaWiFS. *NASA Tech. Memo. 104566, Vol. 3,* S.B. Hooker and E.R. Firestone, Eds., NASA Goddard Space Flight Center, Greenbelt, Maryland, 41 pp.

——, G. Fu., M. Darzi, and J.K. Firestone, 1992b: PC-SEAPAK User's Guide, Version 4.0. *NASA Technical Memorandum 104557,* NASA Goddard Space Flight Center, Greenbelt, Maryland, 408 pp.

——, E-n. Yeh, and G. Fu, 1992c: An Analysis of GAC Sampling Algorithms: A Case Study. *NASA Tech. Memo. 104566, Vol. 4,* S.B. Hooker and E.R. Firestone, Eds., NASA Goddard Space Flight Center, Greenbelt, Maryland, 20 pp., plus color plates.

——, G. Feldman, and W. Esaias, 1993: Oceanic primary production. *Global Change Atlas,* C. Parkinson, J. Foster, and R. Gurney, Eds., Cambridge University Press, 251–263.

——, and E-n. Yeh, 1994: "CZCS Bio-Optical Algorithm Comparison." In: McClain, C.R., J.C. Comiso, R.S. Fraser, J.K. Firestone, B.D. Scheiber, E-n. Yeh, K.R. Arrigo, and C.W. Sullivan, 1994: Case Studies for SeaWiFS Calibration and Validation, Part 1. *NASA Tech. Memo. 104566, Vol. 13,* S.B. Hooker and E.R. Firestone, Eds., NASA Goddard Space Flight Center, Greenbelt, Maryland, 3–8.

——, and ——, 1994: "Sun glint flag sensitivity study." In: C.R. McClain, J.C. Comiso, R.S. Fraser, J.K. Firestone, B.D. Schieber, E-n. Yeh, K.R. Arrigo, and C.W. Sullivan, 1994: Case Studies for SeaWiFS Calibration and Validation, Part 1. *NASA Tech. Memo. 104566, Vol. 13,* S.B. Hooker and E.R. Firestone, Eds., NASA Goddard Space Flight Center, Greenbelt, Maryland, 46–47.

McClain, E.P., 1989: Global sea surface temperatures and cloud clearing for aerosol optical depth estimates. *Int. J. Remote Sens.*, **10,** 763–769.

——, W.G. Pichel, and C.C. Walton, 1985: Comparative performance of AVHRR-based multichannel sea surface temperatures. *J. Geophys. Res.*, **90,** 11,587–11,601.

McLean, J.T., and B.W. Guenther, 1989: Radiance calibration of spherical integrators. *Optical Radiation Measurements II,* SPIE, **1109,** 114–121.

Mecherikunnel, A.T., and H.L. Kyle, 1991: Eleven-year cycle of solar constant variation from spacecraft measurements: 1978 to 1990. *Science,* (withdrawn).

Meindl, E.A., and G.D. Hamilton, 1992: Programs of the National Data Buoy Center, *Bull. Am. Meteor. Soc.*, **73,** 985–993.

Michaelsen, J., X. Zhang, and R.C. Smith, 1988: Variability of pigment biomass in the California Current system as determined by satellite imagery, 2. temporal variability. *J. Geophys. Res.*, **93,** 10,883–10,896.

Mitchell, B.G., 1990: Algorithms for determining the absorption coefficient for aquatic particulates using the quantitative filter technique. *Ocean Optics X,* R.W. Spinrad, Ed., SPIE, **1302,** 137–148.

——, and D.A. Kiefer, 1984: Determination of absorption and fluorescence excitation spectra for phytoplankton. *Marine Phytoplankton and Productivity,* O. Holm-Hansen, L. Bolis, and R. Gilles, Eds., Springer-Verlag, 157–169.

——, and ——, 1988: Chlorophyll-*a* specific absorption and fluorescence excitation spectra for light-limited phytoplankton. *Deep-Sea Res.,* **35,** 639–663.

——, and O. Holm-Hansen, 1991: Bio-optical properties of Antarctic Peninsula waters: differentiation from temperate ocean models. *Deep-Sea Res.,* **39,** 1,009–1,028.

Morel, A., 1980: In-water and remote measurements of ocean color. *Bound.-layer Meteor.,* **18,** 178–201.

——, and L. Prieur, 1977: Analysis of variations in ocean color. *Limnol. Oceanogr.,* **22,** 709–722.

——, and R.C. Smith, 1982: Terminology and units in optical oceanography. *Mar. Geod.,* **5,** 335–349.

Mueller, J.L., 1985: Nimbus-7 CZCS: confirmation of its radiometric sensitivity decay rate through 1982. *Appl. Opt.,* **24,** 1,043–1,047.

——, 1988: Nimbus-7 CZCS: electronic overshoot due to cloud reflectance. *Appl. Opt.,* **27,** 438–440.

——, 1991: Integral Method for Irradiance Profile Analysis. *CHORS Tech. Memo. 007-91,* San Diego State Univ., San Diego, California, 10 pp.

——, 1993: The First SeaWiFS Intercalibration Round-Robin Experiment, SIRREX-1, July 1992. *NASA Tech. Memo. 104566, Vol. 14,* S.B. Hooker and E.R. Firestone, Eds., NASA Goddard Space Flight Center, Greenbelt, Maryland, 60 pp.

——, and R.E. Lang, 1989: Bio-optical provinces of the northeast Pacific Ocean: a provisional analysis. *Limnol. Oceanogr.,* **34,** 1,572–1,586.

——, and R.W. Austin, 1992: Ocean Optics Protocols. *NASA Tech. Memo. 104566, Vol. 5,* S.B. Hooker and E.R. Firestone, Eds., NASA Goddard Space Flight Center, Greenbelt, Maryland, 45 pp.

——, B.C. Johnson, C.L. Cromer, J.W. Cooper, J.T. McLean, S.B. Hooker, and T.L. Westphal, 1994: The Second SeaWiFS Intercalibration Round-Robin Experiment, SIRREX-2, June 1993. *NASA Tech. Memo. 104566, Vol. 16,* S.B. Hooker and E.R. Firestone, Eds., NASA Goddard Space Flight Center, Greenbelt, Maryland, 121 pp.

Muller-Karger, F., C.R. McClain, and P. Richardson, 1988: The dispersal of the Amazon water. *Nature,* **333,** 56–59.

——, ——, T.R. Fisher, W.E. Esaias, and R. Varela, 1989: Pigment distribution in the Caribbean Sea: Observations from space. *Prog. Oceanogr.,* **23,** 23–64.

——, ——, R.N. Sambrotto, and G.C. Ray, 1990: A comparison of ship and CZCS-mapped distributions of phytoplankton in the Southeastern Bering Sea. *J. Geophys. Res.,* **95,** 11,483–11,499.

——, J.J. Walsh, R.H. Evans, and M.B. Meyers, 1991: On the seasonal phytoplankton concentration and sea surface temperature cycles of the Gulf of Mexico as determined by satellites. *J. Geophys. Res.,* **96,** 12,645–12,665.

– N –

National Academy of Sciences, 1984: *Global Ocean Flux Study, Proceedings of a Workshop,* National Acad. Press, 360 pp.

National Aeronautics and Space Administration, 1982: The marine resources experiment program (MAREX). *Report of the Ocean Color Science Working Group,* NASA Goddard Space Flight Center, Greenbelt, Maryland, 107 pp.

National Oceanic and Atmospheric Administration (NOAA), 1990: *NDBC Data Availability Summary,* 1801-24-02 Rev. E, U.S. Dept. of Commerce, National Data Buoy Center, Stennis Space Center, 88 pp.

National Research Council, 1990: *TOGA, A Review of Progress and Future Opportunities.* National Academy Press, Washington, D.C., 66 pp.

National Space Science Data Center, 1991: NSSDC CDF User's Guide for UNIX Systems, version 2.1. *Publication NSSDC-WDC-A-R&S 91-30,* 245 pp.

——, 1993: NODIS (NSSDC's On-line Data and Information Service) [database on-line] Master Directory [cited July 1993] Data Set Information Search; identifier: Multiple Key Word Search—TOMS and COADS.

Neckel, H., and D. Labs, 1984: The solar radiation between 3300 and 12500 Å. *Sol. Phys.,* **90,** 205–258.

– O –

Olesen, F.-S., and H. Grassel, 1985: Cloud detection and classification over the oceans at night with NOAA-7. *Int. J. Remote Sens.,* **6,** 1,435–1,444.

Olsen, L.M., and C.R. McClain, 1992: Cooperative efforts in support of ocean research through NASA's Climate Data System. *Proc. Eighth Int. Conf. on Interactive Inform. and Processing Systems for Meteor., Oceanogr., and Hydrol.,* Am. Meteor. Soc., 206–211.

– P, Q –

Pagano, T.S., and R.M. Durham, 1993: Moderate resolution imaging spectroradiometer (MODIS). *Proc. SPIE,* **1,939,** 2–17.

Palmer, J.M., 1988: Use of self-calibrated detectors in radiometric instruments. *Recent Advances in Sensors, Radiometry, and Data Processing for Remote Sensing.* P.N. Slater, Ed., SPIE, **924,** 224–231.

Paltridge, G.W., and C.M.R. Platt, 1976: Radiative processes in meteorology and climatology. *Developments in Atmospheric Science, Vol. 5.* Elsevier Scientific Publishing Co., 318 pp.

Parikh, J.A., 1977: A comparative study of cloud classification techniques. *Remote Sens. Environ.,* **6,** 67–81.

Patt, F.S., C.W. Hoisington, W.W. Gregg, and P.L. Coronado, 1993: Analysis of Selected Orbit Propagation Models for the SeaWiFS Mission. *NASA Tech. Memo. 104566, Vol. 11,* S.B. Hooker and E.R. Firestone, Eds., NASA Goddard Space Flight Center, Greenbelt, Maryland, 16 pp.

——, and W.W. Gregg, 1994: Exact closed-form geolocation algorithm for Earth survey sensors. *Inter. J. Remote Sens.*, **15**, 3,719–3,734.

Petzold, T.J., 1988: A Method for Obtaining Analytical Curve Fits to Underwater Radiometric Measurements. *Tech. Memo. Oc Op/TJP-88-06t*, Scripps Inst. of Oceanogr., La Jolla, California, 20 pp.

——, and R.W. Austin, 1988: Characterization of MER-1032. *Tech. Memo. EV-001-88t*, Vis. Lab., Scripps Inst. of Ocean ogr., La Jolla, California, 56 pp.

Pinder, G.F., and W.G. Gray, 1977: *Finite Element Simulation in Surface and Subsurface Hydrology*. Academic Press, 295 pp.

Phulpin, T., M. Derrien, and A. Brard, 1983: A two-dimensional histogram procedure to analyze cloud cover from NOAA satellite high-resolution imagery. *J. Climate Appl. Meteor.*, **22** 1,332–1,345.

Platt, T., and S. Sathyendranath, 1988: Oceanic primary production: estimation by remote sensing at local and regional scales. *Science*, **241**, 1,613–1,620.

——, ——, C.M. Caverhill, and M.R. Lewis, 1988: Ocean primary production and available light: further algorithms for remote sensing. *Deep-Sea Res.*, **35**, 855–879.

——, and ——, 1993: Comment on "The remote sensing of ocean primary productivity: Use of a new data compilation to test satellite algorithms," by, William Balch et al., *J. Geophys. Res.*, **98**, 16,583–16,584.

– R –

Raschke, E., P. Bauer, and H.J. Lutz, 1992: Remote sensing of clouds and surface radiation budget over polar regions. *Int. J. Remote Sens.*, **13**, 13–22.

Research Systems, Inc., 1992a: *Interactive Data Language (IDL) User's Guide, Ver. 3.0.* Boulder, Colorado, 356 pp.

——, 1992b: *Interactive Data Language (IDL) Reference Guide, Version 3.0.* Boulder, Colorado, 424 pp.

Reynolds, D.W., and T.H. Vonder Haar, 1977: A bispectral method for cloud parameter determination. *Mon. Wea. Rev.*, **105**, 446–457.

Reynolds, R.W., 1988: A real-time global sea surface temperature analysis. *J. Climate*, **1**, 75–86.

Rossow, W.B., L.C. Garder, P.-J. Lu, and A. Walker, 1988: International Satellite Cloud Climatology Project (ISCCP) Documentation of Cloud Data. *WMO/TD-No. 266*, World Meteor. Org., Geneva.

——, L.C. Garder, and A.A. Lacis, 1989: Global, seasonal cloud variations from satellite radiance measurements. Part I: Sensitivity of analysis. *J. Climate*, **2**, 419–458.

——, and R.A. Schiffer, 1991: ISCCP cloud data products. *Bull. Am. Meteor. Soc.*, **72**, 2–20.

– S –

Saunders, R.W., 1986: An automated scheme for the removal of cloud contamination for AVHRR radiances over western Europe. *Int. J. Remote Sens.*, **7**, 867–888.

——, 1989: A comparison of satellite-retrieved parameters with mesoscale model results. *Quart. J. Roy. Meteor. Soc.*, **115**, 551–572.

——, and K.T. Kriebel, 1988: An improved method for detecting clear sky and cloudy radiances from AVHRR data. *Int. J. Remote Sens.*, **9**, 123–150, *Errata*, ibid., **9**, 1,393–1,394.

Shaw, G.E., 1976: Error analysis of multiwavelength sun photometry. *Pure Appl. Geophys.*, **114**, 1–14.

Simpson, J.J., and C. Humphrey, 1990: An automated cloud screening algorithm for daytime Advanced Very High Resolution Radiometer imagery. *J. Geophys. Res.*, **95**, 13,459–13,481.

Slater, P.N., and J.M. Palmer, 1991: Solar-diffuser panel and ratioing radiometer approach to satellite sensor on-board calibration. *Proc. SPIE*, **1,493**, 100–105.

Slutz, R.J., S.J. Lubker, J.D. Hiscox, S.D. Woodruff, R.L. Jenne, P.M. Steurer, and J.D. Elms, 1985: *Comprehensive Ocean-Atmosphere Data Set; Release 1.* Climate Research Program, Boulder, Colorado, 263 pp.

Smith, R.C., and K.S. Baker, 1981: Optical properties of the clearest natural waters (200–800 nm). *Appl. Opt.*, **20**, 177–184.

——, ——, and P. Dustan, 1981: Fluorometric techniques for the measurement of oceanic chlorophyll in the support of remote sensing. *SIO Ref. 81-17*, Scripps Inst. of Oceanogr., La Jolla, California 14 pp.

——, and W.H. Wilson, 1981: Ship and satellite bio-optical research in the California Bight. *Oceanography from Space*, J.F.R. Gower, Ed., Plenum Press, 281–294.

——, and K.S. Baker, 1984: Analysis of ocean optical data. *Ocean Optics VII*, M. Blizard, Ed., SPIE **478**, 119–126.

——, and ——, 1985: Spatial and temporal patterns in pigment biomass in Gulf Stream Warm-Core Ring 82B and its environs. *J. Geophys. Res.*, **90**, 8,859–8,870.

——, and ——, 1986: Analysis of ocean optical data. *Ocean Optics VIII*, P.N. Slater, Ed., SPIE, **637**, 95–107.

——, O.B. Brown, F.E. Hoge, K.S. Baker, R.H. Evans, R.N. Swift, and W.E. Esaias, 1987: Multiplatform sampling (ship, aircraft, and satellite) of a Gulf Stream warm core ring. *Appl. Optics*, **26**, 2,068–2,081.

——, X. Zhang, and J. Michaelsen, 1988: Variability of pigment biomass in the California Current system as determined by satellite imagery, 1. Spatial variability. *J. Geophys. Res.*, **93**, 10,863–10,882.

——, and K.S. and Baker, 1989: Stratospheric ozone, middle ultraviolet radiation and phytoplankton productivity. *Oceanography*, **2**, 4–10.

——, K.J. Waters, and K.S. Baker, 1991: Optical variability and pigment biomass in the Sargasso Sea as determined using deep-sea optical mooring data. *J. Geophys. Res.*, **96**, 8,665–8,686.

——, B.B. Prézelin, K.S. Baker, R.R. Bidigare, N.P. Boucher, T. Coley, D. Karentz, S. MacIntyre, H.A. Matlick, D. Menzies, M. Ondrusek, Z. Wan and K.J. Waters, 1992: Ozone depletion: Ultraviolet radiation and phytoplankton biology in Antarctic waters. *Science*, **255**, 952–959.

Smith, S.L., W. Balch, K. Banse, W. Berelson, P. Brewer, O. Brown, K. Cochran, H. Livingston, M. Luther, C. McClain, D. Olson, L. Peterson, W. Peterson, W. Prell, L. Codispoti, A. Devol, H. Ducklow, R. Fine, G. Hitchcock, D. Lal, D. Repeta, E. Sherr, N. Surgi, J. Swallow, S. Wakeham, and K. Wishner, 1991: U.S. JGOFS: Arabian Sea Process Study. *U.S. JGOFS Planning Report No. 13,* Woods Hole Oceanographic Institution, Woods Hole, Massachusetts, 164 pp.

Smith, W.L., P.K. Rao, R. Koffler, and W.P. Curtis, 1970: The determination of sea surface temperature from satellite high-resolution infrared window radiation measurements. *Mon. Wea. Rev.,* **98,** 604–611.

Sørensen, B., 1981: Recommendations of the 2nd international workshop on atmospheric correction of satellite observation of sea water colour. March 30–April 1, Ispra, Italy, 49 pp.

Stackpole, J.D., 1990: GRIB and BUFR: The only codes you will ever need. *Sixth Intl. Conf. on Interactive Information and Processing Systems for Meteorol., Oceanogr., and Hydrol.,* Am. Meteorol. Soc., Anaheim, California, 23–30.

Stone, R.S., G.L. Stephens, C.M.R. Platt, and S. Banks, 1990: The remote sensing of thin cirrus cloud using satellites, lidar and radiative transfer theory. *J. Appl. Meteor.,* **29,** 353–366.

Stowe, L.L., C.G. Wellemeyer, T.F. Eck, H.Y.M. Yeh, and the Nimbus-7 Cloud Data Processing Team, 1988: Nimbus-7 global cloud climatology. *J. Climate,* **1,** 445–470.

——, E.P. McClain, R. Carey, P. Pellegrino, G. Gutman, P. Davis, C. Long, and S. Hart, 1991: Global distribution of cloud cover derived from NOAA/AVHRR operational satellite data. *Adv. Space Phys.,* **11**(3), 51–54.

Stramski, D., 1990: Artifacts in measuring absorption spectra of phytoplankton collected on a filter. *Limnol. Oceanogr.,* **35,** 1,804–1,809.

Strickland, J.D.H., and T.R. Parsons, 1972: *A Practical Handbook of Sea Water Analysis.* Fish. Res. Board. Canada, 310 pp.

Strub, P.T., C. James, A.C. Thomas, and M.R. Abbott, 1990: Seasonal and nonseasonal variability of satellite-derived surface pigment concentration in the California Current. *J. Geophys. Res.,* **95,** 11,501–11,530.

Sturm, B., 1981: The atmospheric correction of remotely sensed data and the quantitative determination of suspended matter in marine water surface layers. *Rem. Sens. in Meteor., Oceanogr., and Hydrol.,* A.P. Cracknell, Ed., John Wiley & Sons, 163–197.

——, 1993: CZCS data processing algorithms. *Ocean Colour: Theory and Applications in a Decade of CZCS Experience,* V. Barale and P.M. Schlittenhardt (Eds.), ECSC, EEC, EAEC, Brussels and Luxembourg, Kluwer Academic Publishers, Norwell, Massachusetts, 95–116.

Sullivan, C.W., C.R. McClain, J.C. Comiso, and W.O. Smith, Jr., 1988: Phytoplankton standing crops within an Antarctic ice edge assessed by satellite remote sensing. *J. Geophys. Res.,* **93,** 12,487–12,498.

– T –

Thiermann, V., and E. Ruprecht, 1992: A method for the detection of clouds using AVHRR infrared observations. *Int. J. Remote Sens.,* **13,** 1,829–1,841.

Toll, R.F., Jr., and W.M. Clune, 1985: An operational evaluation of the Navy Operational Global Atmospheric Prediction System (NOGAPS): 48-hour surface pressure forecasts. *Mon. Wea. Rev.,* **113,** 1,433–1,440.

Traganza, E., V. Silva, D. Austin, W. Hanson, and S. Bronsink, 1983: Nutrient mapping and recurrence of coastal upwelling centers by satellite remote sensing: Its implication to primary production and the sediment record. *Coastal Upwelling,* E. Suess and J. Thiede, Ed., Plenum Press, 61–83.

Trees, C.C., M.C. Kennicutt, II, and J.M. Brooks, 1985: Errors associated with the standard fluorometric determination of chlorophylls and phaeopigments. *Mar. Chem.,* **17,** 1–12.

Trenberth, K.E., and J.G. Olson, 1988: An evaluation and intercomparison of global analyses from the National Meteorological Center and the European Centre for Me-dium Range Weather Forecasts. *Bull. Am. Meteor. Soc.,* **69,** 1,047–1,057.

——, W.G. Large, and J.G. Olson, 1990: The mean annual cycle in global ocean wind stress. *J. Phys. Ocean ogr.,* **20,** 1,742–1,760.

Tucker, C.J., and L.D. Miller, 1977: Soil spectra contributions to grass canopy spectral reflectance. *Photogrammetry, Engineering, and Remote Sens.,* 721–726.

Tyler, J.E., and R.C. Smith, 1970: *Measurements of Spectral Irradiance Underwater.* Gordon and Breach, 103 pp.

– U –

University of Illinois at Urbana-Champaign, 1989: *NCSA HDF Specification.* 43 pp.

——, 1993: *NCSA HDF Calling Interfaces and Utilities, Version 3.2.* 121 pp.

– V –

Viollier, M., 1982: Radiance calibration of the Coastal Zone Color Scanner: a proposed adjustment. *Appl. Opt.,* **21,** 1,142–1,145.

Viollier, M., D. Tanré, and P.Y. Deschamps, 1980: An algorithm for remote sensing of water color from space. *Bound.-Layer Meteor.,* **18,** 247–267.

Voss, K.J., J.W. Nolten, and G.D. Edwards, 1986: Ship shadow effects on apparent optical properties. *Ocean Optics VIII,* M. Blizard, Ed., SPIE, **637,** 186–190.

——, and G. Zibordi, 1989: Radiometric and geometric calibration of a spectral electro-optic "fisheye" camera radiance distribution system. *J. of Atmos. and Ocean. Technol.,* **6,** 652–662.

– W –

Walker, J.H., R.D. Saunders, J.K. Jackson, and D.A. McSparron, 1987: Spectral Irradiance Calibrations. *NBS Special Publication 250–20,* U.S. Dept. of Commerce, National Bureau of Standards, Washington, D.C., 37 pp. plus appendices.

——., C.L. Cromer, and J.T. McLean, 1991: Technique for improving the calibration of large-area sphere sources. *Ocean Optics,* B.W. Guenther, Ed., SPIE, **1493,** 224–230.

Walsh, J.J., G.T. Rowe, R.L. Iverson, and C.P. McRoy, 1981: Biological export of shelf carbon is a sink of the global $CO_2$ cycle. *Nature,* **291,** 196–201.

Walters, N.M., 1983: *Coastal zone colour scanner (CZCS) algorithm description for the South African coastal waters.* Internal report, NPRL Div. of Optical Sciences, Pretoria, S. Africa, 30 pp.

Warneck, P., 1988: *Chemistry of the Natural Atmosphere.* Academic Press, 757 pp.

Waters, K.J., R.C. Smith, and M.R. Lewis, 1990: Avoiding ship induced light field perturbation in the determination of oceanic optical properties. *Oceanogr.,* **3,** 18–21.

Weare, B.C., 1992: A comparison of the ISCCP C1 cloud amounts with those derived from high resolution AVHRR images. *Int. J. Remote Sens.,* **13,** 1,965–1,980.

Weinreb, M.P., G. Hamilton, S. Brown, and R.J. Koczor, 1990: Nonlinear corrections in calibration of Advanced Very High Resolution Radiometer infrared channels. *J. Geophys. Res.,* **95,** 7,381–7,388.

Weller, M. and U. Leiterer, 1988: Experimental data on spectral aerosol optical thickness and its global distribution. *Beitr. Phys. Atmosph.,* **61,** 1–9.

Wertz, J.R. (Ed.), 1978: *Spacecraft Attitude Determination and Control.* D. Reidel, Dordrecht, Holland, 858 pp.

Williams, S.P., E.F. Szajna, and W.A. Hovis, 1985a: Nimbus 7 Coastal Zone Color Scanner (CZCS) Level 1 Data Product Users' Guide. *NASA Tech. Memo. 86203,* NASA Goddard Space Flight Center, Greenbelt, Maryland, 49 pp.

——, ——, and ——, 1985b: Nimbus 7 Coastal Zone Color Scanner (CZCS), Level 2 Data Product Users' Guide. *NASA Tech. Memo. 86202,* NASA Goddard Space Flight Center, Greenbelt, Maryland, 57 pp.

Wilson, W.H., R.C. Smith, and J.W. Nolten, 1981: The CZCS Geolocation Algorithms. *SIO Ref. 81-32,* Scripps Inst. of Oceanogr., La Jolla, California, 37 pp.

Woodruff, S.D., R.J. Slutz, R.L. Jenne, and P.M. Steurer, 1987: A comprehensive ocean-atmosphere data set. *Bull. Am. Meteor. Soc.,* **68,** 1,239–1,250.

Woodward, R.H., J. Firestone, and C.R. McClain, 1992: Progress report on AVHRR/Pathfinder activities. Internal document submitted to Pathfinder Project, NASA Goddard Space Flight Center, Greenbelt, Maryland, 14 pp.

——, R.A. Barnes, C.R. McClain, W.E. Esaias, W.L. Barnes, and A.T. Mecherikunnel, 1993: Modeling of the SeaWiFS Solar and Lunar Observations. *NASA Tech. Memo. 104566, Vol. 10,* S.B. Hooker and E.R. Firestone, Eds., NASA Goddard Space Flight Center, Greenbelt, Maryland, 26 pp.

World Meteorological Organization, 1990: Report of the International Ozone Trends Panel, 1988: *World Meteorological Organization Global Ozone Research and Monitoring Project, Report No. 18, 2 Vols.,* Geneva, Switzerland.

Wroblewski, J.S., J.L. Sarmiento, and G.R. Flierl, 1988: An ocean basin scale model of plankton dynamics in the North Atlantic 1. solutions for the climatological oceanographic conditions in May. *Global Biogeochem. Cycles,* **2,** 199–218.

Wu, R., J.A. Weinman, and R.T. Chin, 1985: Determination of rainfall rates from GOES satellite images by a pattern recognition technique. *J. Atmos. Ocean. Technol.,* **2,** 314–330.

Wyatt, C.L., 1978: *Radiometric Calibration: Theory and Methods.* Academic Press, 200 pp.

– X, Y –

Yamanouchi, T., and S. Kawaguchi, 1992: Cloud distribution in the Antarctic from AVHRR data and radiation measurements at the surface. *Int. J. Remote Sens.,* **13,** 111–127.

Yentsch, C.S., 1983: Remote Sensing of Biological Substances. *Remote Sensing Applications in Marine Science and Technology,* A.P. Cracknell, Ed., D. Reidel Publishing Co., 263–297.

——, and D.W. Menzel, 1963: A method for the determination of phytoplankton, chlorophyll, and phaeophytin by fluorescence. *Deep-Sea Res.,* **10,** 221–231.

——, and D.A. Phinney, 1985: Rotary motion and convection as a means of regulating primary production in warm core rings. *J. Geophys. Res.,* **90,** 3,237–3,248.

Yoder, J.A., C.R. McClain, J.O. Blanton, and L.-Y. Oey, 1987: Spatial scales in CZCS-chlorophyll imagery of the southeastern U.S. continental shelf. *Limnol. Oceanogr.,* **32,** 929–941.

– Z –

Zalewski, E.F., and C.R. Duda, 1983: Silicon photodiode device with 100% external quantum efficiency. *Appl. Opt.,* **22,** 2,867–2,873.

### The SeaWiFS Technical Report Series

Vol. 1

Hooker, S.B., W.E. Esaias, G.C. Feldman, W.W. Gregg, and C.R. McClain, 1992: An Overview of SeaWiFS and Ocean Color. *NASA Tech. Memo. 104566, Vol. 1,* S.B. Hooker and E.R. Firestone, Eds., NASA Goddard Space Flight Center, Greenbelt, Maryland, 24 pp., plus color plates.

Vol. 2

Gregg, W.W., 1992: Analysis of Orbit Selection for SeaWiFS: Ascending vs. Descending Node. *NASA Tech. Memo. 104566, Vol. 2,* S.B. Hooker and E.R. Firestone, Eds., NASA Goddard Space Flight Center, Greenbelt, Maryland, 16 pp.

Vol. 3

McClain, C.R., W.E. Esaias, W. Barnes, B. Guenther, D. Endres, S. Hooker, G. Mitchell, and R. Barnes, 1992: Calibration and Validation Plan for SeaWiFS. *NASA Tech. Memo. 104566, Vol. 3,* S.B. Hooker and E.R. Firestone, Eds., NASA Goddard Space Flight Center, Greenbelt, Maryland, 41 pp.

Vol. 4

McClain, C.R., E. Yeh, and G. Fu, 1992: An Analysis of GAC Sampling Algorithms: A Case Study. *NASA Tech. Memo. 104566, Vol. 4,* S.B. Hooker and E.R. Firestone, Eds., NASA Goddard Space Flight Center, Greenbelt, Maryland, 22 pp., plus color plates.

Vol. 5

Mueller, J.L., and R.W. Austin, 1992: Ocean Optics Protocols. *NASA Tech. Memo. 104566, Vol. 5,* S.B. Hooker and E.R. Firestone, Eds., NASA Goddard Space Flight Center, Greenbelt, Maryland, 43 pp.

Vol. 6

Firestone, E.R., and S.B. Hooker, 1992: SeaWiFS Technical Report Series Summary Index: Volumes 1–5. *NASA Tech. Memo. 104566, Vol. 6,* S.B. Hooker and E.R. Firestone, Eds., NASA Goddard Space Flight Center, Greenbelt, Maryland, 9 pp.

Vol. 7

Darzi, M., 1992: Cloud Screening for Polar Orbiting Visible and IR Satellite Sensors. *NASA Tech. Memo. 104566, Vol. 7,* S.B. Hooker and E.R. Firestone, Eds., NASA Goddard Space Flight Center, Greenbelt, Maryland, 7 pp.

Vol. 8

Hooker, S.B., W.E. Esaias, and L.A. Rexrode, 1993: Proceedings of the First SeaWiFS Science Team Meeting. *NASA Tech. Memo. 104566, Vol. 8,* S.B. Hooker and E.R. Firestone, Eds., NASA Goddard Space Flight Center, Greenbelt, Maryland, 61 pp.

Vol. 9

Gregg, W.W., F.C. Chen, A.L. Mezaache, J.D. Chen, J.A. Whiting, 1993: The Simulated SeaWiFS Data Set, Version 1. *NASA Tech. Memo. 104566, Vol. 9,* S.B. Hooker and E.R. Firestone, and A.W. Indest, Eds., NASA Goddard Space Flight Center, Greenbelt, Maryland, 17 pp.

Vol. 10

Woodward, R.H., R.A. Barnes, C.R. McClain, W.E. Esaias, W.L. Barnes, and A.T. Mecherikunnel, 1993: Modeling of the SeaWiFS Solar and Lunar Observations. *NASA Tech. Memo. 104566, Vol. 10,* S.B. Hooker and E.R. Firestone, Eds., NASA Goddard Space Flight Center, Greenbelt, Maryland, 26 pp.

Vol. 11

Patt, F.S., C.M. Hoisington, W.W. Gregg, and P.L. Coronado, 1993: Analysis of Selected Orbit Propagation Models for the SeaWiFS Mission. *NASA Tech. Memo. 104566, Vol. 11,* S.B. Hooker, E.R. Firestone, and A.W. Indest, Eds., NASA Goddard Space Flight Center, Greenbelt, Maryland, 16 pp.

Vol. 12

Firestone, E.R., and S.B. Hooker, 1993: SeaWiFS Technical Report Series Summary Index: Volumes 1–11. *NASA Tech. Memo. 104566, Vol. 12,* S.B. Hooker and E.R. Firestone, Eds., NASA Goddard Space Flight Center, Greenbelt, Maryland, 28 pp.

Vol. 13

McClain, C.R., K.R. Arrigo, J. Comiso, R. Fraser, M. Darzi, J.K. Firestone, B. Schieber, E-n. Yeh, and C.W. Sullivan, 1994: Case Studies for SeaWiFS Calibration and Validation, Part 1. *NASA Tech. Memo. 104566, Vol. 13,* S.B. Hooker and E.R. Firestone, Eds., NASA Goddard Space Flight Center, Greenbelt, Maryland, 52 pp., plus color plates.

Vol. 14

Mueller, J.L., 1993: The First SeaWiFS Intercalibration Round-Robin Experiment, SIRREX-1, July 1992. *NASA Tech. Memo. 104566, Vol. 14,* S.B. Hooker and E.R. Firestone, Eds., NASA Goddard Space Flight Center, Greenbelt, Maryland, 60 pp.

Vol. 15

Gregg, W.W., F.S. Patt, R.H. Woodward, 1994: The Simulated SeaWiFS Data Set, Version 2. *NASA Tech. Memo. 104566, Vol. 15,* S.B. Hooker and E.R. Firestone, Eds., NASA Goddard Space Flight Center, Greenbelt, Maryland, 42 pp., plus color plates.

Vol. 16

Mueller, J.L., B.C. Johnson, C.L. Cromer, J.W. Cooper, J.T. McLean, S.B. Hooker, and T.L. Westphal, 1994: The Second SeaWiFS Intercalibration Round-Robin Experiment, SIRREX-2, June 1993. *NASA Tech. Memo. 104566, Vol. 16,* S.B. Hooker and E.R. Firestone, Eds., NASA Goddard Space Flight Center, Greenbelt, Maryland, 121 pp.

Vol. 17

Abbott, M.R., O.B. Brown, H.R. Gordon, K.L. Carder, R.E. Evans, F.E. Muller-Karger, and W.E. Esaias, 1994: Ocean color in the 21st century: a strategy for a 20-year time series. *NASA Tech. Memo. 104566, Vol. 17,* S.B. Hooker and E.R. Firestone, Eds., NASA Goddard Space Flight Center, Greenbelt, Maryland, 20 pp.

Vol. 18

Firestone, E.R., and S.B. Hooker, 1995: SeaWiFS Technical Report Series Summary Index: Volumes 1–17. *NASA Tech. Memo. 104566, Vol. 18,* S.B. Hooker and E.R. Firestone, Eds., NASA Goddard Space Flight Center, Greenbelt, Maryland, 46 pages.

*Vol. 19*

McClain, C.R., R.S. Fraser, J.T. McLean, M. Darzi, J.K. Firestone, F.S. Patt, B.D. Schieber, R.H. Woodward, E-n. Yeh, S. Mattoo, S.F. Biggar, P.N. Slater, K.J. Thome, A.W. Holmes, R.A. Barnes, and K.J. Voss, 1994: Case Studies for SeaWiFS Calibration and Validation, Part 2. *NASA Tech. Memo. 104566, Vol. 19,* S.B. Hooker, E.R. Firestone, and J.G. Acker, Eds., NASA Goddard Space Flight Center, Greenbelt, Maryland, 73 pp.

*Vol. 20*

Hooker, S.B., C.R. McClain, J.K. Firestone, T.L. Westphal, E-n. Yeh, and Y. Ge, 1994: The SeaWiFS Bio-Optical Archive and Storage System (SeaBASS), Part 1. *NASA Tech. Memo. 104566, Vol. 20,* S.B. Hooker and E.R. Firestone, Eds., NASA Goddard Space Flight Center, Greenbelt, Maryland, 40 pp.

*Vol. 21*

Acker, J.G., 1994: The Heritage of SeaWiFS: A Retrospective on the CZCS NIMBUS Experiment Team (NET) Program. *NASA Tech. Memo. 104566, Vol. 21,* S.B. Hooker and E.R. Firestone, Eds., NASA Goddard Space Flight Center, Greenbelt, Maryland, 43 pp.

*Vol. 22*

Barnes, R.A., W.L. Barnes, W.E. Esaias, and C.R. McClain, 1994: Prelaunch Acceptance Report for the SeaWiFS Radiometer. *NASA Tech. Memo. 104566, Vol. 22,* S.B. Hooker, E.R. Firestone, and J.G. Acker, Eds., NASA Goddard Space Flight Center, Greenbelt, Maryland, 32 pp.

*Vol. 23*

Barnes, R.A., A.W. Holmes, W.L. Barnes, W.E. Esaias, C.R. McClain, and T. Svitek, 1994: SeaWiFS Prelaunch Radiometric Calibration and Spectral Characterization. *NASA Tech. Memo. 104566, Vol. 23,* S.B. Hooker, E.R. Firestone, and J.G. Acker, Eds., NASA Goddard Space Flight Center, Greenbelt, Maryland, 55 pp.

*Vol. 24*

Firestone, E.R., and S.B. Hooker, 1995: SeaWiFS Technical Report Series Summary Index: Volumes 1–23. *NASA Tech. Memo. 104566, Vol. 24,* S.B. Hooker and E.R. Firestone, Eds., NASA Goddard Space Flight Center, Greenbelt, Maryland, 36 pp.

# REPORT DOCUMENTATION PAGE

*Form Approved*
*OMB No. 0704-0188*



**1. AGENCY USE ONLY** *(Leave blank)*

**2. REPORT DATE**
June 1995

**3. REPORT TYPE AND DATES COVERED**
Technical Memorandum

**4. TITLE AND SUBTITLE**
SeaWiFS Technical Report Series
Volume 24–SeaWiFS Technical Report Series Cumulative Index: Volumes 1–23

**5. FUNDING NUMBERS**
Code 970.2

**6. AUTHOR(S)**
Elaine R. Firestone and Stanford B. Hooker

Series Editors: Stanford B. Hooker and Elaine R. Firestone

**7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)**
Laboratory for Hydrospheric Processes
Goddard Space Flight Center
Greenbelt, Maryland 20771

**8. PERFORMING ORGANIZATION REPORT NUMBER**
95B00092

**9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)**
National Aeronautics and Space Administration
Washington, D.C. 20546–0001

**10. SPONSORING/MONITORING AGENCY REPORT NUMBER**
TM–104566, Vol. 24

**11. SUPPLEMENTARY NOTES**
Elaine R. Firestone: General Sciences Corporation, Laurel, Maryland

**12a. DISTRIBUTION/AVAILABILITY STATEMENT**
Unclassified–Unlimited
Subject Category 48
Report is available from the Center for AeroSpace Information (CASI),
800 Elkridge Landing Road, Linthicum Heights, MD 21090; (301)621-0390

**12b. DISTRIBUTION CODE**

**13. ABSTRACT** *(Maximum 200 words)*

The Sea-viewing Wide Field-of-view Sensor (SeaWiFS) is the follow-on ocean color instrument to the Coastal Zone Color Scanner (CZCS), which ceased operations in 1986, after an eight-year mission. SeaWiFS is expected to be launched in 1995, on the SeaStar satellite, being built by Orbital Sciences Corporation (OSC). The SeaWiFS Project at the National Aeronautics and Space Administration's (NASA) Goddard Space Flight Center (GSFC), has undertaken the responsibility of documenting all aspects of this mission, which is critical to the ocean color and marine science communities. This documentation, entitled the *SeaWiFS Technical Report Series,* is in the form of NASA Technical Memorandum Number 104566. All reports published are volumes within the series. This particular volume serves as a reference, or guidebook, to the previous 23 volumes and consists of 6 sections including: an errata, an addendum (summaries of various SeaWiFS Working Group Bio-optical Algorithm and Protocols Subgroups Workshops, and other auxiliary information), an index to key words and phrases, a list of all references cited, and lists of acronyms and symbols used. It is the editors' intention to publish a cumulative index of this type after every five volumes in the series. Each index covers the topics published in all previous editions, that is, each new index will include all of the information contained in the preceeding indices.

**14. SUBJECT TERMS**
SeaWiFS, Oceanography, Cumulative, Index, Summary, Overview, Errata, Addendum, Glossary, Symbols, References, Bio-optical, Algorithm Workshop, Protocols Subgroup Workshop

**15. NUMBER OF PAGES**
36

**16. PRICE CODE**

| 17. SECURITY CLASSIFICATION OF REPORT | 18. SECURITY CLASSIFICATION OF THIS PAGE | 19. SECURITY CLASSIFICATION OF ABSTRACT | 20. LIMITATION OF ABSTRACT |
|---|---|---|---|
| Unclassified | Unclassified | Unclassified | Unlimited |