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Estimating Stratospheric Temperature Trends Using Satellite Microwave Radiances

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Abstract:

The objective is to evaluate and intercompare stratospheric temperatures using Microwave Sounding Unit (MSU) data as a basis data set. The MSU, aboard the the NOAA polar orbiter satellite series, provides twice daily global coverage over a layer (50-150 mb) at approximately a $(170km)^2$ resolution. Conventional data sets (e.g. the NMC, BMO, FUB, radiosondes and rocketsondes) will be compared to the satellite data in the lower stratosphere in order to assess their quality for trend computations.

Summary of Progress and Results:

Approximately 10 years of daily gridded satellite radiance and geopotential height data have been obtained from the British Meteorological Office. This data is comprised of the High resolution Infrared Radiation Sounder (HIRS), the Microwave Sounding Unit (MSU), and the Stratospheric Sounding Unit (SSU). The TOVS instruments provide global coverage of vertical temperature data from the surface to the stratopause. The data was first transferred to magnetic cartridge on the NASA/GSFC IBM 3081 for faster processing. Missing values were linearly interpolated in time at each grid point, such that gaps of eight days or less were filled in. Gaps of nine days or more were left blank. Monthly means of these gridded interpolated data have been computed with a minimum of 20 days of data needed to compute a monthly average. The monthly averaged data have also been transferred from the IBM to the NASA/GSFC PACF VAX for easier temperature trend analysis. Data processing on the IBM required considerable time in learning the system and developing software.

Two other research areas have involved collaborative efforts with colleagues at NCAR, and NASA/GSFC respectively. The first effort involved the comparison of NMC to MSU data, and the comparison of NMC to RAOB data in the Antarctic region. This analysis was performed in order to answer questions concerning temperature trends during the Austral spring. The second research area involved the analysis of lidar observations during October and November 1989 at Table Mountain, California. NMC analyses and RAOB data were used to calculate transport effects on lidar ozone profiles.

Publications:

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A STUDY OF THE AEROSOL EFFECT ON UMKEHR OZONE PROFILES USING SAGE II DATA

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ABSTRACT

The study of Aerosol Effects on Umkehr Ozone Profiles using SAGE II Data was proposed for a three-year period. The eight major steps in performing this study are as follows: (1) acquire necessary computer hardware and arrange for off-site mainframe computer time, (2) modify SAGE I computer routines to ingest SAGE II data, (3) construct SAGE II trace constituent files in a standard matrix, accounting for missing events, (4) acquire and ingest Umkehr ozone data during SAGE II period, (5) determine coincident SAGE II/Umkehr cases, (6) create PC-based files and routines to analyze cases, (7) perform statistical analyses to determine aerosol effect on Umkehr profiles, and (8) publish results.

SUMMARY OF PROGRESS AND RESULTS

A significant part of the first-year funding was designated to acquire the computer hardware. The remainder was designated to modify the SAGE I routines and process the SAGE II trace constituent matrices. At this time, we have acquired and installed the computer hardware, modified the SAGE I routines (resulting in approximately 2500 lines of code), processed one quarter of the SAGE II matrices and acquired the Umkehr data. We expect to process the remaining matrices and also to select the coincident cases for study before the end of the first contract year.

The next year of this contract is designated to porting the data to the PC environment and performing the analyses. We have a contractual arrangement and a scientific understanding with Dr. Derek Cunnold at Georgia Tech to analyze the SAGE II/Umkehr cases for aerosol effects. The outline for the scientific analysis is the same as the SAGE I/Umkehr study published in JGR (Newchurch, 1986).

JOURNAL PUBLICATIONS

None

REFERENCES

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