P1.7 LONG TERM REMOTE SENSING DATA SETS FOR APPLIED CLIMATOLOGY

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1. INTRODUCTION

The Atmospheric Sciences Data Center (ASDC) at NASA Langley Research Center processes, archives and distributes data relating to the Earth's radiation budget, clouds, aerosols, and tropospheric chemistry. Several of these data holdings provide long-term series which can be used for climate monitoring and climate change studies.

2. RADIATION BUDGET DATA FROM ERBE AND CERES

The Clouds and the Earth's Radiant Energy System (CERES) experiment is a cornerstone of NASA's Earth Science Enterprise. The first CERES instrument was launched in November 1997 on the Tropical Rainfall Measuring Mission Satellite. CERES instruments are also currently orbiting on the EOS Terra and Aqua satellites, providing data since March of 2000. CERES produces a category of "ERBE-like" data products that are processed with algorithms similar to those used with the Earth Radiation Budget Experiment (ERBE) instrument data. ERBE instruments operated from 1984 through 1995 on NASA's Earth Radiation Budget Satellite (ERBS) and on NOAA's operational weather satellites NOAA-9 and NOAA-10. These two sets of instruments provide long term values for parameters including broadband shortwave, longwave and net radiative fluxes for clear sky and cloudy conditions.

CERES ES-4 Regional Monthly Averaged Total-Sky Shortwave Flux
July 2002

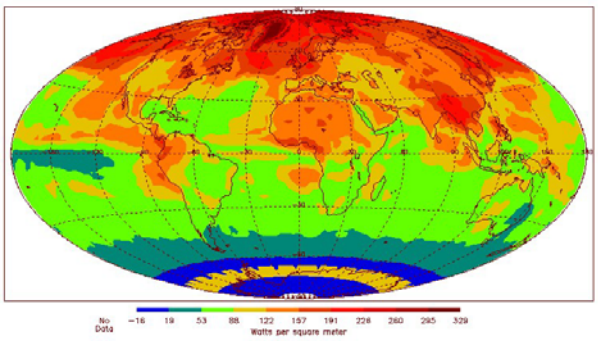

Figure 1. CERES ES-4 Shortwave Flux

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There are three CERES ERBE-like products: ES-4, ES-8, and ES-9.

The ES-8 instantaneous TOA estimates product contains filtered radiances recorded every 0.01-second for the total, shortwave (SW), and window (WN) channels and the unfiltered SW, longwave (LW), and WN radiances. The SW and LW radiances at spacecraft altitude are converted TOA fluxes with a scene identification algorithm and Angular Distribution Models which are like those used for ERBE.

The ES-9 product provides monthly averages of the instantaneous measurements on a grid of 2.5 degree regions. For each region, hourly, daily, monthly by hour of the day, and total monthly average flux are derived from an algorithm that uses the available data, scene identification data, and diurnal models. Values are reported for total and clear-sky albedo, longwave flux, shortwave flux, and solar incidence, along with net flux, TOA flux and outgoing longwave radiation.

The ES-4 product reports the monthly geographic averages derived from the ES-9 values on 2.5 degree, 5 degree and 10 degree grids and then aggregates them on a zonal and global basis. Figure 1 shows a plot of the Regional Monthly (Day) Averaged Total-Sky Shortwave Flux CERES ES-4 data for July 2002.

These CERES data sets can be used in conjunction with the corresponding ERBE S-8, S-9 and S-4 data sets to create a long-term radiation budget climatology.

3. AEROSOL AND OZONE CLIMATOLOGY FROM THE SAGE INSTRUMENTS

The Stratospheric Aerosol and Gas Experiment's (SAGE) three instruments provide a nearly continuous climatology of the spatial distribution of stratospheric aerosols and ozone. SAGE I aerosol extinction profile data are available from February 1979 to November 1981. SAGE II data include profiles of aerosol extinction, ozone number density, nitrogen dioxide number density, and water vapor mixing ratio from October 1984 until June 2001.

The SAGE III instrument uses self-calibrating solar occultation to measure profiles of aerosols, clouds, ozone, nitrogen dioxide and water vapor, and uses lunar occultation observations to monitor the key nighttime species nitrogen trioxide and chlorine dioxide. The first of the planned SAGE III instruments is currently orbiting

on a Russian Meteor-3M(1) platform which launched on December 10, 2001 and has been providing data since May of 2002.

Figure 2 shows a long-term climatology of stratospheric optical depth using measurements from SAGE I and SAGE II along with polar stratospheric aerosol data from the Stratospheric Aerosol Measurement II (SAM II) instrument. SAM II flew on board the NIMBUS-7 satellite, making measurements from October 1978 through December 1993.

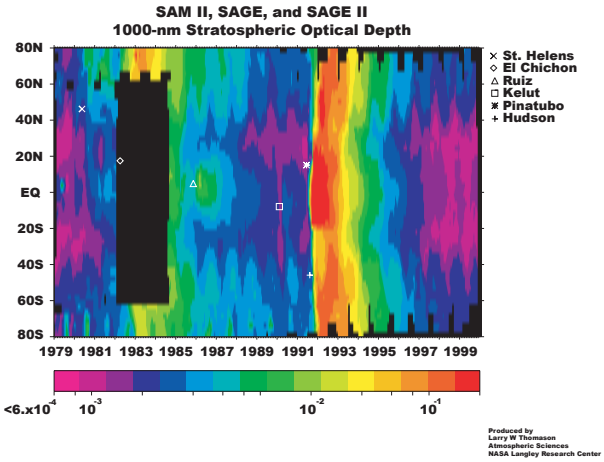

Figure 2. Long term stratospheric optical depth climatology from SAGE and SAM II data

4. CLOUD PROPERTIES FROM ISCCP

Since 1983, the International Satellite Cloud Climatology Project (ISCCP) has focused on the distribution and variation of cloud radiative properties to improve the understanding of the effects of clouds on climate, the radiation budget, and the long-term global hydrologic cycle. Global coverage for ISCCP is provided by five geostationary meteorological satellites (GOES-EAST, GOES-WEST, GMS, INSAT, and METEOSAT) and at least one polar orbiting NOAA satellite.

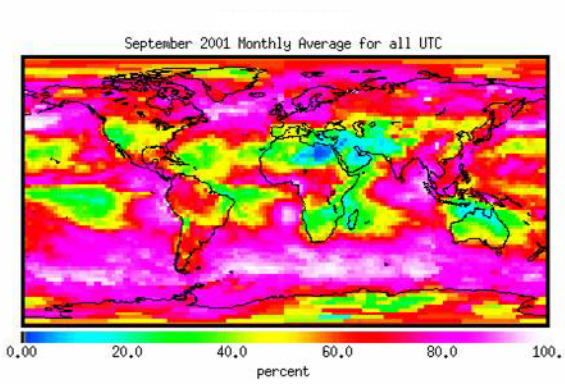

Figure 3. ISCCP Mean Cloud Amount

ISCCP data are available at a pixel size of 30 km resolution and a three hour time resolution for 1983-2001. Derived products include monthly global climatologies on a 280 km equal area grid. Available parameter categories include clouds, ice, ozone, precipitable water, radiance, reflectance, and snow. Figure 3 shows a plot of the ISCCP monthly average cloud amount.

5. DATA AVAILABILITY

These data are available free of charge from the NASA Langley Atmospheric Sciences Data Center. Information about these and other data holdings is available at the ASDC web site:

http://eosweb.larc.nasa.gov.