

**PLANNING FOR THE UTILIZATION OF THE PCDS IN STUDYING THE  
INTERACTION OF CLOUDS (ISCCP-C DATA) AND THE EARTH  
RADIATION BUDGET (ERBE DATA)**

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The PCDS affords an opportunity to analyze data from different but highly complementary data sets. Two of these highly complementary data sets supported by the PCDS are the International Satellite Cloud Climatology Project (ISCCP) and the Earth Radiation Budget Experiment (ERBE). Both data set sponsors are aware of the utility of one data set to the other, and both projects utilize gridded data on a 2.5° by 2.5° grid. The ISCCP data have been collected since July 1983, and the NOAA-9 data for ERBE have been collected for more than a year. Therefore, there is a good chance to use these temporally overlapping data sets to investigate hypothesized relationships.

Changes in cloudiness affect both cloud albedo feedback (shortwave) and the greenhouse effect (longwave). The relative importance of the effects of clouds on albedo versus outgoing longwave radiation (OLR) in determining the radiation balance has long been a matter of controversy. Now, however, changes in cloud amount as observed by the ISCCP can be correlated to corresponding changes in the albedo and changes in the OLR from ERBE. Monthly means can be utilized in all instances.

The marriage of these two data sets represents a significant opportunity for radiation balance-related research. Suggestions for additional research studies were presented, along with suggestions for data manipulation tools and techniques that could prove helpful in the PCDS.

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# **Plan for Utilization of the PCDS in Studying the Interaction of Clouds (ISCCP – C Data) and the Earth's Radiation Budget (ERBE Data)**

1. Objectives of the Study
2. Data Sets Required
3. Studies to be Performed
4. Requirements of the PCDS

# 1. Objectives of the Study

- o To understand the influence of changes in cloud cover (amount and type) on the Earth's radiation budget
  - How does cloud cover affect the OLR, albedo and net radiation?
  - What is the influence of surface type on the cloud cover?
  - How is the distribution of clouds (amount and height) on the Earth related to the variation of the components of its radiation budget?
  - What parameters other than clouds must be taken into account to enable one to estimate the radiation budget?

$$\text{Net} = Q - F$$

$$Q = S_o (1 - \alpha)$$

$$\delta = \frac{\partial(\text{Net})}{\partial A_c} = -S_o \frac{\partial \alpha}{\partial A_c} - \frac{\partial F}{\partial A_c}$$

$$\delta = -S_o \frac{\Delta \alpha}{\Delta A_c} - \frac{\Delta F}{\Delta A_c}$$

## 2. Data Sets Required

- o Monthly mean ERBE scanner OLR and albedo for a  $2.5^{\circ} \times 2.5^{\circ}$  grid, including the scene type.
- o Monthly mean ISCCP cloud parameters (amount, top temperature, type, etc.) for the  $2.5^{\circ} \times 2.5^{\circ}$  grid above, for the same months as ERBE.
- o Monthly mean correlative data such as surface temperature for the same grid.

### 3. Studies to be Performed

- o Compute  $\frac{\Delta\alpha}{\Delta A_c}$ ,  $\frac{\Delta F}{\Delta A_c}$ , and  $\frac{\Delta(\text{Net})}{\Delta A_c}$  for each  $2.5^\circ \times 2.5^\circ$  grid area by using interannual changes in the monthly means.
- o Determine the distribution of above in space and time as functions of surface and predominant cloud type.
- o Develop relationships to enable the estimation of the Earth's radiation budget from the ISCCP data.
- o Develop relationships to enable the estimation of the cloud cover from ERBE data.

## 4. Requirements of the PCDS

- o Be able to store for ready access required ERBE and ISCCP monthly mean products and correlative parameters (approx. 250,000 values per month or 3,000,000 per year.
- o Be able to perform multiple linear and nonlinear regressions, including signifance tests.
- o Be able to do EOF or spherical harmonic analyses of various results