International Satellite Cloud Climatology Data Products (Current Version; ISCCP)

Description:

ISCCP has been collecting, since July 1983, the infrared and visible radiances obtained from imaging radiometers carried on the international constellation of weather satellites. These radiance data, together with ancillary data describing the composition and temperature structure of the atmosphere and surface properties, have been analyzed to characterize the main cloud radiative properties and their variations over the whole globe. The cloud detection procedure labels the image pixels as cloudy or clear based on a series of tests of the space-time variations of the IR and VIS radiances: smaller variability is associated with clear conditions and larger variability with cloudy conditions. If the measured radiances differ from the inferred clear sky values by more than a threshold amount in any spectral channel at each location and time, they are labeled as cloudy (additional tests are performed over snow and ice-covered regions). The radiation analysis procedure then retrieves from the radiances the properties of the surface (visible reflectance, skin temperature) and of the clouds (visible optical thickness, top temperature/pressure) using two microphysical models, one for liquid water clouds and one for ice crystal clouds. Cloud cover fraction is reported for larger spatial regions by counting the fraction of the total number of image pixels that are labeled cloudy.

Data Availability:

All ISCCP data products are available from NOAA NCDC and NASA LARC. All ISCCP data products can be obtained from NOAA/NESDIS/NCDC. (Satellite Services Group at ncdc.satorder@noaa.gov) and from the NASA Langley Research Center (LaRC) EOS DAAC (http://eosweb.larc.nasa.gov). Selected monthly-mean variables are available for online viewing and downloading and the whole monthly mean D2 dataset, along with READ software and complete documentation of all products, is available from the ISCCP website at http://isccp.giss.nasa.gov. A space-time sampled, calibrated, navigated and formatted versions of the radiances are called the B3 (30 km, 3 hr) and B1U (10 km, 3 hr) datasets. A separate database of radiance calibration coefficients is available (BT). There are three cloud products: (1) DX is the pixel-level product (30 km, 3 hr) for each satellite intended for research on remote sensing of Earth or for more detailed studies of cloud processes, (2) D1 is the globally gridded (2.5 degree, 3 hr) for global or regional studies of cloud variations, including joint histograms of the mesoscale variations of cloud properties, and (3) D2 is the monthly mean globally gridded product for cloud climatological studies. Several additional products have been produced: a climatology of cloud particle sizes (RE), a Lagrangian tracking subset of cold-topped cloud systems at lower latitudes (CT), a mesoscale cloud regime classification for the tropics, subtropics and midlatitudes (WS), a Lagrangian tracking subset of midlatitude cyclone-associated clouds (CY), and a global radiative flux profile dataset calculated using the ISCCP cloud products at 2.5 degree, 3 hr intervals (FD).

Quality:

For the ISCCP radiance calibrations: a) the total *relative* uncertainties in the radiance calibrations are estimated to be ≈ 5% for visible and ≈ 2% for infrared; *absolute* uncertainties are < 10%and < 3%, respectively. For cloud cover, determined for regions about 280 km in size, the estimated random error is ≈ 10% for instantaneous values and ≈ 3% for monthly mean values. Random errors are larger in the polar regions, at least 20-30% for instantaneous values. Systematic errors include underestimates by 5-10% in global mean total cloud cover because of failure to detect very thin (optical thicknesses < 0.3) cirrus clouds, especially in the tropics, and thin and very low level (cloud top heights < 1 km) over sea-ice-covered regions. Retrievals of cloud top temperatures appear to be accurate to within 2-3 K; the main systematic errors are an underestimate of thin (optical thickness < 2) cirrus cloud top heights by 2-4 km when they overlie low-level clouds, which occurs about 10-15% of the time, and an overestimate of top heights by 2-3 km for isolated, very thin (optical thickness < 0.5) cirrus. Retrievals of cloud optical thickness appear to be accurate to about 10-20%, relative, mostly associated with uncertainties in cloud particle sizes and the effects of three-dimensional cloud structure; errors are somewhat larger for ice-phase clouds and for clouds observed at large solar zenith angles. Systematic errors for liquid water clouds associated with uncertainties of droplet size are < 5% and for ice clouds they are < 15%. Errors in retrieved cloud properties are also caused by detection errors but these do not appear to be much larger than the retrieval errors. When a scene is clear, the ISCCP analysis also retrieves surface visible reflectances and skin temperatures. The former appear to be accurate to about 5% with most of the uncertainty associated with unknown aerosol effects. The latter have random errors, mostly due to cloud detection effects of 2-4 K; these values are actually "brightness" temperatures, retrieved assuming a surface infrared emissivity of unity, so they are systematically lower than the actual skin temperatures. For most surfaces (water, vegetated land, ice and snow), the low bias is < 2 K but for grassland and, especially deserts, the bias can be 4-8 K. The radiative fluxes have estimated errors for regional monthly mean values of < 10 Wm^{-2} for top-of-atmosphere fluxes and < 15 Wm^{-2} for surface fluxes.

Relationship to other GEWEX products:

ISCCP cloud-cleared radiances are used by GACP to retrieve aerosol properties over oceans. ISCCP cloud products are used in SRB to determine radiative fluxes at the top-of-atmosphere and surface.