International Satellite Cloud Climatology Project (ISCCP)

Reporting Period: November 2005—October 2006
ISCCP Start Date: August 1982
ISCCP End Date: September 2007 (September 2010)
URL: http://isccp.giss.nasa.gov
Chairman: William B. Rossow, NASA Goddard Institute for Space Studies

Objectives

(1) Produce a global, reduced-resolution, calibrated and normalized, infrared and visible radiance data set, along with basic information on the radiative properties of the atmosphere, from which cloud parameters can be derived.
(2) Coordinate basic research on techniques for inferring the physical properties of clouds from satellite radiance data.
(3) Derive and validate a global cloud climatology.
(4) Promote research using ISCCP data to improve parameterizations of clouds in climate models.
(5) Improve understanding of the earth's radiation budget (top-of-atmosphere and surface) and hydrological cycle.

Status

ISCCP completed its 23rd year of data collection on 30 June 2006. Radiances from all operating meteorological satellites are being routinely collected by the cognizant Sector Processing Centers (SPC) and delivered to the Global Processing Center (GPC) in accordance with project requirements, except for routine deliveries of METEOSAT-8 (MSG-1). All project data sets are now being delivered via Internet. Currently operating satellites are NOAA-17, NOAA-18, MTSAT-1R, FY-2C, GOES-11, GOES-12, METEOSAT-5 and METEOSAT-7 and 8 with METEOSAT-6, METEOSAT-9 and GOES-13 in reserve. METEOSAT-5, located at 63 E longitude, will soon be replaced by METEOSAT-7 and METEOSAT-9 will soon replace METEOSAT-8. METOP-1 launch was scheduled for launch in September 2006.

The Satellite Calibration Center (SCC) in Lannion, France, provides monthly satellite-to-satellite radiance normalization for four wavelength channels when available, nominally at 0.6, 6.7, 11 and 12 m. Normalization data are complete through May 2006 as scheduled.

The GPC monitors the calibration of the polar orbiting radiometers (AVHRR) that serve as the reference standard for the radiance data. Monitoring results are complete through December 2005 (the end of the NOAA-16 record). These results will be compared with the calibrations of MODIS on TERRA and AQUA early next year. Calibration information posted on the ISCCP Web page is complete through June 2005.

Stage B3 data are archived for the period July 1983 through June 2005 (22 years).

Atmospheric temperature and humidity profiles and the sea ice and snow correlative data sets are archived for the period from July 1983 through June 2005 (22 years).

Stage DX, D1 and D2 data are archived for the period from July 1983 through June 2005 (22 years). All D2 data are now on-line on the ISCCP Web site.

A complete survey of mesoscale convective clouds has been finished and released. This survey provides the properties, motion and lifecycle evolution of each mesoscale system from the ISCCP DX data. Available on-line is software and a database (ISCCP Convection Co-locator) that allows the nearest system to be identified for a given location and time. A complete survey of cloud particle sizes, both liquid and ice, has been completed and will be released in a few months. These data will also be combined with the aerosol product produced by the Global Aerosol Climatology Project to facilitate studies of cloud-aerosol interactions.

New Directions

Two significant changes to ISCCP are being explored. One is provided by the work at NOAA National

Climatic Data Center (NCDC) to refurbish the ISCCP B1 radiance data set, which has a spatial sampling interval of about 10 km instead of the 30 km sampling being used now. The major increase in use of the ISCCP products to study cloud and precipitation processes recommends such a change because the denser sampling would make the results less noisy at mesoscale. This would also significantly decrease the noise level in the shortwave fluxes determined by SRB.

Recently, the Group on Earth Observations (GEO) documents have pointed to Global Climate Observing System (GCOS) plans as representing the priorities of its climate activities and GCOS has strongly endorsed the continuation of ISCCP as part of the climate observing system. However, the current ISCCP institutional arrangements were not designed for "permanent operations." In particular, the Global Processing Center at NASA Goddard Institute for Space Studies (GISS) is funded out of research programs with no long-term commitment. In contrast, most of the other ISCCP data centers are now fully operational (the other exception is the Satellite Calibration Center). Proposals are being submitted to obtain funding to re-engineer the processing software to make ISCCP fully operational in the near future.

Future

During the next year (under the current funding plan), some revisions of the analysis method will be completed to improve treatments of polar clouds and the angular dependence of the radiances and a re-survey of the radiance calibration and image quality will be done. A replacement atmospheric temperature/humidity data set will be selected (in coordination with the GEWEX Precipitation Climatology Project (GPCP) and Surface Radiation Budget (SRB) Project) to reduce artifacts in the interannual variations. Then, the whole ISCCP data set will be reprocessed.

Key Results

(1) A series of recent papers have established the link between patterns in the mesoscale joint distributions of cloud properties, as determined by ISCCP, and the meteorological state of the atmosphere. These results provide not only a more potent method for evaluating weather and climate model cloud representations but also a comprehensive analysis tool to link atmospheric motions, clouds and diabatic heating into feedback relationships.
(2) An extensive survey of tropical convection that penetrates into the stratosphere was contributed to a workshop jointly sponsored by Stratospheric Processes and Their Role in Climate (SPARC) and the GEWEX Cloud System Study (GCSS).
(3) The second international workshop to assess cloud products, including those from ISCCP, was held this past summer. Early analyses have identified a number of possible causes of artifacts in satellite cloud products, but problems for the ISCCP product from under sampling, incomplete coverage, calibration changes and view angle changes cannot account for the interannual variations of total cloud amount found by ISCCP.
(4) An extensive survey of midlatitude cyclones is now being completed that will provide a comprehensive description of cloud structures over the life cycle of these weather systems; when combined with new CloudSat and Calipso data, the complete 3-D structure of storm clouds will become available.
(5) A survey of cloud particle sizes, for both liquid and ice clouds, has been completed covering almost the whole ISCCP record (the later years can not be analyzed because the AVHRRs stopped collecting the radiances at the needed wavelengths).

Issues and Recommendations

Given the severe funding "confusion" at NASA, approval of funds for extending the operations of the Global Processing Center, much less obtaining some additional funds to re-engineer the analysis software to switch to the B1 radiances and make the whole project fully operational are in doubt.

Contributions to WCRP

ISCCP contributes directly to one of the primary goals of WCRP – to increase understanding and reduce the uncertainty of cloud-climate feedbacks.

Summary

Data processing activities are routine, but a delay always occurs when changing the calibration reference standard to a new satellite as is happening now. Some features of the newest AVHRRs that are causing

problems. Research use of ISCCP products continues to grow very rapidly; through 2004, more than 1000 papers based on ISCCP have been published. Extending the project and making it a permanent part of the climate observing system is in doubt.

Key Publications

Jakob, C., G. Tselioudis and T. Hume (2005), The radiative, cloud and thermodynamic properties of the major Tropical Western Pacific cloud regimes, *J. Climate, 18*, 1203-1215.

Luo, Z., and W.B. Rossow (2004), Characterizing tropical cirrus life cycle, evolution and interaction with upper tropospheric water vapor using Lagrangian trajectory analysis of satellite observations, *J. Climate, 17*, 4541-4563.

Rossow, W.B., Y-C. Zhang and J-H. Wang, 2005: A statistical model of cloud vertical structure based on reconciling cloud layer amounts inferred from satellites and radiosonde humidity profiles. *J. Climate*, **18**, 3587-3605.

Rossow, W.B., G. Tselioudis, A. Polak and C. Jakob, 2005: Tropical climate described as a distribution of weather states indicated by distinct mesoscale cloud property mixtures. *Geophys. Res. Lett.*, **32**, doi 10.1029/2005GL024584, (1-4).

Tselioudis, G., and W.B. Rossow, 2006: Climate feedback implied by observed radiation and precipitation changes with midlatitude storm strength and frequency. *Geophys. Res. Lett.*, **33**, doi 10.1029/2005GL024513, (1-5).

Williams, K.D., C.A. Senior, A. Slingo and J.F.B. Mitchell (2006), Towards evaluating cloud response to climate change using objective identification of cloud regimes, *Climate Dynamics*, (in press).

ISCCP Meetings, Workshops

6-7 July 2006: 2nd Cloud Climatology Intercomparison Workshop, Madison, WI, USA

Planned Meetings, Workshops

None

ISCCP Members

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Kenneth Holmlund (EUMETSAT, Germany)
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