CGMS XXXIII NOAA-WP-21
Agenda Item: II/4
Discussed in WG-II

Assessment of Global Cloud Cover and Properties – Summary from the Workshop on Cloud Climatology Assessment held 5-6 April 2005 in Madison, Wisconsin

Summary and Purpose of Document

This paper summarizes the current state of cloud climatologies and suggests some future work. CGMS is asked to take note of the recommendations from this international group.

Action Requested: None

Assessment of Global Cloud Cover and Properties – Summary from the Workshop on Cloud Climatology Assessment held 5-6 April 2005 in Madison, Wisconsin

Bryan Baum (NASA LaRC), Bill Rossow (NASA GISS), and Garrett Campbell (CSU)

1. Introduction

Under the auspices of the GEWEX Radiation Panel, a workshop was convened on April 5-7 in Madison, Wisconsin, to assess the quality and reliability of available global cloud data sets for climate studies. The meeting was chaired by Bill Rossow (NASA), Bryan Baum (NASA), and Garrett Campbell (Colorado State University); it was attended by cloud specialists from USA, Europe, and Japan. The focus at this workshop was placed on data sets that had a minimum of 20 years duration. More specifically, the workshop was tasked as an international community to assess how well the existing global cloud data sets capture the variability over the past 20 years. The data set of particular focus was the International Satellite Cloud Climatology Project (ISCCP), although assessments of other climatologies were included in the hopes of learning important information for our interpretation of the 20+ year global cloud trends.

At the beginning of the workshop, it was stated that when there are multiple data sets, both agreements and dis-agreements are expected. As none of the datasets were designed to be used for decadal trends, one of the challenges becomes that of connecting datasets obtained from multiple sensors, each of which has its own unique characteristics. As most comparisons have tended to be superficial in content, the task was to identify areas of interest and encourage researchers to perform more critical analyses. In other words, the goal was to foster collegial activity that leads to greater understanding of decadal differences in both regional and global cloud properties.

The goals for the workshop are summarized below:

1. From the perspective of a global climate modeler wanting to compare model results with one or more cloud climatologies, what aspects of the various cloud climatologies would be most understood and believable?
2. If two or more data sets agree, is the reason for such agreement understood?
3. Likewise, if two or more data sets disagree, are the reasons understood for the differences? In any comparison between data sets, there will be discrepancies, and it is insufficient to simply note them without understanding the causes.
4. Can we agree on a set of methods to discern actual trends, rather than the rather simplistic approach typically used of drawing a least-squares regression line through the time period of interest?
5. Where would the greatest problems exist, thereby decreasing the likelihood of obtaining coherent comparisons?

At this point, we were more interested in interpretation of variations or long-term trends of cloud properties over time, rather than on the absolute values of certain parameters such as cloud fraction that are dependent on the resolution of the observation, instrumentation or algorithm.

Presentations at the workshop were primarily in four groups: (1) surface observations, specifically the nature of the observations and their error characteristics, (2) satellite-based cloud climatologies from various sensors including both polar- and geostationary platforms, (3) polar cloud climatologies, and (4) new algorithms for the detection/analysis of multilayered clouds and upcoming new data sets from the upcoming constellation of afternoon-based satellite instruments (i.e., the A-Train). There was also considerable discussion related to intercomparing various cloud products and establishing contacts for future research.

Highlights from the presentations include (1) within the physical uncertainty of the different data sets, no trends on the large scale cloud amount are found, (2) consistency between different data sets on the global scale variations (at + 1%) implies more accurate estimates of the variations are at hand in the next few years, (3) the increase of available geostationary measurements in the past two decades offers more near nadir views and likely produces a decrease in estimated cloud cover in the International Satellite Cloud Climatology Project (ISCCP) data, (4) ISCCP and other visible/near infrared approaches are detecting low marine stratus clouds more reliably than infrared only techniques, and (5) HIRS on NOAA-15 onwards are producing CO2 slicing detection of high cloud that is out of family with results from NOAA-14 backwards. Future plans include detailed comparisons between different data sets to better understand the detectability of small amplitude variations, combination of approaches sensitive to high clouds (e.g. CO2 slicing) with those sensitive to low clouds (e.g. PATMOS-x or ISCCP vis/near IR spatial threshold and continuity techniques), expansion of trends in cloud cover to include time variations of cloud properties (these are especially sensitive to calibration), and special efforts in the polar regions as some regional changes above the uncertainty are evident. All the data sets examined are public and links to the different data sets are available at: http://isccp.giss.nasa.gov/assessment.html

2. Recommendations from the Workshop

A selected set of recommendations from the workshop are as follows.

2a. Work is ongoing to link the surface observations to satellite-based cloud products such as cloud coverage and cloud height. Improvements are being made in the satellite-based cloud products over polar regions, especially with MODIS. Improvements in cloud products are on-going. The workshop recommends that efforts should be made to make historical and future cloud products as consistent as possible.

2b. With regards to the intercomparison of satellite-based cloud products, several issues are noted. First, none of the data sets were designed for climate studies, i.e., each was developed more as a shorter-term research product, with funding dependent on proposals with a three-year term. Second, adjustments have to be made to account for orbital drift (i.e., changes in equatorial crossing time) as well as seasonal/annual changes in trace gases such as ozone and carbon dioxide. It is also imperative to account for inter-satellite calibration, as well as account for changes in calibration over time with each instrument. Each time a new satellite is launched, there seems to be a discontinuity in the data record. The workshop recommends that an initiative aimed at historical inter-satellite calibration be undertaken, and the entire data record be reprocessed so that the climate record is more continuous.

2c. The workshop also recommended that an activity be undertaken to merge data from complementary satellite instruments. In the historical record from polar-orbiting platforms, it is recommended that cloud products should be generated from merged AVHRR and HIRS data. As HIRS cloud properties use infrared (IR) bands, this would make the cloud products more consistent between daytime and nighttime data, as well as in regions of low sun angle. In the future, similar activities would involve the derivation of cloud products from both the imager (VIIRS) and the IR spectrometer (CrIS).

3. CGMS XXXIII

CGMS XXXIII is asked to consider these recommendations and initiate appropriate actions as necessary.