CERES NEWS CCCM
RelB1
Data Quality Summary

Data Product:

**CALIPSO Cloudsat
CERES and MODIS (CCCM)**

Data Set:

**Aqua (Instruments: CALIPSO, CALIOP;
CloudSat, CPR;
CERES, FM-3;
MODIS**

Data Set Version:

RelB1 (905906)

The purpose of this document is to inform users of the accuracy of this data product as determined by the CERES Science Team. The document summarizes key validation results, provides cautions where users might easily misinterpret the data, provides links to further information about the data product, algorithms, and accuracy, and gives information about planned data improvements. This document also automates registration in order to keep users informed of new validation results, cautions, or improved data sets as they become available.

This document is a high-level summary and represents the minimum information needed by scientific users of this data product. It is strongly suggested that authors, researchers, and reviewers of research papers re-check this document for the latest status before publication of any scientific papers using this data product.

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Nature of the CCCM Product:

The CALIPSO-CloudSat-CERES-MODIS (CCCM) data set integrates measurements from the Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations (CALIPSO) Cloud-Aerosol Lidar with Orthogonal Polarization (CALIOP), CloudSat Cloud Profiling Radar (CPR), Clouds and the Earth's Radiant Energy System (CERES), and the Moderate Resolution Imaging Spectroradiometer (MODIS) data. The cloud and aerosol properties from CALIOP and cloud properties from the CPR are matched to a MODIS pixel and then an Aqua CERES footprint. The product contains only the CERES footprint in each scan that has the highest CALIPSO and CloudSat ground track coverage. The product consists of all cloud and aerosol properties derived from MODIS radiances included in the Single Scanner Footprint (SSF) product and computed irradiances included in the Cloud Radiative Swath (CRS) product. Two sets of SSF variables are including the CCCM data. One set covers the entire CERES footprint and the other set is only over CALIOP and CPR ground track. CERES derived top-of-atmosphere (TOA) shortwave, longwave and window irradiances by angular distribution models are also included. In addition, irradiance profiles computed by a radiative transfer model using MODIS, CALIOP, and CPR derived aerosol, clouds, and surface properties are included in the product. Furthermore, MODIS-derived cloud properties from the algorithm that incorporates CALIOP and CPR cloud information are also included. MODIS-derived cloud properties and TOA irradiances derived from CERES radiances are produced by the same algorithm that produces CERES SSF and CRS products. However, the CCCM product should not be considered as a climate data record since various input data product versions and algorithm modifications will occur along the course of the measurement period. The scan and packet numbers unique to the CERES footprint provide the means to match the data to other CERES products, although the CCCM product contains more near nadir CERES footprints compared with SSF and CRS products. The resulting HDF granule contains 24 hours of data.

Difference from the Previous Version (RelB1 905905):

In the previous version (905905), clouds and aerosols derived from CALIPSO and CloudSat are sometimes missing due to a problem in staging their data to generate CCCM. Affected dates are first and last days of the month, such as

2006 July 31, 2006 August 1 and 31 etc. The problem occurs because a small fraction of the orbit of beginning of the month is included in the previous month of the original CALIPSO and CloudSat data or the fraction of the orbit of the last day of the month is included in the next month. Not staging these previous and next months' files leads to missing a small portion of the orbits. The impact of missing clouds and aerosols are minor and does not affect the monthly mean cloud fraction significantly (Figures 1 and 2). However, the cloud fraction in June 2009 is affected significantly. The newer version (905906) includes missing clouds and aerosols and has been processed using the exactly the same code used to process the 905905 version.
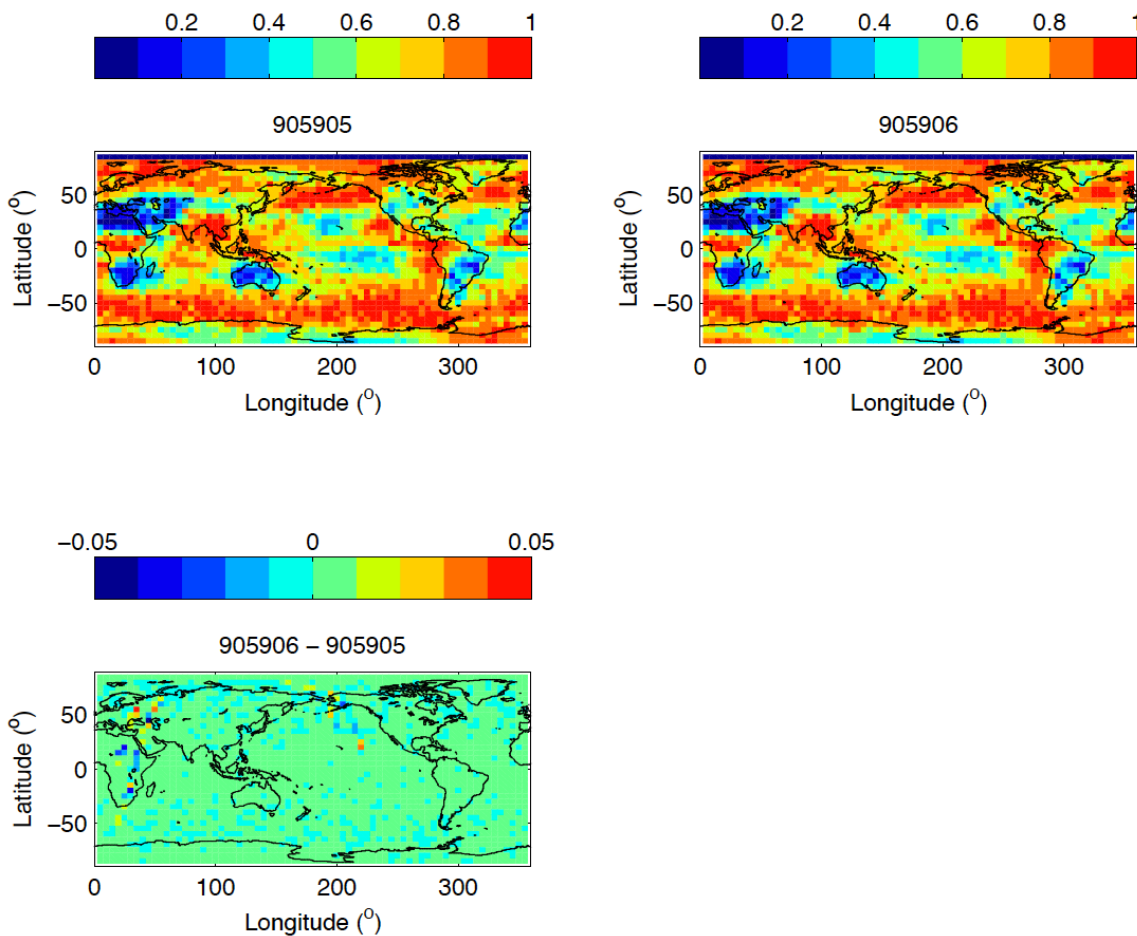
Figure 1. Monthly mean (Aug. 2008) cloud fraction derived over 5°×5° grid boxes from the 905905 version (top left) and from the 905906 version (top right). The difference is shown in the lower plot. The global monthly mean cloud fraction is 0.684 and 0.685 for 905905 and 905906, respectively.
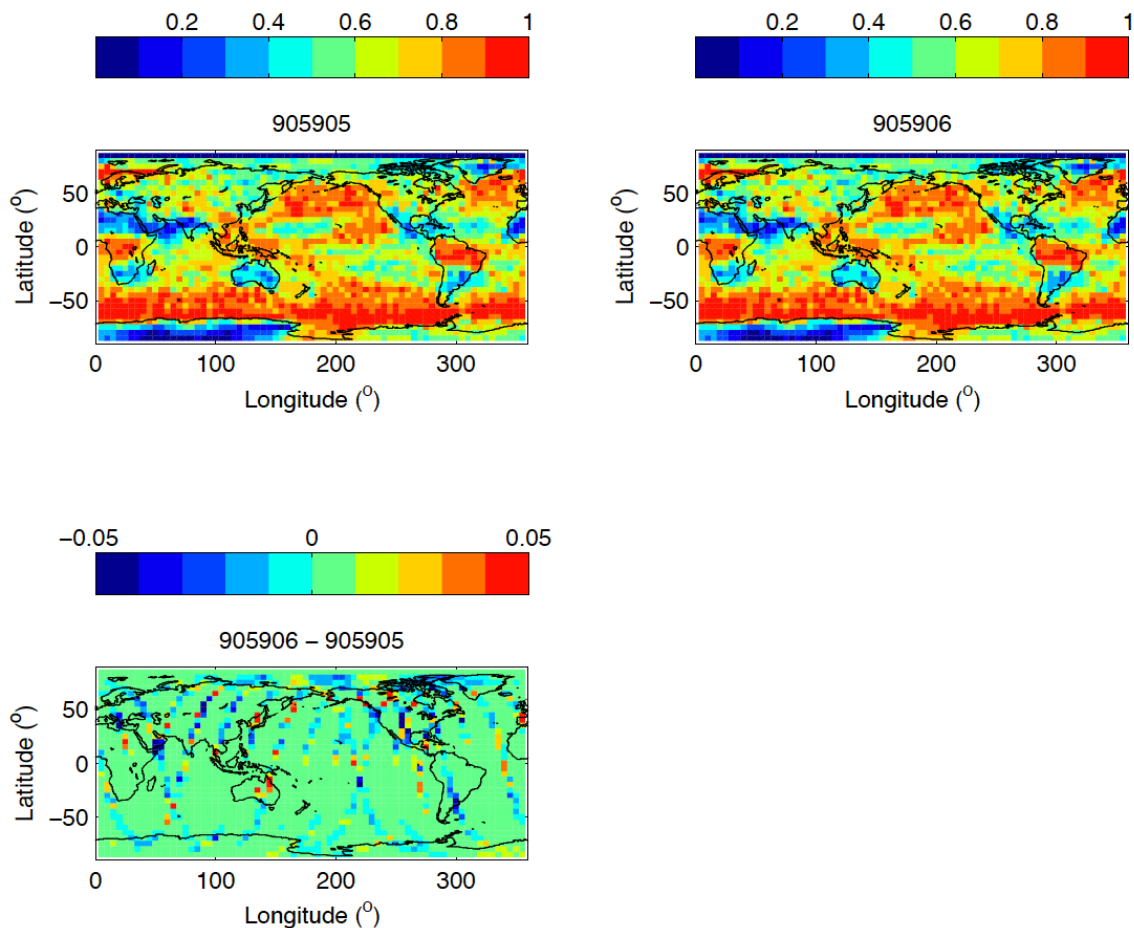
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Figure 2. Same as Figure 1 but for April 2009. The global monthly mean cloud fraction is 0.673 for both cases.

Data Used for Producing CCCM Data (Version B1)

Data used for producing currently available CCCM version B1 data are:
- CALIPSO
    1. CALIPSO_VFM: CAL_LID_L2_VFM-ValStage1-V3-01.YYYY-MM-DDTHH-*hdf
    2. CALIPSO_05kmALay: CAL_LID_L2_05kmALay-Prov-V3-01.YYYY-MM-DDTHH-*hdf
    3. CALIPSO_05kmCLay: CAL_LID_L2_05kmCLay-Prov-V3-01.YYYY-MM-DDTHH-*hdf
    4. CALIPSO_05kmCPro: CAL_LID_L2_05kmCPro-Prov-V3-01.YYYY-MM-DDTHH-*hdf
- CloudSat
    1. CLOUDSAT_CLDCLASS:YYYYJDY*_CS_2B-CLDCLASS_GRANULE_P_R04_E02.hdf
    2. CLOUDSAT_CWC-RO:YYYJDY*_CS_2B-CWC-RO_GRANULE_P_R04_E02.hdf
- MODIS (retrievals are done by the CERES cloud algorithm)
    1. MAC: MAC021S1.AYYYYJDY.HHMM.002.*hdf
    2. MAC_GEO: MAC03S1.AYYYYJDY.HHMM.002.*.hdf
    3. MAC_AEROSOL: MAC04S1.AYYYYJDY.HHMM.002.*.hdf
- CERES
    1. Aqua FM3 Edition3 (Cal/Val)

Cautions, Helpful Hints, and Known Problems:

- Because CALIPSO 5 km cloud profile product used in CCCM are beta version, the CCCM-53 through CCCM-60 variables are beta version (see Data Product Catalog (PDF) for the variable names).
- Users also need to read CALIPSO, CloudSat, CERES, and MODIS quality summary or similar documents before they analyze variables from those instruments.
    - **CALIPSO:** Data Quality Statements and user's guide (http://www-calipso.larc.nasa.gov/resources/calipso_users_guide/)
    - **CloudSat:** CloudSat Standard Data Products
    - **CERES and MODIS:** CERES SSF Aqua Edition2C Data Quality Summary

- CALIPSO, CloudSat and MODIS data are separated and stored by CERES footprints. For each CERES scan line, a CERES footprint that contains largest CALIPSO and CloudSat ground track was kept in CCCM.
- Besides cautions related to variables mentioned in CALIPSO and CloudSat documents, other cautions in using variables in this product.

  o **Cloud property retrieval from MODIS radiances by the CERES cloud code (Edition 3 beta 2)**
  When optically thick clouds (cloud top temperature less than 233 K) occur in a footprint, daytime cloud phase of all clouds within the footprint is sometimes all ice even when low-level clouds are present within the footprint.
  Thick dust aerosols are often identified as clouds.
  A large uncertainty and a larger occurrence of default value exist in the retrieval properties when the solar zenith angle is between 82 and 87.5 degrees.

  o **Quick view of data**
  Plots made from CCCM products are available from http://earth-www.larc.nasa.gov/cgi-bin/cgiwrap/eheckert/qcplt.hr.cgi?menu=1

  o **CALIPSO CloudSat derived cloud fraction**
  The sum of cloud group cloud fractions (cloud group area percentage coverage CCCM-12) or 100 minus cloud-free area percent coverage (CCCM-21) are the cloud fraction over a CERES footprint. When computing a cloud fraction averaged over an area and a time period, it is recommended to check the total number of good CloudSat profile (CCCM-8) and total number of good CALIPSO profile (CCCM-11). Because of a large sensitivity difference between CALIOP and CPR, when one of instruments is down, the cloud fraction is different from the value derived from both instruments.

  o **CALIPSO signal attenuation level**
  Mean CALIPSO signal attenuation level height (CCCM-25) contains a default value for all footprints.

  Known bug
  LWC and IWC from CloudSat below 3 km are 50% of the correct value. Affected variables are CCCM-67, CCCM-68, CCCM-70, CCCM-71, CCCM-85, and CCCM-86 (Figure 3). The problem happens when clouds extend below 3 km to above 3 km. If all clouds in the atmospheric column are below 3 km or all clouds in the atmospheric column are above 3 km, LWC and IWC are not affected by this problem.
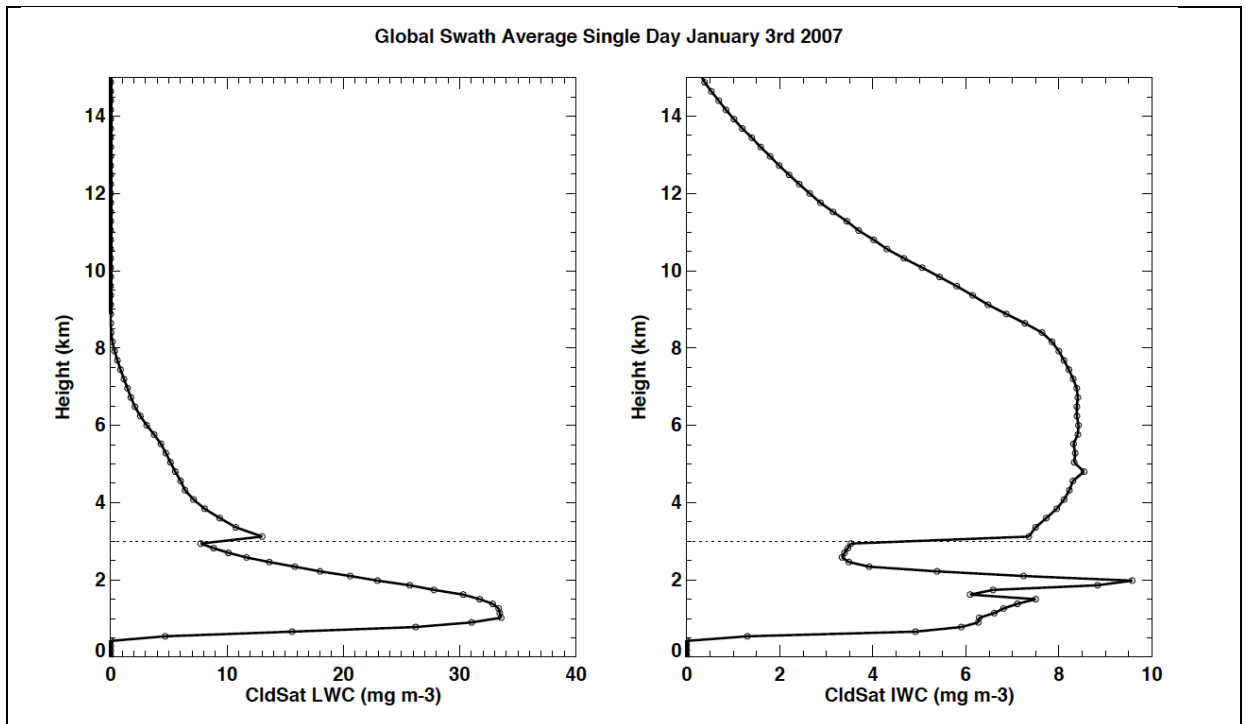

Figure 3: Daily mean (left) liquid water (CCCM-67) and (right) ice water (CCCM-70) contents averaged for the entire globe for January 3 2007. The discontinuity shown at 3 km is due to a problem in the algorithm to produce the CCCM data product. LWC = IWC = 0 are used for clear-sky footprints.

Feedback and Questions

For questions or comments on the CERES Quality Summary, contact the User and Data Services staff at the Atmospheric Science DataCenter.

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

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