Overview of CALIPSO, CloudSat, CERES, and MODIS merged product

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CALIPSO-CloudSat-CERES-MODIS Merged Product

- Funded by the NASA Energy Water Cycle Study (NEWS) project.
- Not a climate data product

**Expected contribution of the product**
To provide a global data set along the lidar/radar ground track with the most accurate and comprehensive aerosol properties, cloud properties, and vertical radiative flux profiles to researchers.

**Area of studies that are greatly improved by our data set includes:**
1. Assimilation and prediction by global aerosol models through better understanding of aerosol layer location.
2. Better understanding of multi-layered and polar cloud systems and their radiative impacts.
3. Better understanding of frequency of occurrence of thin cirrus and boundary layer clouds and their radiative impacts.
Data

• CALIPSO – CloudSat derived cloud profile (along their ground track).
• MODIS derived cloud properties (along the ground track and full CERES footprint) by the CERES cloud algorithm.
• Cloud properties derived from the MODIS standard and enhanced algorithm
• CERES derived TOA irradiance and computed Irradiance profile
• More than 400 variables
Input data

MODIS (retrievals are done by the CERES cloud algorithm)

MAC021S1.AYYYYJDY.HHMM.*.hdf, MAC_GEO
MAC03S1.AYYYYJDY.HHMM.*.hdf
MAC_AEROSOL: MAC04S1.AYYYYJDY.HHMM.*.hdf

CALIPSO

CALIPSO_VFM:CAL_LID_L2_VFM-Prov-V2-01.YYYY-MM-DDTHH-*hdf
CALIPSO_05kmALay:CAL_LID_L2_05kmALay-Prov-V2-01.YYYY-MM-DDTHH-*hdf
CALIPSO_05kmClay:CAL_LID_L2_05kmClay-Prov-V2-01.YYYY-MM-DDTHH-*hdf
CALIPSO_05kmCPro:CAL_LID_L2_05kmCPro-Beta-V2-01.YYYY-MM-DDTHH-*hdf

CloudSat

CLOUDSAT_CLDCLASS:YYYYJDY*_CS_2B-CLDCLASS_GRANULE_P_R04_E00.hdf
CLOUDSAT_2B-ΤΑΥ:YYYYJDY*_CS_2B-ΤΑΥ_GRANULE_P_R04_E02.hdf
CLOUDSAT_CWC-ΜΟ:YYYYJDY*_CS_2B-CWC-ΜΟ_GRANULE_P_R04_E01.hdf
Radiative effect of Cirrus, cloud overlap, cloud-aerosol overlap
Comparison with CERES fluxes

TOA Reflected Shortwave

TOA Longwave

CERES
Model

Flux (W m⁻¹)

TOA Longitude (°)

Flux (W m⁻¹)

Co-latitude (°)
Cloud mask merging

<table>
<thead>
<tr>
<th>Cloud boundary</th>
<th>CALIPSO</th>
<th>CloudSat</th>
<th>Merged Cloud boundary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top</td>
<td>Detected</td>
<td>Detected</td>
<td>Higher cloud top</td>
</tr>
<tr>
<td>Top</td>
<td>Detected</td>
<td>Undetected</td>
<td>CALIPSO cloud top</td>
</tr>
<tr>
<td>Top</td>
<td>Undetected</td>
<td>Detected</td>
<td>CloudSat cloud top</td>
</tr>
<tr>
<td>Base</td>
<td>Not completely attenuated</td>
<td>Undetected</td>
<td>CALIPSO cloud base</td>
</tr>
<tr>
<td>Base</td>
<td>Not completely attenuated</td>
<td>Detected</td>
<td>CALIPSO cloud base</td>
</tr>
<tr>
<td>Base</td>
<td>Totally attenuated</td>
<td>Detected</td>
<td>CloudSat cloud base</td>
</tr>
<tr>
<td>Base</td>
<td>Totally attenuated</td>
<td>Undetected</td>
<td>CALIPSO lowest unattenuated base</td>
</tr>
</tbody>
</table>

Cloud mask source flags are included

1: CALIPSO only
2: CALIPSO height but CloudSat also detected
3: CALIPSO lowest signal height
4: CloudSat only
5: CloudSat height, CALIPSO signal not attenuated
6: CloudSat height, CALIPSO signal attenuated
Cloud Grouping

Up to 16 groups in a CERES footprint
Up to 6 vertical layers in a profile
Convolution validation

Cloud fraction of Cloud Group 10 to 16
Cloud fraction difference

Red: before grouping
Blue: after grouping
Number of overlapping layers
Aerosols related variables

- MODIS clear percent coverage over CALIPSO-CloudSat cloud-free area (CCCM-27).
- Aerosol layer top and base height (up to 16 layers cloud free area)(CCCM-23, 24).
- Aerosol layer top and base height overlapping with cloud (1 layer for a cloud group)(CCCM-18, 19).
- Mean CALIOP-derived 532 and 1064 nm aerosol optical depth (CCCM-43, 46).
- Relative humidity of aerosol layer (CCCM-47).
- Mean CALIOP-derived optical thickness over cloud-free area (CCCM-49).
- CloudSat precipitation flag (CCCM-17)
Atmospheric Data Fusion (ADF) Group

Welcome to the ADF Group Homepage 04.14.2008

Our group integrates atmospheric data taken from multiple satellite instruments and provides data products for scientific analyses. Integrating data taken from multiple satellite instruments often increases information contents and potentially becomes more accurate description of atmospheric states.

Our group is currently working on integrating Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observation (CALIPSO), CloudSat, Clouds and the Earth's Radiant Energy System (CERES) and Moderate Resolution Imaging Spectroradiometer (MODIS) data to provide global vertical profiles of aerosol, clouds, and broadband radiative flux. All of these instruments are flying in formation as part of what is called the Aqua Train, or simply, A-Train. These new data will provide unprecedented ability to test and improve global cloud and aerosol models, to investigate aerosol direct and indirect radiative forcing, and to validate the accuracy of global aerosol, cloud and radiation data sets especially in polar regions and for multi-layers cloud conditions.

NASA Fact

A mile, also called a "statute mile," is the unit of distance most U.S. citizens are familiar with. To convert statute miles into kilometers multiply the statute miles by 1.609347.

More NASA facts...
WEB visualization tool
Production schedule

• One month (July 2006) beta version.
• Produce 1 year of data by the end of 2009.