Application of CALIOP, CloudSat, CERES, and MODIS (CCCM) to Evaluation of Standard "Passive-sensor-only" CERES CRS Results

Thomas P. Charlock (1), Fred G. Rose (2), Seiji Kato (1), Patrick Minnis (1), Walter Miller (2), David Fillmore (3), and David A. Rutan (2)

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We compare the LW radiation in a product combining active and passive sensors (CCCM, see poster by Seiji Kato, et al) with LW from an analogous passive-sensor-only code (CERES Aqua CRS Surface and Atmospheres Radiation Budget SABR).

CCCM has a set of radiative transfer calculations with the Langley Fu-Liou code; global and at the scale of 20-bn CERES footprints. Inputs include clouds from MODIS (Minnis et al.), aerosols from the MODIS Atmosphere Team and the MATCH aerosol assimilation, and GEOS4 meteorological variables.

CCCM runs only at the smaller scale of CALIOP and CloudSAT.

It uses a prototype CERES Edition 3 code for cloud retrievals with MODIS; those retrievals are further buttressed (for CCCM, but not CRS) with the active sensors. The narrow CCCM track spans a small fraction of any given CERES FOV; it intersects only near-nadir CERES FOV.

CRS and CCCM both use aerosols from MATCH, which itself assimilates MODIS AODs. But there is a big difference: The CRS height profiles of aerosols are from MATCH, while the CCCM height profiles used here are measured directly by CALIOP. This untuned run of CRS also uses proto-Edition 3 cloud inputs, but they are not adjusted by the active sensors.

The zonal mean, column-integrated aerosol forcing to LW cooling of the atmosphere, both all sky and clear sky, in CRS and CCCM runs only at the smaller scale of CALIOP and CloudSAT at the scale of CALIOP and CloudSAT.

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Cloud inputs include fractional area, height of top and base, optical depth, particle size, and phase. MATCH aerosol assimilation provides aerosol height for 7 types (used to assign single scattering albedo as per ORAC classes and 2 size ranges of desert dust from A. Lacis).

MODIS AOD retrievals in each CERES footprint are preferred, but the gridded MATCH AODs are used in most cases.

Fidelity of Simulated OLR (CRS and CCCM)

CRS uses Passive height

Domain for comparison of CCCM and CRS

OLR Bias vs Latitude

Cloud Forcing to Downward LW at Surface

Aerosol Forcing to LW Cooling of Atmosphere

Aerosol forcing in the above sampled CALIOP domain is not a fair global representation. Aerosol forcing to downward LW at the surface is 2.2 W/m². For comparison with that 2.2 W/m² of the sampled CALIOP domain, use the column-averaged CERES OLR value of 1.98 W/m² for July 2006 (not realistic).

David Rutan's CAVE home page (google “CERES CAVE”) validates each of ~50 sites in detail each month.

How good is the archived CERES/SABR?

AQC CRS SABR and CERES (SABR-Decibel) within 25 km of ARM SGP sites

-1      0      1      0.97     35765  CCCM all sky

OBS      Bias  RMS   Corr         N
266.7     -1       7       0.98     35765  CRS      all sky

266.7     -1       7       0.98     35765  CRS      all sky

288.5    -10      10     0.96     35765  CRS      clear as per CRS

288.5    -10      10     0.96     35765  CCCM     clear as per both

-1       0      1      0.97     35765  CCCM     clear as per both

-1       0      1      0.97     35765  CCCM     clear as per both

CCCM has larger RMS because the narrow track spans only a fraction of the CERES FOV observation to which it is compared.

We use only CCCM samples with CALIOP aerosol heights.