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Impact of active sensors scene ID on the radiance-to-flux conversion

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Medium resolution imaging sensors, such as MODIS (Moderate Resolution Imaging Spectroradiometer) on board Terra and Aqua platforms, are currently used in the interpretation of radiance measurements and in the target identification required in the flux estimation from top of the atmosphere (TOA) radiances. Instantaneous radiative flux estimates are difficult to derive from satellite broad-band radiometers due to the non-isotropic character of the emitting target. CERES (Clouds and the Earth's Radiant Energy System) radiance-to-flux retrieval algorithms successfully exploit the MODIS spectral capabilities to infer the required information from the scene target. However, since MODIS is a passive sensor, it provides limited information of the scene.

Active sensors, such as lidar and radar, could provide more accurate scene identification since they measure realistic atmospheric vertical profiles. Considering that CERES, MODIS and the active sensors on board CALIPSO (Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observation) and CloudSat are part of the payload of the A-Train, this study will assess the impact of the use of active sensors on the CERES flux retrieval algorithms.

A priori, the use of active sensors in the CERES scene ID may result in both advantages and disadvantages. Potential MODIS flaws, for example, cirrus clouds over snow or overlapped clouds, could produce a misinterpretation of scenes which could now be corrected by the use of active sensor products. However, the coherence of the CERES retrieval algorithms may be partially lost if there is a systematic scene misidentification, since the flux retrieval algorithms are based on MODIS scene detection.

The integrated CALIPSO, CloudSat, CERES and MODIS merged product (CCCM or C3M) provides a perfect opportunity to compare both active and passive atmospheric products for many targets. Systematic and occasionally MODIS scene misidentification will be detected and treated differently. For non-statistically significant passive and active discrepancies it is assumed that CERES provides correct fluxes for these scene classes, thus CERES models will be employed together with the new active scene ID to calculate fluxes. A statistical analysis of the flux differences will determine the CERES flux biases. On the other hand, if systematic errors exist the flux bias, originally due to the scene misidentification, will be assessed by comparing CERES flux results against theoretical fluxes computed for those scenes using the active and passive products of clouds and atmosphere as inputs for a radiative transfer code.