Geophysical Research Abstracts,
Vol. 11, EGU2009-12728, 2009
EGU General Assembly 2009

Evaluation of cloud properties in General Circulation Models using A-train observations

D. Konsta, H. Chepfer, J-L Dufresne, and S. Bony
LMD/IPSL, Université Pierre et Marie Curie, CNRS, France

The cloud properties strongly modulate the radiative budget of the Earth-atmosphere system. Large-scale climate models have progressed substantially over the last few years in their simulation of fluxes at the top of the atmosphere, the geographical cloud distribution and their seasonal variation. Nevertheless clouds still constitute the main source of uncertainty in models estimates of climate sensitivity and their evaluation in GCMs constitutes a key step in the process of reducing cloud feedback uncertainties. Clouds simulated by climate models have long been evaluated using passive remote-sensing, making the vertical structure of clouds difficult to assess. However a correct value of the fluxes alone may be the result of various compensating errors and is a weak constraint to evaluate how models simulate clouds. The A-train offers the possibility to observe the cloud radiative properties with passive remote sensors (PARASOL, CERES) and provides accurate information on the vertical distribution of clouds with the new generation of satellites carrying cloud profiling radar and lidar instruments such as CLOUDSAT and CALIOP/CALIPSO.

In the current study we analyse some of the A-train observations. CERES instrument measures broadband radiances in the SW and LW domains. PARASOL measures the total and polarised directional reflectances in the visible domain under different viewing directions and is very suitable for the evaluation of the cloud optical depth. The CALIOP lidar provides us a unique description of the cloud top height, of the optically thin clouds and of the cloud vertical distribution in the atmosphere. This information is being supplemented by the radar CLOUDSAT for the lower part of these clouds. We also use dynamical atmospheric regimes in order to classify the cloud properties.

These observations are then compared to the results of the LMDZ general circulation model using a model-to-satellite approach. To ensure the consistency between climate model and Caliop lidar and Cloudsat radar observations, active remote sensing simulators have been developed in the frame of the CFMIP project. We also used a PARASOL simulator to directly compare the directional reflectances observed with PARASOL to those simulated by the GCM. This method is then used to evaluate two versions of the LMDZ model with two very different sets of parameterization: the LMDZ4 model used for the CMIP3-AR4 runs and a version with new convective boundary layer and cloud scheme. We will show how these A-train observations allow differentiating the cloud properties simulated by the two versions of the model. More precisely we will show that:

• there is a lack of low level clouds simulated by the model over the tropical ocean (Eastern Pacific, Atlantic) which are better represented by the new version all along the tropics and at the subsidence regions. High cloud cover is relatively well predicted by the model.

• the cloud optical thickness is overestimated by both the two versions with the difference being much more pronounced for the new version.

• while the observations show that high values of cloud cover correspond to various values of reflectances, the old version of the model shows a linear relation between reflectance and cloud cover and the new version finds more limited values.