3rd International Conference on Earth System Modelling
Vol. , 3ICESM-51, 2012
3rd International Conference on Earth System Modelling

Using CALIPSO, PARASOL, and CERES satellite observations to evaluate compensating errors in the vertical distribution and optical properties of low-level clouds amongst six CMIP5 general circulation models.

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CALIPSO, PARASOL and CERES satellite observations are used to evaluate the vertical distribution and optical properties of Tropical low-level clouds, as well as their associated cloud radiative forcings, as simulated by six CMIP5 general circulation models. To facilitate the comparison with observations, each of these models has been run with the CALIPSO and Parasol satellite simulator from the Cloud Feedback Model Intercomparison Project's Observations Simulator Package (COSP).

Systematic model errors in the cloud amount and associated cloud radiative forcing in regions of stratocumulus and shallow cumulus clouds are identified and quantified. Stratocumulus and shallow cumulus regions, as defined by large-scale subsidence and lower tropospheric stability, show that models simulate a similar vertical distribution of cloud cover in the lowest 4km of the atmosphere in both regions. Nearly all models underestimate the frequency of cloud fractions greater than 0.2 above 1.5 km and overestimate the frequency of cloud cloud fractions greater than 0.6 below 1.5 km. We want to understand why the modeled low-level clouds are more often concentrated within the lowest 2 km of the atmosphere than observed.

The similarities between the vertical distribution of modeled stratocumulus and shallow cumulus cloud regimes lead to a comparison of environmental conditions, specifically the large-scale subsidence and surface fluxes. We are currently trying to understand how these properties influence the transport of moisture and energy in the boundary layer; thereby affecting the vertical distribution of low-level clouds and their reflectances in the models.