

## **Stratocumulus to Cumulus Transition Climate Process Team (CPT)**

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The goal of this CPT is to improve the representation of the cloudy boundary layer in NCEP GFS and NCAR CAM5 with a focus on the subtropical stratocumulus to cumulus (Sc-Cu) transition. The strategy is based on improving the representation of process interactions, in particular by analyzing LES and SCM simulation of two new Sc-Cu transition GEWEX Cloud System Studies (GCSS) cases.

The work performed so far with the NCEP GFS has contributed to an improved energy budget by identifying a lack of atmospheric heating due to dissipation of turbulent kinetic energy (TKE) in the boundary layer. Single column-GFS simulation of GCSS cases suggested several modifications to the shallow cumulus parameterization to bring the GFS into much closer agreement with LES simulations. Results showed significant improvement in the distribution of tropical sea-surface temperature (SST), cloud cover, and cloud radiative forcing. It also produced slight improvements in the vertical structure of the boundary layer in the SE Pacific Sc-Cu transition, with a deeper, cloudier boundary layer near the South American coast and a reduction in stratocumulus 2000 km offshore, where cloud cover was being overpredicted. As hoped, there was a reduction in shallow cumulus precipitation and associated latent heating, in much better agreement with other climate models.

The work performed with CAM5 aims to impose consistency between the cloud physics parameterizations. A PDF-based macrophysics scheme was implemented and tested, and plans for expansion to a more complete version are under development. Over the course of this development a number of unexpected issues related to coupling between cloud physics processes were identified and resolved.

An Eddy-Diffusivity/Mass-Flux (EDMF) parameterization for dry convection in the single column version of GFS, and validated against a range of large-eddy simulations, performed using an LES model. The new EDMF parameterization performs well, surpassing in accuracy the previous scheme (a combination of K-diffusion and counter-gradient term).

Plans for the third year of the CPT include more analysis of GFS and CAM5 climate simulation biases and their impact of on the simulated Sc-Cu transition, improve microphysics to increase deep cloud, improve Sc entrainment formulation to enhance coastal Sc, testing of the EDMF scheme for cloud-topped boundary layers, and Detailed evaluation of new PDF-based cloud macrophysics and mixing schemes, and interactions with other schemes in CAM5.

The institutions participating in the CPT are NCEP, NCAR, JPL, U. of Washington, U. of California Los Angeles, and LLNL.