CPT on Cloud Parameterization and Aerosol Indirect Effects

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The motivation for this CPT is to unify the boundary layer turbulent mixing, shallow convection, and stratiform cloud parameterization schemes in climate models. This is being achieved by implementing in the GFDL and NCAR climate models a higher-order closure for cloudy boundary layers based on assumed double-Gaussian PDFs for the conserved thermodynamic variables and vertical velocity. The motivation is to improve the representation of aerosol indirect effects because the magnitude of these effects depends so strongly upon how low clouds respond to aerosol changes. The project team is making significant use of Large-Eddy Simulation (LES), Single-Column Models (SCMs), and observations from both satellites and field experiments (in particular from the VOCALS Regional Experiment).

The presentation will highlight the significant progress that has been made in the past year and identify challenges that remain. The new unified scheme has been successfully incorporated into both GCMs and is currently being extensively tested and refined by comparison with observations. Currently, the results with the new physics are competitive with those of the current schemes in terms of several cloud metrics. SCM work is focusing upon the degree to which the new physics can represent key cloud responses to aerosol perturbations. A satellite toolkit is being developed and used to produce new metrics including precipitation rates and cloud microphysical properties. Field data are being synthesized to produce additional and complementary observational metrics on boundary layer and cloud structure. Together, the new observational metrics are being used to ascertain the skill of the existing and new model physics. The presentation will also highlight how the new scheme is being used outside of the current CPT project to expand the model capability in other centers and for other goals.