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Understanding Climate Model Parameterization Errors in Short-Range Weather Forecasts Using Field Experiment Data

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Abstract

Diagnosing climate model deficiencies in climate simulations is difficult since results depend on all aspects of the model and the compensation of multiple errors can mask real model problems. To address this issue, the U.S. Department of Energy (DOE)'s Climate Change Prediction Program (CCPP) and Atmospheric Radiation Measurement Program (ARM) sponsored a joint project to develop a climate model parameterization testbed, i.e., the CCPP-ARM Parameterization Testbed (CAPT), which can be easily used to run climate models in forecast mode. Under CAPT, climate models are initialized with realistic atmospheric states from NWP analyses and model parameterizations are evaluated in their short-range weather forecasts against observations. Using such an approach, we could identify specific model deficiencies before the compensation of multiple errors occurs. We can also link model deficiencies directly with specific atmospheric processes through case studies using data collected from major field programs. In the presentation, we will provide examples using simulations with the NCAR and GFDL climate models. Observational data collected from ARM and other major field campaigns, such as the Tropical Warm Pool-International Cloud Experiment (TWP-ICE), the TOGA_COARE, and the Mixed-Phase Arctic Cloud Experiment (M-PACE), are used to understand model deficiencies in the parameterizations of cumulus clouds and mixed-phase clouds in these two climate models.