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The effects of cloud-scale physicsuUncertainty on climate prediction

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The effects of uncertainty in the simulation of several key convective processes on the variability of the mean climate state are studied. Particularly, the focus is on studying convective momentum transport and entrainment of environmental air into convective plumes. These processes are highly variable in both space and time, but to date this variability is not captured in current model parameterizations. Many processes with a large effect on global circulation, namely ENSO, are highly sensitive to these convection representations. A two-track strategy has been developed regarding stochastic variability, with one track examining idealized parametric spectra and the other track examining more realistic spectra. The climate response to perturbations of these parameters is simulated using version 4 of NCAR's Community Climate System Model. In the idealized experiments, the constant parameters in the representations have been replaced with variable parameters perturbed by white and red noise about the standard value within the ranges cited in literature. Model diagnostic tools are utilized in the analysis of the results to investigate the effects on large-scale phenomena. While maintaining energy balance, the experiments indicate basin and sub-continental scale changes in distributions of convective activity. Future work will utilize a realistic spectra of perturbations, and the parameters will be constrained based on the results of cloud resolving model data obtained from a super-parameterized version of the Community Atmosphere Model. This more realistic treatment of convection, allowing key convective parameters to vary between synoptic systems, is expected to improve global circulation and the simulation of ENSO.