Perturbed-parameter Ensemble of CAM5 Simulations of the MJO

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Abstract

The Madden-Julian Oscillation (MJO) is a dominant source of intraseasonal variability in precipitation and has been a great challenge for climate models to simulate. Model simulated MJOs are usually too weak and/or too fast. The model errors could be due to either deficiencies in parameterizations of sub-grid processes or poor interactions among the parameterizations or with the large-scale state. To some extent the interactions between processes are governed by parameters in the physics (e.g. entrainment rate, RH crit in some convection schemes). It would be of interest to know how good an MJO is possible with a single set of parameterizations by adjusting the uncertain parameters in the physics (e.g. 'tuning'). In this study, we have performed perturbed-parameter AMIP type of "free-running" simulations with the fifth version of the Community Atmosphere Model (CAM5) to fully explore the multi-dimensional space of the uncertain parameters in CAM5 physics. The goal is to systematically examine the parameter-dependent performance of CAM5 in simulating MJO, and then to understand which parameters and associated physical processes are critical for a model to produce a good MJO simulation.

22 parameters in CAM5's physical parameterizations are perturbed (1) One-At-a-Time (OAT) and (2) simultaneously using Latin Hypercube Sampling (LHS). The dependencies of CAM5's MJO simulation on uncertain physical parameters are being explored in this study with several widely used MJO Metrics. Specifically we would like to know what parameter values lead to a "good" MJO simulation and good simulations by these simple MJO metrics are really good MJOs. To what extent we see the trade-off between mean-state and variability in these set of climate model simulations. More detailed results from this study will be presented in the meeting.

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