Simulation of Madden-Julian Oscillation with the NCEP MRF model

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It has been shown in a few studies that the previous reanalysis version of the National Centers for Environmental Prediction (NCEP) medium range forecast (MRF) model was not capable of maintaining the observed tropical Madden-Julian oscillation (MJO), resulting in a reduced skill of forecast of tropical and extratropical activities associated with MJO events. The current NCEP MRF model has undergone substantial changes in its physics package, including the inclusion of prognostic cloud water and modifications to cloud radiation interaction, boundary layer turbulence and convection parameterizations. This paper is to investigate whether these changes have led to an improvement of model's performance in simulating the observed MJO.

We have performed simulations with the current NCEP MRF model forced with observed sea surface temperatures. Simulations are conducted with a horizontal resolution of T62 and different vertical resolutions are used. Analysis of tropical velocity and precipitation fields from the simulations reveals the current NCEP MRF model is capable of capturing the observed tropical eastward propagating intraseasonal oscillation. Spectral calculations of 850 mb and 200 mb zonal velocity indicate that, on average, the model's variance within the intraseasonal time scales (20 to 90 days) are comparable to observations. The model's variance of appreciable amplitude, however, is found to be distributed to a wider frequency range than the observed. Near observed peaks around the period of 55 days, the model's amplitude of spectral power is slightly weaker than the observed values. At lower frequencies (periods longer than 60 days) and higher frequencies (periods shorter than 30 days), the model's variability appears to be too strong. These features are not found to change with vertical resolution.