

Influence of the initial and boundary conditions input dataset on the MM5 simulation of the Madden-Julian Oscillation

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Since the 1980s, the MJO has received a great deal of attention in part because of its impact on weather systems around the globe. A lot of work has been devoted in the accurate simulating and forecasting of the MJO. Various studies focused on evaluating models, whether global climate models, regional models and multiscale models, or comparing them. For example, the MM5 v.3 regional model was shown to capture the dominant features of the MJO, such as the observed location of convection, its eastward propagation and the strong first baroclinic structure of the MJO (Gustafson and Weare, 2004a and 2004b). These previous studies used only one dataset (NCEP/NCAR Reanalysis) as input for the model.

This study focuses on the influence of the initial and boundary conditions input dataset on the simulation of the MJO with the MM5 model. The model was ran separately with two reanalysis datasets (ECMWF ERA-40 and NCEP/NCAR) for a time period of 26 months, over the tropics (22.5°S-22.5°N) and half the globe in longitude (15°E-197.5°E). The aim of this study is to assess the realism of the simulated MJO and the major differences between the two simulations, following the procedure described in Zhang, 2005. Furthermore, the two datasets were analyzed to understand these differences.

Results show that high-level zonal winds are very well reproduced, as they display the correct MJO spatial and vertical structures, phase speed and space-time power spectrum. The study indicates that the ERA40 run reproduces the MJO dynamical fields more accurately than the NCEP run, especially at lower levels and over Indonesia-Papua New Guinea. On the other hand, the ERA40 run exhibits a lack of organization and a weak propagation in the OLR, specific humidity and precipitation. While these fields look more organized in the NCEP run, they only present a coherent propagation West of Indonesia.

Overall, this study reveals that the choice of input data used for the initial and boundary conditions of the model has a significant impact on the realism of the MJO simulation. Therefore, some care should be taken when choosing the dataset.

References

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