

A Numerical Case Study on the Initiation of the Madden-Julian Oscillation

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Abstract

A mesoscale tropical channel model is used to study the long-standing problem of the initiation of the Madden-Julian Oscillation (MJO). With initial and lateral boundary conditions provided by a global reanalysis, this model is able to reproduce the initiation and gross features of two observed MJO events up to two months after the start of simulations. This leads to a conjecture that these two MJO events were generated by the influences from the lateral boundaries. This conjecture is supported by a series of sensitivity tests. These sensitivity tests demonstrate that the simulated MJO initiation does not critically depend on detailed characteristics of sea surface temperature (time dependent vs. independent, mean distribution from boreal spring vs. winter), initial conditions (within a 10 day period), the latitudinal location of the lateral boundaries (21 – 38°N and S), and even latent heating and moist processes. The only factor found critical to the reproduction of the MJO initiation is time dependent lateral boundary conditions from the reanalysis. When such lateral boundary conditions are replaced by time

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independent ones, the model fails to reproduce the MJO initiation. These results support the idea that extratropical influences can be an efficient mechanism for MJO initiation. Implications of these results are discussed. A detailed diagnosis is undergoing at present to find the mechanisms of extratropical influences for the MJO initiation.