A New Interpretation of the Ability of Simulating the MJO by Global Models

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It has been widely perceived that currently few global models can reproduce the MJO whereas others cannot. This perception is based on diagnostics of multiple global models using pattern correlation of time-lag regression in precipitation between model simulations and observations and other methods of extracting statistical signals of the MJO. In this study, we demonstrate that this perception is incorrect. Of 27 global model simulations diagnosed, all produce the MJO. The main difference between these models is how often they produce the MJO. Other features, such as strength, propagation speed, and longitudinal range, of the simulated MJO are not distinguishable with statistical significance between most of these models. These results were reached by using a method of tracking individual MJO events. A hypothesis is proposed to interpret our results with preliminary, partial diagnostic support: A package of parameterization in a model can produce the MJO only in a particular mean state. A model simulates the MJO frequently if its mean state is in favor of MJO reproduction by its parameterization package. Otherwise, it may simulate the MJO infrequently only when its mean state that is normally not in favor of MJO reproduction occasionally migrates into a condition conducive to MJO reproduction by its parameterization package. This hypothesis also explains the conundrum that certain models can produce MJO statistics well in their climate simulations but cannot predict individual MJO events with realistic initial conditions.

Key Points:

1. Diagnostics of MJO simulations by global models based on an MJO tracking method have led to a very different conclusion reached by previous statistical appraisals.

2. All 27 models diagnosed produce the MJO, some frequently, others infrequently, but without statistical significant distinctions in other features of the MJO, such as propagation speed, longitudinal range, and strength.

3. It is hypothesized that a parameterization package of a model can produce the MJO only in a particular mean state.