**Tropical Convection and Subseasonal Weather Prediction in a Global Convection-Permitting Model**

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Month-long simulations targeting four Madden-Julian Oscillation events made with several global model configurations are verified against observations to assess the roles of grid spacing and convective parameterization in global models. Specifically, the performance of a global convection-permitting model (CPM) configuration with a uniform 3-km mesh is compared to that of a global 15-km configuration with and without convective parameterization, and of a variable-resolution “channel” simulation using 3-km grid spacing in the tropics and 15-km in the extratropics with a scale-aware convection scheme over the entire domain.

It is shown that global 3-km simulations produce realistic tropical precipitation statistics, except for an overall wet bias and delayed diurnal cycle. The channel simulation performs similarly, though with an unrealistically high frequency of heavy rain. The 15-km simulations with and without cumulus schemes produce too much light and heavy tropical precipitation, respectively. A deeper look at the environmental sensitivity of simulated precipitation reveals that the 15-km model with a cumulus parameterization triggers convection under unrealistically stringent environmental stability and moisture conditions; specifically, convection in the 15-km configuration is unrealistically dependent on environmental stability and lacks nonlinear sensitivity to moisture variations. These problems are alleviated in the global CPM configuration.

Only the global CPM configuration is able to capture eastward-propagating Madden- Julian Oscillation events, while the 15-km runs favor stationary or westward-propagating convection organized at the planetary scale.The global CPM also exhibits the highest extratropical forecast skill aloft and at the surface (particularly during week-3), consistent with its superior MJO representation. While more cases are needed to statistically verify these results, this study highlights the benefits of using global CPMs for identifying flaws in current-generation models, examining tropical convection and its relationship to environmental factors, and improving subseasonal forecasting.