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Simulations of Tornadoes, Tropical Cyclones, MJOs, and QBOs, using GFDL's multi-scale global climate modeling system

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A multi-scale High-Resolution Atmosphere Model (HiRAM) is being developed at NOAA/Geophysical Fluid Dynamics Laboratory. The model's dynamical framework is the non-hydrostatic extension of the vertically Lagrangian finite-volume dynamical core (Lin 2004, Monthly Wea. Rev.) constructed on a stretchable (via Schmidt transformation) cubed-sphere grid. Physical parametrizations originally designed for IPCC-type climate predictions are in the process of being modified and made more "scale-aware", in an effort to make the model suitable for multi-scale weather-climate applications, with horizontal resolution ranging from 1 km (near the target high-resolution region) to as low as 400 km (near the antipodal point). One of the main goals of this development is to enable simulation of high impact weather phenomena (such as tornadoes, thunderstorms, category-5 hurricanes) within an IPCC-class climate modeling system previously thought impossible.
We will present preliminary results, covering a very wide spectrum of temporal-spatial scales, ranging from simulation of tornado genesis (hours), Madden-Julian Oscillations (intra-seasonal), topical cyclones (seasonal), to Quasi Biennial Oscillations (intra-decadal), using the same global multi-scale modeling system.