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High resolution global climate modeling with GEOS-5: intense precipitation, convection and tropical cyclones on seasonal time-scales.

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In 2008 the World Modeling Summit for Climate Prediction concluded that "climate modeling will need--and is ready--to move to fundamentally new high-resolution approaches to capitalize on the seamlessness of the weather-climate continuum." Following from this, experimentation with very high-resolution global climate modeling has gained enhanced priority within many modeling groups and agencies. The NASA Goddard Earth Observing System model (GEOS-5) has been enhanced to provide a capability for the execution at the finest horizontal resolutions possible with a global climate model today. Using this high-resolution, non-hydrostatic version of GEOS-5, we have developed a unique capability to explore the intersection of weather and climate within a seamless prediction system. Week-long weather experiments, to multi-year climate simulations at global resolutions ranging from 3.5- to 14-km have demonstrated the predictability of extreme events including severe storms along frontal systems, extra-tropical storms, and tropical cyclones. The primary benefits of high resolution global models will likely be in the tropics, with better predictions of the genesis stages of tropical cyclones and of the internal structure of their mature stages. Using satellite data we assess the accuracy of GEOS-5 in representing extreme weather phenomena, and their interaction within the global climate on seasonal time-scales. The impacts of convective parameterization and the frequency of coupling between the moist physics and dynamics are explored in terms of precipitation intensity and the representation of deep convection. We will also describe the seasonal variability of global tropical cyclone activity within a global climate model capable of representing the most intense category 5 hurricanes.