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A Study of Meso and Frontal Scale Air-Sea Interactions Using a High-Resolution Atlantic Regional Coupled Model

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A high-resolution fully coupled Atlantic regional model is developed and used to investigate the role of meso and frontal scale air-sea interactions in extreme climate phenomena within the Atlantic sector, such as Atlantic hurricanes and winter storm tracks along the Gulf Stream extension. The regional coupled model consists of the Weather Research and Forecasting (WRF) model with horizontal grid resolution of up to 9 km coupled to the Regional Ocean Modeling System (ROMS) with a uniform 9 km grid. A common model grid approach is adopted for the coupled model, so that no interpolation is used for the air-sea flux exchange during the coupling. The WRF and ROMS are coupled every hour, allowing for a fully resolved diurnal cycle. At these resolutions, we can begin to resolve important aspects of atmospheric convection and oceanic eddies, facilitating a better examination of meso and frontal scale air-sea interactions. We have conducted ensembles of coupled simulations and uncoupled WRF-only simulations for both boreal summer-fall, when Atlantic hurricanes are active, and winter-spring, when North Atlantic winter storm track variability is at its peak. By contrasting the coupled and uncoupled simulations, we will reveal how meso and frontal scale air-sea interactions can affect Atlantic hurricanes and winter storm track variability along the Gulf Stream extension.