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Intensification of tropical cyclones in the GFS model

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Abstract. Special forecasts from the Global Forecast System (GFS) model were used in this study to evaluate how the intensification process in a tropical cyclone is represented in this model. Several tropical cyclones that developed in 2005 were analyzed in terms of the storm-scale circulation rather than more traditional measures such as maximum wind or minimum central pressure. The primary balance governing the circulation in the planetary boundary layer is between the convergence of environmental vorticity, which tends to spin up the storm, and surface friction, which tends to spin it down. In addition, we employ recently developed ideas about the relationship between precipitation and the saturation fraction of the environment to understand the factors controlling mass, and hence vorticity convergence. The budget of moist entropy is central to this analysis.

Two well-known governing factors for cyclone intensification emerge from this study; surface moist entropy fluxes, dependent in the model on sea surface temperature and cyclone-generated surface winds, and ventilation of the system by dry environmental air. Quantitative expressions for the role of these factors in cyclone intensification are presented in this paper.

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