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The impact of the diurnal insolation cycle on the tropical cyclone heat engine MORGAN E. O'NEILL, Department of Earth and Planetary Sciences, Weizmann Institute of Science, DIAMILET PEREZ-BETANCOURT, Program in Atmospheres, Oceans and Climate, Massachusetts Institute of Technology, ALLISON A. WING, Lamont-Doherty Earth Observatory, Columbia University — A hurricane, or tropical cyclone, is understood as a heat engine that moves heat from the warm sea surface to the cold tropopause. The efficiency of this engine depends in part on the strength and duration of solar heating. Over land, peak rainfall associated with individual thunderstorms occurs in the late afternoon. Over ocean, with its markedly higher surface heat capacity, deep convection responds more to radiational cooling than daytime surface heating. However, the role of daily varying solar forcing on the dynamics of tropical cyclones is poorly understood. Recently, Dunion et al. (2014) reported significant, repeating diurnal behavior propagating outward from tropical cyclone centers, using infrared imagery from nine years of North Atlantic tropical cyclones. We study the impact of the diurnal cycle on tropical cyclones using a high resolution 3D numerical model, the System for Atmospheric Modeling (Khairoutdinov and Randall 2003). Simulations are run with and without variable sunlight. We are able to reproduce the observational finding of Dunion et al. (2014), and further identify a diurnally-varying residual circulation in the tropical cyclone at midlevels. The impact of the diurnal cycle on the equilibrium dynamics of tropical cyclones is also discussed.

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