UNDERSTANDING THE TROPICAL CYCLONE DIURNAL CYCLE USING NUMERICAL MODELING

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The tropical cyclone diurnal cycle (TCDC) directly impacts storm structure and intensity. Thus far, the TCDC has been studied using satellite IR data, lightning data, rawinsondes and dropsondes, numerical modeling, a high-resolution global precipitation dataset, and TRMM. The TCDC manifests in different variables, and consistent timing of the diurnal cycle for those variables is found in the literature: the cirrus canopy reaches its maximum areal extent around 18 LT, precipitation peaks around 06 LT, and enhanced convection occurs overnight producing the coldest cloud-tops at around 04 LT. Despite the consistent story told, there are conflicting theories behind what drives the cirrus canopy expansion, whether and how precipitation is tied to the cirrus canopy expansion, whether the diurnal cycle is tied mainly to the outflow layer or is a column-deep phenomenon, and whether and how the observed diurnal pulse (Dunion et. al 2014) is related to the diurnal cycle.

This research will use the axisymmetric version of the Bryan Cloud Model Version 1 (CM1) to try and answer these questions. The first step is to assess how different microphysics schemes induce changes to the tropical cyclone structure and intensity since it has been shown that the choice of microphysics scheme results in tropical cyclone track, structure, and intensity differences. CM1 is used to spin-up a tropical cyclone for twelve days, the last six of which are averaged to remove transients. Fourier harmonic analysis is then conducted to separate out the diurnal cycle. Results shown will focus on comparing the timing of the diurnal cycle in the model to the observed timing of cirrus canopy expansion, overnight convection, precipitation, and intensity changes. The microphysics scheme that produces the most realistic diurnal cycle when compared to observations will be identified. This simulation will then be used when conducting further experiments to determine the main drivers behind the diurnal cycle as portrayed by CM1.