ATS/CIRA Colloquium

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The Inner Core Thermodynamics of the Tropical Cyclone Boundary Layer

Hosted by Wayne Schubert

Friday, August 31, 2018

ATS room 101
Discussion will begin at 11:15 a.m.
Refreshments will be served at 10:45 a.m. in the weather lab

Although considerable progress has been made in understanding the dynamics which govern the inner-core structure of the tropical cyclone boundary layer (TCBL), our knowledge of the inner-core thermodynamics of the TCBL remains limited. In this talk, numerical simulations of the thermal structure of the TCBL are examined for a stationary vortex, a translating vortex, and for a vortex undergoing an eyewall replacement cycle (ERC). For a stationary and a translating vortex, it is shown that the mean thermal structure of the TCBL consists of a near-surface superadiabatic layer, a thermally mixed layer within the lower portion of the inflow layer, and a layer of marked thermal stability in the upper portion of the inflow layer. It is shown that the structure of the near-surface superadiabatic layer is governed by heating from turbulent dissipation and evaporative cooling from precipitation, which sensitively depends on the choice of microphysical parameterization. The marked thermal stability in the upper-portion of the inflow layer is found to be due to differential radial advection of potential temperature and diabatic processes near the eyewall cloud base. Conversely, during an ERC, the moat region is characterized largely by a sharp vertical gradient in specific humidity and a weaker thermal stability due to the effects of dry subsidence. During an ERC, the depth through which subsidence impinges upon the inflow layer are dynamically controlled by the relative eyewall strength and the moat width. Sensitivity tests show that reduced moat widths tend to reduce the influx of moist entropy into the eyewall.

Link to colloquia page: https://www.atmos.colostate.edu/colloquia/