ATS/CIRA Colloquium

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Investigating the diurnal cycle of clouds and convection in tropical cyclones

Hosted by Michael Bell

Friday, April 5, 2019

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

Previous research has documented a clear diurnal cycle of cloudiness and rainfall in tropical cyclones (TCs): enhanced convection occurs overnight, precipitation peaks near sunrise, and the cirrus canopy expands radially outward throughout the day, reaching its maximum areal coverage in the early evening hours. Despite these consistent signatures, open questions remain as to how the diurnal cycle is linked to inner-core convective processes and whether it is a column-deep phenomenon or mainly tied to outflow-layer dynamics. Investigating these questions is relevant to TC forecasting as the diurnal cycle of clouds and rainfall, and therefore latent heating, has implications for storm structure and intensity, as evidenced by the diurnal cycle in objective measures of TC intensity and the extent of the 50-kt wind radius.

To investigate whether the diurnal cycle in TCs is a column-deep feature and to further explore its relationship with convection, this research will document the diurnal cycle of lightning in Atlantic-basin TCs using data from the World Wide Lightning Location Network (WWLLN). Preliminary results show most lightning flashes in TCs occur at night and during the early morning hours, with minimal activity after local noon. In addition, an outwardly propagating, diurnal lightning signal is sometimes present, matching the timing of the previously documented diurnal pulse found using IR brightness temperatures, suggesting that diurnal pulses are sometimes associated with deep-convective processes. For those TCs where an outward propagating diurnal lightning signal is not present, a diurnal pulse is often still found in the six-hour IR brightness temperatures difference fields. Case studies of TCs will be conducted to examine why some diurnal pulses are electrified while others are not.

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