Latent Heat Retrievals in Hurricanes from

Conically Scanning Airborne Doppler Radar

The release of latent heat in clouds is one of the most fundamental properties of the atmosphere, responsible for driving circulations on a vast array of space and time scales including the Hadley circulation and convective vortices within hurricanes. Inadequate observations are largely responsible for the significant uncertainties in current estimates of latent heating leading to gaps in our knowledge of these circulations.

In order to reduce these uncertainties and improve our understanding of atmospheric circulations, I propose to estimate latent heating in developing and mature hurricanes from two conically scanning airborne Doppler radars. The primary instrument to be used in this work is NASA’s new High-altitude Imaging Wind and Rain Airborne Profiler (HIWRAP) on board the Global Hawk UAS at an altitude of 20 km. The HIWRAP instrument operates at Ku and Ka band with two incidence angles tracing out an inverted cone beneath the aircraft. The second instrument is very similar to HIWRAP, but flies on board the NOAA WP-3D aircraft at low altitudes (~ 2 – 3 km) and is called IWRAP. The IWRAP instrument operates at C and Ku band with four incidence angles. Both instruments complement each other well. For example, while HIWRAP samples at a lower resolution than IWRAP, HIWRAP is much more sensitive and gathers data from the full column of the atmosphere.

There are two key ingredients for computing latent heating: water content parameters (i.e. precipitation) and winds. The dual-frequency nature of these two instruments will allow for improved estimates of water content parameters. To estimate winds, a new algorithm for retrieving the three Cartesian wind components from HIWRAP and IWRAP data will be designed and evaluated.

The dataset for both instruments during the proposal award period will be rich. The IWRAP instrument has been flying for many years and several mature hurricanes have been sampled. While HIWRAP is in the early stages of data collection, participation in the Hurricane and Severe Storm Sentinel (HS3) field program between 2012 – 2015 will enable a large dataset with long sampling times from the Global Hawk.