The Hurricane Imaging Radiometer (HIRAD) is an airborne passive microwave remote sensor, developed to measure wind speed and rain rate in hurricanes. This dissertation concerns the development of a signal processing algorithm to infer tropical rainfall from HIRAD radiance (brightness temperature, Tb) measurements. The basis of this rain rate retrieval algorithm is an improved forward microwave radiative transfer model (RTM) that incorporates the HIRAD multi-antenna-beam geometry and uses semi-empirical coefficients derived from an airborne experiment that occurred in the Gulf of Mexico off Tampa Bay in 2013. During this flight, the HIRAD observed a squall line of thunder storms simultaneously with an airborne meteorological radar (High Altitude Wind and Rain Profiler, HIWRAP) located on the same airplane. Also ground-based NEXRAD radars from the National Weather Service (located at Tampa and Tallahassee) provided high resolution simultaneous rain rate measurements. Using the NEXRAD rainfall as the surface truth input to the HIRAD RTM, empirical rain microwave absorption coefficients were tuned to match the measured brightness temperatures. Also, the collocated HIWRAP radar reflectivity (dBz) measurements were cross correlated with NEXRAD to derive the empirical HIWRAP radar reflectivity to rain rate relationship. Finally, the HIRAD measured Tb's were input to the HIRAD rain retrieval algorithm to derive estimates of rain rate, which were validated using the independent HIWRAP measurements of rain rate.

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The public is welcome to attend.