Wind Speed and Rain Rate Retrievals from HIRAD and Comparison with the Stepped Frequency Microwave Radiometer

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**Summary**

- HIRAD retrievals of wind speed and path average rain rate are presented for Hurricane Karl
  - Three flight legs (6, 8 & 10) on Sept. 16, 2010
- HIRAD absolute brightness temperature (Tb) calibration is derived from simultaneous SFMR measurements (see slide-6 & 7)
- Also comparisons are presented with NOAA P-3 Stepped Frequency Microwave Radiometer (SFMR) and Tail Doppler Radar measurements (see slides-9, 10 & 11)

**HIRAD Instrument**

- Synthetic aperture radiometer
- Freq: 4, 5, 6 & 6.6 GHz
- H-pol @ EIA = 60
- Spatial resolution:
  - 2 km @ nadir
  - 6 km @ edge of swath
- Swath = 3 AC altitude
  - ~ 60 km for GRIP

**HIRAD Flight Tracks for Karl**

- Storm-centric coordinate system adjusts for storm translation in time

**HIRAD Excess Tb Images**

- Excess Tb removes the incidence angle variation

**SFMR flight tracks and 2D Wind & Rain Surface Analyses**

- Near simultaneous SFMR wind speed & rain rates used to calculate the theoretical Tb for HIRAD chans
- Theoretical Tb used to set the absolute brightness scale

**HIRAD Calibrated Tb Time Series Karl, Leg-6**

- Contains an example of the theoretical and calibrated Tb as well as SFMR flight track
- Includes wind speed and rain rate 2D images
  - High radar dBz corresponds to high excess Tb

**P-3 Tail Doppler Radar Reflectivity in storm-centric co-ordinates**

- Storm-centric Longitude (deg)
- Storm-centric Latitude (deg)

**HIRAD and SFMR Wind Speed and Rain Rate Comparisons**

- Karl Leg-6: WS & RR Time Series (HIRAD & SFMR)
  - Infrequent anomalous retrievals (shown as ellipses in slide-11) result from improper Tb calibration

**Conclusions**

- HIRAD absolute Tb calibration continues
- Preliminary wind speed and rain rate retrievals are encouraging compared to SFMR
- Wind speed and rain rate 2D images are high resolution and show dominate hurricane eye-wall structure in a single aircraft pass
- High radar dBz corresponds to high excess Tb

**Original HIRAD Tb**

- Theoretical Tb
- Calibrated Tb

**Absolute Calibration of HIRAD 7 GHz Image @ EIA = 56 using SFMR**

- Contains a graph comparing the original, theoretical, and calibrated Tb

**Storm-centric Coordinates (degrees)**

- HIRAD 7 GHz Tb swath SFMR flight track
- Original HIRAD Tb

**HIRAD Ad Hoc Tb Calibration based upon SFMR Measurements**

- Contains an example of the theoretical and calibrated Tb as well as SFMR flight track