Observations Of C-Band Brightness Temperature And Ocean Surface Wind Speed And Rain Rate In Hurricanes Earl And Karl (2010)

Timothy Miller, Mark James, J. Brent Roberts#, and Sayak Biswas*
NASA Marshall Space Flight Center
**Corresponding Author: Tim.Miller@nasa.gov*
#Presenting Author: Jason.B.Roberts@nasa.gov

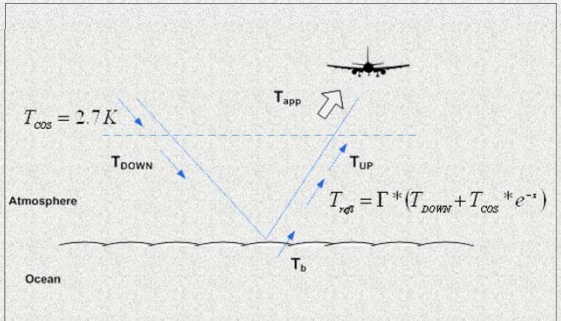
Eric Uhlhorn
Atlantic Oceanographic and Meteorological Laboratory (AOML)

Peter Black
SAIC, Inc at NRL/
Marine Meteorology Division

W. Linwood Jones, Jimmy Johnson, Spencer Farrar, and Saleem Sahawneh
Central Florida Remote Sensing Laboratory
University of Central Florida

Christopher S. Ruf and Mary Mo
Space Physics Research Laborat
AOSS Dept., University of Michig

HIRAD Physical Principles



Ocean surface emission is affected by:

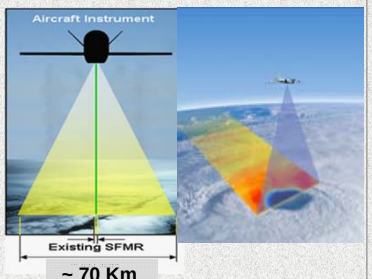
- **Sea surface temperature**
- **Wind speed (foam fraction)**
- **Salinity**

After production of calibrated Tb fields, geophysical fields wind speed and rain rate (or column) are retrieved

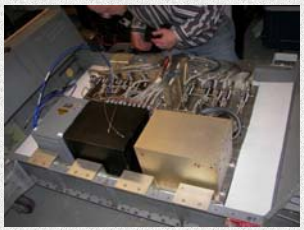
Hurricane Imaging Radiometer (HIRAD)

HIRAD utilizes NASA Instrument Incubator Technology:

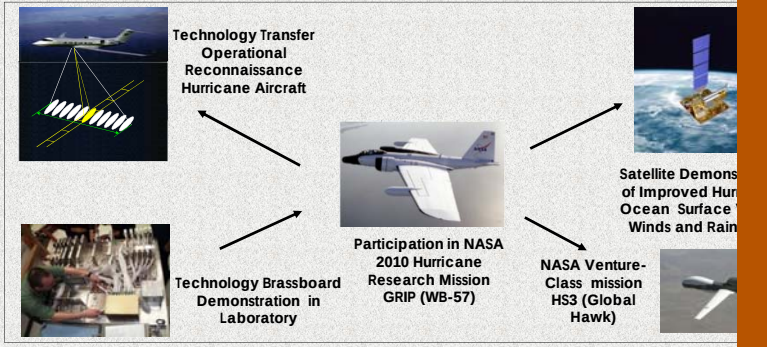
- **Provides unique observations of sea surface wind, temp and rain**
- **Advances understanding & prediction of hurricane intensity**
- **Expands Stepped Frequency Microwave Radiometer capabilities**
- **Uses synthetic thinned array and RFI mitigation technology of Lightweight Rain Radiometer (NASA Instrument Incubator)**



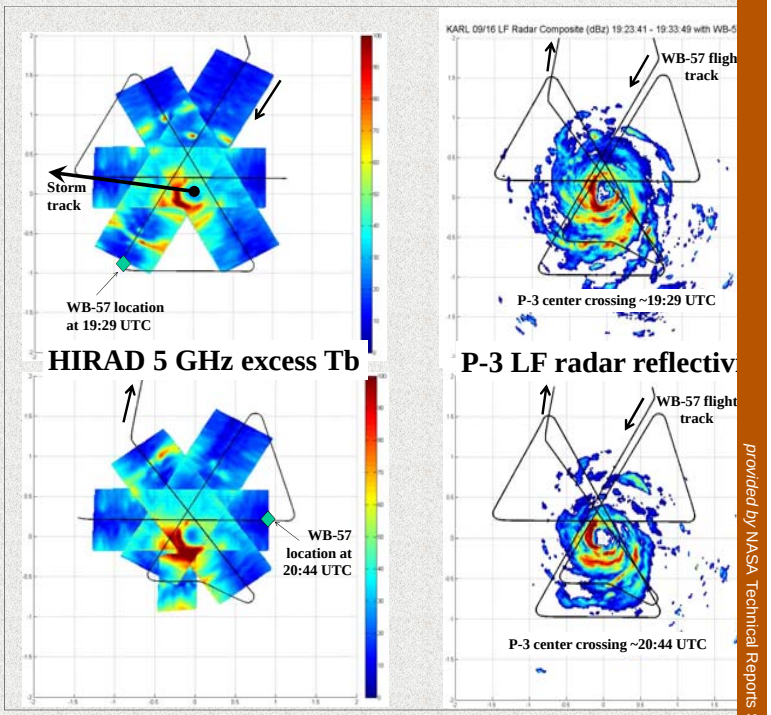
Passive Microwave C-Band Radiometer withFreq: 4, 5, 6 & 6.6 GHz:
•*Version 1:* H-pol for ocean wind speed,
•*Version 2:* dual-pol for ocean wind vectors
Performance Characteristics:
•Earth Incidence angle: 0° - 60° ,
•Spatial Resolution: 2-5 km,
•Swath: ~70 km for 20 km altitude
Observational Goals:
WS 10 - >85 m/s RR 5 - > 100 mm/hr



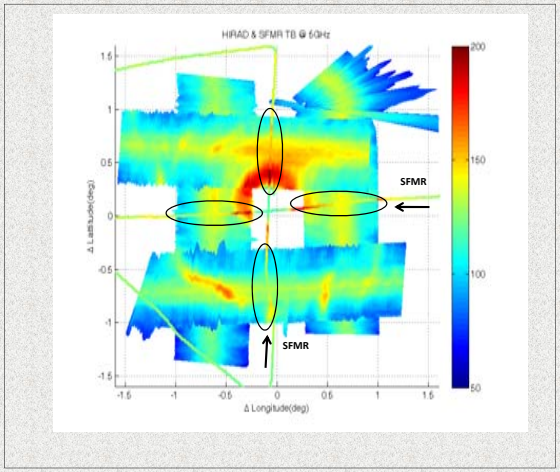
HIRAD Technology Investment Roadmap



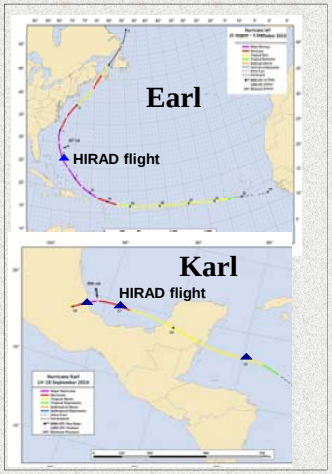
Karl 16 Sept 2010



Earl Flight 1-2 Sept 2010



Earl and Karl Flights



In the figure to the right, HIRAD 5 GHz excess Tb (left) and P-3 lower fuselage radar reflectivity at flight level are shown for two times. The green "diamond" indicates approximate position of the WB-57 at the time of P-3 storm center crossing in the corresponding figure to the right. Key features may be seen in both observations:

1) **Peak eyewall Z centered left of track and open eyewall right of track due to easterly environmental shear.**
2) **Outer eyewall concentric rainband, which together with the eyewall contracts slightly between the two composites.**
3) **Evolving outer rainband structure.**