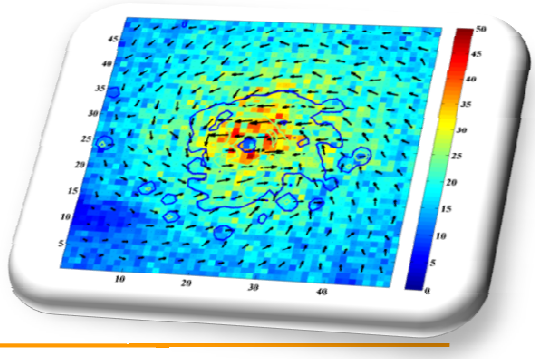


# Improved OVW Retrievals in Extreme High Wind Events using QuikSCAT


W. Linwood Jones & Pete Laupattarakasem

*Central Florida Remote Sensing Lab. (CFRSL)*

*University of Central Florida, Orlando, Florida*

Christopher Hennon

*Dept. of Atmospheric Sciences*

*University of North Carolina – Asheville*

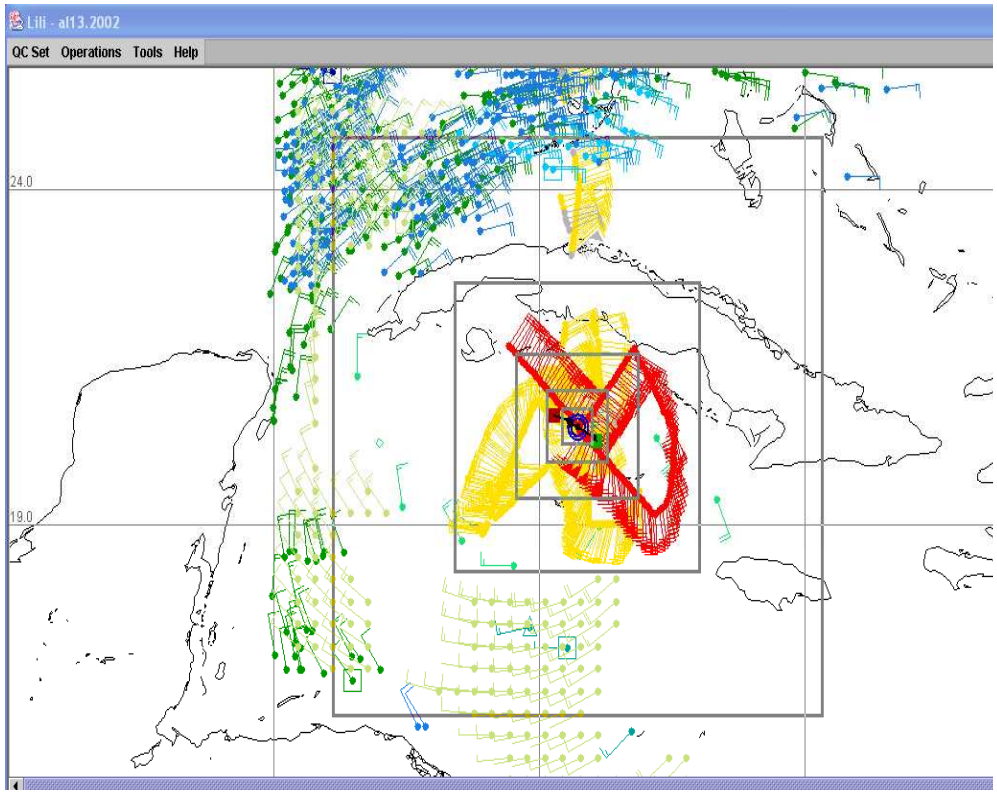


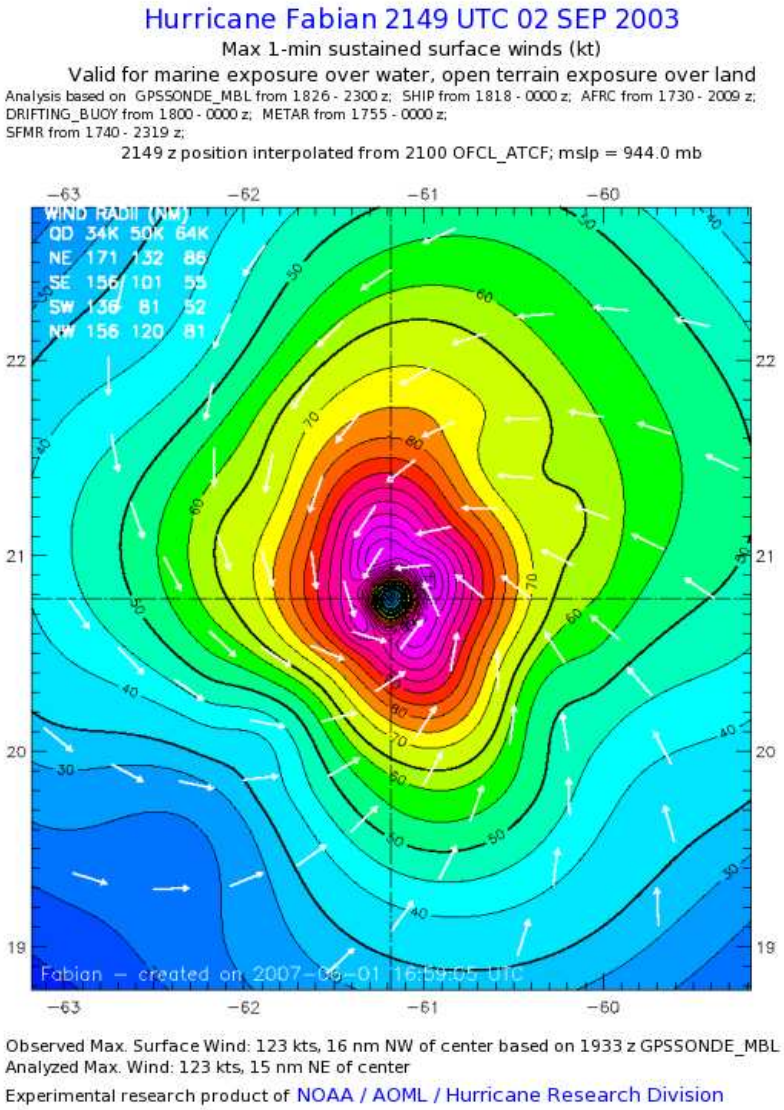
*OVWST Meeting 2008*

# "Q-Winds" Extreme High Wind Events Measurements

- Ocean vector winds retrieval algorithm
  - Tailored for Tropical Cyclone ocean vector wind measurements
  - High resolution 12.5 km wind vector cells
- Q-Winds OVW retrievals independent validation using
  - NOAA-HRD H*Wind analysis
  - Compared with JPL L2B-12.5 km

# NOAA HRD H*Wind Surface Analysis



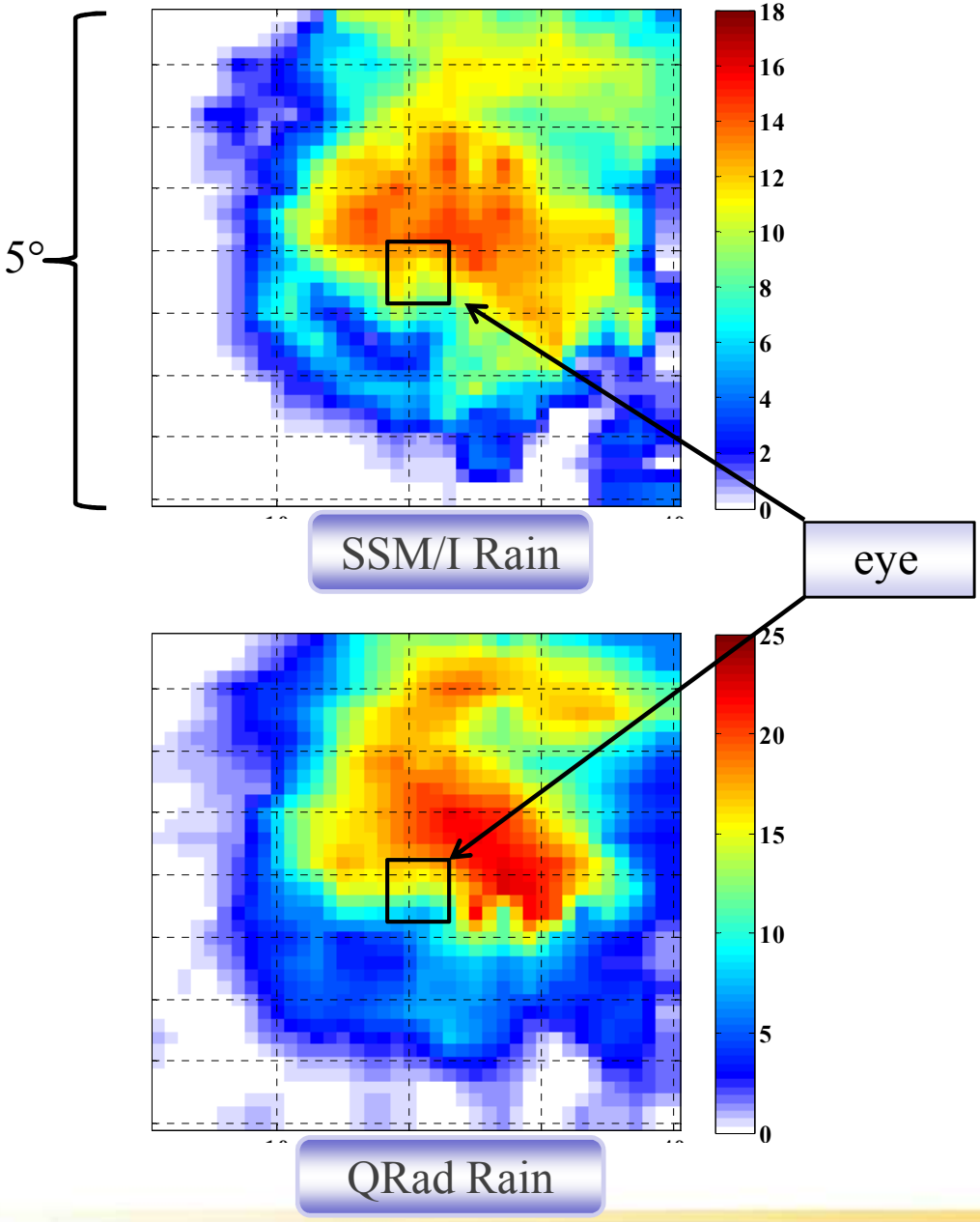

- High resolution (6 km) hurricane surface wind field, (1-min average)

# Q-Winds Attributes

Unique SeaWinds active/passive retrieval algorithm

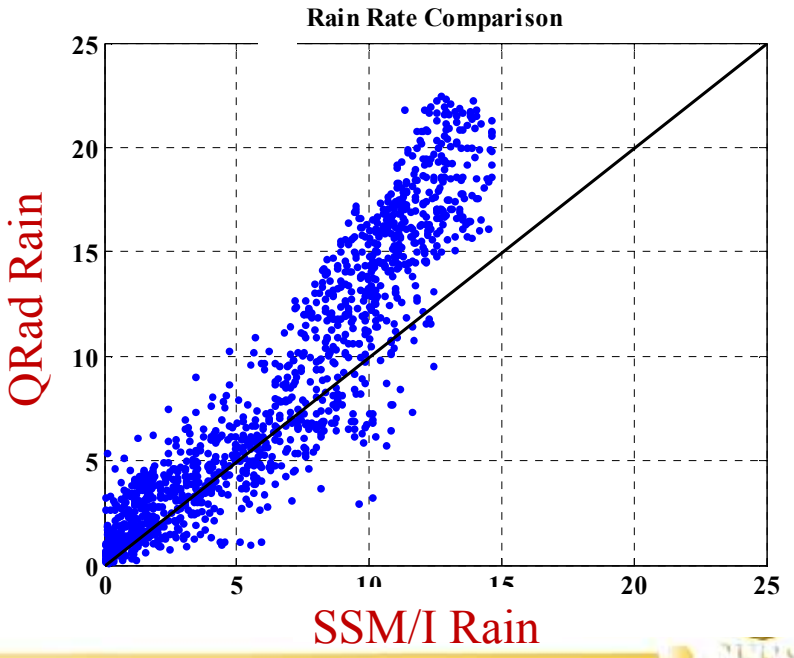
- **QuikSCAT Radiometer (QRad) to identify rain contamination**

# QRad & SSMI Rain Comparison in Hurricane Ivan

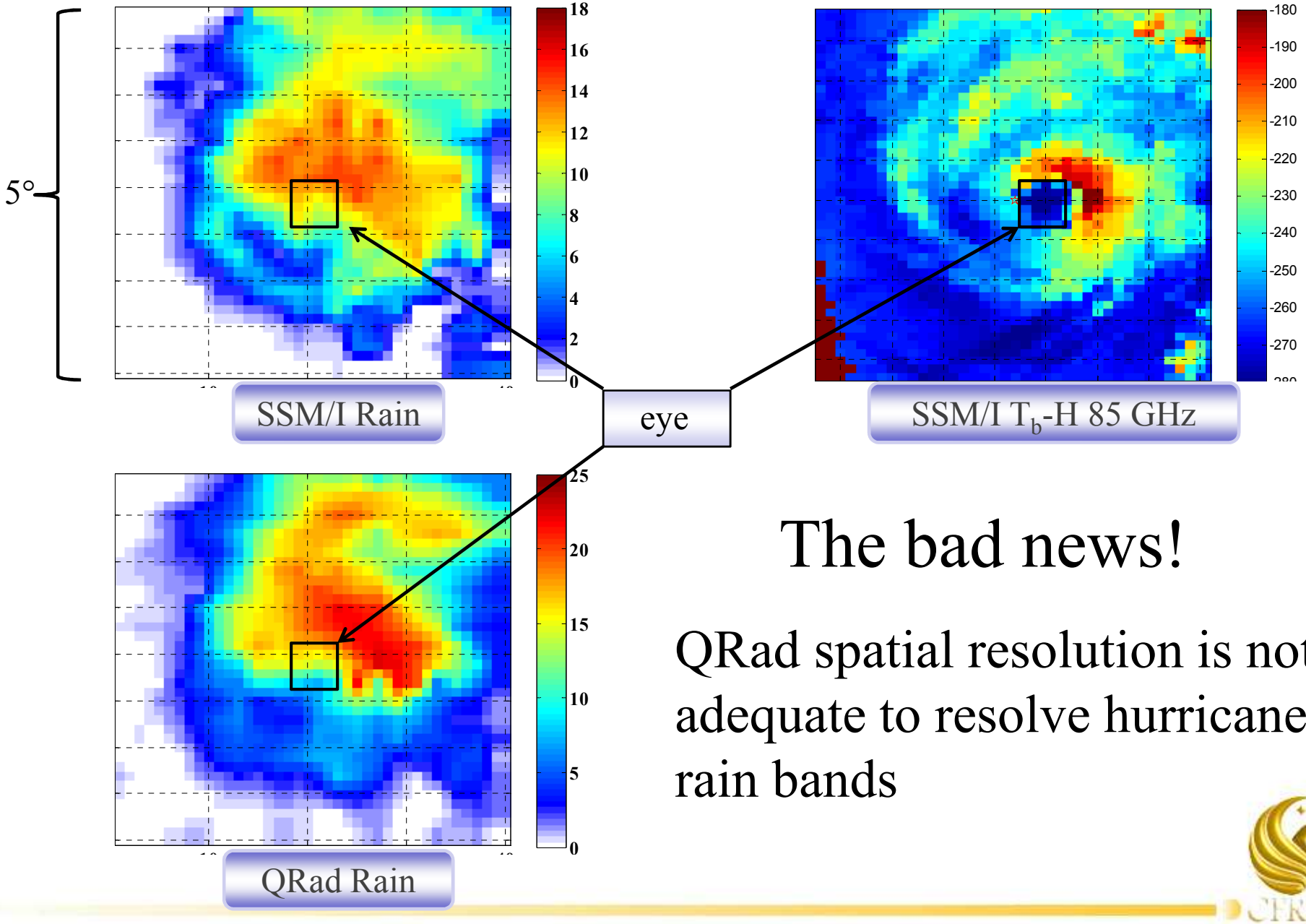



## The good news!

QRad measures rain as well as SSMI retrievals



# QRad & SSMI Rain Comparison in Hurricane Ivan




## The bad news!

QRad spatial resolution is not adequate to resolve hurricane rain bands

# Q-Winds Attributes

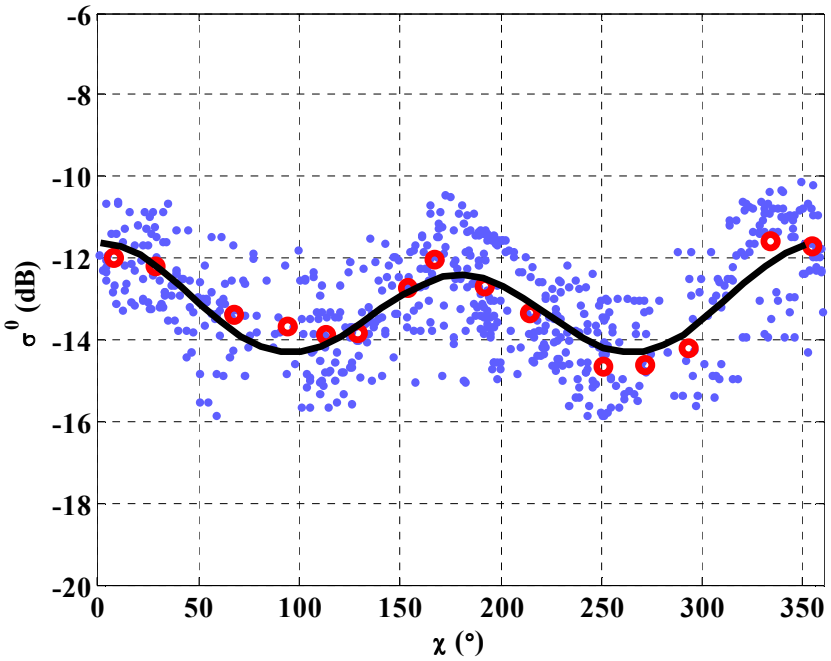
Unique OVW active/passive retrieval algorithm

- QuikSCAT Radiometer (QRad) passive $T_b$'s used to correct rain effects
  - Two-way rain attenuation/transmissivity
- Uses special geophysical model function (XW-GMF) "tuned" for hurricanes

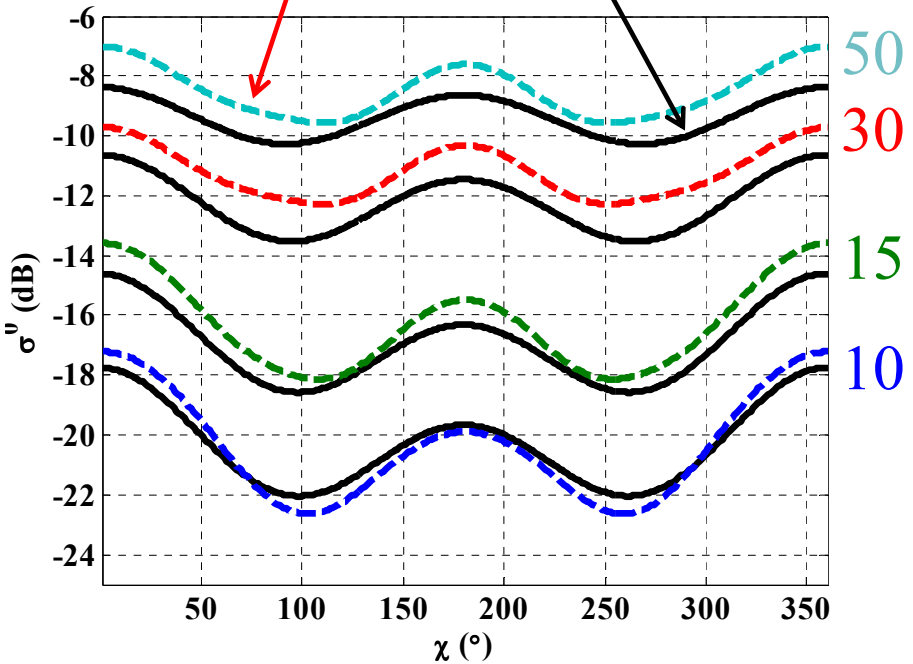
# Extreme Winds GMF (XW-GMF)

Rain-free or light-rain attenuation corrected sigma-0 collocated with H*Wind surface wind vector

Binned Wind Speed @ 30 m/s




QS-GMF & XW-GMF H-pol



# Q-Winds Attributes

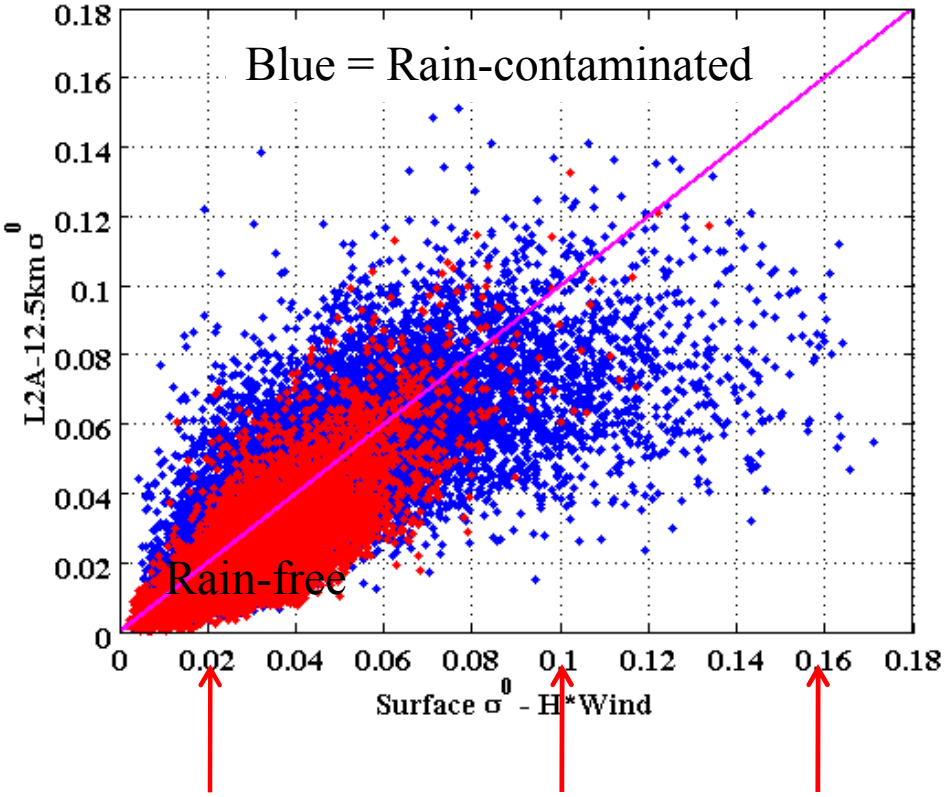
Unique OVW active/passive retrieval algorithm

- QuikSCAT Radiometer (QRad) passive $T_b$'s used to correct rain effects
  - ❖ Two-way rain attenuation/transmissivity
- Uses special geophysical model function (XW-GMF) "tuned" for hurricanes

- QuikSCAT Radiometer (QRad) passive $T_b$'s used to correct rain effects
  - ❖ Estimate two-way rain transmissivity for light rains < 6 mm/hr averaged over 12.5 km wind vector cells

# Meas Sigma-0 & H*Wind estimated Sig-0 Comparisons

Rain-free & Rain-contaminated Sig-0



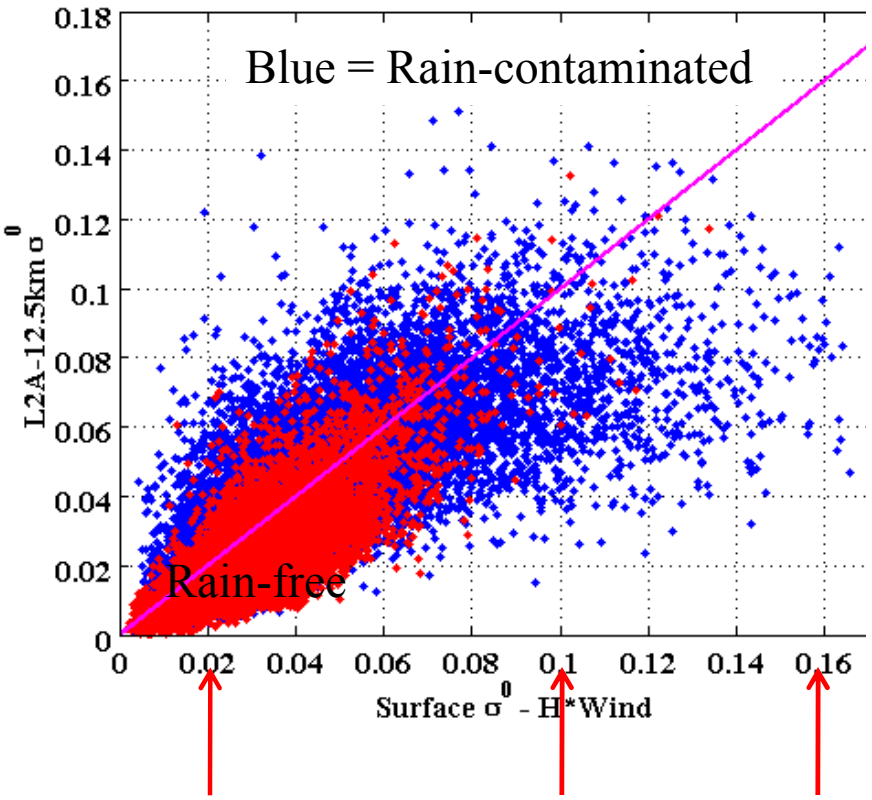

22 m/s 45 m/s 66 m/s

$$\sigma^{o}_{meas} = L2A\_12.5km\ sigma-0$$

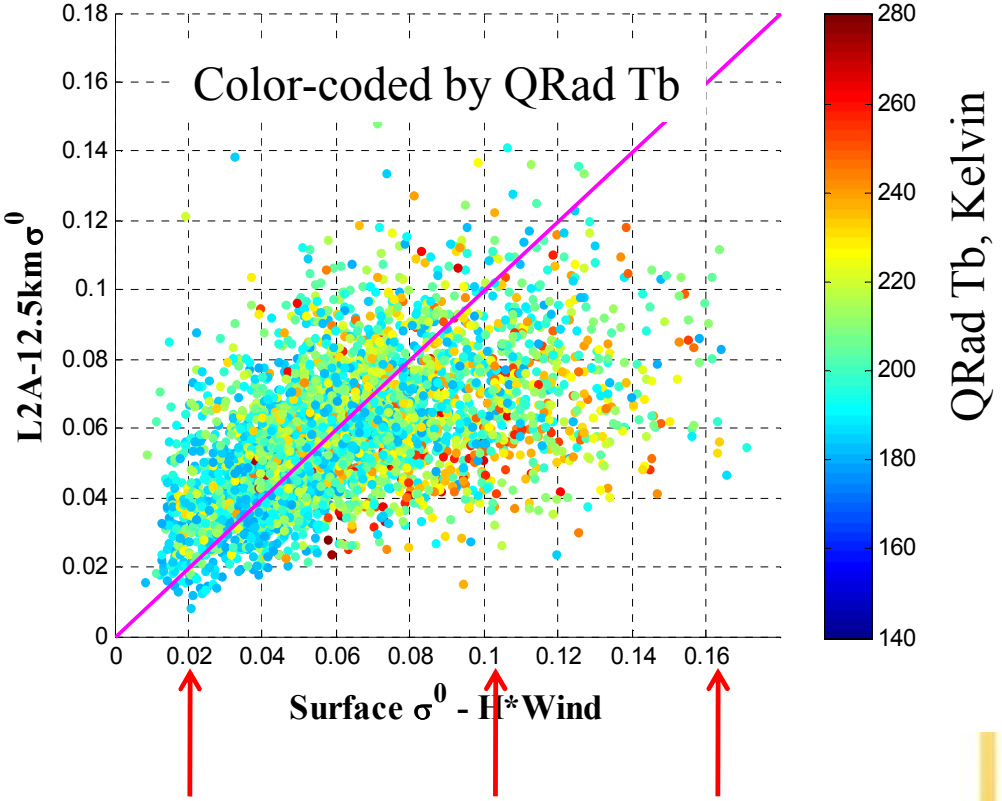
$$\sigma^{o}_{surface} = XWGMF(H*Wind)$$

# Meas Sigma-0 & H*Wind estimated Sig-0 Comparisons

Rain-free & Rain-contaminated Sig-0




Rain-contaminated Sig-0

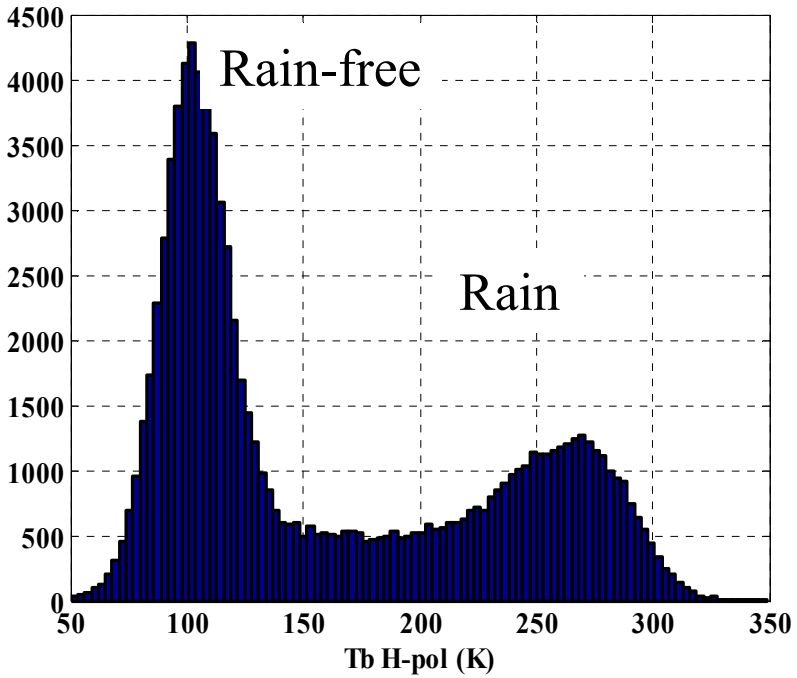



22 m/s 45 m/s 66 m/s

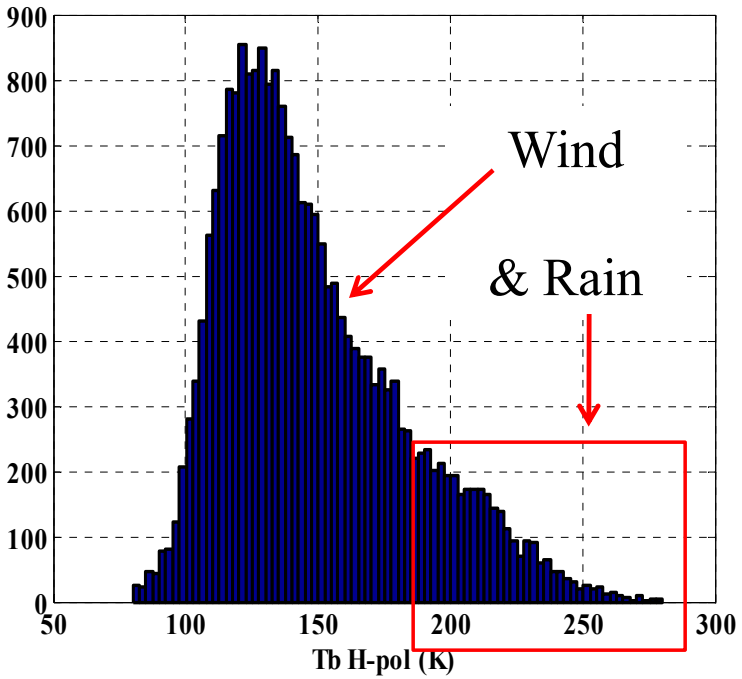
# QRad $T_b$ H-pol Histograms

- Using QRad Tb's:
  - for Winds < 20 m/s: it is possible to separate rain & rain-free conditions
  - For extreme high winds: it is NOT possible

Non-hurricane



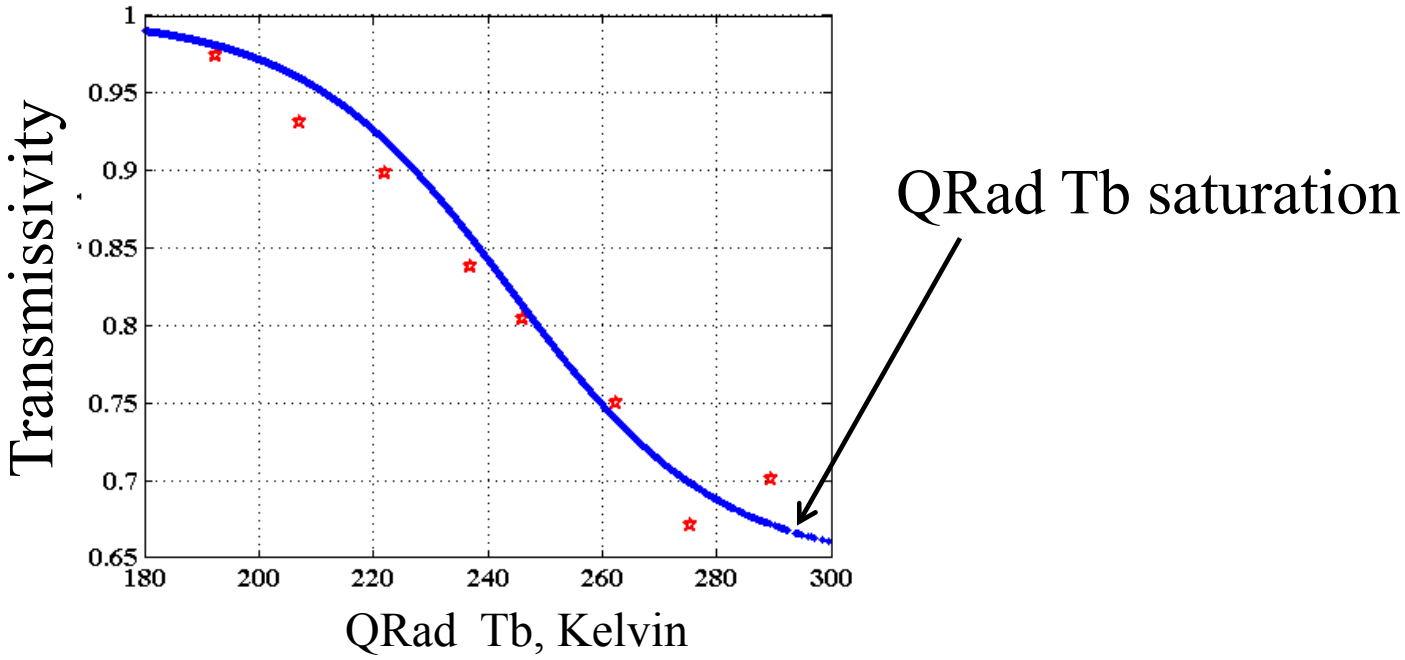

Hurricane



# Rain Transmissivity Correction

- Rain transmissivity ($\tau$)

$$\tau = \frac{<\sigma^{o}_{meas}>}{<\sigma^{o}_{surface}>} = \frac{Sigma\_0_{L2A-12.5km}}{XWGMF(H*Wind)}$$

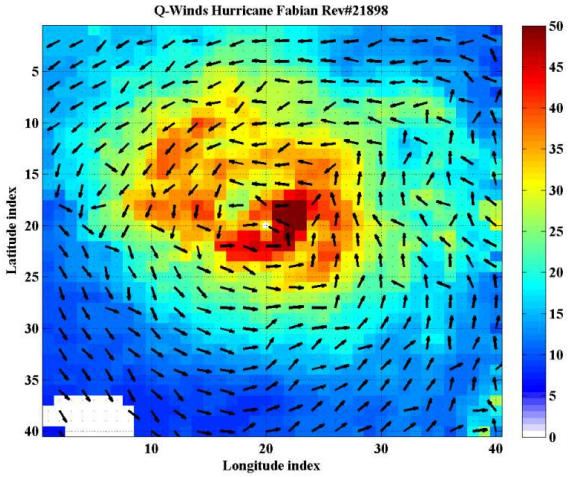


# Q-Winds Attributes

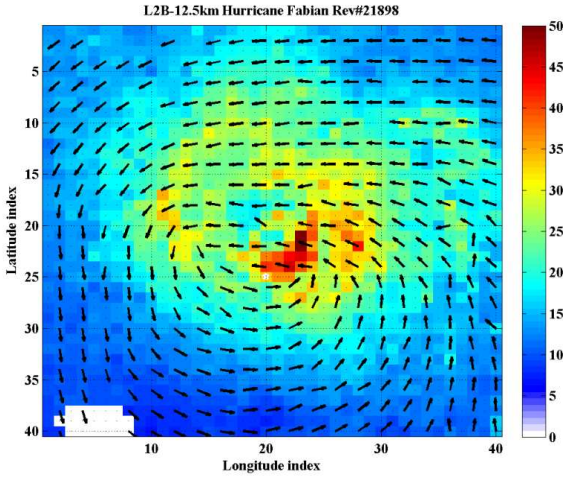
Unique OVW active/passive retrieval algorithm

- QuikSCAT Radiometer (QRad) passive $T_b$'s used to correct rain effects
  - ❖ Two-way rain attenuation/transmissivity
- Uses special geophysical model function (XW-GMF) "tuned" for hurricanes
- QuikSCAT Radiometer (QRad) passive $T_b$'s used to correct rain effects
  - ❖ Estimate two-way rain transmissivity
- ➢ Uses standard MLE OVW retrieval

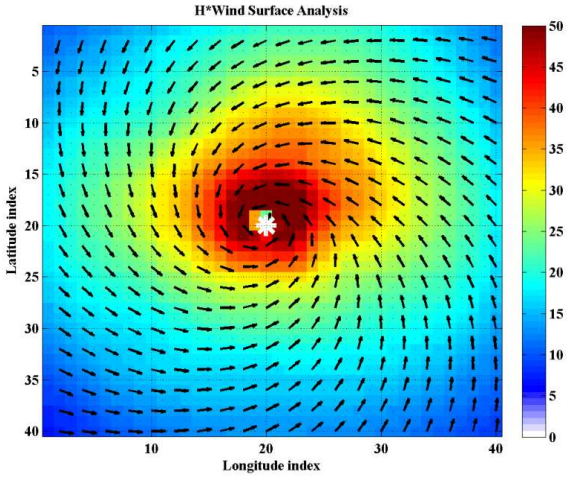
# Hurricane Fabian (09/02/2003)




Q-Winds

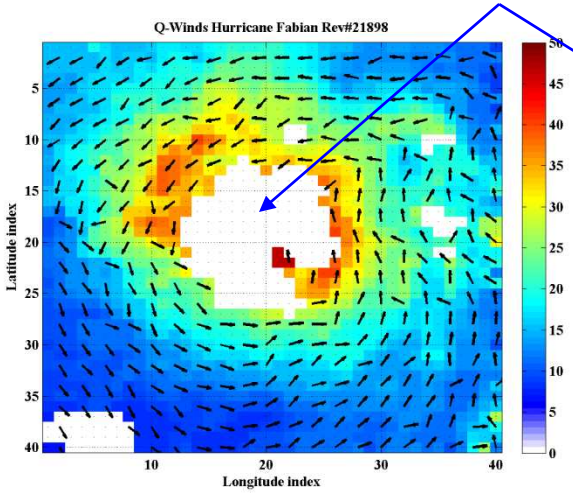



L2B-12.5km

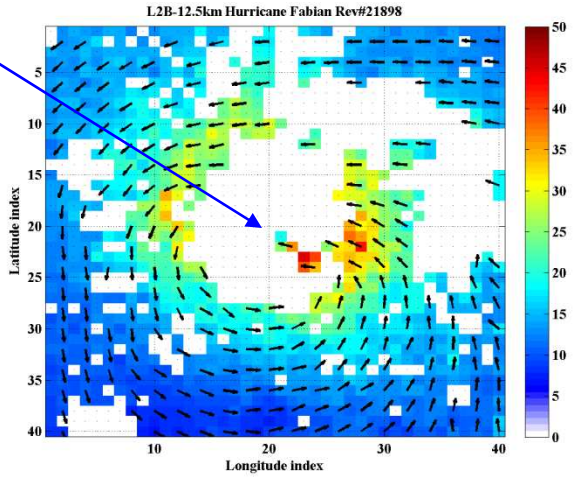



H*Wind

Rain flag

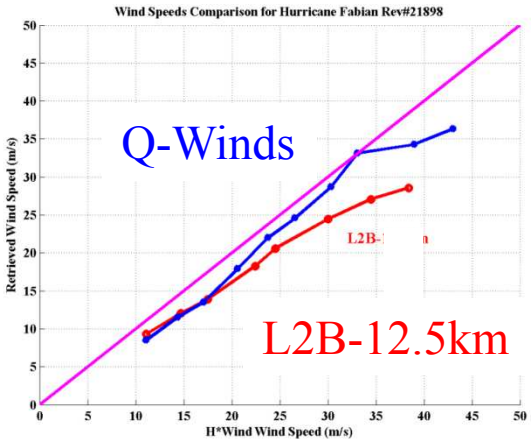



Q-Winds

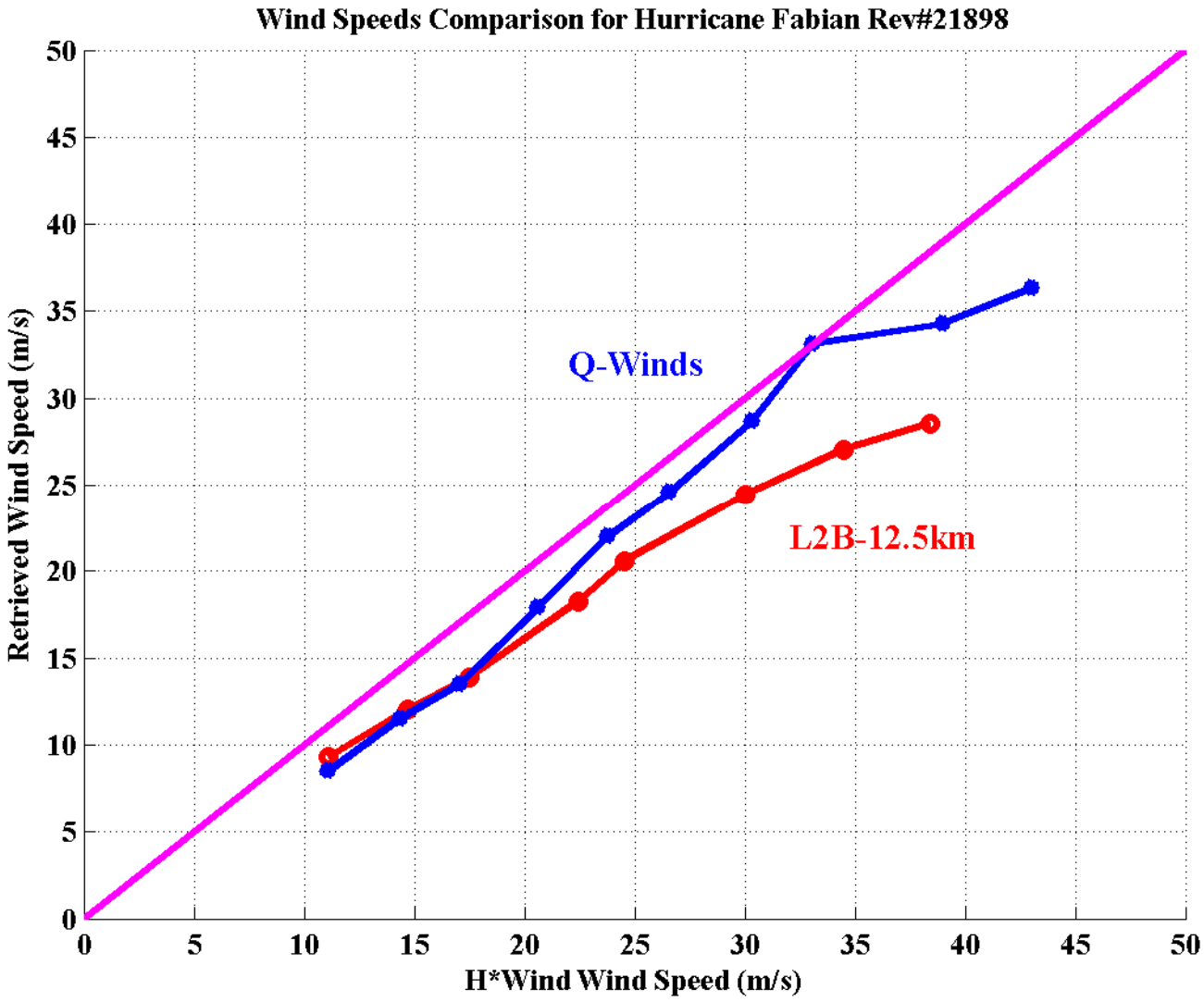



L2B-12.5km

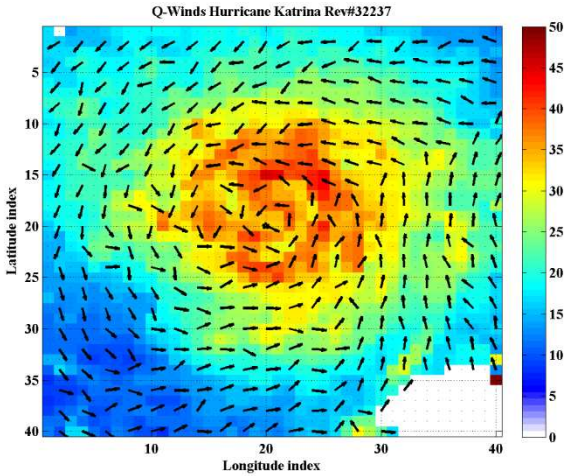
Retrieved Wind Speeds



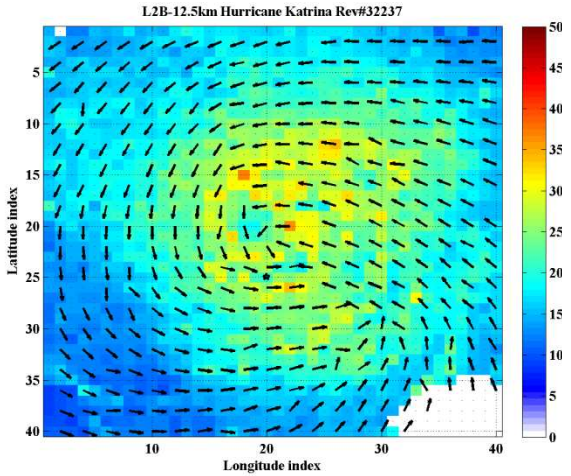

H*Wind


Wind Speeds Comparison for Hurricane Fabian Rev#21898
Retrieved Wind Speed (m/s)
H*Wind Wind Speed (m/s)
Q-Winds
L2B-12.5km
0
5
10
15
20
25
30
35
40
45
50

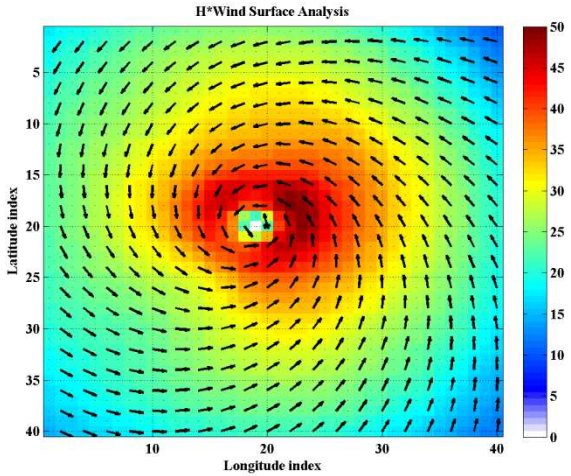
# Hurricane Katrina (08/25/2005)




Q-Winds

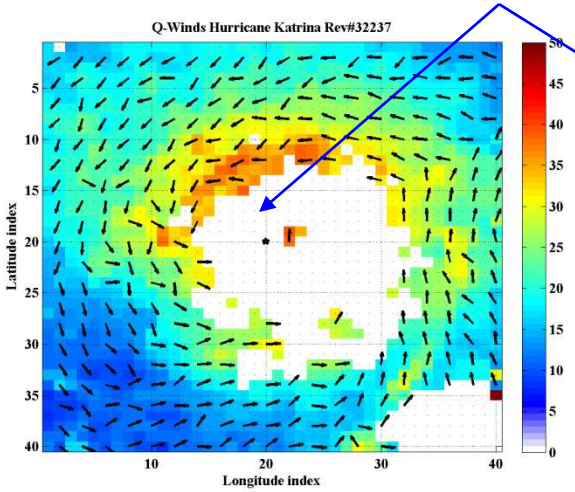



L2B-12.5km

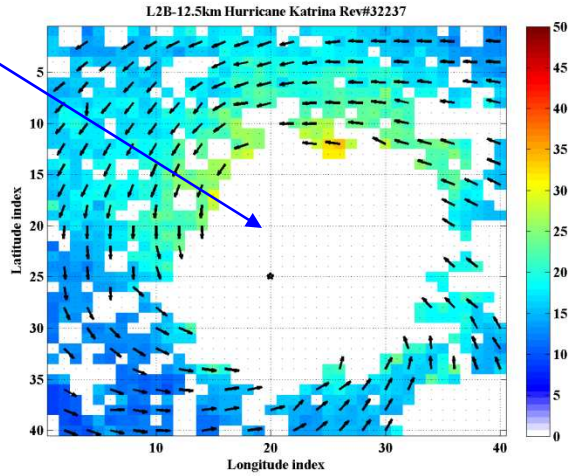



H*Wind

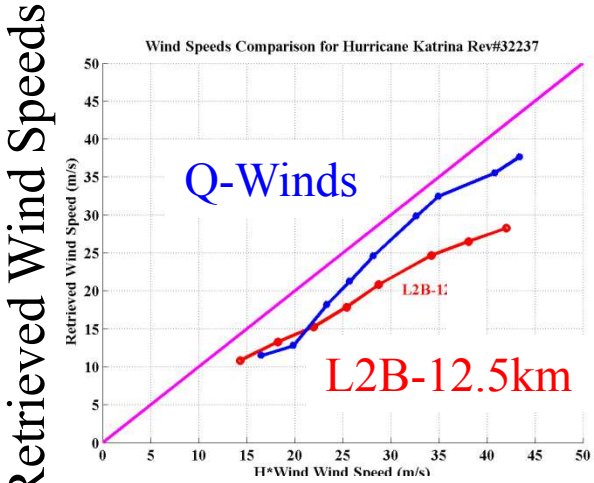
Rain flag



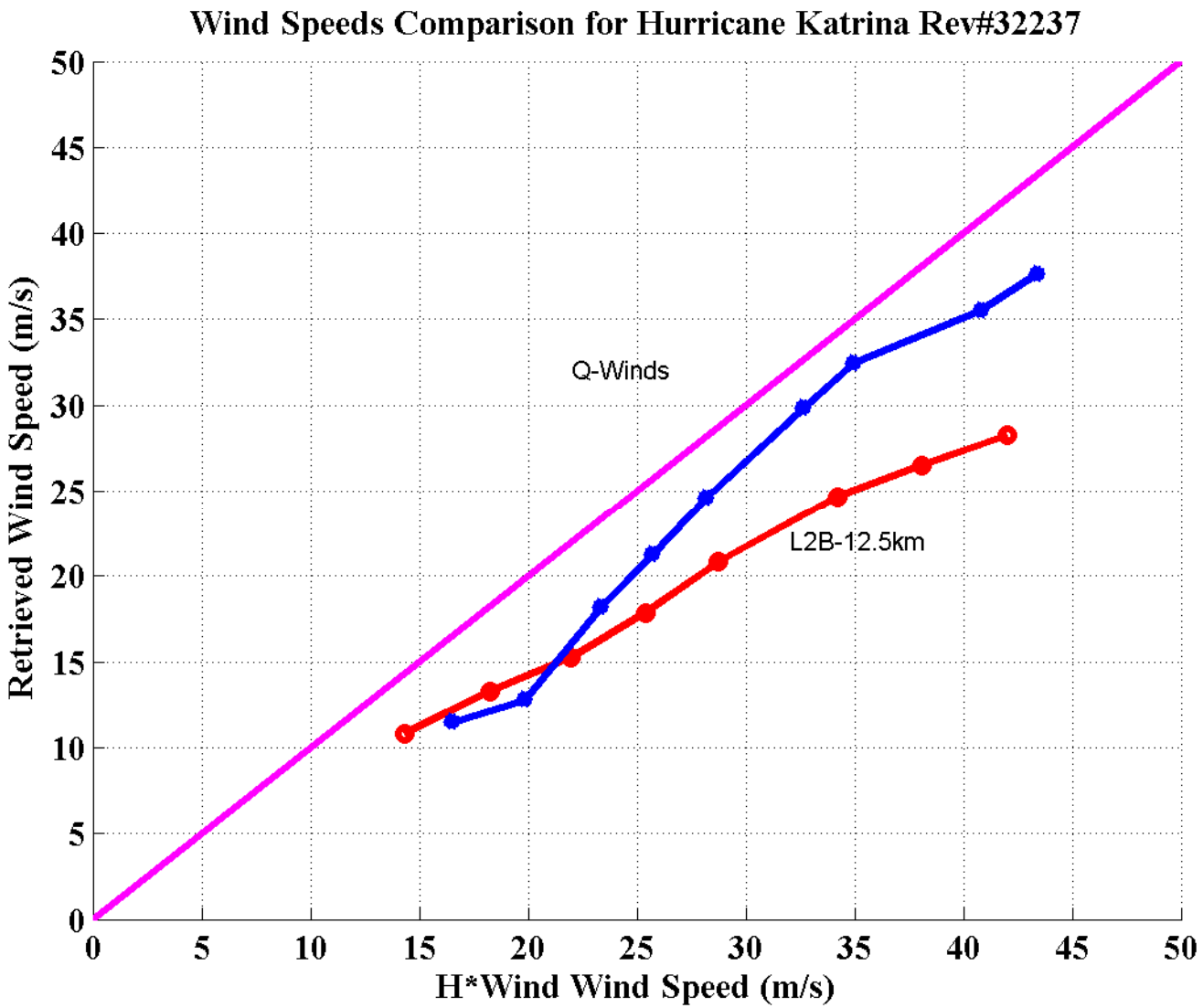

Q-Winds



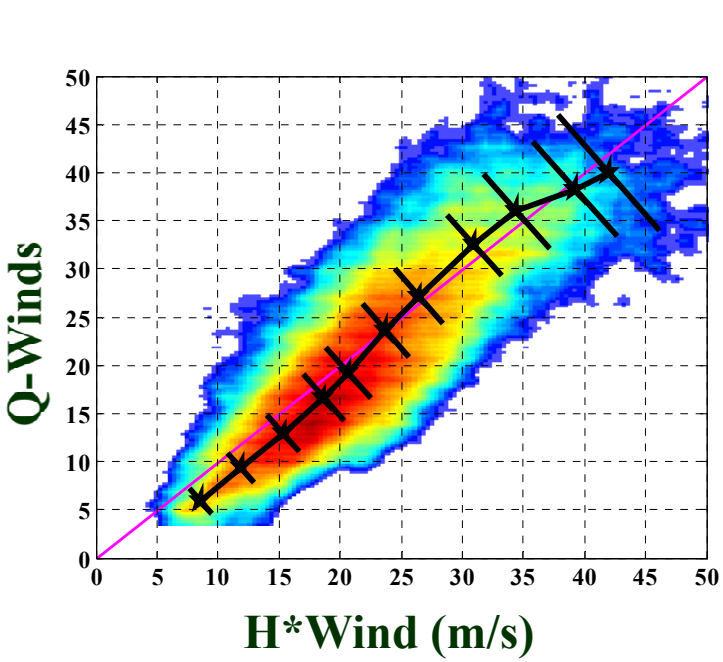

L2B-12.5km

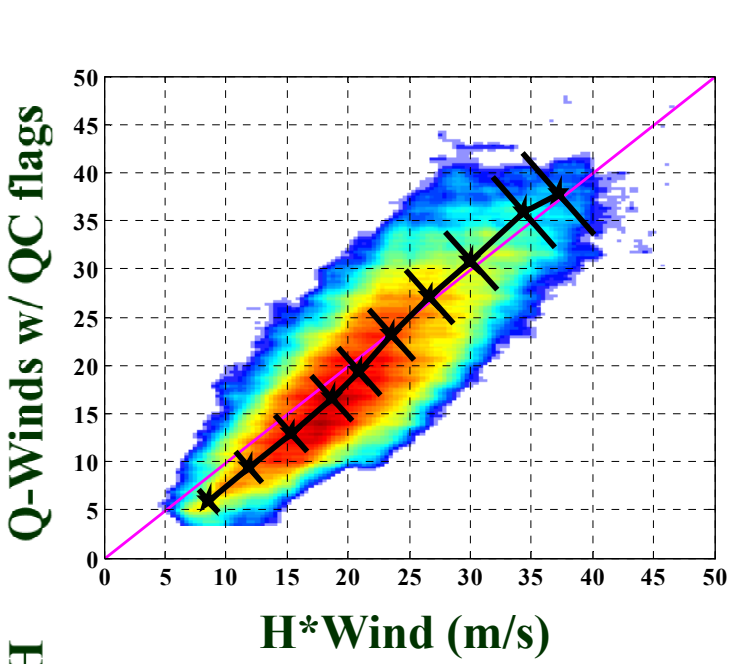


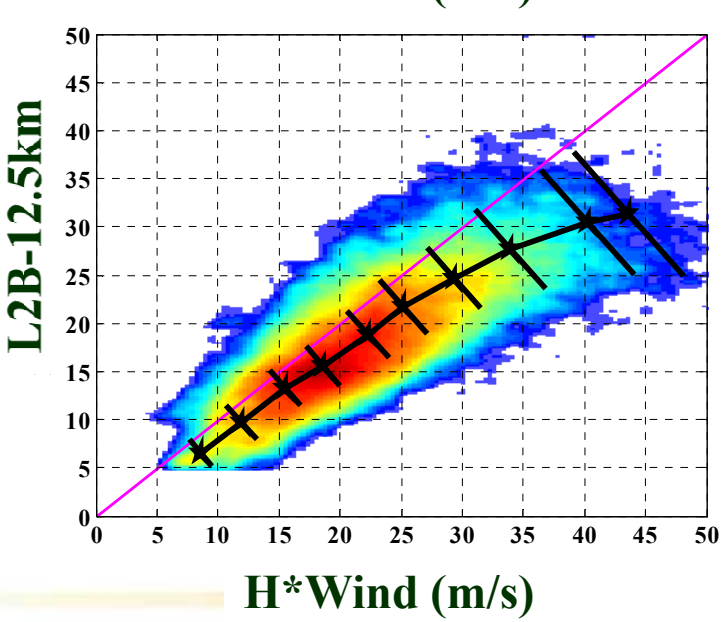

H*Wind

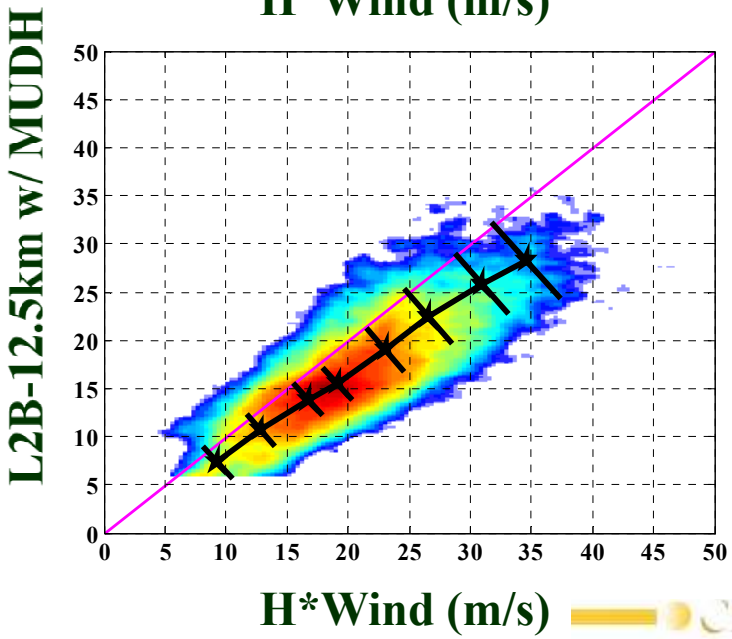

Wind Speeds Comparison for Hurricane Katrina Rev#32237
Retrieved Wind Speed (m/s)
H*Wind Wind Speed (m/s)
Q-Winds
L2B-12.5km
0
5
10
15
20
25
30
35
40
45
50

# Wind Speeds Comparison for 18 Revs



# Summary

- Collocated QRad $T_b$ provides improved rain effects correction/flagging
  - Corrects transmissivity for light rain < 6 mm/hr
  - Excessive rain rate QC flagging
- Q-Winds wind speeds comparison to H*Wind:
  - Exhibits no apparent saturation for wind speeds < 40 - 45 m/s
- QuikSCAT L2B-12.5km compared to H*Wind
  - Shows severe wind speed saturation
    - Maximum wind speeds approach ~ 30 - 35 m/s in mean