Improved OVW Retrievals in Extreme High Wind Events using QuikSCAT

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“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
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

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- 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

\[ \sigma_{meas}^o = L2A_{12.5km} \, \sigma - 0 \]

\[ \sigma_{surface}^o = XWGMF(H*Wind) \]
Meas Sigma-0 & H*Wind estimated Sig-0 Comparisons

Rain-free & Rain-contaminated Sig-0

Blue = Rain-contaminated

Rain-contaminated Sig-0

Color-coded by QRad Tb

Surface $\sigma^0$ - H*Wind

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 ($\tau$)

$$
\tau = \frac{\sigma^o_{\text{meas}}}{\sigma^o_{\text{surface}}} = \frac{\text{Sigma}_0 - 0_{L2A-12.5\text{km}}}{XWGMF(H \ast \text{Wind})}
$$

Graph showing transmissivity vs. QRad Tb, Kelvin.
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 Katrina (08/25/2005)

Q-Winds

Rain flag

L2B-12.5km

H*Wind

Retrieved Wind Speeds

Q-Winds

L2B-12.5km

H*Wind
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