The Development of a C-Band Advanced Scatterometer (ASCAT) Geophysical Model Function at NOAA/NESDIS

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Outline

- <u>Goal</u>: To improve ASCAT wind speed retrieval at high wind speed

- Derivation of new *DC* term (B_0) in CMOD5.5
- Validation Results
- Extratropical Cyclone Examples
- Conclusion

DC Term Derivation

- Collocate ASCAT sigma-0 with high wind speed data source: QuikSCAT
  - 4 month training dataset (April-July 2008)
  - 25km / ±1.5 hour Spatial/Temporal window
  - Rain-free dataset
- Combine left/right swaths sigma-0 and normalized to the average incidence angles within 21 wind vector cells
  - Fore/Aft beams: 37°-63°
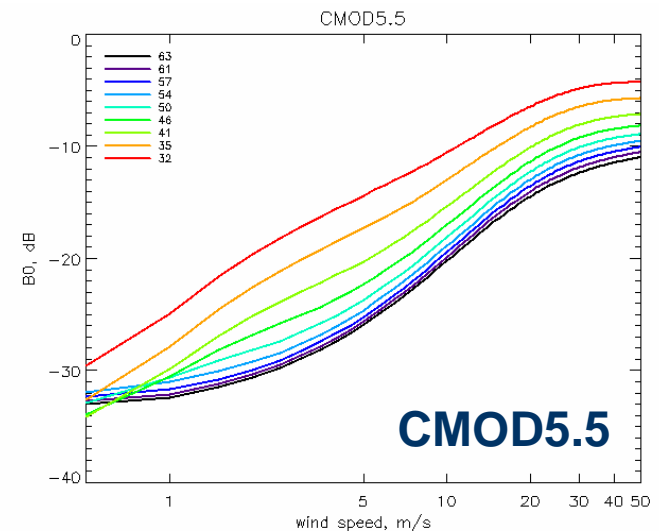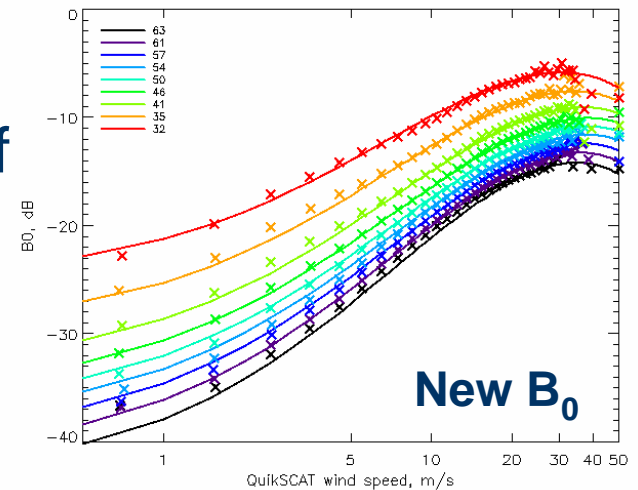 - Mid beams: 27°-36°

DC Term Derivation – Cont.

- Use the NSCAT1 GMF technique of Wentz and Smith (1999)
- Model the normalized sigma-0 – QuikSCAT wind speed relationship using a simplified equation

$$B_0 = c_0 + c_1 \log(W + c_2) + 0.434294 \cdot W \cdot c_3$$
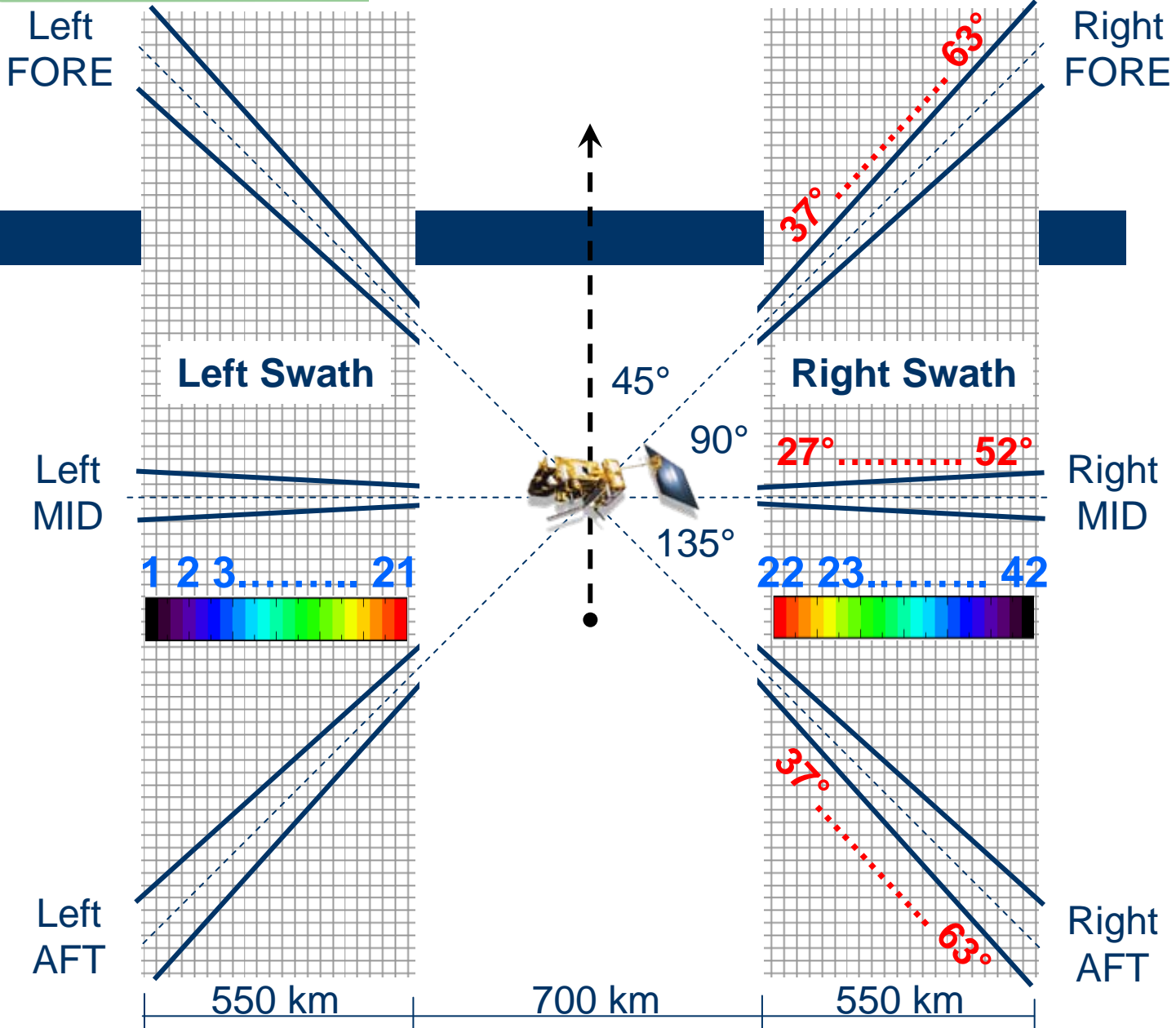
where

$W = $ QuikSCAT wind speed

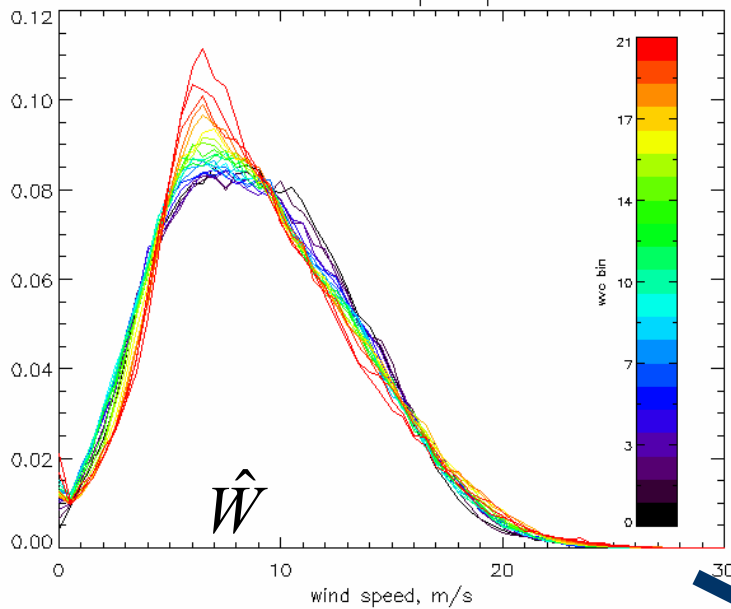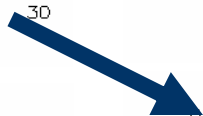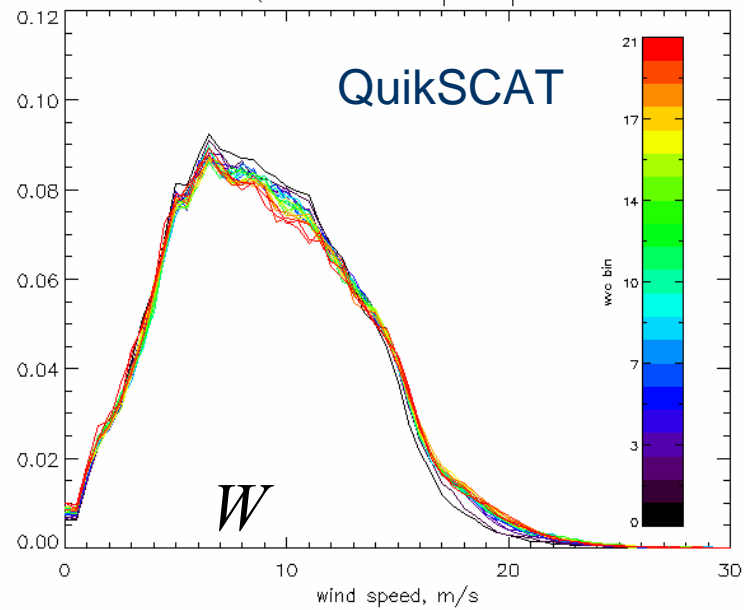c_0, c_1, c_2, c_3 are incidence angle dependent coefficients

New B₀

CMOD5.5

ASCAT Measurement Swaths

ASCAT wind speed pdf

$\hat{W}$

QuikSCAT wind speed pdf

QuikSCAT

W

$\varepsilon(\hat{W}) = W - \hat{W}$

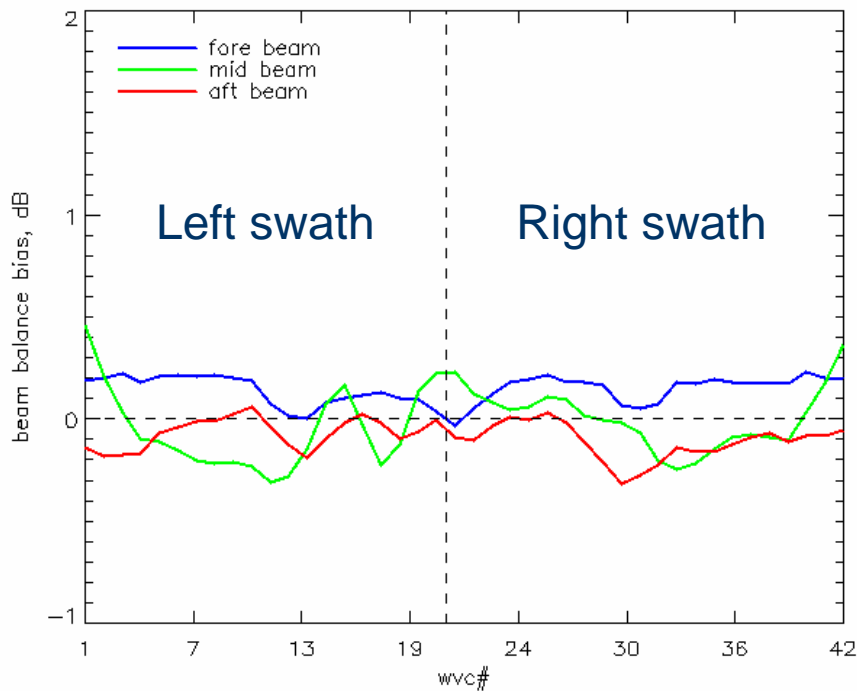$\hat{W} = F(W)$

ASCAT wind speed pdf
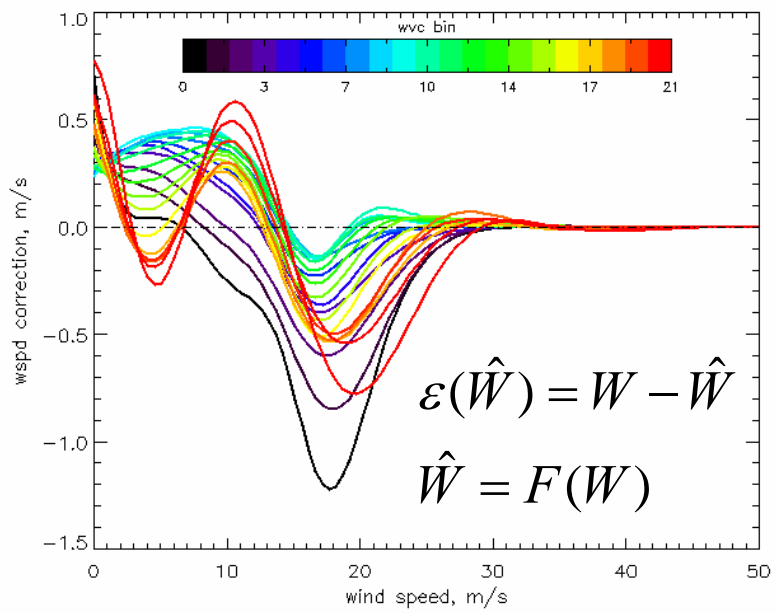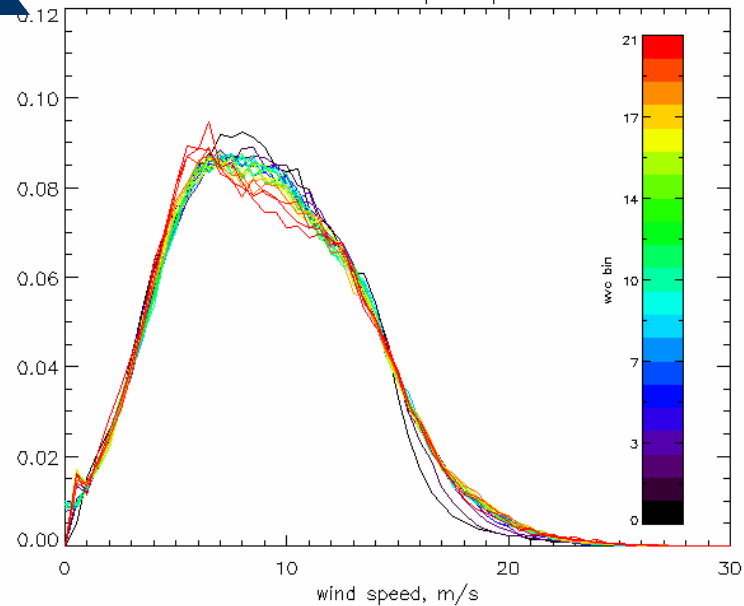
Beam Balance Bias

$$b_i(\theta) = \left\langle \overline{\sigma}(\theta) - \sigma_i(\theta) \right\rangle - \left\langle \overline{F}(\vec{w}, \theta) - F_i(\vec{w}, \theta) \right\rangle$$

where

σ_i is an ocean backscatter measurment

for beam i ($i = 1, 2, ... 6$) at incidence angle θ

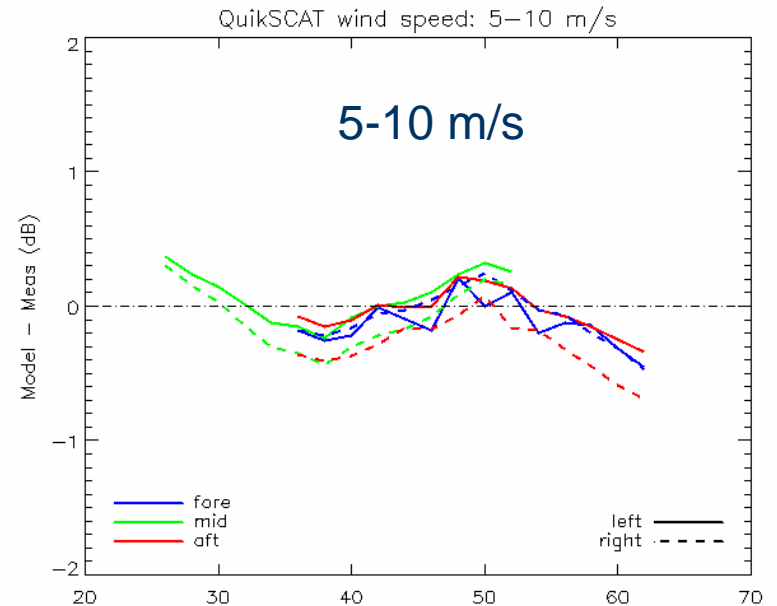$\overline{\sigma}$ is an average of all 6 beams at θ

F_i is a model backscatter for beam i at

QuikSCAT wind vector $\vec{w}$, and
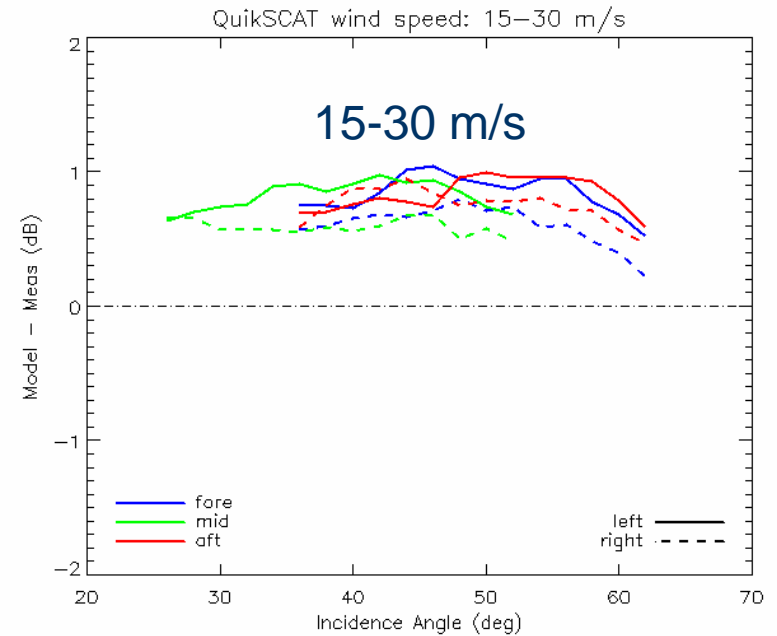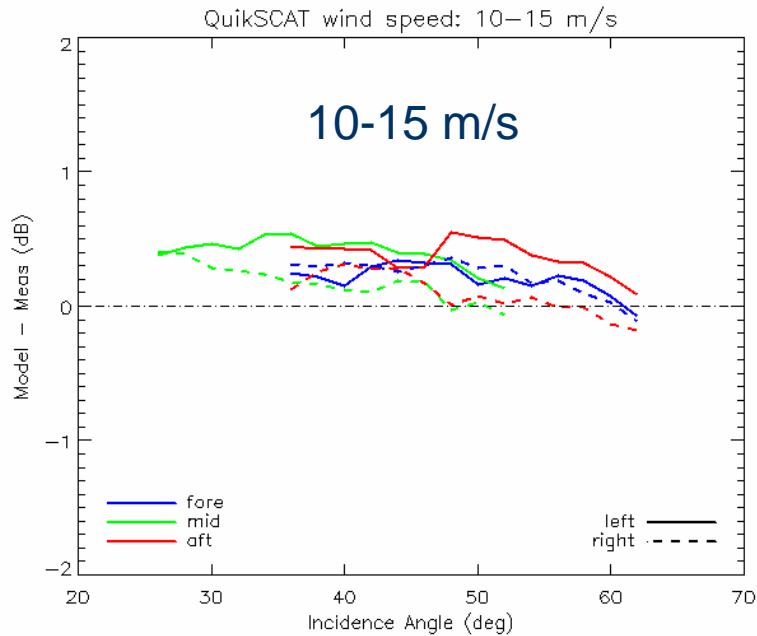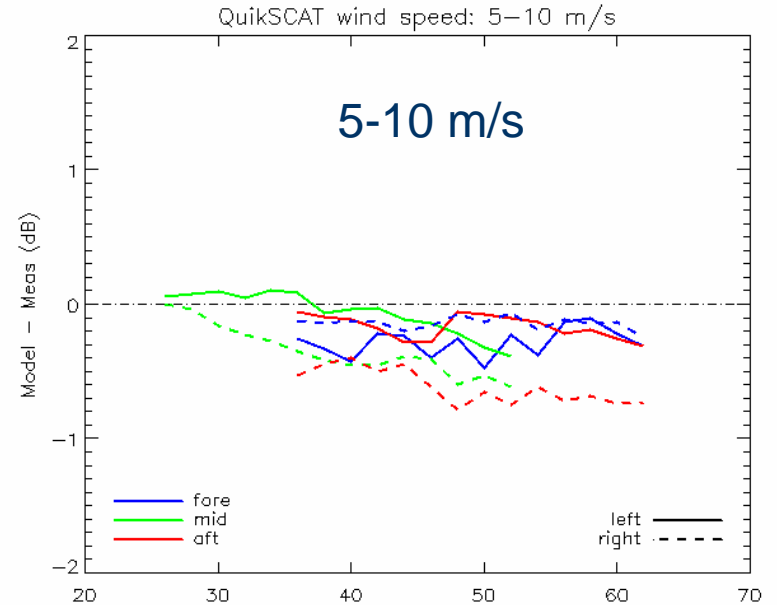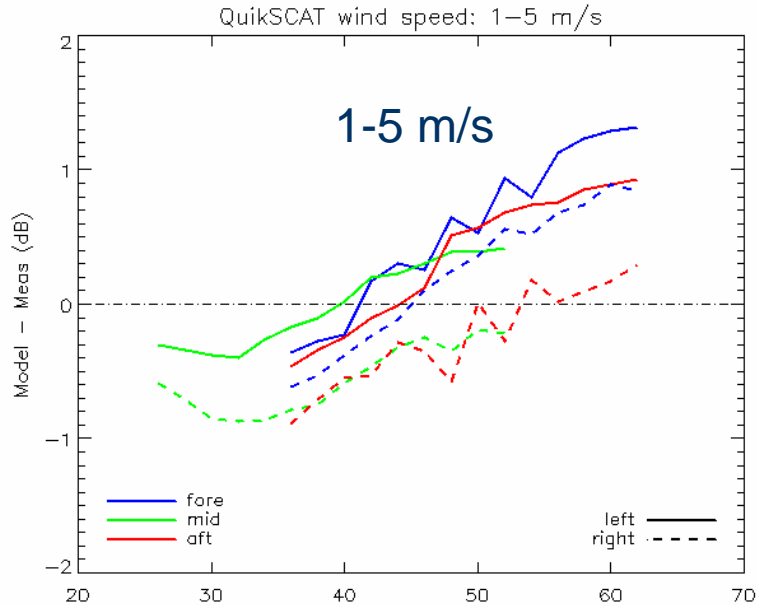
$\overline{F}$ is the average model backscatters of 6 beams

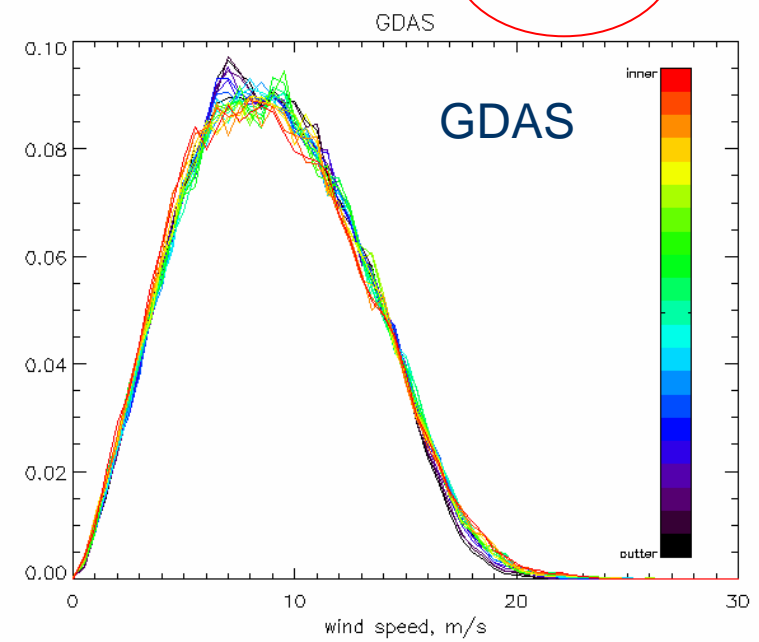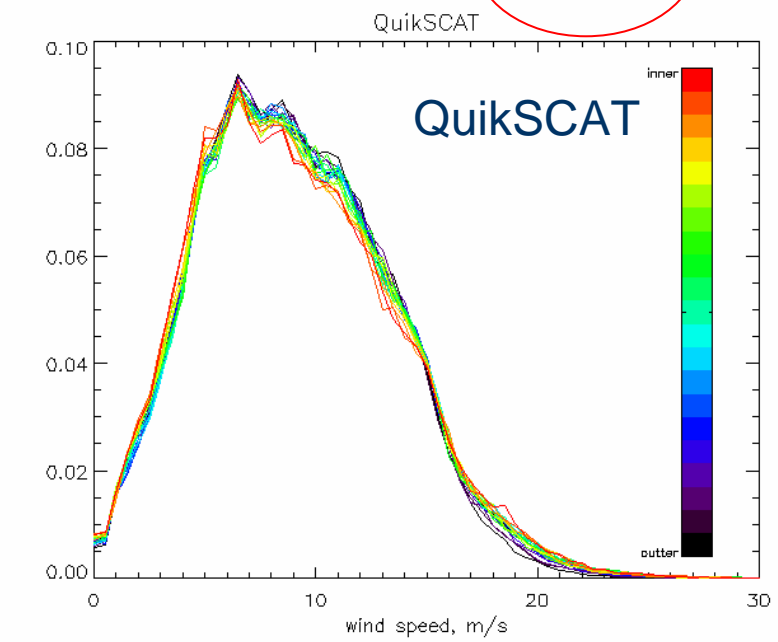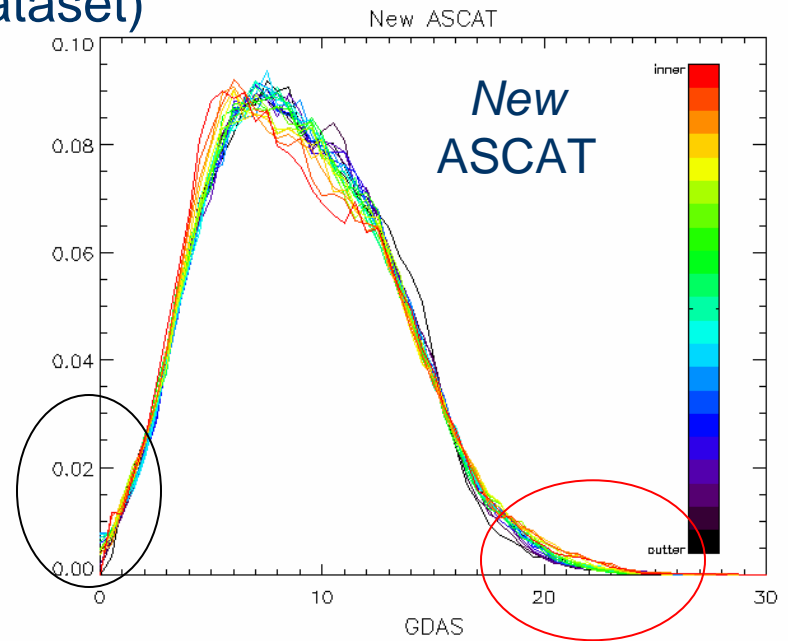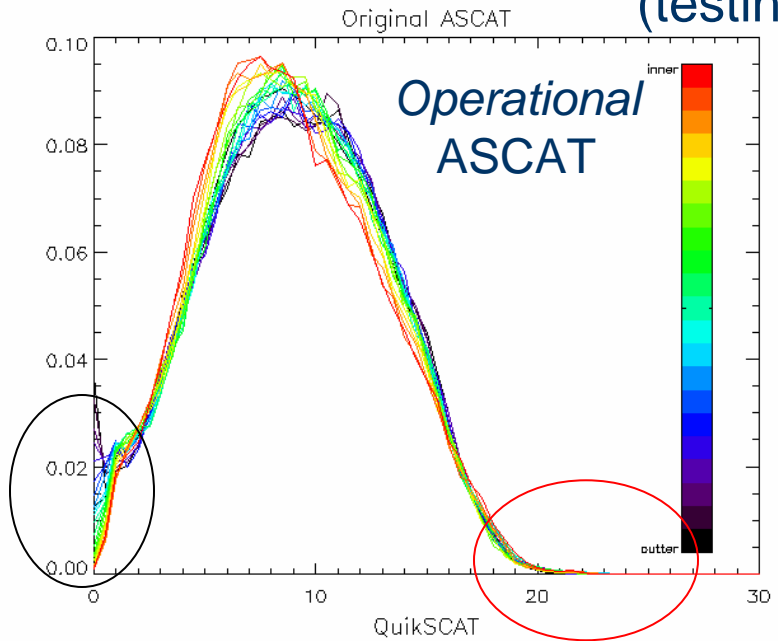# Sigma-0 Residual Errors
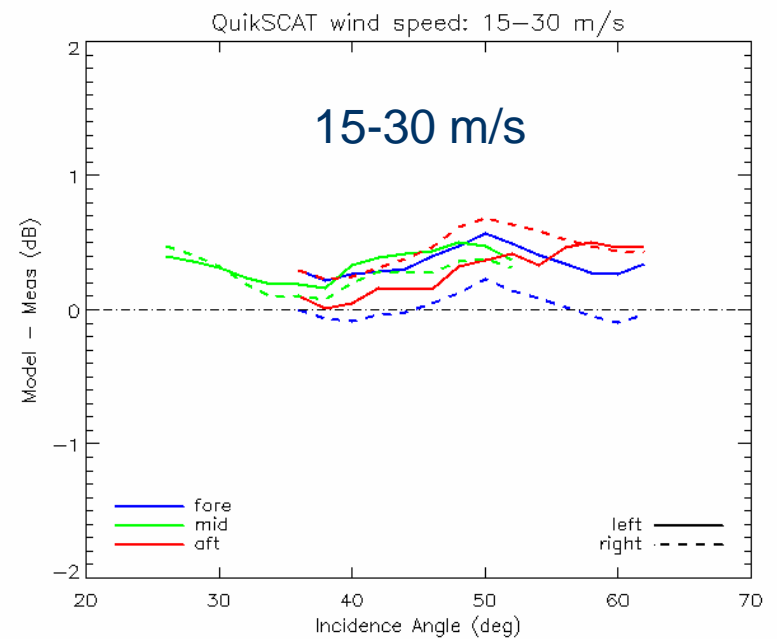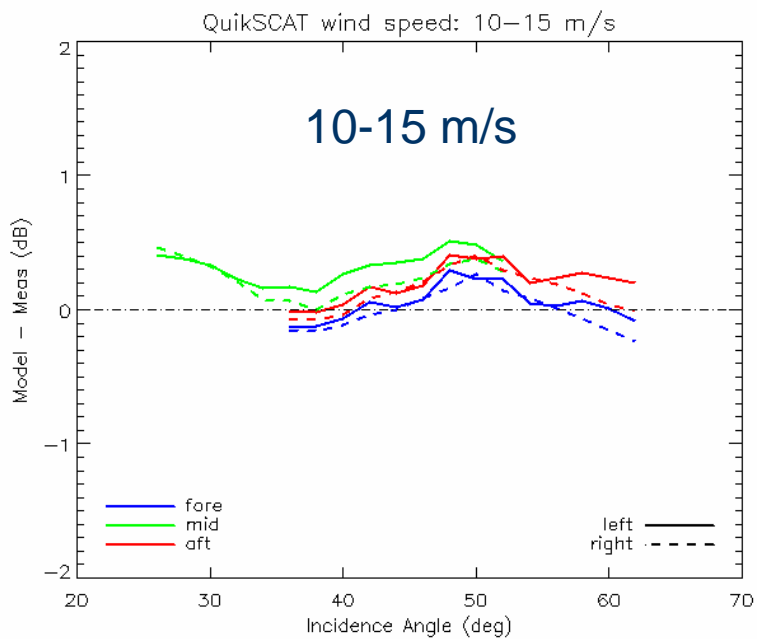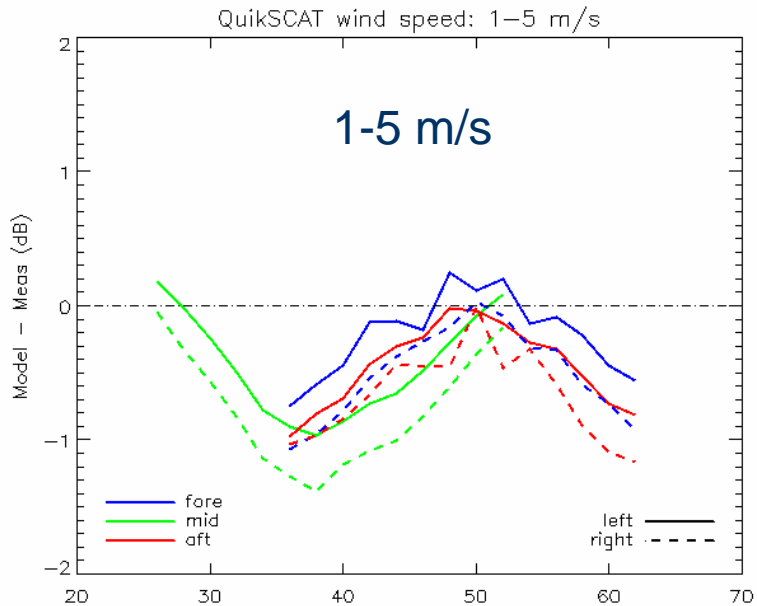
Sigma-0 Residual Errors (CMOD5.5)

Validation Results

- Use 3 months of collocation testing dataset (August,September, and November 2008)
  - 25km / ±1.5 hour Spatial/Temporal window
  - > 30° latitudes
  - 1.7M data points
- Rain-free dataset
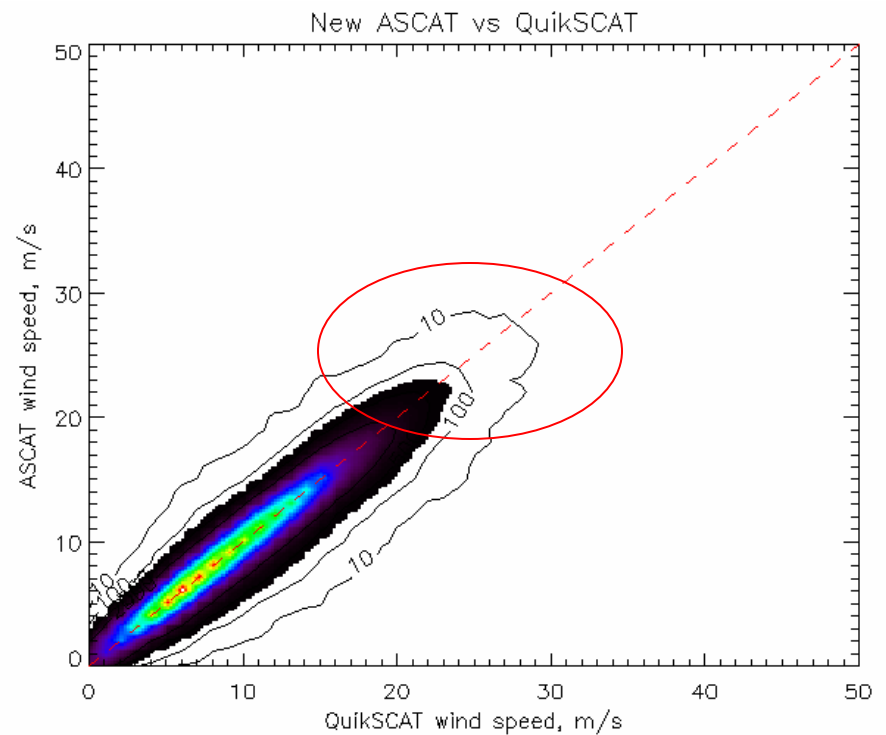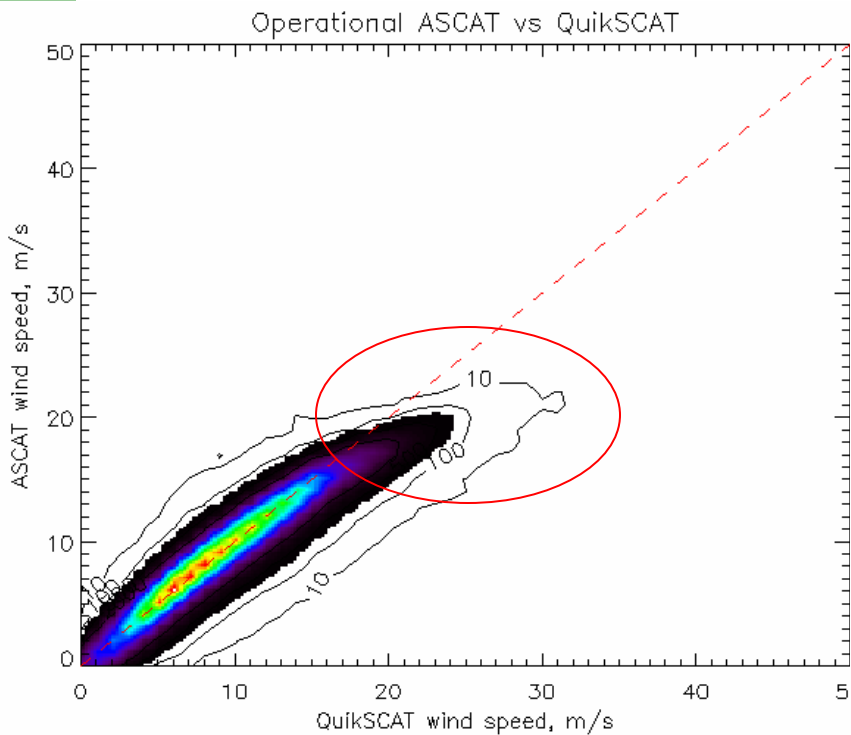 - QuikSCAT rain flag
  - ASCAT KNMI Quality Control flag

Normalized Wind Speed Histogram
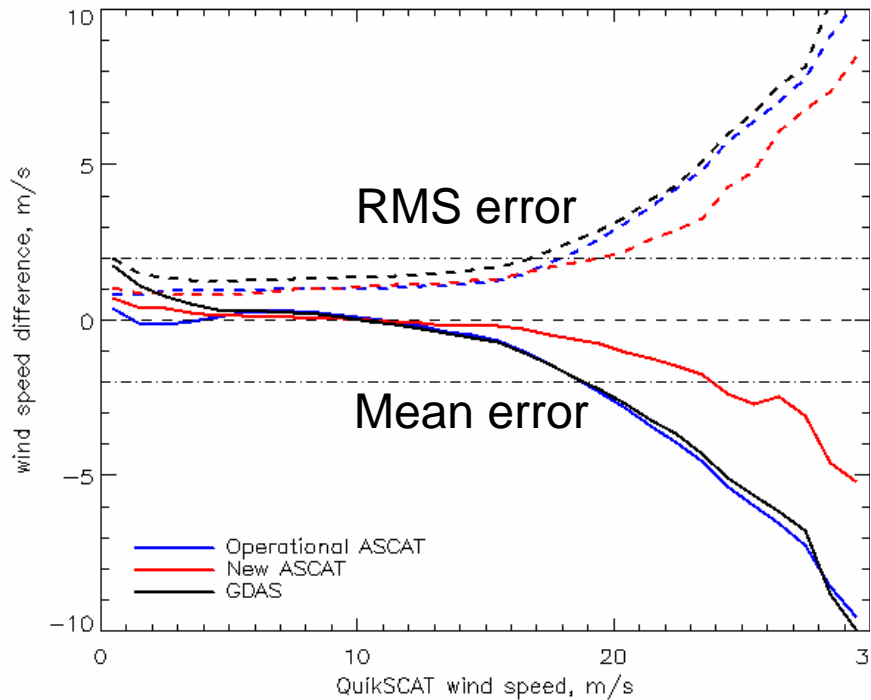## (testing dataset)
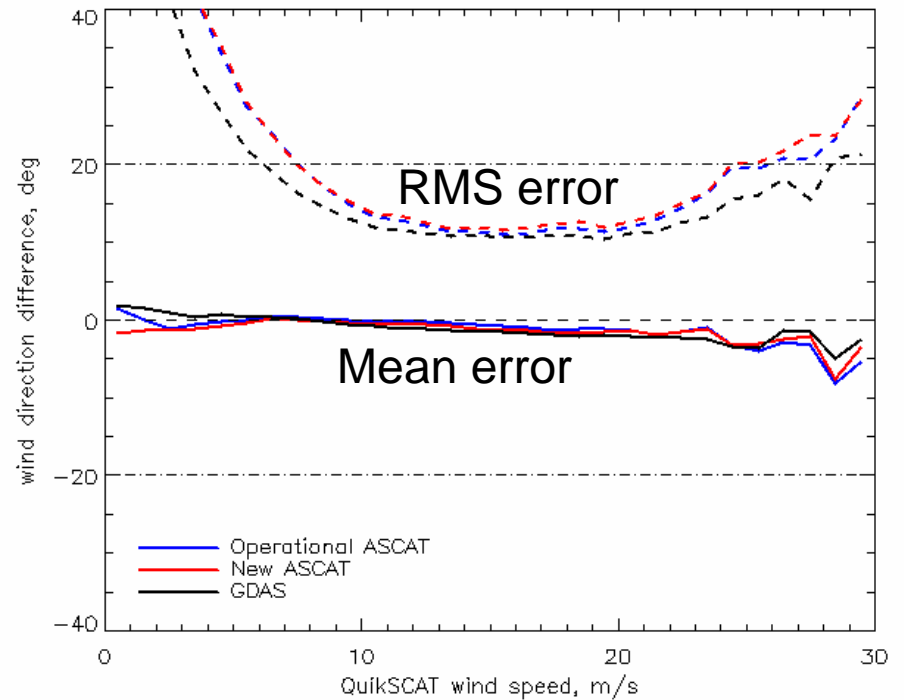
Wind Speed Scatter Diagram
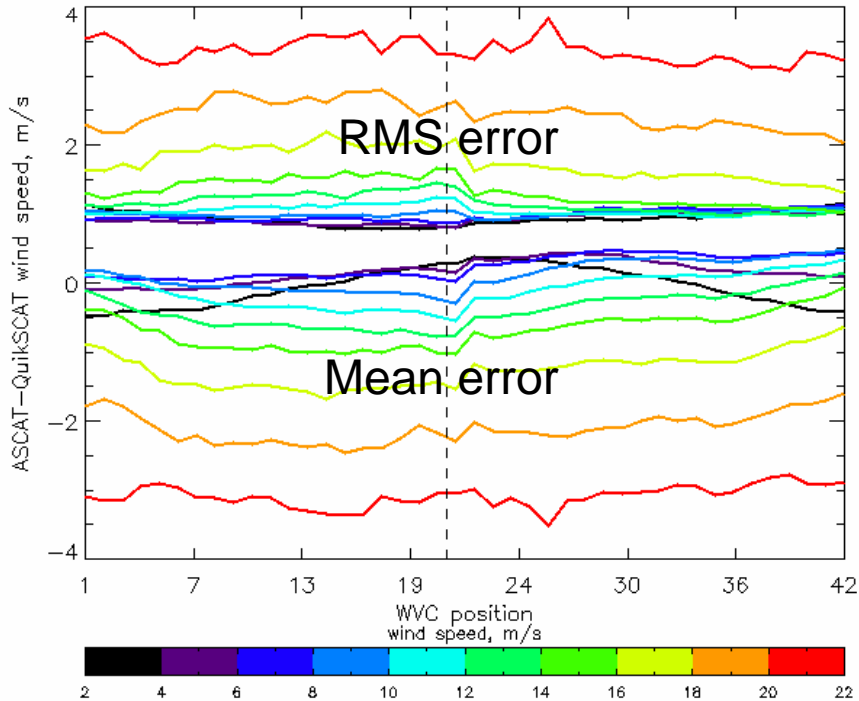
Wind Retrieval Biases
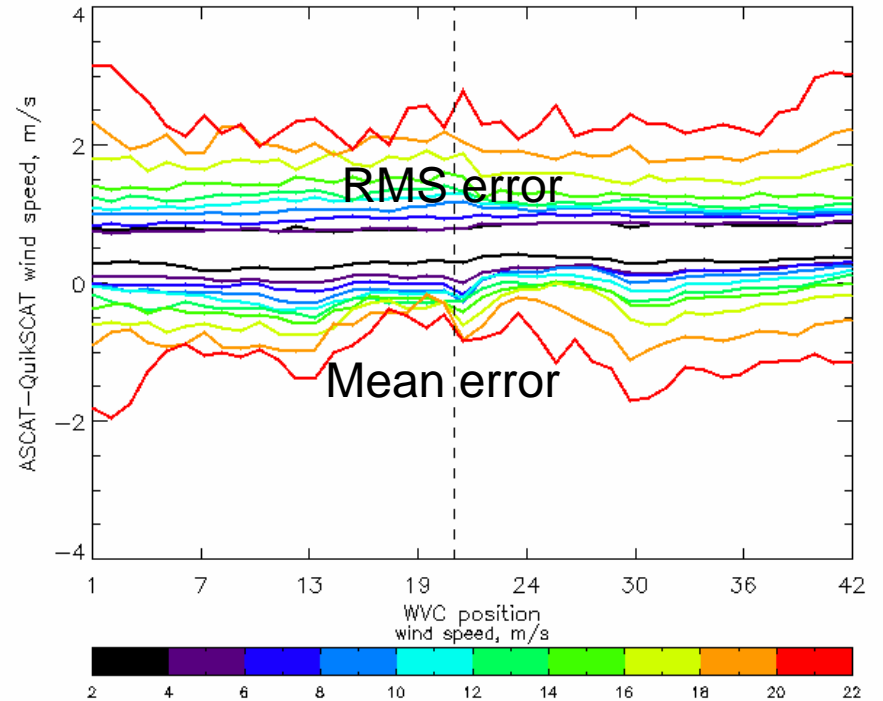

Wind Speed

Wind Direction
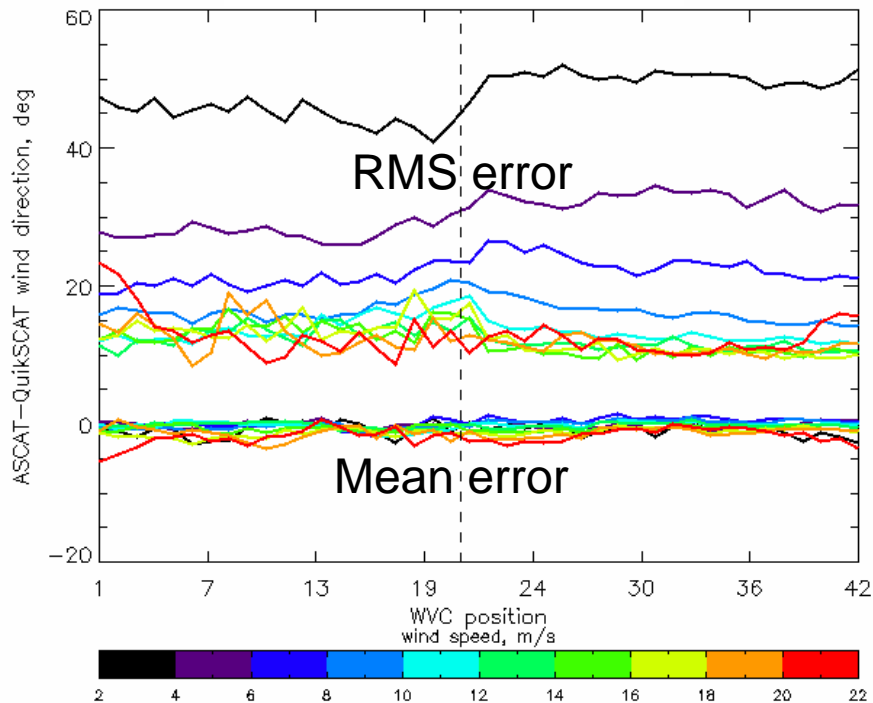
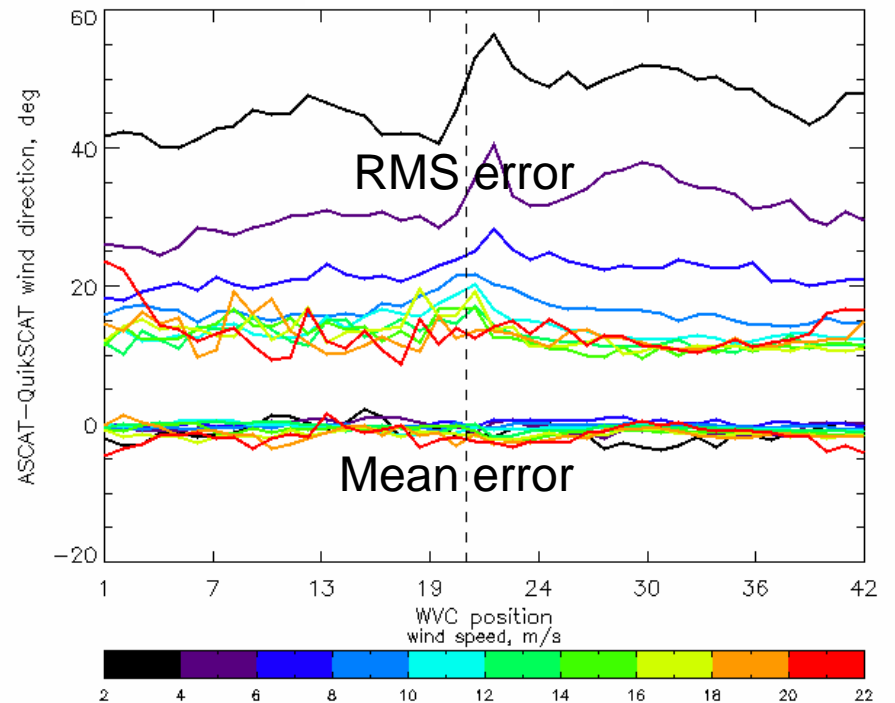# Wind Speed Across Swath

Operational ASCAT
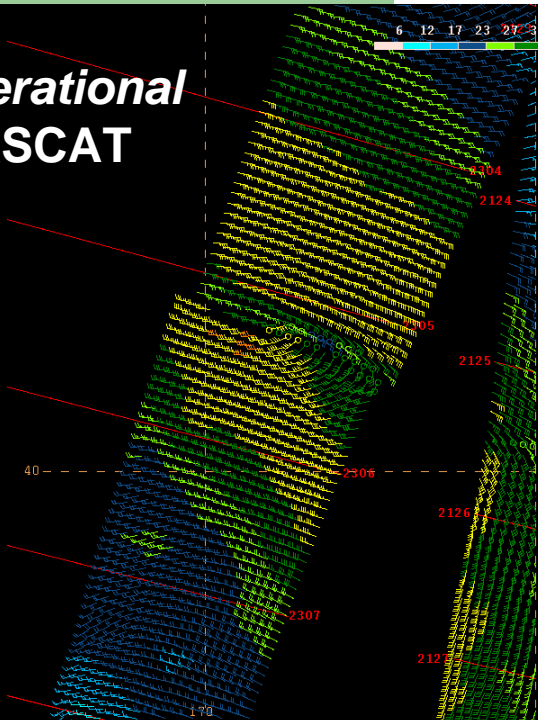
New ASCAT

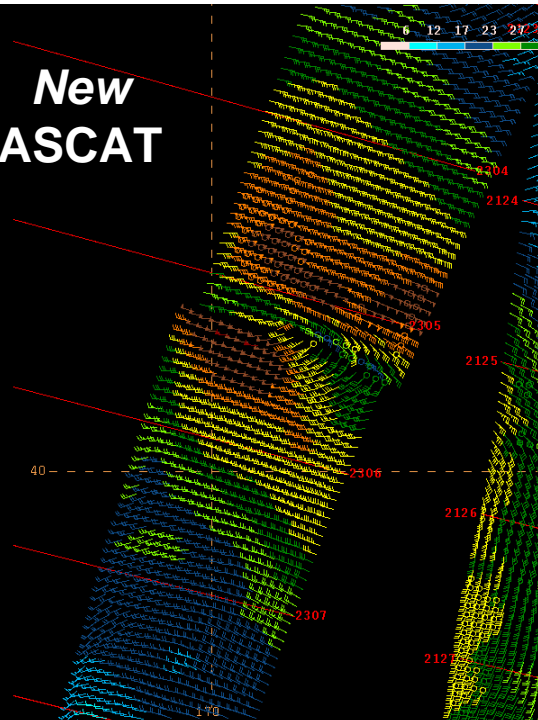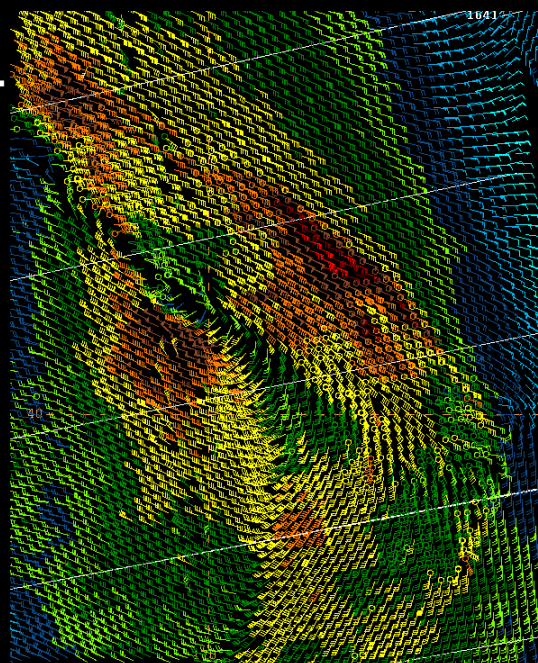# Wind Direction Across Swath

Operational ASCAT

New ASCAT

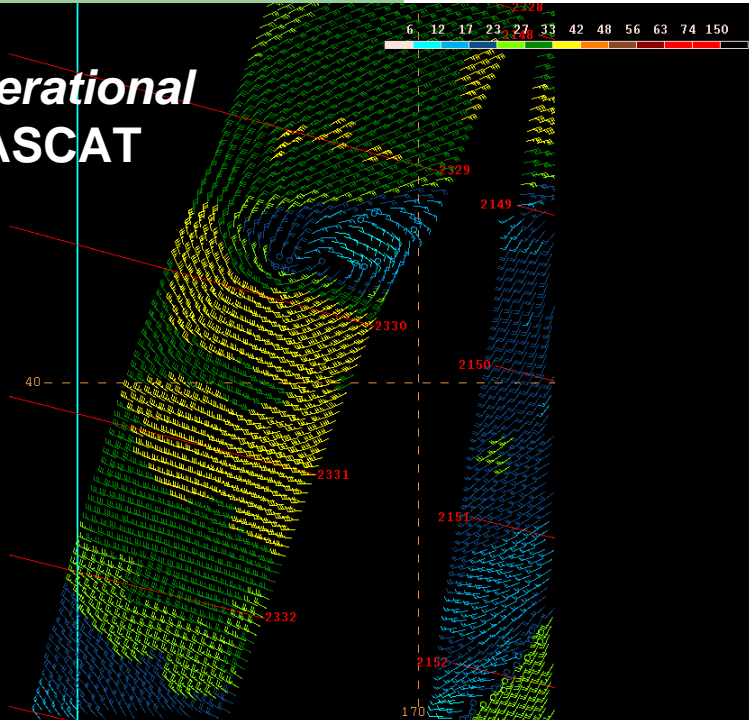*Operational* ASCAT

New ASCAT
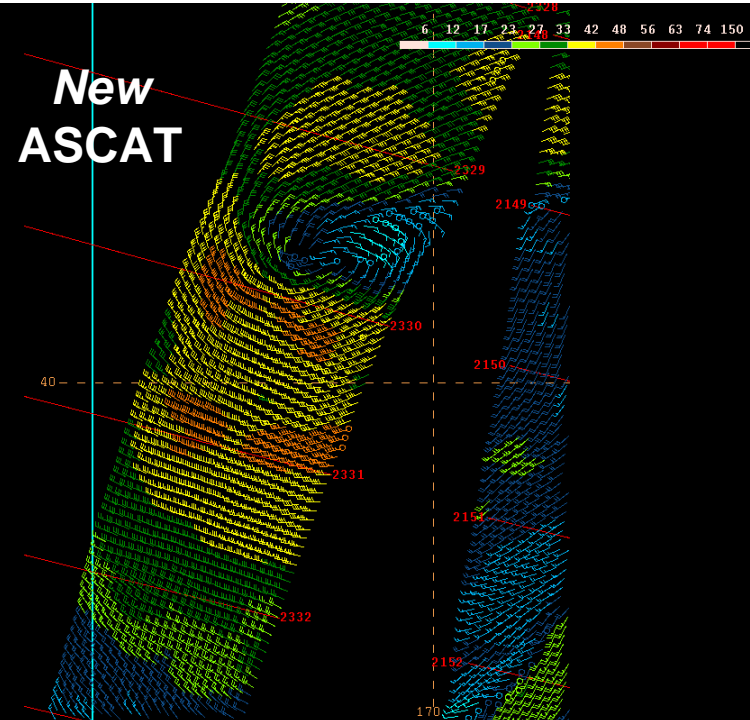
QuikSCAT

November 8, 2008

Images courtesy of Khalil Ahmad

Operational ASCAT · *New* ASCAT · QuikSCAT
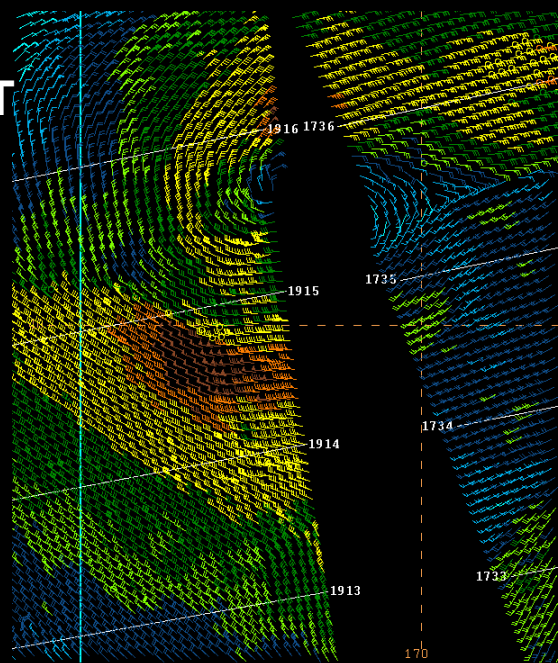
November 2, 2008

Images courtesy of Khalil Ahmad

Conclusion

- A revised ASCAT GMF is developed by introducing a new *DC* term in CMOD5.5

- The new model function shows improvement in ASCAT wind speed retrieval for > ~15 m/s while wind direction shows no significant changes

- <u>Future works</u>:
  - Derive *DC* term coefficients using ASCAT 25-km resolution product
  - Investigate impact of the revised GMF on Quality Control Flag
  - Implement revised GMF in the operational ASCAT