QuikSCAT High Precision Wind Speed Cross Sections 2010-2017

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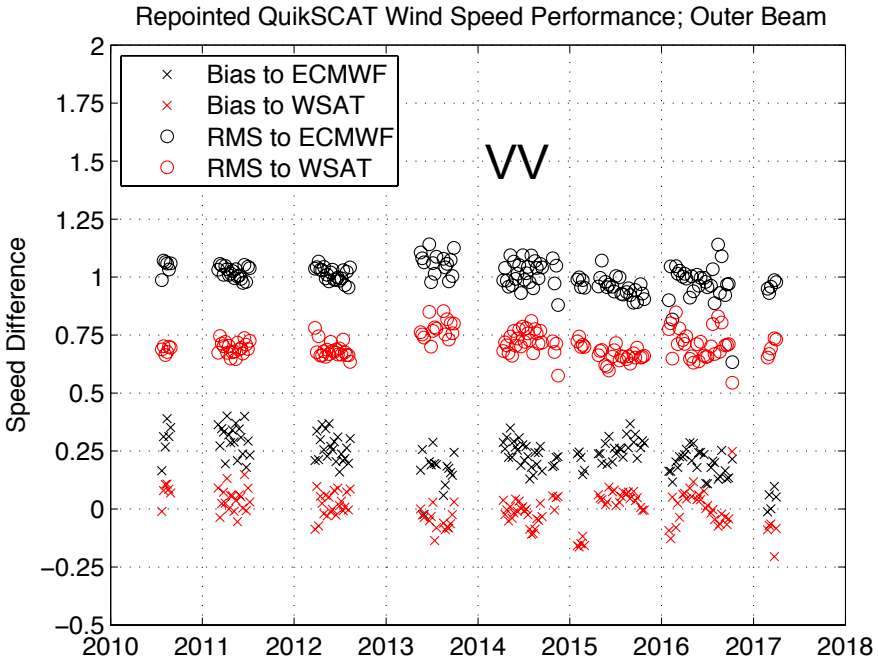
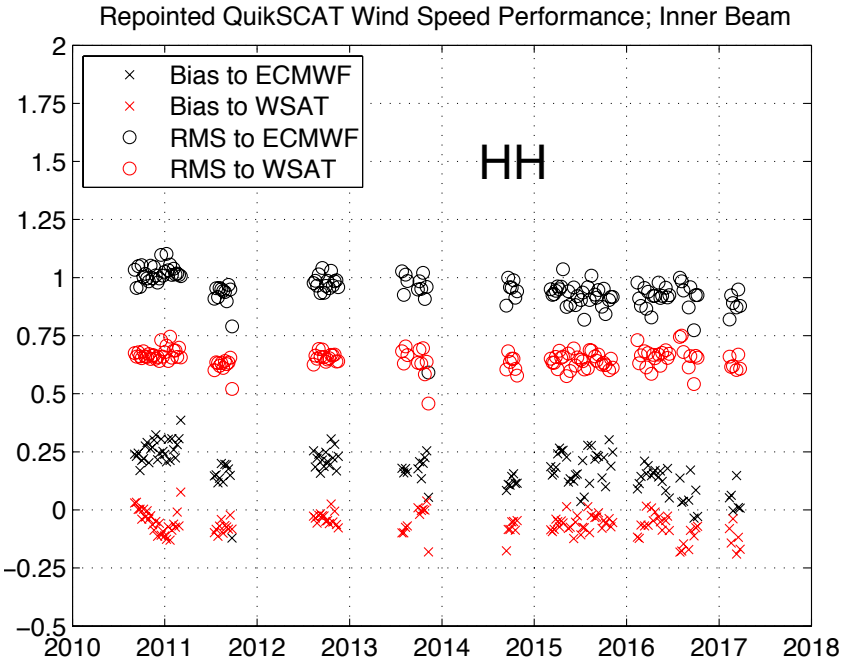
QuikSCAT Overview

- From 1999 to 2009, QuikSCAT operated in a nominal mode with a spinning antenna.
  - *Every 3.3 s, the antenna rotated 360, collecting 611 backscatter measurements.*
  - *The measurements are spread out across an 1800-km swath.*
  - *Each individual measurement has a resolution of 25 by 35 km.*
  - *Every point on the ground was observed from 2-4 different azimuths allowing wind direction retrieval*
- Since 2009, the QuikSCAT antenna has been stationary*
  - *In 3.3 s, 305 measurements are collected*
  - *All these measurements fall in approximately a 30 by 45 km box.*
    - The large number of colocated measurements results in an order of magnitude less random noise.
  - *There is no azimuth variety so wind directions cannot be determined independently.*
    - Numerical wind product directions (i.e. ECMWF) are used with QuikSCAT backscatter to estimate precise wind speeds.

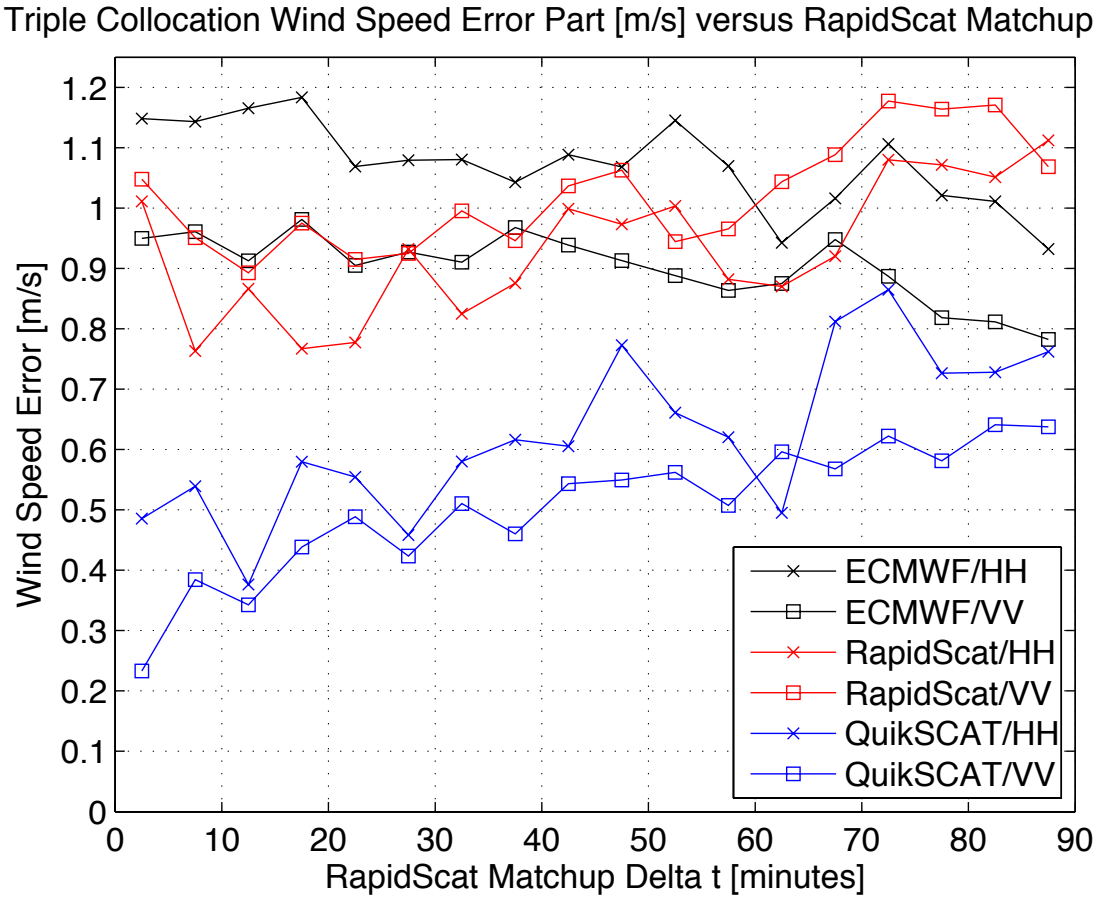
One-to-one Comparisons to ECMWF and WindSAT





- QuikSCAT speeds have 1.0 m/s RMS difference w.r.t ECMWF
- Wind speeds are retrieved separately for HH and VV copol backscatter measurements. In its current mode QuikSCAT alternates biweekly between different polarizations.

QuikSCAT/RapidScat/ECMWF Triple colocations



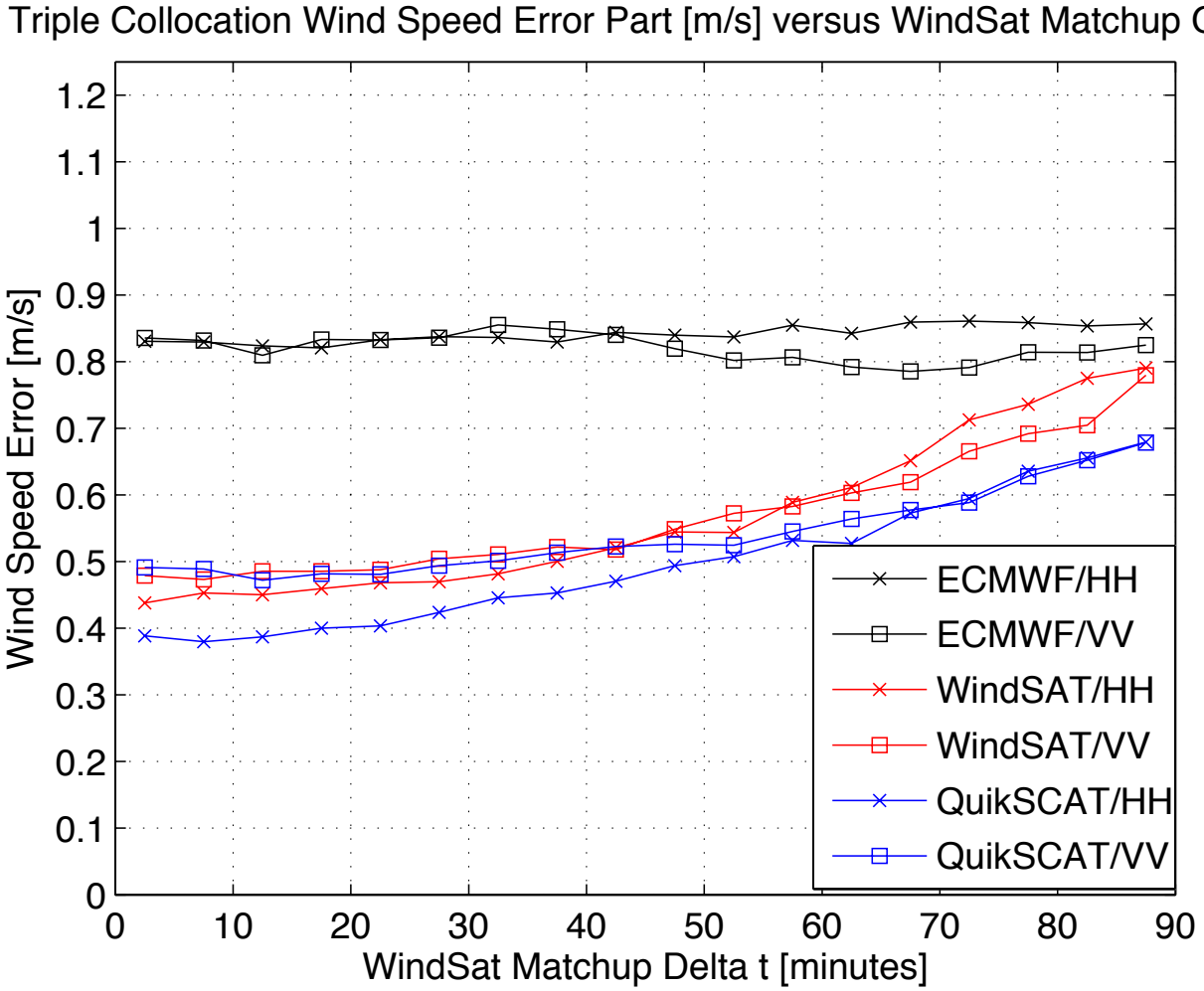
Triple colocations between ECMWF, RapidScat and QuikSCAT nonspinning wind speeds are used to estimate random errors in each of the three cases.

QuikSCAT has the lowest estimate of the three,

Because the three datasets are not measuring winds at the same time or resolution, the random error estimates are upper bounds.

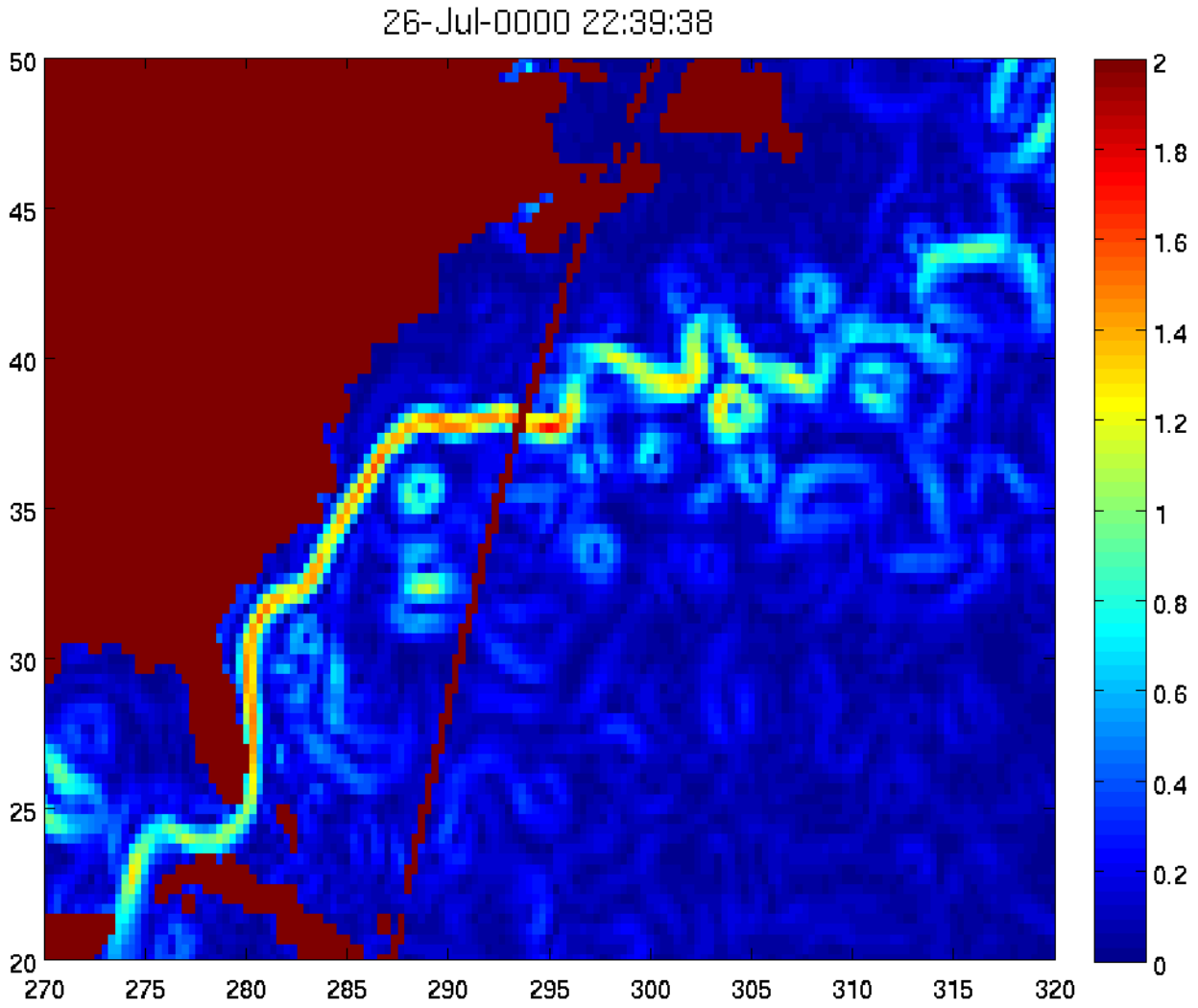
QuikSCAT estimated error decreases as time matchup becomes closer.

QuikSCAT/WindSAT/ECMWF Triple colocations



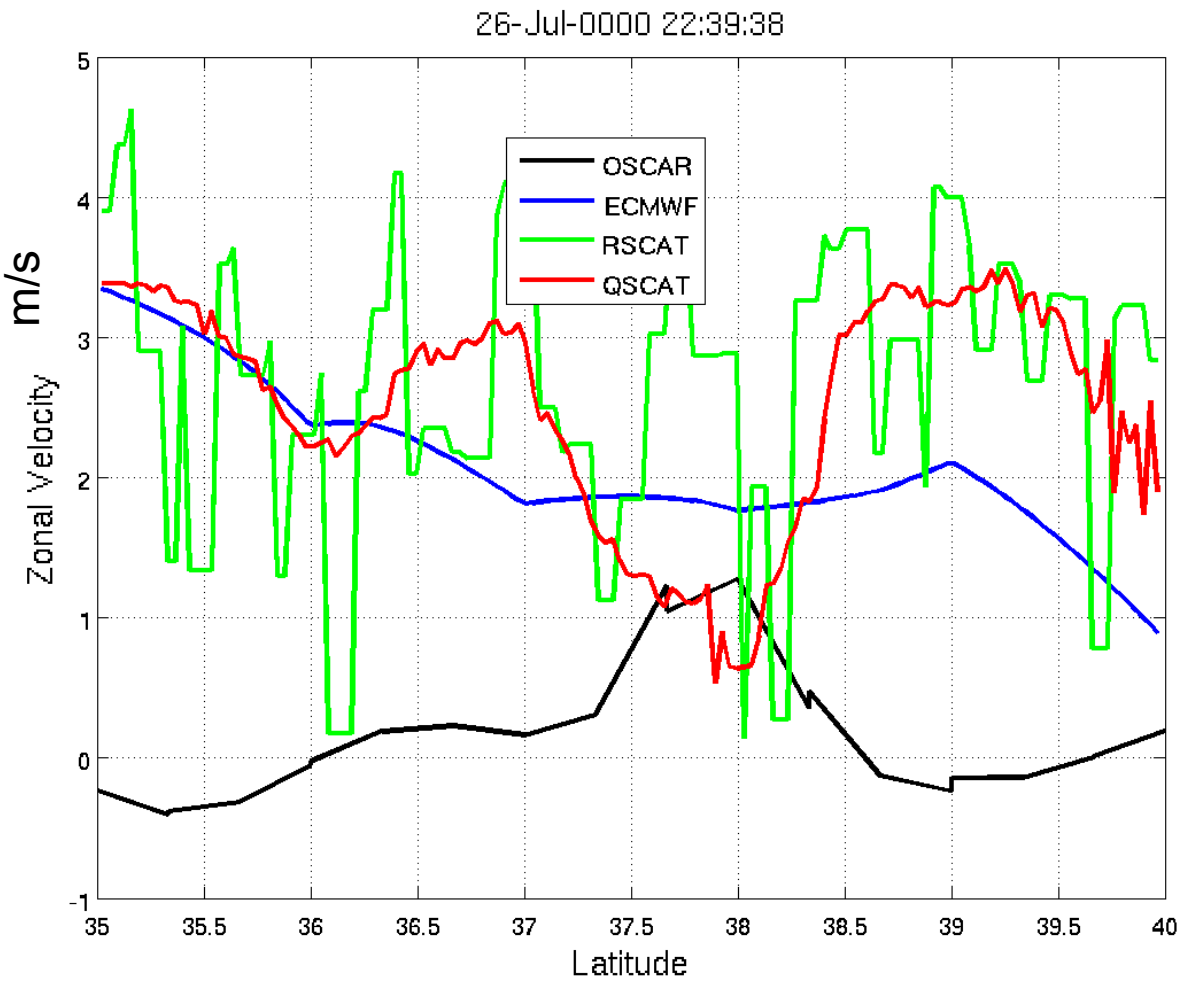
Triple colocations with QuikSCAT, WindSAT, and ECMWF behave similarly with the exception that WindSAT scores a significantly smaller random speed error than RapidSCAT.

Gulf Stream Profiles



The dark red line depicts a nonspinning QuikSCAT profile crossing the Gulf Stream on 26-Jul 2016. The underlying image is OSCAR 0.3 degree weekly ocean currents.

Gulf Stream Profiles



This figure depicts colocated ECMWF and RapidScat wind speeds and OSCAR currents along the QuikSCAT track.

RapidScat has much larger random errors than does QuikSCAT.

QuikSCAT observed a drop in speed across the Gulf Stream that is consistent with a reduction in the difference between the ocean current and the near surface winds.

Summary

- After its antenna stopped spinning in 2009, QuikSCAT has continued to measure backscatter with sufficient stability to calibrate two other Ku-band ocean wind scatterometers: ISRO's OceanSAT-2 and NASA's RapidScat
- Although it can no longer make independent wind direction estimates, QuikSCAT remains capable of precisely determining ocean surface wind speeds.
- In nonspinning mode, QuikSCAT swath width is reduced from 1800 km to 30 km. While it once obtained nearly global coverage in 1 day, it now takes 2 months.
- What it loses in coverage, it makes up for in measurement precision.
  - *Roughly 50 times as many colocated measurements are obtained for each observed point on the ground.*
  - *Random speed errors drop from 0.7 m/s to 0.1 m/s.*
- Comparing the high precision QuikSCAT speed profiles to available SST and ocean current data sets has the potential to provide new insights into the relationship among the three quantities.
- Nonspinning QuikSCAT backscatter and speed data (Level 1C) is publicly available from the NASA PO.DAAC data archive, along with documentation describing the format and a MATLAB reader for the files.
  - *A new version with improved QuikSCAT 2015-2016 calibration and 2017 data will be archived soon, see Alex Fore's poster.*