Calibration and Validation of Multi-Satellite scatterometer winds

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<u>Topics</u>

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Estimation of homogeneous long time series of surface wind vector over global ocean

Processing, combining, analyzing, and validating data from ERS-1, ERS-2, NSCAT, QuikSCAT, and ASCAT

Assessement of surface wind comparisons between various scatterometer retrievals at various scales

- Caracterisation of the differences
- Empirical bias correction

Example of Long Time Series from Multiu-Satellite Observations (Bentamy et al, 2009)

Time series of statistical parameters of NDBC buoy and blended wind speed differences: a) bias(m/s); b) Std(m/s); c) regression slope coefficient; d) correlation coefficient; e) sampling length

NDBC / Blended



ASCAT / QuikSCAT

Previous Comparison results (Bentamy et al, 2008):

Period : April – November 2007 / ASCAT: Actual winds

Present Study : April 2007 – November 2009

Focus : November 2008 – November 2009

ASCAT

•Data Source: OSI SAF / KNMI

•Products: L1b & L2b 25

•GMF : CMOD5 and CMOD5n

•Wind retrieval: Selected solution

•Data selection:

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All WVC

- ■Wind Speed : 0 50m/s
- ■Wind direction : 0° 360°
- Quality flags

QuikSCAT

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Data Source: PODAAC / JPL
Products: L1b & L2b 25
GMF : QSCAT-1/F13
Wind retrieval: Selected solution
Data selection:

All WVC
Wind Speed : 0 – 50m/s
Wind direction : 0° – 360°
Quality flags:

Ancillary Data

Buoy

- NDBC (hourly / Pacific and Atlantic)
- MFUK (hourly / Atlantic and Mediterranean)
- TAO (10mn-Hourly / Pacific)
- PIRATA (10mn-Hourly / Atlantic)
- RAMA (10mn-Hourly / Indian)
- Buoy U10N Calculation: Tang et al (1996)

Numerical Model

• ECMWF Analyses (6-hourly/0.5°)

QuikSCAT I2b products

RSS

• KNMI

Collocation

Matchup Data

•For Each QSCAT swath all ASCAT WVC occurring within 4 hours and 50km of QSCAT data are selected

- •Only the closest, in space and time, collocated data are used
- •Only valid retrievals are selected with respect to ASCAT and QuikSCAT Quality flags.
- •QuikSCAT rain flagging:

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•Only QSCAT WVC wind data such as both IMUDH algorithm and rain detection are valid, are selected

•Mp_rain-probability values are selected for further investigations.



Error Sources

Temporal Separation Impact

- Statistics of differences between buoy wind speeds Wbq Wba
- Wbq and Wba are buoy data collocated with QSCAT and ASCAT, respectively.



No systematic bias is found

Mean differences are lower than <u>0.30m/s</u> for 95% of buoys

Error Sources

Using ECMWF analysis

- 6-hourly Estimates are interpolated in time and space over ASCCAT and QuikSCAT Swaths
- Simulated data are spatially and temporally collocated (ASCAT / QSCAT procedure)



Local Assessement fo ASCAT/QSCAT Collocated Data

Comparisons with NDBC buoy hourly measurements



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Error Analysis

Scaterometer wind speed errors as determined from triplet collocated data: buoy(NDBC and MFUK), ASCAT, and QuikSCAT during the period: April 2007 – November 2009.

 $\mathbf{V}_{b} = \boldsymbol{\alpha}_{b} \mathbf{U} + \boldsymbol{\varepsilon}_{b}; \mathbf{U}_{a} = \boldsymbol{\alpha}_{a} \mathbf{U} + \boldsymbol{\varepsilon}_{a}; \mathbf{U}_{q} = \boldsymbol{\alpha}_{q} \mathbf{U} + \boldsymbol{\varepsilon}_{q} \text{ (e.g. <u>Janssen$ *et al*, 2007</u>).



Global Comparisons

Mean Wind Fields from Collocated ASCAT and QuikSCAT data during November 2008 – November 2009 period.

ASCAT

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QuikSCAT



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Global Comparisons

Spatial distributions of <u>*Correlation coefficients*</u>



Analysis of ASCAT and QSCAT Differences



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Tropical Buoy Comparisons



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Analysis of ASCAT and QSCAT Differences Rain Impact

Wind Speed Differences: November 2008 – November 2009

50 All QSCAT - ASCAT 0 -50 0.5 50 **QSCAT** *Rain free (Quality* 0 flag) - ASCAT 0 -50 50 QSCAT <u>Rain free (Quality</u> -0.5 flag+mrp threshold) -0 **ASCAT** -50 50 100 200 250 300 350 150 0

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Analysis of ASCAT and QSCAT Differences

- Analysis is performed over Tropical area and as a function of
 - Wind speed ranges
 - Swath locations



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Analysis of ASCAT and QSCAT Differences





Summary

- 30 months of space and time collocated wind from ASCAT and QuikSCAT have been investigated over global ocean
- Winds from both scatterometers agree very well with a global bias of 0.20m/s and rms of 1.10m/s
- The main bias spatial patterns are found in inter-tropical and at high latitude zones.
- The main parameters founded to be associated with such differences are
 - Rain impact on Ku band measurements
 - Wind distributions along swath for both scatterometers
 - MLE distribution

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- ASCAT Wind distribution with respect to azimuth direction
- For long time series calculation data selection and empirical bias correction determined from above parameters will be applied.