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Bringing Consistency Among Scatterometer Winds Using Radiometer Observations

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Integrating all scatterometers measurements into a 20+ year Climate Data Record (CDR) of Ocean Vector Winds

•We used quality-controlled radiometer winds (RSS V7) to intercalibrate all scatterometer GMFs and bring consistency to all wind measurements. Ku-band: QuikSCAT, RapidScat C-band: ASCAT L-band: Aquarius

•Other OVW CDRs will be created by other institutions, with their own choices for bringing consistency in their winds.

•Availability of multiple CDRs is useful for identification of potential issues and for estimating uncertainty of climate-quality Ocean Vector Winds.

•Synergy: Scatterometer winds are useful for identifying issues in radiometers too.

Intercalibrated MW data: RSS W emss.com



<u>Sun-Synchronous</u>: SSMI, SSMIS, AMSR-E, AMSR2, QSCAT, ASCAT, WindSat, Aquarius <u>Non-Sun-Synchronous</u>: TMI (1998-2014), GMI (2014-), RapidScat (2014-)

TMI/GMI variable Local Time of observation very useful for CROSS-CALIBRATION TMI 17-YEAR MISSION TIES THEM ALL





Checking for Intercalibration

Rain-free90-min Colocations Scatterometer/Radiometer



Scatterometers versus TMI

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Scatterometers versus WindSat

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Remote Sensing Systems www.remss.com Regional Biases QuikScat, RapidScat, ASCAT

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1.0

0.6

-0.2

-0.2

-0.6

m∕s





Remote Sensing Systems www.remss.com Regional Biases Aquarius versus

Aquarius versus WindSat, GMI, SSMI

0.6

- 0.2

-0.2

-0.6

0.6

0.2

0.6

(m/s)





ISSUE: Regional Bias due to Atmospheric Effects on SSMI (winds from 18 GHz instead of 10GHz)



Development of new ASCAT GMF C-2015

C-2013 ISSUES:

 Developed in 2013 using SSMI F16 for calibration → atmospheric effects; F16 stability issues were recently identified, sudden unexplained biases
 C-2013 used ASCAT sigma0 pre-recalibration

C-2015

Uses a combination of TMI, GMI, WindSat for calibration, no SSMI
Uses re-calibrated ASCAT Sigma0 (released by EumetSat in 2014)





Scatterometers versus buoys



Comparison of storm winds: Remote Sensing Systems www.remss.com Aquarius, RapidScat, ASCAT, WindSat

Nov 18, 2014, 51N, 331E

Dec 9, 2014, 56N, 333E

PAM, Mar 10, 2015, 7S 170E



•Even at these high winds, scatterometers seem to be consistent within a 10%

 Some differences are due to rain effects and differences in time of observation (~3hr)



Scatterometers bias versus NCEP, for different rain rates (in color) Different rain impact for different scatterometers

Monitoring Scatterometer/Radiometer

Global 55NS Monthly ASCAT-Validation Wind Timeseries



ASCAT/QSCAT/WindSat/TMI/GMI global wind anomaly timeseries are very stable
Differences within 0.1 m/s → Climate Quality
V1.1 RapidScat in line with others
Issues for SSMI F16, F17 emerge
Has ASCAT slightly dropped recently (~0.1 m/s)?

Daily Monitoring of RapidScat

13

12

(m/s)

Wind Speed

Average

OCT 2014

NOV

DEC

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90-min Colocations With WindSat 6pm/am



MAY

Very good intercalibration with WindSat and AMSR2, even at this early stage

Years

FEB

MAR

APR

JAN 2015



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Summary:

We described our efforts towards intercalibrating L-band, C-band, and Ku-band scatterometers using MW radiometer winds

Main results:

- Scatterometer winds are consistent within 0.1 m/s
- Consistency valid at all wind speeds
- New ASCAT GMF C2015 coming soon
- L-band winds are good \rightarrow potential for SMAP
- RapidScat is very good, in line with all others
- Non-sun-synchronous TMI, GMI, RapidScat very useful to check consistency among sensors at different times of day
- Synergy Radiometers $\leftarrow \rightarrow$ Scatterometers



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Thank you.





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