

Progress and Future Plans on an Ocean Vector Wind Climate Record

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Long-term goal

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

Challenges

Scatterometers operate at different frequencies: Ku-band: QuikSCAT, NSCAT, OSCAT, RapidScat C-band: ASCAT, ERS L-band: Aquarius, SMAP

Different geometry (conical scanning or fan beam)

- > Observations obtained at different times of the day
- Different rain impact at different frequencies
- Different sensors might have different sources of bias



Priorities

1. Accurate intercalibration of different scatterometers

- Consistent GMFs (Ku, C, and L-band)
- Consistent intercalibration of rain-free wind measurements
- Intercalibration valid at all wind speed regimes

2. Continuous monitoring and removal of other sources of bias

- Regional biases ?
- Atmospheric/Surface state effects (SST, atm. stability, etc..)
- Imperfect GMF calibration? Sensor changes? Drift in timeseries?
- Understand rain impact

3. Removal of diurnal signals

- Understand diurnal impact using current satellites, buoys and model data
- Use RapidSCAT for in-depth analysis of regional impact of diurnal variability



Priority #1: Intercalibrated GMFs

- 1. Completed: Ku-2011 (valid at QSCAT incidence angles), C-2013 (all incidence angles Θ) used for ASCAT, L-band GMF (Meissner (2013), tested on Aquarius wind retrievals). All processed and available from RSS.
- 2. In progress: We are developing an extended Ku-band GMF valid at all incidence angles. It is derived using Ku-2011 as starting point, and NSCAT old GMF and NSCAT sigma0 observations to understand Θ dependence. Careful attention to high winds. Preliminary reprocess of NSCAT (9-months 1996-1997).
- 3. The new GMF has the same calibration target as Ku-2011: RSS V7 radiometer winds (SSMI, WindSat).
- 4. Why radiometer as ground truth? Linear emissivity model up to 40 m/s (Meissner and Wentz, 2012), does not lose sensitivity at high winds. Buoys, and NWP model not reliable above 15 m/s. Radiometer high winds validated with some aircraft data so far. More validation needed (HIRAD, SFMR)
- 5. This new NSCAT-2014 GMF will be used for RapidScat, and can be used to reprocess OSCAT.



A0H

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A0V

- 0.4 Incidence angle 22 26 30 34 0.3 38 42 46 50 0.2 58 62 66 0.1 0.0 15 Wind (m/s) 5 10 n
- **NSCAT-2014**
- NSCAT sigma0
- Ku-2011 (46H, 54V)



NSCAT-2014 GMF

NASA

Directional coefficients A1, A2

A1H





- ---- NSCAT-2014
- NSCAT sigma0
- Ku-2011 (46H), 54V)

GMF development: The more the colocations, the better

Validation of GMF at RapidScat angles using repointed QuikSCAT (58V, 49H)









NSCAT-2014 Wind Speed Validation





Remote Sensing Systems,

www.remss.com



"Unforgiving" Wind Speed Validation

WIND PDF







GMF at these angles and speed needs adjustment





NSCAT 2014



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Low Winds

Moderate Winds

High Winds







L-band Winds: Aquarius

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Combined Aquarius Scatterometer/Radiometer (Meissner et al, 2014). Validation of winds for 2011-2013. Wind speed accuracy matches the other scat/rad

winds.









Priority #2: Continuous monitoring of sources of bias





m/s



Stability of the Wind Timeseries



ASCAT-QSCAT GLOBAL WIND ANOMALY TIMESERIES IS VERY STABLE Differences within 0.1 m/s

This type of analyses of timeseries will be performed for every scatterometer that will be included in the CDR. It is very important that data from different platforms are colocated before comparing timeseries, to represent same sampling



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Rain Impact: Bias Comparison of Ku, C, and L-band



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Priority #3: Diurnal Signal

Amplitude

Derived from QSCAT/ASCAT (4 years data)

Derived from MERRA Reanalysis (5 years data, pre-QuikSCAT)





Diurnal Signal Phase

Derived from QSCAT/ASCAT (4 years data) WWW.Terriss.com

Derived from MERRA Reanalysis (5 years data, pre-QuikSCAT)



Conclusions and Future Plans

Completed (all available at www.remss.com): •QuikSCAT (full mission 1999-2009) •ASCAT (2007-2011) •WindSat (polarimetric radiometer, 2003-current) OVWs (including in-rain). •Aquarius L-band winds (2011-current)

Planned

•By end of 2014: Complete consistent GMFs for L-, C, and Ku-band scatterometers.
•Ku-band: NSCAT (1996-1997) will be reprocessed; OSCAT (?)
•C-band: ASCAT extended to current, ERS-1 (1991-2000) reprocessed
•L-band: SMAP winds

RapidScat
Use Ku-band GMF (NSCAT-2014) for RapidSCAT
Participate in cal/val of RapidScat retrievals
Study the wind diurnal variability using RapidScat

Other activities

•Use RapidScat and Aquarius/SMAP to understand rain impact

•Validation of scatterometer high winds with HIRAD.