RSS Technical Report: 040416

Remote Sensing Systems

ASCAT on MetOp-A Data Product Update Notes

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April 4, 2016

New release: ASCAT V2.1 Data Products

This is a major new release of ASCAT data from Remote Sensing Systems. We have fully reprocessed the ASCAT-A (ASCAT on MetOp-A) wind data record (2007-2016) and made significant changes as compared to the previous version, V1.2.

The main reason for reprocessing was to change the Geophysical Model Function (GMF) used in the retrieval algorithm. The GMF has been redeveloped to achieve climate quality accuracy in the retrieved winds. The changes made and the timeline of ASCAT processing are summarized below. More details will be released in a forthcoming Technical Report on the C-2015 GMF.

- RSS ASCAT V1 data products were originally released in Nov 2013.
- ASCAT V1 used the C-2013 GMF developed at RSS.
- A small update to ASCAT processing resulted in the release of V1.2 data in August 2015. V1.2 was produced to use recalibrated sigma0 data (L1B files) provided by EUMETSAT but the GMF and wind algorithm were unchanged.
- The new RSS ASCAT V2.1 ocean winds (released in April 2016) have been calibrated for climate-quality accuracy (0.1 m/s) and consistency with QuikSCAT winds (Ricciardulli and Wentz, 2015) and radiometer wind speeds (Ricciardulli et al, 2012).
- ASCAT V2.1 uses the new C-2015 GMF developed at RSS and the recalibrated L1B files available from EUMETSAT.
- ASCAT V2.1 data products also reflect improved quality control and rain-flagging by adding several radiometers to the rain-flagging detection (SSM/I, SSMIS, TMI, GMI, AMSR-E, AMSR2, and WindSat).
- ASCAT V2.1 Level-3 data products (bytemaps) now contain radiometer rain rates instead of columnar rain. The quality flag radiometer rain values are now expressed in units of mm/hr instead of km*mm/hr. Users need to use the new read routines to properly interpret the units and scaling factors.
- The biggest change in the reprocessed winds (V2.1 as compared to V1.2) is at high winds (above 30 m/s) which now have roughly 5-6% higher wind speeds. There is also a 2-4% decrease in the winds between 17 to 27 m/s, and a slight increase at very low winds. The changes are due to the new C-2015 GMF.
- ASCAT V2.1 data start in March 2007 and extends to the present. Due to the process of obtaining L1B data from EUMETSAT, we process ASCAT data with approximately a 2 week delay.

C-2015 GMF

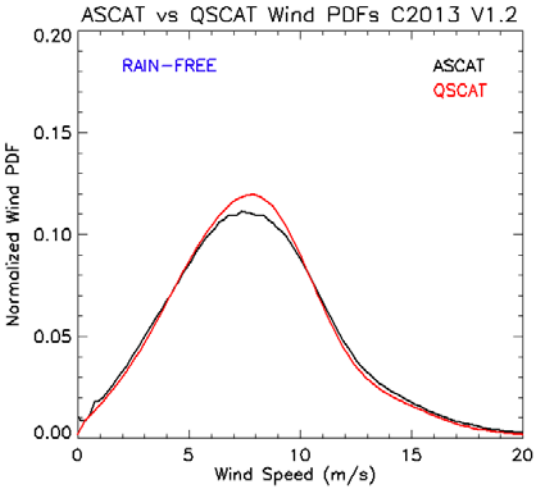
The new C-2015 GMF was developed using 8 years of ASCAT L1B sigma0 data collocated with rain-free winds from the well-calibrated, non-sun-synchronous TMI and GMI radiometers. ASCAT observes the Earth at about 9:30 AM/PM Local Time. We used a 2-hour collocation window and a very conservative rain-flagging procedure for GMF development. The previous C-2013 GMF was developed using a shorter time period of sigma0 data collocated mostly with SSMIS F16 (about 8 AM/PM). Other sensors observe the Earth at about 6 PM/AM (QuikSCAT and WindSat), or around 1:30 AM/PM (AMSR-E and AMSR2), and do not provide optimal time collocations. Over time, we found the F16 SSMIS lacked the stability and accuracy required for deriving climate-quality winds. The TMI and GMI data used for the development of the new C-2015 GMF have been recently reprocessed by RSS to the highest standard of calibration (Wentz 2015, Wentz 2016).

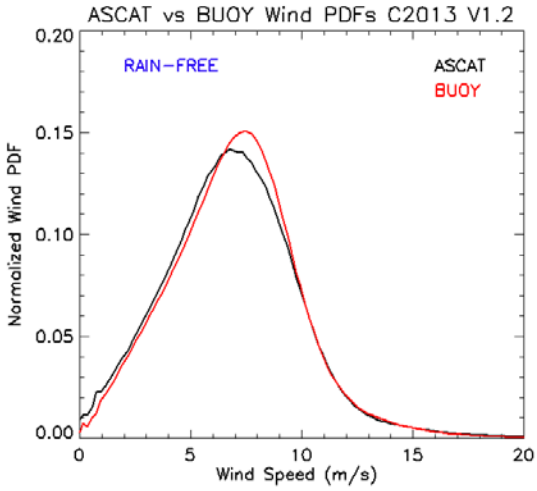
The biggest change in the GMF is at high wind speeds. The old C-2013 GMF was mostly extrapolated at high winds as there were very few radiometer high winds collocated within 2 hours in the small development data set used. The ability to closely collocate TMI and GMI winds in time with ASCAT has provided a much larger training set for use in the C-2015 GMF development. Additionally, we used a new statistical approach to tune the GMF at high winds rather than extrapolate. Over time, we have built a database consisting of more than 50 extratropical storms containing very high winds that are mostly rain-free. These storms are observed by QuikSCAT, WindSat and ASCAT. This collection has allowed us to tune the GMF in such a way as to match the ASCAT wind intensity to the storm wind fields in the database. More details about the C-2015 GMF will be provided in an upcoming RSS technical report and a peer-reviewed publication.

Comparisons of V2.1 ASCAT to Previous Products and Other Instruments

The following examples show analyses performed at RSS during the development and testing of the new V2.1 ASCAT wind products. Each figure highlights one of the significant changes discussed above.

The following plots show the wind speed Probability Distribution Functions (PDFs) of QuikSCAT (left) winds and moored buoy (right) winds as compared to ASCAT-A V1.2 (top) and V2.1 (bottom) winds. Note the improvement in PDF agreement for the new V2.1 data in the rain-free conditions used in this analysis. Data from 2007 to 2009 were used for QuikSCAT comparisons with a 4-hr collocation. Data from 2007 to 2012 were used for buoy comparisons with a 30 minute collocation.


ASCAT vs QSCAT Wind PDFs C2013 V1.2
RAIN-FREE
ASCAT
QSCAT
Normalized Wind PDF
Wind Speed (m/s)
0.00
0.05
0.10
0.15
0.20
0
5
10
15
20


ASCAT vs BUOY Wind PDFs C2013 V1.2
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ASCAT
BUOY
Normalized Wind PDF
Wind Speed (m/s)
0.00
0.05
0.10
0.15
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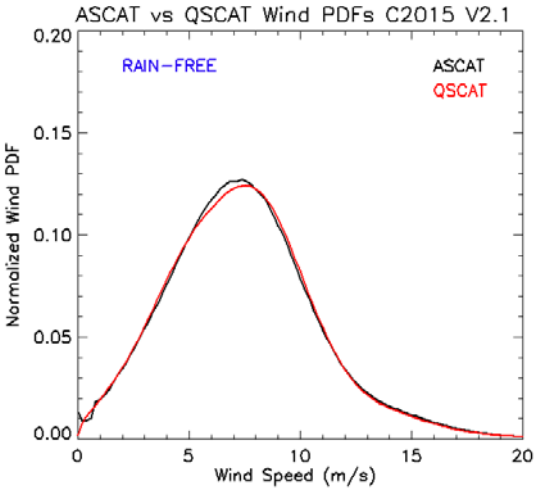
20

a) **V2.1**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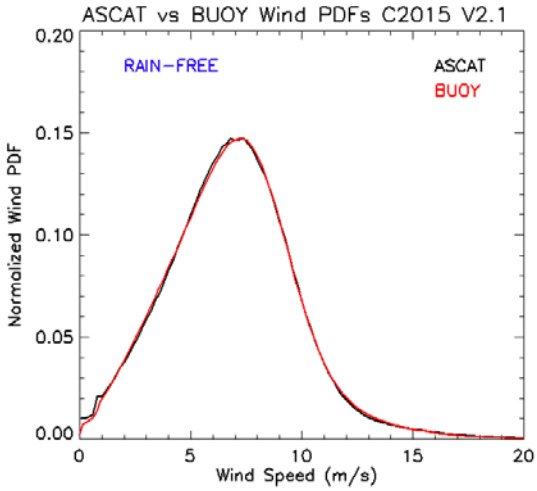
ASCAT vs BUOY Wind PDFs C2015 V2.1
RAIN-FREE
ASCAT
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Normalized Wind PDF
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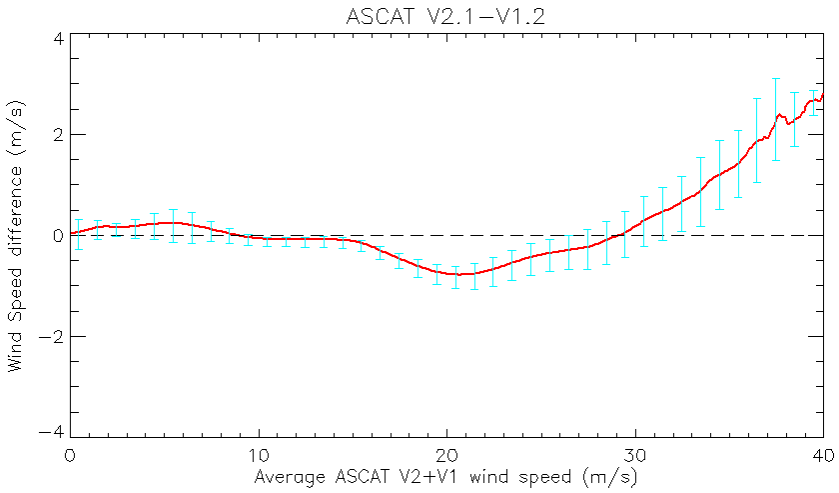
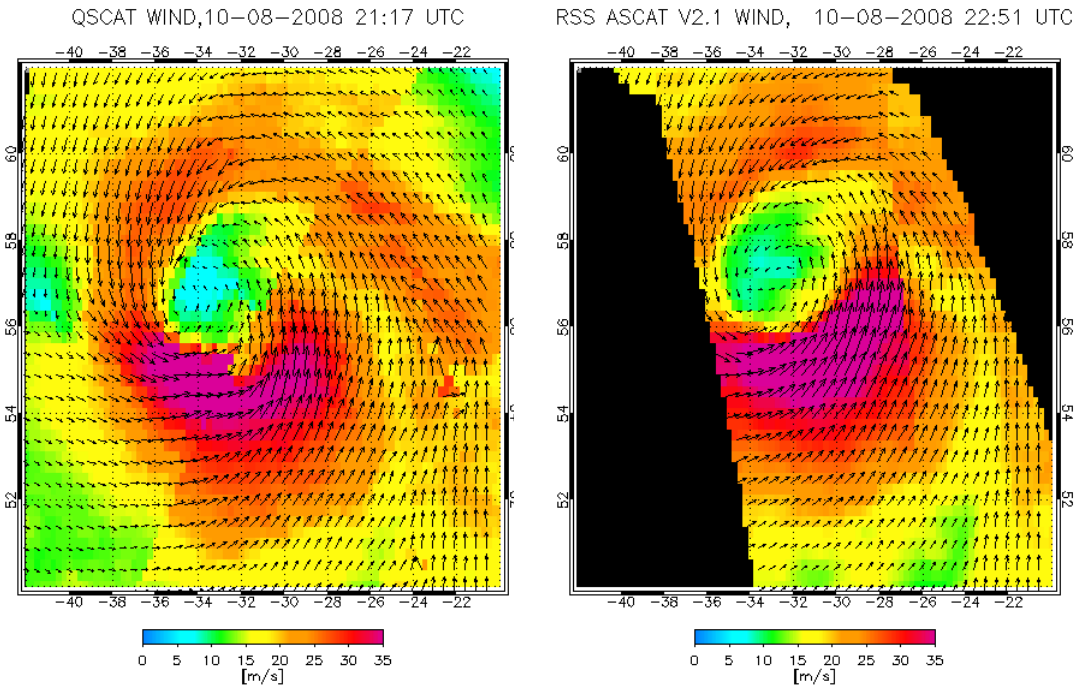
The next figure shows the differences between the ASCAT-A V2.1 minus V1.2 winds as a function of wind speed, averaged over one year (2008). Note that most of the changes occur at higher wind speeds above 30 m/s.

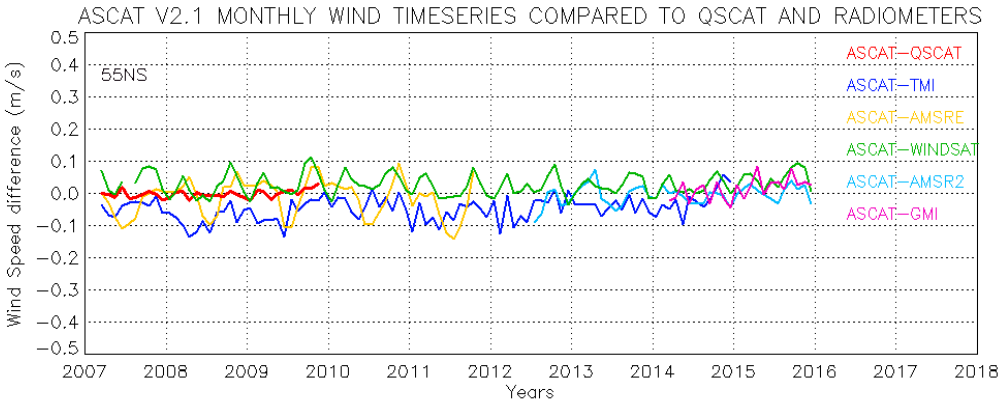


This Extratropical Storm example shown below provides a comparison of QuikSCAT and ASCAT (V2.1) winds for a northern latitude storm. The wind field is from October 8, 2008. The time refers to the average observation UTC time over the selected region (QuikSCAT wind field is composed of two adjacent swaths).



Intercalibration of ASCAT to Radiometers and QuikSCAT for Climate Accuracy

The primary goal of the GMF work has been to develop climate quality (to 0.1 m/s), consistent winds from the many satellite microwave sensors in orbit. The following figure shows monthly time series of wind speed differences of ASCAT V2.1 to wind from other instruments. All collocations were made to within 4 hours and the time series were constructed with data from 55S to 55N, with the exception of TMI for which data are only available from 40S to 40N.



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