

Inter-calibration of scatterometers and radiometers under extreme wind conditions using NOAA hurricane hunter flight data

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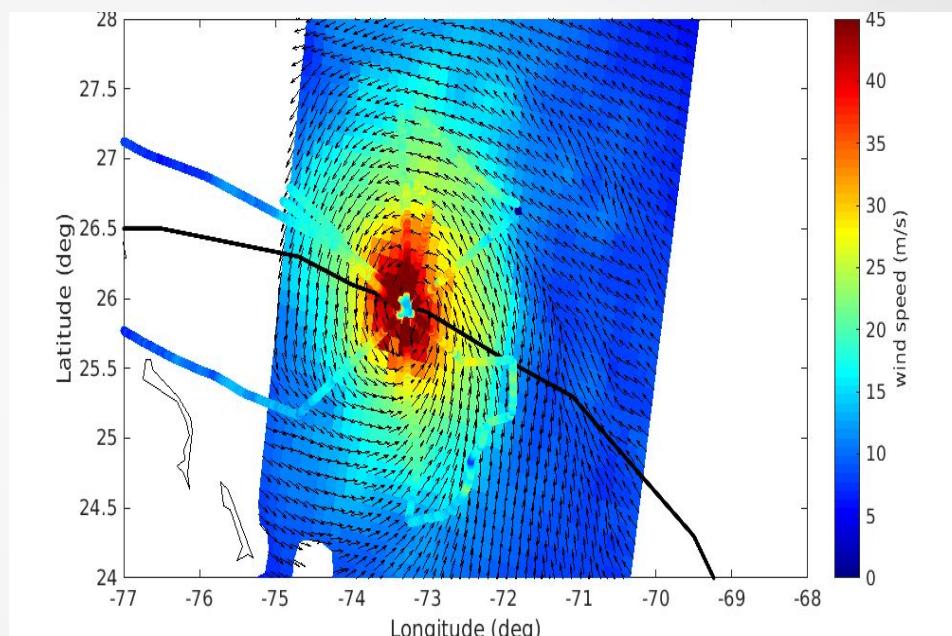
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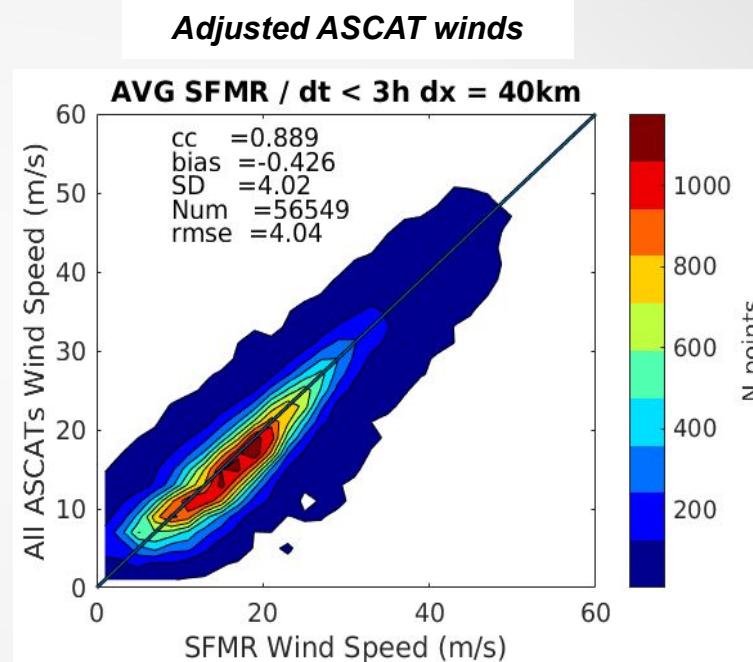
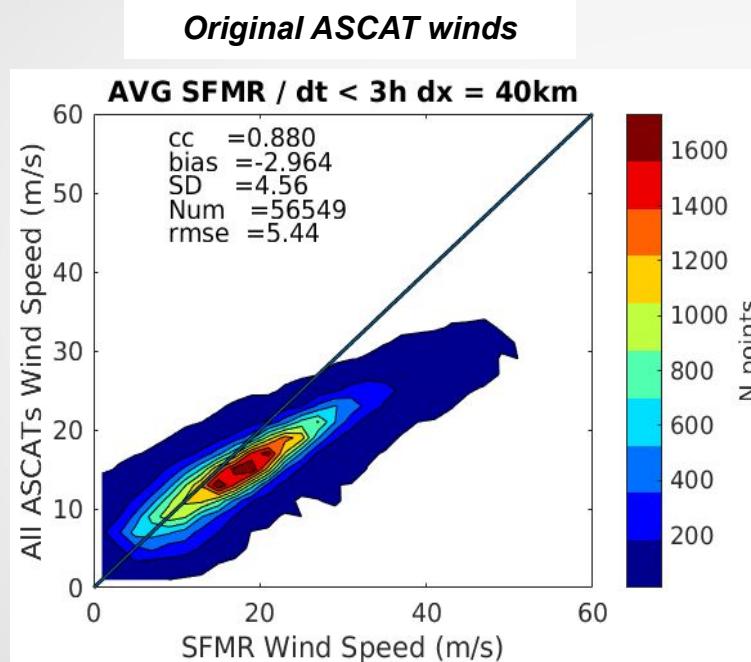
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ASCAT adjusted wind field over Hurricane Dorian
using SMFR winds as calibration reference

C-band scatterometer extreme wind adjustment

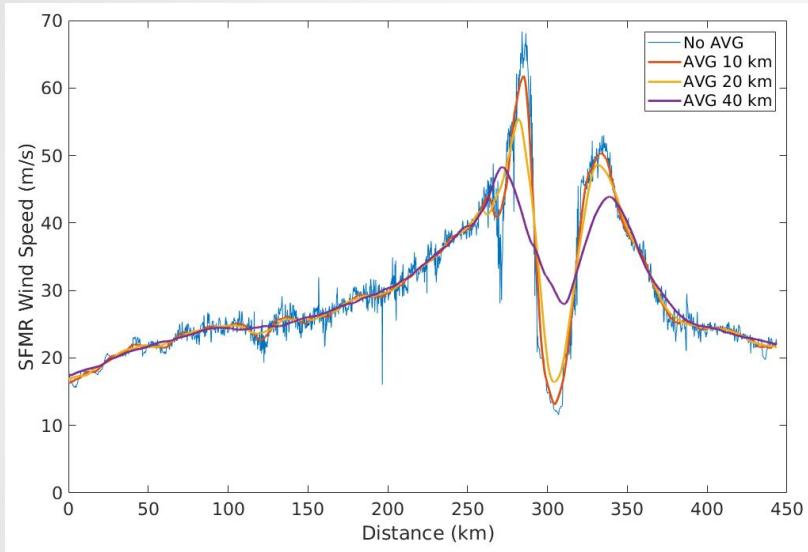


- **Adjusted ASCATs consistent with SFMR (as expected)**

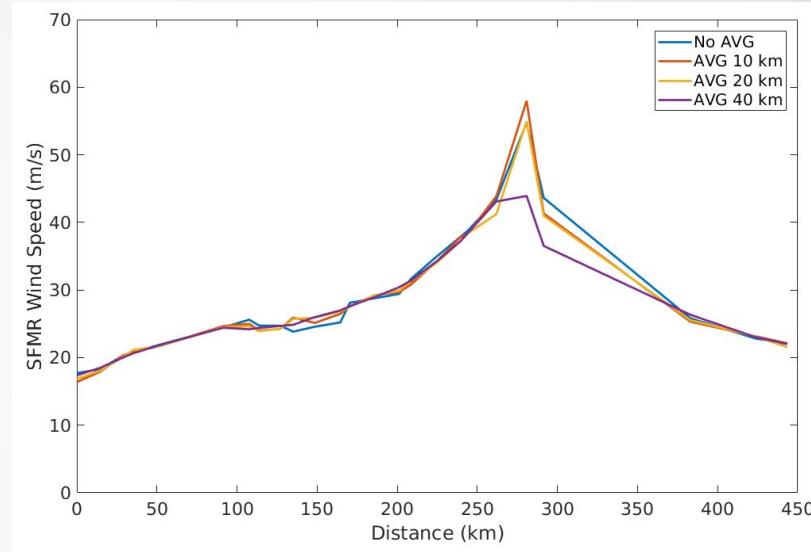
ESA MAXSS project (WP2100)

- Aim: To adjust radiometers & scatterometers high & extreme winds using SFMR (2010-2020)
 - OSI SAF: ASCAT-A, -B & -C, Rapidscat, OSCAT, OSCAT2, HY-2A & -2B
 - REMSS: Windsat (v7), AMSR-2 (v8), SMAP (v1)
 - Ifremer: SMOS (v2)
- Assess spatial representativeness
 - Look for suitable SFMR upscaling for each SCAT & RAD
- Analyse QC effects
- Assess SFMR calibration
- Ensure inter-calibration among all satellite systems

SFMR upscaling effects



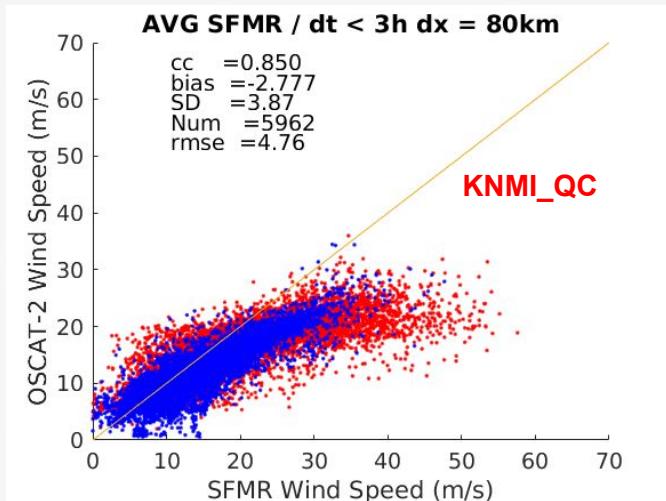
SFMR upscaling effects at SFMR 1-sec sampling



SFMR upscaling effects at 12.5 km sampling

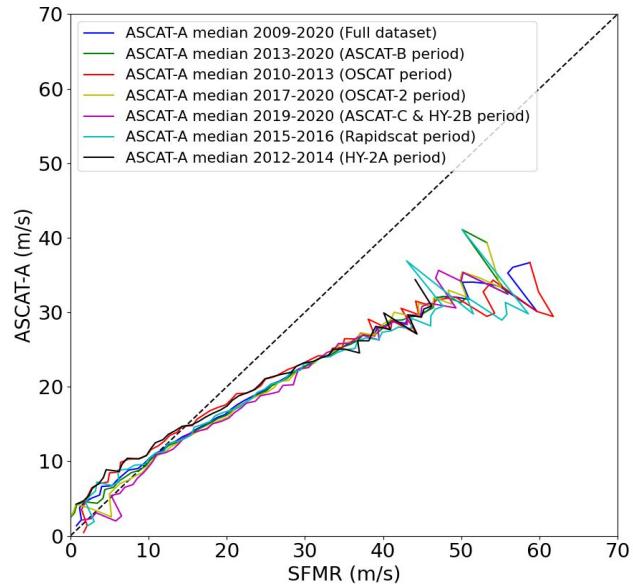
- **SFMR upscaling effects are significantly smaller at 12.5-km (ASCAT-A) sampling**

Ku-band QC effects



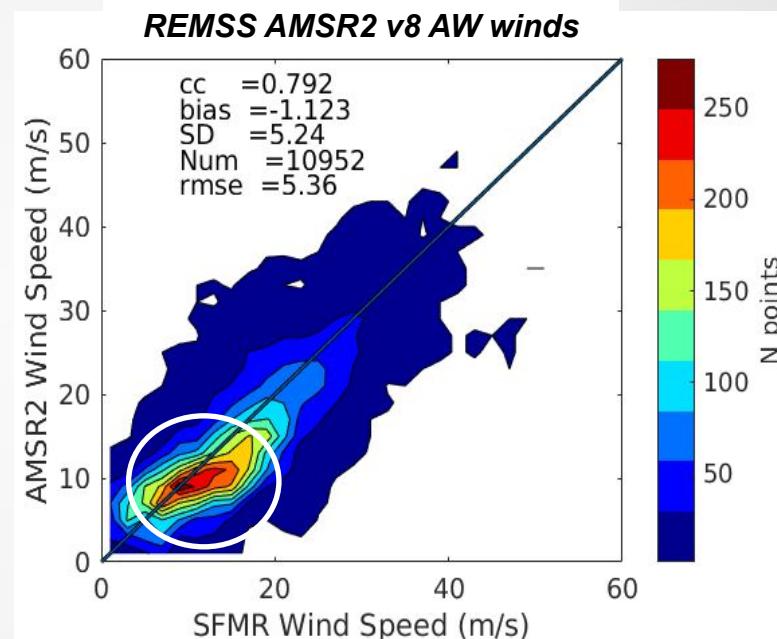
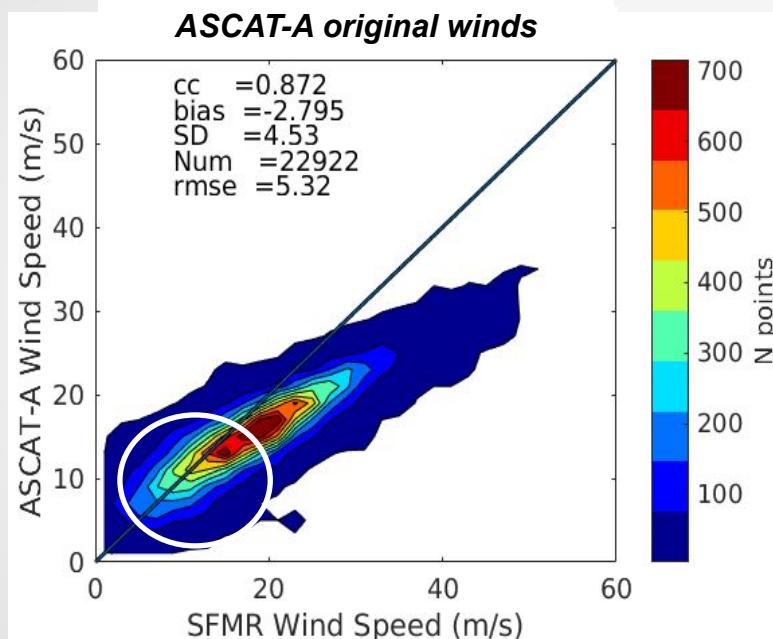
- *Rain contamination filtered out by KNMI_QC; but then, only few extreme wind points left*

SFMR calibration effects



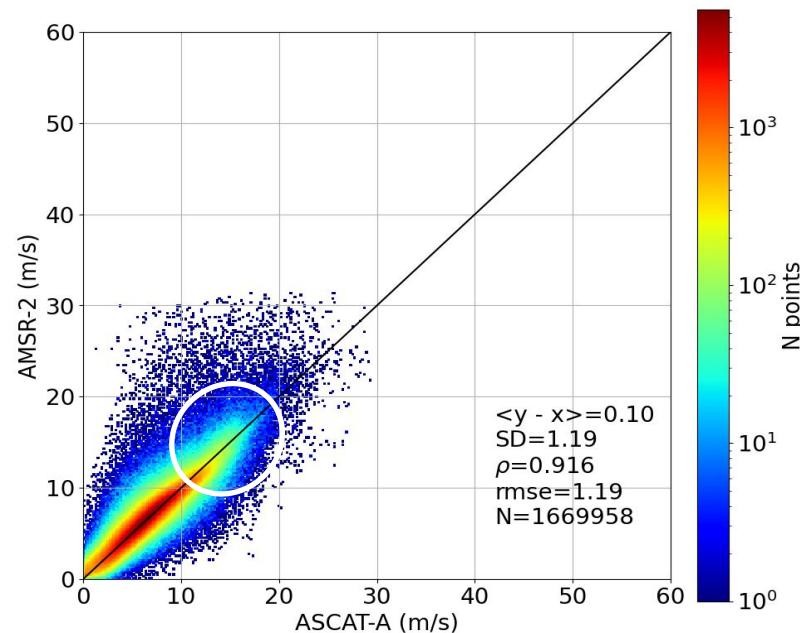
- ***SFMR calibration variations of up to 2 m/s between the range 15-30 m/s***

Radiometer extreme wind adjustment



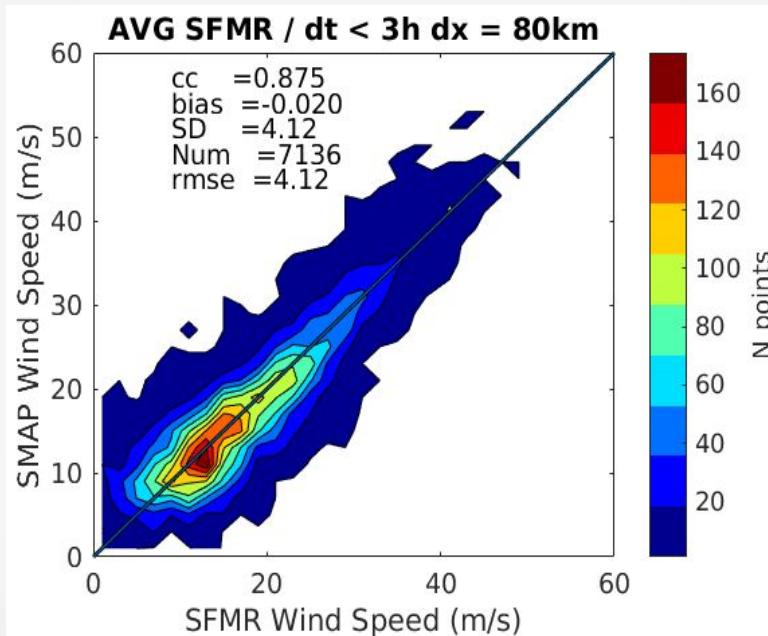
- **ASCAT-A & AMSR2 winds inconsistent in the range 10-15 m/s when collocated with SFMR (2012-2020)**
- **AMSR-2 wind retrieval issues under TC conditions?**

Radiometer extreme wind adjustment



- **ASCAT-A & AMSR2 winds mostly consistent in the range 10-15 m/s when directly collocated (max. of 3-hour distance)**

Radiometer extreme wind adjustment



- *SMAP winds show good correlation although a slight overestimation at extremes w.r.t. SFMR*
- *SFMR based fitting leads to more consistent (adjusted) SMAP winds*

Conclusions

- SFMR-based adjustment of scatterometers & radiometers
- SFMR spatial representativeness effects less pronounced due to “sparse” satellite sub-sampling (few eyewall “hits”)
- Ku-band scatterometer winds strongly affected by rain near the eyewall
- Significant SFMR calibration variations over time (up to 2 m/s differences)
- A mean SFMR calibration is assumed by adjusting all ASCATs at once
- SFMR-based Ku-band adjustment leads to poor C/Ku-band wind inter-calibration
- ASCAT adjusted winds used as reference to adjust Ku-band winds
- ASCAT adjusted & SFMR winds used to adjust REMSS radiometer (AMSR-2, Windsat, SMAP) & Ifremer SMOS wind products
- AMSR-2 & Windsat winds in the range 10-20 m/s show poor performance under TC conditions

Scatterometer data availability (2010-2020)

Scatterometer systems	FORMAT	PERIOD	SOURCE	FREQUENCY
ASCAT-A	BUFR/NetCDF	Full period	OSI SAF	C-band
ASCAT-B	BUFR/NetCDF	11/2012 – 12/2020	OSI SAF	C-band
ASCAT-C	BUFR/NetCDF	01/2019 – 12/2020	OSI SAF	C-band
OceanSat-2	BUFR/NetCDF	01/2010 - 02/2014	OSI SAF	Ku-band
RapidScat	BUFR/NetCDF	11/2014 - 08/2016	OSI SAF	Ku-band
Scatsat-1	BUFR/NetCDF	01/2017 – 12/2020	OSI SAF	Ku-band
HY-2A	BUFR/NetCDF	06/2012 - 04/2015	OSI SAF	Ku-band
HY-2B	BUFR/NetCDF	01/2019 – 12/2020	OSI SAF	Ku-band
HY-2C	BUFR/NetCDF	11/2020 – 12/2020	OSI SAF	Ku-band
CFOSAT	BUFR/NetCDF	01/2019 – 12/2020	OSI SAF	Ku-band

Radiometer data availability (2010-2020)

Radiometers	FORMAT	PERIOD	SOURCE	FREQUENCY
SMOS	NetCDF-4	Full period	IFREMER	L-band
SMAP	Bytemap	04/2015 – 12/2020	REMSS	L-band
WindSat	Bytemap	01/2010 – 10/2020	REMSS	Channels (GHz): 6.8; 10.7; 18.7; 23.8; 37.0
AMSR2	Bytemap	07/2012 – 12/2020	REMSS	Channels (GHz): 6.93; 7.3; 10.65; 18.7; 23.8; 36.5; 89.0
SSMI / SSMIS	Bytemap	Full period	REMSS	Channels (GHz): 19.35; 23.235; 37.0; 85.5
GMI	Bytemap	03/2014 – 12/2020	REMSS	Channels (GHz): 10.65; 18.7; 23.8; 36.5; 89.0; 165.5; 183.31
TMI	Bytemap	01/2010 – 12/2014	REMSS	Channels (GHz): 10.65; 19.35; 21.3; 37.0; 85.5
AMSRE	Bytemap	01/2010 - 10/2011	REMSS	Channels (GHz): 6.93; 10.65; 18.7; 23.8; 36.5; 89.0