Towards an improved Ku-band pencil-beam scatterometer wind quality control under moist convection conditions

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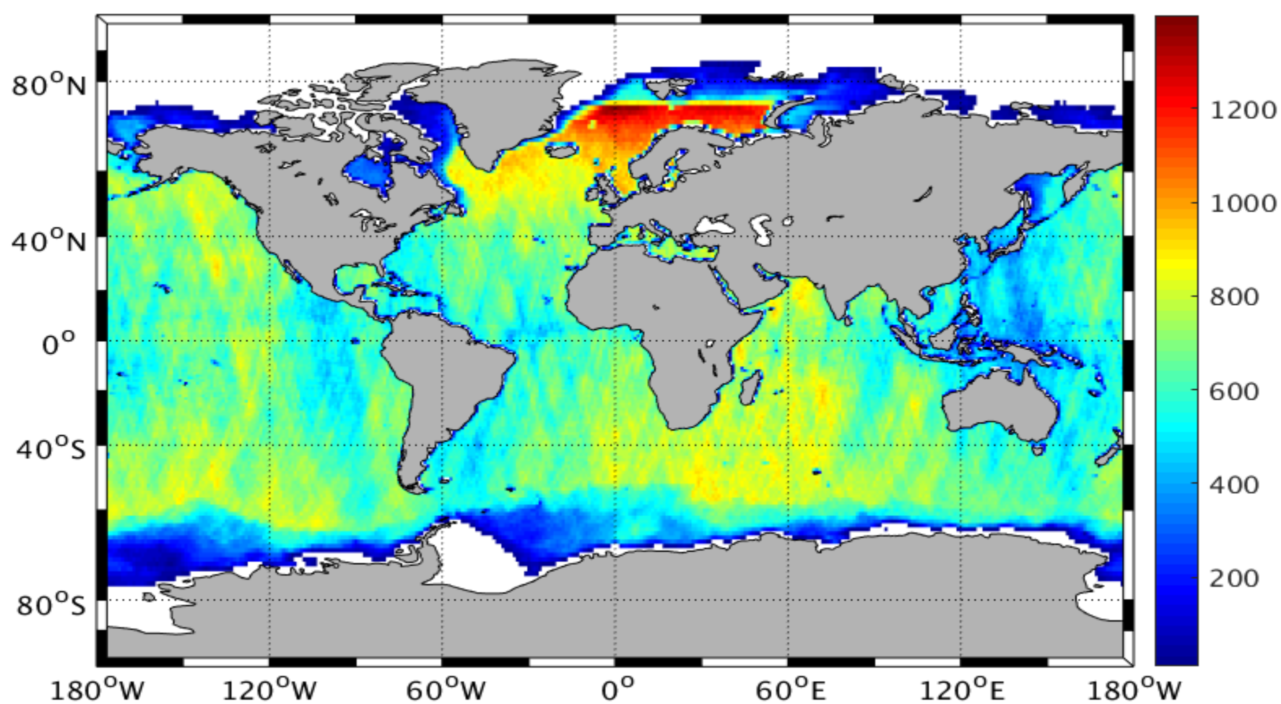
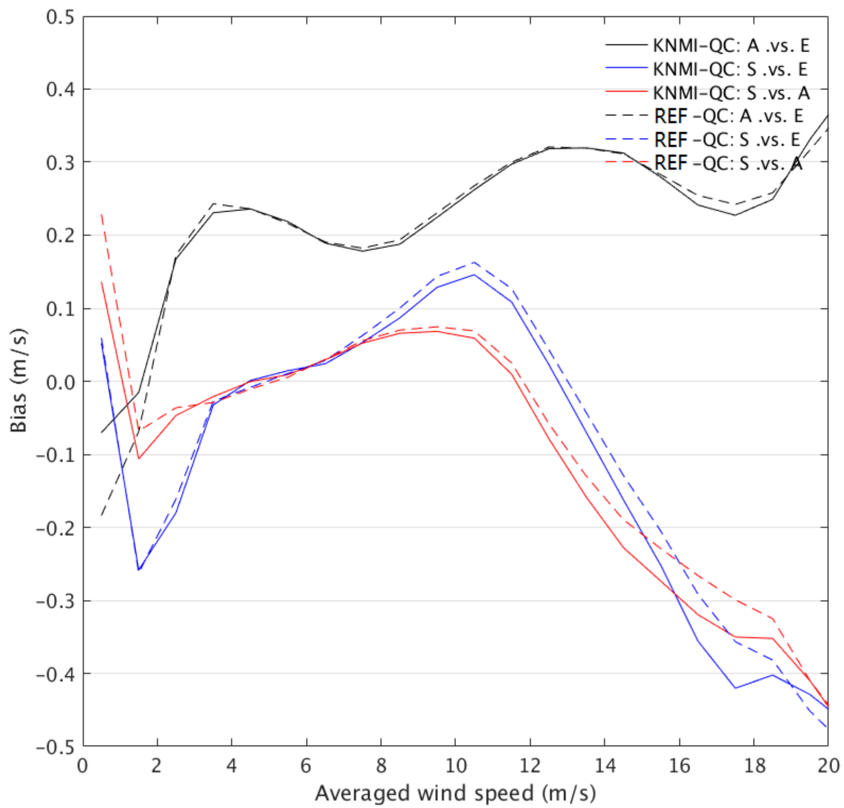
Data

1. 10 months (October'16 – July'17) of collocated ASCAT-A & SCATSat-1 25-km L2 winds.
2. SCATSat-1 winds are processed with PenWP from L2A v1.1.3 σ0 "egg" data, using **NSCAT-4** & **NSCAT-5** GMFs.
3. ASCAT winds are reprocessed with AWDP using **CMOD7** GMF.
4. Collocation criteria are within 30 min and 25 km distance lead to about 28 million collocs (26.6 million QC-accepted).
5. A GMI rain rate collocated dataset is also generated.



1. Analysis



Mean wind speed difference between ASCAT and ECMWF (black curve), SCATSat and ECMWF (blue curve), and SCATSat and ASCAT (red curve), as a function of the averaged wind speed of each pair of wind sources, with a binning of 1 m/s.

A speed-dependent bias correction is applied to ASCAT winds in order to match the C- and Ku-band speed distributions.

$$\Delta V_{SA} = \overline{V_S - V_A}(v)$$

$$V_A' = V_A + \Delta V_{SA}(V_A)$$

The remaining speed difference is investigated

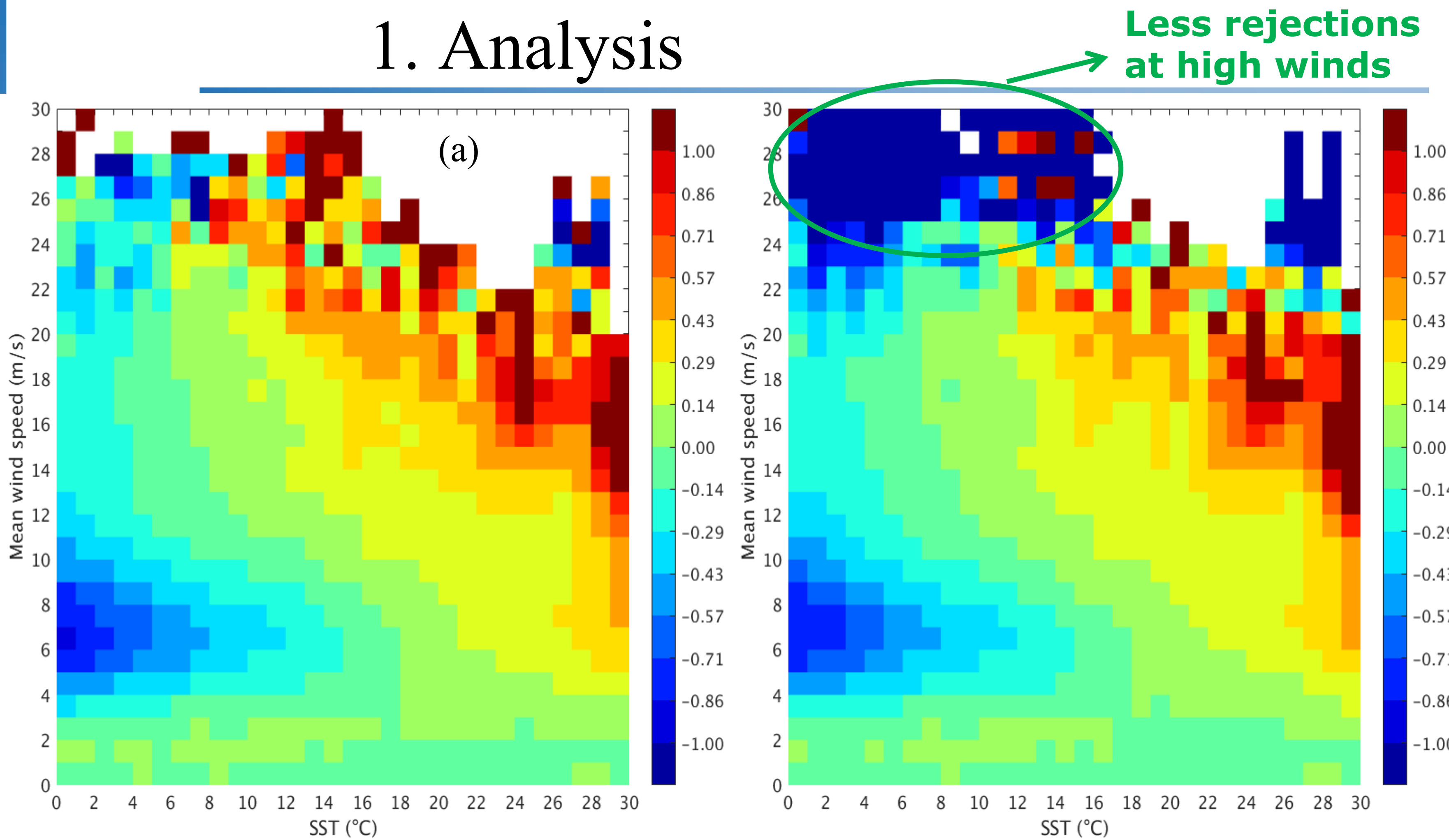
$$\Delta V_{SA}' = V_S - V_A'$$

REF-QC (86.9%):
MLE < 5 & A-S speed diff < 5 m/s

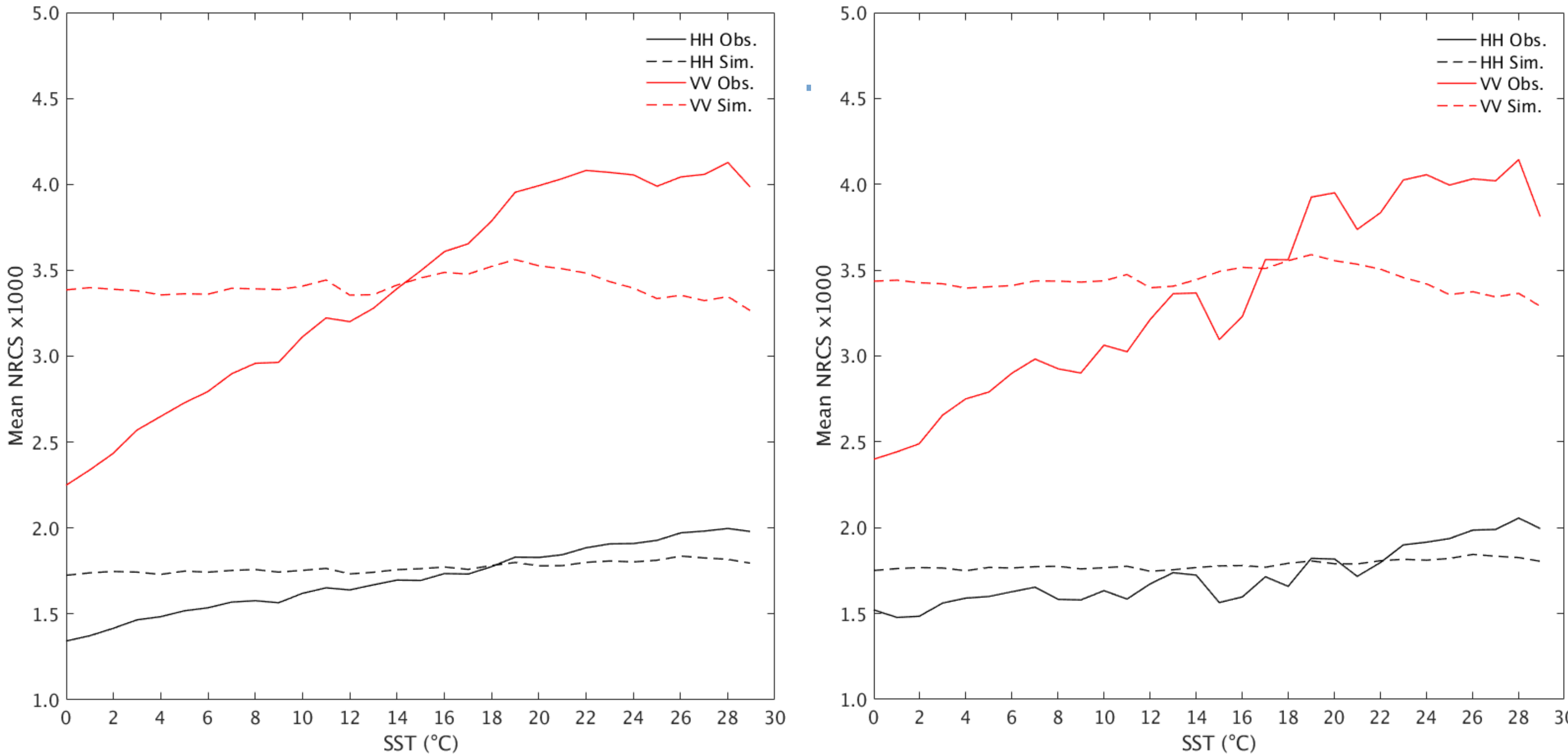
KNMI-QC (94.6%):
MLE thresholds only

RIGO-QC (75.6%):
MLE_Scatsat*0.3

1. Analysis

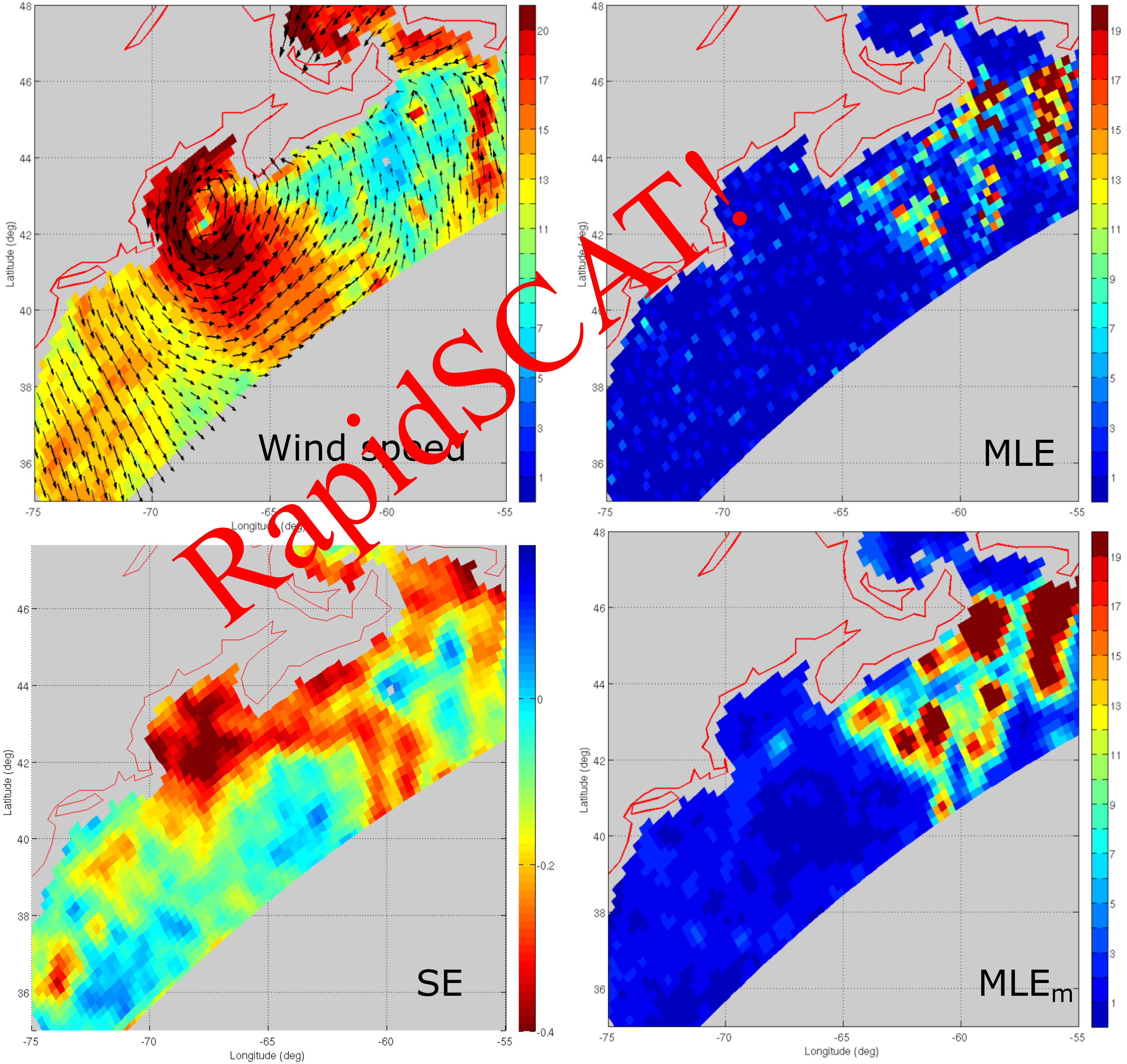


Mean wind speed difference (m/s) between SCATSat and ASCAT as a function of averaged wind speed and SST, for **REF-QC** (left) and **KNMI-QC** (right).



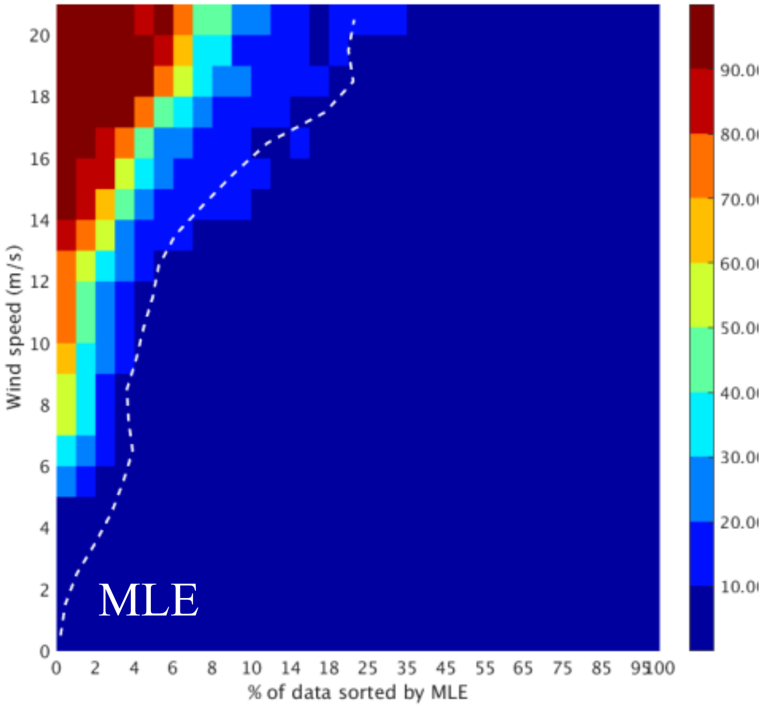
Mean observed and simulated NRCS (value times 1000) as a function of SST for wind speed of 5.5 m/s<*V*<6 m/s, for **REF-QC** (left) and **KNMI-QC** (right).

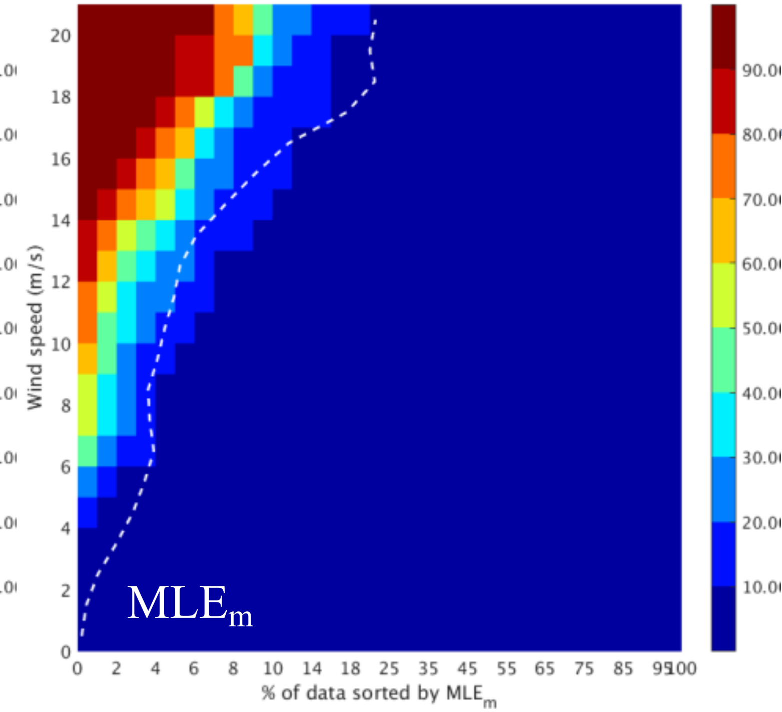
- ***KNMI-QC data show more irregularity due to more increased wind variability conditions***
- ***REF-QC appears a more effective filter for GMF development***

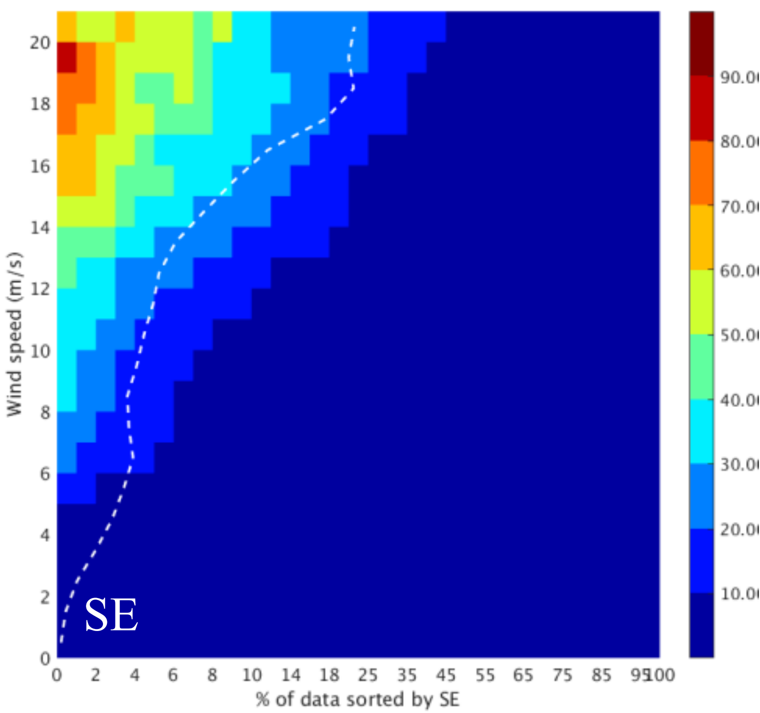


2	3	2
3	4	3
2	3	2

$$\ldots r)\rangle\big] + o\left(\frac{1}{\log r_0}\right)$$



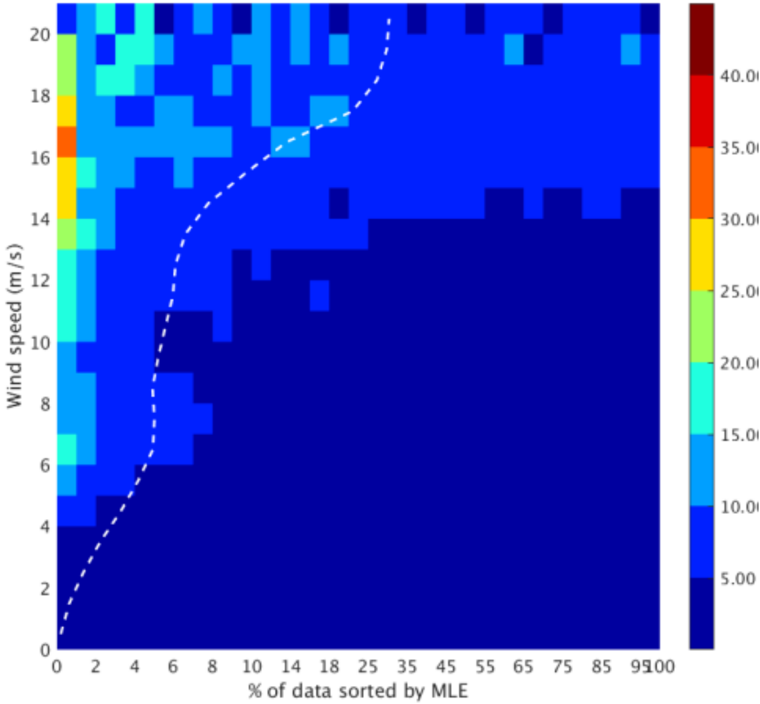


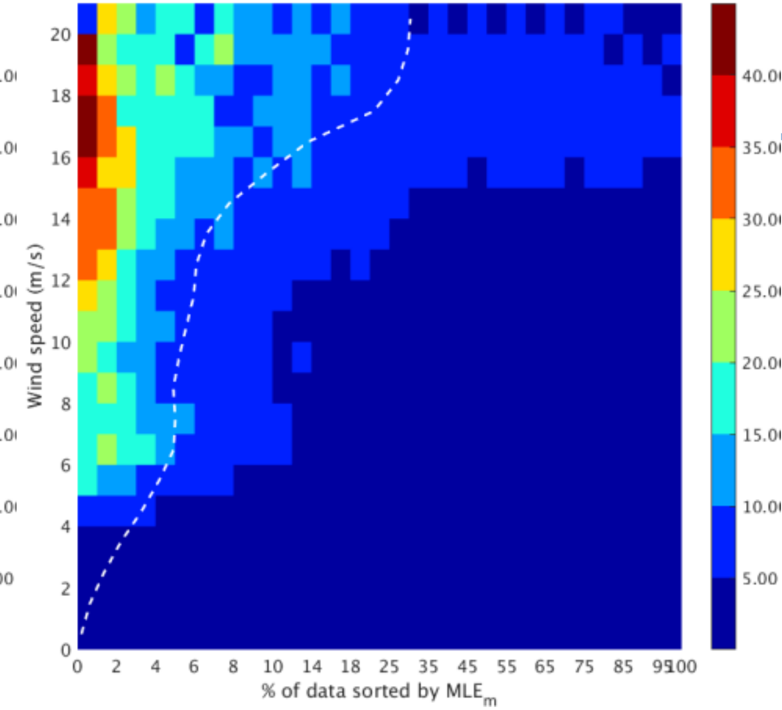


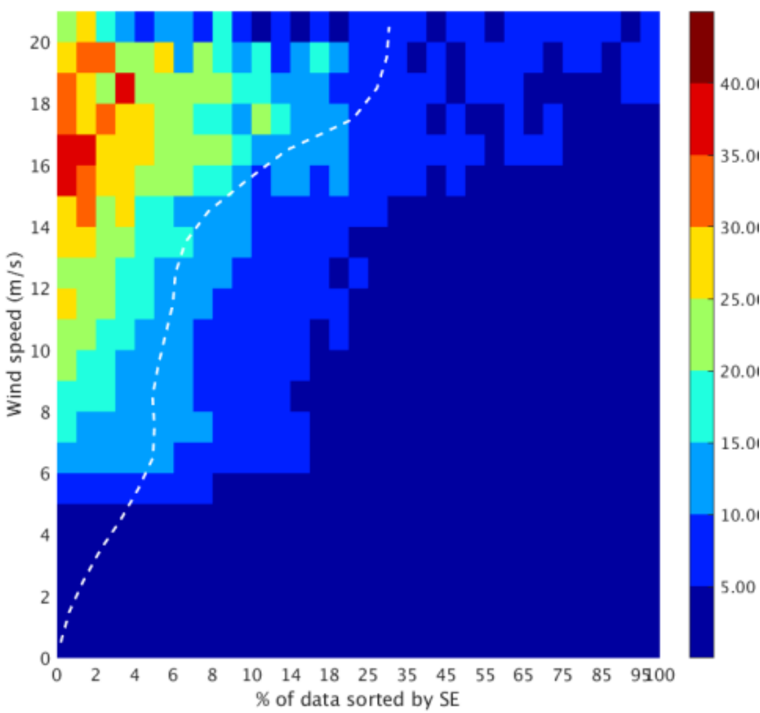
The probability of GMI RR> 1 mm/h as a function of wind speed and sorted MLE/MLE$_m$/SE bins @ **sweet swath region.**

White dashed curve--The operational MLE threshold

- MLEm & MLE more sensitive to rain than SE
- SE is more likely to sense wind variability rather than rain
- At nadir (not shown), the lack of azimuth diversity does somewhat impact rain identification, although the MLE(m) sensitivity to rain is still quite high



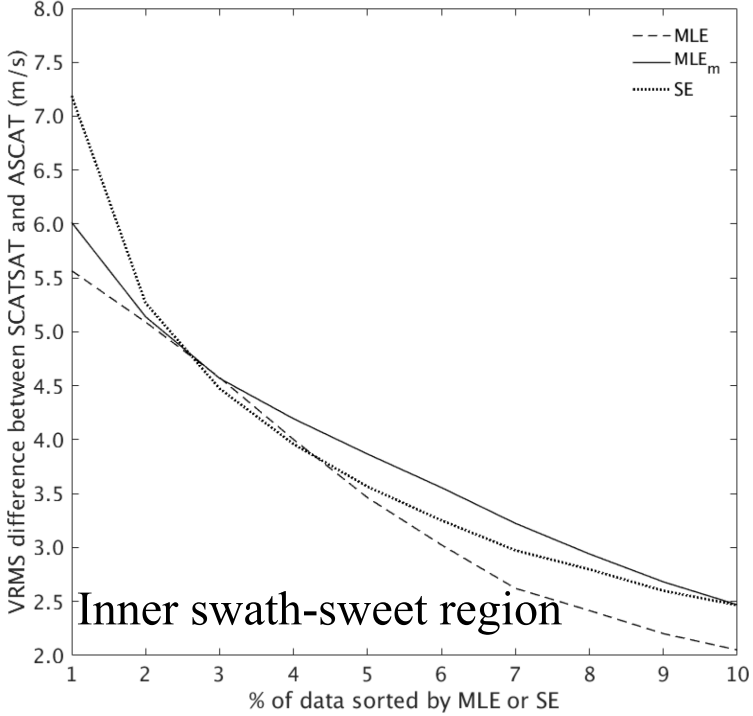


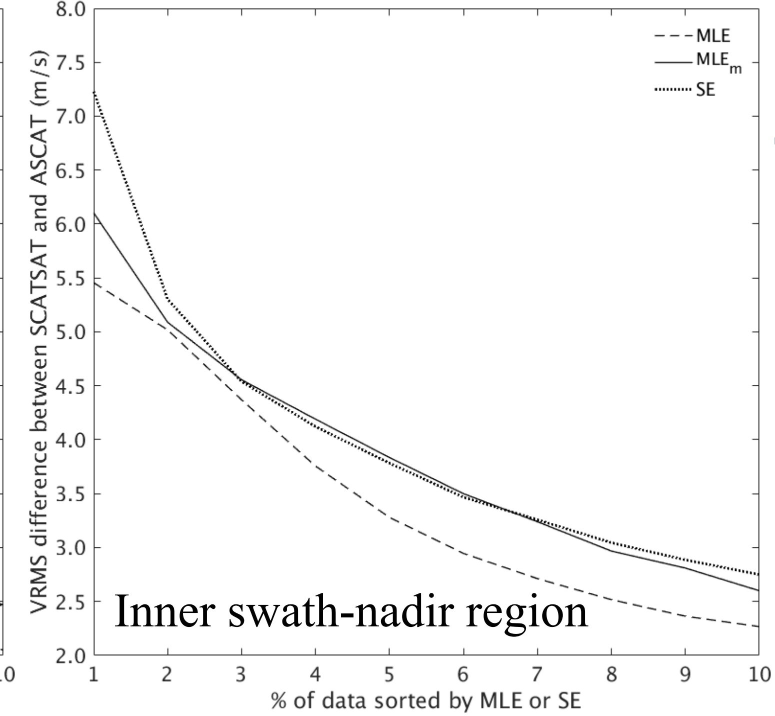


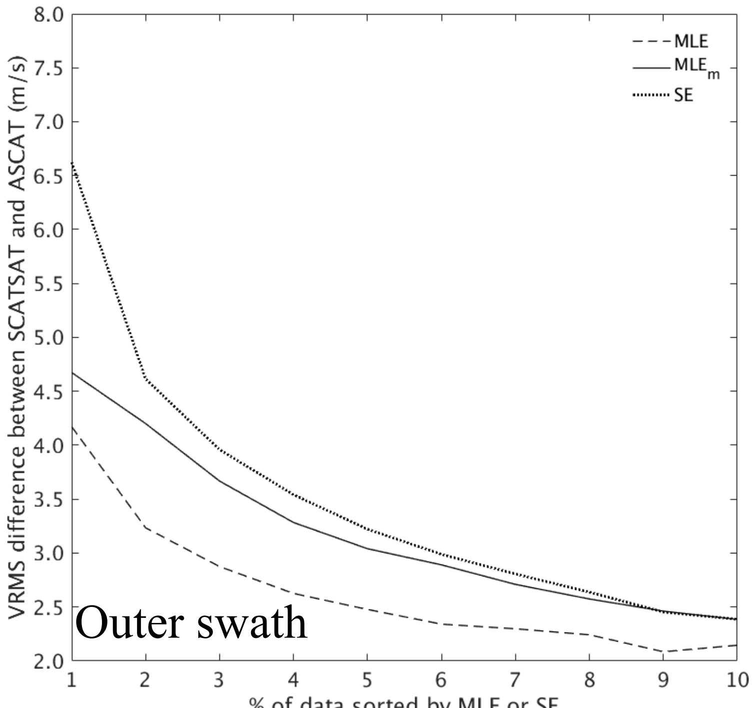
The probability of GMI RR> 1 mm/h as a function of wind speed and sorted MLE/MLE$_m$/SE bins @ **outer swath region.**

White dashed curve--The operational MLE threshold

- In general, much lower sensitivity to rain than for the inner (nadir + sweet) swath region
- SE more sensitive to rain than MLEm & MLE
- In the outer region, the lack of azimuth diversity does substantially impact rain identification







VRMS different between SCATSat and ASCAT as a function of the sorted bins of MLE, MLE$_m$ and SE.

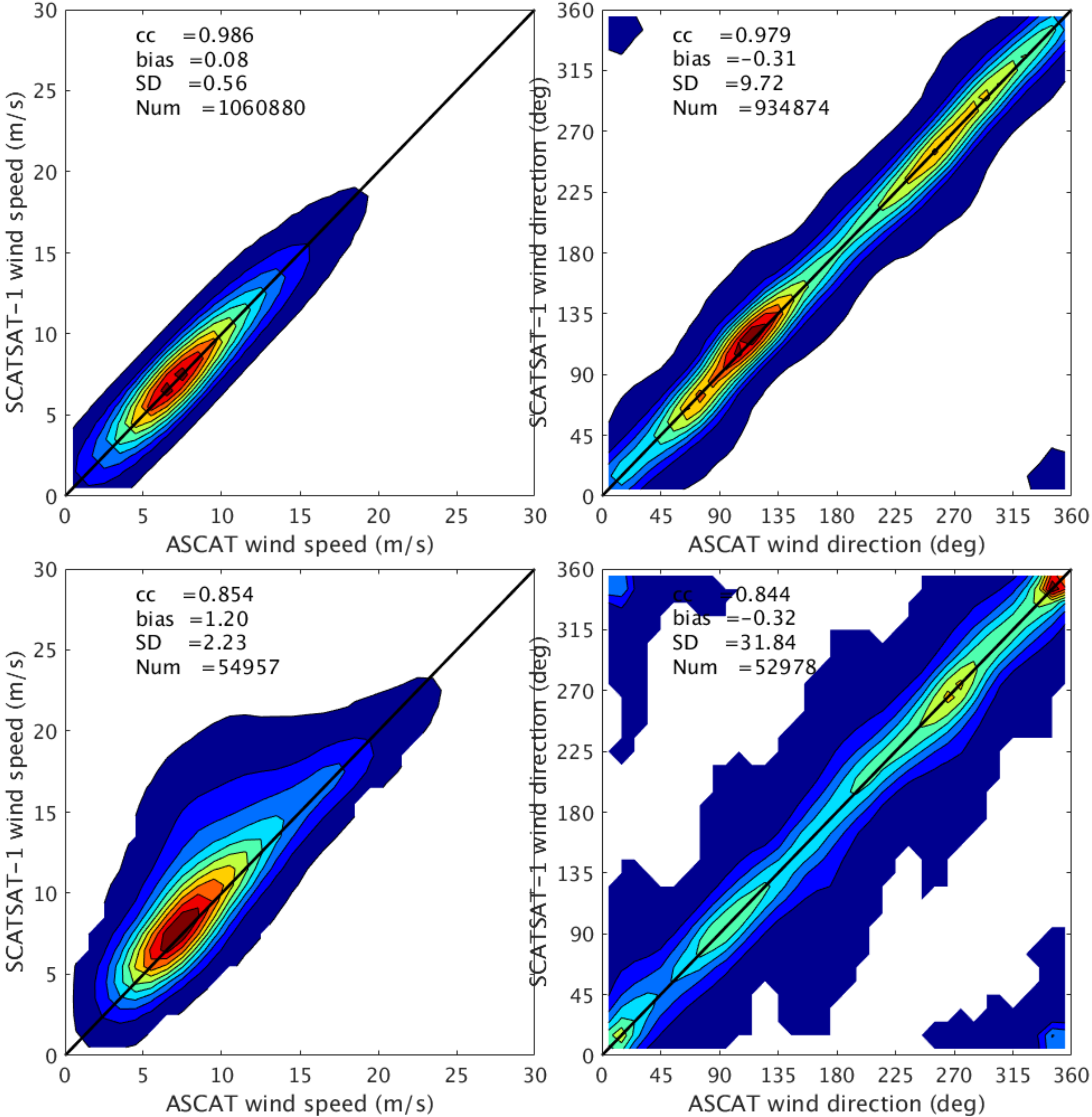
Inner swath : VV + HH
Outer swath: only VV

- All three indicators show high sensitivity to "wind quality" (i.e., largest discrepancies to ASCAT winds), SE being more sensitive than MLEm and MLE, particularly for the top 3% of data.

QC effectiveness (SCATSat-1 vs ASCAT)

Table 2. VRMS (m/s) difference between SCATSat-1 and ASCAT winds categorized by different QC methods and swath regions. The rejection ratio is shown in parenthesis.

Swath	MLE		MLE_m		SE	
	Accept	Reject	Accept	Reject	Accept	Reject
Sweet	1.48	4.65 (**5.0%**)	1.44	4.87 (**5.0%**)	1.36	5.14 (**5.3%**)
Nadir	1.84	4.57 (**5.6%**)	1.79	4.93 (**5.7%**)	1.73	5.31 (**5.9%**)
Outer	1.68	3.26 (**4.9%**)	1.60	3.82 (**4.9%**)	1.47	4.55 (**5.0%**)



SE QC-accepted

SE QC-rejected

Conclusions

- The sensitivity of different QC algorithms (which filter from 5.4% to 24.4% of data) to NSCAT-5 GMF development has been tested.
- Although the main GMF sensitivities do not significantly depend on QC, it is found that a stricter QC (REF-QC) is preferred for GMF development.
- Three different QC indicators (MLE, MLEm & SE) are used to improve the current operational QC.
- MLEm & MLE are in general more sensitive to rain than SE, except for the outer region.
- All QC indicators show lower sensitivity to rain in the outer region as compared to the sweet & nadir regions.

Conclusions

- SE turns out to be the most sensitive parameter to SCATSat vs ASCAT wind differences.

- Further work will focus on analyzing whether such SCATSat-ASCAT discrepancies are mainly due to poor quality SCATSat winds or to collocation errors… or to both (increased wind variability)

- A combination of MLE(m) & SE should lead to an optimized QC.