Towards an improved wind quality control for RapidScat

Wenming Lin

Marcos Portabella

Lin and Portabella, TGRS, in press

Wind quality indicators

1. MLE

$$MLE = \sum_{i}^{N} \frac{\left(\sigma^{0}_{mi} - \sigma^{0}_{si}\right)^{2}}{\left(K_{pi} \cdot \sigma^{0}_{mi}\right)^{2}}$$

2. Spatially averaged MLE

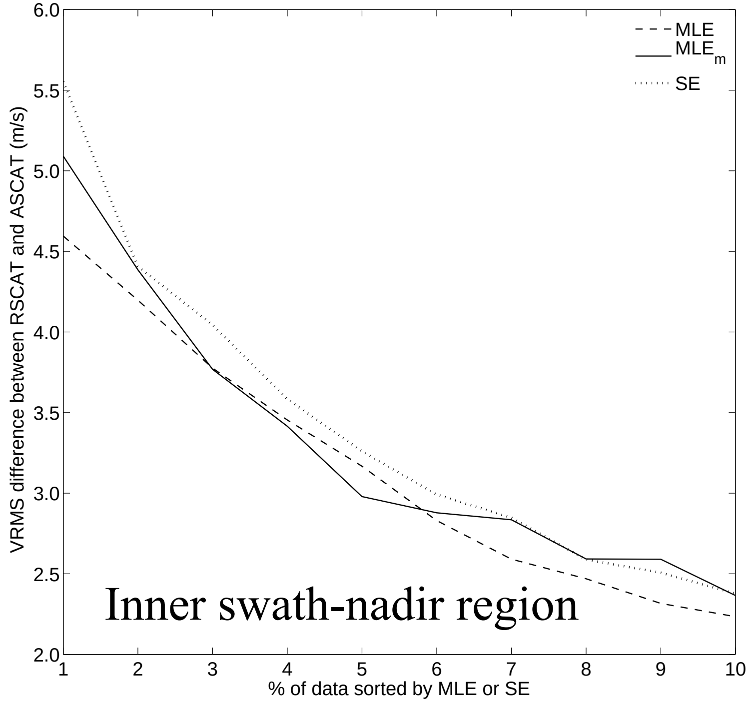
$$\mathrm{MLE}_{\mathrm{m}} = \frac{\sum_{i} w_i \mathrm{MLE}_i}{\sum_{i} w_i}$$

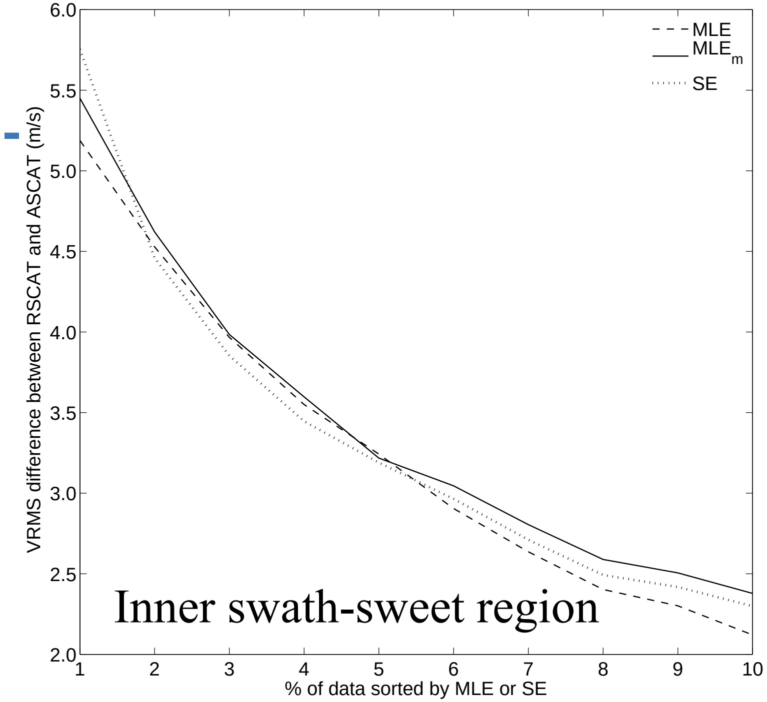
2	3	2
3	4	3
2	3	2

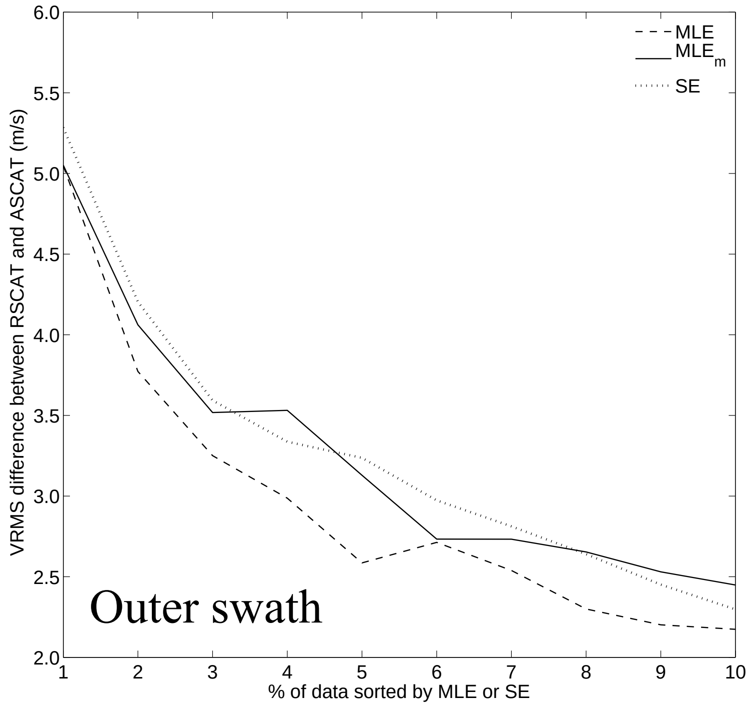
3. Singularity exponent

derived from (u,v, and MLE)

$$h(\mathbf{x}) = \frac{\log\left[\mathrm{T}_{\psi} \left\|\nabla s\right\|(\mathbf{x}, r) \big/ \left\langle \mathrm{T}_{\psi} \left\|\nabla s\right\|(\cdot, r)\right\rangle\right]}{\log r_0} + o\left(\frac{1}{\log r_0}\right)$$



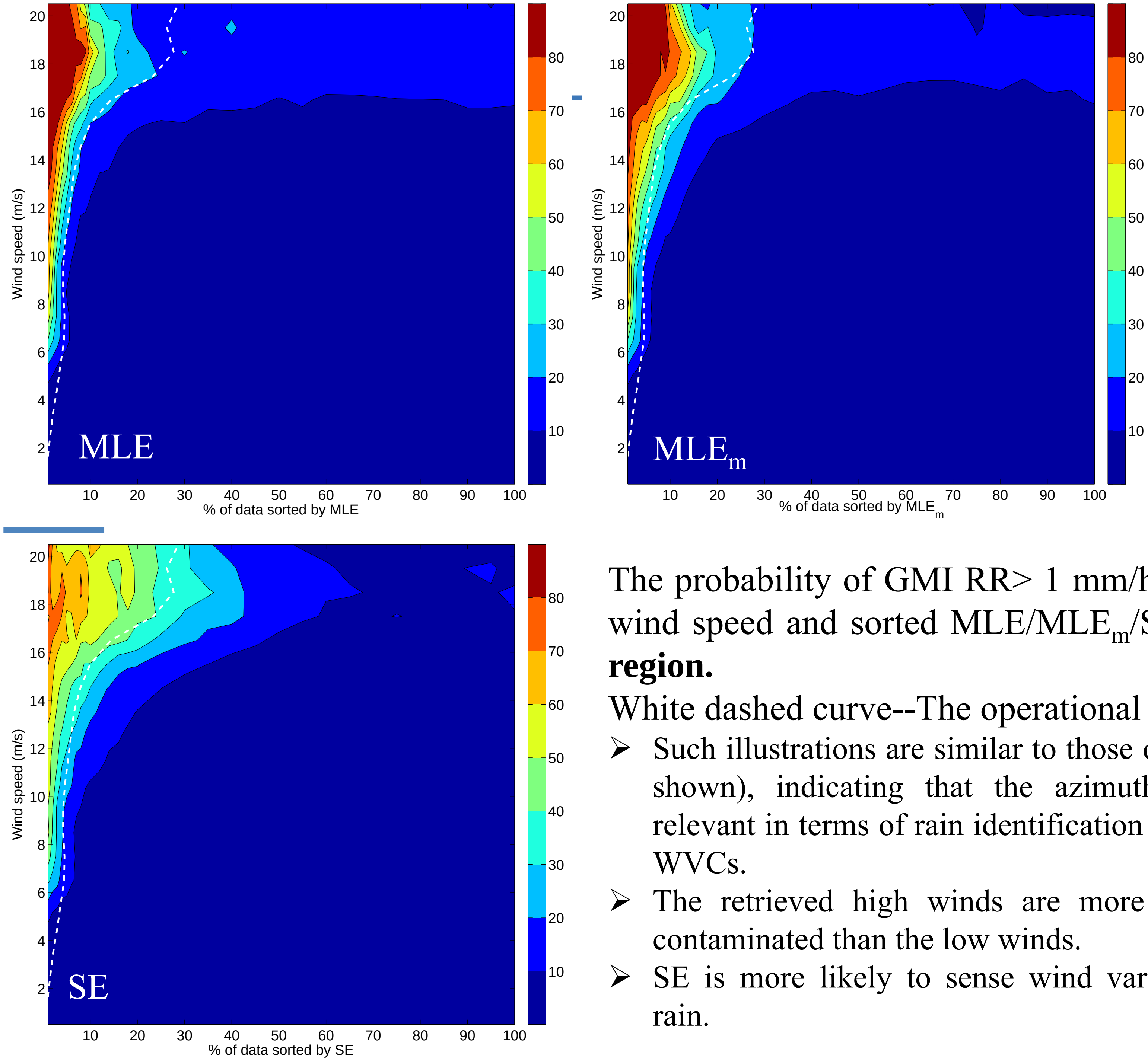




VRMS different between RSCAT and ASCAT as a function of the sorted bins of MLE, MLE_m and SE.

Inner swath : VV + HH
Outer swath: only VV

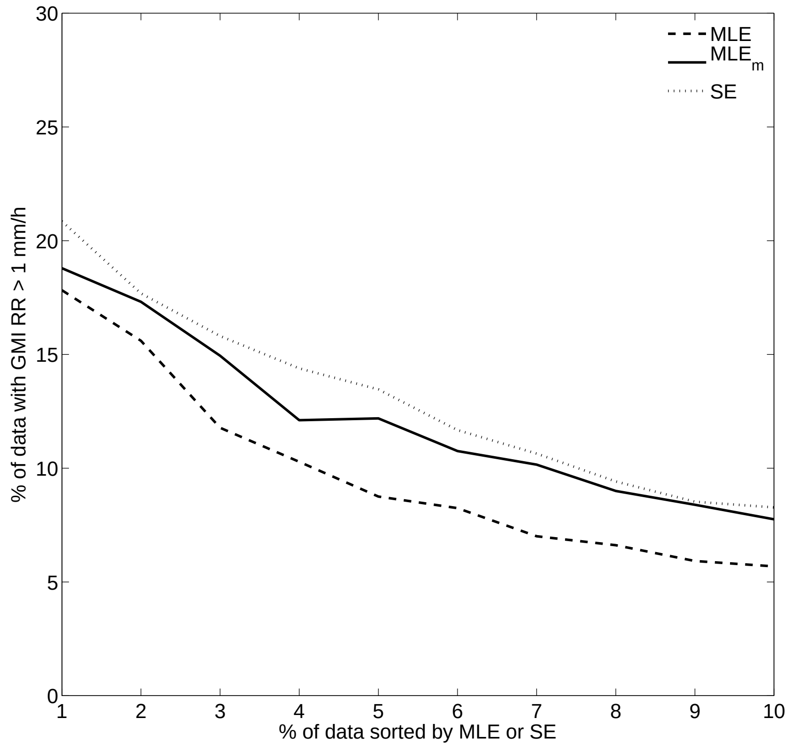
- For the sweet region, the three indicators show their highest sensitivity to wind quality, the MLE_m being slightly more sensitive than SE and MLE.
- For the nadir region and outer-swath WVCs, SE is generally the most effective indicator (particularly for the top 3% of data).



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

White dashed curve--The operational MLE threshold

- Such illustrations are similar to those of nadir region (not shown), indicating that the azimuth diversity is not relevant in terms of rain identification for the inner swath WVCs.
- The retrieved high winds are more likely to be rain contaminated than the low winds.
- SE is more likely to sense wind variability rather than rain.

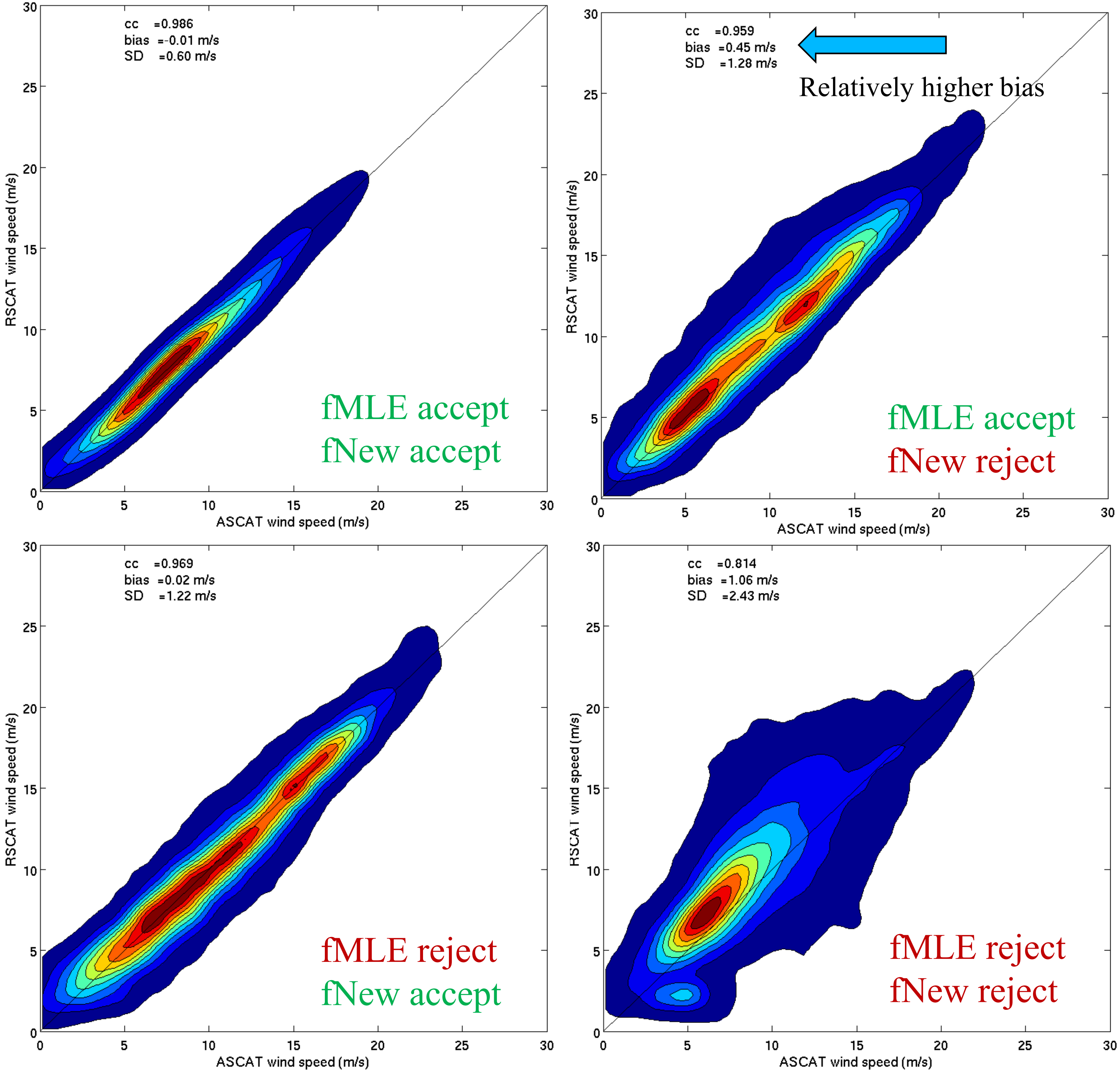


The probability of GMI RR> 1 mm/h as a function of the sorted percentiles by MLE (dashed curve), MLE_m (solid curve) and SE (dotted curve) @ **outer swath** WVCs.

For Ku-band scatterometer QC purposes, one may use MLE_m over the inner-swath WVCs and SE over the outer-swath WVCs.

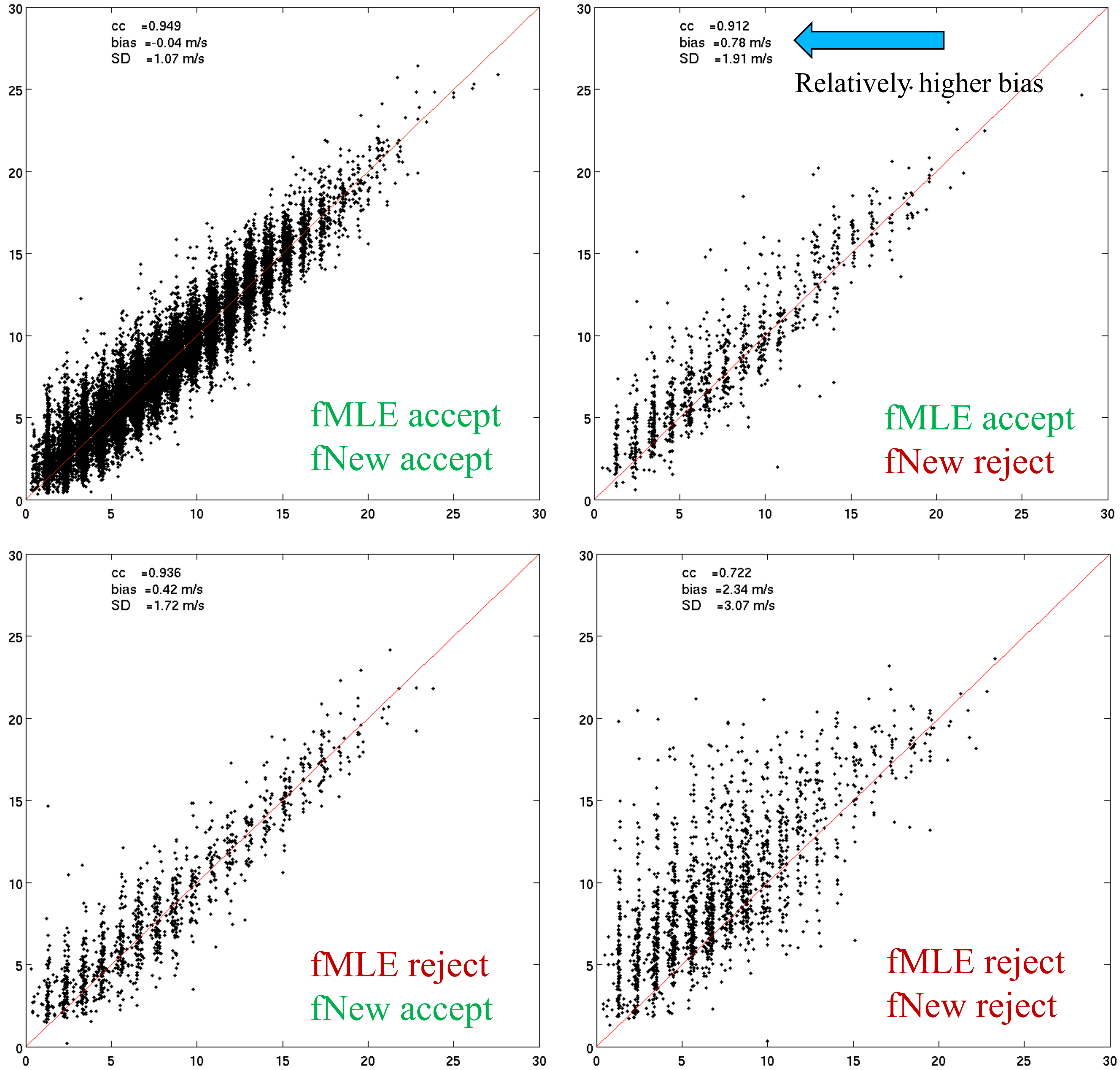
Statistics of RSCAT winds versus buoy winds for the different combinations of the PenWP MLE-based QC and the proposed QC (denoted as fNEW) flags.

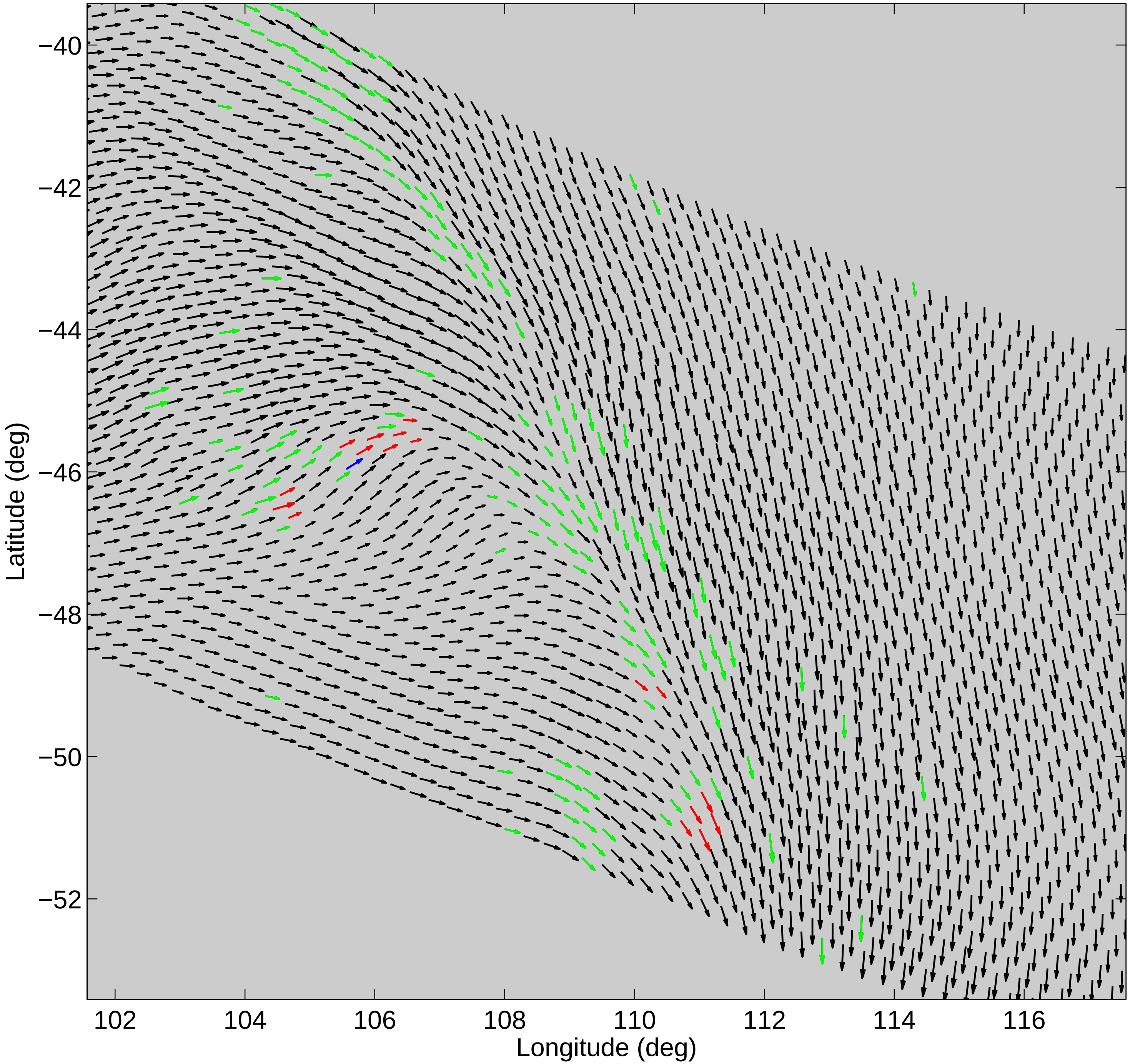
	New QC accept					New QC reject				
	B_s (m/s)	SD_s (m/s)	SD_d (°)	VRMS (m/s)	P (%)	B_s (m/s)	SD_s (m/s)	SD_d (°)	VRMS (m/s)	P (%)
Old QC accept	-0.04	1.07	18.1	2.25	91.0	0.73	1.86	33.6	4.43	2.4
Old QC reject	0.40	1.69	27.8	3.60	2.4	2.30	3.06	40.6	6.67	4.2



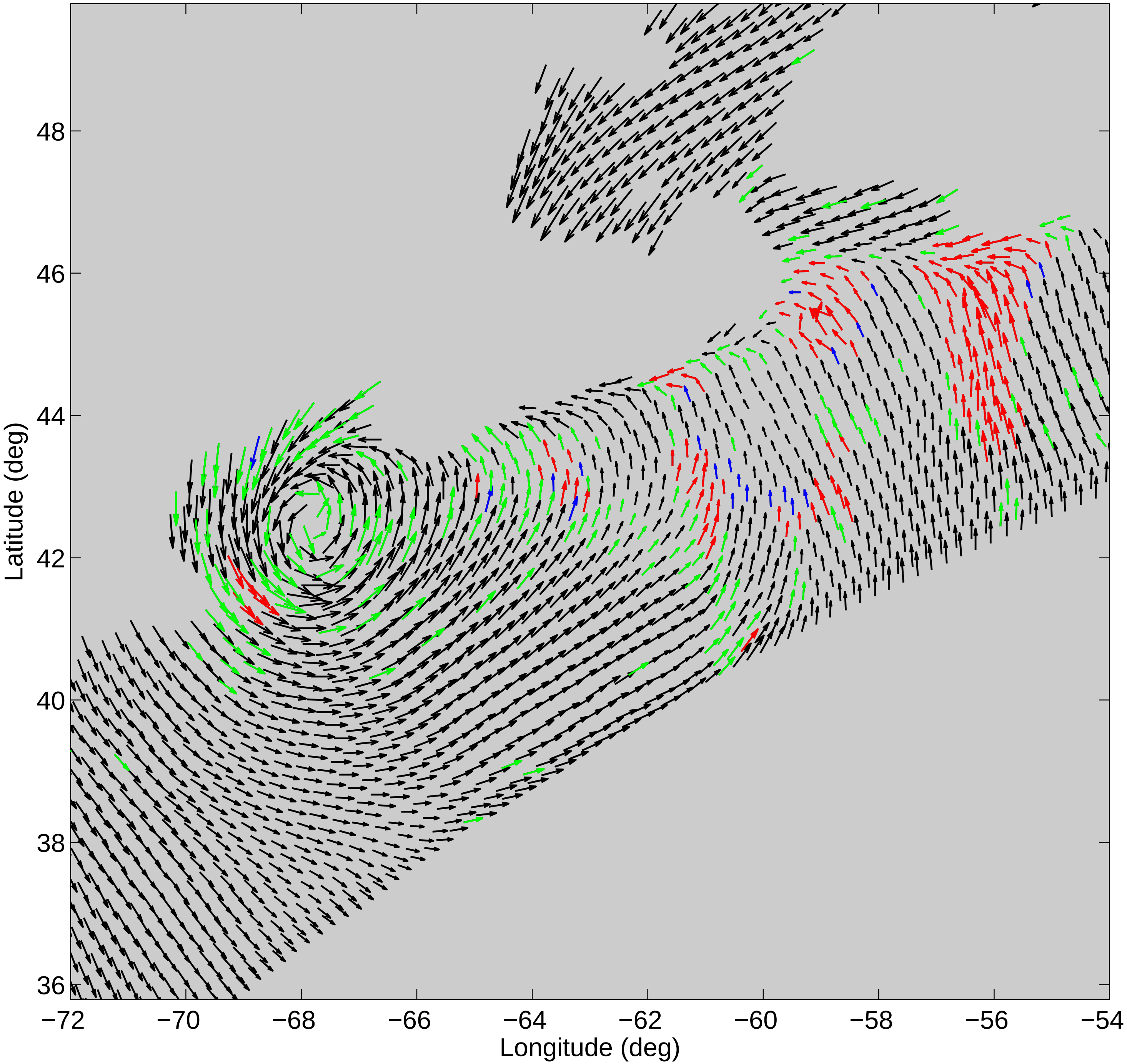
RSCAT vs ASCAT

RSCAT vs BUOY





−40
−42
−44
−46
−48
−50
−52
Latitude (deg)
102
104
106
108
110
112
114
116
Longitude (deg)



48
46
44
42
40
38
36
Latitude (deg)
−72
−70
−68
−66
−64
−62
−60
−58
−56
−54
Longitude (deg)

Conclusions

- RSCAT QC is revisited using collocated ASCAT winds as reference.
- MLEm and SE are more sensitive to wind quality than MLE
- MLEm is used in the inner swath, while SE is used in the outer swath.
- The new (MLEm/SE-based) QC is more effective than the old (MLE-based) QC both in terms of rain discrimination and increased wind variability detection.
- The new QC mitigates over-rejection of good-quality high winds (w.r.t. old QC)
- Further developments needed to reduce false alarm cases