Towards an improved wind quality control for RapidScat

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Lin and Portabella, TGRS, in press
Wind quality indicators

1. MLE

\[ MLE = \sum_{i}^{N} \left( \frac{\sigma_{mi} - \sigma_{si}}{K_{pi} \cdot \sigma_{mi}^0} \right)^2 \]

2. Spatially averaged MLE

\[ MLE_m = \frac{\sum_{i}^{N} w_i MLE_i}{\sum_{i}^{N} w_i} \]

3. Singularity exponent
derived from (u,v, and MLE)

\[ h(x) = \log \left[ \frac{T_{\psi} \| \nabla s \| (x, r)}{\langle T_{\psi} \| \nabla s \| (\cdot, r) \rangle} \right] + o \left( \frac{1}{\log r_0} \right) \]
VRMS difference 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), MLEₘ (solid curve) and SE (dotted curve) @ outer swath WVCs.

For Ku-band scatterometer QC purposes, one may use MLEₘ 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.

<table>
<thead>
<tr>
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<th>New QC accept</th>
<th>New QC reject</th>
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<tbody>
<tr>
<td></td>
<td>Bs (m/s)</td>
<td>SDs (m/s)</td>
</tr>
<tr>
<td>Old QC accept</td>
<td>-0.04</td>
<td>1.07</td>
</tr>
<tr>
<td>Old QC reject</td>
<td>0.40</td>
<td>1.69</td>
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</tbody>
</table>
RSCAT vs ASCAT

Relatively higher bias
RSCAT vs BUOY

- Relatively higher bias

- Scatter plots with correlation coefficients, bias, and standard deviation values:
  - Top left: cc = 0.943, bias = 0.04 m/s, SD = 1.07 m/s
  - Top right: cc = 0.912, bias = -0.26 m/s, SD = 1.91 m/s
  - Bottom left: cc = 0.931, bias = -0.42 m/s, SD = 1.72 m/s
  - Bottom right: cc = 0.722, bias = -2.34 m/s, SD = 3.07 m/s
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