Radiometer pointing accuracy assessment

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Method: assess \( Ta \) at land/ocean transitions

Good agreement of model/data at full land and full ocean locations for that example

⇒ There should be small impact of model uncertainty on relative levels during transitions

⇒ ‘Shift’ in front location due to pointing error?

⇒ Shift of about 1.5 sample (\( \sim 2 \text{ sec.} \sim 15 \text{ km} \)) between model & data

15 km difference due to uncertainty in land/sea mask for model?
Results: case study #1

Orbit on 21 Aug 2011 – 00:18:25 UTC to 00:20:25 UTC

Transition from ocean to land – ascending orbit
Method: simulate pointing error, search for ‘minimum difference’

- Land fraction: GSFC (blue dots) very similar to L2–computed (blue curve) [scaled]
- GSFC $T_a$ at front (red-dash) in good agreement with land fractions
- L2 ‘expected $T_a$’ (green) not a good metric at transition, computation do not integrate the mixed scene
- $T_a$ GSFC is scaled to match L2 at full land and full ocean
- Difference $T_a$ [L2 – GSFC_scaled] is large over the front (-28 K) because of position discrepancy

=> Introduce pointing error in GSFC simulation to find minimum difference over front
Method: simulate pointing error, search for ‘minimum difference’

Pointing errors introduced:

look angle (off nadir): -1.5° → +1.5°, steps 0.3°

azimuth angle: -2° → +2°, steps 0.4°

Mean absolute difference L2 – GSFC_scaled computed for a few points over the front, search for minimum of squared mean error at V- and H-pol
Results: all beams for case #1
Results: all beams, both polarizations

Pointing error computed per beam and per polarization (green curve) gives slightly better results than computation for all beams/all polarizations (red curve).
Results: the ugly truth

<table>
<thead>
<tr>
<th></th>
<th>beam 1 H-pol/V-pol</th>
<th>beam 2 H-pol/V-pol</th>
<th>beam 3 H-pol/V-pol</th>
<th>All Beams both pol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min error (K)</td>
<td>1.94/1.61</td>
<td>1.34/0.63</td>
<td>0.69/0.72</td>
<td>2.21</td>
</tr>
<tr>
<td>Look angle error (°)</td>
<td>1.5/0.9</td>
<td>0.9/1.2</td>
<td>1.2/0.6</td>
<td>0.6</td>
</tr>
<tr>
<td>Azimuth angle error (°)</td>
<td>1.6/2.0</td>
<td>0.8/-0.4</td>
<td>2.0/1.2</td>
<td>1.6</td>
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Results are not consistent from beam to beam and across polarizations
Results: ‘mapping’ of the error

Beam 1  H-pol
azimuth error = -2°

Beam 3  H-pol

Beam 1  V-pol
azimuth error = +2°

Beam 3  V-pol

Look angle error (°)

Look angle relatively poorly constrained
negative azimuth error very unlikely for beam 1 & 3
Results: case study #2

Orbit on 21 Aug 2011 – 00:54:00 UTC to 00:58:00 UTC

Transition from land to ocean – descending orbit
Results: all beams for case #2

In that case, the model does poor at simulating land $Ta$ (more than a constant bias issue)

=> Comparison model/data to locate the front are less accurate
## Results: both cases

<table>
<thead>
<tr>
<th>Case 1</th>
<th>beam 1 H-pol/V-pol</th>
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<table>
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<tr>
<th>Case 2</th>
<th>beam 1 H-pol/V-pol</th>
<th>beam 2 H-pol/V-pol</th>
<th>beam 3 H-pol/V-po</th>
<th>All Beams both pol</th>
</tr>
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<tr>
<td>Min error (K)</td>
<td>0.69/1.36</td>
<td>1.61/1.26</td>
<td>4.50/2.72</td>
<td>2.07</td>
</tr>
<tr>
<td>Look angle error (°)</td>
<td><strong>0.6/0.9</strong></td>
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<tr>
<td>Azimuth angle error (°)</td>
<td>-2.0/0.0</td>
<td>-1.6/-1.2</td>
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Results: ‘mapping’ of the error for case #2

Minimum error was found for azimuth = 0°, but results for other azimuths are very close.

The results for beam 3 being never close to 0 illustrate that the comparisons need to account for model inaccuracies.

Conclusion:
Can the inclusion of more fronts with different geometry coastline vs FOV better constrain solution and improve consistency?