Aquarius Cold Sky Calibration

Emmanuel Dinnat
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Motivations for Cold-Sky Calibration (CSC)

• Objective:
  • Check validity of ocean calibration over large Tb dynamic range
  • Provide calibration largely independent of ocean model

• Limitation
  – not independent of antenna pattern model
  – different geometry than nominal data acquisition
  – just a few minutes of data every few months (limits temporal drift assessment)
  – about 0.5K uncertainty in Sky Tb
Cold Sky Calibration at a glance

Nominal mode

~3K * 4%

~100K * 96%

CSC mode

~3K * 97%

~100K * 3%

Spacecraft 180 deg pitch

Ocean

Earth FOV limit

Land
Actual CSC
March 2012 – December 2012

Pointing to calm/homogeneous Sky + Ocean under spacecraft (lower $T_b$, more precise, less RFI compared to land)
‘Early’ pseudo-CSC
September 2011 – October 2011

Pointing to calm/homogeneous Sky on Sept 16 & 17

Land with relatively precise Tb and low RFI under spacecraft
Example of Ta during a CSC maneuver

- Cold bias of a few K over Sky after ocean calibration
- Bias depends on antenna gain pattern model

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<tr>
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<th>Scale-Model</th>
<th>GRASP 2012</th>
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<tbody>
<tr>
<td></td>
<td>V-pol</td>
<td>H-pol</td>
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<tr>
<td>B1</td>
<td>-1.71</td>
<td>-1.40</td>
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<tr>
<td>B2</td>
<td>-1.51</td>
<td>-2.09</td>
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<tr>
<td>B3</td>
<td>-1.70</td>
<td>-1.26</td>
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<tr>
<td></td>
<td>B1</td>
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<td></td>
<td>-2.37</td>
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<td>-2.76</td>
<td>-3.06</td>
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Pitch = 180°
Time variation of ocean bias

2 major time drift components:

1. Exponential decrease = -0.75K over first few months

2. Months-scale offset/wiggles of +/- 0.1K

Residual in ocean bias after both exponential and offset corrections
Time variation of Cold Sky bias

CSC bias varies within ~0.1K
⇒ supports 0.75K exponential correction from 09/2011 to 03/2012
⇒ supports offset/wiggles correction?

CSC bias varies within ~0.4K
⇒ similar as corrections
Conclusions

• Ocean calibration results in a few K cold bias at the low end of Ta’s

• Temporal variation of cold Sky bias supports correction for large exponential drift at beginning of the mission (note: using less reliable pseudo-CSC data)

• Temporal variation of cold Sky bias & offset/wiggles = inconclusive

• 1K uncertainty due to antenna pattern model
  – Use ocean/land transitions to assess antenna spillover