JPSS1 ATMS Thermal Vacuum Calibration Early Results

2014 STAR JPSS Science Team Meeting

Kent Anderson, Edward Kim, and Otto Bruegman

with contributions from Joseph Lyu, Vince Leslie, and Hemanshu Patel

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JPSS1 ATMS Instrument Calibration Test Profiles

- Testing performed for 4 redundancy configurations at each calibration step
- For each calibration step, 278 scans of data processed to yield 271 scans of derived accuracy data

<table>
<thead>
<tr>
<th>Scene Temperature</th>
<th>330 K</th>
<th>305 K</th>
<th>280 K</th>
<th>255 K</th>
<th>230 K</th>
<th>205 K</th>
<th>180 K</th>
<th>155 K</th>
<th>130 K</th>
<th>105 K</th>
<th>95 K</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gain Fluctuation Test</td>
<td>305K</td>
<td>305K</td>
<td>280K</td>
<td>255K</td>
<td>230K</td>
<td>205K</td>
<td>155K</td>
<td>130K</td>
<td>105K</td>
<td>95K</td>
<td></td>
</tr>
<tr>
<td>Hysteresis Test (repetition of 305 K and 130K levels, after downward transition)</td>
<td>305K</td>
<td>305K</td>
<td>280K</td>
<td>255K</td>
<td>230K</td>
<td>205K</td>
<td>155K</td>
<td>130K</td>
<td>105K</td>
<td>95K</td>
<td></td>
</tr>
</tbody>
</table>

Baseplate Temperature:
- **Mid**
  - V-shelf at +16.6° C
  - Cold Plate at +7.7° C
- **High**
  - V-shelf at +26.9° C
  - Cold Plate at +18.5° C
- **Low**
  - V-shelf at +6.2° C
  - Cold Plate at -3.1° C
JPSS1 ATMS NEDT Performance

- Worst Case of 4 Redundancy Configurations
- Scene temperature at 300 K

- Waiver request will be submitted for Channel 17 NEDT
- All other channels compliant
JPSS1 ATMS NEDT Performance

- Worst Case of 4 Redundancy Configurations
- Scene temperature interpolated to 300 K
JPSS1 ATMS On-Orbit Accuracy

- Worst Case of 4 Redundancy Configurations
- All channels compliant
Radiometric Transfer Functions

Channel 1 Accuracy vs Scene Temperature, +7.7C Coldplate

- RC1 Accur
- RC2 Accur
- RC5 Accur
- RC6 Accur
- RC1 Accur Hyst.
- RC2 Accur Hyst.
- RC5 Accur Hyst
- RC6 Accur Hyst
- Poly. (RC1 Accur)
- Poly. (RC2 Accur)
- Poly. (RC5 Accur)
- Poly. (RC6 Accur)

Channel 2 Accuracy vs Scene Temperature, +7.7C Coldplate

- RC1 Accur
- RC2 Accur
- RC5 Accur
- RC6 Accur
- RC1 Accur Hyst.
- RC2 Accur Hyst.
- RC5 Accur Hyst
- RC6 Accur Hyst
- Poly. (RC1 Accur)
- Poly. (RC2 Accur)
- Poly. (RC5 Accur)
- Poly. (RC6 Accur)

Channel 3 Accuracy vs Scene Temperature, +7.7C Coldplate

- RC1 Accur
- RC2 Accur
- RC5 Accur
- RC6 Accur
- RC1 Accur Hyst.
- RC2 Accur Hyst.
- RC5 Accur Hyst
- RC6 Accur Hyst
- Poly. (RC1 Accur)
- Poly. (RC2 Accur)
- Poly. (RC5 Accur)
- Poly. (RC6 Accur)

Channel 4 Accuracy vs Scene Temperature, +7.7C Coldplate

- RC1 Accur
- RC2 Accur
- RC5 Accur
- RC6 Accur
- RC1 Accur Hyst.
- RC2 Accur Hyst.
- RC5 Accur Hyst
- RC6 Accur Hyst
- Poly. (RC1 Accur)
- Poly. (RC2 Accur)
Radiometric Transfer Functions (cont.)

Channel 5 Accuracy vs Scene Temperature, +7.7C Coldplate

Channel 6 Accuracy vs Scene Temperature, +7.7C Coldplate

Channel 7 Accuracy vs Scene Temperature, +7.7C Coldplate

Channel 8 Accuracy vs Scene Temperature, +7.7C Coldplate
Radiometric Transfer Functions (cont.)

Channel 9 Accuracy vs Scene Temperature, +7.7C Coldplate

Channel 10 Accuracy vs Scene Temperature, +7.7C Cold Plate

Channel 11 Accuracy vs Scene Temperature, +7.7C Coldplate

Channel 12 Accuracy vs Scene Temperature, +7.7C Coldplate
Radiometric Transfer Functions (cont.)

Channel 13 Accuracy vs Scene Temperature, +7.7°C Coldplate

Channel 14 Accuracy vs Scene Temperature, +7.7°C Coldplate

Channel 15 Accuracy vs Scene Temperature, +7.7°C Coldplate

Channel 16 Accuracy vs Scene Temperature, +7.7°C Coldplate
Radiometric Transfer Functions (cont.)

Channel 17 Accuracy vs Scene Temperature, +7.7C Coldplate

Channel 18 Accuracy vs Scene Temperature, +7.7C Coldplate

Channel 19 Accuracy vs Scene Temperature, +7.7C Coldplate

Channel 20 Accuracy vs Scene Temperature, +7.7C Coldplate
• Consistency between 4 redundancy configurations
  • Indicator of measurement repeatability
  • Feasible to use one set of curves for all 4 redundancy cases
Lunar Intrusion Alternate Scheme

Get actual cold space obs by changing to an uncontaminated scan profile (SP #1 -> #4) during LI. Example LI case below. The data outside the yellow ticks are good SV data. The dashed line is treated as previously good SV, which is adopted to replace the contaminated SV data. Note the TB offset that could result unless gain variations can be predicted.

All 4 Ch 1 SV pixels are LI contaminated between yellow tick lines. Note that the SV counts did not return to the level prior to LI (due to random gain changes).
Remarks on Alternate LI Mitigation

• Switching scan profiles has already been done on orbit with S-NPP, and can be done over polar regions to minimize impact.
• Losing a few scans over the polar region is better than the worst LI correction cases, which could last for 25 min or longer.
• Since contaminated obs are replaced by un-contaminated actual obs, there should be no additional error.
• During commissioning, after switching between SP #1 and #4, no bias was found.
• This LI mitigation approach by switching between different SPs should work for all ATMS 22 channels. Namely, with proper SP selection (when applicable), there should be sufficient number of SV pixels that can be used for producing the SDR product uncontaminated by LI.
Inter-channel Correlation Coefficients

Correlation Coefficients of (left) AMSU-A1 and (right) ATMS Channel Gains.
NEDT for J-1 and NPP at Mid Cold Plate
Temp Interpolated to 300K
“Striping”

• All microwave imagers exhibit striping at some level—e.g., evidence is now being found of striping on AMSU, MHS, etc.—yet no NWP users saw striping-related issues with forecasts that used AMSU, MHS, etc data.

• The striping observed with S-NPP ATMS is not exceeding any hardware specs.

• Even so, ground processing changes (averaging) are being considered to somewhat reduce the existing striping. Such changes can be applied to S-NPP & J1-J3 ATMS without requiring any hardware changes.

• NWP users must therefore demonstrate the quantitative impact on forecasts from ATMS striping before any hardware changes can be considered. Even then the timeframe would be J4+.