Aqua MODIS Performance Review for Atmosphere Group

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# MODIS Performance

<table>
<thead>
<tr>
<th>Performance Issue</th>
<th>Terra</th>
<th>Aqua</th>
</tr>
</thead>
<tbody>
<tr>
<td>Band 26 Striping and elevated background signal</td>
<td>Correction in L1B now in place for Collect 4.</td>
<td>No Improvement Correction will be necessary</td>
</tr>
<tr>
<td>S/MWIR Electronic Crosstalk</td>
<td>An ongoing issue</td>
<td>Improved (reduced but not eliminated)</td>
</tr>
<tr>
<td>PC LWIR Band Optical Leak</td>
<td>Corrected in L1B; 1-2% uncertainty</td>
<td>Fixed during prelaunch</td>
</tr>
<tr>
<td>Detector Striping</td>
<td>Exists in several thermal IR bands</td>
<td>Improved</td>
</tr>
</tbody>
</table>
## MODIS Performance cont.

<table>
<thead>
<tr>
<th>Performance Issue</th>
<th>Terra</th>
<th>Aqua</th>
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</thead>
<tbody>
<tr>
<td>5um thermal leak into SWIR</td>
<td>Small influence; Effectively Corrected in L1B</td>
<td>Improved; Correction in L1B TBD</td>
</tr>
<tr>
<td>SWIR Band Subsample Departure</td>
<td>On going issue No on-orbit correction</td>
<td>Much Improved</td>
</tr>
<tr>
<td>Noisy Detectors</td>
<td>Several in LWIR CO2 bands, one in B24, 25, 27, 28,30</td>
<td>Much Improved (B36 chan 5)</td>
</tr>
<tr>
<td>Saturation in Band 2</td>
<td>Saturation on thick water cloud, sunglint regions</td>
<td>Slightly Worse (lower saturation level)</td>
</tr>
<tr>
<td>Performance Issue</td>
<td>Terra</td>
<td>Aqua</td>
</tr>
<tr>
<td>-------------------------------------------------------</td>
<td>-------------------------------</td>
<td>-----------------------------------------</td>
</tr>
<tr>
<td>Scan Mirror reflectance vs. angle of incidence</td>
<td>Ongoing issue.</td>
<td>Much Improved Good prelaunch characterization</td>
</tr>
<tr>
<td>Dead detectors in SWIR bands</td>
<td>None</td>
<td>B6 severely impacted; B5 has one dead detector</td>
</tr>
</tbody>
</table>
Other Aqua MODIS Calibration Considerations

• Currently using pre-launch calibration coefficients. These will be updated with on-orbit calibration (BB warmup/cooldown, SD) in upcoming LUT.

• Co-registration between focal planes seems stable. Cold to warm focal plane offset is about 0.3 km.

• B31 (11um) and B32 (12um) prelaunch calibration is essentially invalid. Proceeding with linear calibration until the LUT update.
SMWIR Electronic Crosstalk

Skinny:
Reduced but not eliminated on Aqua
Terra MODIS
June 25, 2002
1750 UTC
Band 26
Terra MODIS
June 25, 2002
1750 UTC
Band 5
Electronic Xtalk in Aqua MODIS SWIR

June 25, 2002; 2100 UTC

Dashed lines - Terra
Aqua MODIS
June 25, 2002
2100 UTC
Band 20
Electronic Xtalk in Aqua MODIS MWIR

June 25, 2002; 2100 UTC

Scene Temperature (K)

Along Track Line Counter

- B20
- B22
- B23 (2 frame offset)
- B22 (5 frame offset)
PC LWIR Optical Leak

Skinny:
Effectively eliminated on Aqua
PC Bands (32-36) 11μm Optical Leak

Lunar Response

Terra MODIS B35

Aqua MODIS B35

Courtesy MCST
A known optical leak at 11um caused the image of the earth’s surface (in this case, Baja peninsula) to be present in MODIS 14.3um data. Through testing, the pre-launch correction coefficients were revised, removing the contamination.
Baja is not visible in Aqua MODIS B36 imagery. The PC band optical leak on Terra MODIS is not present on Aqua.
MODIS Scan Mirror RVS

Skinny:
Much Improved characterization on Aqua
Aqua MODIS
June 25, 2002
2100 UTC
Band 35
MODIS B26 Performance

Skinny:
No Significant Improvement on Aqua
Terra MODIS
June 25, 2002
1750 UTC
Band 26
Terra Average Clear Sky Reflectance: Uncorrected B26
Terra Average Clear Sky Reflectance: Corrected B26
Aqua MODIS B6 performance

Skinny:
Many Dead Detectors; Future Utility Questionable
## Early Aqua MODIS B6 Earth View Observations

<table>
<thead>
<tr>
<th>Date</th>
<th>Dead Detectors in B6 (SBRS order)</th>
</tr>
</thead>
<tbody>
<tr>
<td>June 25 (2002176)</td>
<td>1,2,3,5,6,7,8,9,11,15,19</td>
</tr>
<tr>
<td>June 26 (2002177)</td>
<td>1,2,3,5,6,7,8,9,11,15,19</td>
</tr>
<tr>
<td>June 27 (2002178)</td>
<td>1,2,3,5,6,7,8,9,11,15,19</td>
</tr>
<tr>
<td><strong>SAF E H O L D</strong></td>
<td></td>
</tr>
<tr>
<td>July 4 (2002185)</td>
<td>1,2,3,5,6,7,8,9,11,15,16,19</td>
</tr>
<tr>
<td>July 5 (2002186)</td>
<td>1,2,3,4,5,6,7,8,9,11,15,16,19</td>
</tr>
<tr>
<td>July 6 (2002187)</td>
<td>1,2,3,5,6,7,8,9,15,19</td>
</tr>
<tr>
<td>July 7 (2002188)</td>
<td>1,2,3,5,6,7,8,9,15,19</td>
</tr>
<tr>
<td>July 8 (2002189)</td>
<td>1,2,3,5,6,7,8,9,15,19</td>
</tr>
<tr>
<td>July 9 (2002190)</td>
<td>1,2,3,5,6,7,8,9,15,19</td>
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</table>

A. ITWK/VDET returned to at-launch value.
Aqua MODIS
June 25, 2002
2100 UTC
Band 5

Aggregated 1 km data
Aqua MODIS
June 25, 2002
2100 UTC
Band 7

Aggregated 1 km data
Aqua MODIS 1 km Aggregated SWIR Band Radiances

Day 02176, 2100 UTC

- Band 5 (1.24 um)
- Band 6 (1.6 um)
- Band 7 (2.1 um)
Aqua and Terra MODIS Striping Comparison

1 KM Data; Day 02176

Radiance (W/m² sr um)

Along Track Line Number

Aqua B5
Aqua B6
Aqua B7
Terra B5
Terra B6
Terra B7
Striping in Aqua MODIS TIR Band Data

Skinny:
Much Improved (reduced) on Aqua
Aqua MODIS B33  

Terra MODIS B33
Aqua MODIS B34

Terra MODIS B34
Aqua MODIS B35

Terra MODIS B35
Striping in MODIS TIR Bands: Aqua vs Terra

June 25, 2002; Gulf of California

Dashed lines - Terra

Scene Temperature (K)

Along Track Line Counter
Striping in MODIS TIR Bands: Aqua vs Terra

June 25, 2002; Gulf of California

Scene Temperature (K)

Along Track Line Counter

B24 (Aqua)
B24 (Terra)
Striping in MODIS TIR Bands: Aqua vs Terra

June 25, 2002; Gulf of California

Scene Temperature (K)

Along Track Line Counter
Striping in MODIS TIR Bands: Aqua vs Terra

June 25, 2002; Gulf of California

Scene Temperature (K)

Along Track Line Counter

B27 (Aqua)

B27 (Terra)
Striping in MODIS TIR Bands: Aqua vs Terra

June 25, 2002; Gulf of California

Along Track Line Counter

Scene Temperature (K)
Striping in MODIS TIR Bands: Aqua vs Terra

June 25, 2002; Gulf of California

Dashed lines - Terra
Striping in MODIS TIR Bands: Aqua vs Terra

June 25, 2002; Gulf of California

Scene Temperature (K)

Along Track Line Counter

B33 (Aqua)
B33 (Terra)
B30 (Aqua)
B30 (Terra)
Striping in MODIS TIR Bands: Aqua vs Terra

June 25, 2002; Gulf of California

Scene Temperature (K)

Along Track Line Counter
Striping in MODIS TIR Bands: Aqua vs Terra

June 25, 2002; Gulf of California

Scene Temperature (K)

Along Track Line Counter

Noisy detector 5 (PO)
MODIS SWIR Band Subframe Performance (Moon View Data Set)

Skinny:
Much Improved on Aqua
B5 Subframe Difference
Lunar View

AQUA MODIS

TERRA MODIS

Courtesy
MCST
Summary

• Aqua MODIS Improvements
  – PC LWIR Xtalk eliminated
  – SWIR Subframe differences much smaller
  – Striping in SWIR, and TIR is much reduced
  – High quality LWIR CO2 data.

• Some Issues:
  – Band 26 striping.
  – Utility of Band 6 is questionable.
  – Still some influence of Electronic Xtalk in high contrast scenes for SMWIR bands.