ALOS – AVNIR-2
Cyclic Report #16
08 December 2007 to 23 January 2008

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<th>ALOS AVNIR-2 Cyclic Report – Cycle 16</th>
<th>issue</th>
<th>revision</th>
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<tr>
<td>author</td>
<td>ADEN QC Optical Team</td>
<td></td>
<td></td>
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<tr>
<td>date</td>
<td>11 February 2008</td>
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## Change Log

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<td>0</td>
<td>11 February 2008</td>
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AVNIR-2 CYCLIC REPORT # 16

1 INTRODUCTION

The AVNIR-2 Cyclic Report is distributed by the ADEN AVNIR-2 QC team to keep the AVNIR-2 community informed of any modification regarding quality control, instrument performance, the data production chain and the results of calibration and validation campaigns at the end of each ALOS cycle, which represents 671 orbits, or 46 days.

The AVNIR-2 instrument is part of the Japanese JAXA ALOS mission and its products are received and processed via ESA’s ADEN ground segment across Europe. This is done through an agreement between JAXA and ESA, where ALOS is classed as an ESA Third Party Mission, for which it is responsible for data reception and product dissemination across the European and African regions. A series of quality checks are undertaken in order to assess the ground segment, the instrument performance and the product quality.

Checks are currently made on a weekly (header parameters, PDS status) or bi-monthly (visual report) basis to have a constant view on the mission status. The cyclic report presents the results of the analysis for the different part of the chain, from satellite to end-product.

This document is available online at:
http://earth.esa.int/pcs/alos/avnir/reports/cyclic/

1.1 Acronyms and Abbreviations

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADEN</td>
<td>ALOS Data European Node</td>
</tr>
<tr>
<td>ALOS</td>
<td>Advanced Land Observing Satellite</td>
</tr>
<tr>
<td>AVNIR-2</td>
<td>Advanced Visible and Near Infra-red Radiometer Type-2</td>
</tr>
<tr>
<td>CEOS</td>
<td>Committee on Earth Observation Satellites</td>
</tr>
<tr>
<td>EO Help</td>
<td>Earth Observation Help Desk</td>
</tr>
<tr>
<td>GCP</td>
<td>Ground Control Points</td>
</tr>
<tr>
<td>JAXA</td>
<td>Japan Aerospace Exploration Agency</td>
</tr>
<tr>
<td>OCM</td>
<td>Orbit Control Manoeuvre</td>
</tr>
<tr>
<td>PDS</td>
<td>Payload Data Segment</td>
</tr>
<tr>
<td>PI</td>
<td>Principal Investigator</td>
</tr>
<tr>
<td>QC</td>
<td>Quality Control</td>
</tr>
<tr>
<td>SPPA</td>
<td>Sensor Performance Products Algorithms</td>
</tr>
<tr>
<td>TOA</td>
<td>Top of Atmosphere</td>
</tr>
</tbody>
</table>
1.2 Reference Documents

RD.1 ALOS/AVNIR-2 Level 1 product format description Rev J - October, 2006 JAXA (NEB 00016)


RD.3 Saunier S., Goryl P et al, The contribution of ESA to the ALOS PRISM / AVNIR-2 commissioning phase IGARSS 2007 proceedings


1.3 Background information

The AVNIR-2 instrument is an optical instrument part of the ALOS mission built by the Japanese Space Agency (JAXA).

The ALOS mission has its data produced and disseminated through geographical nodes. The European node (ADEN) was set up and is operated by ESA through the Tromso, Matera, Mas Palomas and Frascati ground stations. As a third party mission (TPM), only the ground segment and data processing are dealt with by ESA, the platform being the responsibility of the owner: JAXA. Each node operates their ground segment independently and shares results with JAXA when required.

The ADEN-ALOS team is responsible for the operation and maintenance of the data received in Europe and North Africa. The ADEN team took part in the Cal/Val activities during the ALOS commissioning phase (January to October 2006). The methodologies used and results obtained are documented (RD.3 and RD.4) and made available to the user through the site: http://earth.esa.int/object/index.cfm?fobjectid=3738

As part of the ADEN operations, a series of quality checks are undertaken in order to assess the ground segment and instrument performance and the product quality for products requested by European users. Checks are currently made on a weekly basis (header parameters, PDS status) to have a constant view on the mission status.

Details on the commissioning phase will be uploaded onto the ALOS PCS website, which can be found: http://earth.esa.int/pcs/alos/
2 SUMMARY

Cyclic Report: 16

Cycle Start: 08 December 2007

Cycle End: 23 January 2008

The main issues during the cycle have been as follows:

- Processor Version
  
  Current AVNIR-2 processor version: 4.05
  
  See Section 3 for more information
3 SOFTWARE & AUX FILE VERSION CONFIGURATION

<table>
<thead>
<tr>
<th>Current Optical Processor Version</th>
<th>ESRIN</th>
<th>Matera</th>
<th>Tromso</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.05</td>
<td>09/01/08</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.04</td>
<td></td>
<td>05/10/07</td>
<td></td>
</tr>
<tr>
<td>3.00</td>
<td></td>
<td></td>
<td>20/08/07</td>
</tr>
</tbody>
</table>

Table 3-1 Optical Processing Versions

The reason for this particular configuration of processor versions as listed in Table 3-1 is that the release of the v4.02 of the optical processor solved a number of problems with the previously installed v3.00. However the PRISM components of the processor experienced some issues with the newer version, and therefore, v3.00 was maintained at Tromso, while the updated version was installed at Matera and ESRIN. Subsequently, v4.02 has been upgraded to 4.04 in both ESRIN and Matera, but v3.00 is still maintained at Tromso.

Please note that there is a discrepancy between the optical processor version number within the product header and work report, and that reported by the ADEN operations team. This issue is currently being investigated, and will be clarified in future reports.

A history of the ADEN optical processor release notes will be made available on the ALOS ADEN PCS website, location: [http://earth.esa.int/pcs/alos/avmir/userinfo/](http://earth.esa.int/pcs/alos/avmir/userinfo/)
4 PDS STATUS

4.1 Planned Instrument Unavailability
None reported during this cycle.

4.2 Unplanned Instrument Unavailability
None reported during this cycle.

4.3 Current Platform Status
Information on the platform provided by JAXA:
None reported during this cycle.

4.4 ADEN PDS Unavailability
None reported during this cycle.

4.5 Periods of missing precision orbit data
For the periods described in Table 4-1, JAXA has announced that precision orbit data is missing.

<table>
<thead>
<tr>
<th>From (UT)</th>
<th>To (UT)</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date Time</td>
<td>Date Time</td>
<td></td>
</tr>
<tr>
<td>Jan 18, 2008 16:41:00.000000</td>
<td>Jan 18, 2008 17:44:00.000000</td>
<td>Due to OCM</td>
</tr>
<tr>
<td>Jan 11, 2008 21:48:00.000000</td>
<td>Jan 11, 2008 22:52:00.000000</td>
<td>Due to OCM</td>
</tr>
<tr>
<td>Jan 04, 2008 20:23:00.000000</td>
<td>Jan 04, 2008 21:26:00.000000</td>
<td>Due to OCM</td>
</tr>
<tr>
<td>Dec 15, 2007 06:18:00.000000</td>
<td>Dec 15, 2007 07:22:00.000000</td>
<td>Due to OCM</td>
</tr>
</tbody>
</table>

Table 4-1 Missing Precision Orbit Data

4.6 JAXA Observation Strategy
The JAXA observation strategy can be found:

5 DATA QUALITY CONTROL

5.1 Instrument Related Anomalies
No reported anomalies this cycle.

5.2 Processor Related Anomalies
No reported anomalies this cycle.

5.3 Daily Report Issues
During the past cycle, daily checks have been undertaken on all AVNIR-2 products generated by ADEN, although on a weekly basis due to current data volumes.

38 products have been examined during the course of this cycle, and no issues have arisen from the checks.

5.4 User Queries
An AVNIR-2 FAQ containing the common user requests can be found at on the ESA PCS website.

The link to this site is: http://earth.esa.int/pcs/alos/avnir/userinfo/

5.5 Image quality status
Image quality analysis continued throughout this cycle in the form of Visual Anomaly Reports by the ADEN QC Optical operations team.

There were no image anomalies detected that have not already been documented in the JAXA document that details common expected visual issues:

http://www.eorc.jaxa.jp/hatoyama/satellite/data_tekyo_setsumei/alos_tyui/index_e.html

5.6 Product Performance Monitoring
This section is dedicated to following the stability of the mission, and for that, a set of characterisations are performed. A part of these characterisation procedures are performed on data acquired over well defined target zones.
One AVNIR-2 product processed into 1B2R processing level has been investigated. The product was observed over the La Crau (France) target zone.

<table>
<thead>
<tr>
<th>File Name</th>
<th>ESA</th>
<th>Obs Date</th>
<th>DOY since Launch</th>
<th>Pointing Angle</th>
<th>Software version</th>
<th>Preparation date</th>
<th>Proc Center</th>
</tr>
</thead>
<tbody>
<tr>
<td>AV2_MMC_IP_000008401</td>
<td></td>
<td>02/06/2007</td>
<td>494</td>
<td>-21.5</td>
<td>45003075002</td>
<td>29/11/2007</td>
<td>IP</td>
</tr>
</tbody>
</table>

### Table 5-1 Working dataset

5.6.1 1B2R PRODUCT INTERBAND

The purpose of inter-band alignment is to check that the AVNIR-2 channels of L1B2 products can be perfectly superimposed.

Verification is performed through an automatic test for measuring the offset of all band pair. The method relies on correlation matrix algorithm. It allows interpolation in a reference band of an estimated in other bands.

The test is applied on data acquired over a dedicated test site. For results consistency, spectral difference between bands shall be minimized so that AVNIR-2 data from area with low vegetation content shall be chosen.

Results demonstrate that inter-band accuracy remains mainly within 0.4 and 0.6 pixels for band 1, 2, 3. Inconsistent result with band 4 is not reported anymore (see previous report).

5.6.2 1B2R PRODUCT GEO LOCATION (MULTI DATE)

The purpose of 1B2R product geo location is to firstly demonstrate the stability of the orbit and attitude determination system. In addition, the assessment is performed on a same test site and results are collected all together to highlight the product geo location accuracy tendency.

The 1B2R product level is free from geometric distortions and the image product is 'path oriented'. Products are not corrected from effects due to terrain relief. The computation of RMS is based on results from low altitude (<50m) GCP dataset sample located over flat area.

The method for geo location assessment is semi-automatic; an operator sets Ground Control Points (GCP) manually on the working data. GCP geographical coordinates are matched with the ones belonging to the reference data. The operator adjusts the GCP location for ensuring the best matching between the both views.
The reference data are measurements from GPS data, SPOT4 post processed and IKONOS data. The test site is La Crau, France.

The computation of the product geo location accuracy is based on a pre defined GCPs population for which elevation remains below 100m above ellipsoid.

The product investigated has been acquired in June 07', this last assessment demonstrates that the product geo location accuracy is 115 m (RMS).

The error is mainly pronounced along with in-track direction that means a shift in time has occurred.

The figure depicts that the geo location accuracy according the across track direction (RMSX) remains stable with time and for a given processing software version.

However, the along track shift is increasing and is varying from 10 m to 100 m (RMS).

The external orientation procedure output results that are not conformed to initial specification defined in October 07' by ESA.

The geometric model can be set when adding one ground reference point. Then, the product geo location accuracy becomes below 15 m (RMS). No geometric distortion is observed into the image data.
Figure 5-2 Error vector fields x 50, channel 1, 2, 3, no ground reference point added
Figure 5-3 Error vector fields x 50, channel 1, 2, 3, one ground reference point added
6 CALIBRATION/VALIDATION ACTIVITIES & RESULTS

This information will be reported on in future reports.

6.1 VICARIOUS CALIBRATION

This information will be reported on in future cyclic reports.

6.2 SENSOR INTER COMPARISON

This information will be reported on in future cyclic reports.
7 DISCLAIMERS

No new disclaimers have been issued during this cycle.

A list of known product errors caused by image processing algorithm errors is listed on the JAXA site at:

8 EVENTS

The following section details events that may be of interest to ALOS data users.

- 29 January 2008: Users are now able to submit orders for ALOS future acquisitions via EOLI-SA (email eohelp@esa.int for more information)
## APPENDIX A  DATASET FOR L1B2 PERFORMANCE MONITORING

<table>
<thead>
<tr>
<th>File Name ESA</th>
<th>Obs Date</th>
<th>DOY since Launch</th>
<th>Pointing Angle</th>
<th>Software version</th>
<th>Preparation date</th>
<th>Proc Center</th>
</tr>
</thead>
<tbody>
<tr>
<td>AV2_MMC_IP_000008401</td>
<td>02/06/2007</td>
<td>494</td>
<td>-21.5</td>
<td>45003075002</td>
<td>29/11/2007</td>
<td>IP</td>
</tr>
</tbody>
</table>
APPENDIX B PRODUCT SPECIFICATION AS DETERMINED FROM THE ADEN VERIFICATION PERIOD

Geometric activities performed during data verification period demonstrated that the pointing accuracy improved over time and with processing software updates. The orbit shift in time was been significantly reduced and is now below the pixel. The geo-location accuracy of the 1B2R product reaches 50 metres (RMS). The internal accuracy which reflects the image geometry is evaluated to be around 18 metres (RMS).

Several assessments to compute the inter-band registration have been done; results are agree that the band-to-band registration remains mainly 0.5 pixel.

Radiometric activities performed on stable and invariant test site demonstrated that the radiometric band to band calibration and radiometric calibration remains very stable over one year. In addition, the sensor inter-comparison procedures have been set up and applied to a same dataset. The conclusions of these three methods agree that the radiometric calibration of AVNIR-2 is satisfactory, given the error bar of the methodologies which is estimated to be around 5%.

The product specifications as output from ADEN data verification periods can be summarised as follow:

<table>
<thead>
<tr>
<th>AVNIR-2</th>
<th>Radiometric accuracy</th>
<th>Geometric accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level1B2</td>
<td>Band 1 –5.6% (1σ)</td>
<td>RMS 48 m</td>
</tr>
<tr>
<td></td>
<td>Band 2 -0.1% (1σ)</td>
<td>Pixel (CT) 10 m</td>
</tr>
<tr>
<td></td>
<td>Band 3 N/A*</td>
<td>Line (AT) 49 m</td>
</tr>
<tr>
<td></td>
<td>Band 4 –2.7% (1σ)</td>
<td>Norm</td>
</tr>
</tbody>
</table>

Sensor Intercomparison with various EO Sensor (Meris, Landsat ...) as reference (ESA/ESTEC, USGS, LISE)

*Not evaluated due to image saturation

Polynomial coefficients embedded within product are used to predict geo location (GAEL).

* Acquisition with a 0 pointing degree.

AVNIR-2 Product specifications, radiometric and geometric accuracy
### AVNIR-2 Product specifications, image quality

<table>
<thead>
<tr>
<th>AVNIR-2</th>
<th>Image Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1B1</td>
<td><strong>MTF@Nyquist</strong></td>
</tr>
<tr>
<td>Band 1</td>
<td>0.51</td>
</tr>
<tr>
<td>Band 2</td>
<td>0.50</td>
</tr>
<tr>
<td>Band 3</td>
<td>0.48</td>
</tr>
<tr>
<td>Band 4*</td>
<td>N/A</td>
</tr>
</tbody>
</table>

*HR/LR Method (ONERA)*

*Not evaluated due to image saturation