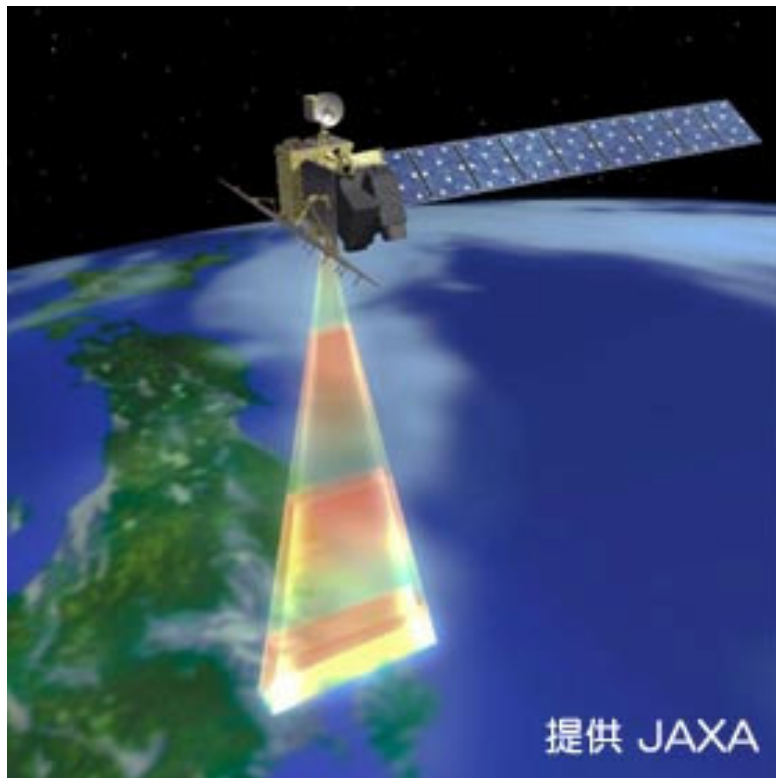


**ADEN ALOS AVNIR-2 CYCLIC REPORT**  
**CYCLIC REPORT #20**  
**09 JUNE 2008 TO 25 JULY 2008**



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## AVNIR-2 CYCLIC REPORT # 20

### 1 INTRODUCTION

The AVNIR-2 Cyclic Report is distributed by the IDEAS AVNIR-2 QC team to keep the AVNIR-2 community informed of any modifications 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*

ADEN	ALOS Data European Node
ALOS	Advanced Land Observing Satellite
AVNIR-2	Advanced Visible and Near Infra-red Radiometer Type-2
CEOS	Committee on Earth Observation Satellites
EO Help	Earth Observation Help Desk
GCP	Ground Control Points
IDEAS	Instrument Data quality Evaluation and Analysis Service
JAXA	Japan Aerospace Exploration Agency
OCM	Orbit Control Manoeuvre
PCS	Product Control Service
PDS	Payload Data Segment
PI	Principal Investigator
PRISM	Panchromatic Remote-sensing Instrument Stereo Mapping
QC	Quality Control

SPPA                      Sensor Performance Products Algorithms  
TOA                        Top of Atmosphere

## **1.2    *Reference Documents***

- |      |  |
|------|--|
| RD.1 | ALOS/AVNIR-2 Level 1 product format description Rev J - October, 2006 JAXA (NEB 00016)   |
| RD.2 | Bouvet M., Goryl. P., Santer R., Chander G., Saunier S, Preliminary radiometric calibration assessment of ALOS AVNIR-2 IGARSS 2007 proceedings |
| RD.3 | Saunier S., Goryl. P et al, The contribution of ESA to the ALOS PRISM / AVNIR-2 commissioning phase IGARSS 2007 proceedings                    |
| RD.4 | Saunier S., Goryl P, Final calibration / Validation report AVNIR-2 Instrument Issue 1 Rev 0 – July 2007  |

## **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 team is responsible for the operation and maintenance of the node that receives data acquired over 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.

## 2 SUMMARY

**Cyclic Report:** 20

**Cycle Start:** 09 June 2008

**Cycle End:** 25 July 2008

The main issues during the cycle have been as follows:

- **Processor Version**

Current AVNIR-2 processor version: 4.05

- **Upgrade of processor at Tromsø**

The optical processor at Tromsø was upgraded to version 4.05 on 18/06/08 after a successful validation. The processor versions across ADEN sites are now aligned.

See Section 3 for install dates of ADEN processors.

### 3 SOFTWARE & AUX FILE VERSION CONFIGURATION

Current Optical Processor Version	ESRIN	Matera	Tromso
4.05	09/01/08	14/02/08	18/06/08

**Table 3-1 AVNIR-2 Processing Versions**

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/avnir/userinfo/>



## 4 PDS STATUS

Please note; the major source of information for this document is the ALOS monthly report provided by JAXA. The monthly reporting timescale means that data concerning events conducted within this cycle may not be available at the time of writing. In this event, information will be included in the next cyclic report.

JAXA information reported on in this document cover the period 01/6/2008 to 31/07/2008.

### 4.1 *Planned Instrument Unavailability*

For the periods described in Table 4-1, JAXA has announced planned instrument unavailability.

From (UT)		To (UT)		Reason
Date	Time	Date	Time	
Jun. 14 <sup>th</sup> , 2008	18:11	Jun. 15 <sup>th</sup> , 2008	00:45	In plane OCM
Jun. 17 <sup>th</sup> , 2008	16:45	Jun. 17 <sup>th</sup> , 2008	21:03	In plane OCM
Jun. 20 <sup>th</sup> , 2008	17:20	Jun. 20 <sup>th</sup> , 2008	21:27	In plane OCM
Jun. 23 <sup>rd</sup> , 2008	19:36	Jun. 23 <sup>rd</sup> , 2008	22:54	In plane OCM
Jun. 11 <sup>th</sup> , 2008	04:37	Jun. 12 <sup>th</sup> , 2008	00:22	Inclination Manoeuvres
Jul. 19 <sup>th</sup> , 2008	-	Jul. 19 <sup>th</sup> , 2008	-	OCM <sup>1</sup>
Jul. 29 <sup>th</sup> , 2008	22:26	Jul. 31 <sup>st</sup> , 2008	05:42	Inclination and related in plane OCM

Table 4-1 Planned instrument unavailability

### 4.2 *Unplanned Instrument Unavailability*

None reported during this cycle.

### 4.3 *Current Platform Status*

Information on the platform provided by JAXA:

Current platform status: Normal.

<sup>1</sup> Start and stop times of this OCM not yet available.

#### 4.4 *Upcoming Instrument Unavailability*

For the periods described in Table 4-2, JAXA has announced planned instrument unavailability.

From (UT)		To (UT)		Reason
Date	Time	Date	Time	
Aug. 2 <sup>nd</sup> , 2008	14:27	Aug. 3 <sup>rd</sup> , 2008	06:05	In-plane OCM
Aug. 5 <sup>th</sup> , 2008	14:02	Aug. 5 <sup>th</sup> , 2008	18:08	In-plane OCM
Aug. 8 <sup>th</sup> , 2008	19:21	Aug. 8 <sup>th</sup> , 2008	23:28	In-plane OCM
Aug. 11 <sup>th</sup> , 2008	13:10	Aug. 11 <sup>th</sup> , 2008	17:17	In-plane OCM

Table 4-2 Upcoming instrument unavailability

#### 4.5 *ADEN PDS Unavailability*

None reported during this cycle.

#### 4.6 *Periods of missing precision orbit data*

For the periods described in Table 4-3, JAXA has announced that precision orbit data is missing.

From (UT)		To (UT)		Reason
Date	Time	Date	Time	
May. 16 <sup>th</sup> , 2008	07:20:00.00	May. 16 <sup>th</sup> , 2008	21:40:00.00	OCM
Jun. 9 <sup>th</sup> , 2008	08:30:00.00	Jun. 10 <sup>th</sup> , 2008	23:59:00.00	LSSR Acquisition Failure
Jun. 11, 2008	00:00:00.00	Jun. 11, 2008	22:01:00.00	Due to LSSR Acquisition Failure and orbit manoeuvring
Jun. 14 <sup>th</sup> , 2008	18:51:00.00	Jun. 14 <sup>th</sup> , 2008	20:51:00.00	OCM
Jun. 17 <sup>th</sup> , 2008	18:05:00.00	Jun. 17 <sup>th</sup> , 2008	19:09:00.00	OCM
Jun. 20 <sup>th</sup> , 2008	18:24:00.00	Jun. 20 <sup>th</sup> , 2008	19:28:00.00	OCM
Jul. 19 <sup>th</sup> , 2008	10:00:00.00	Jul. 19 <sup>th</sup> , 2008	11:04:00.00	OCM

Table 4-3 Missing Precision Orbit Data

#### 4.7 *Periods of missing precision attitude data*

For the periods described in Table 4-4, JAXA has announced that precision attitude data is missing.

From (UT)		To (UT)		Reason
Date	Time	Date	Time	
Jun. 14 <sup>th</sup> , 2008	18:09:01	Jun. 14 <sup>th</sup> , 2008	23:59:59	OCM
Jun. 11 <sup>th</sup> , 2008	01:58:16	Jun. 11 <sup>th</sup> , 2008	22:52:00	Satellite's attitude changed to standard mode
Jun. 09 <sup>th</sup> , 2008	08:13:24	Jun. 10 <sup>th</sup> , 2008	10:32:50	LSSR Acquisition Failure

Table 4-4 Missing Precision Attitude Data

#### 4.8 *Periods lacking Yaw steering*

For the periods described in Table 4-5, JAXA has announced that Yaw steering was not available.

From (UT)		To (UT)		Reason
Date	Time	Date	Time	
Jun. 11 <sup>th</sup> , 2008	00:45:00	Jun. 12 <sup>th</sup> , 2008	01:15:00	OCM
Jun. 14 <sup>th</sup> , 2008	15:50:00	Jun. 15 <sup>th</sup> , 2008	01:35:30	OCM

Table 4-5 No Yaw steering

#### 4.9 *JAXA Observation Strategy*

The JAXA observation strategy can be found at:  
<http://www.eorc.jaxa.jp/ALOS/obs/overview.htm>

#### 4.10 *Artefact repositories*

A number of image artefacts are not due to instrument or processing chain malfunctions. These are fully documented in the following JAXA web pages.

<http://www.eorc.jaxa.jp/en/about/distribution/info/alos/characteristics.html>

## **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 and electronically disseminated. Checks are currently conducted on a weekly basis due to current data volumes.

Browse products for all optical images are visually inspected and reported on in each daily report.

78 products have been examined during the course of this cycle, and no issues have arisen from either the daily QC or browse product checks.

### **5.4 *Visual Inspection Report Issues***

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/en/about/distribution/info/alos/characteristics.html>

### **5.5 *User Queries***

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

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

## 5.6 Product Performance Monitoring

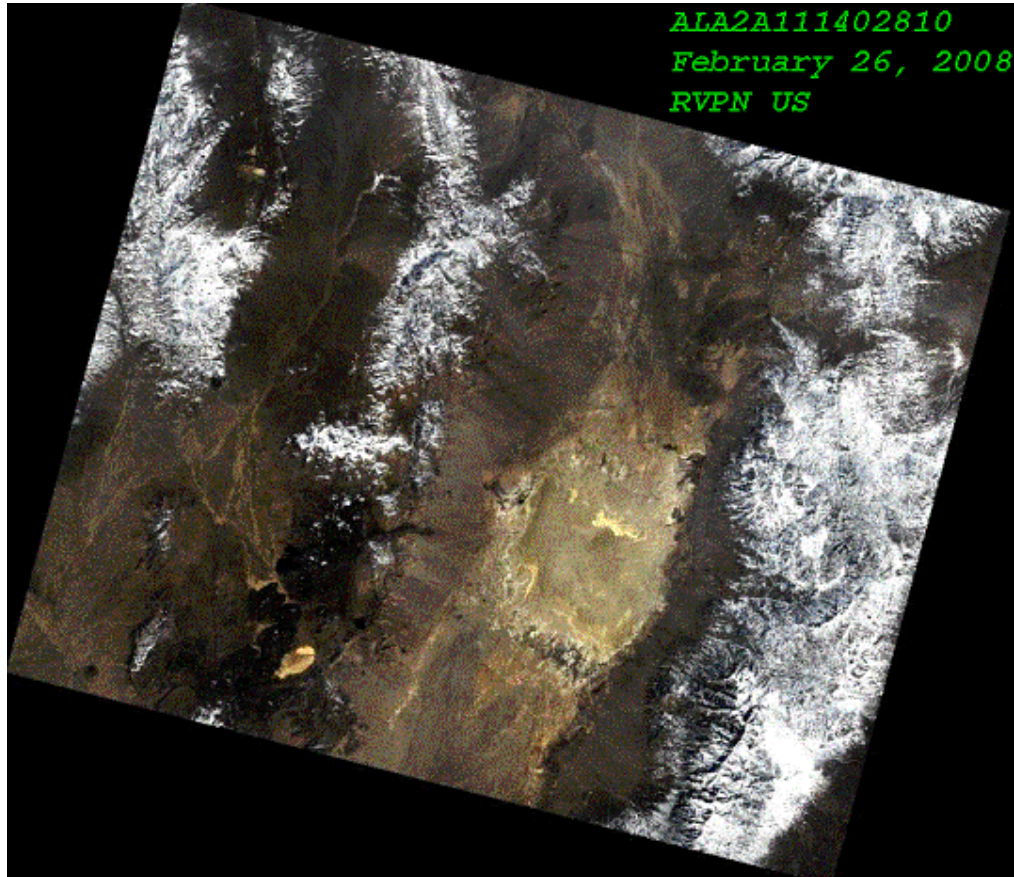


Figure 5.1 - Image of the cycle.

### 5.6.1 GEOMETRY

#### 5.6.1.1 Band to band registration

The band to band registration procedure for AVNIR-2 data processed into 1B2R product level has been played back. The good band to band registration of AVNIR-2 user products is confirmed.

	1	2	3	4		1	2	3	4
1	X	x	x	x	1	x	x	x	x
2	0,06	X	x	x	2	0,09	x	x	x
3	0,08	0,05	x	x	3	0,08	0,07	x	x
4	0,11	0,07	0,05	x	4	0,13	0,1	0,06	x
Line displacements (pixel unit)					Pixel displacements (pixel unit)				

Table 5-1 Interband registration – Disparity results

A real improvement is noticed when comparing with the past products (Y2007), some geometric shifts between bands of about 0.5 up to 0.8 pixels were observed. The assessment has been based on data acquired February 2008, and processed with last version of processing software.

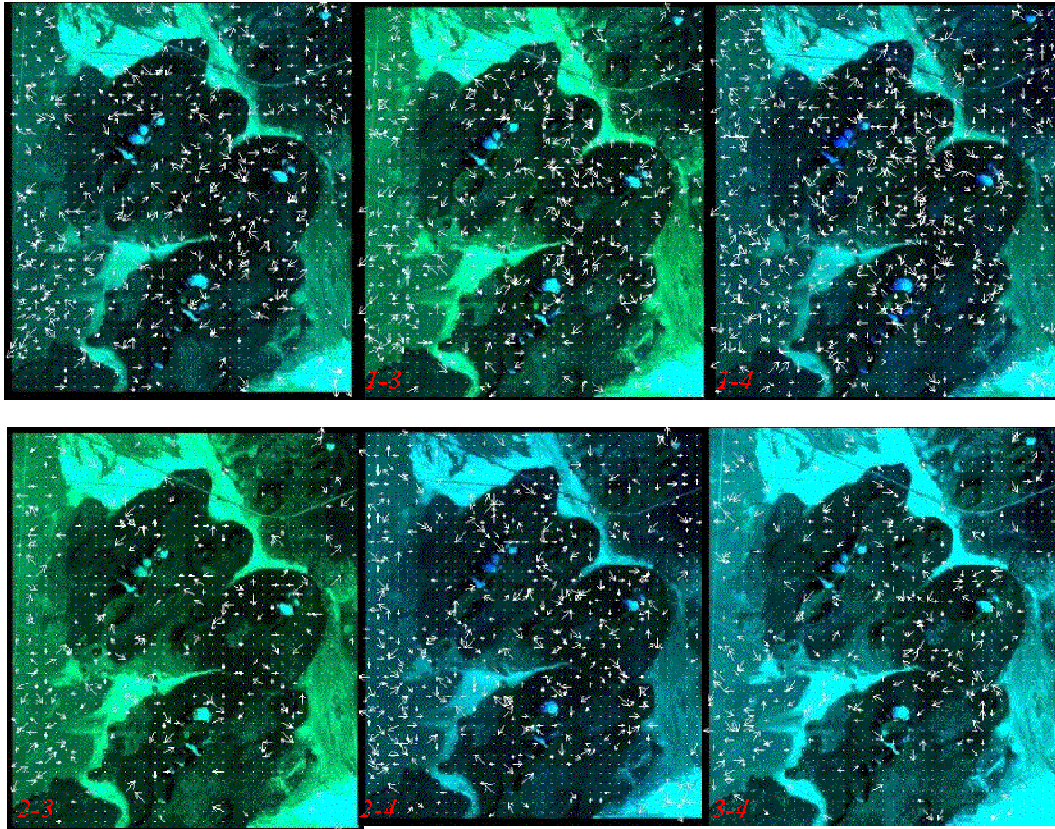
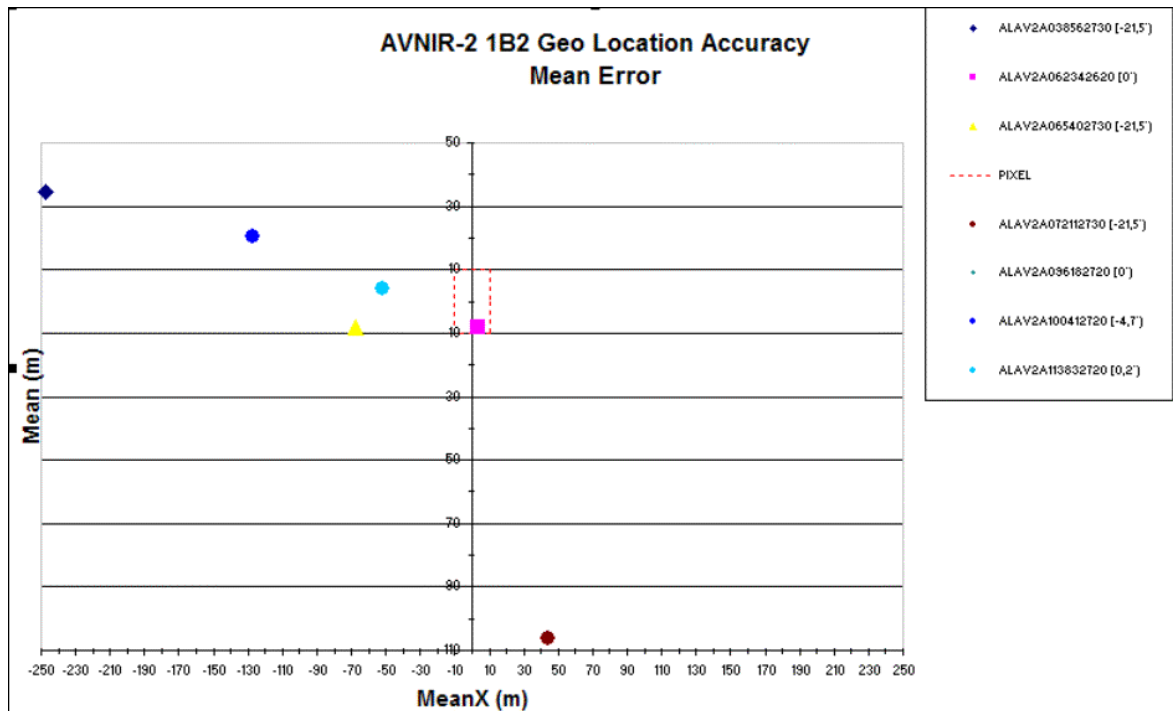


Figure 5.2 Interband registration – error vector fields.

### 5.6.1.2 Product Geolocation

The results provided in this section are computed by comparing the product geolocation accuracy with reference data.

The direct geometric model is used to predict the geolocation. The location model is based on the polynomial functions embedded within the CEOS product.



**Figure 5.3 - Mean geolocation Error of AVNIR-2 products**

For the last six products analysed, the mean product geolocation accuracy results are listed in Table 5-2.

Mean RMS	111 m
Mean RMSx (pixel)	99.02 m
Mean RMSy(line)	37.72 m

**Table 5-2 - 1B2R product geolocation monitoring – Cycle 20 results**

The shift is more pronounced in pixel direction. Except for the product reference ALAV2A072112730 Day of Year since launch (494), please refer to the mean error figure, just here before.

We observed an anomaly with the product reference ALAV2A096182720, Day Of Year since launch (660), acquisition data November,14, 2007.

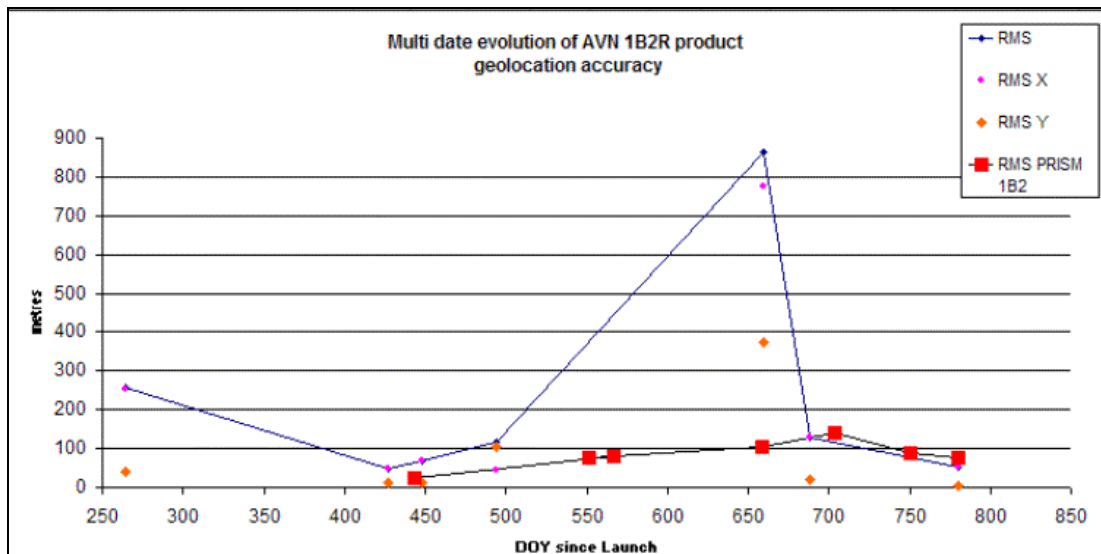
Inconsistent results have been found and are under investigation. This is more likely due to the use of GPSR raw for the orbit prediction / consolidation.

Mean RMS	862.1 m
Mean RMSx (pixel)	776.05 m
Mean RMSy (line)	375.19 m

**Table 5-3 - Geolocation results, Anomaly with ALAV2A096182720**

When analysing the product geolocation trend, and comparing with the results from PRISM, one can observe a degradation of the accuracy but not with a similar magnitude.





**Figure 5.4 – Product Geo location trend, RMS.**

At DOY790 since the launch, the PRISM / AVNIR-2 accuracy results were consistent.

The direct model provided with products can be refined to account for bias inherent to the model; the location is predicted at ellipsoid level.

When setting one ground reference point to refine the model, the accuracy of AVNIR-2 products reaches the operational goal of 10 m RMS (1 sigma).

## 5.6.2 RADIOMETRIC CALIBRATION

The radiometric calibration stability of the AVNIR-2 ADEN product is monitored. Results are based on statistics computed on 35 scenes acquired over Libya (desert site) from May 06' until July 07'.

Top of Atmosphere (TOA) calibration stability is studied using multi-temporal analysis of TOA values.

Band to band calibration stability is studied using multi-temporal analysis of band radiance ratio.

For TOA calibration, the analysis of the mean values, the standard deviation values, the trend, and when accounting the limit of the method, one can conclude a stability of the TOA radiometric calibration of AVNIR-2 over stable and uniform test sites.



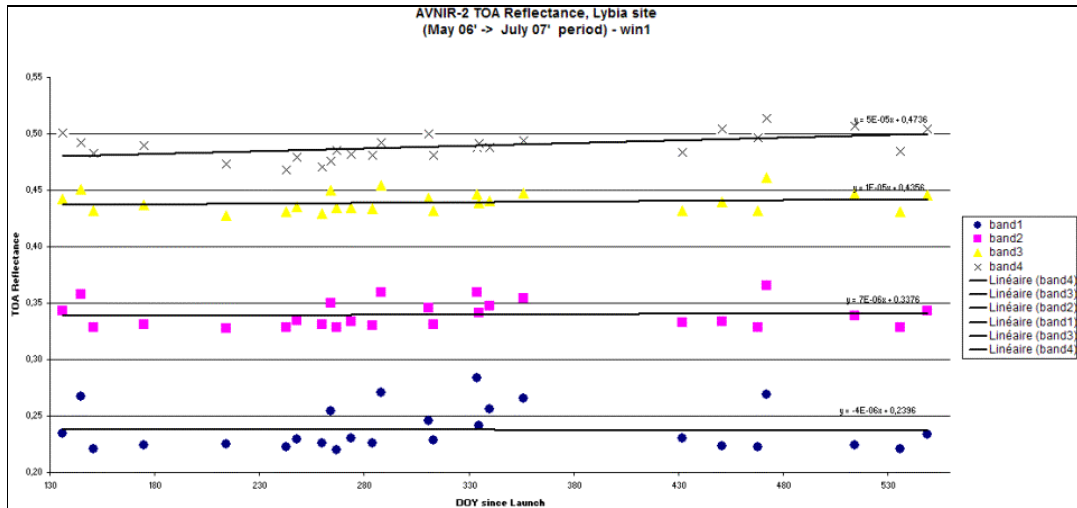


Figure 5.5 - AVNIR-2 - TOA calibration

As depicted below, the band to band calibration remains stable.

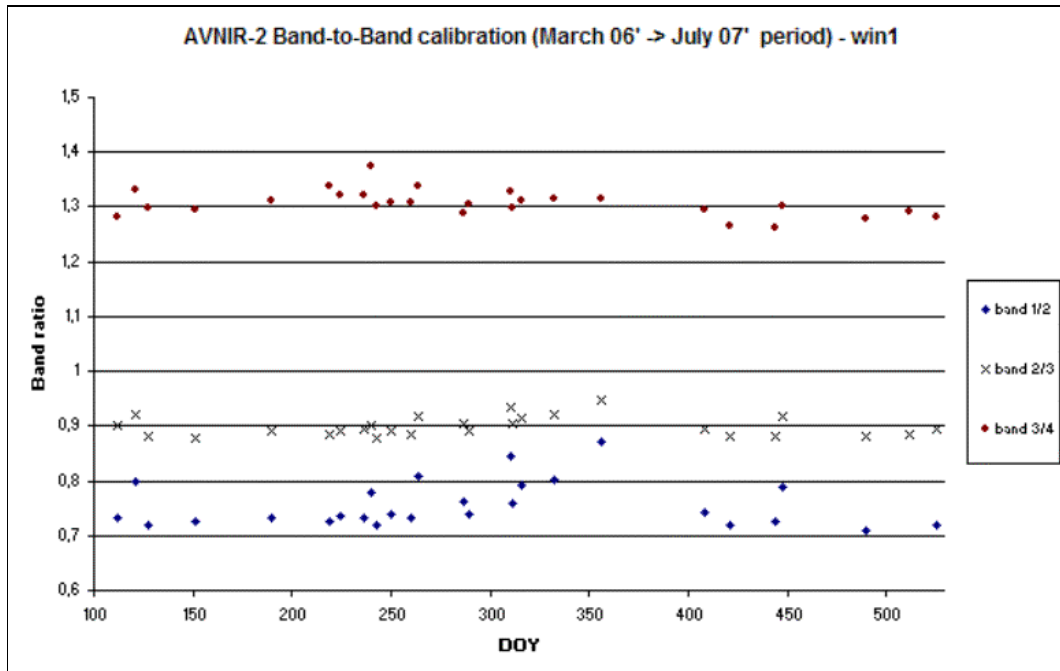
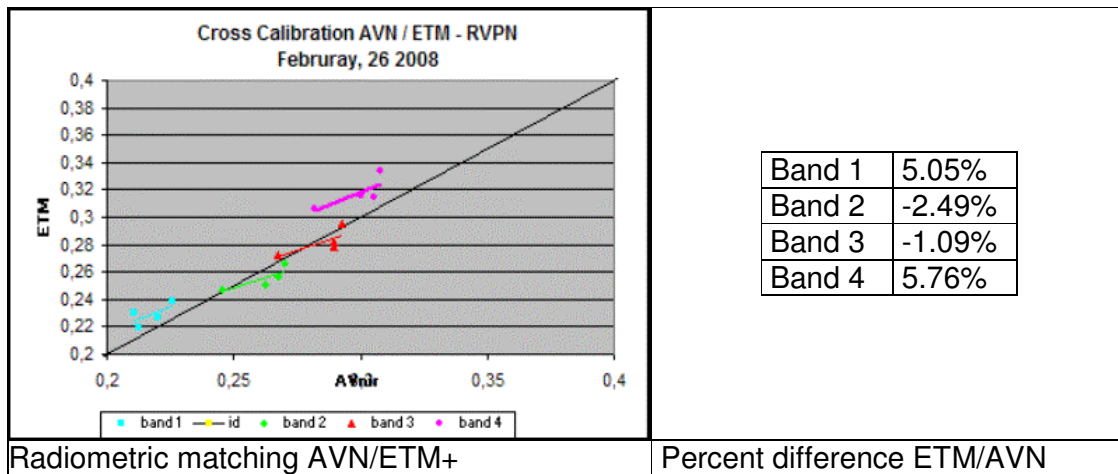


Figure 5.6 - AVNIR-2 band to band calibration

## 6 CALIBRATION/VALIDATION ACTIVITIES & RESULTS

### 6.1 Radiometric cross calibration AVNIR-2 / LANDSAT ETM+

The methodology involves calibration of surface observations based on image statistics from areas observed nearly simultaneously by the two sensors. The average percent differences in at-sensor reflectance estimates obtained from these sensors agree within six percent.



Radiometric matching AVN/ETM+

Percent difference ETM/AVN

#### Cross calibration results

As observed in the past (RD.2), for band 2 and band 3, the calibration is very close to the one of the reference within 2.5 %.

It is more difficult to conclude for band 1 and band 4.

## 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:

[http://www.eorc.jaxa.jp/hatoyama/satellite/data\\_tekyo\\_setsumeai/alos\\_renraku\\_e.html](http://www.eorc.jaxa.jp/hatoyama/satellite/data_tekyo_setsumeai/alos_renraku_e.html)

## 8 EVENTS

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

- The second ALOS PI Symposium will be taking place from the 3rd to the 7th of November in Rhodes, Greece. For more information, please see <http://earth.esa.int/ALOS2008>.
  - Note that the deadline for abstract submission was June 15 2008.
  - The deadline for full paper submission is November 3 2008.
- ALOS Simulations:
  - Analysis report and Adoption/Rejection information of simulation 9 were released by JAXA on 09/06/2008.

### 8.1 *Past Events:*

- The submission of request files for ALOS simulation number 10 was due by 20<sup>th</sup> of June.
- The submission of request files for ALOS simulation number 9 was due by March 21, 2008
- The ALOS PCS Site is now available at: <http://earth.esa.int/pcs/alos/>
- ALOS simulation #8 for Cycle 18-21
  - The results of the second stage simulation were made available by JAXA on Feb.4<sup>th</sup>.
  - The Analysis Report on ALOS simulation #8 was delivered by JAXA on Feb.12<sup>th</sup>.
- 29 January 2008: Users are now able to submit orders for ALOS future acquisitions via EOLI-SA (email [eoHELP@esa.int](mailto:eoHELP@esa.int) for more information)

## **APPENDIX A      DATASET   FOR   L1B2   PERFORMANCE MONITORING**

There was no L1B2 performance monitoring in this report.

## 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:

AVNIR-2	Radiometric accuracy	Geometric accuracy			
Level1B2	Band 1 -5.6% (1 $\sigma$ ) Band 2 -0.1% (1 $\sigma$ ) Band 3 N/A* Band 4 -2.7% (1 $\sigma$ )	<b>RMS</b>	<b>Pixel (CT)</b>	<b>Line (AT)</b>	<b>Norm</b>
		Nadir*	48 m	10 m	49 m
	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		Image Quality	
Level 1B1	MTF@Nyquist	<b>Pixel (CT)</b>	<b>Line (AT)</b>
	<b>Band 1</b>	0.51	0.24
	<b>Band 2</b>	0.50	0.30
	<b>Band 3</b>	0.48	0.32
	<b>Band 4*</b>	N/A	N/A
HR/LR Method (ONERA)			
*Not evaluated due to image saturation			

**AVNIR-2 Product specifications, image quality**

## APPENDIX C INSTRUMENT ANOMALIES

Below is a list of ALOS anomalies that may have an impact on image quality, radiometric calibration or localisation accuracy (from 24th October 2006).

- LSSR acquisition failure 11<sup>th</sup> June 2008,
- Orbit manoeuvres conducted on 19<sup>th</sup> July 2008,
- Orbit manoeuvres conducted on 11<sup>th</sup>, 14<sup>th</sup>, 17<sup>th</sup>, 20<sup>th</sup>, 23<sup>rd</sup> June 2008,
- Calibration operations for Star Tracker conducted on 11th and 13th of May 2008,
- Orbit manoeuvres conducted on 16th May 2008,
- Orbit manoeuvres conducted on 26th April 2008,
- Orbit manoeuvres conducted on 4th April 2008.
- Orbit manoeuvres conducted on 26th January and 2nd, 15th, 29th February 2008.
- YAW steering was suspended on 28th January 2008
- Orbit manoeuvres conducted on 15th December 2007, 4th, 11th & 18th January 2008.
- Observation, yaw steering, and precision attitude system suspended on 31st October 2006 between 03:50 and 15:50 UT due to change AOCS on-board orbit model to that of 15th order.
- Yaw steering suspended during 23rd February 00:12 UT to 24th February 2007 23:01 UT (yaw steering suspended due to calibrating operations for Star Tracker (STT) and Precision Attitude Determination).
- Yaw steering suspended during 22nd March 00:24 UT to 23rd March 2007 23:17 UT (yaw steering suspended due to calibrating operations for Star Tracker (STT) and Precision Attitude Determination).
- Yaw steering on/off switching on 10th April 2007:  
Yaw steering on to off: 12:57 – 13:22 UT (data unavailable)  
No yaw steering operation: 13:22 – 14:42 UT (data available)  
Yaw steering off to on: 14:42 – 15:45 UT (data unavailable)
- Orbit manoeuvres on 25th, 27th and 29th April 2007.



- Orbit manoeuvres on 8th and 22nd June 2007.
- Orbit manoeuvres conducted on 7th and 20th July 2007.
- Yaw steering on/off switching on 31st July 2007:  
Switching in progress: 00:00 – 00:30, 21:57 – 22:46 UT (Observation suspended)  
No yaw steering observation: 00:30 – 21:57UT (Data available)
- Orbit manoeuvres conducted on 3rd and 25th August 2007.
- Orbit manoeuvres conducted on 6th, 12th and 26th October 2007.
- Orbit manoeuvres conducted on 10th and 23rd November 2007.
- Orbit manoeuvres conducted on 7th and 15th December 2007.
- Orbit manoeuvres conducted on 4th, 11th, 18th and 26th January 2008.
- Orbit manoeuvres conducted on 2nd, 15th and 29th February 2008.
- Orbit manoeuvres conducted on 8th March 2008.