/document title/ titre du document

SCIAMACHY Bi-MONTHLY Report: September - October 2007

prepared by/*préparé par* Angelika Dehn

reference/*réference* ENVI-SPPA-EOPG-TN-07-0074
issue/*édition* 1
revision/*révision* 0
date of issue/*date d'édition* 30 November 2007
status/*état*
Document type/*type de document* Technical Note
Distribution/*distribution*

APPROVAL

Title *titre*	SCIAMACHY Bi-Monthly Report: September - October 2007	issue 1 *issue*	revision 0 *revision*

author *auteur*	Angelika Dehn, SERCO, Manfred Gottwald, SOST-DLR, Stefan Noël, SOST-IFE	date *date*	21/11/2007

approved by *approuvé by*	T. Fehr ESA/ESRIN, D/EOP-GQ G. Lichtenberg, DLR	date *date*	30/11/2007

CHANGE LOG

reason for change */raison du changement*	issue/*issue*	revision/*revision*	date/*date*

CHANGE RECORD

Issue: 1 Revision: 0

reason for change/*raison du changement*	page(s)/*page(s)*	paragraph(s)/*paragraph(s)*

TABLE OF CONTENTS

SCIAMACHY Bi-monthly Report September – October 2007

1 INTRODUCTION

The SCIAMACHY Bi-Monthly report documents the current status and recent changes to the SCIAMACHY instrument, its data processing chain, and its data products.
The Bi-Monthly Report (hereafter BMR) is composed of analysis results obtained by the DPQC, combined with inputs received from the different groups working on SCIAMACHY operation, calibration, product validation and data quality.
The first part of the report is dedicated to Instrument Configuration and Performance. It is composed of contributions from SOST-DLR and SOST-IFE.
The remainder of the report is dedicated to level 1b and level 2 performance assessment and is generated by ESA/ESRIN DPQC with contributions from ESA/ESTEC PLSO and DLR-IMF.

The structure of the report will be in constant evolution through the ENVISAT mission, as experience with SCIAMACHY data and quality control grows.

1.1 Scope

The main objective of the BMR is to give, on a regular basis, the status of SCIAMACHY instrument performance, data acquisition, results of anomaly investigations, calibration activities and validation campaigns. The BMR is composed of the following six sections:

- Summary;
- Instrument Configuration and Performance;
- Data Availability Statistics;
- Level 1 Product Quality Monitoring;
- Level 2 Product Quality Monitoring;
- Validation Activities and Results.

1.2 References

[1] ‘Instrument Operation Manual’, MA-SCIA-0000DO/01, Issue F R2, 16 Dec. 2004
[2] ‘ENVISAT-1 Products Specifications Volume 15: SCIAMACHY Products Specifications’, PO-RS-MDA-GS-2009, Issue 3, Rev: K, Gianni Sotis, 06 May 2006
[3] ‘SCIAMACHY cL0 Statistics, PO-TN-DLR-SH-0012, Issue 1, Rev. 1 14 April 2005’

[4] SCIAMACHY cL0 Statistics 2003, PO-TN-DLR-SH-0013, Issue 1, Rev. 0 14 April 2005
[5] 'SCIAMACHY Consolidated Level 0: Statistics for the Year 2005', PO-TN-DLR-SH-0014, Issue 1, Rev. 0 11 July 2006
[6] 'Summary of the Atmospheric Chemistry Instrument Validation results as presented at the ACVE-3 Workshop', Paul Snoeij, Ankie Piters, Herbert Fischer, Yasjka Meijer, Jean-Christopher Lambert, Thorsten Fehr
[7] 'SCIAMACHY Extra Misalignment Model', PO-TN-DLR-SH-0016 Issue 1, M. Gottwald, E. Krieg, DLR-IMF, C. von Savigny, S. Noël, K. Bramstedt IUP-IFE, 07 March 2007
[8] 'Verification of the extra misalignment correction in the SCIAMACHY IPF 6.03 processor', TN-IUP/IFE-2007-cvs-02, C. von Savigny, A. Dehn, H. Bovensmann, J. Steinwagner IUP-IFE, 05 July 2007
[9] 'SCIAMACHY SciCal Tool Change of Leakage ADF generation' ENV-TN-DLR-SCIA-0094, Issue 1.0, Bernd Aberle, Guenter Lichtenberg, 08 November 2007

1.3 Acronyms and Abbreviations

ADC	Analogue to Digital Converter
ADF	Auxiliary Data File
ANX	Ascending Node Crossing
AOCS	Attitude and Orbit Control System
APSM	Aperture Stop Mechanism
ASM	Azimuth Scan Mechanism
ATC	Active Thermal Control
BMR	Bi-Monthly Report
CA	Corrective Action
CCA	Communication Area
CTI	Configurable Transfer Item
DAC	Digital Analogue Converter
DLR-IMF	Deutsches Zentrum fuer Luft- und Raumfahrt
DPQC	Data Processing Quality Control
EOL	End of Life
ESM	Elevation Scan Mechanism
FPN	Fixed Pattern Noise
HK	Housekeeping
ICE	Instrument Control Electronics
ICU	Instrument Control Unit
IECF	Instrument Engineering and Calibration Facilities
IOM	Instrument Operation Manual
LK1	Leakage Current Auxiliary File (SCI_LK1_AX)
LLI	Life Limited Item
LOS	Line of Sight
MCMD	Macro Command
MPH	Main Product Header
MPS	Mission Planning Schedule
MR	Monthly Report
NCWM	Nadir Calibration Window Mechanism
NDFM	Neutral Density Filter Mechanism
NIVR	Netherlands Agency for Aerospace Programmes
NNDEC	Non-nominal Decontamination
NRT	Near Real Time
OAR	Observation Anomaly Report
OBM	Optical Bench Module
OCR	Operations Change Request
OSDF	Orbit Sequence Definition File
OSV	Orbit State Vector
PCF	Product Control Facility
PDHS	Payload Data Handling Station (PDS)
PDHS-E	Payload Data Handling Station – ESRIN

PDHS-K	Payload Data Handling Station – Kiruna
PDS	Payload Data Segment
PE1	Pixel to Pixel/ Etalon Auxiliary File (SCI_PE1_AX)
PLSO	Payload Switch OFF
PMD	Polarization Measurement Device
QUADAS	Quality Analysis of Data from Atmospheric Sounders
QWG	Quality Working Group
SAA	South Atlantic Anomaly
SCIAMACHY	Scanning Imaging Absorption Spectrometer for Atmospheric Chartography
SCICAL	SCIAMACHY Calibration tool
SEU	Single Event Upset
SLS	Spectral Line Source
SMR	Sun Mean Reference
SOST	SCIAMACHY Operations Support Team
SP1	Spectral Calibration Auxiliary File (SCI_SP1_AX)
SU1	Sun Reference Auxiliary File (SCI_SU1_AX)
SZA	Sun Zenith Angle
TC	Thermal Control
TCFoV	Total Clear Field of View
TOA	Top of Atmosphere
TRUE	Tangent height Retrieval by UV-B Exploitation
VCD	Vertical Column Density
WLS	White Light Source
WUR	Wageningen University and Research

2 SUMMARY

- The level 2 off-line processor was updated from version 3.00 to version 3.01 and became operational 09/10/2007

- A level 2 Limb data processing anomaly occurred starting with the activation of processor version 3.01. Limb data were processed incomplete due to a wrong configuration setting in the ground segment. This affected the data set between 23 September 2007 and 27 October 2007. Data after that period are nominal again.

- Full mission (02 August 2002 – 28 September 2007) reprocessing started

  - Level 1b, IPF 6.03, start day 24 September 2007
  - Level 2 off-line 3.01, start day 12 October 2007

- During the reported period SCIAMACHY measurements were nominal with respect to planning, besides one unavailability periods during following orbits:

  - 29107 - 29165 (24/28 September 2007) ENVISAT service module anomaly

- Monthly Calibration was executed during Orbits:

  - 29211-29215 (01/02-Oct-2007)
  - 29554-29558 (25/26-Oct-2007)

- Following occultation measurements with the moon rising on nightside were executed

  - 29556-29574 (25-Oct-2007 until 27-Oct-2007)

- One OCR was implemented (OCR_031: spatial straylight characterisation, Limb mode)

  - 28917-28920 (11-Sep-2007)

- No TC adjustments were required

- Light Path monitoring:

  - Channel 1&2: degradation in UV for all light paths involving ESM increases with a rate of <1 % per month. The average throughput loss in channel 1 is currently ca. 40%.

- Channel 3 small throughput loss (about 4%)
- Channels 4-7 small throughput loss (sub percent level)
- Channel 8 throughput remains stable at about 67%
- Channels 6-8 show a slight throughput decrease of about 0.5% in two months, which is a little larger than observed before

- PMD monitoring:

  - UV degradation visible in science channels is also visible in PMD 1 to 3
  - PMD 4 and 7 show a large decrease in throughput
  - PMD 6 results still under investigation

3 INSTRUMENT CONFIGURATION AND PERFORMANCE

3.1 In-Flight Status and Performance

Detailed operations, planning and instrument status information can be found on the website of the *SCIAMACHY Operations Support (SOST)* under http://atmos.caf.dlr.de/projects/scops/. These pages are maintained on a daily basis and show the history and actual progress of the SCIAMACHY mission.

3.1.1 Planned Operations and Measurements (SOST-DLR)

The reporting period covers the orbits 28771 (ANX = 01-Sep-2007, 00:34:41.807) to 29643 (ANX = 31-Oct-2007, 22:36:51.148). One OSDF specified the planning baseline.

Orbit		ANX		OSDF
Start	Stop	Start	Stop	
28771	29643	01-Sep-2007 00:34:41.807	31-Oct-2007 22:36:51.148	MPL_OSD_SHVSH_20070920_010101_00000000_34130001_20070901_003443_20071101_001725.N1

Table 3-1: SCIAMACHY OSDF planning file from September – October 2007

Measurements were nominal, i.e. timelines executed limb/nadir sequences with wide swath settings on the dayside of the orbit. In-flight calibration and monitoring measurements occurred on daily, weekly and monthly timescales according to the mission scenarios. Regular monthly calibration was scheduled between orbits:

- 29125-29129 (25/26-Sep-2007)
- 29211-29215 (01/02-Oct-2007)
- 29554-29558 (25/26-Oct-2007)

Due to an anomaly occurring on 24-Sep-2007 the monthly calibration scheduled between orbits 29125-29129 was repeated – without lunar measurements – as early as possible in October. It was executed in orbits 29211-29215.

The moon was in the limb TCFoV between orbits

- 29068-29153 (21-Sep-2007 until 27-Sep-2007)
- 29492-29574 (21-Oct-2007 until 27-Oct-2007)

Occultation measurements with the moon rising on the nightside could be executed between orbits

- 29556-29574 (25-Oct-2007 until 27-Oct-2007)

One OCR was implemented. This was OCR_031 (*Characterisation of spatial straylight in limb measurement mode*). Due to the complexity of OCR_031 it had been agreed to implement this OCR in two parts. Between orbits 28917-28920 (11-Sep-2007) the first

part of OCR_031 was successfully executed. Results have been analysed confirming the already proposed implementation of part 2.

3.1.2 Instrument Measurement Status (SOST-DLR)

The final flight status for states and timelines remained unchanged.

3.1.3 Executed Operations and Measurements (SOST-DLR)

Measurements and instrument availability

The OSDF planning file has been scheduled as requested except for one period:

- orbit 29107-29165 (24/28-Sep-2007): transfer to OFF-SAFE due to an ENVISAT service module anomaly (note that the originally planned OCM was executed during the recovery phase).

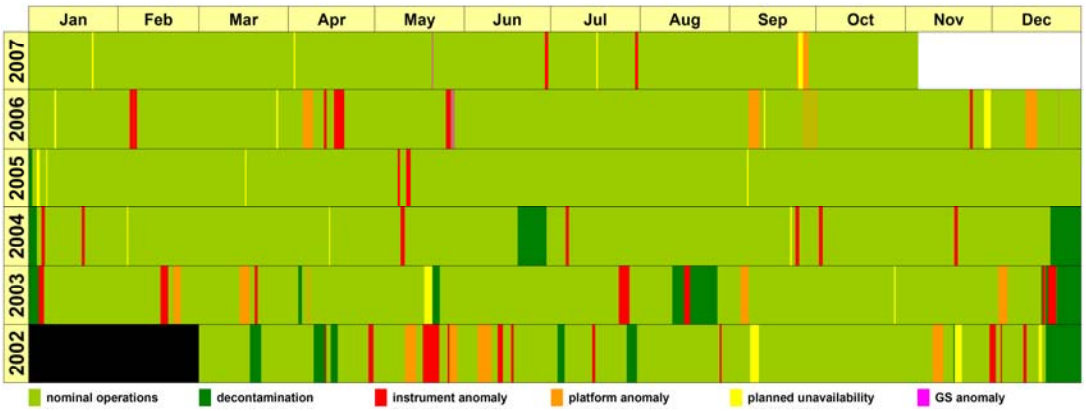


Fig. 3-1: Current instrument availability status including the reporting period

Detector thermal adjustment

No TC adjustment was executed. Thus the TC settings remained unchanged at

- DAC1 = 0.53 W
- DAC2 = 0.50 W
- DAC3 = 0.00 W

APSM/NDFM health checks & PMD ADC cal

In the reporting period 1 APSM/NDFM health check and 2 PMD ADC calibrations were executed. All showed nominal results.

APSM/NDFM			PMD ADC	
Orbit	ANX	Result	Orbit	ANX
n.a.	n.a.	n.a.	29107	24-Sep-2007 12:27:00 *note: executed via switch-off due to ENVISAT service module anomaly*
29618	30-Oct-2007 06:13:49	ok	29619	30-Oct-2007 07:50:19

Table 3-2: APSM/NDFM health check and PMD ADC calibration

Anomalies

One major on-board platform anomaly had occurred. In orbit 29107 (24-Sep-2007, 12:27:00 UTC) the payload was switched-off due to a service module anomaly. Subsequent recovery led to resuming MPS driven operations in orbit 29165 (28-Sep-2007).

Orbit	Date	Entry - UTC	Level	Entry Type	ID Content/Transition	Mode	Remark
29107	24-Sep-2007	2007.267.12.27.00.000	ENVISAT	SWITCHING	SM anomaly (global AOCS surveillance triggered)	OFF-SAFE	ENVISAT payload switch-off

Table 3-3: Instrument & platform anomalies between September and October 2007

3.1.4 Performance Monitoring - System (SOST-DLR)

Detector and OBM temperatures are monitored according to the requirements of the IOM *[1]*. It requests to ensure that the average temperature per orbit remains within the specified limits.

Detector temperatures

For each detector the average temperatures per orbit are determined from HK telemetry parameters. Fig. 3-2 displays the temperatures of all 8 detectors. Colour coding is as on the operational monitoring website, i.e. data from orbits with HK telemetry coverage > 90% are shown in red, for < 90% in green. Minimum/maximum values per orbit are indicated as vertical bars. The temperature limits of each detector are shown as horizontal lines.

All temperatures remained within limits.

It has to be noted that the detector temperature curves since 2002 clearly indicate a degrading TC system with constantly rising temperatures (0.2-0.3 K/year for detectors 1-6 and 1 K/year for detectors 7 & 8). This is, however, a predicted behaviour.

OBM temperatures

The average OBM temperature per orbit is determined from specific HK telemetry parameters. In addition power readings for the ATC heaters are monitored. Temperatures and ATC heater powers are given in Fig. 3-3 and 3-4. Colour coding is as in Fig. 3-2.

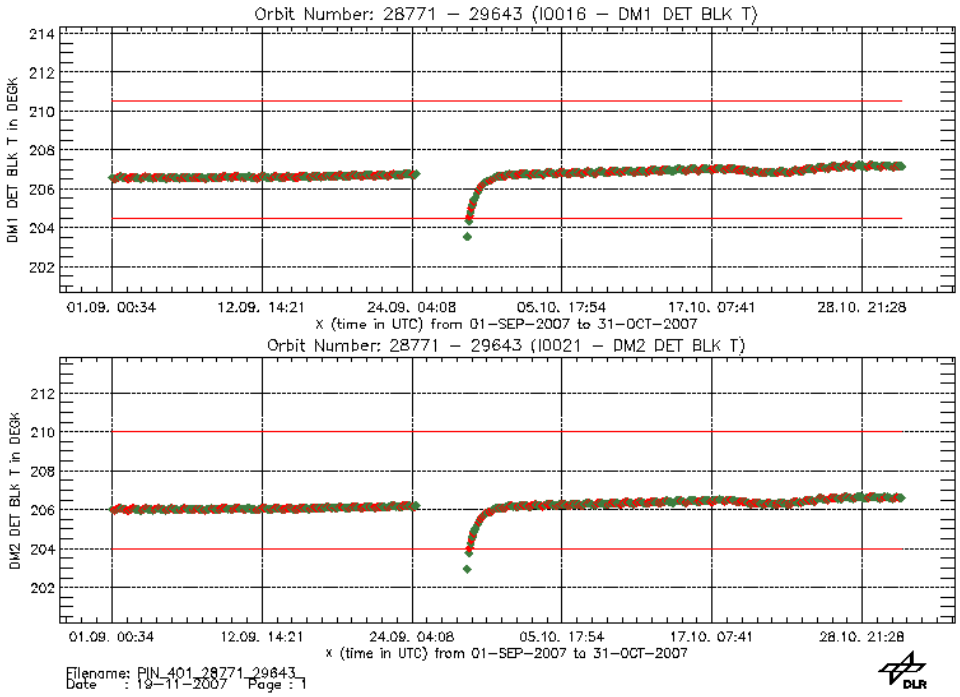
OBM temperatures and ATC heater powers remained within limits.

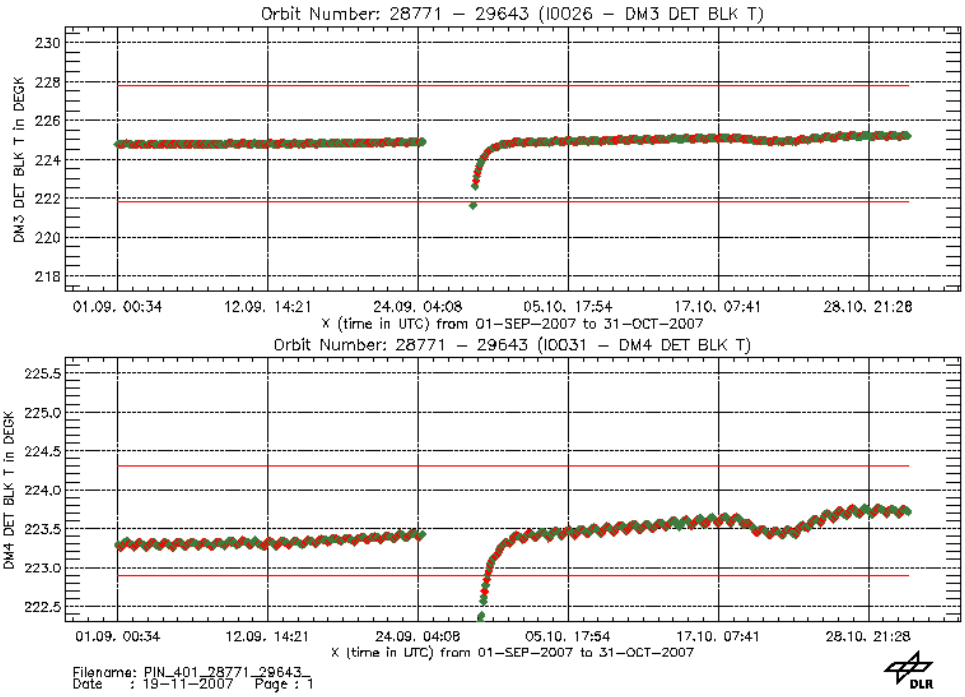
Due to the degradation of the ATC system the ATC nadir heater power came close to its lower limit of 1.63 W by end of October. In preparation of the required adjustment of the ATC setpoints the corresponding documentation and tools have been analysed to initiate the IOM adjustment procedure as soon as this becomes necessary. Note: According to the available documentation special attention has to be given to the calibration status after an ATC adjustment.

PMD ADC status

The status of the PMD ADC is monitored according to the requirements of the IOM *[1]*. It requests to ensure that no glitches occur caused by an SEU.

No PMD ADC glitches have been detected.


Orbit Number: 28771 – 29643 (10016 – DM1 DET BLK T)
DM1 DET BLK T in DEGK
214
212
210
208
206
204
202
01.09. 00:34
12.09. 14:21
24.09. 04:08
05.10. 17:54
17.10. 07:41
28.10. 21:28
X (time in UTC) from 01-SEP-2007 to 31-OCT-2007
Orbit Number: 28771 – 29643 (10021 – DM2 DET BLK T)
DM2 DET BLK T in DEGK
212
210
208
206
204
202
01.09. 00:34
12.09. 14:21
24.09. 04:08
05.10. 17:54
17.10. 07:41
28.10. 21:28
X (time in UTC) from 01-SEP-2007 to 31-OCT-2007
Filename: PIN_401_28771_29643
Date : 19-11-2007 Page : 1
DLR


Orbit Number: 28771 – 29643 (10026 – DM3 DET BLK T)
DM3 DET BLK T in DEGK
230
228
226
224
222
220
218
01.09. 00:34
12.09. 14:21
24.09. 04:08
05.10. 17:54
17.10. 07:41
28.10. 21:28
X (time in UTC) from 01-SEP-2007 to 31-OCT-2007
Orbit Number: 28771 – 29643 (10031 – DM4 DET BLK T)
DM4 DET BLK T in DEGK
225.5
225.0
224.5
224.0
223.5
223.0
222.5
01.09. 00:34
12.09. 14:21
24.09. 04:08
05.10. 17:54
17.10. 07:41
28.10. 21:28
X (time in UTC) from 01-SEP-2007 to 31-OCT-2007
Filename: PIN_401_28771_29643
Date : 19-11-2007 Page : 1
DLR

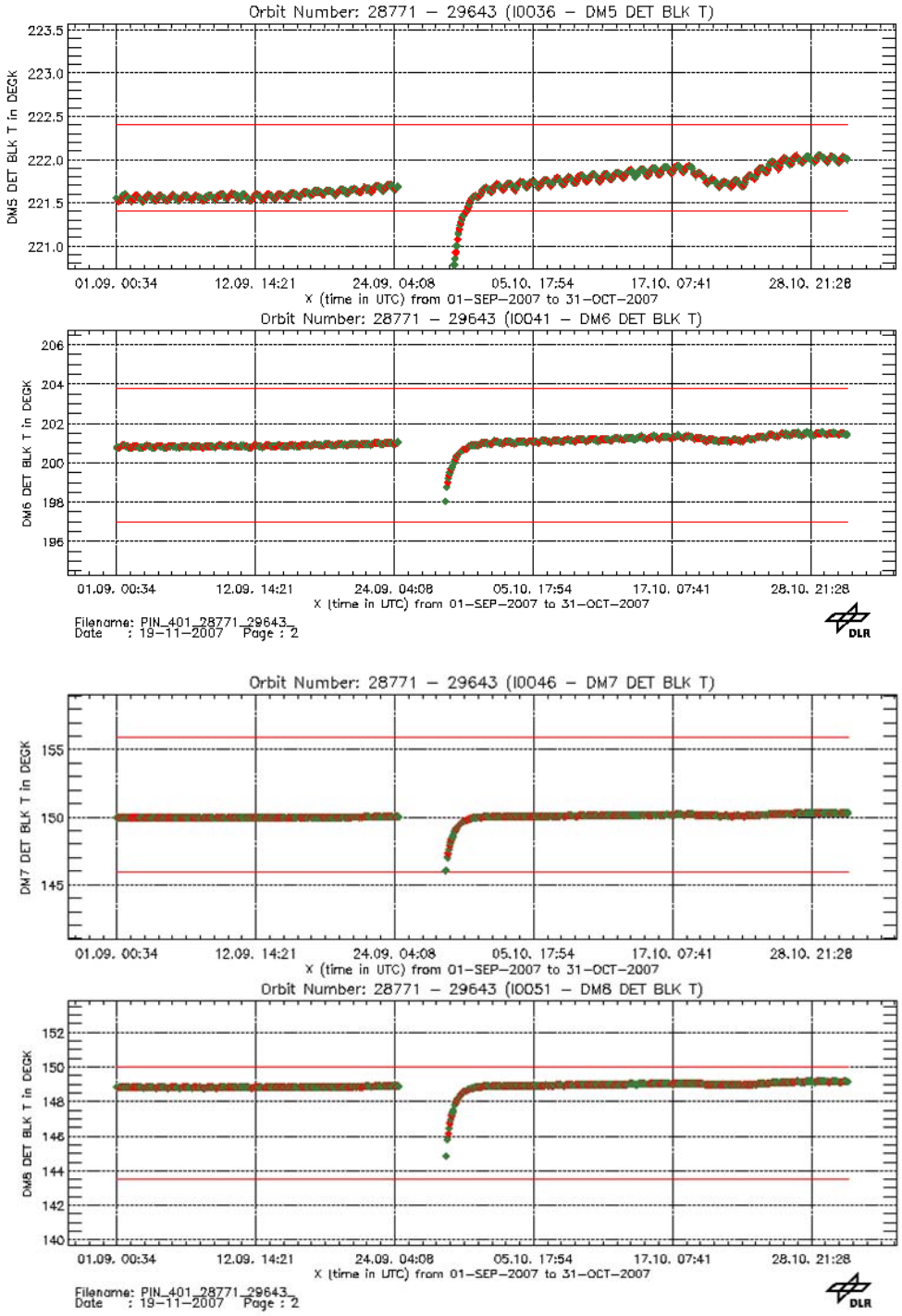


Fig. 3-2: Detector temperatures

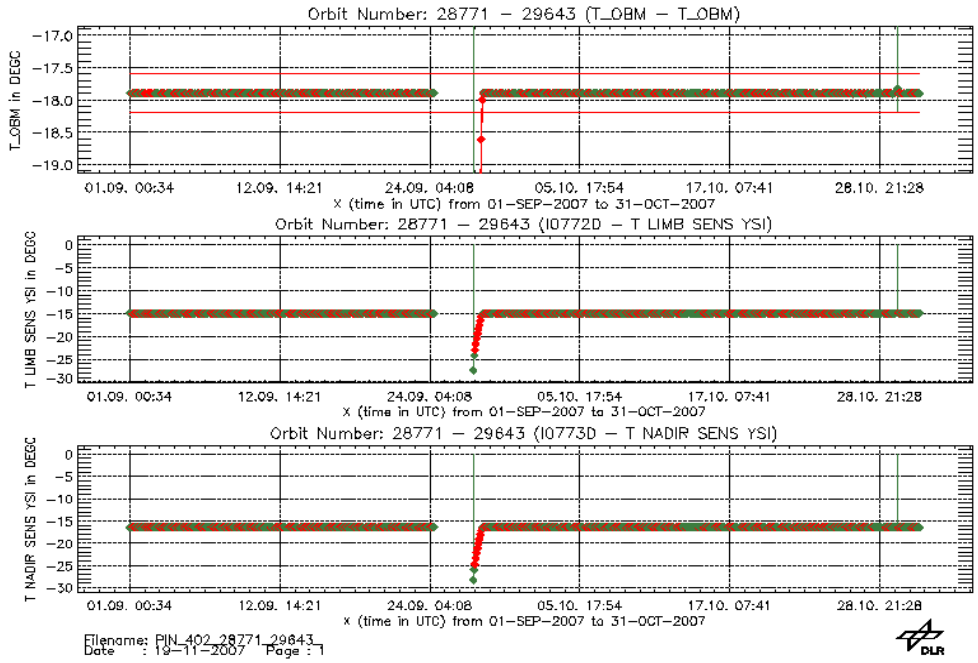


Fig. 3-3: OBM temperatures (top: derived OBM, middle: limb sensor, bottom: nadir sensor)

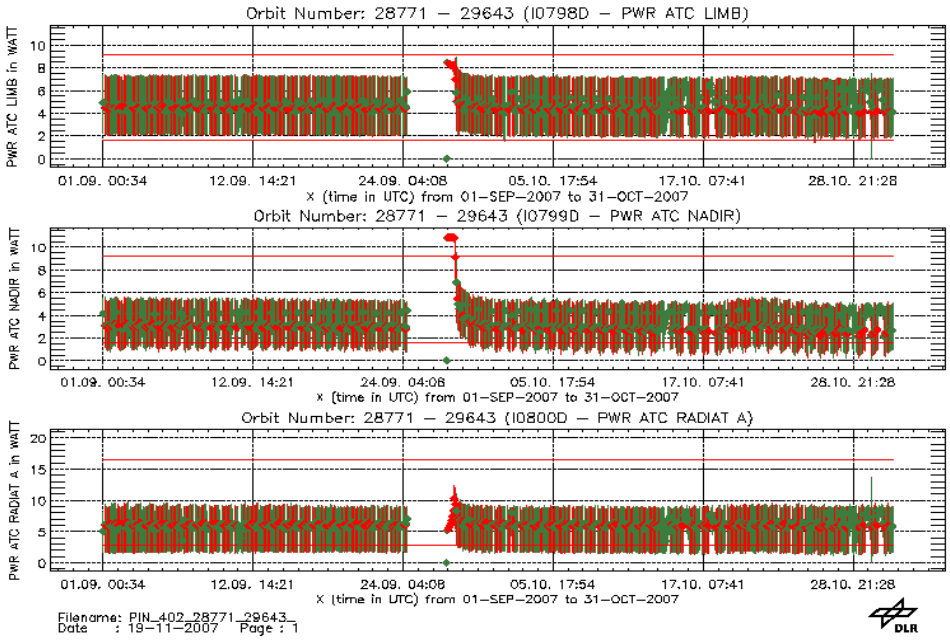


Fig. 3-4: ATC heater power (top: ATC limb, middle: ATC nadir, bottom: ATC Rad A)

LLI status

Life Limited Items are monitored based on analysis of the

- OSDF: This yields a predicted LLI usage.
- Report format: This counts the actual LLI switches or used LLI cycles. No WLS/SLS burning times can be derived thereof.

In addition, the in-flight usage of the cryogenic heat pipe is recorded. This subsystem has a limited number of cycles. Each decontamination increases the accumulated number of cycles by 1.

At the end of the reporting period the fractional usage of the LLI relative to the allowed in-flight budget was (based on OSDF prediction)

- NDFM: 0.38
- APSM: 0.35
- NCWM (sub-solar port): 0.72
- WLS (switches): 0.13
- WLS (burning time): 0.25
- SLS (switches): 0.05
- SLS (burning time): 0.01

For the NDFM and APSM the safety margin factor of 2 was no longer applied in the calculation of the fractional usage since it was found acceptable to stay below the figures of the lifetests. How the relative LLI usage has accumulated since launch can be seen in fig. 3-5. ‘EOL’ assumes a total mission lifetime until end of 2010. The relative usage at EOL in fig. 3-5 reflects the modifications of the mission scenario implemented in October 2006 (reduction of subsolar rate to 2/week).

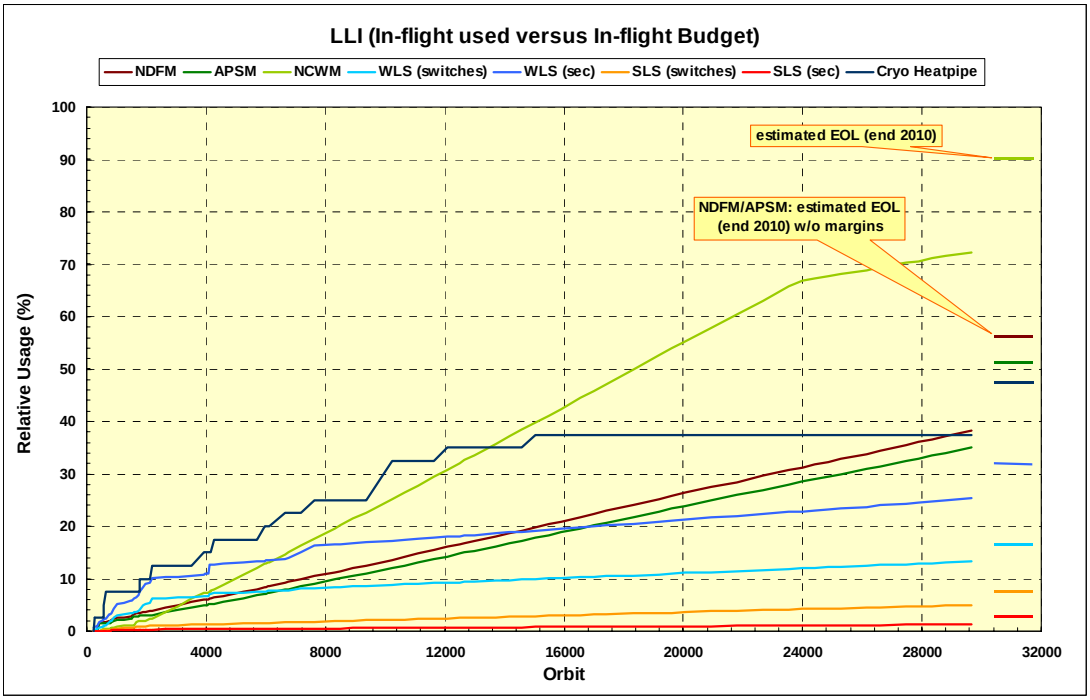


Fig. 3-5: Relative usage of LLIs. 'EOL' is derived for a mission lifetime until 2010. For the NDFM and APSM no margin factors have been applied to derive the EOL relative usage. Note the change in slope for the NCWM due to the reduction of subsolar measurements starting in October 2006.

The number of cryogenic heatpipe cycles did not increase (no decontamination). The budget used remained at 38% of the allowed in-flight budget.

Time reference

The times quoted in all planning files refer to the reference orbit. Since the actual orbit differs from the reference orbit (e.g. orbit drift), the times given w.r.t. the reference orbit also do not reflect exactly the actual absolute times of events along the orbit (e.g. ANX, sunrise, sub-solar, moonrise, eclipse). The requirements for orbit maintenance may result in time differences of usually < ±10 sec. In some cases this value may even reach ±1 min, however.
SOST monitors how the reference time deviates from the actual time. This is done by using the predicted time which comes very close to the actual = restituted time. If the predicted times are delayed w.r.t. the reference orbit, then the difference *predicted – reference time* is > 0 sec; in the other case it is < 0 sec.

Fig. 3-6 displays the time difference *predicted – reference*. Orbit manouevres cause distinct discontinuities.

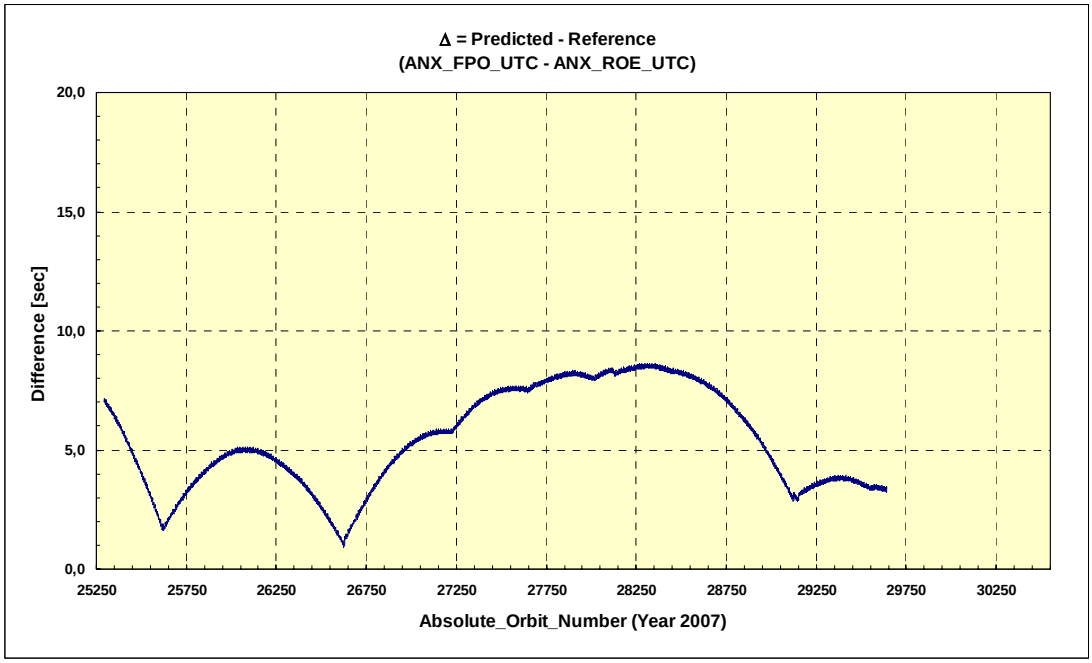


Fig. 3-6: Time difference between predicted and reference time.

3.1.5 Performance Monitoring - Light Path (SOST-IFE)

3.1.5.1 Science Channel Averages

One part of the SOST long-term monitoring activities is the trend analysis of measurements with the internal White Light Source (WLS) and of observations of the unobscured Sun above the atmosphere. In order to monitor the different SCIAMACHY light paths solar measurements are taken in various viewing geometries: In limb/occultation geometry (via ASM and ESM mirrors), in nadir geometry (via the ESM mirror through the subsolar port), and via the so-called calibration light path involving the ASM mirror and the ESM diffuser. SCIAMACHY long-term monitoring comprises a regular analysis of these measurements. The plots displayed in Fig. 3.7 show results of these monitoring activities for the time interval September to October 2007.
Note that the reported arithmetical channel averages are medians.

The displayed data have been produced in the following way:
All measured spectra have been divided by the corresponding measurement at a reference time; then for each channel a median of the ratio is computed, yielding an effective instrument throughput for the different light paths.
The reference spectra for all light paths are derived from measurements on 16 January 2003 (the time of the first monthly calibration performed with final flight settings). The resulting medians are then scaled to be 1 just after the first decontamination under

(quasi-) nominal measurement conditions in August 2002. Therefore, the reference date for all data is in fact 2 August 2002.
Subsolar measurements before 30 November 2002 (about orbit 3922) did not consider the known yaw misalignment of SCIAMACHY on ENVISAT and thus may not be used for monitoring purposes. Therefore there are no subsolar data shown before December 2002. Since no valid subsolar measurements are available for August 2002 the subsolar throughput data have been scaled to 2 August 2002 by using the same factor as for the limb light path.
Note that measurements performed during times of reduced instrument performance (e.g. switch-offs or decontamination periods) have been omitted.
The results presented in Fig. 3.7 are based on the analysis of Level 0 data, which have been corrected for dead/bad pixels, dark current (fixed value from August 2002), scan angle dependencies, quantum efficiency changes, and the seasonally varying distance to the Sun. Additional calibration steps have not been performed, like for example a straylight correction. Therefore, variations smaller than about 1% require careful interpretation. Especially, small variations of the throughput signal may be caused by remaining seasonal effects due to the limited calibration of the data.
Until October 2006 the nadir/subsolar light path was monitored based mainly on fast sweep measurements. However, subsolar pointing measurements are considered to have a better quality for monitoring purposes (especially for PMD monitoring) and thus have become the new baseline.
Since 1 October 2006 subsolar measurements in fast sweep scan mode are only executed once per month (before that time: daily) whereas subsolar measurements in pointing mode are executed twice per week (before: once per month).

The channel average plots in Fig. 3.7 show both data sets for the subsolar light path.
Note that the reference time for the subsolar pointing data is 16 January 2003 (instead of 10 January 2003 for subsolar fast sweep).
The light path monitoring results presented in this section may be regarded as a first step towards spectrally resolved monitoring factors (m-factors) which will be produced based on fully calibrated data.
Daily updated light path monitoring results can be found on the SOST or IUP web site (http://www.iup.uni-bremen.de/sciamachy/LTM/LTM.html).

The following specific features can be identified from the light path monitoring results during the time interval of this report:

- Overall, the instrument throughput changes were close to expectation.
- For all light paths involving the ESM mirror the degradation in the UV (channels 1 and 2) increases with a rate of about 0.5-1% per month, similar as observed during the previous time intervals. The maximum average throughput loss in channel 1 lies currently around 40% (for the limb light path; the WLS throughput is considered to be not representative here because a degradation of the lamp may not be excluded). The throughput of the calibration light path which involves the ESM diffuser instead of the ESM mirror is currently about 89%, showing a small decrease of less than 1% over the two months covered by this report.

- The overall degradation of channel 3 is very small (about 4%) compared to channels 1 and 2. Except for the WLS light path which shows a decrease in throughput of much less than 0.5% no clear change in throughput is observed within two months.
- Channels 4 and 5 remain stable on a sub-percent level.
- Channels 6 to 8 show a slight throughput decrease of about 0.5% in two months, somewhat larger than observed before.
- The Channel 8 transmission remains for all light paths at around 67%.

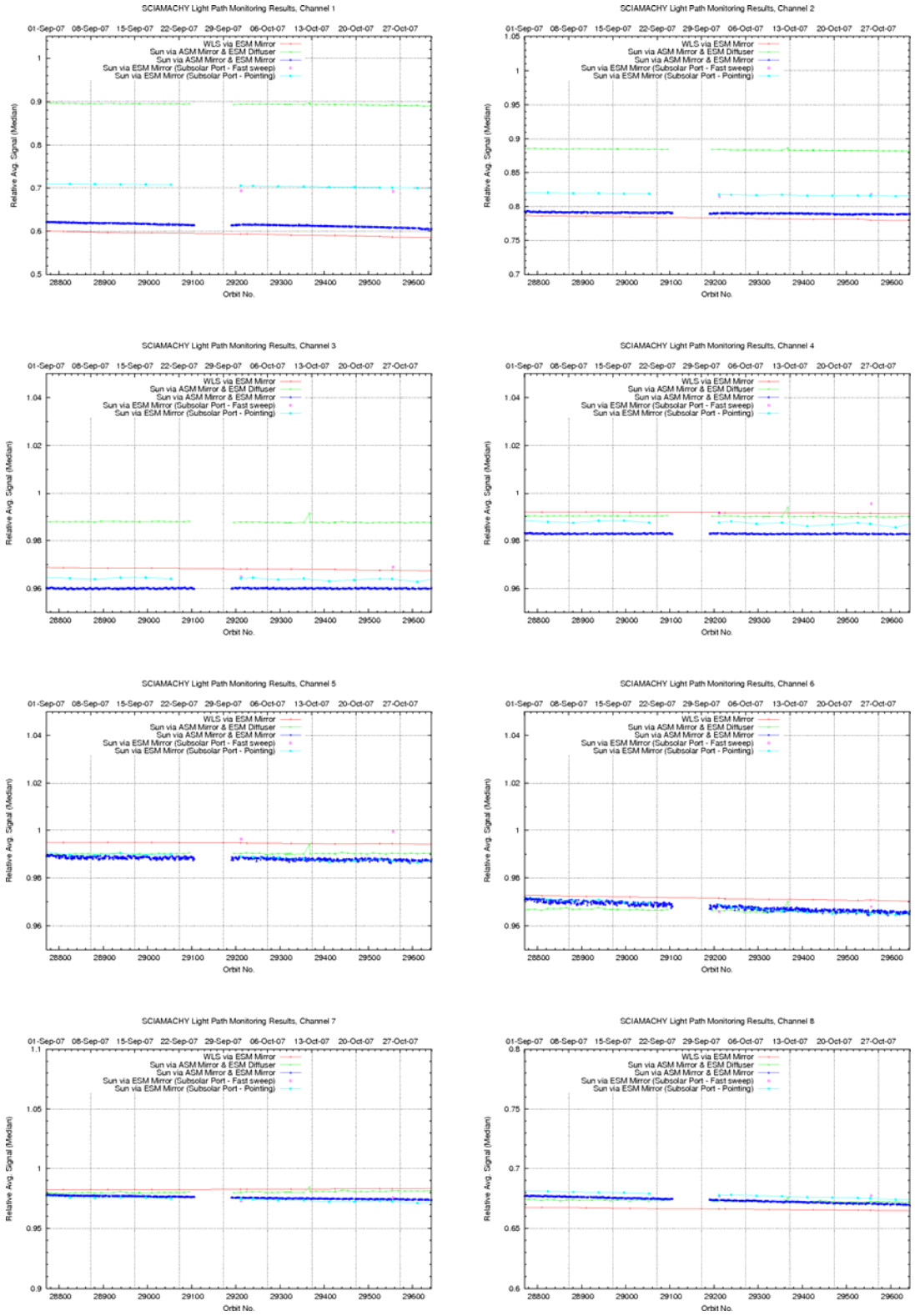


Fig. 3.7: Light path monitoring results September to October 2007 (medians).

3.1.5.2 Spectral light path monitoring results

Fig. 3.8 – 3.11 show results of spectral throughput monitoring performed by SOST-IFE for the different light paths (nadir, limb, calibration, and WLS). These results have been derived from Level 0 data analysed in a similar way as for the channel averaged throughput data (but of course without spectral averaging). Because the variation in spectral direction is very small within two months, Fig. 3.8 – 3.11 show the complete time series from 2 August 2002 to the end of October 2007.

Notes:

- The data (12:00 UTC reference time) have been interpolated over dead/bad pixels (using the on-ground list).
- Data from times of reduced instrument performance (like decontaminations or instrument switch-offs) have not been considered. These times are masked out by grey vertical bars.
- All data have been transformed to a daily grid, involving averaging and interpolation.
- Ratios have been performed on a pixel axis without any spectral interpolations. The wavelength axis is just for illustration and gives only approximate values, assuming a linear relation between pixel number and wavelength.
- Depending on the availability of measurement data, features close to large data gaps (especially before and after a decontamination) may be caused by interpolation.
- WLS data have not been corrected for a potential degradation of the lamp. Only the intensity jump after the extended WLS usage in June 2003 has been removed.
- As mentioned before, the timing of subsolar measurements before 30 November 2002 did not consider the known yaw misalignment of SCIAMACHY on ENVISAT. The timing has been corrected in the final flight settings. To take this change into account, all subsolar measurements have been referred to orbit 4519 (10 January 2003).
  Therefore, subsolar results before 30 November 2002 are not reliable.
- Subsolar pointing data are not considered here yet because of their low measurement frequency before October 2006. Activities to generate a joined consistent subsolar fast sweep/pointing data set are ongoing.
- Subsolar data affected by blocking of the subsolar port (May/June 2007) have been excluded.

The underlying data for the spectral monitoring are available via the SOST-IFE web site (see http://www.iup.uni-bremen.de/sciamachy/LTM/LTM_spectral/LTM_spectral.html). As for the plotted results, these data are regularly updated one to two times per month.

The following main features can be identified in the spectral monitoring plots:

- As expected, the UV degradation generally decreases with increasing wavelength.
- The SCIAMACHY degradation strongly depends on wavelength and is largest at the channel edges. The prominent degradation peak around 350 nm in channel 2

coincides with a region of high polarisation sensitivity, although this is probably not directly related.

- The minimum throughput is below 50% for the limb and WLS (nadir) light paths at the short wavelength edge of channel 1.
- Also solar activity variation can be seen in the plots, e.g. the intensity change of the solar Mg II Fraunhofer line at about 280 nm.
- The degradation in channel 3 which was already indicated by the channel integrated results is much better visible in the spectrally resolved plots, where the propagation of this effect in time to higher wavelengths can be clearly identified.
- The difference in degradation between the diffuser light path and the other light paths is also visible in the plots; however, the spectral regions where degradation is strongest coincide quite well.
- The spectral plots also show that the relative stability for channels 4 and 5 observed in the integrated data is not present over the whole spectral range; also these channels show variations, but these are restricted to the overlap regions close to the channel edges.
- Channel 6 spectral results confirm the assumption of a slight degradation in this channel which is concentrated at the lower wavelength edge and independent of the overlaid remaining seasonal cycle.
- For channels 7 and 8 the spectral behaviour of the throughput loss is consistent with (broadband) ice absorption features. The effect of the decontaminations is of course also clearly visible in these channels.
- Especially channel 8 shows a large pixel dependence of the throughput variation caused by the different sensitivity of the pixels. This variation is much higher for light paths where the small aperture is involved (i.e. nadir (subsolar) and limb), indicating that the small aperture causes additional effects which need to be considered when applying these results to Earthshine data.
- In general, the WLS data are much smoother than the solar data.

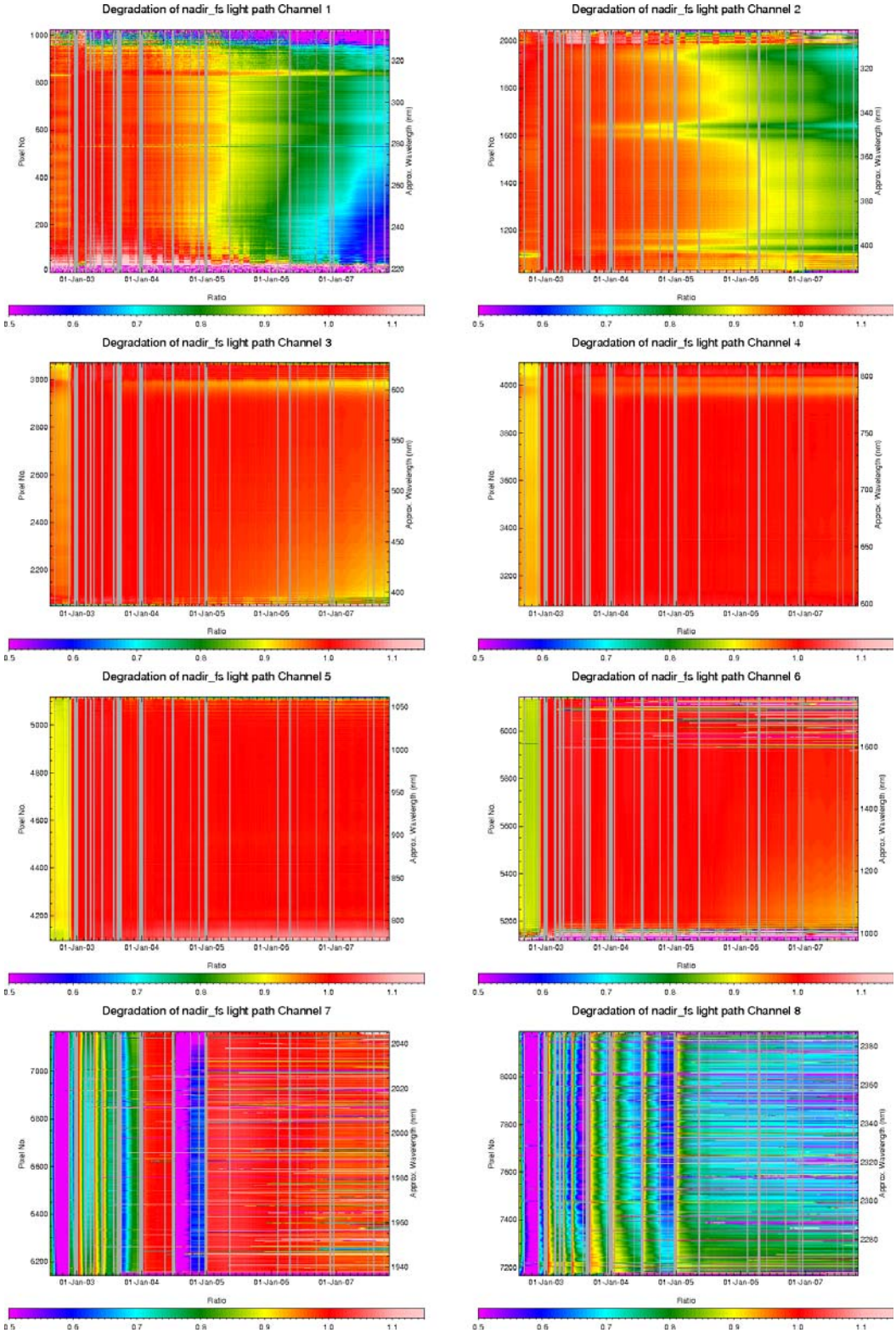


Fig. 3.8: Spectral light path monitoring results August 2002 to October 2007 (nadir light path)

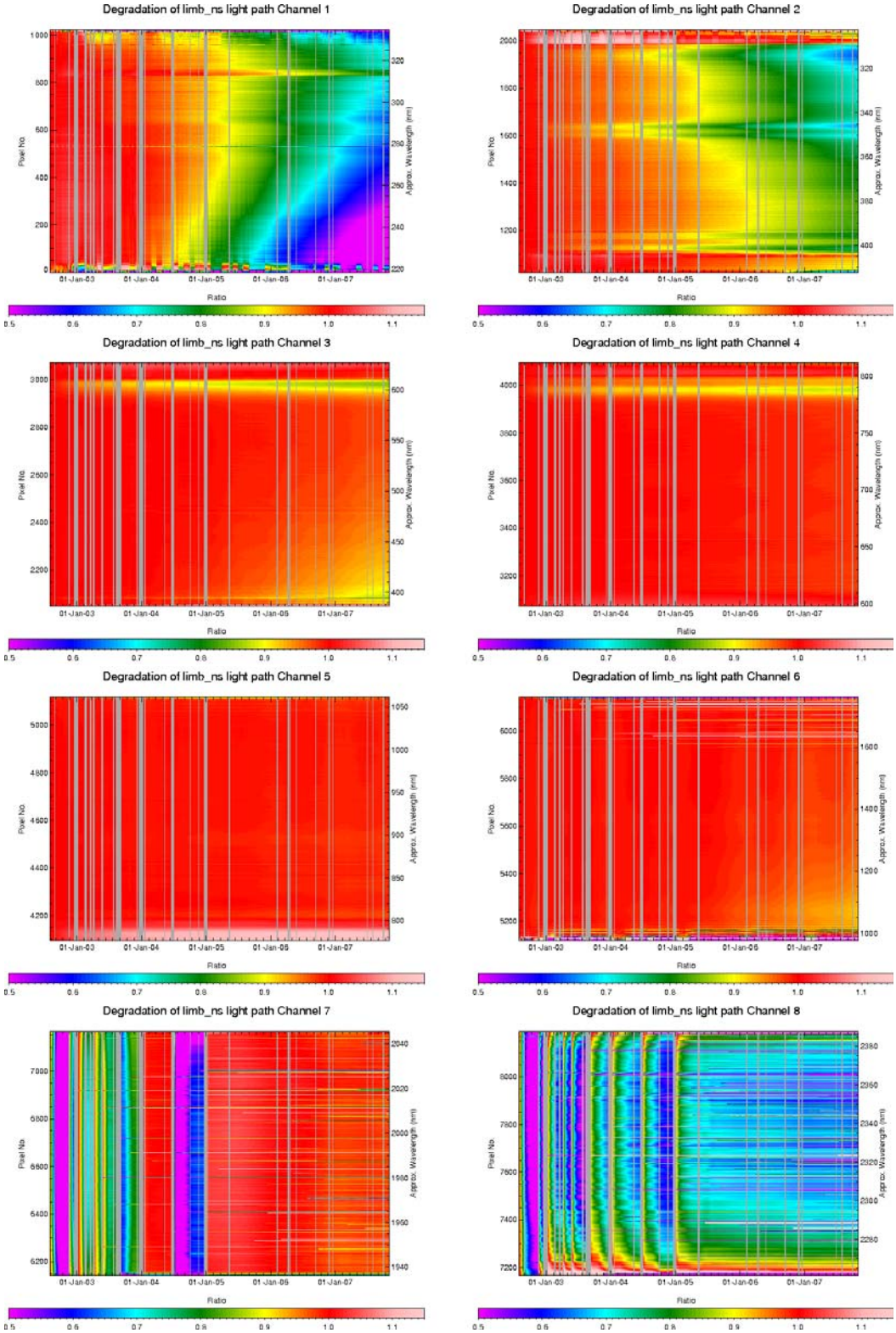


Fig. 3.9: Spectral light path monitoring results August 2002 to October 2007 (limb light path)

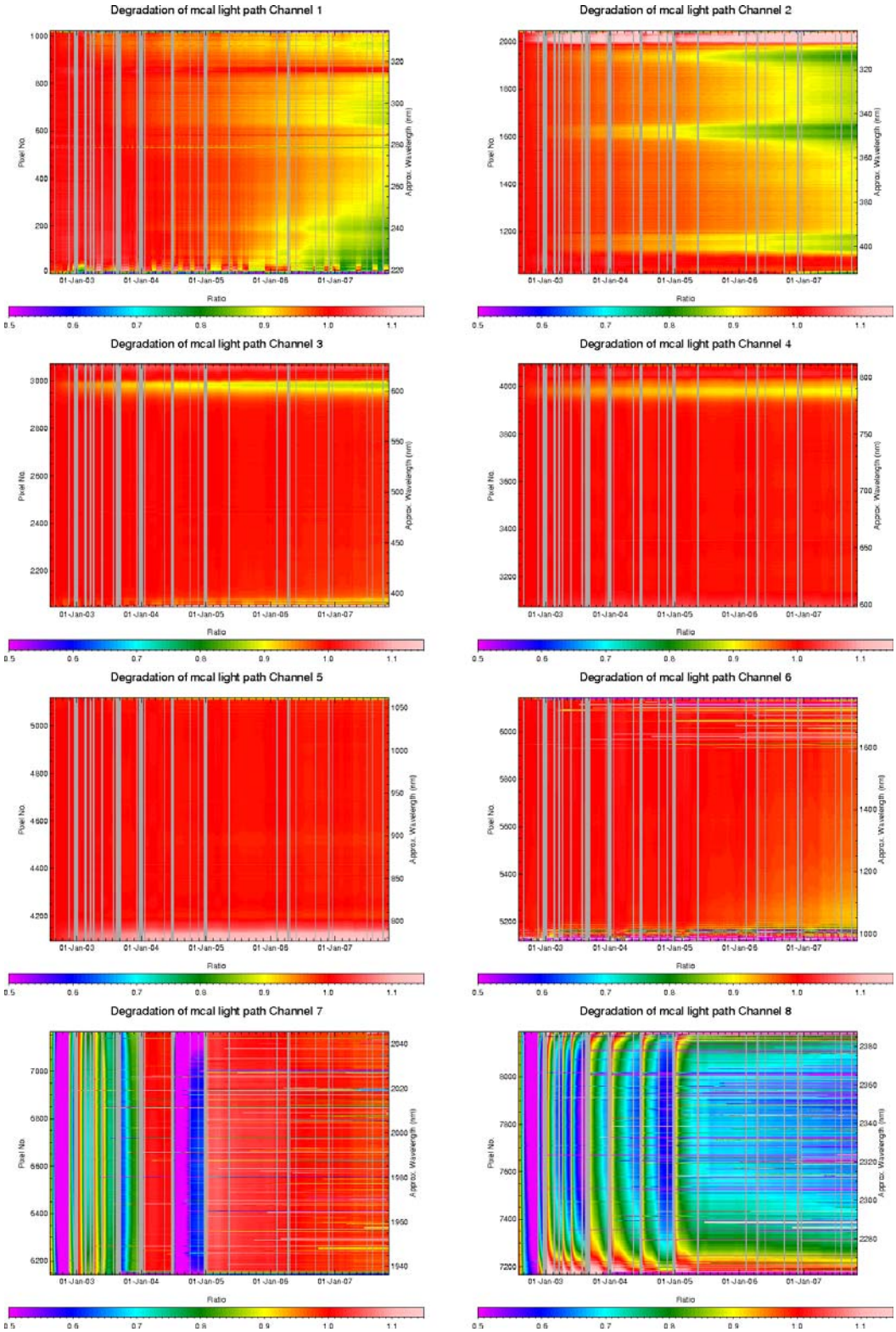


Fig. 3.10: Spectral light path monitoring results August 2002 to October 2007 (calibration light path)

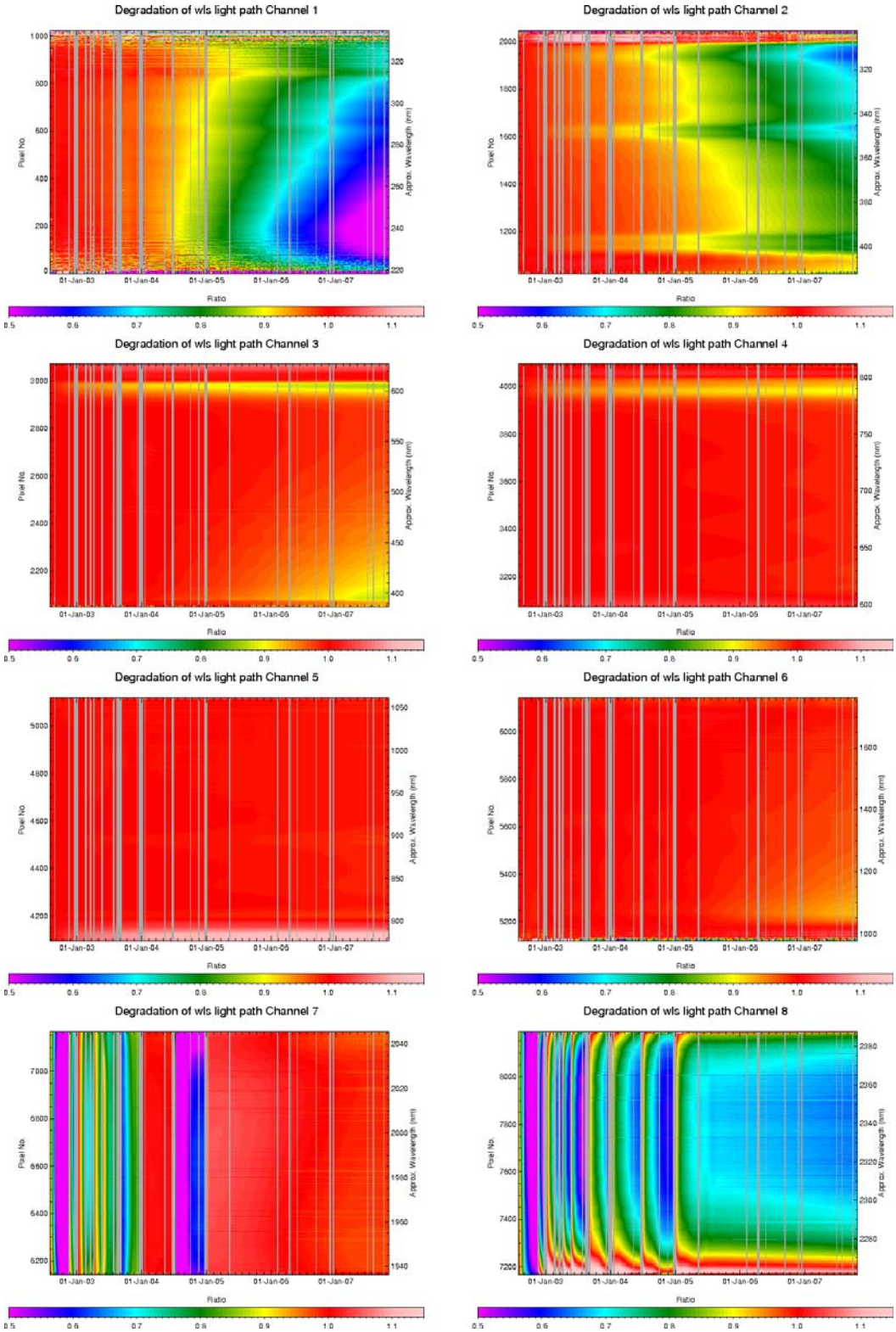


Fig. 3.11: Spectral light path monitoring results August 2002 to October 2007 (WLS light path)

3.1.5.3 PMD monitoring results

The SCIAMACHY PMDs are monitored in a similar way as the science channels, but of course no channel averaging is performed. However, the results presented here are based on the same measurements as the science channel results (but using the PMD low gain signal), and they have been normalized to the same reference times as the spectral results. Thus, the reference time for the subsolar data is January 2003, whereas it is August 2002 for the other data sets.
For the nadir light path it is not possible to use subsolar fast sweep measurements for PMD monitoring, because these show too large scatter. This is probably caused by a combination of the very time-sensitive measurement type and scan mode and the fact that the PMDs measure a sampled signal, not an integrated one. Therefore, subsolar pointing measurements are used for monitoring of the PMD nadir light path, because the pointing signal is much more stable. Until October 2006 subsolar pointing measurements were only performed once per month, therefore the temporal sampling is much less than for the other light paths. Since 1 October 2006 the number of subsolar pointing measurements has been increased (on the cost of subsolar fast sweep data).
Fig. 3.12 shows the PMD throughput variation for the whole time period between 2 August 2002 and 31 October 2007. Note that a constant dark signal for each of the PMDs has been assumed. To verify this assumption, Fig. 3.12 also shows the variation of the PMD dark signal over time, which is usually quite low.
Note that PMD 7 results are most likely dominated by straylight and not reliable. They are only shown for completeness. Furthermore, WLS data are only available for PMD 1 to 3 because of saturation in the other PMD channels.

Considering the broadband character of the PMDs, the observed PMD throughput changes are (except for PMD 4 and 7) very similar to those of the science channels with the following features:

- The UV degradation apparent in the science channels is also visible in PMD 1 to 3.
- PMD 4 and 7 (which cover the same wavelength interval) show a considerably large decrease in throughput which is still unexplained (but may be related to the specific detector material).
- There are remaining seasonal variations in the data which could up to now not be corrected out. The amplitude of these seasonal variations increases with the wavelength range covered by the PMD. This issue is still unresolved.
- The PMD 6 dark signal shows a strange variation over time which is still under investigation.

A more detailed investigation of the open issues listed above requires a better calibration of the monitoring data which is currently (in the context of m-factor generation) under development, but will probably take some time.

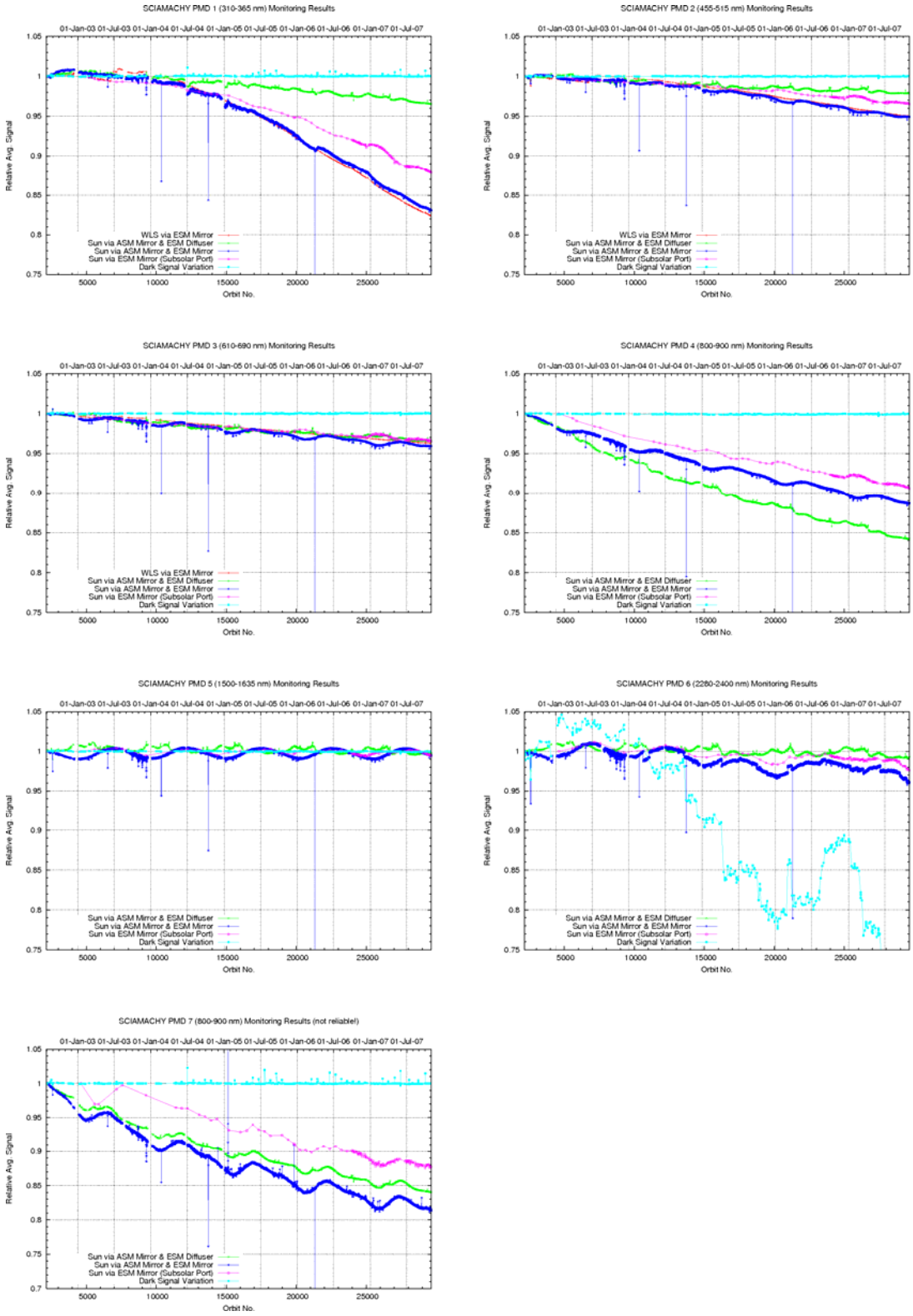


Fig. 3.12: PMD monitoring results August 2002 to October 2007

4 DATA AVAILABILITY STATISTICS

4.1 Downlink/Acquisition Performance

Problems are known for the products listed in Tab. 4.1:

Product	Day	Filename	description
SCI_NL__0P	04-SEP-2007	SCI_NL__0PNPDK20070904_093120_000059802061_00208_28819_6024.N1	sciamachy_source_packets ERROR: incorrect file size
SCI_NL__0P	10-SEP-2007	SCI_NL__0PNPDK20070910_144017_000058992061_00297_28908_6079.N1	sciamachy_source_packets ERROR: incorrect file size
SCI_NL__0P	13-OCT-2007	SCI_NL__0PNPDK20071013_090608_000059682062_00265_29377_6333.N1	sciamachy_source_packets ERROR: incorrect file size
SCI_NL__0P	15-OCT-2007	SCI_NL__0PNPDK20071015_161709_000058992062_00298_29410_6355.N1	Data corruption (but no format problem) no processing to level 1 possible
SCI_NL__0P	24-OCT-2007	SCI_NL__0PNPDK20071024_163308_000060362062_00427_29539_6439.N1	sciamachy_source_packets ERROR: incorrect file size

Table 4-1

These occurrences of data corruptions are currently under investigation.

4.2 Statistics on unconsolidated data (SCI_NL__0P, SCI_NL__1P)

This paragraph reports the availability of NRT data on a monthly basis. The statistics are based on level 0 data and level 1 data inventoried in the ground segment. Unavailability periods due to instrument anomalies or Satellite switch-offs are excluded. The gaps considered are only interfile gaps.

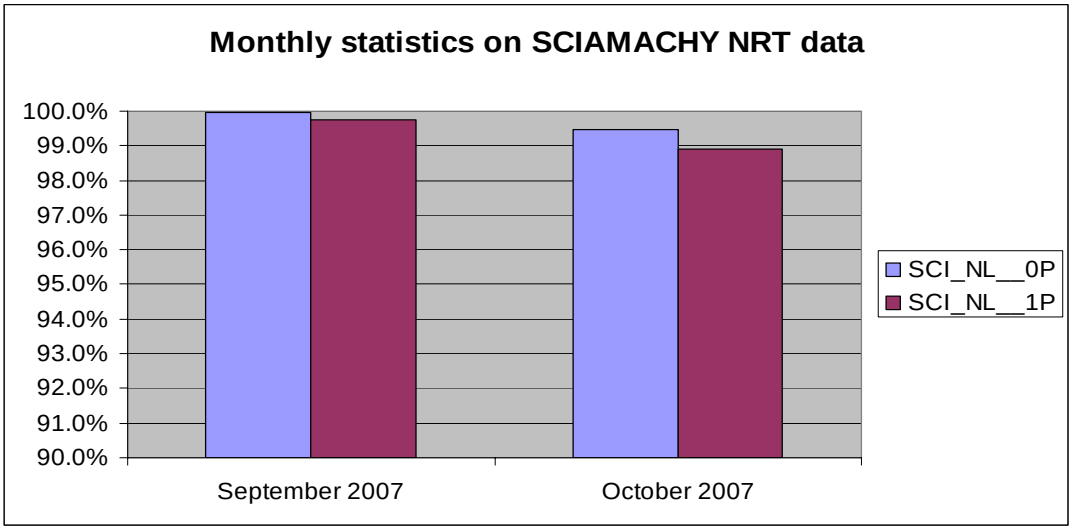


Fig. 4-1: Statistics on available unconsolidated level 0 and level 1 products

4.3 Statistics on consolidated data

In this chapter an overview about operational off-line data (consolidated data) is provided.

4.3.1 Anomalies on level 0 consolidated data products

In the past it had been reported by SOST-DLR that the SCIAMACHY consolidated level 0 data contain errors and are not complete. Following specific problems have been identified and are reported in detail in the technical notes *[3]*, *[4]* for years 2003 and 2004 as well as for products of 2005 *[5]*:

- For one orbit there can be more than one consolidated level 0 product. These products may be identical or different in content (disregarding the product type file counter).
- Some orbits are not covered by consolidated level 0 products although SCIAMACHY was operational.
- Some orbits are covered by consolidated level 0 products but the product duration does not comply with the actually planned and executed instrument operations in that particular orbit.
- Some consolidated level 0 products exceed the Reed Solomon correction threshold and are flagged accordingly. The occurrence of Reed Solomon errors is non-uniform.
- Until late October / early November 2003 consolidated level 0 data are hampered by an incorrect orbit number.

More details on consolidated level 0 anomalies can be found on the SOST web page, which contains a catalogue of available level 0 consolidated data and description of errors.
http://atmos.caf.dlr.de/projects/scops/data_availability/availability.html

A recovery plan was initiated in order to reprocess erroneous data 2002 - 2006. This activity has been completed.

The overall goal is to achieve a level 0 consolidated data ‘master set’ that allows data reprocessing of improved data quality.

4.3.2 Availability of consolidated SCI_NL__1P products

SCIAMACHY level 1b consolidated data are generated at D-PAC using the consolidated level 0 products as input for processing. The available level 1b off-line products on the D-PAC ftp-server are checked for completeness and an overview for the months September to October 2007 is summarised here, considering flight segment and ground segment anomalies. Note that from this report also interfile gaps are considered but no data gaps inside the products.

Month/Year	Planned orbit range	Number of orbits unavailable due to anomalies	Number of unique orbits available at D-PAC	Expected number of orbits (considering anomalies)	Availability in percentage during month
09/2007	28771 – 29199	58	369	371	99.4%
10/2007	29200 - 29643	0	*	444	*

Table 4-2 Consolidated level 1b statistics

4.4 Statistics on reprocessed data

4.4.1 Level 1b re-processing IPF 6.03

The second reprocessing cycle has started on 24 September 2007 for level 1b processing using the level 1b IPF version 6.03 at D-PAC.
A new re-processing flag was introduced in the filename and MPH, which is the letter "R" replacing the Processing Stage flag "P" for off-line level 1b products, that was valid for IPF 5.04 and IPF 6.02 products.

Currently (status 20 November 2007) the level 1b data of the period 02 August 2002 – January 2007 are reprocessed and available at the D-PAC server. Analysis on processing data gaps is on-going. Reprocessing currently continues until May 2007.
However, the statistics on the re-processed data set is generally very high. Besides a few exceptions the monthly availability lies between 95% and 100%. Also the processing speed is performing very well.
Detailed statistics will be provided in the next BMR, when the reprocessing is expected to be completed.

* The statistics for October will be provided in the next BMR.

4.4.2 Level 2 re-processing processor version 3.01

Level 2 off-line re-processing has started after the upgrade of processor version 3.00 to version 3.01 on 12 October at D-PAC.
Also the level 2 off-line reprocessed data set contains the new processing flag “R” in the filename and MPH.
While level 1b re-processed data are already made available to the complete SCIAMACHY user community, level 2 off-line products are being validated by the SCIAVALIG team before giving access to the user community.
Currently (status 20 November 2007) the level 2 data of the period 02 August 2002 – December 2004 are re-processed.
As for level 1b data, the processing rate is generally very high. Detailed statistics will be provided in the next BMR, when the reprocessing is expected to be completed.

5 LEVEL 1 PRODUCT QUALITY MONITORING

5.1 Processor Configuration

5.1.1 Version

The operational IPF version used for processing of near real-time SCIAMACHY level 1b data is 6.03 at Kiruna and ESRIN. The same IPF is used for level 1b off-line processing at D-PAC for forward processing and the second SCIAMACHY full mission re-processing cycle.

The corresponding product specification is Volume 15 issue 3/k *[2]*. It is available at http://earth.esa.int/pub/ESA_DOC/ENVISAT/Vol15_Sciamachy_3k.pdf

The updated (November 2007) disclaimer at http://envisat.esa.int/dataproducts/availability/disclaimers/SCI_NL__1P_Disclaimers.pdf describes known artefacts as well as major improvements with respect to the previous IPF version.

Table 5.1 gives a brief overview of changes implemented with processor versions IPF 6.03, 6.02, 6.01 and 5.04/5.01.

IPF Version	Description	Proc Centre	Date	Start Orbit
6.03	Following changes are implemented with IPF 6.03 • New pointing correction (new SCI_LI1_AX) • Updated of the ESA CFI (5.6) software • Correction of a non compliancy report, impacting the Leakage GADS in the consolidated data processing chain (channels 6-8)	D-PAC	04-JUL-2007	27937
		PDHS-E	19-JUL-2007	28153
		PDHS-K	19-JUL-2007	28145
6.02	No algorithm specification changes were implemented, but following non compliances of version 6.01 have been corrected, to get • Polarisation correction factors different from 0 • Correct order of SMR spectra in Sun Reference ADS	D-PAC	05-MAY-2006	21843
		PDHS-E	07-JUN-2006	22327
		PDHS-K	07-JUN-2006	22318

	• Solar mean reference spectra in New Sun Reference Data set with positive sign (was negative in IPF 6.01)			
6.01	• Improved parameterization of the Memory effect for channels 1 to 5 • New correction for the Non-Linearity effect in the infrared channels • Usage of improved key data for the radiometric calibration of all channels • Each solar spectrum is provided in a calibrated and un-calibrated manner for all channels • Orbital dependency of channel 6 to 8 leakage calculated; currently applied only to channel 8 • Improvement of the pointing accuracy through the usage of the ENVISAT Restituted Attitude auxiliary files for the off-line processing • decontamination flag added to the SPH	D-PAC	No operations activated	-
		PDHS-E	22-MAY-2006	22098
		PDHS-K	22-MAY-2006	22090
5.04	No algorithm specification changes were implemented, but two algorithm implementation errors have been corrected. In addition, code adaptations have been performed to resolve performance problems encountered during reprocessing. The list of modifications is as follows: • An incorrect polarisation-ratio calculation has been corrected, to remove radiance discrepancies up to 1% between prototype and operational processor. • Memory leaks have been detected and eliminated • Two modifications have been performed to avoid level 1B processing crashes	PDHS-K	21-AUG-2004	12942
		LRAC	20-AUG-2004	12750
		PDHS-E	16-AUG-2004	12823
		DPAC	12-AUG-2004	12879

5.01		DPAC	31-MAR-2004	
		PDHS-E PDHS-K LRAC	24-MAR-2004	

Tab. 5-1: Processor Version and main changes

5.1.2 Anomalies

During a detailed quality check by the QWG an anomaly was found in the MPH of the level 1b consolidated data products. The field of the Orbit State Vector (OSV) in the MPH contains wrong values. Analysis of this problem showed that the anomaly was introduced during a ground segment upgrade in December 2006. However the MPH OSV is not used by the IPF itself for geolocation calculation, but the attached restituted Orbit File (AUX_FRO). The wrong OSV determination was corrected in the ground segment on day 14 September 2007. Data starting from orbit 28750 (corresponding to sensing start 30 August 2007) are nominal again. All products that were already processed with IPF 6.03 but with the wrong OSV will be generated again during the re-processing campaign. Data with correct OSV can be easily identified with the Processing flag “R”.

5.2 Auxiliary Data Files

For operation of the SCIAMACHY level 1 processor, a set of auxiliary files as input is required.
One subset of these auxiliary files usually changes only in correspondence with a new IPF version, namely the Initialisation file (SCI_LI1_AX), the Key Data File (SCI_KD1_AX).
In addition there is the m-factor file (SCI_MF1_AX), which shall describe the degradation of the instrument during its stay in orbit. Note that the m-factor file has not been changed so far.

Another subset of auxiliary files are the In-flight calibration data files which are generated when calibration measurements are included in the set of level 0 data to be processed. Four types of In-flight calibration auxiliary files exist:

- Leakage Current Calibration (SCI_LK1_AX - updated on orbital basis)
- Solar Reference Spectrum (SCI_SU1_AX - updated on daily basis)
- Spectral Calibration Parameters (SCI_SP1_AX - updated on a weekly basis)
- Pixel-to-Pixel Gain and Etalon Parameters (SCI_PE1_AX - updated on a weekly basis)

Table 5-2 lists the actual Key Data File and Initialisation File used with IPF 6.02 and IPF 6.03. The SCI_LI1_AX was updated with IPF 6.03 in order to improve the instrument pointing correction.

Table 5-2 Key data and Initialisation configuration

SCI_LI1_AXVIEC20060523_182643_20020701_000000_20991231_235959 (until 18/07/2007)
SCI_LI1_AXVIEC20070628_134108_20020701_000000_20991231_235959 (from 18/07/2007)
SCI_KD1_AXVIEC20060523_182626_20020301_000000_20991231_235959

Fig. 5.1 shows statistics of the SU1 and LK1 ADFs generated operationally with SCICAL. It has to be noted that unavailability periods are excluded from statistics. Generation of SU1 ADFs for September and October 2007 was 100%.
The LK1 ADF statistic is calculated by dividing the number of all LK1 ADFs by number of all available (to SCICAL) level 0 products. The statistics on available LK1 ADFs during September (57.4%) and October 2007 (72.6%) are on a nominal level. The lower availability in September is most likely a seasonal effect, in October the availability increases again as during previous years.

The statistic does not exclude dark measurements that cannot be used for ADF generation due to SAA and orbit phase constraints leading to an over-estimation of missing files.

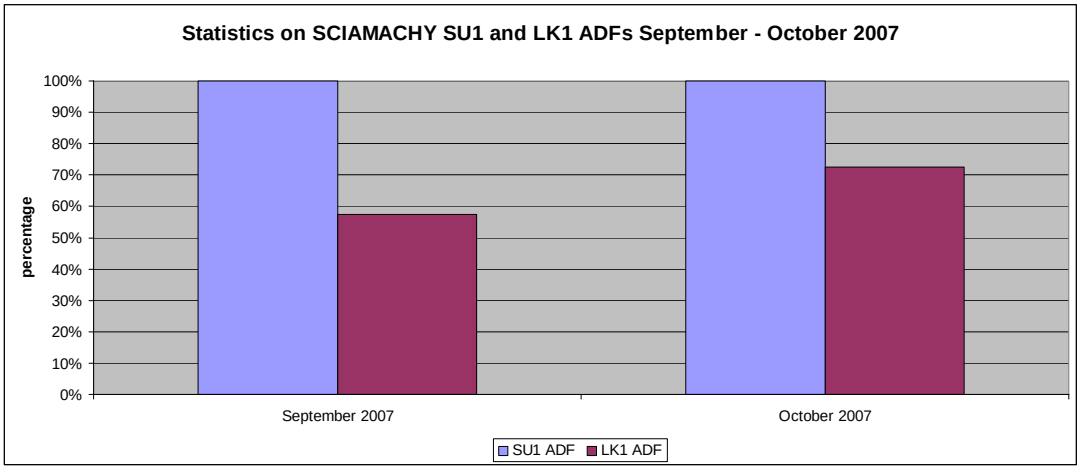


Fig. 5-1: Statistics on SU1 and LK1 processing

5.2.1 Spectral Performance

Future reports will contain analyses of spectral performance.

5.2.2 Radiometric Performance

Future reports will contain analyses of spectral performance.

5.2.3 Other Calibration Results

5.2.3.1 SMR analysis

SCICAL generates daily SU1 Auxiliary Files. Solar spectra obtained from ESM and ASM calibration measurements are provided in two ways:

- fully calibrated
- not radiometrically calibrated.

The different types of spectra can be recognized by the so called identifier in the solar reference global annotation data set record.

Note the following recommendation:

- Use a not radiometrically calibrated ASM diffuser spectrum (A0) for DOAS type applications.
- All retrieval methods requiring absolute calibrated radiance and irradiance are obliged to use the calibrated ESM diffuser spectrum (D0) (see also disclaimer).

Fig. 5-2 to Fig. 5-5 show the ratios of SMR spectra derived from calibrated SMR/ESM (D0) during the months September - October 2007. The ratios were determined by dividing the spectra of the beginning of each month to a set of days during each month. All ratios are not corrected for variation of distance earth/sun.
In detail the spectra used for the ratios of each month are the following:

- **September 2007**
  Reference SMR - 01 September 2007
  SMR used for ratios: 02, 03, 04, 05, 06, 07, 08, 09, 10, 14, 21, 30 September 2007
- **October 2007**
  Reference SMR - 01 October 2007
  SMR used for ratios: 02, 03, 04, 05, 06, 07, 08, 09, 10, 14, 21, 31 October 2007

The overall changes lie at about 1-2 % during one month for all channels, which is at least partly caused by the decreasing distance between sun and earth. In channel 1 around pixel 550 (at 282 nm) some strong features can be noticed, as well as in channel 2 near pixel 840 (near 393 nm). These strong features coincide with the Mg II and Ca Fraunhofer lines respectively. These lines are partially formed in the solar chromosphere and are known to change with solar variability.
The weaker spectral features in channel 2 (e.g. near pixels 550, 650,750), on the other hand, correlate with strong Fraunhofer lines, which are not chromospheric. These features probably arise from small wavelength shifts (order of 1/100 of a pixel).
Generally a spectral feature could have significant impact on the product quality, especially when the affected spectral parts are used for DOAS retrieval.

The large features in the end of channel 6 (channel 6+) and channels 7 and 8 are due to bad pixels.
Note that the bad pixel mask used is still from the on ground calibration.

A regular update of the bad pixel mask is implemented starting with IPF 6.02. However a bad pixel correction will not be applied to the SMR spectra, but only to PMD out-of-band factors, in order to enable the user to apply a different mask from the one provided by the ADF.

Fig. 5-6 and Fig. 5-7 show SMR ratios on a long term trend dividing the ESM spectra from days 30 September 2002 and 30 September 2007, respectively 31 October 2002 and 31 October 2007.
The first spectrum available exists for 18-Jul-2002. However to consider sun/earth distance, the ratio was performed with spectra from same calendar days. All SCI_SU1_AX files used were generated with SCICAL.

What can be concluded is that for channels 1-2 an average degradation in 5 years of about 7-10% is observed, channels 3 degrades by about 2% and channels 4-5 degrade by less than 1%, channel 6 by about 4-5%. The signal in channel 7 has increased with respect to the SMR of year 2002. This is due to the impact of the icing of the IR detectors.
This is consistent with the Light Path monitoring at SOST-IFE.

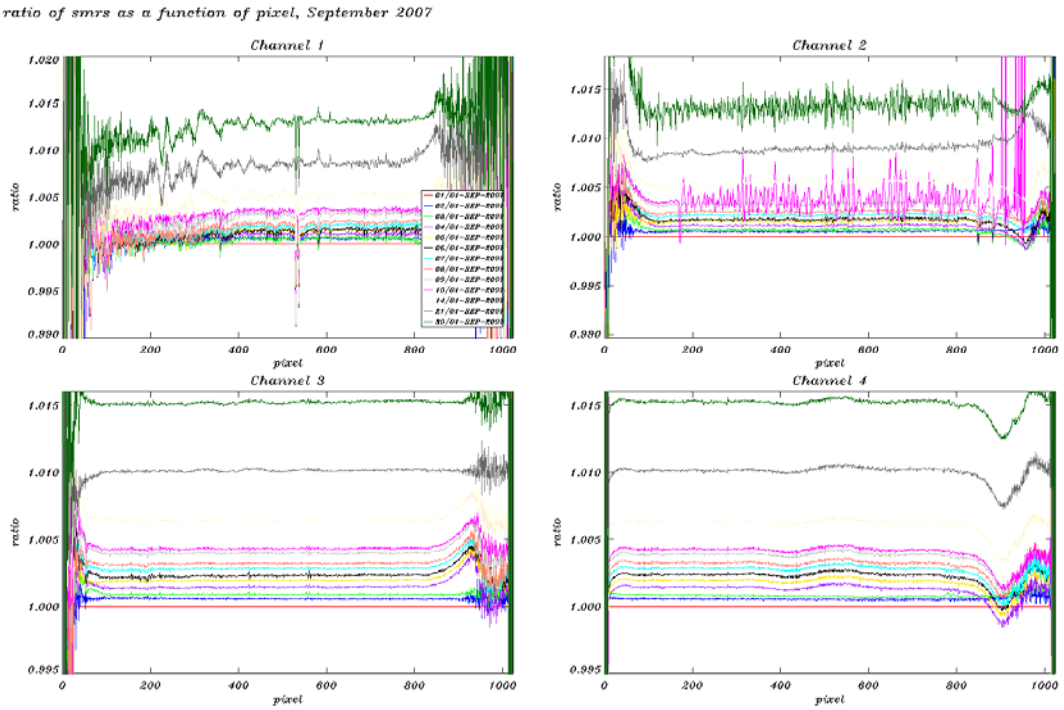


Fig. 5-2: SMR ratios per detector channel 1-4 (changes during September 2007)

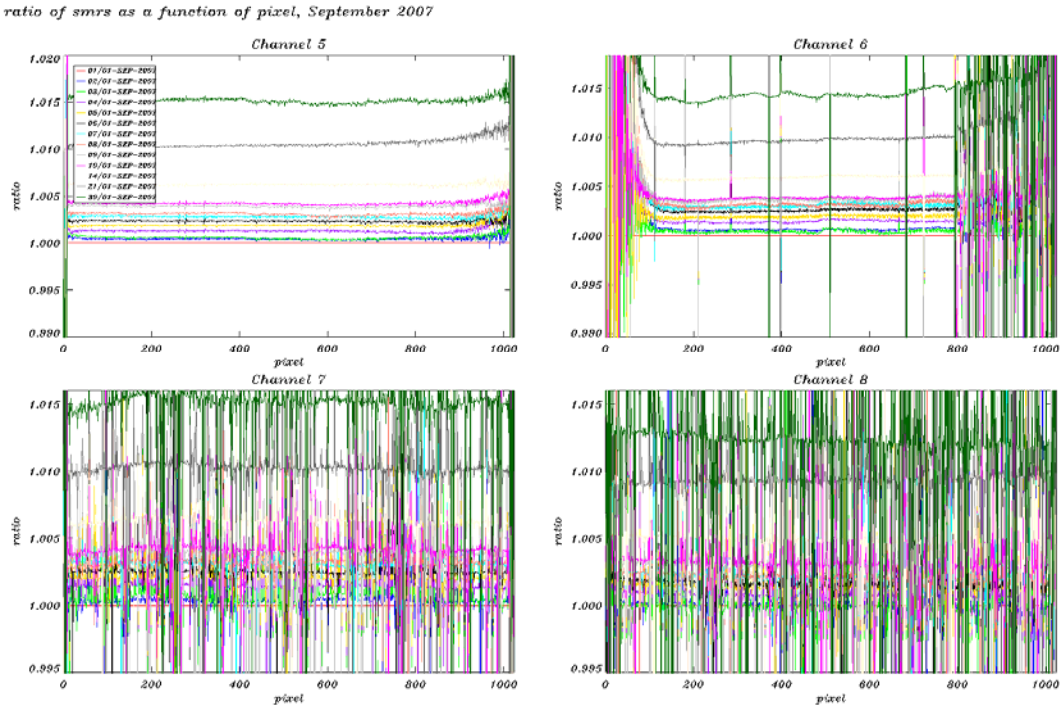


Fig. 5-3: SMR ratios per detector channel 5-8 (changes during September 2007)

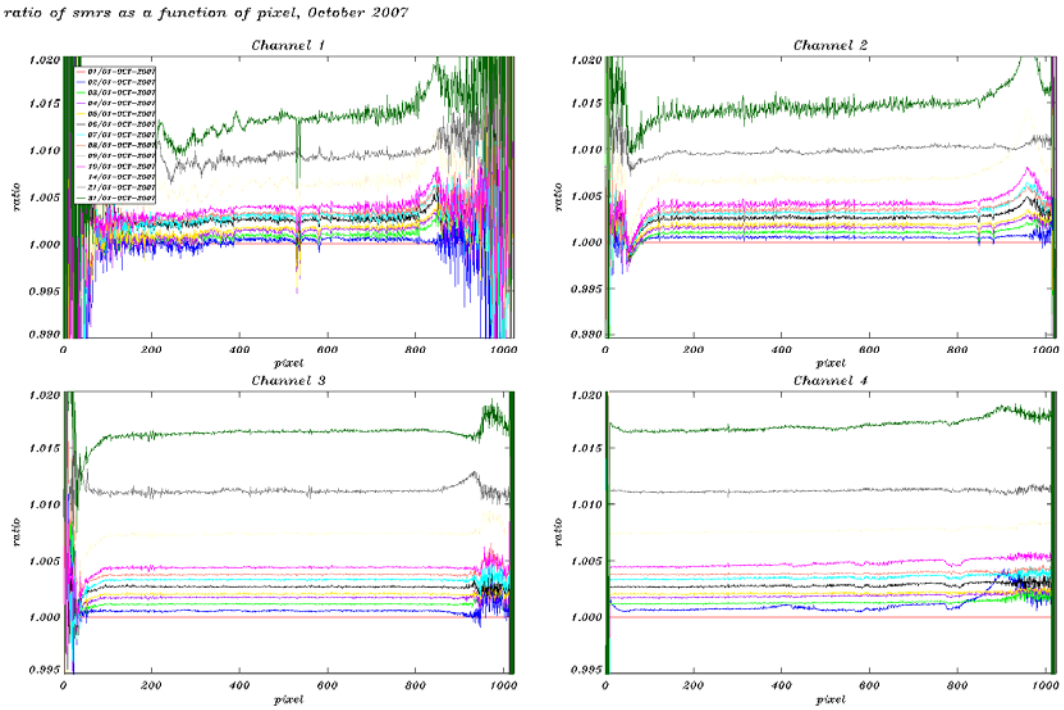


Fig. 5-4: SMR ratios per detector channel 1-4 (changes during October 2007)

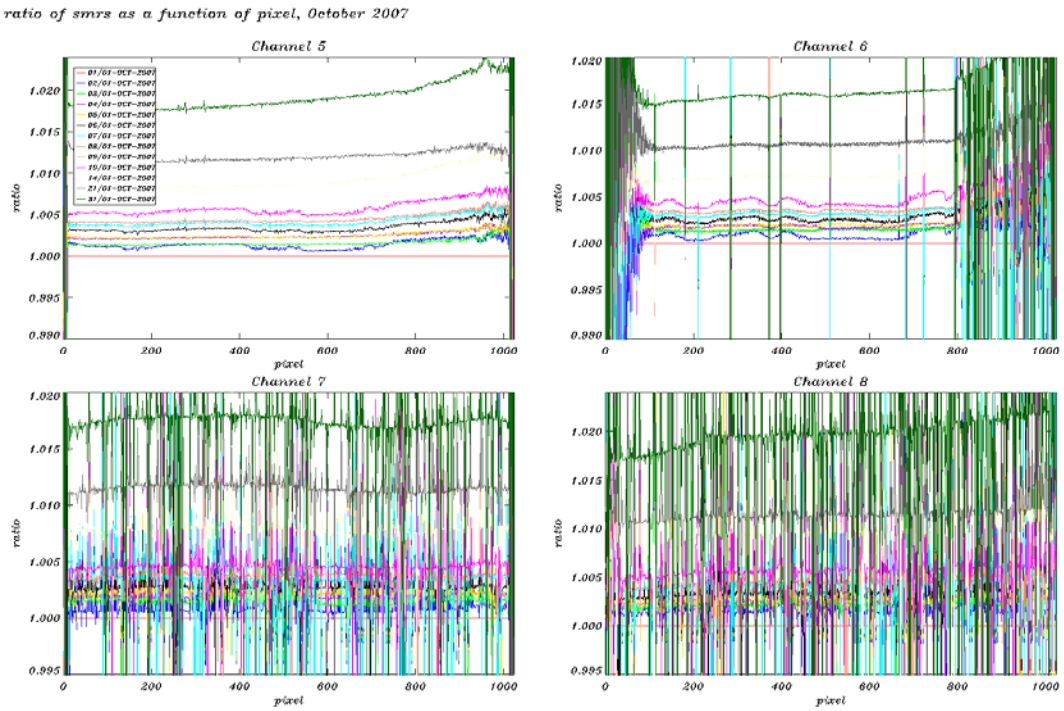


Fig. 5-5: SMR ratios per detector channel 5-8 (changes during October 2007)

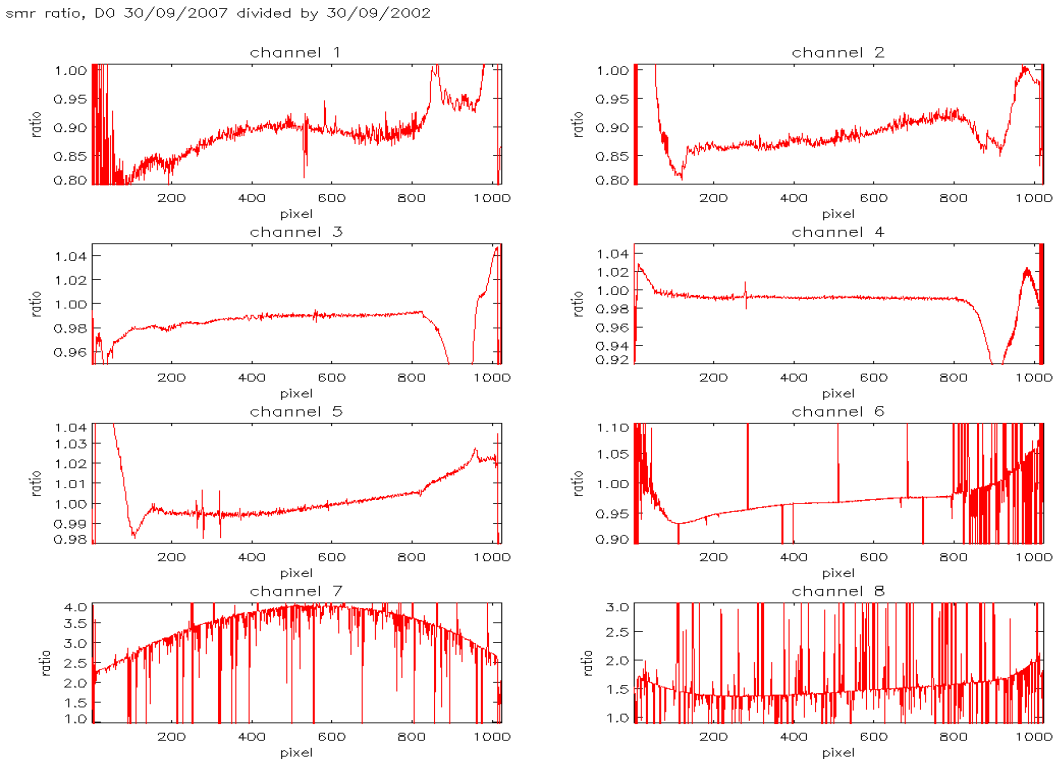


Fig. 5-6: SMR ratios per detector channel on Long Term Trend

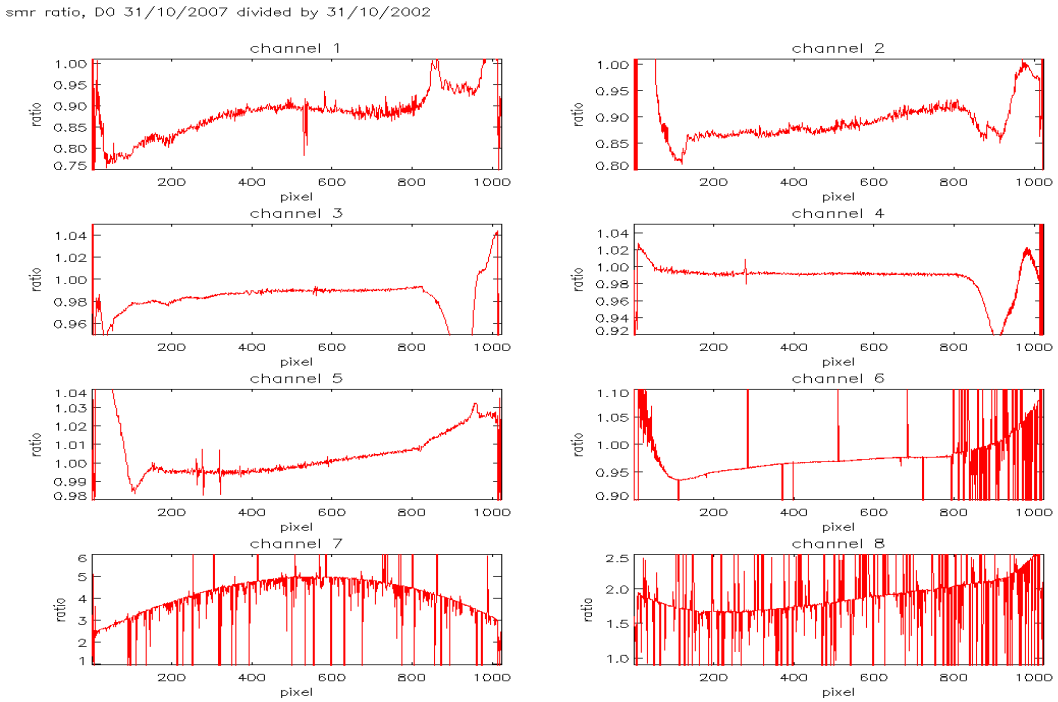


Fig. 5-7: SMR ratios per detector channel on Long Term Trend

5.2.3.2 LK1 analysis

5.2.3.2.1 Leakage Constant part

On an orbital basis a leakage current calibration is performed, if measurement data do not lie in the South Atlantic Anomaly region.
In Fig. 5-8 to Fig. 5-11 the leakage constant part FPN (fixed pattern noise) of the LK1 ADFs are analysed by determining the ratios of the FPN of each month with a time distance of one orbit, one day, one week, two weeks, three weeks and a month.
For channels 1-5 and the first part of channel 6, during up to three weeks nearly no changes can be noticed. Sudden jumps however between the different dark current ratios can be seen for channels 1, 2, 4 and 5 between 4 weeks. They are very small but above the noise level.
The IR channels show a lot of noise. Note that since the processor version IPF 6.02, the time dependent part of the leakage current is considered (see 5.1.5.2.2).

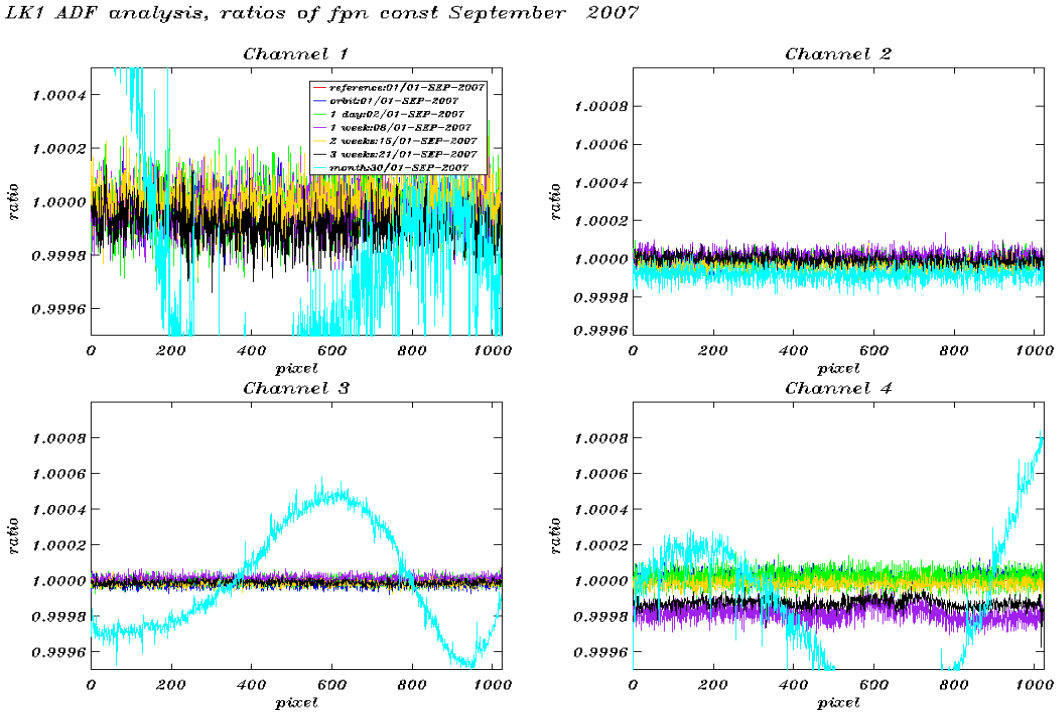


Fig. 5-8: dark current ratios (constant part) channel 1-4 during September 2007, Reference Spectrum used: Orbit 28775, 01-September-2007

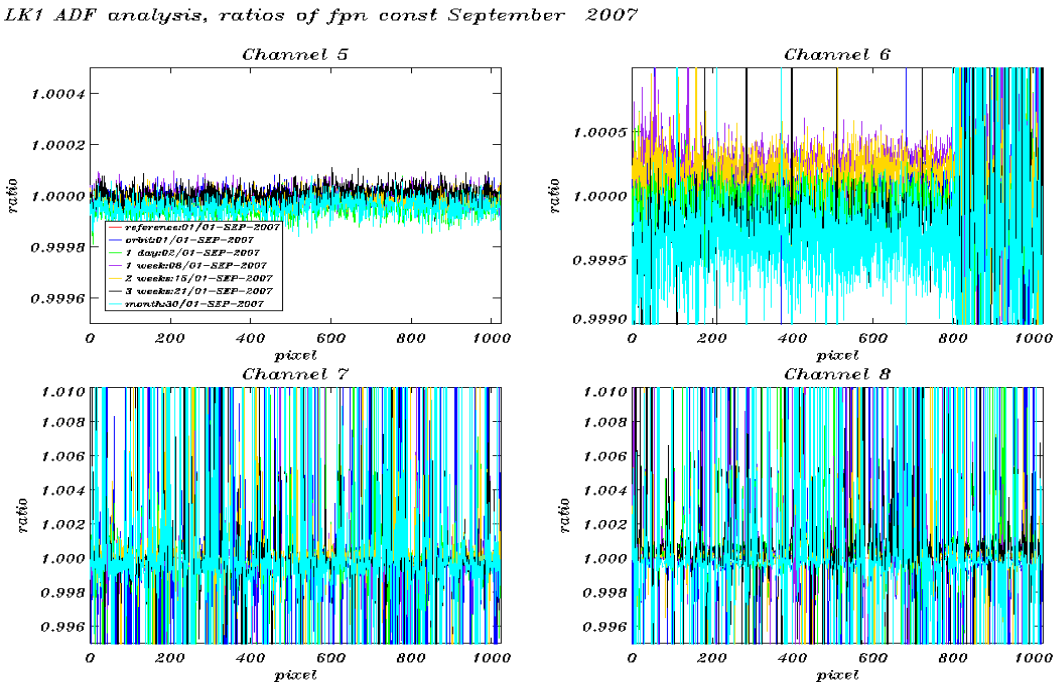


Fig. 5-9: dark current ratios (constant part) channel 5-8 during September 2007, Reference Spectrum used: Orbit 28775, 01-September-2007

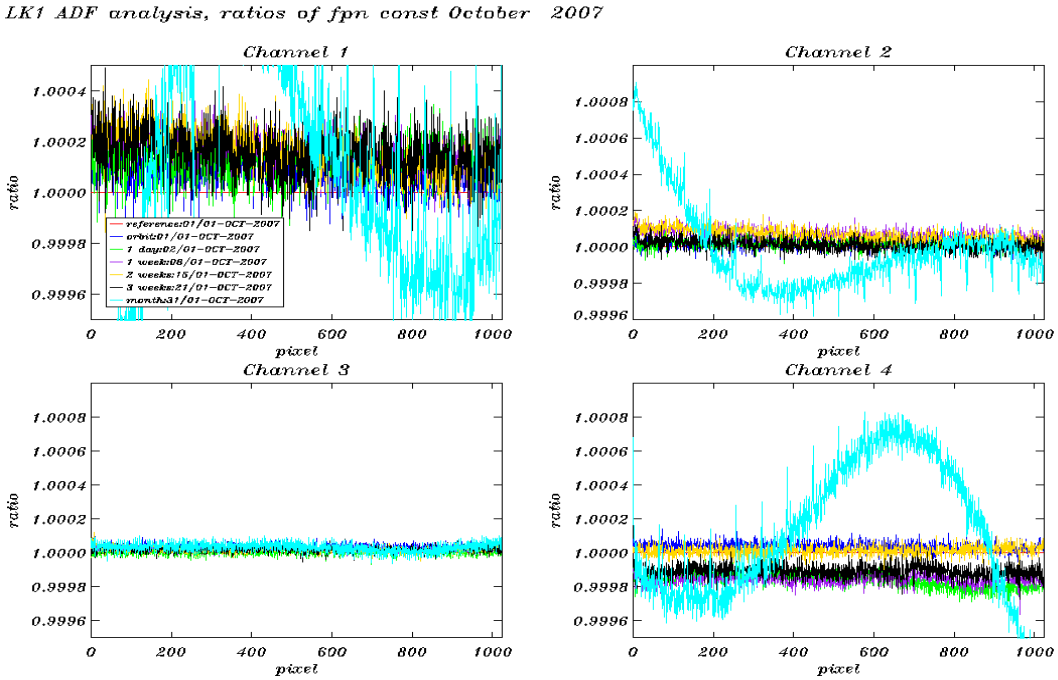


Fig. 5-10: dark current ratios (constant part) channel 1-4 during October 2007, Reference Spectrum used: Orbit 29204, 01-October 2007

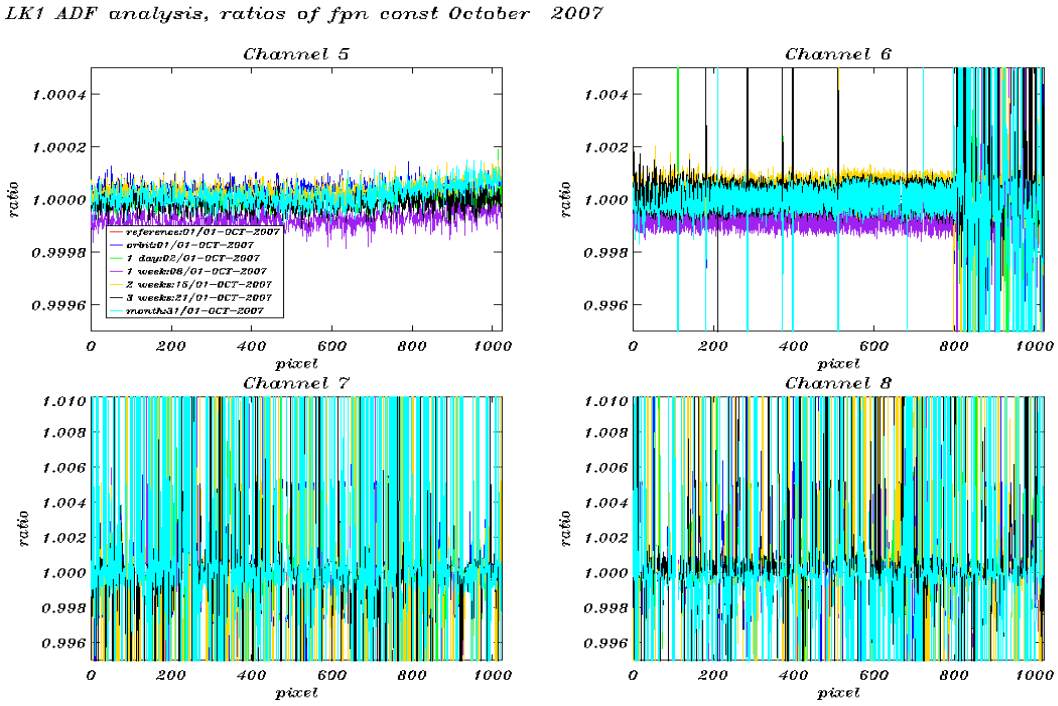


Fig. 5-11: dark current ratios (constant part) channel 5-8 during October 2007, Reference Spectrum used: Orbit 29204, 01-October-2007

5.2.3.2.2 Leakage Variable part

Since IPF 6.02 the orbital dependency of channel 6 to 8 leakage current is considered.
SCIAMACHY detector channels 6 – 8 have a time dependent leakage dark signal that consists of two components, the leakage current of the detector pixel and second a component due to thermal background that varies along the orbit.
The implementation of the orbital variation of the leakage current is expected to improve retrieval especially in detector channel 8, e.g. for infrared products.

Figure 5-12 shows the evolution of the leakage variable part of the SCI_LK1_ADF during the time span 01 May 2007 to 13 November 2007. The leakage variation for a selected pixel (222) in channel 7 corresponding to orbit phase 5 are shown.
Updates of the leakage variable are expected after the processing of the monthly calibration orbits, i.e. once per month. During this period Monthly Calibration sequences were scheduled for:

- 30 May 2007
- 12 July
- 29 July
- 27 August
- 01 October
- 25 October

The successful processing of the monthly calibration for day 29 July can be clearly seen by the change of the Leakage Variable value.
All other calibrations do not appear to have been successful, as no changes can be seen in the plot.
Deeper investigation showed that the monthly calibration itself was processed successfully with the calibration tool, but not correctly copied into the ADFs following afterwards. To correct this malfunction, a patch was implemented in the SCICAL tool in the beginning of November, which is described in a technical note *[9]*.
The ADF data set including 01 – 31 May had already been re-calibrated.
As next step the ADF set 01 June 2007 – 01 November 2007 will be re-calibrated and corresponding level 1b data will be reprocessed.

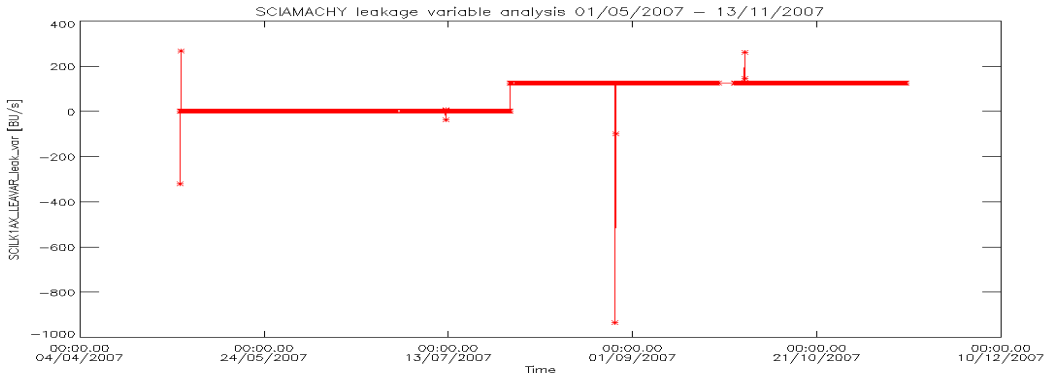


Figure 5-12: Leakage VARIABLE, SCI_LK1_AX, 01-May – 13 November 2007, channel 7, Orbit phase=5 pixel 222

5.3 Pointing Performance

Since the SCIAMACHY processor IPF 6.02, a limb pointing correction scheme was implemented.
Further analysis and investigation by IFE-Bremen, DLR and ESTEC resulted in a proposal for an improved pointing correction. Technically the solution for the correction of the roll misalignment was realized with an updated initialization file (SCI_LI1_AX) activated with IPF 6.03, see table 5-2.

A technical note of the verification [8] is showing the successful implementation of the extra misalignment correction (see [7]).

5.4 SciaL1c tool

The SciaL1c tool is an application provided to the users of SCIAMACHY Level 1b products. This application allows selecting specific calibrations to apply to Level 1b data, which are in case of SCIAMACHY defined as not fully calibrated Level 0 channel information in combination with calculated calibration data. The generated Level 1c products are suitable for the user's particular applications.
The SciaL1C Calibration and Extraction Software was upgraded to be compatible with IPF 6.02 data. It is downward compatible, i.e. it can also be used with data from older IPF versions.
SciaL1c can be downloaded at:

http://envisat.esa.int/scial1c

LINUX, Sun Solaris, LINUX on DEC-Alpha and HP-UX on IA64 versions are available.

6 LEVEL 2 NRT PRODUCT QUALITY MONITORING

6.1 Processor Configuration

6.1.1 Version

Since 08 May 2006 the near real time processing of SCIAMACHY level 2 data has been suspended, evolution is currently restricted to the level 2 Off-line processor (see chapter 7).
The last IPF version used was 5.04. The corresponding product specification is *[2]*. The disclaimer at
http://envisat.esa.int/dataproducts/availability/disclaimers/SCI_NL__2P_Disclaimers.pdf
describes known artefacts.

An overview on the implementation dates of the IPF at the different PDS processing centres and the main modifications implemented can be found in previous BMR (June-May 2007).

6.1.2 Auxiliary Data Files

An overview of Auxiliary Files being used as input for SCI_NL__2P products can be found in previous BMR (June-May 2007).

7 LEVEL 2 OFF-LINE PRODUCT QUALITY MONITORING

7.1 Processor Configuration

7.1.1 Version

The new Level 2 Off-line processing version is 3.01, the operational switch from the previous processor version 3.0 took place on 09 October 2007. Level 2 data with this version were processed in backlog starting with orbit 29092, 23 September 2007.
The product specification corresponding to the level 2 off-line processor 3.01 is Volume 15, issue 3/k *[2]* and can be found at
http://earth.esa.int/pub/ESA_DOC/ENVISAT/Vol15_Sciamachy_3k.pdf

The updated (November 2007) disclaimer at
http://envisat.esa.int/dataproducts/availability/disclaimers/SCI_OL__2P_Disclaimers.pdf
describes known artefacts.
The anomalies are reported in previous BMR corresponding to OAR 2574, OAR 2605, OAR 2810 and OAR 2811 could be successfully resolved.

SCI_OL__2P products contain geo-located vertical column amounts of O_3 and NO_2 Nadir measurements, as well as stratospheric Limb profiles of O_3 and NO_2. Additionally the fractional cloud coverage, the cloud-top height, and the cloud optical thickness are derived and provided as product to the user. The major upgrades are summarised in table 7.1.

Processor Version	Description	Proc Centre	Date	Start Orbit
3.01	Main processor changes: • Updated SACURA cloud algorithm • Offset applied in NO_2 slant column processing was removed • Number of retrieved profiles per state was set from one to four (4) • Cloud and Aerosol MDS are filled with the next valid value instead of being set to zero • Molecular Ring correction applied on NADIR O3 slant column density Non-compliance corrections: • Inter change of Pressure and	D-PAC	23-SEP-2007	29092

	Temperature values in LIMB MDS • Erroneous Cloud and Aerosol Quality Flags • AAI erroneously set to zero in Cloud and Aerosol MDS • Scaling of too large NO_2 error estimate			
3.00	• Nadir UV/Visible algorithm for ozone and NO2 is based on the GDP (GOME Data Processor) Version 4.0 • Nadir UV/Visible algorithm for cloud-top height and cloud optical thickness based on the SACURA algorithm • Limb UV/Visible products: Stratospheric Ozone and NO2 profiles • Improved pointing performance through the use of the ENVISAT Restituted Attitude information in the consolidated Level 1b product	D-PAC	03-MAY-2006	21824
2.5	• First operational version of processor	D-PAC	January 2005	-

Table 7-1: Level 2 off-line Processor Configuration

7.1.2 Anomalies

With the operation of the new off-line processor version 3.01 an erroneous processing configuration was activated for the operational processing chain, containing a too short time-out setting. This led to an incomplete Limb MDS processing; only a reduced number of tangent latitude values were processed. Nadir MDS were nominal and not effected by this anomaly. The data set concerned is between 23 September 2007 and 27 October 2007. Data after this period are processed nominally again as the configuration was corrected.
The data of the time span, containing a reduced number of LIMB MDS, will be reprocessed.

7.1.3 Auxiliary Data Files

Input for level 2 Off-line processing is the so-called Initialization File. For processor version 3.01 a new Initialization file became active which is
SCI_IN__AXNPDE20070629_092400_20070720_000000_20991231_235959
This ADF is usually changed only in case of a processor upgrade.

7.2 Monitoring results

7.2.1 Nadir: NO_2 consistency checking

The world map plots of nadir NO_2 vertical column density (VCD) values averaged over one month are generated from the SCI_OL__2P nadir products. Fig 7.1 and 7.3 show the monthly world map plots for September and October 2007.
Figures 7.2 and 7.4 show the VCD errors for the monthly average plots. The errors are given in relative fraction. Generally the equator region has NO_2 values with higher errors.

For the month of September large errors can be found over the west part of the Antarctis, which coincides partially with the SAA region.

High concentration of NO_2 is expected over industrial regions, as over North America, especially the East coast, over central Europe, China and South Africa, which is reflected in the world maps.

7.2.1.1 Nadir: VCD NO2 map September 2007

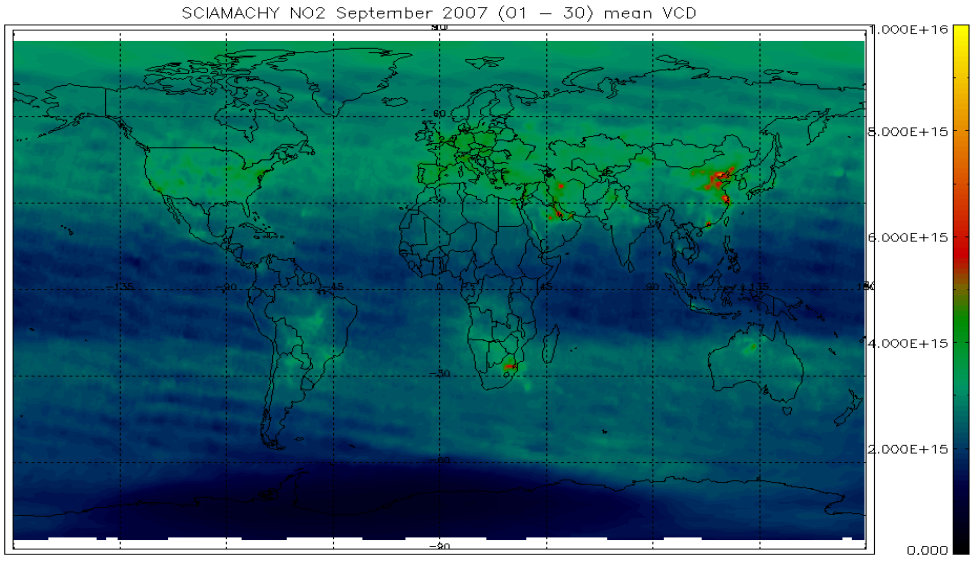


Figure 7-1: NO2 VCD world map 01 - 30 September 2007 – monthly average

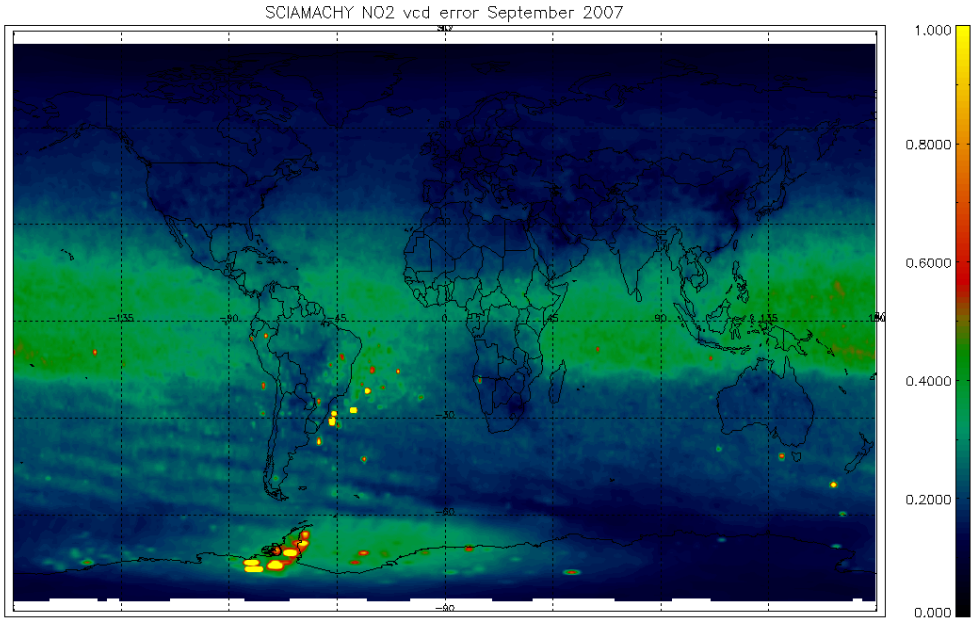


Figure 7-2: NO2 VCD error, 01-30 September 2007

7.2.1.2 Nadir: VCD NO2 map October 2007

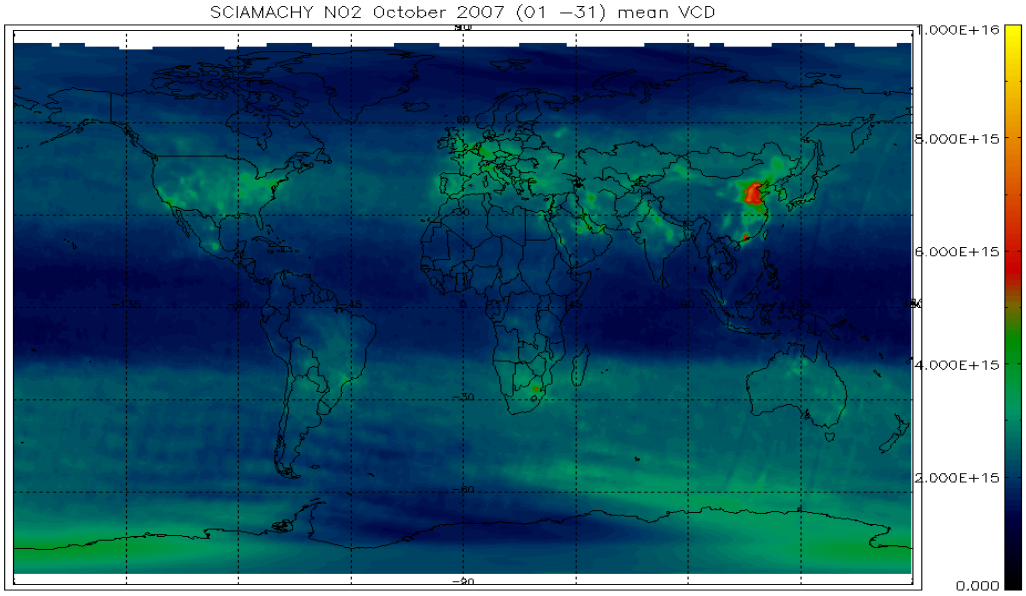


Figure 7-3: NO2 VCD world map 01- 31 October 2007 – monthly average

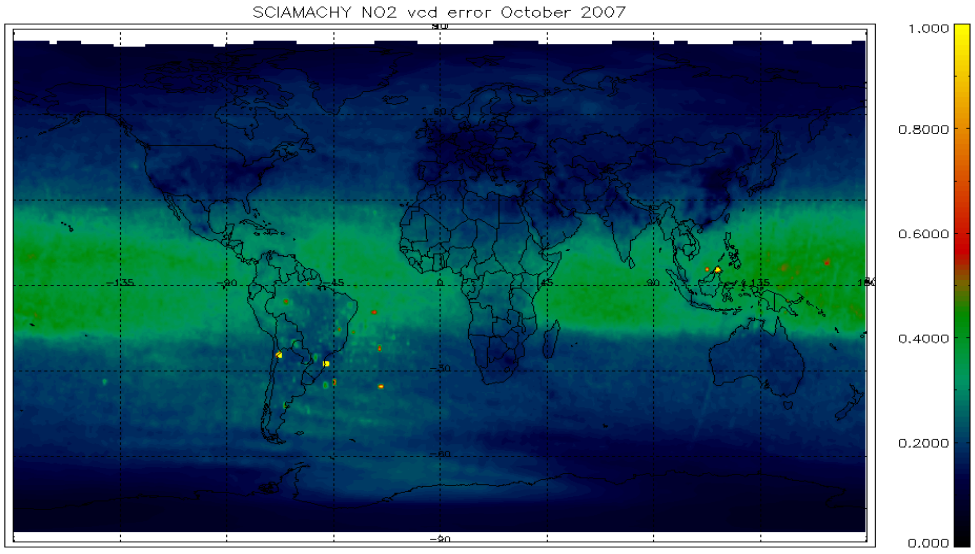


Figure 7-4: NO2 VCD error, 01-31 October 2007

7.2.2 Nadir: O3 consistency checking

Analogous to the NO_2 world maps, O_3 vertical column density (VCD) values averaged over one month are generated from the SCI_OL__2P nadir products and plotted on a world map. Fig 7.5 and 7.7 show the ozone distribution converted in Dobson units for September and October 2007. The seasonal Ozone Hole evolution over the Antarctica can be seen very well during these two months.
The VCD errors as monthly average plots are shown in Figures 7.6 and 7.8. The errors are given in relative fraction. Especially in Figure 7-6 (September 2007) systematically higher error values along the latitude of the Antarctic area are visible, while the October VCD errors are systematically higher at the North Pole area.

7.2.2.1 Nadir: VCD O3 map September 2007

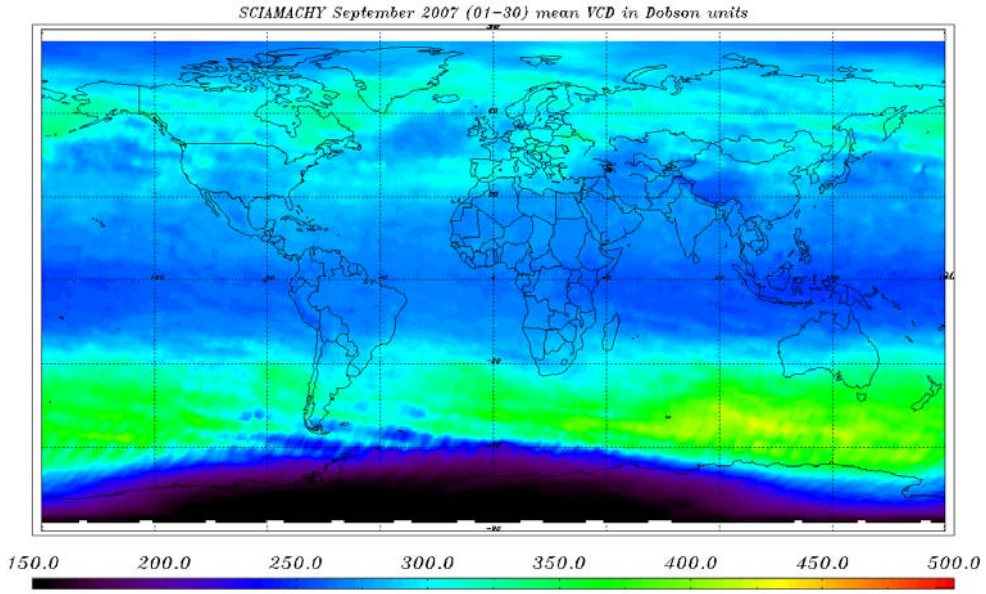


Figure 7-5: O_3 VCD world map 01-30 September 2007 – monthly average

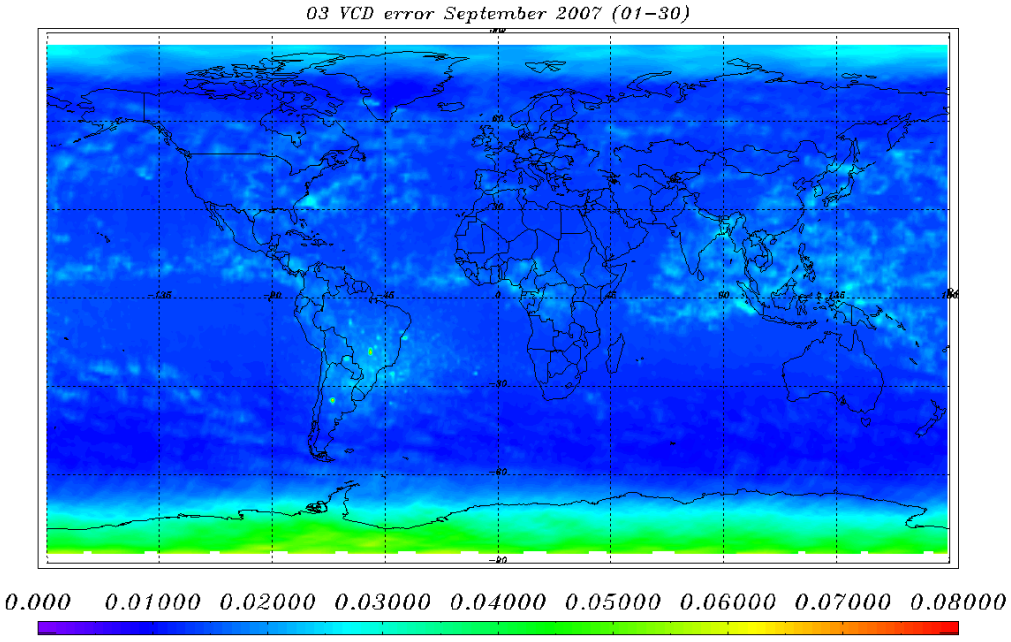


Figure 7-6: O_3 VCD error 01-30 September 2007

7.2.2.2 Nadir: VCD O3 map October 2007

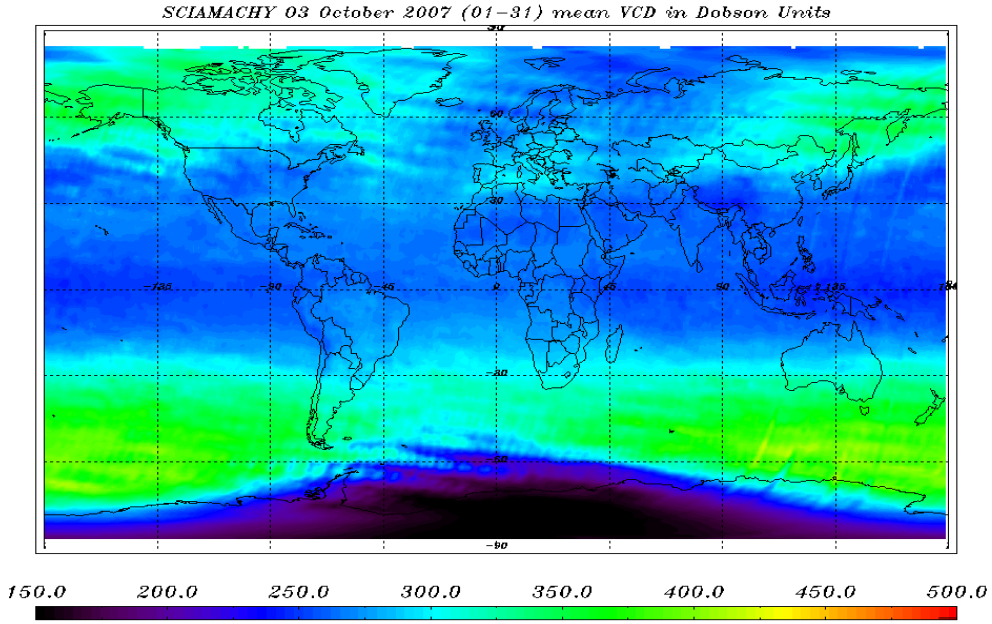


Figure 7-7: O_3 VCD world map 01-31 October 2007 – monthly average

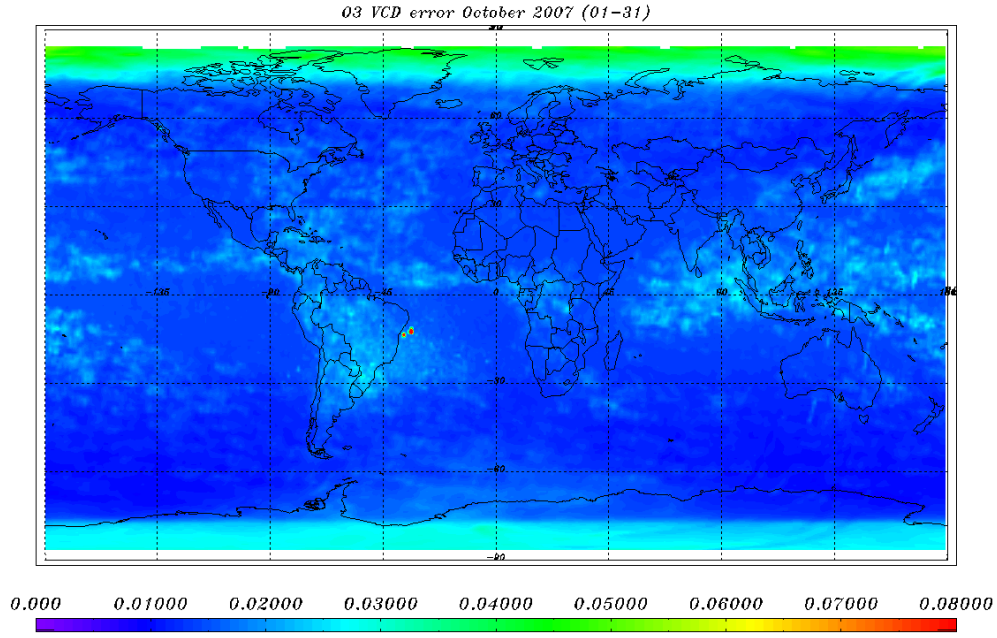


Figure 7-8: VCD error 01-31 October 2007

7.2.3 Limb

Future reports will contain information on this issue.

8 VALIDATION ACTIVITIES AND RESULTS

Validation activities started with the availability of products from re-processing, level 1 IPF 6.03 and level 2 off-line processor 3.01.