Product Quality README file for SCIAMACHY Level 1b version 8 dataset

Field	*Content*
Document Title	Product Quality Readme file: SCIAMACHY Level 1b version 8 dataset
Reference	ENVI-GSOP-EOGD-QD-16-0140, issue 1.2, 05/04/2018
Abstract	This document describes the major fields of improvement in the SCIAMACHY Level 1 baseline version 8.0X compared to previous version 7.0X, and details the Level 1b dataset version 8.0X resulting from the full mission reprocessing campaign completed in 2016.
Applicability	This README file applies to the latest SCIAMACHY Level 1b consolidated products (SCI_NL__1P) generated with ESA processor baseline versions 8.01 and 8.02. The dataset covers ENVISAT orbits from 02 August 2002 (orbit 2204) to 08 April 2012 (orbit 52867), and presents an upgraded processing stage flag “Y”, replacing the previous set of products with flag “W”.
Reference Documents	[RD1] Input / Output Format (IODD): ENVISAT-1 SCIAMACHY Level 0 to 1b Processing, ENV-TN-DLR-SCIA-0005, issue 8, 2014. [RD2] Algorithm Description (ATBD): ENVISAT-1 SCIAMACHY L0-1c Processor Algorithm Theoretical Baseline Document for processor version 8, ENV-ATB-DLR-SCIA-0041, Issue 6, 2014. [RD3] ENVISAT-1 Product Specification: PO-RS-MDA-GS-2009, Volume 15, Issue 3M, 2016. [RD4] ENVISAT-1 Product Specification: PO-RS-MDA-GS-2009, Volume 05, issue 3E. [RD5] SCIAMACHY Command Line Tool Software User's Manual (SUM), ENV-SUM-DLR-SCIA-0071, issue 3C, 2015. Documents can be downloaded here.
Filled by	SPPA Engineer

Change log

The table below records history and status of this Product Quality Readme file.

Issue	Date	Change
1.0	04/05/2016	First release for new dataset version 8.0X
1.1	01/12/2016	General revision, adding issues discovered in sections "Known Instrument Features", and "Known Processing Issues".
1.2	05/04/2018	Added results from the ESA SCILOV-15 project on the validation of measured radiance and irradiance spectra.

Content

Contents

1. Level 1 processor version 8

The implementation of processor version 8 was completed after the end of the operational phase of the ENVISAT mission (April 8th 2012) and was used in the first post-operational data reprocessing campaign by ESA.

Within this document, the version of a processor baseline is often indicated with generic version number N.0X, pointing to the set of processors developed starting from baseline N.00 as natural evolution of the planned implementation, with possible baseline integrations fixing bugs and inconsistencies until a new major update with baseline version number N+1 is reached. For the current Level 1b baseline, version 8.0X indicates processor versions 8.00, 8.01, and 8.02. The following algorithm changes have been

implemented in the Level 1b version 8.01 processing baseline, compared to version 7.0X (see also Table 1):

- As ENVISAT entered its post-operational phase, ESA reviewed the processor development strategy, removing the industrial implementation of the processor into the so-called Instrument Processor Facility (IPF). The instrument prototype processor (IPP) developed by DLR was thus chosen to become the "operational processor".
- The stray light matrix approach is extended to channels 3-8 leading to an improved stray light correction.
- The memory effect correction (MEC) for limb data is improved, correcting the estimate for the signal of the reset readout at new tangent heights. This is especially significant for measurements above 40 km tangent height.
- The scaling factor used for the non-linearity correction (NLC) for co-added data is corrected. In the previous version, the NLC was wrongly calculated when PMD signals were affected by high noise.
- The hot pixel correction for limb dark measurements is completely revised leading to more reliable results.
- The polarisation correction for occultation is switched off, since no reliable calibration data exist for this case, and since no significant amount of polarisation is expected in this mode.
- The states used for the dark calculation can now be selected in the configuration file. This is important for channel 8. Now, only dark states with pixel exposure times between 0.125 and 1 second are used.
- The radiometric calibration uses a new physical model of the scanner unit including contamination layers (the scan mirror model).
- The radiometric and the polarisation key data are updated from on-ground calibration data and adapted for the scan mirror model.
- The degradation is calculated using the scan mirror model that provides a scan angle dependent degradation correction. The degradation is now corrected in the Level 1 processing via m-factor application as part of the radiometric calibration.

Item	Improvement	Affected channel
Stray Light	Matrix Approach extended	3-8
MEC	Correction improved for Limb data	1-5
Hot Pixel Detection	Improved Limb darks	All
Dark calculation	Dark states used are configurable	8
Key data update	New, consistent calculation	All
Radiometric calibration	Scan mirror model implemented	All
Degradation correction	Scan mirror model leads to scan angle dependent correction	All

Table 1: Improvements for SCIAMACHY IPP version 8.01

A fix for processing baseline version 8.01 became necessary after it was discovered that corrupted or incomplete states within Level 0 products were transferred into Level 1b data. A new version of the SCIAMACHY Level 1 processor (version 8.02) was developed by DLR-IMF applying minor algorithms changes, and revising consistency checks on measurement states. IPP version 8.02 drops corrupted states out of the resulting Level 1b products with behaviour similar to the version 7.04 processing.

2. Data Reprocessing

Data reprocessing is fundamental to improve the quality of existing datasets, and to generate coherent long-term series of geophysical parameters to be used for atmospheric applications, such as climate studies and trend analysis.

The SCIAMACHY consolidated Level 1b version 8.0X dataset is the result of the latest full-mission reprocessing campaign, completed in 2016. The new dataset represents the first complete reprocessing after the conclusion of the in-flight phase of the ENVISAT mission; it brings significant improvements to the quality of the Level 1b products with a new approach to compensate degradation.

Figure 1 summarizes the history of the SCIAMACHY reprocessing campaigns, and places the present 4th reprocessing campaign within the data processing evolution scheme along the entire mission lifetime. Level 0-1b processing was performed using for the first time DLR Instrument Prototype Processor: IPP versions 8.01 and 8.02. The reprocessed dataset covers the whole operational mission lifetime period, from the 2nd of August 2002 up to the 8th of April 2012. Users of SCIAMACHY Level 1b products are strongly recommended to migrate to the new reprocessed version 8.0X dataset.

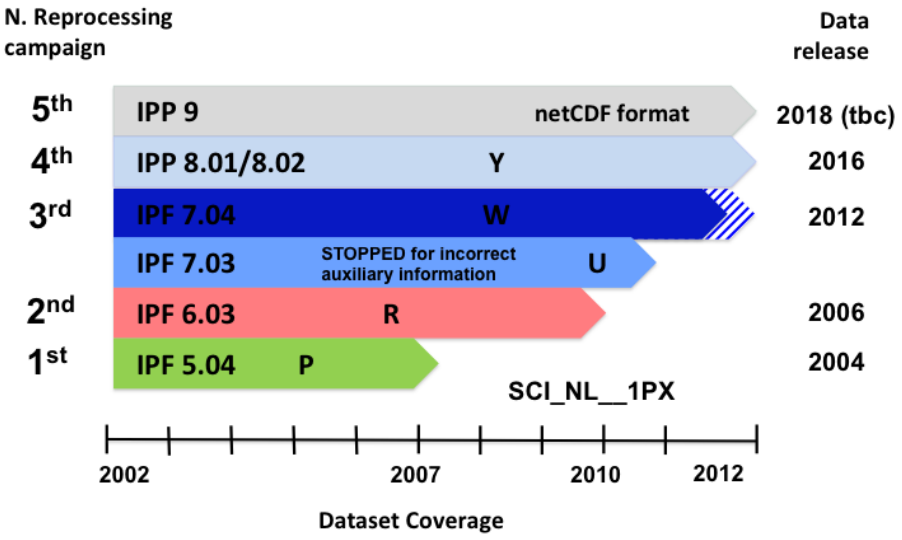

Figure 1 - History and details of the SCIAMACHY Level 1b reprocessing campaigns. The diagram reports for each reprocessing campaign the software version, the processing stage flag, the coverage, and the year of data release (on right side).

In general, data reprocessing is performed as a single bulk processing for data over an entire mission, but, for its complexity, reprocessing is often accomplished in stages with post-processing activities (deltas) on limited subsets of data, integrating or correcting previous processing steps. This is the case of the SCIAMACHY version 8.0X dataset, completed in three processing stages.

The initial reprocessing was accomplished at D-PAC for the full mission with baseline version 8.01. From the not negligible number of processing failures, it was found that some Level 0 products require more than the 8 GB of RAM available at D-PAC; processing of specific orbits was thus successfully repeated with the same processor in the development environment (DLR-IMF) on a 32 GB machine.
In September 2015, a major issue was discovered in the SCIAMACHY Level 1b version 8.01 reprocessed dataset. A significant number of Level 0 products, containing incomplete states due to downlink or ground-station problems, were not compatible with the Level 1 version 8.01 processing, generating incorrect Level 1b data. A new baseline was thus developed by DLR (IPP version 8. 02) introducing suitable patches to

- include state ID 67 measurements before July 20th 2003, having integration times incompatible with previous version 8 processing;
- fix states with missing scanner readouts (i.e. last geolocation missing);
- exclude truncated or perforated states;
- exclude measurements with a wrong combination of state ID and measurement category.

8288 SCIAMACHY Level 1b version 8.01 products were identified as incorrect and required corrective Level 0-1b delta reprocessing. As for the version 8.01 processing, data were generated both in the D-PAC (SCI_NL__1PYDPA*) and DLR-IMF (SCI_NL__1PYIMF*) environment due to different RAM requirements.

The new SCIAMACHY Level 1b dataset is the combination of products generated with baseline versions 8.01 and 8.02, satisfying quality standards. ***Table 2*** reports the number of Level 1b products available for every year of the mission. In total 47715 products have been generated, with a total data volume of about 18 TB. An overview of the complete SCIAMACHY consolidated Level 1b data set version 8.0X is provided here.

YEAR	L1b generated
2002	1789
2003	4689
2004	4972
2005	5042
2006	4773
2007	4966
2008	5120
2009	4987
2010	4966
2011	5052
2012	1359
	47715

Table 2: Number of SCIAMACHY Level 1b products (v8.01/8.02) obtained from the 4th reprocessing campaign.

The final dataset presents filenames characterizing the different processing stages of the

reprocessing campaign, with different combinations of processing stage counter and processing centers.

SCI_NL__1PY**DPA**YYYYMMDD_HHMMSS_000000000000_00000_00000_**0000**.N1
SCI_NL__1PY**IMF**YYYYMMDD_HHMMSS_000000000000_00000_00000_**0001**.N1
SCI_NL__1PY**DPA**YYYYMMDD_HHMMSS_000000000000_00000_00000_**0002**.N1
SCI_NL__1PY**IMF**YYYYMMDD_HHMMSS_000000000000_00000_00000_**0002**.N1

Value 0000 identifies the first set of data generated at D-PAC with IPP 8.01; value 0001 identifies the corrective processing in the DLR-IMF 32 GB environment with baseline value 0002 distinguishes the processing with baseline version 8.02 both at D-PAC and DLR-IMF.

Table 3 presents the distribution of the Level 1b version 8.0X products with respect to processing phase and processing center. Only one product per orbit is available in the Level 1b dataset.

Access to SCIAMACHY products can be provided to existing ESA Proposals and/or Registrations by contacting EO Helpdesk, or through a new user Registration on the ESA EOPI Portal.

The required storage space for the entire Level 1b version 8.0 (uncompressed) dataset is 18 TB.

center stage	DPA	IMF	#	IPP version
0000	39311	-	39311	8.01
0001	-	42	42	
0002	8281	81	8362	8.02
	47592	**123**	**47715**	

Table 3**: Distribution of products within the Level 1b v8.0X dataset on the basis of the processing center and the processing stage counter.**

3. Processor Verification

The SCIAMACHY Quality Working Group and expert teams have verified the entire Level 1b dataset in order to ensure correct processing and content.
Quality checks on the new Level 1b version 8.0X products revealed minor inconsistencies (listed in Section "Known Processing Issues") which did not justify any baseline changes. The QWG team prepared a Level 1b verification report.
The quality of the solar irradiances was assessed by comparison to well-known reference spectra showing for most part of the spectrum above 350 nm excellent agreement within 5%. The irradiance validation is summarized in the SCILOV-15 report:

- Hilbig, T., M. Weber, K. Bramstedt, and J. P. Burrows, SCIAMACHY V8 solar spectral irradiance validation, V2, November 2017.

The quality of the measured radiances for SCIAMACHY Level 1b version 7 and version 8 products, and the impact of instrument degradation, was investigated by the SCILOV-15 team. Two methods were used for the verification of spectra: a soft calibration approach applied to the UV range, based on comparisons of observed radiances with simulations for nadir viewing geometry; and on correlation analyses of direct comparisons of

SCIAMACHY top-of-atmosphere (TOA) reflectances in the VIS range with collocated MERIS measurements at few available wavelengths. Results are detailed in the final reports of the SCILOV-15 project:

- Bötel et al., SCIAMACHY L1b V8 UV Radiance Validation using a Soft-Calibration approach, SCILOV-15-IUP-UVR-ScV-TN, issue 2, 7 October 2016.
- Bötel et al., SCIAMACHY L1b V8 VIS Reflectance Validation, SCILOV-15-IUP-VISrefl-ScV-TN, issue 2, 7 October 2016.

Additionally, as part of the verification process required by ESA to assess the improvements obtained with the new processing baseline, a subset of orbits along the entire mission was selected in order to create a Diagnostic Data Set (DDS). These orbits (~5000) were processed up-to Level 2 products before commencing the Level 2 reprocessing of the full-mission, and were provided for inspection to the validation teams. The DDS permitted QWG and validation teams to judge the quality of the final products (evaluating the impact of Level 1 algorithm changes on the Level 2 products), and to verify the proper functionality of the new SCIAMACHY processing chain: IPP 8.0X + SGP 6.01. Validation reports were provided for the validation activities within the Multi-TASTE phase F project:

- D. Hubert et al., Multi-TASTE Phase F Report “Delta-validation of SCIAMACHY SGP upgrade from V5.02 to V6.00”, TN-BIRA-IASB-MultiTASTE-Phase-F-VR1-Iss2-RevA, 18 September 2015.
- D. Hubert et al., "Multi-TASTE Phase F Final Report / October 2013 - December 2015", TN-BIRA-IASB-MultiTASTE-Phase-F-FR issue 2 revision A, 1 February 2016.

Documents are available here.

4. Calibration options

Spectral Stray Light

The spectral stray light was initially described by means of focused ghosts and a uniform stray light component per channel. Fit residuals for ozone retrieval in channel 2 pointed towards residual stray light effects, clearest in the deep absorption lines and channel overlap region. As of version 8.0X, the spectral stray light for channels 2-8 is described as the sum of ghosts and non-uniform stray light in the form of a matrix.

Memory Effect

The memory effect correction (MEC) is an additive correction, which is applicable to data from channels 1 to 5 only. Physically, the actual readout of a detector pixel depends on its previous readout (memory). The amount of “memory” depends on the filling (i.e. the observed scene intensity). Due to an improved parameterization, former uncertainties for high dynamic range ground scenes could be removed. It is now accurate to ±5 binary units [BU]. However, three situations remain, for which the memory effect can only be estimated:

- memory effect of the first readout in a state;
- memory effect for the first limb readout at a new tangent height. The calculation for this case was corrected in version 8.0X and largely improved;
- memory effect for co-added data.

In these conditions the correction is principally less accurate, because it depends on the previous readout, which is unknown in these cases; an associated error cannot be specified.

Non-Linearity Effect

This effect, which is a pure infrared detector effect and which therefore only affects channels 6 to 8, was improved for co-added data: In the previous processor version, noise in the PMD data used to derive the correction for co-added data could lead to wrong correction values. This was corrected by discarding noisy PMD data before the calculation of the correction. As an additive correction, non-linearity effect has a large impact on Level 2 processing.

Dynamic Bad & Dead Pixel Mask

Due to the manufacturing of the IR detectors, individual pixels in the detector do not response or show an abnormal behavior (e.g. high noise or random change of the dark signal). During on-ground calibration, tests were made to identify those pixels. This resulted in a mask (DBPM) that shows for all pixels if they are usable (value 0) or if they are not (value 1).

After launch it was discovered that the IR detectors were degrading with time, i.e. the number of abnormal pixels increased. The reason was most likely fast protons hitting the detector, when ENVISAT passed through the South Atlantic Anomaly (SAA) region. Now a dynamic bad pixel mask is included in the processor to account for additional degradation. Note that the mask is still regarded as experimental and the retrieved products should be carefully inspected. Future versions of the processor will contain an improved dynamical mask.

Dark Signal Correction

For channels 1 to 5, no problems are known with the provided dark signal correction (note, however, the spatial stray light mentioned below under “Known Instrument Features”). The behavior of IR channels 6 to 8 on the other hand is much more complex. In contrast to the visible channels, the integration time dependent part of the dark signal has a strong thermal background component, which, in addition, is modified by an ice layer, which gradually grows on the detector in channels 7 and 8 after each decontamination (see below). In order to assure the best possible dark signal correction for this part of the spectrum, the dark states used for the determination of the dark signal can now be selected in the processor. This leads to an improved dark correction for channel 8.

Etalon Correction

The etalon is an interference pattern, introduced by the protective coating of channel 1 to 5 RETICON detectors, seen as “periodic” bumps in the uncorrected signal. Usually, these features are very stable, but may change after

- unintended interruptions/transitions to standby;
- planned interruptions like decontamination.

In the time between such an event and the next recalibration (a dedicated measurement is required, which usually is performed only once per week), the provided information will be wrong (i.e. it will lead to unintended spectral features in the calibrated radiance). The correction of changes in the etalon is now included in the degradation correction done

with the m-factors. Therefore, the etalon correction should be no longer used, although it is still available for backward compatibility.

Spectral Calibration

Spectral calibration is the process to assign a wavelength to an individual detector pixel. It is achieved by looking to light sources (special calibration lamp, sun) with known spectrum/spectral lines.
The spectral calibration quality is generally very good, except for channels 7 and 8 as well as for the channel overlap regions, where it is less good, due to systematic problems (e.g. insufficient number of calibration lines). An orbital dependency can be neglected. However, calibration quality might be affected by transient problems (see etalon).

Polarisation

Polarisation calibration is mandatory in case absolute calibrated radiance is required. In order to compensate for the polarisation sensitivity of the instrument, which has a different throughput for parallel and perpendicular polarized light, the atmospheric polarisation needs to be determined and compensated by sensitivity parameters, which were derived during on-ground calibration. The latter are also called polarisation key-data.

The quality of the polarization calibration, therefore, depends on both, the absolute values of the retrieved atmospheric degree of polarisation and the accuracy of the instrument polarisation key-data. It also depends on further data treatment, whether the polarization correction improves the retrieval or not. Here are some recommendations:

- In case of full retrieval methods it is mandatory to apply the polarization correction.
- In case of monitoring data, the polarisation calibration cannot be applied.
- In case of occultation data it is not recommended to apply the polarization corrections, because the key-data do not properly consider the small aperture, which is used during the measurements. Therefore, a correction is no longer calculated in this case.
- Due to the approach, it cannot be excluded that spectral features in the instrument polarization appear in the corrected signal. They might disturb DOAS type retrievals.

The polarisation correction degrades somewhat with time due to degradation in the PMD signals. This effect is now corrected using the scan mirror model. At the same time the polarization key data have been updated.

Radiance, Irradiance and Reflectance

Fully calibrated radiance of the observed ground scene is only one aspect of radiometric calibration. The quality of solar irradiance is also of great importance. Revision and re-computation of involved calibration key-data widely removed the known offsets of SCIAMACHY solar irradiance. The agreement between Kurucz reference spectrum (Kurucz, 2010) and SCIAMACHY is now in the order of 5% or better for wavelength above 300 nm.

SCIAMACHY spectral solar irradiance (SSI) in version 8 agrees to within 4% with present solar reference spectra in most parts of the visible and NIR from about 350 to 1400 nm. SCIAMACHY V8 improves in the overlap regions between Channels 3 and 4 (near 600 nm) and between Channels 4 and 5 (near 800 nm), but also produces features (900-1050 nm, > 1500 nm).

In the NIR, at wavelengths larger than 1400 nm SCIAMACHY is lower by more than 5% (to about 10% near 1600 nm) than the ATLAS-3 composite widely considered a standard solar

reference spectrum (Thuillier et al., 2004). A similar deficit has been observed between ground-based NIR measurements (Bolsée et al., 2014) as well as SOLAR aboard the ISS (Thuillier et al., 2014, Meftah et al. 2017) with respect to ATLAS-3. These discrepancies are also discussed in e.g. Bolsée et al. (2014) and cannot be explained by the uncertainties of the spectra.

The biases seen in the differences between SCIAMACHY and other reference solar spectra may point at some calibration changes between the on-ground characterization to post-launch condition. The change into space vacuum may have changed the calibration parameters. The current approach does not account for icing of the NIR detectors (Channels 7 and 8). A new on-ground to in-flight correction using SCIAMACHY's internal White Light Source (WLS) will be implemented in the next data product version 9 and provides a clue at these changes. Details about the SCIAMACHY solar reference spectrum version 9 can be found in Hilbig et al., Sol Phys., (in revision 2017).

With the new approach of a physical model of the scanner unit, a correction of the influence of instrument degradation is possible. However, there is still some seasonal variation evident in the ESM diffuser solar spectra. This might be due to limitations in the ESM diffuser calibration and is one issue to be covered in future version 9.

In version 8, the optical throughput model does not account for the natural solar variability (solar cycle, 27-day solar rotation). This will be changed in V9 in a first attempt.

Further details can be found in the SCILOV-15 validation report Hilbig et al., SCIAMACHY V8 Solar Spectral Irradiance Validation, Version 2.0, 27-11-2017.

Due to the proven consistency between radiance and irradiance calibration parameters, the reflectance (sometimes also referred to as sun normalized radiance) too should benefit.

SCIAMACHY reflectances agree in the visible to MERIS for all wavelengths (442.5, 510, 665, 708.8, and 890 nm) to within 0.5%, except for 709 nm where SCIAMACHY has a +1% bias to MERIS (Bötel et al., 2016a). The UV soft calibration using SCIATRAN radiative transfer calculation indicates in channel 1 a negative bias of 10% in the radiances, while channel 2 shows a positive bias of +20% up to 350 nm with negligible changes over the entire mission. It should be noted here that the main contribution to the observed biases are due to calibration changes from pre-launch to post launch conditions, which are not accounted for in the current degradation correction from the mirror model. For other spectral channels so far an extensive validation is still missing as was the case for earlier data versions.

Even though there might still be uncertainties on the absolute value of the reflectance or radiances, they generally do not disturb DOAS type retrievals, which are insensitive to broadband offsets in the reflectance.

Degradation correction

The instrument degradation is corrected using a scan mirror model that models two contamination layers on the scanner surface(s). It uses in-flight data to determine the thickness of the layers and their change over time. From this parameter the degradation for each wavelength and scan angle is calculated. This correction is now applied in the Level 0-1b processing step and corrects the polarization sensitivity and the radiometric sensitivity stated in the product. Thus, if the user applies the polarization correction or the radiometric correction, the degradation will be automatically corrected. The fully calibrated solar reference spectrum (identifier D0) is also corrected for degradation. For a proper calculation of the reflectance, one must use this solar reference spectrum (D0) for

radiometrically corrected Earth data, and the not radiometrically corrected sun mean references (E0 or A0) for Earth measurements that were not radiometrically corrected.
Note that because the degradation correction is already contained in the Level 1b product, the user must not apply the m-factor correction provided with the SciaL1c tool (v3.2) to Level 1b version 8.0X products (the option is still available for backwards compatibility when using Level 1b products version 7.04). The degradation correction is with respect to a reference day on-orbit, whence it does not correct for changes in the calibration from pre-launch to post-launch condition.

On-Ground Calibration Data (Key-Data)

The on-ground calibration of the instrument is represented in the so-called key data of the instrument. They are ultimately used to correct for polarization sensitivity of the instrument and to obtain absolutely calibrated spectra. Since processor version 8.01, an update to the stray light correction in channels 3 to 8 is available, which will benefit the radiometric calibration of these channels, in particular in the deep absorption lines. The radiometric and polarization key data were updated using on-ground calibration data.

Solar Reference Spectra

Handling of solar reference spectra has been adapted to special needs of trace gas retrievals. Following recommendations from verification scientists, solar spectra, obtained from both ESM and ASM calibration measurements are provided in a calibrated and un-calibrated way (see table below). Spectra can be distinguished on the basis of identifiers (i.e. first field in the solar reference global annotation data set record). Globally, it is recommended to use a "not radiometrically calibrated" ASM diffuser spectrum (A0) for DOAS-type applications. This diffuser results in reduced spectral features which is beneficial to DOAS type retrievals. However, all retrieval methods requiring absolute calibrated radiance and irradiance shall use the calibrated ESM diffuser spectrum (D0).

ID	Content	Remark
D0	ESM diffuser, calibrated, ND filter in	Absolutely calibrated spectrum.
D1	ESM diffuser, calibrated, ND filter out	Absolutely calibrated spectrum. However, it is only updated once per month.
D2	ASM diffuser, calibrated	This spectrum is pseudo calibrated i.e. the ESM diffuser BRDF is applied to the ASM diffuser measurement.
E0	ESM diffuser, un-calibrated, ND filter in	Radiometric calibration not applied. Corresponds to D0.
E1	ESM diffuser, un-calibrated, ND filter out	Radiometric calibration not applied. Corresponds to D1.
A0	ASM diffuser, un-calibrated	Radiometric calibration not applied. Corresponds to D2.
A1	ASM diffuser, un-calibrated	Additive offsets removed, as a function of wavelength; spectrum of 09.04.2003. This spectrum was provided already in the past and will remain in the product.
N1 **N2** **N3** **N4** **N5**	Placeholder – not used	

Table 4: SCIAMACHY Solar Reference Spectra.

5. Known Instrument Features

This section reports a list of known instrument features for Level 1b version 8.0X products, which might get in conflict with intended data usage.

- Solar irradiances at wavelengths below about 350 nm (Channels 1 and 2 show a systematic low bias due to pre-launch to post-launch changes in the calibration not accounted for in the current degradation correction. This will to a large extent not affect sun-normalized radiances and reflectances.
- Spectral feature around 480 nm caused by a change of a channel separating dichroic filter.
- Mid-scale spectral feature around 350 nm (channel 2), probably caused by non-uniformity of detector pixels. Size of the feature depending on the intensity distribution of ground scene.
- Light leak hampering all retrievals in channel 7.
- Varying throughput due to ice in channels 6, 7 and 8, partly compensated by m-factors.
- Spatial stray light resulting from scattering off the scan- and/or telescope-mirrors affects limb dark measurements around sunrise. Also other very high contrast scenes may be affected, like high bright clouds below the limb field of view. The spatial stray light extends to a few degrees and is wavelength and angle dependent.
- During time intervals where ENVISAT was working in Yaw Steering Mode (YSM) only a degraded pointing performance was achieved especially for limb and occultation data.
- Limb-Mesosphere states (ID 55) are treated as regular limb states in the calibration approach which is not optimised for that height region. It is recommended not to apply polarisation correction to these states.
- Comparisons with independent solar measurements showed, that the radiometrically calibrated SMR 'D0' gives 5% to 9% higher irradiances in the spectral region 800 – 1000 nm (channel 5) than expected.

6. Impact of ENVISAT Orbit Change

The following applies to limb tangent heights retrieved since orbit 45262 (27 October 2010).

To account for the reduced orbit altitude after the ENVISAT orbit manoeuvre end of October 2010, ESM settings in the Basic Scan Profile table reflecting a fixed line-of-sight altitude had to be adjusted. This occurred with the upload of the new final flight configuration on 27 October 2010. A detailed description of the modifications is given in the Operations Change Request number 48 (OCR_048). Note that the number of vertical steps was reduced by one: from 31 to 30. Verification of the modified configuration revealed that the tangent heights derived with the CFIs when viewing in limb type geometry did not fully comply with the specified values.

State (ID)	Nominal Orbit	
	Start	Stop
	Tangent height (km)	
limb (28-37,40,41)	-6.3	264
limb_mesosphere (27)	153.5	n.a.

mesosphere_thermosphere (55)	153.3	370
State (ID)	**Mission Extension Orbit**	
	Start	**Stop**
	Tangent Height (km)	
limb (28-37,40,41)	-6.2	270
limb_mesosphere (27)	158.2	n.a.
mesosphere_thermosphere (55)	158	350

Table 5: Executed tangent heights in several limb-type states for nominal and mission extension orbit. Note that "start" refers to the first altitude from where the line-of-sight immediately moves to the first measurement altitude, i.e. horizontal scan, by one vertical step of about 3 km. The column labelled "stop" indicates the altitude where the final dark current pointing occurs.

Between orbits 45262 and 45864 (07 December 2010) the states from Table 5 were executed with Basic Scan Profile settings yielding to the listed start/stop altitudes. For the limb states 28-37 and 40/41 this is equivalent to a final horizontal scan at about 90 km.

State (ID)	**Mission Extension Orbit**	
	Start	**Stop**
	Executed (km)	
limb (28-37, 40, 41)	-2.7	263
limb_mesosphere (27)	152.3	n.a.
mesosphere_thermosphere (55)	152.3	370*

Table 6: Executed tangent heights in several limb-type states for the mission extension orbit with the new Basic Scan Profile table ESM settings as tested on 7 December 2010 and permanently uploaded in orbit 46340 (* this is an orbital mean value since the corresponding elevation angle is not Earth model corrected).

Between orbits 45865 and 45868 on 07 December 2010, four test orbits with slightly modified Basic Scan Profile ESM parameters were scheduled. Only the stop altitude for state 55 could not be tested because mesosphere/thermosphere states were not planned for that day. The achieved altitudes are those listed in Table 6 and are considered acceptable.

Between orbits 45869 and 46339 (10 January 2011), the Basic Scan Profile settings as uploaded in orbit 45262 were operational again yielding the tangent heights from Table 5. From orbit 46340 (11 January 2011) onward, the Basic Scan Profile parameters tested on 07 December 2010 were permanently uploaded generating a new final flight configuration with retrieved tangent heights as listed in Table 6.

7. Transient data quality degradation events

Decontamination intervals

During decontamination periods, SCIAMACHY detectors were heated in order to remove contaminants. For the following time intervals SCIAMACHY was in decontamination mode (from start to stop of warm-up phase):

Orbit start/stop		Date start/stop		Notes
2124	2175	27/07/2002	31/07/2002	
3746	3752	17/11/2002	18/11/2002	
4204	4428	19/12/2002	04/01/2003	
5718	5736	04/04/2003	05/04/2003	
6384	6420	21/05/2003	23/05/2003	
7574	7789	12/08/2003	27/08/2003	interleaved with transfer to HTR/RF
9407	9644	18/12/2003	03/01/2004	
12031	12174	18/06/2004	28/06/2004	
14675	14860	20/12/2004	02/01/2005	
35574	35783	19/12/2008	03/01/2009	

Table 7: SCIAMACHY decontamination periods.

Additional information can be found on the SOST web site http://atmos.caf.dlr.de/projects/scops/ (topic: Data Quality History).

Any data products generated during these intervals should not be used.

After decontamination has ended, a cool down phase starts. Starting in 2003, the cool down phases are as follow (note: the first cool down period in 2003 was spoiled by an instrument anomaly):

Orbit start/stop		Date start/stop	
5736	5766	05/04/2003	07/04/2003
6420	6449	23/05/2003	25/05/2003
7789	7827	27/08/2003	29/08/2003
9644	9673	03/01/2004	05/01/2004
12174	12208	28/06/2004	30/06/2004
14860	14912	02/01/2005	05/01/2005
35783	35848	03/01/2009	07/01/2009

Table 8: SCIAMACHY cool down phases.

During these periods detector temperatures are not stable and data quality might be reduced.

Instrument Anomalies

After instrument switch-offs, detector temperatures needed some time to stabilise again. During these periods, the measurements of especially the IR detectors may be degraded. For a list of affected periods see SOST under “Data Quality History”.

Pointing Anomalies

During the following periods ENVISAT was operated in Yaw Steering Mode (instead of Stellar Yaw Steering Mode) which reduced the pointing accuracy:

Orbit start/stop		Date start/stop		
9280	9328	09-DEC-2003 10:00:00	12-DEC-2003 17:48:32	attitude tests
12070	12087	21-JUN-2004 07:56:33	22-JUN-2004 11:50:18	reduced pointing performance
45261	45353	27-OCT-2010 01:43:53	02-NOV-2010 10:25:00	orbit change

Table 9: ENVISAT Yaw Steering Mode periods.

Other periods of potentially reduced pointing performance during e.g. orbit control manoeuvres are listed on SOST under "Data Quality History".

8. Known Processing Issues

This section reports the problems identified during verification of the SCIAMACHY consolidated Level 1b data generated with processing baseline version 8.0X. The lists of products affected are available here.

Unprocessed Level 1 products

The number of unprocessed Level 1 products in dataset version 8.0X is higher with respect to the past reprocessing campaign (555 missing products in version 8.0X dataset, evenly spread over the years). The new processor has revealed to be more sensitive to corrupted input Level 0 measurements (e.g. wrong sync word, corrupted ISP, downlink damages, incorrect reconsolidation, etc.). In these cases, the Level 1b files often inherited such problems with IPF v7.04, while IPP v8.0X processing does not produce a corresponding output Level 1b product. Processing failures are also a consequence of the IDL to C++ porting of baseline version 8.0X, which applies a different filtering of corrupted/incorrect states. The capability to jump over the unprocessable part of the Level 0 files will be added in the next baseline.

MPH product error flag

In the new Level 1b version 8.0X dataset, MPH field PRODUCT_ERR reports value 1 according to ESA specifications. This flag has a different implementation with respect to version 7.04 products, and it does not indicate the level of confidence in the product, e.g. reporting errors occurred in the processing, but it declares the provision of additional information within the file (details in RD4). The MPH PRODUCT_ERR field indicates if the presence of errors is tracked within the Level 1b product itself. No filtering based on this flag has to be applied.

PRODUCT_ERR=0 means that information on errors is not provided.

PRODUCT_ERR=1 indicates that details on error condition are provided in SPH or SUMMARY ADS.

Incomplete states

Baseline version 8.02 filters incomplete states. However, for some orbits, filtering was not optimal, and some Level 1b version 8 products still present incomplete states, with measurements duration shorter than expected. This issue affects all types of measurements: nadir, limb, occultation and monitoring. In these products, nadir states could have few ground-pixels missing, while for occultation measurements first or last measurements of the state could be missing. Moreover, small subsets of limb states are truncated with final planned dark measurement missing in the MDS. Limb dark states are not used operationally for leakage-correction so no impact on higher level processing is expected. Users of dark current calibrations from limb dark states are recommended to verify that the last available measurement in the limb state is indeed a dark measurement with tangent height reaching 150 km.

Incomplete states can be identified by inspecting the geolocation information, comparing the actual number of geolocations ('num_rep_geo' from states GADS) to the expected number of geolocations, calculated from the state duration and the shortest integration time. A list of orbits with truncated limb states is reported in the Annex. About 20% of the

corrupted limb states are mesospheric states (cat 26/27), which are not used in the operational processing.

Different SPH start/stop latitude/longitude

For SPH start and stop latitude/longitude fields, a different implementation has been introduced with processor versions 8.0X. Latitude and longitude for the sub-satellite track are now used, while version 7.04 adopted coordinates of the tangent ground point of the first measurement for the state of interest. The new implementation is more reliable and representative of the orbit coordinates. It is also in line with the requirements for SPH fields indicated in Product Specification Volume 15.

Missing usage of Restituted Attitude files

ENVISAT attitude file provides pitch, roll, and yaw of the satellite, and is required in the processing to accurately define the geo-location of the measurements. When the restituted attitude file (AUX_FRA_AX) is missing, SCIAMACHY processing uses attitude predictions, thus Level 1b products present a reduced quality in the pointing knowledge.

SCIAMACHY Level 1b products for 08 April 2012 (seven products on the last day of SCIAMACHY operations, orbits from 52861 to 52867) have been generated without ENVISAT Restituted Attitude auxiliary file, as the last in-flight AUX_FRA_AX file generated does not supply suitable coverage for that day.

Incorrect usage of Restituted Attitude files

For an inconsistency found in the following auxiliary file AUX_FRA_AXVSER20131126_000000_20120321_000000_20120323_000000, the restituted attitude information was not correctly applied to the Level 1b version 8 products generated for day 21 March 2012. The following products are affected by reduced pointing knowledge:

SCI_NL__1PYDPA20120321_012530_000060093113_00003_52603_0000.N1
SCI_NL__1PYDPA20120321_030544_000060093113_00004_52604_0000.N1
SCI_NL__1PYDPA20120321_044557_000060093113_00005_52605_0000.N1
SCI_NL__1PYDPA20120321_062610_000060093113_00006_52606_0000.N1
SCI_NL__1PYDPA20120321_080624_000060093113_00007_52607_0000.N1
SCI_NL__1PYDPA20120321_094637_000060093113_00008_52608_0000.N1
SCI_NL__1PYDPA20120321_112651_000060093113_00009_52609_0000.N1
SCI_NL__1PYDPA20120321_130704_000060093113_00010_52610_0000.N1
SCI_NL__1PYDPA20120321_144717_000060093113_00011_52611_0000.N1
SCI_NL__1PYDPA20120321_162731_000060093113_00012_52612_0000.N1
SCI_NL__1PYDPA20120321_180744_000060513113_00013_52613_0000.N1
SCI_NL__1PYDPA20120321_194839_000059683113_00014_52614_0002.N1
SCI_NL__1PYDPA20120321_212811_000060093113_00015_52615_0000.N1
SCI_NL__1PYDPA20120321_230824_000060093113_00016_52616_0000.N1

Anomalous data format

The ESA verification process comprises a screening to guarantee readability for every Level 1b data generated. For this task, the Common Data Access toolbox (CODA) is used for verifying the data format. 733 Level 1b products resulted in being not fully compliant with the expected data format. Almost all these products did not pass the standard format check as the SPH dataset descriptor for bad and dead pixel mask results were written

twice, with additional 280 bytes to the total file size. The CODA check inspection fails due to this size discrepancy. The structure of the binary part of the product is not compromised, and higher level processing (Level 1b->2) results are feasible.

In order to use CODA with the SCIAMACHY version 8.0X Level 1b dataset, the latest CODA definition file ENVISAT_SCIAMACHY-20140916.codadef specifying the new format has to be used.

Usage of Reference auxiliary data files

The Level 1b version 8.0X baseline extracts calibration information of specific in-flight parameters from a calibration database. For some orbits along the mission, proper entries in the database do not exist (e.g. calibration measurements not yet performed, generation of calibration data failed after decontamination phases). In these cases, calibrations are extracted from begin-of-life reference auxiliary data files (ADFs). In particular, the processing of the first days of the mission for quasi-nominal in-flight conditions (i.e. August 2002) makes use of default values for the calibration parameters. For the next reprocessing, the database search algorithm will be revised implementing a nearest neighbour selection of calibration records. In case very old ADFs are used with respect to measurement time, slightly reduced quality is expected. The following problems were discovered:

- Eleven consolidated Level 1b products for 02 August 2002 (orbits 2204-2215) were generated with PPG/ETALON information extracted from the reference auxiliary files as the corresponding calibration database entries start only for 2002-08-02 at 21:05.

- The A0 SMR spectrum enclosed into the Level 1b products is maintained constant over the period August-December 2002 as the first A0 diffuser SMR measurement occurred on 15 December 2002 at 14:11:57 (search for nearest neighbour database, forward selection allowed).

- Along the entire mission, 1436 Level 1b consolidated products were generated without updated in-flight average dead and bad pixel mask (DBPM) as measurements in the previous days result were too sparse. DBPM calculation in fact uses individual masks for the last seven days (around 100 orbits) to calculate a smoothed average mask. For these orbits, DBPM from a reference auxiliary file was used. Products affected are indicated in the table below.

Products	Mission interval	
	Start	Stop
705	2291 (08-AUG-2002)	3069 (01-OCT-2002)
4	4056 (09-DEC-2002)	4059 (09-DEC-2002)
166	4267 (24-DEC-2002)	4461 (06-JAN-2003)
135	7672 (19-AUG-2003)	7809 (28-AUG-2003)
76	9528 (26-DEC-2003)	9603 (31-DEC-2003)
52	9604 (01-JAN-2004)	9655 (04-JAN-2004)
62	12123 (24-JUN-2004)	12184 (29-JUN-2004)

99	**14773 (27-DEC-2004)**	**14873 (03-JAN-2005)**
137	**35672 (26-DEC-2008)**	**35811 (04-JAN-2009)**

Table 10: SCIAMACHY L1b v8 products without usage of in-flight average DBPM.

Sub-optimal selection of A0 SMR spectrum

For eight Level 1b consolidated products (year 2002) the selection and transfer of the A0 SMR spectrum from the calibration database to Global Annotation Data Sets (GADS) enclosed into the Level 1b products are not optimal. In this case more than a single database entry exists for one day; the nearest neighbour search was not fully deterministic and the selection of the calibration parameter deviated from expectation. Orbits affected are from 2398 to 2401 and from 3272 to 3275. The impact on data quality is limited as A0 entries from contiguous days exist, and the calibration values derived are similar to the ones expected.

D0 SMR spectra inconsistency

For some orbits, the reference solar spectra (D0 SMR) enclosed into Level 1b version 8.0X products have the Bad and Dead Pixel Mask (BDPM) applied. D0 spectra are usually not bad-pixel-corrected in the calibration database, and should actually not be modified during the Level 0-1b processing. Nevertheless, whenever a SLS measurement (measurement category 10) is found in a Level 0 product, the D0 SMR spectrum is used to calculate new spectral coefficients; the solar spectrum gets bad-pixel-corrected and transcribed into Level 1 GADS. This issue will be fixed in the next processor version. Level 2 products are not impacted as bad-pixels are corrected for all Level 2 calculations.

Negative values for orbit-phase

Within the dataset, the following products were found to be affected by negative orbit-phase values (within STATES GADS):

SCI_NL__1PYDPA20030219_061513_000045962014_00020_05084_0002.N1
SCI_NL__1PYDPA20050111_120950_000045132033_00410_14993_0002.N1
SCI_NL__1PYDPA20061223_112341_000045392054_00066_25170_0002.N1
SCI_NL__1PYDPA20070423_144106_000046022057_00297_26904_0002.N1
SCI_NL__1PYDPA20071211_131047_000045112064_00110_30224_0002.N1
SCI_NL__1PYDPA20090504_124127_000045092078_00396_37524_0002.N1
SCI_NL__1PYDPA20091013_124955_000045092083_00210_39843_0002.N1
SCI_NL__1PYDPA20091119_100827_000043682084_00237_40371_0000.N1
SCI_NL__1PYDPA20111021_112431_000044873107_00411_50425_0000.N1

For these products, the iterative calculation of the orbit-phase via ESA CFI routines failed, returning an error and negative values. The orbit-phase is used for the determination of the orbit-dependent part of leakage signal and for the orbit-phase dependent spectral calibration. For negative values, orbit-phase zero is used.

Incorrect consolidation of Level 0 products

Sometimes the consolidation process did not restitute the desired outcome. Orbits 45262/45263/45264 come immediately after the orbit lowering OCM in October 2010. The associated Level 0 products present incomplete durations or incorrect start/stop times due to incorrect ANX cuts. The following products are affected:

SCI_NL__0PPLRA20101027_014400_000048213095_00420_45262_7828.N1
SCI_NL__0PPLRA20101027_025002_000060833095_00421_45263_7829.N1
SCI_NL__0PPLRA20101027_042922_000087263095_00422_45264_7830.N1

The problem is reflected in the corresponding Level 1b version 8 products, and explains the failure of the Level 0-to-1 processing of orbit 45264. The following Level 1b products present an inconsistent content with respect to the commanded measurements.

SCI_NL__1PYDPA20101027_014400_000048403095_00420_45262_0002.N1
SCI_NL__1PYDPA20101027_025002_000061333095_00421_45263_0002.N1

Level 0 consolidation bug

A bug in the consolidator software caused gaps in some consolidated Level 0 products over the entire mission. Under particular circumstances, it occurred that solar states existing in two adjacent Level 0 NRT files were not correctly sewed. Shortened solar occultation states were thus inherited by the Level 1b products. The following products within the version 8 dataset are impacted. Recovery is currently not possible.

SCI_NL__1PYDPA20021021_224002_000060542010_00302_03362_0002.N1
SCI_NL__1PYDPA20021101_165201_000060542010_00456_03516_0002.N1
SCI_NL__1PYDPA20021117_233235_000060112011_00188_03749_0002.N1
SCI_NL__1PYDPA20021223_143659_000060412012_00197_04259_0002.N1
SCI_NL__1PYDPA20030103_153135_000060412012_00355_04417_0002.N1
SCI_NL__1PYDPA20030109_154419_000059572012_00441_04503_0002.N1
SCI_NL__1PYDPA20030207_171248_000060062013_00356_04919_0002.N1
SCI_NL__1PYDPA20031013_204033_000060142020_00401_08471_0002.N1
SCI_NL__1PYDPA20041116_160649_000060642032_00112_14194_0002.N1
SCI_NL__1PYDPA20051014_203336_000060282041_00358_18949_0002.N1
SCI_NL__1PYDPA20051121_153733_000060402042_00398_19490_0002.N1
SCI_NL__1PYDPA20051124_154338_000060242042_00441_19533_0002.N1
SCI_NL__1PYDPA20061025_215721_000060312052_00230_24332_0002.N1
SCI_NL__1PYDPA20080127_162925_000060402065_00284_30899_0002.N1
SCI_NL__1PYDPA20081122_160034_000060242074_00069_35193_0002.N1
SCI_NL__1PYDPA20090223_203917_000060332076_00401_36527_0002.N1
SCI_NL__1PYDPA20091007_203645_000059882083_00129_39762_0002.N1
SCI_NL__1PYDPA20091121_152010_000060242084_00269_40403_0002.N1

Corrupted cluster configuration

Corrupted cluster configuration was identified in STATES GADS for 41 Level 1b version 8 products distributed over the entire mission. The anomaly affects different types of states. For example, for orbit 28910 (10-09-2007), state ID 62 (ESM diffuser measurement) within the Level 1b version 8.02 product presents a corrupted clusters configuration with 41 cluster definitions (usually only 40), and deviations from the expected configuration starting from cluster ID 9. The origin for such differences is currently unknown. The list indicating the problematic states and the corresponding products is available here.

Degradation over-correction

In the new contamination mirror model both radiance and irradiance are corrected independently. Their uncertainties thus became part of the reflectance. For short wavelengths that suffer strongly from (scan-angle dependent) degradation the model is a large improvement. Uncorrected observations in wavelengths longer than 600 nm show

	little (<1%) degradation in reflectance, however the exact wavelength where no degradation is expected cannot be predicted and thus it is not possible to turn off the model at a particular pre-determined wavelength. Investigation has shown that due to the introduced uncertainties sometimes a small degradation correction is visible in the reflectance at longer wavelengths. **Wrong degradation correction for PMD signals** The PMD values written to the Level 1 product contain a wrong degradation correction. They should not be used. The polarization correction might be affected as well. This may lead to residual polarisation features in the spectrum. ## 9. Product format and tools The SCIAMACHY Level 1b products generated with IPP versions 8.01/8.02 have an updated format. Size and structure of the ASCII headers (SPH Data Set Descriptors) have been revised to reflect the usage of the new calibration database in place of auxiliary data files. Owing to this, the BEAT, VISAN and CODA softwares have been updated in order to read the new products, allowing fields' extraction and data handling. Latest BEAT version 6.9.1, VISAN version 3.11, and CODA version 2.16 are aligned to the new specifications. In order to use CODA with the SCIAMACHY Level 1b version 8.0X data, a new CODA definition file ENVISAT_SCIAMACHY-20180102.codadef, specifying the new format, has to be used. **SciaL1c** SCIAMACHY Level 1b products contain not fully calibrated Level 0 channel information in combination with calculated calibration data. The SCIAMACHY Calibration and Extraction Tool, SciaL1c, allows users to select specific calibration steps they like to apply to Level 1b data, obtaining fully or partially calibrated spectra within Level 1c products. Calibration can be combined with several filters to allow an extraction of special scenes or sub-set of measurement data, for example Nadir observations only. Current version (3.2) is designed to process Level 1b 8.0X products, but backward compatibility to other product versions is provided. The SciaL1c tool incorporates new features adjusted to the SGP version 6.01 Level 1b-2 processing needs. In particular, it applies a new hot pixel mask detection algorithm and it was adjusted reflecting the modified calibration scheme: degradation and etalon correction is now performed in the Level 0-1 processing step via m-factors (previously during Level 1-2 processing). Details of the changes can be found in the Software Release Note. SciaL1c 3.2 is available for the following platforms: • Linux on x86 • Linux on amd64 • Windows Executable files as well as complete documentation can be found here.
Acronyms	ADF Auxiliary Data File ANX Ascending Node Crossing ASM Azimuth Scan Mechanism

	ATBD	Algorithm Theoretical Baseline Document
	BEAT	Basic ENVISAT Atmospheric Toolbox
	CFI	Customer Furnished Items
	CODA	Common Data Access Toolbox
	CTI	Configuration Table Interface
	DDS	Diagnostic Data Set
	DBPM	Dead and Bad Pixel Mask
	DORIS	Doppler Orbitography and Radiopositioning Integrated by Satellite
	DLR-IMF	Deutsches Zentrum für Luft- und Raumfahrt (German Aerospace Centre)
	D-PAC	German PAC
	ENVISAT	Environmental Satellite
	ESA	European Space Agency
	ESM	Elevation Scan Mechanism
	GADS	Global Annotation Data Set
	IDEAS	Instrument Data quality Evaluation and Analysis Service
	IODD	Input / Output Data Definition
	IPF	Instrument Processor Facility
	IPP	Instrument Prototype Processor
	ISP	Instrument Source Packet
	L0	Level 0
	L1b	Level 1b
	L2	Level 2
	MDS	Measurements Data Set
	MEC	Memory Effect Correction
	MPH	Main Product Header
	NDF	Neutral Density Filter
	NLC	Non-linear correction
	OCM	Orbit Change Manoeuver
	PMD	Polarization Measurement Device
	QWG	Quality Working Group
	SAA	South Atlantic Anomaly
	SCIAMACHY	Scanning Imaging Absorption Spectrometer for Atmospheric Chartography
	SCILOV	SCIAMACHY Long-term Validation
	SGP	SCIAMACHY Ground Processor
	SMR	Sun Mean Reference
	SOST	SCIAMACHY Operations Support Team
	SPH	Specific Product Header
	SPPA	Sensor Performance, Products and Algorithm
	SYSM	Stellar Yaw Steering Mode
	YSM	Yaw Steering Mode

WWW References	Additional information on the SCIAMACHY instrument, its data processing, anomalies, products' quality, calibration activities and validation campaigns can be found on-line. **Instrument operations** The list of events affecting the SCIAMACHY mission can be found on: SOST web-page at http://atmos.caf.dlr.de/projects/scops/ ESA SPPA portal at https://earth.esa.int/web/sppa/mission-performance/esa-missions/envisat/sciamachy/mission-highlights

	Processors documentation https://earth.esa.int/web/sppa/mission-performance/esa-missions/envisat/sciamachy/products-and-algorithms/products-information **Consolidated data sets** https://earth.esa.int/web/sppa/mission-performance/esa-missions/envisat/sciamachy/quality-control-reports/products-availability **Tools** The Basic ENVISAT Atmospheric Toolbox (BEAT) can be downloaded at: http://www.stcorp.nl/beat/ The new version of the SCIAMACHY Calibration and Extraction Tool SciaL1c, compatible with the Level 1b version 8.0X products, can be downloaded at https://earth.esa.int/web/guest/software-tools/content/-/article/scial1c-command-line-tool-4073
Inputs	SCIAMACHY Quality Working Group, SCIAMACHY Validation team, IDEAS+ (Instrument Data quality Evaluation and Analysis Service) team
Approver	Angelika Dehn (Angelika.Dehn@esa.int)
Annex	Products affected by truncated limb states within version 8.0X dataset (106 orbits). SCI_NL__1PYDPA20020806_022619_000057272008_00204_02262_0002.N1 SCI_NL__1PYDPA20020822_035853_000060922008_00434_02492_0002.N1 SCI_NL__1PYDPA20020822_035853_000060922008_00434_02492_0002.N1 SCI_NL__1PYDPA20020913_072956_000059552009_00250_02809_0002.N1 SCI_NL__1PYDPA20030312_081145_000060492014_00322_05386_0002.N1 SCI_NL__1PYDPA20030403_114240_000059752015_00138_05703_0002.N1 SCI_NL__1PYDPA20030410_230621_000059992015_00245_05810_0002.N1 SCI_NL__1PYDPA20030413_080625_000060432015_00279_05844_0002.N1 SCI_NL__1PYDPA20030417_074049_000059992015_00336_05901_0002.N1 SCI_NL__1PYDPA20030511_233648_000057682016_00188_06254_0002.N1 SCI_NL__1PYDPA20030613_093311_000057582017_00151_06718_0002.N1 SCI_NL__1PYDPA20030624_120817_000057302017_00310_06877_0002.N1 SCI_NL__1PYDPA20030701_000400_000057652017_00403_06970_0002.N1 SCI_NL__1PYDPA20030808_064835_000060842018_00450_07518_0002.N1 SCI_NL__1PYDPA20040328_080617_000060482025_00279_10854_0002.N1 SCI_NL__1PYDPA20040418_020423_000060332026_00075_11151_0002.N1 SCI_NL__1PYDPA20040606_012813_000057302027_00275_11852_0002.N1 SCI_NL__1PYDPA20040630_103651_000057062028_00123_12201_0002.N1 SCI_NL__1PYDPA20040822_074615_000060342029_00379_12958_0002.N1 SCI_NL__1PYDPA20040825_111301_000060642029_00424_13003_0002.N1 SCI_NL__1PYDPA20041028_142303_000060202031_00340_13921_0002.N1 SCI_NL__1PYDPA20041112_181256_000060642032_00056_14138_0002.N1 SCI_NL__1PYDPA20041113_210237_000060772032_00072_14154_0002.N1 SCI_NL__1PYDPA20041210_133123_000060432032_00454_14536_0002.N1 SCI_NL__1PYDPA20050124_063413_000060292034_00092_15176_0002.N1 SCI_NL__1PYDPA20050129_021551_000060242034_00161_15245_0002.N1 SCI_NL__1PYDPA20050129_021551_000060242034_00161_15245_0002.N1

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