SCIAMACHY Command Line Tool

SciaL1c

Software Release Note

ENV-SRN-DLR-SCIA-0078

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Change Record

Issue	Rev.	Date	Page	Description of Change
1.0		14/02/07	all	completely new
	B	23/02/07	several	some minor glitches fixed
	D	02/08/07	p. 9	- description of a new functionality and fixed bugs
	E	13/11/07	p. 9	- installation instructions revised
2		29/12/08	p. 9	- new release added
			p. 12	- requirements in release 1.28.10 revised
			p. 13	- information about initial release of the tool was added
	B	26/08/08	p. 9	- new release 2.1.x
3		18/03/14	p. 2.4	- description for release 2.1.74plus4 added
			p. 2	- description for release 3.1 added
			p. 15	- installation instructions for releases 3.1 and above
	B	28/05/15	p. 2	- description for release 3.2 added

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1 Introduction

1.1 Purpose and Scope of Document

SCIAMACHY is a joint project of Germany, The Netherlands and Belgium for atmospheric measurements. SCIAMACHY has been selected by the European Space Agency (ESA) for inclusion in the list of instruments for Earth observation research for the ENVISAT polar platform. The SCIAMACHY programme is currently in progress with the intensive advice by the SCIAMACHY science team (SSAG), headed by the Principal Investigators Professor J. P. Burrows (University of Bremen, Germany), Dr. I. Aben (SRON, The Netherlands) and Dr. C. Muller (BISA, Belgium).

Since 2007 the development of the processors is coordinated by the SCIAMACHY Quality Working Group (SQWG).

The Remote Sensing Technology Institute (IMF) which has been founded in 1999 as split of German Remote Sensing Data Centre (DFD) and other DLR institutes, plays a major role in the design, implementation and operation of the SCIAMACHY ground processors (SGPs) which are part of the ENVISAT payload data segment (PDS), as described in [A1]. The present document is part of the technical documentation provided by DLR for the SciaL1c tool which is used for a proper SCIAMACHY Level 1b-1c data processing. After the failure of the ENVISAT platform, the SCIAMACHY project is now in phase F.

ESA distributes to data users the SCIAMACHY Level 1b and Level 2 products for their own scientific purposes. During the process of development of the SCIAMACHY project, the distribution philosophy was completed in providing several tools to the users with which the ability of application to SCIAMACHY data on higher detail level was extended. One of those tools is the software SciaL1c which has been originally part of the EnviView software package. SciaL1c allows users to extract from Level 1b data products which are in case of SCIAMACHY defined as not fully calibrated Level 0 channel information in combination with calculated calibration data, data in Level 1c format. Here, Level 1c means fully calibrated spectra from the detector channels. To extend the variety of applications and allow users to apply their own calibration routines, SciaL1c was designed so that users can select those calibration steps which they like to apply. Additionally, the extraction can be combined with several filters to allow an extraction of special scenes or sub-set of measurement data, for example Nadir observations only. In the past, the development of SciaL1c was totally separated from the development of the Level 0-1b and Level 1b-2 data processors. Thus, for every upgrade of the Level 1b-1c data processing a specific project must be initiated for upgrading the tools. This led in the past on one side to a delay between data processing and tools and on the other side to an additional development effort. That is why it was decided to derive SciaL1c calibration applications from the data processor kernel. This gave us the advantage that an upgrade of a data processor software can be easily followed within days by an upgrade of SciaL1c. In addition development and maintenance of data processor remain in one hand ensuring that software shall be compatible together in high availability.

1.2 Documents

Following documents are applicable for this technical note:

[A1]   ENVISAT-1 Ground Segment Concept, ESA/PB-EO(94)75, Issue 5, 20 September 1994

[A2]   ESA Software Engineering Standards, ESA PSS-05-0, Issue 2, Feb. 1991

[A3]   ENVISAT Product Specification Volume 15, PO-RS-MDA-GS-2009

[A4]   IECF Technical Description, PO-TN-ESA-GS-11$_{42}$

[A5]   SCIAMACHY Level 0-1b Data Processing: Detailed Processing Model (DPM), ENV-DPM-DLR-SCIA-0006

[A6]   SCIAMACHY Level 0-1b Data Processing Tools: SciCal DPM, ENV-DPM-DLR-SCIA-0071

References

[R1]   SCIAMACHY L0-1c Processor ATBD V. 8, ENV-ATB-DLR-SCIA-0041, issue 6, May 7 2014

1.3 Abbreviations and Acronyms

A list of abbreviations and acronyms which are used throughout this document is given below:

ADD	Architectural Design Document
AO	Announcement of Opportunity
ATP	Acceptance Test Plan
CFI	Customer Furnished Items
DARA	Deutsche Agentur für Raumfahrtangelegenheiten
DFD	Deutsches Fernerkundungsdatenzentrum
DLR	Deutsche Forschungsanstalt für Luft- und Raumfahrt e.V.
DOAS	Differential Optical Absorption Spectroscopy
D-PAC	German Processing and Archiving Centre
ENVISAT	Environmental Satellite
ERS	European Remote Sensing Satellite
ESA	European Space Agency
ESRIN	European Space Research Institute
ESTEC	European Space Centre of Technology
FD	Fast Delivery
GOME	Global Ozone Monitoring Experiment
GS	Ground Segment
IBM AIX	Unix Operating System of IBM Workstations
IFE	Institut für Fernerkundung der Universität Bremen
IMF	Institut für Methodik der Fernerkundung, DLR e.V.
IPF	Instrument Processing Facility
LBR	Low Bit Rate
MPH	Main Product Header
NRT	Near Real Time
PAC	Processing and Archiving Centre
PCD	Product Confidence Data
PDS	Payload Data Segment
PF_HS	Processing Facility Host Structure
SCIAMACHY	Scanning Imaging Absorption Spectrometer for Atmospheric CHartography
SGP	SCIAMACHY Ground Processor
SGP_01	SCIAMACHY Ground Processor for Level 0 to 1b Processing
SOS	SCIAMACHY Operations Support
SoW	Statement of Work
SQWG	SCAMACHY Quality Working Group
SRD	Software Requirements Document
SSAG	SCIAMACHY Scientific Advisory Group
SUM	Software User Manual
TDD/TPD	Test Data Definition / Test Procedure Document
UTC	Universal Time Co-ordinate
UV	Ultra-Violet

1.4 Document Overview

The present document provides information about

- changes in the current release, covering fixed faults found in previous releases and newly added functionalities;
- configuration items included in this release and;
- installation instructions.

2 Tool's evolution

2.1 Changes in Release 3.2
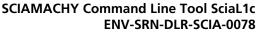
2.1.1 New Requirements Incorporated in this Release

- This release is designed to process Level 1b version 8 files. Should a user be willing to process other versions, a new –*compat* option with appropriate parameters has to be used.

- The SciaL1c tool is thought to process V8 Level 1b products only. Therefore it will abort if the MPH of the processed Level 1b product presents SOFTWARE_VERSION different from "SCIA/8.". A –*compat* option and an appropriate parameter can be used to be able to process other product versions.

- New V8 Level 1b products already contain m-factor and etalon correction, therefore a warning is printed if the user tries to apply these corrections with SciaL1c and the calibration step is skipped. If nevertheless the user wants to perform a specific correction, a –*compat* option and an appropriate parameter has to be used. See –*compat* help for details.

- There are two –*compat* options to allow m-factor calibration: -*compat* 4 and -*compat* 5 to be applied individually. Option 4 allows m-factor corrections during radiometric calibration without D0 SMR adjustment. Option 5 implies 4. That is if you want to perform m-factor correction and D0 SMR adjustment, it is sufficient to use option 5 along with radiometric calibration. In case when option 5 is used without radiometric calibration only D0 SMR correction will be carried out.

- The "calibration flags" field in the Level 1c file is appropriately updated according to –*compat* options being used.

- Since etalon correction is already calculated in, –*cal all* and –*allcal* no longer include this type of calibration. Should a user be willing to apply this option, it must be specified explicitly by number (-cal 3) and forced with –compat 2 option.

- Reference of the calibration database are copied from Level 1b into Level 1c product MPH.

- If one state in a set fails, processing of other states will be continued. (Previously the tool would abort.)

- By default, the program stops processing when m-factor directory is specified, but appropriate m-factor file is not found. A special –*compat* option can be used to ignore this error and allow further processing.

- The MPH SOFTWARE_VERSION field for Level 1c products is set to "SciaL1c/3.2".

2.2 Changes in Release 3.1

This was an internal test version never released to the public.

2.2.1 New Requirements Incorporated in this Release

- For V8 Level 1b products a Fractional Polarisation sign change is implemented for all measurement types whereas for V7 products and lower versions it was done only for LIMB and OCCULTATION. The Level 1b product version is identified through the MPH string SOFTWARE_VERSION.

- A new hot pixel detection algorithm by Sander Slijkhuis has been implemented (see [R1]) No backward compatibility to hot pixel detection algorithm used in SciaL1c version 1.x and 2.x will be kept.

2.3 Changes in Release 3.0

This was an internal test version never released to the public.

2.4 Changes in Release 2.1.74plus4

This was an internal release for SQWG members.

2.4.1 Bug fixes in this Release

- Bugfix for incorrect subsatellite mean calculation, when the satellite crosses 360 degree longitude boundary (reported by Klaus Bramstedt on 29-APR-2011 per e-mail).
- Compatibility bugfix to allow SciaL1c to correctly communicate with 64-bit networks OSes returning inode IDs bigger than DWORD.
- Bugfix for special cases when -topleft, -bottomright, -starttime and -stoptime options filtered out less than they should. Before this fix it was assumed that suitable states will make a sequence without gaps in between. It has been proven that on some states it is not true.
- Bugfix to allow code to compile on GCC 4.4 and higher.
- Bugfix for cases when integration times are not dividable by each other. This has been observed by Sebastian Gimeno Garcia on orbit orbit 12543 (2004/07/24) for product version 7.04-W, reported on 09-FEB-2012 and fixed in commit 8006 on 17-FEB-2012. This particular orbit has NADIR state ID 9 which cannot be processed by normal means. The bugfix is for a broader case. Any integration time inconsistencies are now checked before the state is processed. Should any error be found the state will be automatically excluded from the processing and a log file will be populated with an appropriate warning.

2.4.2 New Requirements Incorporated in this Release

- Calculated mean subsatellite geolocation for each cluster is now included in ascii output.
- Reverted state filtering algorithm for -cat and -type to what it originally was, because states must be in a sorted order relevant to the measurement cathegory.
- For compatibility with previous versions, log entry severity will not be escalated to an error on almost the same type of warning. Previously same warnings would accumulate into an error if they occur more than once.
- Allow -state option to take multiple arguments separated by commas.

2.5 Changes in Release 2.1.73

The release 2.1.73 is the first full public release of version 2.1 after version 1.24.

2.5.1 Bug Fixes in this Release

- CAL_OPTIONS GADS was always saved, even when –ds filter was used.

2.5.2 New Requirements Incorporated in this Release

- PET and Coadding values are added to ASCII output.

2.6 Changes in Release 2.1.71

2.6.1 Bug Fixes in this Release

- Calibrations were not applied on big-endian architectures (full fix)

2.7 Changes in Release 2.1.70

2.7.1 Bug Fixes in this Release

- Calibrations were not applied on big-endian architectures (quick fix)

2.8 Changes in Release 2.1.69

2.8.1 Bug Fixes in this Release

- When m-factor calibration was performed, etalon correction in user options GADS (CAL_OPTIONS) was marked as applied
- SciaL1c log file was not created and not populated
- Epitaxx correction was not applied to infrared channels
- In DSDs NOT_USED was replaced with "NOT USED"
- When –state option was used, all states were saved into level 1c file instead of just one
- Usage of time filters (-starttime or –stoptime) was not correctly saved in user options GADS
- Polarisation was applied to monitoring states
- Memory effect non linearity was not applied for monitoring states
- Various memory leaks while copying DSDs from level 1b to 1c were fixed
- Not all states were saved into ascii file
- Potential segmentation fault fixed during creation of level 1c file
- Handling of states without MDSes revised

2.8.2 New Requirements Incorporated in this Release

- SciaL1c functionality is now based on GDP version 4.0
- User's choice during dark flag correction is now saved in user options GADS
- Logging system was completely revised and made more verbose.
- Now SciaL1c can process files without STATES ADS attached.
- Number of datasets in MPH now holds number of DSDs in level 1c that refer any binary data
- All events in log file now have millisecond values in order to help users understand error flow better
- Batch files can now have comments starting with '#'
- Program can now dump SMR vectors into a text file
- STATES ADS now includes only states that were processed
- -list option now simulates execution process in order to allow users to combine it with other options to show, which states will be processed, if user used them for processing
- SciaL1c internal help system revised and updated

2.8.3 Configuration Items Included in this Release

- new option "-ascii"
- new option "-ascii-smr"
- new option "-clearlog"

2.9 Changes in Release 2.0.4

This release was not public but only distributed within the SQWG in order to perform the verification of the offline L12 processor version 4.0.

2.9.1 Bug Fixes in this Release

- INIT_VERSION and DECONT flags are not copied into level 1C
- START_TIME and STOP_TIME in SPH are not updated

2.9.2 New Requirements Incorporated in this Release

- The tool now can process monitoring states.

2.10 Changes in Release 1.28.10

Internal release to the SQWG in order to test the impact of m-factor application on the Level 2 products.

2.10.1 Bug Fixes in this Release

- -cal 0,1,2,3,4,5,6,7 was not equal to –allcal (execution)
- Help system rewritten (execution)
- Option parsing rewritten (execution)
- NRT center estimation (execution)
- Incorrect object destruction may result in segmentation fault in some circumstances (execution)
- On some systems default mode for ifstream is text (execution)
- uint is undefined datatype (compilation)
- SS_ID may be undefined (compilation)
- SS_ID string fixed for SciaLevel1cProduct.cc (compilation)

2.10.2 New Requirements Incorporated in this Release

- Monitoring factors (m-factors) implemented for NADIR, LIMB, OCCULTATION and SMR correction. A user can select either a directory where m-factors are located and the program picks the best suitable or specify m-factor file exactly.
- Dark flag implemented allowing switching between LIMB and GADS dark corrections.
- -cal 8 is no longer equal to –allcal, -cal all implemented, -cal 8 is now a separate option.
- -starttime -stoptime –bottomright –topleft accept two argument, both arguments must be enclosed in quotes. –bottomright and –topleft arguments can be separated by a comma without spaces.
- Solution to NA-OAR-07-02875: Option parsing is now performed according to the standard. This means that each option accepts only one argument and if you want, for example, to specify several calibrations, you must either:
  - enclose calibration into quotes (-cal "0, 1, 2, 3, 4, 5, 6, 7, 8")
  - escape spaces (-cal 0,\ 1,\ 2,\ 3,\ 4,\ 5,\ 6,\ 7,\ 8)
  - or not use spaces at all (-cal 0,1,2,3,4,5,6,7,8).

2.11 Changes in Release 1.24.5

According to clients' request, we compiled *SciaL1c^{DLR}* tool for ia64-hp-hpux11.23 and alphaev67-unknown-linux-gnu and fixed several bugs.

2.11.1 Bug Fixes in this Release

- Reliance on exception handling for dead pixels introduced division-by-zero on alphaev67-unknown-linux-gnu, because it does not handle SIGFPE as Pentiums and Athlons.
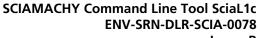
- Possible segmentation fault in Level1bProduct::setClusterFlag due to two uninitialized attributes in the constructor of Level1bProduct: currentNadirState and currentLimbState.
- Number of states in the SPH header is always zero when calibration options are present.

2.11.2   New Requirements Incorporated in this Release

- Binaries for *SciaL1c^{DLR}* are now available for ia64-hp-hpux11.23 and alphaev67-unknown-linux-gnu.
- Linux version of *SciaL1c^{DLR}* is compiled under kernel version 2.6.

2.12   Release 1.23

SciaL1c^{DLR} version 1.23 was the first version of the tool released to the public, which was based on C++ code of the Level 1B-2 SCIAMACHY processor. It replaced Java-based tool with the same name from ESA.

3 Installation Instructions

3.1 Releases 3.1 and 3.2

Binaries are static and should run on all platforms of the same type. The following is a dependency list for various platforms:

Platform	Dependency list
i686-pc-linux-gnu	Linux kernel 3.12
x86_64-pc-linux-gnu	Linux kernel 3.12
i686-pc-mingw32 (windows)	Windows 2003 or higher

3.2 Releases prior to 3.1

Binaries are static and should run on all platforms of the same type. The following is a dependency list for various platforms:

Platform	Dependency list
i686-pc-linux-gnu	Linux kernel 2.6
i686-pc-mingw32	Windows XP or higher
sparc-sun-solaris2.7	<none>
alphaev67-unknown-linux-gnu	<none>
ia64-hp-hpux11.23	libhplx.so libunwind.so.1 libm.so.1 libc.so.1 libuca.so.1 libdl.so.1