

EPS-SG SCA Level 1B Product Format Specification

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Change Record

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V1	15 December 2014	---	Initial version
V1A	11 February 2015	---	Updates following comments by reviewers
V1B	18 November 2015	---	Updates after the receiving of the instrument design documentation.
V1C	5 January 2016	EUM-EPSSG-DCR-170	- Updates following the Instrument PDR and subsequent internal review for PDAP ITT release - Updates following the SAG review - Updates following revision of GPSF document (Ref. EUM/LEO-EPSSG/SPE/13/702108) - Minor editorial changes (e.g., revision of references, acronyms, etc.)
V2	30 September 2016		Section 1.5: list of acronyms updated Sections 1.7, 1.8 removed Section 3 updated: - processing chain description updated - Figure 3-1 modified - Level 1B full resolution product description updated (introduction of the HV polarisation state for the mid beam) - Level 1B re-sampled product description updated (introduction of the combination of the HV and VH measurements for the mid beam) Section 3.1: global, regional and local data product introduced Section 3.2: “.nc” extension added Section 4.2.1: table 2 updated (size) Section 4.2.2: Figure 4-1 modified Section 4.2.3.1: table 3 updated - conventions -> Conventions - organisation -> institution - baseline removed - summary updated - Doi added - instrument updated - sensing start and stop time format updated - “absolute orbit” added to orbit numbers Section 4.2.4.1.2: table 4 updated: - leap_second_items, orbit_parameter_items and state_vector_items deleted - dimension length for manoeuvre_items updated
			Section 4.2.4.1.3: table 5 updated:

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			- epoch_time_ut1, epoch_time_tai and tolerances deleted - descriptions of Keplerian elements, OSV elements and platform attitude errors updated - sat_track_azi and asc_desc_pass deleted - valid min attribute changed from 0e0 to -1e9 for all variables related to the time - leap_second_value type changed, range updated - manoeuvre_start_time -> manoeuvre_start_time_utc, range updated - manoeuvre_end_time -> manoeuvre_end_time_utc Section 4.2.4.2.2: table 6 updated: - dimension length for mode_items updated - num_antennae, sfe_number and active units dimensions deleted Section 4.2.4.2.3: table 7 updated (instrument_config, sfe_temp, ant_temp, receiver_gain, sbt_timetag, pri_count_timetag, pri_count deleted) Section 4.2.4.3.1: table 8 updated: - generating facility deleted - baseline added Section relative to the Group Name: satellite_status_flags deleted
			Section 4.2.5 Group Name data: text updated; 12 new sub-sections introduced, reflecting the data group structure. Each sub-group introduced corresponds to the antenna beam activated in the left or right swath and to the transmitting and receiving polarisation states used: - Group name: left_fore_VV - Group name: left_mid_VV - Group name: left_mid_VH - Group name: left_mid_HV - Group name: left_mid_HH - Group name: left_aft_VV - Group name: right_fore_VV - Group name: right_mid_VV - Group name: right_mid_VH - Group name: right_mid_HV - Group name: right_mid_HH - Group name: left_aft_VV Dimension table (table 10) updated for each sub-group (dimension length modified,

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			dimensions deleted, other dimensions added) Variable table (table 11) updated for each sub-group (variable names, descriptions, variable ranges and types updated, scale factors removed, variables deleted, other variables added) Section relative to the Group name: measured_data deleted Section relative to the Group name: processing_flag deleted Section relative to the Group name: quality_information deleted Section 4.2.6.2: text updated Section 4.2.6.3: text updated, table on the quality variables updated Section relative to the Group name: quality_statistic deleted Section 4.3.1: table 14 upated (size) Section 4.3.2: text updated, figure 4-2 modified Section 4.3.3.1: table 15 updated (same modifications performed on table 3)
			Section 4.3.5 Group Name data: text updated; 12 new sub-sections introduced, reflecting the data group structure. Each sub-group introduced corresponds to the antenna beam activated in the left or right swath and the transmitting and receiving polarisation states used. The group naming used follows the same introduced in Section 4.2.5. In addition, one further sub-section, Group name: grid, has been introduced. It corresponds to the sub-group grid added under the data group and provides the information for the definition of a 6.25 km regular grid. Section relative to the Group name: measured_data deleted Section relative to the Group name: processing_flag deleted Section relative to the Group name: quality_information deleted Section 4.3.6.2: Table 31 (quality dimensions) introduced Section 4.3.6.3: Table 32 (quality variables) updated (variable names, descriptions, ranges updated, variables deleted, other variables added) Section relative to the Group name: quality_statistic deleted Section 4.4: title changed Section 4.4.1: text updated, table 33 updated (size)

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			Section 4.3.2: figure 4-2 modified Section 4.4.3.1: text updated, table 34 updated (same modifications performed on table 3) Sections 4.4.4, 4.4.5: updated Section 4.4.5.1: title, text updated Section 4.4.5.2: title, text updated, table 35 updated (variables description and range modified) Section 4.4.5.2.1: title, text updated, table 36 updated (variable names, description, range updated, offset introduced, scale factors modified, variables deleted, other variables added) Section relative to the Group Name processing_flag deleted Section relative to the Group Name quality information deleted Sections 4.4.6, 4.4.6.1: updated Section 4.4.6.2: text modified and table 37 introduced
			Section 4.4.6.3: text updated and table 38 (quality variables) updated (variable names, description, range updated, variables deleted, other variables added) Section 3: table 39 updated Appendix A: text and table 40 updated Appendix B: text updated, previous tables deleted, table 41 introduced Appendix C: text modified, xml files updated, xml schema removed Appendix D introduced In all the document the time unit modified: "s since 2020-01-01T00:00:00.000Z" -> "s since 2020-01-01T00:00:00.000"
V2A	06 December 2016	DCR-491	- Updates following the internal review - Updates following revision of GPSF document (Ref. EUM/LEO-EPSSG/SPE/13/702108) - Minor editorial changes (e.g., revision of references, acronyms, etc.)
V2B	22 August 2017		- Document signature table updated - Section 1.6 updated - Section 3: text and Figure 3.1 updated - Table 2: product size updated - Table 3: Conventions, metadata_conventions, title and keywords attributes updated - Tables 5 and 7: units variable attribute has been deleted for dimensionless variables; the units for variables representing the time has

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			been aligned with the CF convention - Table 8: processor_name attribute specified, format_version and source attributes updated - Table 9: the units for variables representing the time has been aligned with the CF convention - Group data dimensions introduced (section 4.2.5.1) - Group data variables introduced (section 4.2.5.2) - Tables 12 updated - Table 13: list of variables updated, units variable attribute removed apart for the variables representing the time, the latitude and longitude; valid_min and valid_max attributes removed for all the variable apart from the "longitude" variable, missing attributes removed for all the variables - Table 14: type of the overall_quality_flag changed to NC-USHORT; range or type of the overall_quality_flag specified
			- Quality variables for SCA-1A-PRE product deleted - Table 15: product size updated - Table 16: Conventions, metadata_conventions, title, summary and keywords attributes updated - Section 4.3.5.1.2 updated, in table 17 the number of sample across track has been changed to a better representative value - Table 18: list of variables updated, units variable attribute has been deleted for dimensionless variables, valid_min and valid_max attributes removed for all the variable apart from the "longitude" variable, missing_value attribute deleted for the variables representing the time and the flags - Section 4.3.5.2.2 updated; in table 19 the number of sample across track has been changed to a better representative value - Section 4.3.5.3.2 updated; in table 20 the number of sample across track has been changed to a better representative value - Section 4.3.5.4.2 updated; in table 21 the number of sample across track has been changed to a better representative value - Section 4.3.5.5.2 updated; in table 22 the number of sample across track has been changed to a better representative value - Section 4.3.5.6.2 updated; in table 23 the

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			number of sample across track has been changed to a better representative value - Section 4.3.5.7.2 updated; in table 24 the number of sample across track has been changed to a better representative value - Section 4.3.5.8.2 updated; in table 25 the number of sample across track has been changed to a better representative value - Section 4.3.5.9.2 updated; in table 26 the number of sample across track has been changed to a better representative value - Section 4.3.5.10.2 updated; in table 27 the number of sample across track has been changed to a better representative value - Section 4.3.5.11.2 updated; in table 28 the number of sample across track has been changed to a better representative value - Section 4.3.5.12.2 updated; in table 29 the number of sample across track has been changed to a better representative value - Table 30: updated
			- Table 31: updated; valid_min and valid_max attributes removed for all the variable apart from the "longitude" variable, missing_value attribute deleted for the variable representing the time - Table 32: updated - Section 4.3.6.3 updated, table 33: list of variables updated, units, valid_min, valid_max and missing attributes removed for all the variables - Table 34: product size updated - Table 35: Conventions, metadata_conventions, title and summary attributes updated - Table 36: updated - Table 37: list of variables updated, units variable attribute has been deleted for adimensional variables, valid_min and valid_max attributes removed for all the variable apart from the "longitude" variable, missing_value attribute deleted for the variables representing the time and the flags - Table 38 updated - Section 4.4.6.3 updated, table 39 list of variables updated, units, valid_min, valid_max and missing attributes removed for all the variables - Tables 40 updated

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			- Appendices A, B, C updated - TBC and TBD list has been updated - notation used for double type variables has been made uniform in all the document (decimal point has been deleted)
V2C	11 December 2017	DCR 824	- Updates following the internal review - Updates following revision of GPSF document (Ref. EUM/LEO-EPSSG/SPE/13/702108) - Table 11: name of the global variables of the SCA-1A-PRE has been changed - Table 13: the valid_min and valid_max attributes have been reintroduced for the variable latitude; the attributes flag_masks and flag_meanings have been introduced for the variable flag_generic - Table 15: size of the product has been updated
			- Table 18: the valid_min and valid_max attributes have been reintroduced for the following variables: latitude; incidence_angle; azimuth_angle; lcr; flag_pass; flag_surface; flag_quality; the attributes flag_masks and flag_meanings have been introduced for the variable flag_generic; the attributes flag_values and flag_meanings have been introduced for the variables: flag_pass; flag_surface; flag_quality - Table 31: the valid_min and valid_max attributes have been reintroduced for the following variables: latitude_point_left; latitude_point_right - Table 33: the summary_flag variable has been introduced - Table 34: size of the product has been updated - Table 37: the valid_min and valid_max attributes have been reintroduced for the following variables: latitude; - incidence_angle; azimuth_angle; lcr; fcr; kp, flag_pass; flag_surface; flag_quality; the attributes flag_masks and flag_meanings have been introduced for the variable flag_generic; the attributes flag_values and flag_meanings have been introduced for the variables: flag_pass; flag_surface; flag_quality - Table 39: the summary_flag variable has been introduced - Table 42 has been updated - Xml file names updated - Update of the TBD/TBC tables

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			- Minor editorial changes
3A	6 th March 2020	DCR 1640	- Update of the signature table - Update of document structure section - Update of Table 2 (size of the Level 1A product) - Update of the overall group structure of the Level 1A product (section 4.2.2.): the number of sub-groups in the Group Data has been reduced to 10, as for the mid antenna beams the radiometric and calibrations parameters corresponding to the cross-polarised channels VH and HV have been merged; figure 4.1 updated accordingly - Update of table 8 - Removal of the Global Dimensions and the Global Variables for the Level 1A product
			- Update of the dimension table (Table 10) for all the sub-groups in the Group Data of the Level 1A product - Update of the variable table (Table 11) for all the sub-groups in the Group Data of the Level 1A product: introduction of a variable representing the EPS-SG time stamp, i.e. tstamp, removal of the variables smoothed_power_gain, smoothed_noise, antenna_gain_correction, torbit - Introduction of quality variables for the Level 1A product (Tables 13 and 14) - Update of Table 15 (size of the Level 1B full resolution product) - Update of the dimension tables for all the sub-groups in the Group Data of the Level 1B full resolution product - Update of the variable tables for all the sub-groups in the Group Data of the Level 1B full resolution product: removal of the variables alpha, beta, gamma - The spatial width of the regular grid defined in the sub-group grid has been increased to 12.5 km - Update of the dimension table (Table 32) of the Quality Group of the Level 1B full resolution product - Update of the variable table (Table 33) of the Quality Group of the Level 1B full resolution product - Update of Table 34 (size of the Level 1B re-sample product) - Update of the variable table (Table 37) of the Data Group of the Level 1B re-sample product:

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			removal of the numval variable - Update of the dimension table (Table 38) of the Quality Group of the Level 1B re-sample product - Update of the variable table (Table 39) of the Quality Group of the Level 1B re-sample product - Update of table 40 - Removal of Appendix A - Update of current Appendix A: update of Table 41 (size of the SCA products) - Update of current Appendix B: update of the xml files - Update of current Appendix D: update of the TBC, TBD and TBW - Minor editorial changes, formatting clean-up
4A	25 th August 2022	DCR 2386	- Section 4.2.5.1.2. - Table 10: Update value of 'time' dimension' changed - Section 1.6 - Added description on the inversion of dimension between NetCDF and NCML - Section 4.3.5.1.3. - Table 18: change the scale factor of the 'backscatter' variable in the SZF product from 10-5 to 10-7 - Section 4.2.5.1.3. - Table 11: change long_name from "normalisation factor at mid swath" to "maximum normalisation factor " - Section 4.4.5.2.1. - Table 37: change the flag_surface variable from 1 dimensional (number_points) to 2 dimensional (number_points by number_beams) - Section 3.2 – 'Mode' of disposition updated with upper/lower case to indicate the last product of a dump - flag_pass, flag_surface, flag_quality have changed - Section 4.3 - SZR product – number of samples per row changed to 340, fcr variable deleted, corrected_cross_pol and faraday_rotation_angle added - Section 4.2.4.3.1 – Table 8 - Update of reference documents - section 5 (product format version control numbers) clarity of text and table improved - SZF product: Value of 'time' dimension changed in several groups

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			- Appendix A (product sizes) rewritten for clarity - Appendix B (NCML description of SCA products) NCML files updated - Appendix C (BUFR format description) was changed to be aligned with the latest PFS version

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1 INTRODUCTION

1.1 Purpose and Scope

This document is the Format Specification for EPS-SG SCA Level 1 products generated centrally by the EPS-SG Ground Segment at the EUMETSAT Headquarters. It aims to specify the detailed format of the SCA Level 1 products in agreement with the format and naming conventions set out in the Generic Product Format Specification [GPFS] applicable to all EPS-SG products. The instrument specific Product Format Specification contains all the instrument specific NetCDF details, including specific metadata. The common groups and metadata are defined in the [GPFS].

This document addresses the native format of the products generated in the EPS-SG Ground Segment, which is NetCDF-4 as specified in [GPFS]. Other user formats will be specified elsewhere.

1.2 Relation to other documents

The EPS-SG SCA Level 1B Product Format Specification [SCA-L1B-PFS] is a System document in the System Specification Tree. It is applicable to the [SRD], [OGSRD], SCA Level 1B Product Generation Specification [SCA-L1B-PGS], SCA EPS-SG Level 1B Auxiliary Data Specification and EPS-SG System and Ground Segment documents including ICDs/IRDs wishing to convey information about the SCA Level 1 products format and content.

The Level 0 products are described in [L0-PFS]. The SCA Level 1B Auxiliary Data files are described in [SCA-L1B-ADS].

This document is derived from and compliant to [GPFS] for generic product format and naming conventions applicable to all EPS-SG products.

1.3 Applicable Documents

ID	Title	Reference and version
[GPFS]	EPS-SG Generic Product Format Specification	EUM/LEO-EPSSG/SPE/13/702108
[MCSD]	EPS-SG Mission Conventions and Standards Document	EUM/LEO-EPSSG/STD/14/74522 1
[DEV]	Development Logic for EPS-SG L0-L1-L2 Processing Specifications	EUM/LEO-EPSSG/TEN/14/76315 9
[HQ-BAS]	EPS-SG Data and Products Generation, Archiving and Dissemination Baseline at EUMETSAT HQ	EUM/LEO-EPSSG/SPE/15/819557
[L0-PFS]	EPS-SG SCA Level 0 Product Format Specification	EUM/LEO-EPSSG/SPE/13/703928

1.4 Reference Documents

ID	Title	Reference
[SRD]	EPS-SG System Requirements Document	EUM/LEO-EPSSG/SPE/13/735903
[OGSRD]	EPS-SG Overall Ground Segment Requirements Document	EUM/LEO-EPSSG/REQ/13/725156
[SCA-L1B-PGS]	EPS-SG SCA Level 1B Product Generation Specification	EUM/LEO-EPSSG/SPE/14/776539
[SCA-L1B-ADS]	EPS-SG SCA Level 1B Auxiliary Data Specification	EUM/LEO-EPSSG/SPE/14/776537
[SCA-L1B-ATBD]	EPS-SG SCA Level 1B Algorithm Theoretical Basis Document (ATBD)	EUM/LEO-EPSSG/SPE/14/739659

1.5 Acronyms

The definition of conventions, terms and abbreviations applicable to the EPS-SG programme can be found in [MCSD]. Abbreviations specific to this document are listed in the following table.

Acronym	Definition
EPS-SG	EUMETSAT Polar System – Second Generation
NA	Not Applicable
NaN	Not a Number
NetCDF	Network Common Data Form
NRT	Near Real Time
PRF	Pulse Repetition Frequency
PRI	Pulse Repetition Interval
TBC	To Be Confirmed
TBD	To Be Defined
TBW	To Be Written
UTC	Universal Time Coordinated
XML	eXtensible Markup Language
XSD	XML Schema Definition

1.6 Conventions and Terminology

Generic conventions and terminology used in this document for EPS-SG products are those described in the [GPFS]. Note that the convention for the order of array dimensions used in this document is the reverse of the convention used by Netcdf, i.e. a 2D array described in the text as [n,m] would be described by Netcdf as [m,n]. The NcML files given in the appendix use the Netcdf convention. Generic terms and definitions applicable to the EPS-SG Programme

can be found in [MCSD]. However, an additional convention is used in this document for defining an “undefined” value to insert into the missing value attribute of each variable. In particular, based on the type of the variable, the following is the default convention used, unless otherwise specified:

Variable Type	Missing Value
NC_BYTE	Minimum negative value allowed for size of integer: $-2^7=-128$
NC_UBYTE	Maximum positive value allowed for size of u-integer: $2^8-1=255$
NC_SHORT	Minimum negative value allowed for size of integer: -2^{15}
NC_USHORT	Maximum positive value allowed for size of u-integer: $2^{16}-1$
NC_INT	Minimum negative value allowed for size of integer: $-2^{31}=-2147483648$
NC_UINT	Maximum positive value allowed for size of u-integer: $2^{32}-1$
NC_DOUBLE	Not a Number (NaN)

Moreover, as default the valid minimum and maximum values the variables can assume have been fixed to the corresponding minimum and maximum values which can be represented taking into consideration the value already used in the missing value attribute. Therefore, unless otherwise specified, the following applies:

Variable Type	Valid min.	Valid max.
NC_BYTE	$-2^7+1=-127$	$2^7-1=127$
NC_UBYTE	0	$2^8-2=254$
NC_SHORT	$-2^{15}+1=-32767$	$2^{15}-1=32767$
NC_USHORT	0	$2^{16}-2$
NC_INT	$-2^{31}+1=-2147483647$	$2^{31}-1=2147483647$
NC_UINT	0	$2^{32}-2$
NC_DOUBLE	-2^{1024}	2^{1024}

1.6.1 Meaning of Table Headings

Element Name	Description
Filename	The name of the product (following naming convention described in [GPFS]).
Product ID	The Product identifier of the product (global attribute: Product identifier as described in the [GPFS]).
Product Description	A summary as defined in the relevant product format specification (global attribute: product_description described in the [GPFS]).
Format	Native format of the product (i.e. netCDF-4).
Size	Size of the product (Byte/Orbit).
Duration	Duration of product disseminated to the user (To be defined during Phase C)
Variable Name	The name of NetCDF variable.

Attribute Name	The name of NetCDF attribute (see also http://www.unidata.ucar.edu/software/netcdf/docs/netcdf/Attribute-Conventions.html) Attributes may be global or related to a group instead of a variable; in this case they must appear before dimensions.
Dimension Name	The name of NetCDF dimension.
Description	Description of the element; for a variable the description must coincide with its “long_name” attribute.
Range or value	Range or value of variables, or value of dimensions or attributes.
Unit	Unit type of variables or attributes.
Data Type or Type	Type of variables or attributes as defined in [GPFS], not used for dimensions.
Dimension	Dimensions of the variables or attributes, in the same order than storage and with one dimension per line. Dimensions must be always defined before variables.
Usage	Usage of the product: - Internal: Product/Data is for use within the EPS-SG system. It is not made available to the end-users. - User: the product is disseminated to the end-users.

1.7 Document structure

Section Number	Title	Content
1	Introduction	The Scope and Purpose of the PFS document is described in this section, along with Open Issues, Assumptions, Applicable and Reference documents.
2	Overview of the instrument: SCA	A reference to the documents describing the main features and characteristics of the SCA is provided in this section.
3	EPS-SG SCA Level 1 Products Overview	A high-level overview on the SCA Level 1 Products structure is presented in this section. The Product List and the Product Naming convention are also specified here.
4	EPS-SG SCA Level 1 Product Detailed Format	The format of each SCA Level 1 Product (detailed description of the NetCDF Data Files of each product) is described in this section.
5	Product Format Version Control	This section is aimed to describe the product format version control number for each product described in this document.
APP A	Size of EPS-SG SCA Level 1 products	In this section the size of each SCA Level 1 Products is estimated.
APP B	NcML Description of EPS-SG SCA L 1 Products Format	The .NcML for each SCA Level 1 Products is provided in this section.
APP C	BUFR Format Description	The BUFR format specification for each SCA Level 1 Products will be provided in this section.
APP D	TBC / TBD /TBW	

2 OVERVIEW OF THE SCA INSTRUMENT

A description of the main features and characteristics of the SCA is provided in the EPS-SG SCA Level 1B Algorithm Theoretical Basic Document [SCA-L1B-ATBD] and in the related EPS-SG SCA Level 1B Product Generation Specification [SCA-L1B-PGS]. The acquisition mode for generating data to be processed in the Ground Segment is described in both the above documents.

3 EPS-SG SCA LEVEL 1 PRODUCTS OVERVIEW

The overall processing chain implemented in the EPS-SG Ground Segment can be decomposed in the stages as depicted in Figure 3-1. The products of each stage are intended either to serve as basis for higher level product generation or to be distributed to users. The latter can be dispensed in NRT and/or in Non-NRT mode.

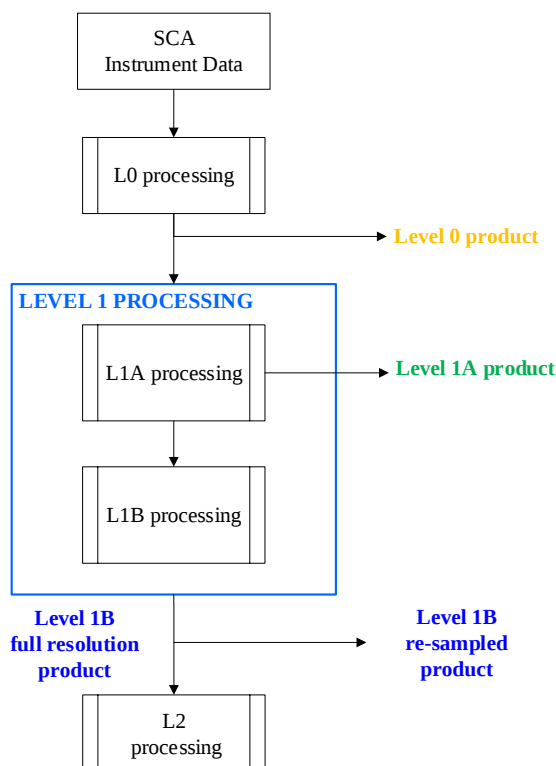


Figure 3-1: SCA processing chain.

From Figure 3-1 it is possible to identify the following SCA products:

1. Level 0 product: it contains unprocessed instrument baseband data in complex representation (I and Q components of the received signal) as they are recorded on board. The only processing performed to the down-linked raw signal data is the collocation and ordering, the restoration of the chronological data sequence and the removal of all communications artefacts and data overlaps at dump boundaries;
2. Level 1A products: it consists of radiometric corrections and calibration factors. Also the geometric registration to geodetic Earth coordinates is computed and appended; it is intended for instrument monitoring and analysis;
3. Level 1B full resolution products: it contains the Normalised Radar Cross Section (NRCS) which is radiometrically calibrated, Earth located and quality controlled, in the original range location;
4. Level 1B re-sample products: it contains the NRCS which is radiometrically calibrated, Earth located and quality controlled, re-sampled to a grid location.

The Level 1 processing chain computes radiometric and spectral calibration as well as geometric registration to geodetic Earth coordinates. As shown in Figure 3-1, this processing is performed in two steps, the Level 1A and Level 1B. The Level 1A products are not intended for the data users, whereas the Level 1B products are made available to the user and together with the auxiliary data constitute the outputs of the Level 1 processing. The format of the Level 1 products is described in the present document, whereas the format of the output auxiliary data is described in [SCA-L1B-ADS].

The Level 1B product elements resulting from the process are organised into two Level 1B products available to the final user:

1. the full resolution product – the backscattering coefficients are provided along the antenna beam and localised on the Earth surface. They correspond to the fore-VV, mid-VV, mid-VH, mid-HV, mid-HH, aft-VV measurements. This product does not include measurement collocation from the different beams into a position on the Earth surface. The data are instead organised per beam measurement and per position along each beam. Other important information provided for each σ^0 value is the incidence angle, the azimuth angle, the measurement time and the geographical position of the sample.
2. the re-sampled product on a 12.5 km x 12.5 km swath grid spacing – the backscattering coefficients are re-sampled through spatial averaging on a grid and provided as quintuplets, the σ^0 values that correspond to the fore-VV, mid-VV, mid-XX (a combination of the mid-VH and mid-HV), mid-HH and aft-VV measurements, respectively. These quintuplets are localised on the Earth surface as a set of nodes on a grid along and across swath. Other important information provided for each quintuplet is the incidence angle, the azimuth angle, the measurement time, the geographical position of the node, the radiometric resolution (k_p), as well as different flags and qualifiers.

The user Level 1B products are distributed in NRT.

Level 2 products are geophysical parameters calculated from NRCS (i.e., ocean surface wind vectors or land surface soil moisture index). Level 2 processing may start from any Level 1B product. Its format is not described here as it is out of the scope of the present document.

3.1 Product List

Product ID	Product Description	Usage
SCA-1A-PRE	Level 1A	Global, Regional, Local
SCA-1B-SZF	Level 1B full resolution	Global, Regional, Local
SCA-1B-SZR	Level 1B re-sampled	Global, Regional, Local

Table 1: EPS-SG SCA Level 1 Product List.

Each SCA product type is generated at the EUMETSAT Headquarters in NRT with *mission type* “global” or “regional”. The regional data product, which comes directly from a number of ground stations, covers a regional area of interest. It arrives to EUMETSAT within few minutes from the sensing time and it is processed immediately. On the other hand, the global data is

sourced from two dumps per orbit, one at Svalbard and the other at McMurdo, so that they arrive at EUMETSAT in proper time to be processed to Level 1B and distributed to users within 70 minutes from sensing.

3.2 Naming Convention

The naming convention of EPS-SG products complies with the naming convention specified in [GPFS] for all EPS-SG Ground Segment products generated in native format.

The product name of the SCA Level 1 products is according to the following convention:

(pflag) ' _ ' (productidentifier) ' _ ' (oflag) ' _ ' (originator) ' _ '
(YYYYMMDDhhmmss) ' _ ' (freeformat)

where the contents of each fields is explained in the [GPFS]. The order of these fields is mandatory.

The ‘mode’ of disposition is related to the suitability of the data for various kinds of uses, and hence the use that should be made of it and the destination to which it should (or should not) be sent. Lower-case letters indicate the last product of a dump.

Identification of the type of processing

(“T” | “t” | “C” | “c” | “O” | “o” | “V” | “v”)

T, t = test data

C, c = produced during commissioning

O, o = routine operations

V, v = during validation of a new processor version during routine operations

Product name examples of all the Level 1 products (for illustrative purpose only):

1)

W_XX-EUMETSAT-Darmstadt,SAT,SGB1-SCA-1A-
PRE_C_EUMT_20220101121212_G_O_20220101103000_20220101104000_O_N__

This is a global Level 1A product, generated in the context of the EPS-SG Global mission, for the SCA instrument embarked on the Metop-SG/B1 satellite (SGB1).

The product was created on the 01 January 2022 at 12:12:12 hours, with a sensing start date of 01 January 2022 at 10:30:00 hours and a sensing end date of 01 January 2022 at 10:40:00 hours.

The file was generated in the Ground Segment operational (O) environment. The disposition mode indicates that it was produced during routine operations (O), in NRT processing (N).

The corresponding product file name using netCDF formatting will carry an extension “.nc” as shown below:

W_XX-EUMETSAT-Darmstadt,SAT,SGB1-SCA-1A-
PRE_C_EUMT_20220101121212_G_O_20220101103000_20220101104000_O_N__.nc

2)

**W_XX-EUMETSAT-Darmstadt,SAT,SGB2-SCA-1B-
SZF_C_EUMT_20220201121212_G_O_20220201103000_20220201104000_O_N__**

This is a global Level 1B full resolution product, generated in the context of the EPS-SG Global mission, for the SCA instrument embarked on the Metop-SG/B2 satellite (SGB2).

The product was created on the 01 February 2022 at 12:12:12 hours, with a sensing start date of 01 February 2022 at 10:30:00 hours and a sensing end date of 01 February 2022 at 10:40:00 hours. The file was generated in the Ground Segment operational (O) environment. The disposition mode indicates that it was produced during routine operations (O), in NRT processing (N).

The corresponding product file name using netCDF formatting will carry an extension “.nc” as shown below:

**W_XX-EUMETSAT-Darmstadt,SAT,SGB2-SCA-1B-
SZF_C_EUMT_20220201121212_G_O_20220201103000_20220201104000_O_N__.nc**

3)

**W_XX-EUMETSAT-Darmstadt,SAT,SGB3-SCA-1B-
SZR_C_EUMT_20220301121212_G_O_20220301103000_20220301104000_O_N__**

This is a global Level 1B re-sampled product, generated in the context of the EPS-SG Global mission, for the SCA instrument embarked on the Metop-SG/B3 satellite (SGB3).

The product was created on the 01 March 2022 at 12:12:12 hours, with a sensing start date of 01 March 2022 at 10:30:00 hours and a sensing end date of 01 March 2022 at 10:40:00 hours. The file was generated in the Ground Segment operational (O) environment. The disposition mode indicates that it was produced during routine operations (O), in NRT processing (N).

The corresponding product file name using netCDF formatting will carry an extension “.nc” as shown below:

**W_XX-EUMETSAT-Darmstadt,SAT,SGB3-SCA-1B-
SZR_C_EUMT_20220301121212_G_O_20220301103000_20220301104000_O_N__.nc**

4 EPS-SG SCA LEVEL 1 PRODUCT DETAILED FORMAT

4.1 Overall Structure of EPS-SG Products

All EPS-SG product types generated by the EPS-SG Ground Segment are NetCDF-4 files complying with the generic structure and data model set out in the [GPFS]. Their high-level structure is presented in the [GPFS] and consists of a *root* group, holding global attributes defined in the [GPFS] and the following sub-groups: *status*, *data* and *quality*.

In the following sections, the physical composition of each product type is specified for the SCA instrument.

4.2 Level 1A

This section describes the detailed content of the NetCDF file, including groups, attributes, variables and dimensions applicable to the SCA Level 1A product.

4.2.1 Product Summary Sheet

The table below provides a summary for the SCA Level 1A product. The Level 1A filename in Table 2 is defined according to the conventions described in the [GPFS]. For ease of consultation, some of the fields (spacecraft, environment, sensing_start, sensing_end, disposition_mode and processing_mode) in the filename description are expressed in terms of the corresponding possible entries reported in Table 5 of the [GPFS]. The granularity (duration in sensing time) of the product (both for global and regional usage) is not yet defined.

Filename	W_XX-EUMETSAT-Darmstadt,SAT,SGB[1-3]-SCA-1A- PRE_C_EUMT_YYYYMMDDhhmmss_[G R L]_[O V I D E]_YYYYMMDD Dhhmmss_YYYYMMDDhhmmss_[T C O V]_[N R]____.nc
Product ID	SCA-1A-PRE
Product Description	SCA Level 1A product
Format	netCDF-4
Size	Approx. 13 200 000 bytes per orbit
Duration	

Table 2: SCA Level 1A product summary sheet.

4.2.2 Overall Group Structure

The overall structure of the SCA Level 1A product is in accordance with [GPFS] and is shown in the following figure. Of particular interest is the data group which contains 10 subgroups each corresponding to the antenna beam activated in the left or right swath, i.e. fore, mid and aft beam, and the transmitting and receiving polarisation states used (i.e. vertical and horizontal). Note that for the mid antenna beams the radiometric and calibration parameters corresponding to the cross-polarised channels VH and HV and needed for the further processing have been merged and reported in the subgroups left_mid_XX and right_mid_XX, for the left and right swath, respectively. Group dimensions, variables and attributes complement each subgroup in accordance with the NetCDF 4 model described in [GPFS].

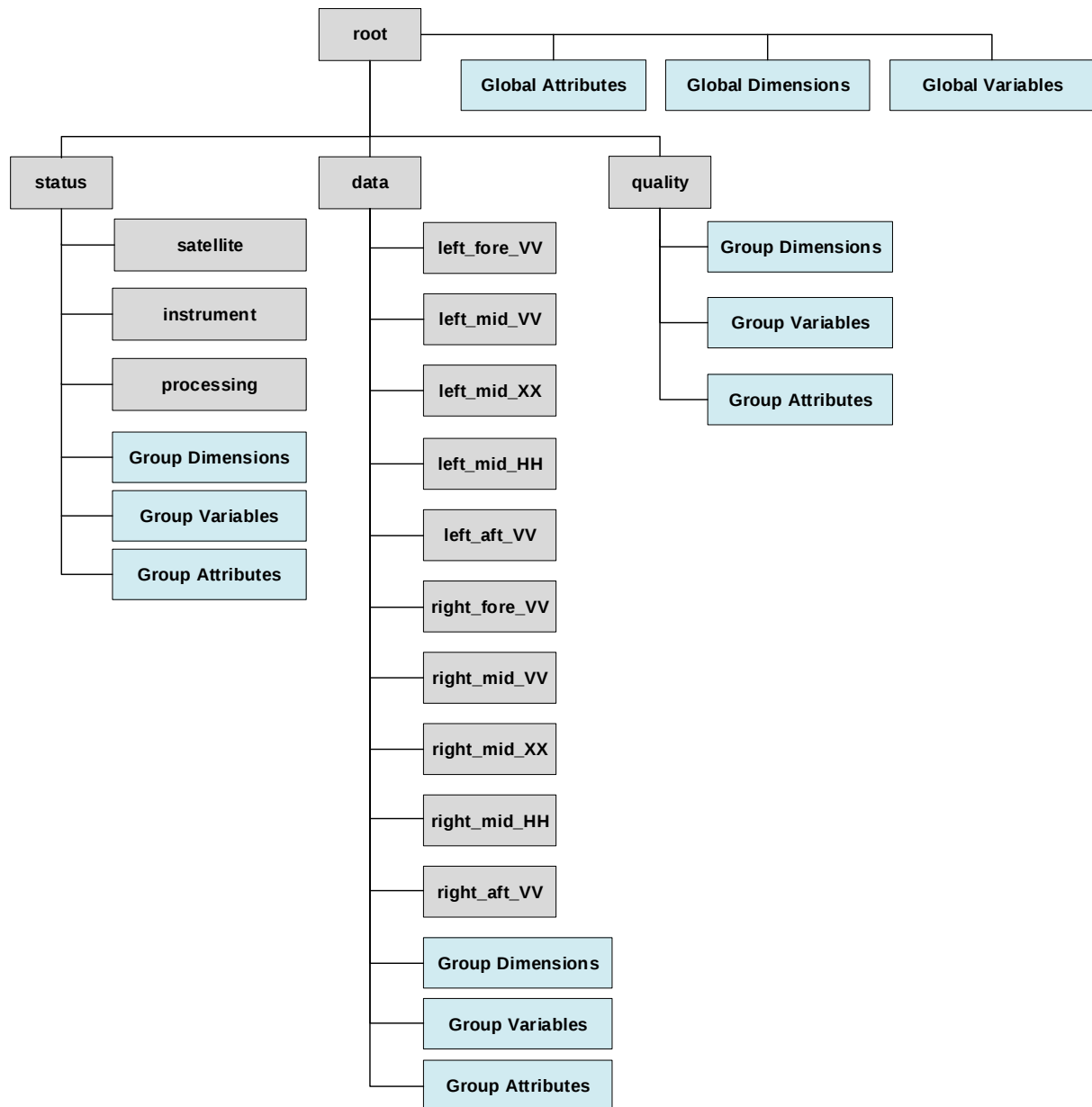


Figure 4-1: Overview of the groups in the SCA-1A-PRE product.

4.2.3 Group Name: root

4.2.3.1 Attributes (global)

Table 3 describes the Global Attributes for the SCA Level 1A product in accordance with ones defined in [GPFS].

EPS-SG SCA Level 1B Product Format Specification

Attribute Name	Description	Type	Unit	Range or Value
Conventions	e.g. "CF-1.6"	NC_STRING	NA	"Latest version of "The Climate and Forecast (CF) Metadata Conventions"."
metadata_conventions	e.g. "Unidata Dataset Discovery v1.0"	NC_STRING	NA	"Applicable version of Unidata Dataset Discovery Conventions"
product_name	Product name formatted as set out in section 3.2	NC_STRING	NA	"W_XX-EUMETSAT-Darmstadt,SAT,SGB[1-3]-SCA-1A-PRE_C_EUMT_YYYYMMDDhhmmss_[G R L]_[O V I D E]_YYYYMMDDhhmmss_YYYYMMDDhhmmss_[T C O V]_[N R]____.nc"
title	Short description of the product	NC_STRING	NA	"EPS-SG SCA Level 1A product"
summary	A summary of the product	NC_STRING	NA	Level 1A product contains the SCA instrument and processor monitoring information (i.e. the reference functions, the state vectors and the mid swath geodetic Earth coordinates).
doi	Digital Object Identifier	NC_STRING	NA	
keywords	Keywords related to the product.	NC_STRING	NA	"EPS-SG SCA Level 1A monitoring"
history	Reference to previous product handling	NC_STRING	NA	["original generated product" "aggregated product" "sub-setted product"]
institution	Name of the originating organisation <i>Note: This field may be extended with other values should products be generated in other locations.</i>	NC_STRING	NA	"EUMETSAT"
spacecraft	Satellite identifier	NC_STRING	NA	"SGB"[1-3]
instrument	Instrument or product identifier and flight model number	NC_STRING	NA	"SCA"
product_level	Product level identifier	NC_STRING	NA	"1A"
type	Character string providing an indication of the type of product.	NC_STRING	NA	"PRE"

EPS-SG SCA Level 1B Product Format Specification

Attribute Name	Description	Type	Unit	Range or Value
mission_type	Global, regional or local reception and processing	NC_STRING	NA	("Global" "Regional" "Local")
disposition_mode	Identification of the type of processing	NC_STRING	NA	("Test" "Commissioning" "Operational" "Validation")
sensing_start_time_utc	UTC time of start of sensing data formatted in CF date and time format with ms precision	NC_STRING	NA	"YYYYMMDDhhmmss.ddd"
sensing_end_time_utc	UTC time of end of sensing data formatted in CF date and time format with ms precision	NC_STRING	NA	"YYYYMMDDhhmmss.ddd"
environment	Environment where the processing takes place	NC_STRING	NA	("Operational" "Validation" "Integration & Verification" "Development" "Engineering")
references	Published web references describing the data and the methods used in the processing	NC_STRING	NA	"www.eumetsat.int"
orbit_start	Absolute orbit number at sensing_start_time_utc	NC_UINT	NA	
orbit_end	Absolute orbit number at sensing_end_time_utc	NC_UINT	NA	

Table 3: Global Attributes for SCA-1A-PRE product.

4.2.3.2 Dimensions (global)

No common Global Dimensions are currently envisaged.

4.2.3.3 Variables (global)

No common Global Variables are currently envisaged.

4.2.4 Group Name: status

This section describes the status group for the SCA Level 1A product.

4.2.4.1 Group Name: satellite

4.2.4.1.1 satellite: attributes

No satellite Group Attributes are currently envisaged.

4.2.4.1.2 satellite: dimensions

Table 4 describes the satellite Group Dimensions for the SCA Level 1A product.

Dimension Name	Description	Range or Value
manoeuvre_items	Number of manoeuvres occurring between product start and end	$0 \leq N$

Table 4: satellite: dimensions for SCA-1A-PRE product.

4.2.4.1.3 satellite: variables

Table 5 describes the satellite Group Variables for the SCA Level 1A product together with their specific attributes. Colours are used to differentiate variable and attributes: variables in light blue and attributes in white with name right-aligned in *italics*. The same colour coding, alignment and style are used throughout the whole tables of the present document. Note that the values for the valid_max and valid_min attributes of the roll/pitch/yaw errors are a deviation from the current version of the GPFS

EPS-SG SCA Level 1B Product Format Specification

Variables Name	Description	Type	Range or Value	Dimension
epoch_time_utc	Epoch time in UTC of the orbital elements	NC_DOUBLE		1
<i>long_name</i>	description of the variable	NC_STRING	"Epoch time in UTC of the orbital elements"	
<i>units</i>	unit type	NC_STRING	"seconds since 2020-01-01 00:00:00.000"	
<i>valid_min</i>	valid minimum of the epoch time	NC_DOUBLE	-1e9	
<i>valid_max</i>	valid maximum of the epoch time	NC_DOUBLE	1e9	
<i>missing_value</i>	missing value	NC_DOUBLE	-9e9	
semi_major_axis	Semi major axis of the orbit at epoch time [TOD]	NC_DOUBLE		1
<i>long_name</i>	description of the variable	NC_STRING	"Semi major axis of the orbit at epoch time [TOD]"	
<i>units</i>	unit type	NC_STRING	"m"	
<i>valid_min</i>	valid minimum of the semi major axis of the orbit	NC_DOUBLE	6.5e6	
<i>valid_max</i>	valid maximum of the semi major axis of the orbit	NC_DOUBLE	8.0e6	
<i>missing_value</i>	missing value	NC_DOUBLE	-9e6	
eccentricity	Eccentricity of the orbit at epoch time [TOD]	NC_DOUBLE		1
<i>long_name</i>	description of the variable	NC_STRING	"Eccentricity of the orbit at epoch time [TOD]"	1
<i>valid_min</i>	valid minimum of the orbit eccentricity	NC_DOUBLE	0.0	
<i>valid_max</i>	valid maximum of the orbit eccentricity	NC_DOUBLE	2.0e-3	
<i>missing_value</i>	missing value	NC_DOUBLE	-9e2	

EPS-SG SCA Level 1B Product Format Specification

Variables Name	Description	Type	Range or Value	Dimension
inclination	Inclination of the orbit at epoch time [TOD]	NC_DOUBLE		1
<i>long_name</i>	description of the variable	NC_STRING	"Inclination of the orbit at epoch time [TOD]"	
<i>units</i>	unit type	NC_STRING	"degrees"	
<i>valid_min</i>	valid minimum of the orbit inclination	NC_DOUBLE	98.5	
<i>valid_max</i>	valid maximum of the orbit inclination	NC_DOUBLE	98.75	
<i>missing_value</i>	missing value	NC_DOUBLE	-99	
perigee_argument	Argument of perigee of the orbit at epoch time [TOD]	NC_DOUBLE		1
<i>long_name</i>	description of the variable	NC_STRING	"Argument of perigee of the orbit at epoch time [TOD]"	
<i>units</i>	unit type	NC_STRING	"degrees"	
<i>valid_min</i>	valid minimum of the perigee argument	NC_DOUBLE	0	
<i>valid_max</i>	valid maximum of the perigee argument	NC_DOUBLE	360	
<i>missing_value</i>	missing value	NC_DOUBLE	-999	
right_ascension	Right ascension of the orbit at epoch time [TOD]	NC_DOUBLE		1
<i>long_name</i>	description of the variable	NC_STRING	"Right ascension of the orbit at epoch time [TOD]"	
<i>units</i>	unit type	NC_STRING	"degrees"	
<i>valid_min</i>	valid minimum of the orbit right ascension	NC_DOUBLE	0	
<i>valid_max</i>	valid maximum of the orbit right ascension	NC_DOUBLE	360	
<i>missing_value</i>	missing value	NC_DOUBLE	-999	

EPS-SG SCA Level 1B Product Format Specification

Variables Name	Description	Type	Range or Value	Dimension
mean_anomaly	Mean anomaly of the orbit at epoch time [TOD]	NC_DOUBLE		1
<i>long_name</i>	description of the variable	NC_STRING	"Mean anomaly of the orbit at epoch time [TOD]"	
<i>units</i>	unit type	NC_STRING	"degrees"	
<i>valid_min</i>	valid minimum of the orbit mean anomaly	NC_DOUBLE	0	
<i>valid_max</i>	valid maximum of the orbit mean anomaly	NC_DOUBLE	360	
<i>missing_value</i>	missing value	NC_DOUBLE	-999	
earth_sun_distance_ratio	Ratio of current Earth-Sun distance to Mean Earth-Sun distance	NC_DOUBLE		1
<i>long_name</i>	description of the variable	NC_STRING	"Ratio of current Earth-Sun distance to Mean Earth-Sun distance"	
<i>valid_min</i>	valid minimum of the Earth-Sun distance ratio	NC_DOUBLE	0.983	
<i>valid_max</i>	valid maximum of the Earth-Sun distance ratio	NC_DOUBLE	1.017	
<i>missing_value</i>	missing value	NC_DOUBLE	-9999	
subsat_latitude_start	Latitude of sub-satellite point at start of product	NC_DOUBLE		1
<i>long_name</i>	description of the variable	NC_STRING	"Latitude of sub-satellite point at start of product"	
<i>units</i>	unit type	NC_STRING	"degrees_north"	
<i>valid_min</i>	valid minimum of the latitude of the sub-satellite point at the start of the product	NC_DOUBLE	-90	

EPS-SG SCA Level 1B Product Format Specification

Variables Name	Description	Type	Range or Value	Dimension
<i>valid_max</i>	valid maximum of the latitude of the sub-satellite point at the start of the product	NC_DOUBLE	90	
<i>missing_value</i>	missing value	NC_DOUBLE	-99	
subsat_longitude_start	Longitude of sub-satellite point at start of product	NC_DOUBLE		1
<i>long_name</i>	description of the variable	NC_STRING	"Longitude of sub-satellite point at start of product"	
<i>units</i>	unit type	NC_STRING	"degrees_east"	
<i>valid_min</i>	valid minimum of the longitude of the sub-satellite point at the start of the product	NC_DOUBLE	0	
<i>valid_max</i>	valid maximum of the longitude of the sub-satellite point at the start of the product	NC_DOUBLE	360	
<i>missing_value</i>	missing value	NC_DOUBLE	-999	
subsat_latitude_end	Latitude of sub-satellite point at end of product	NC_DOUBLE		1
<i>long_name</i>	description of the variable	NC_STRING	"Latitude of sub-satellite point at end of product"	
<i>units</i>	unit type	NC_STRING	"degrees_north"	
<i>valid_min</i>	valid minimum of the latitude of the sub-satellite point at the start of the product	NC_DOUBLE	-90	
<i>valid_max</i>	valid maximum of the latitude of the sub-satellite point at the start of the product	NC_DOUBLE	90	
<i>missing_value</i>	missing value	NC_DOUBLE	-99	

EPS-SG SCA Level 1B Product Format Specification

Variables Name	Description	Type	Range or Value	Dimension
subsat_longitude_end	Longitude of sub-satellite point at end of product	NC_DOUBLE		1
<i>long_name</i>	description of the variable	NC_STRING	"Longitude of sub-satellite point at end of product"	
<i>units</i>	unit type	NC_STRING	"degrees_east"	
<i>valid_min</i>	valid minimum of the longitude of the sub-satellite point at the start of the product	NC_DOUBLE	0	
<i>valid_max</i>	valid maximum of the longitude of the sub-satellite point at the start of the product	NC_DOUBLE	360	
<i>missing_value</i>	missing value	NC_DOUBLE	-999	
state_vector_time_utc	Time of the state vector and attitude items	NC_DOUBLE		1
<i>long_name</i>	description of the variable	NC_STRING	"Time of the state vector and attitude items"	
<i>units</i>	unit type	NC_STRING	"seconds since 2020-01-01 00:00:00.000"	
<i>valid_min</i>	valid minimum of the time of the state vector and attitude items	NC_DOUBLE	-1e9	
<i>valid_max</i>	valid maximum of the time of the state vector and attitude items	NC_DOUBLE	1e9	
<i>missing_value</i>	missing value	NC_DOUBLE	-9e9	
x_position	X-Position of the orbital state vector [EARTH+FIXED]	NC_DOUBLE		1
<i>long_name</i>	description of the variable	NC_STRING	"X Position of the orbital state vector [EARTH+FIXED]"	
<i>units</i>	unit type	NC_STRING	"m"	

EPS-SG SCA Level 1B Product Format Specification

Variables Name	Description	Type	Range or Value	Dimension
<i>valid_min</i>	valid minimum of the x-component of the orbital state vector	NC_DOUBLE	-7.2e6	
<i>valid_max</i>	valid maximum of the x-component of the orbital state vector	NC_DOUBLE	7.2e6	
<i>missing_value</i>	missing value	NC_DOUBLE	-9e6	
y_position	Y-Position of the orbital state vector [EARTH+FIXED]	NC_DOUBLE		1
<i>long_name</i>	description of the variable	NC_STRING	"Y Position of the orbital state vector [EARTH+FIXED]"	
<i>units</i>	unit type	NC_STRING	"m"	
<i>valid_min</i>	valid minimum of the y-component of the orbital state vector	NC_DOUBLE	-7.2e6	
<i>valid_max</i>	valid maximum of the y-component of the orbital state vector	NC_DOUBLE	7.2e6	
<i>missing_value</i>	missing value	NC_DOUBLE	-9e6	
z_position	Z-Position of the orbital state vector [EARTH+FIXED]	NC_DOUBLE		1
<i>long_name</i>	description of the variable	NC_STRING	"Z Position of the orbital state vector [EARTH+FIXED]"	
<i>units</i>	unit type	NC_STRING	"m"	
<i>valid_min</i>	valid minimum of the z-component of the orbital state vector	NC_DOUBLE	-7.2e6	

EPS-SG SCA Level 1B Product Format Specification

Variables Name	Description	Type	Range or Value	Dimension
<i>valid_max</i>	valid maximum of the z-component of the orbital state vector	NC_DOUBLE	7.2e6	
<i>missing_value</i>	missing value	NC_DOUBLE	-9e6	
x_velocity	X-Velocity of the orbital state vector [EARTH+FIXED]	NC_DOUBLE		1
<i>long_name</i>	description of the variable	NC_STRING	"X Velocity of the orbital state vector [EARTH+FIXED]"	
<i>units</i>	unit type	NC_STRING	"m/s"	
<i>valid_min</i>	valid minimum of the x component of the velocity orbital state vector	NC_DOUBLE	-8e3	
<i>valid_max</i>	valid maximum of the x component of the velocity orbital state vector	NC_DOUBLE	8e3	
<i>missing_value</i>	missing value	NC_DOUBLE	-9e3	
y_velocity	Y-Velocity of the orbital state vector [EARTH+FIXED]	NC_DOUBLE		1
<i>long_name</i>	description of the variable	NC_STRING	"Y Velocity of the orbital state vector [EARTH+FIXED]"	
<i>units</i>	unit type	NC_STRING	"m/s"	
<i>valid_min</i>	valid minimum of the y component of the velocity orbital state vector	NC_DOUBLE	-8e3	
<i>valid_max</i>	valid maximum of the y component of the velocity orbital state vector	NC_DOUBLE	8e3	
<i>missing_value</i>	missing value	NC_DOUBLE	-9e3	

Variables Name	Description	Type	Range or Value	Dimension
z_velocity	Z-Velocity of the orbital state vector [EARTH+FIXED]	NC_DOUBLE		1
<i>long_name</i>	description of the variable	NC_STRING	"Z Velocity of the orbital state vector [EARTH+FIXED]"	
<i>units</i>	unit type	NC_STRING	"m/s"	
<i>valid_min</i>	valid minimum of the z component of the velocity orbital state vector	NC_DOUBLE	-8e3	
<i>valid_max</i>	valid maximum of the z component of the velocity orbital state vector	NC_DOUBLE	8e3	
<i>missing_value</i>	missing value	NC_DOUBLE	-9e3	
yaw_error	Yaw attitude error	NC_DOUBLE		1
<i>long_name</i>	description of the variable	NC_STRING	"Yaw attitude error"	
<i>units</i>	unit type	NC_STRING	"degrees"	
<i>valid_min</i>	valid minimum of the yaw attitude error	NC_DOUBLE	-180	
<i>valid_max</i>	valid maximum of the yaw attitude error	NC_DOUBLE	180	
<i>missing_value</i>	missing value	NC_DOUBLE	-999	
roll_error	Roll attitude error	NC_DOUBLE		1
<i>long_name</i>	description of the variable	NC_STRING	"Roll attitude error"	
<i>units</i>	unit type	NC_STRING	"degrees"	
<i>valid_min</i>	valid minimum of the roll attitude error	NC_DOUBLE	-180	
<i>valid_max</i>	valid maximum of the roll attitude error	NC_DOUBLE	180	
<i>missing_value</i>	missing value	NC_DOUBLE	-999	
pitch_error	Pitch attitude error	NC_DOUBLE		1

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Variables Name	Description	Type	Range or Value	Dimension
<i>long_name</i>	description of the variable	NC_STRING	"Pitch attitude error"	
<i>units</i>	unit type	NC_STRING	degrees	
<i>valid_min</i>	valid minimum of the pitch attitude error	NC_DOUBLE	-180	
<i>valid_max</i>	valid maximum of the pitch attitude error	NC_DOUBLE	180	
<i>missing_value</i>	missing value	NC_DOUBLE	-999	
leap_second_time_utc	UTC time of a leap second occurrence in this product	NC_DOUBLE		1
<i>long_name</i>	description of the variable	NC_STRING	"UTC time of occurrence of a leap second in this product (if leap second occurred in the product time window); it represents the time after the leap second occurrence (i.e. midnight of day after the leap second; no leap second results in 0)"	
<i>units</i>	unit type	NC_STRING	"seconds since 2020-01-01 00:00:00"	
<i>valid_min</i>	valid minimum of the time at which leap second was introduced	NC_DOUBLE	-1e9	
<i>valid_max</i>	valid maximum of the time at which leap second was introduced	NC_DOUBLE	1e9	
<i>missing_value</i>	missing value	NC_DOUBLE	-9e9	
leap_second_value	Value of leap second in product: -1 – decrement 0 – no leap second 1 – increment	NC_SHORT		1
<i>long_name</i>	description of the variable	NC_STRING	"Value of leap second in product (1, 0 or -1)"	
<i>units</i>	unit type	NC_STRING	"s"	

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Variables Name	Description	Type	Range or Value	Dimension
<i>valid_min</i>	valid minimum of number of leap seconds	NC_SHORT	-1	
<i>valid_max</i>	valid maximum of number of leap seconds	NC_SHORT	1	
<i>missing_value</i>	missing value	NC_SHORT	-32768	
manoeuvre_occurrence	Occurrence of manoeuvres between start and end times of the product: 1 – in-plane manoeuvre 2 – out-of-plane manoeuvre	NC_BYTE		manoeuvre_items
<i>long_name</i>	description of the variable	NC_STRING	“Occurrence of manoeuvres between start and end times of the product (1 or 2)”	
<i>valid_min</i>	valid minimum of the number of manoeuvre occurrence between the start and end times of the product	NC_BYTE	1	
<i>valid_max</i>	valid maximum of the number of manoeuvre occurrence between the start and end times of the product	NC_BYTE	2	
<i>missing_value</i>	missing value	NC_BYTE	-9	
manoeuvre_start_time_utc	UTC time of start of manoeuvre	NC_DOUBLE		manoeuvre_items
<i>long_name</i>	description of the variable	NC_STRING	“UTC time of start of manoeuvre”	
<i>units</i>	unit type	NC_STRING	“seconds since 2020-01-01 00:00:00.000”	
<i>valid_min</i>	valid minimum of the UTC time of the manoeuvre start	NC_DOUBLE	-1e9	
<i>valid_max</i>	valid maximum of the UTC time of the manoeuvre start	NC_DOUBLE	1e9	
<i>missing_value</i>	missing value	NC_DOUBLE	-9e9	

Variables Name	Description	Type	Range or Value	Dimension
manoeuvre_end_time_utc	UTC time of end of manoeuvre	NC_DOUBLE		manoeuvre_items
<i>long_name</i>	description of the variable	NC_STRING	"UTC time of end of manoeuvre"	
<i>units</i>	unit type	NC_STRING	"seconds since 2020-01-01 00:00:00.000"	
<i>valid_min</i>	valid minimum of the UTC time of the manoeuvre end	NC_DOUBLE	-1e9	
<i>valid_max</i>	valid maximum of the UTC time of the manoeuvre end	NC_DOUBLE	1e9	
<i>missing_value</i>	missing value	NC_DOUBLE	-9e9	

Table 5: satellite: variables for SCA-1A-PRE product.

4.2.4.2 Group Name: instrument

4.2.4.2.1 instrument: attributes

No instrument Group Attributes are currently envisaged.

4.2.4.2.2 instrument: dimensions

Table 6 describes the instrument Group Dimensions for the SCA Level 1A product.

Dimension Name	Description	Range or Value
mode_items	Number of modes the instrument assumed during product duration	$1 \leq N$

Table 6: instrument: dimensions for SCA-1A-PRE product.

4.2.4.2.3 instrument: variables

Table 7 describes the instrument Group Variables for the SCA Level 1A product.

Variables Name	Description	Type	Range or Value	Dimension
mode_start_time_utc	Start time of the mode	NC_DOUBLE		mode_items
long_name	description of the variable	NC_STRING	"Start time of the mode"	
units	unit type	NC_STRING	"seconds since 2020-01-01 00:00:00.000"	
valid_min	valid minimum of the UTC time of the start of the instrument mode	NC_DOUBLE	-1e9	
valid_max	valid maximum of the UTC time of the start of the instrument mode	NC_DOUBLE	1e9	
missing_value	missing value	NC_DOUBLE	-9e9	
mode_end_time_utc	End time of the mode	NC_DOUBLE		mode_items
long_name	description of the variable	NC_STRING	"End time of the mode"	
units	unit type	NC_STRING	"seconds since 2020-01-01 00:00:00.000"	
valid_min	valid minimum of the UTC time of the end of the instrument mode	NC_DOUBLE	-1e9	
valid_max	valid maximum of the UTC time of the end of the instrument mode	NC_DOUBLE	1e9	
missing_value	missing value	NC_DOUBLE	-9e9	
instrument_mode	Name of the instrument mode assumed during period (OPER)	NC_STRING		mode_items
long_name	description of the variable	NC_STRING	"Name of the instrument mode assumed "	
missing_value	missing value	NC_STRING	"UNDEFINED MODE"	

Table 7: instrument: variables for SCA-1A-PRE product.

4.2.4.3 Group Name: processing

4.2.4.3.1 processing: attributes

Table 8 describes the processing Group Attributes for the SCA Level 1A product.

Attribute Name	Description	Type	Unit	Range or Value
processor_name	Name of the product processor	NC_STRING	NA	"SCA_L1B"
processor_version	Version number of the processor	NC_STRING	NA	""
processing_mode	Processing mode in which the product was generated	NC_STRING	NA	""
format_version	Product format version control number.	NC_STRING	NA	"3.1"
atbd_reference_and_version	Reference and version of the ATBD	NC_STRING	NA	"EUM/LEO-EPSSG/SPE/14/73 9659 v4A"
pgs_reference_and_version	Reference and version of the PGS	NC_STRING	NA	"EUM/LEO-EPSSG/SPE/14/77 6539 v4A"
pfs_reference_and_version	Reference and version of the PFS	NC_STRING	NA	"EUM/LEO-EPSSG/SPE/14/77 6554 v4A"
baseline	Climate data record collection version in reprocessed data	NC_STRING	NA	""
source	It is an array of string containing information on the version of the processing software and algorithms and the configuration data used to create the product, as well as information on the products that were inputs to its creation.	NC_STRING	NA	"(AUXILIARY_DATA_NAME)* (INPUT_PRODUCT_NAME)*" where the asterisks indicate zero or more instances

Table 8: processing: attributes for SCA-1A-PRE product.

4.2.4.3.2 processing: dimensions

No processing Group Dimensions are currently envisaged.

4.2.4.3.3 processing: variables

Table 9 describes the processing Group Variables for the SCA Level 1A product.

Variables Name	Description	Type	Range or Value	Dimension
creation_time_utc	UTC time of the product creation	NC_DOUBLE		1
long_name	description of the variable	NC_STRING	"UTC time of the start of the product creation"	
units	unit type	NC_STRING	"seconds since 2020-01-01 00:00:00"	
valid_min	valid minimum of the product creation time in UTC	NC_DOUBLE	-1e9	
valid_max	valid maximum of the product creation time in UTC	NC_DOUBLE	1e9	
missing_value	missing value	NC_DOUBLE	-9e9	

Table 9: processing: variables for SCA-1A-PRE product.

4.2.5 Group Name: data

This section describes the data group for the SCA Level 1A product. As before mentioned in section 4.2.2, it contains 10 subgroups each of them corresponding to the antenna beam activated in the left or right swath, i.e. fore, mid and aft beam, and the transmitting and receiving polarisations used (i.e. vertical and horizontal). Note that for the mid antenna beams the radiometric and calibration parameters corresponding to the cross-polarised channels VH and HV and needed for the further processing have been merged and reported in the subgroups left_mid_XX.

4.2.5.1 Group Name: left_fore_VV

4.2.5.1.1 left_fore_VV: attributes

No left_fore_VV Group Attributes are currently envisaged.

4.2.5.1.2 left_fore_VV: dimensions

Table 10 describes the left_fore_VV Group Dimensions.

Dimension Name	Description	Range or Value
time	Number of samples in the along direction (each sample is associated with the relative time instants corresponding to the leading edge of the transmitting pulse)	N (it assumes a value which differs for each file; a representative figure for a full orbit is 24240 ¹)

Table 10: left_fore_VV (SCA-1A-PRE): dimensions.

4.2.5.1.3 left_fore_VV: variables

Table 11 describes the left_fore_VV Group Variables.

¹ For the estimation of such a value refer to Appendix A.

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Variables Name	Description	Type	Range or Value	Dimension
time	Measurement time	NC_DOUBLE		time
<i>long_name</i>	description of the variable	NC_STRING	"measurement time"	
<i>units</i>	unit type	NC_STRING	"seconds since 2000-01-01 00:00:00"	
tstamp	EPS-SG time stamp	NC_DOUBLE		time
<i>long_name</i>	description of the variable	NC_STRING	"EPS-SG time stamp"	
<i>units</i>	unit type	NC_STRING	"UTC related seconds since 2020-01-01 00:00:00"	
noise	Background noise	NC_DOUBLE		time
<i>long_name</i>	description of the variable	NC_STRING	"background noise"	
power_gain	Power-gain value	NC_DOUBLE		time
<i>long_name</i>	description of the variable	NC_STRING	"power_gain value"	
waveguide_loss	Waveguide loss	NC_DOUBLE		time
<i>long_name</i>	description of the variable	NC_STRING	"waveguide loss"	
latitude	Geodetic latitude at mid swath	NC_DOUBLE		time
<i>long_name</i>	description of the variable	NC_STRING	"geodetic latitude at mid swath"	
<i>units</i>	unit type	NC_STRING	"degrees_north"	
<i>valid_min</i>	valid minimum of the mid swath geodetic latitude	NC_DOUBLE	-90	
<i>valid_max</i>	valid maximum of the mid swath geodetic latitude	NC_DOUBLE	90	
longitude	Longitude at mid swath	NC_DOUBLE		time
<i>long_name</i>	description of the variable	NC_STRING	"longitude at mid swath"	
<i>units</i>	unit type	NC_STRING	"degrees_east"	
<i>valid_min</i>	valid minimum of the mid swath longitude	NC_DOUBLE	-180	
<i>valid_max</i>	valid maximum of the mid swath longitude	NC_DOUBLE	180	
normalisation_factor	Normalisation factor at mid swath	NC_DOUBLE		time

Variables Name	Description	Type	Range or Value	Dimension
<i>long_name</i>	description of the variable	NC_STRING	"maximum normalisation factor"	
flag_generic	Processing flags	NC_UINT		time
<i>long_name</i>	description of the variable	NC_STRING	"generic processing flags"	

Table 11: left_fore_VV (SCA-1A-PRE): variables.

4.2.5.2 Group Name: left_mid_VV

4.2.5.2.1 left_mid_VV: attributes

No left_mid_VV Group Attributes are currently envisaged.

4.2.5.2.2 left_mid_VV: dimensions

The left_mid_VV Group Dimensions coincide with the one listed in Table 10.

4.2.5.2.3 left_mid_VV: variables

The Variables for the left_mid_VV Group coincide with the ones listed in Table 11.

4.2.5.3 Group Name: left_mid_XX

4.2.5.3.1 left_mid_XX: attributes

No left_mid_XX Group Attributes are currently envisaged.

4.2.5.3.2 left_mid_XX: dimensions

The left_mid_XX Group Dimensions coincide with the one listed in Table 10.

4.2.5.3.3 left_mid_XX: variables

The Variables for the left_mid_XX Group coincide with the ones listed in Table 11.

4.2.5.4 Group Name: left_mid_HH

4.2.5.4.1 left_mid_HH: attributes

No left_mid_HH Group Attributes are currently envisaged.

4.2.5.4.2 left_mid_HH: dimensions

The left_mid_HH Group Dimensions coincide with the one listed in Table 10.

4.2.5.4.3 left_mid_HH: variables

The Variables for the left_mid_HH Group coincide with the ones listed in Table 11.

4.2.5.5 Group Name: left_aft_VV

4.2.5.5.1 left_aft_VV: attributes

No left_aft_VV Group Attributes are currently envisaged.

4.2.5.5.2 left_aft_VV: dimensions

The left_aft_VV Group Dimensions coincide with the one listed in Table 10.

4.2.5.5.3 left_aft_VV: variables

The Variables for the left_aft_VV Group coincide with the ones listed in Table 11.

4.2.5.6 Group Name: right_fore_VV

4.2.5.6.1 right_fore_VV: attributes

No right_fore_VV Group Attributes are currently envisaged.

4.2.5.6.2 right_fore_VV: dimensions

The right_fore_VV Group Dimensions coincide with the one listed in Table 10.

4.2.5.6.3 right_fore_VV: variables

The Variables for the right_fore_VV Group coincide with the ones listed in Table 11.

4.2.5.7 Group Name: right_mid_VV**4.2.5.7.1 right_mid_VV: attributes**

No right_mid_VV Group Attributes are currently envisaged.

4.2.5.7.2 right_mid_VV: dimensions

The right_mid_VV Group Dimensions coincide with the one listed in Table 10.

4.2.5.7.3 right_mid_VV: variables

The Variables for the right_mid_VV Group coincide with the ones listed in Table 11.

4.2.5.8 Group Name: right_mid_XX**4.2.5.8.1 right_mid_XX: attributes**

No right_mid_XX Group Attributes are currently envisaged.

4.2.5.8.2 right_mid_XX: dimensions

The right_mid_XX Group Dimensions coincide with the one listed in Table 10.

4.2.5.8.3 right_mid_XX: variables

The Variables for the right_mid_XX Group coincide with the ones listed in Table 11.

4.2.5.9 Group Name: right_mid_HH**4.2.5.9.1 right_mid_HH: attributes**

No right_mid_HH Group Attributes are currently envisaged.

4.2.5.9.2 right_mid_HH: dimensions

The right_mid_HH Group Dimensions coincide with the one listed in Table 10.

4.2.5.9.3 right_mid_HH: variables

The Variables for the right_mid_HH Group coincide with the ones listed in Table 11.

4.2.5.10 Group Name: right_aft_VV**4.2.5.10.1 right_aft_VV: attributes**

No right_aft_VV Group Attributes are currently envisaged.

4.2.5.10.2 right_aft_VV: dimensions

The right_aft_VV Group Dimensions coincide with the one listed in Table 10.

4.2.5.10.3 right_aft_VV: variables

The Variables for the right_aft_VV Group coincide with the ones listed in Table 11.

4.2.6 Group Name: quality

This section describes the quality group for the SCA Level 1A product.

4.2.6.1 quality: attributes

Table 12 describes the quality Group Attributes for the SCA Level 1A product.

Attribute Name	Description	Type	Unit	Range or Value
overall_quality_flag	overall quality	NC_USHORT	NONE	"0" if overall quality is OK Individual bits of the flag are set to indicate degraded conditions, the first four bits are set in case of: Bit 0: Missing input product(s) Bit 1: Data gap(s) Bit 2: Corrupted input product(s) Bit 3: Instrument anomaly Bit 4: missing or degraded auxiliary data Bit 5 to 15: Not used

Table 12: quality: attributes for SCA-1A-PRE product.

4.2.6.2 quality: dimensions

No quality Group Dimensions are currently envisaged for the SCA Level 1A product. **Error! Reference source not found.** describes the quality Group Dimensions of the Level 1A monitoring product.

Dimension Name	Description	Range or Value
number_beams	Number of beams	10

Table 13: quality: dimensions for SCA-1A-PRE product.

4.2.6.3 quality: variables

Table 14 describes the quality Group Variables for the SCA Level 1A product.

Variables Name	Description	Type	Range or Value	Dimension
flag_summary	Summary of generic flags	NC_UINT		1
<i>long_name</i>	description of the variable	NC_STRING	"summary of generic flags"	1
flag_generic	Summary of generic flags in each beam	NC_UINT		[number_beams]
<i>long_name</i>	description of the variable	NC_STRING	"summary of generic flags in each beam"	1

Table 14: quality: variables for SCA-1A-PRE product.

4.3 Level 1B full resolution

4.3.1 Product Summary Sheet

The table below provides a summary for the SCA Level 1B full resolution product. The Level 1B full resolution filename in Table 15 is defined according to the conventions described in the [GPFS]. For ease of consultation, some of the fields (spacecraft, environment, sensing_start, sensing_end, disposition_mode and processing_mode) in the filename description are expressed in terms of the corresponding possible entries reported in table 5 of the [GPFS]. The granularity (duration in sensing time) of the product (both for global and regional usage) is not yet defined.

Filename	W_XX-EUMETSAT-Darmstadt,SAT,SGB[1-3]-SCA-1B-SZF_ C_EUMT_YYYYMMDDhhmmss_[G R L]_[O V I D E]_YYYYMMDDhhmm ss_YYYYMMDDhhmmss_[T C O V]_[N R]____.nc
Product ID	SCA-1B-SZF
Product Description	SCA Level 1B full resolution
Format	netCDF-4
Size (Bytes/orbit)	Approx. 1 580 000 000 bytes per orbit
Duration	

Table 15: SCA Level 1B full resolution product summary sheet.

4.3.2 Overall Group Structure

The overall structure of the SCA Level 1B full resolution product is in accordance with [GPFS] and is shown in the following figure. Of particular interest is the data group which contains 12 subgroups each corresponding to the antenna beam activated in the left or right swath, i.e. fore, mid and aft beam, and the transmitting and receiving polarisation states used (i.e. vertical and horizontal). Group dimensions, variables and attributes complement each subgroup as in accordance with the NetCDF 4 model described in [GPFS]. In addition, there is a group called grid, which contains all the information needed to define a 12.5 km regular grid.

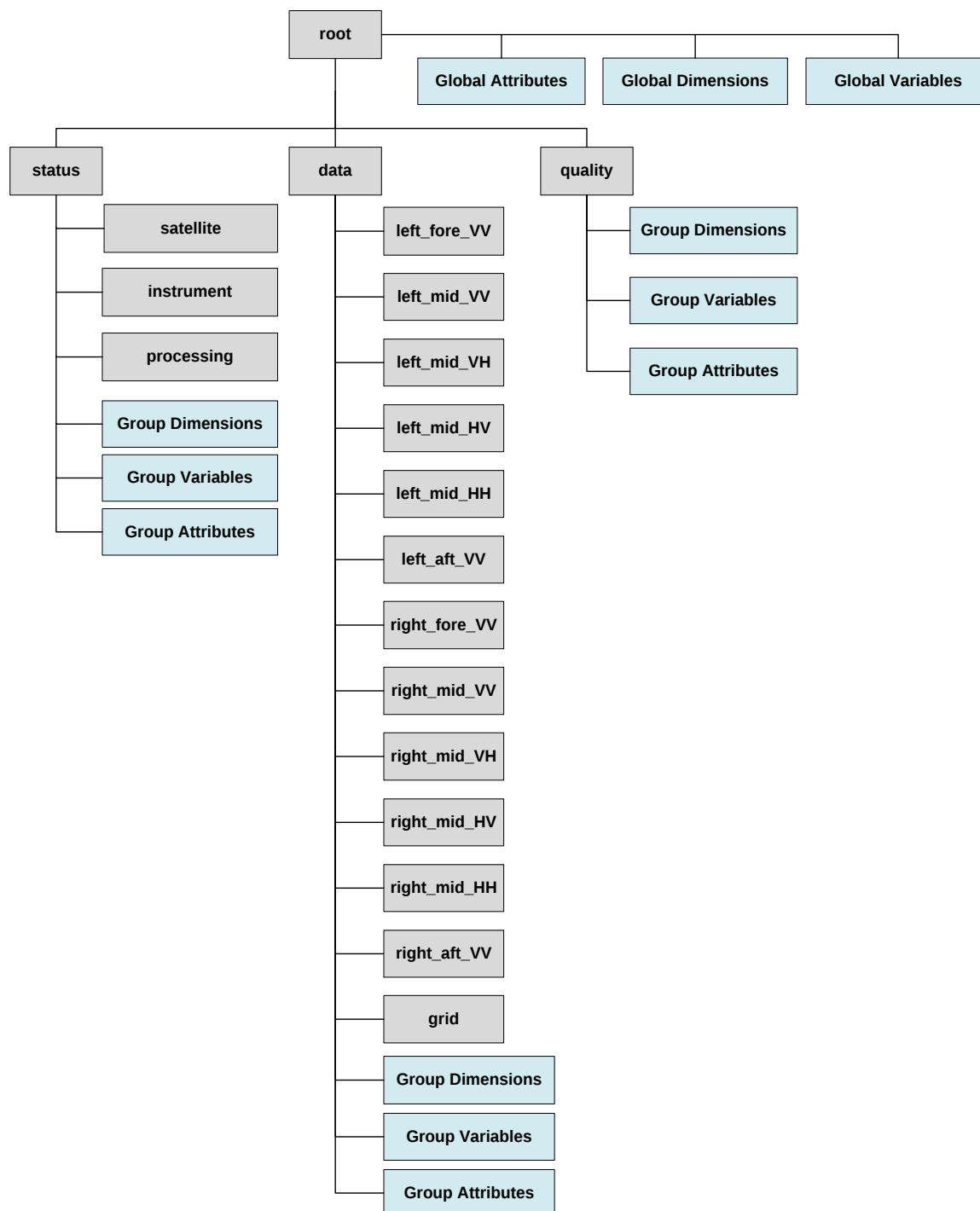


Figure 4-2: Overview of the groups in the SCA-1B-SZF product.

4.3.3 Group Name: root

4.3.3.1 Attributes (global)

Table 16 describes the Global Attributes for the SCA Level 1B full resolution product in accordance with ones defined in [GPFS].

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Attribute Name	Description	Type	Unit	Range or Value
Conventions	e.g. "CF-1.6"	NC_STRING	NA	"Latest version of "The Climate and Forecast (CF) Metadata Conventions"."
metadata_conventions	e.g. "Unidata Dataset Discovery v1.0"	NC_STRING	NA	"Applicable version of Unidata Dataset Discovery Conventions"
product_name	Product name formatted as set out in section 3.2	NC_STRING	NA	"W_XX-EUMETSAT-Darmstadt,SAT,SGB[1-3]-SCA-1B-SZF_C_EUMT_YYYYMMDDhhmmss_[G R L]_[O V I D E]_YYYYMMDDhhmmss_YYYYMMDDhhmmss_[T C O V]_[N R]____.nc"
title	Short description of the product	NC_STRING	NA	"EPS-SG SCA Level 1B full resolution backscatter product"
summary	A summary of the product	NC_STRING	NA	Level 1B full resolution product contains the backscattering coefficients along the antenna beams (fore-VV, mid-VV, mid-VH, mid-HV, mid-HH and aft-VV) and localised on the Earth surface. The data are organised per beam measurement and per position along each beam. Other important information provided for each backscattering coefficient is the incidence angle, the azimuth angle, the measurement time and the geodetic coordinates. This product does not include measurement collocation from the different beams into a position on the Earth surface.
doi	Digital Object Identifier	NC_STRING	NA	
keywords	Keywords related to the product.	NC_STRING	NA	"EPS-SG SCA Level 1B full resolution backscattering coefficient"
history	Reference to previous product handling	NC_STRING	NA	["original generated product" "aggregated product" "sub-setted product"]

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Attribute Name	Description	Type	Unit	Range or Value
institution	Name of the originating organisation <i>Note: This field may be extended with other values should products be generated in other locations.</i>	NC_STRING	NA	"EUMETSAT"
spacecraft	Satellite identifier	NC_STRING	NA	"SGB"[1-3]
instrument	Instrument or product identifier and flight model number	NC_STRING	NA	"SCA"
product_level	Product level identifier	NC_STRING	NA	"1B"
type	Character string providing an indication of the type of product.	NC_STRING	NA	"SZF"
mission_type	Global, regional or local reception and processing	NC_STRING	NA	("Global" "Regional" "Local")
disposition_mode	Identification of the type of processing	NC_STRING	NA	("Test" "Commissioning" "Operational" "Validation")
sensing_start_time_utc	UTC time of start of sensing data formatted in CF date and time format with ms precision	NC_STRING	NA	"YYYYMMDDhhmmss.ddd"
sensing_end_time_utc	UTC time of end of sensing data formatted in CF date and time format with ms precision	NC_STRING	NA	"YYYYMMDDhhmmss.ddd"
environment	Environment where the processing takes place	NC_STRING	NA	("Operational" "Validation" "Integration & Verification" "Development" "Engineering")
references	Published web references describing the data and the methods used in the processing	NC_STRING	NA	"www.eumetsat.int"
orbit_start	Absolute orbit number at sensing_start_time_utc	NC_UINT	NA	
orbit_end	Absolute orbit number at sensing_end_time_utc	NC_UINT	NA	

Table 16: Global Attributes for SCA-1B-SZF product.

4.3.3.2 Dimensions (global)

No common Global Dimensions are currently envisaged.

4.3.3.3 Variables (global)

No common Global Variables are currently envisaged.

4.3.4 Group Name: status

The status group of the SCA Level 1B full resolution product follows exactly the same structure and content of the status group described in section 4.2.4 for the Level 1A product. Thus, for more details the person who reads could refer to such section.

4.3.5 Group Name: data

This section describes the data group for the SCA Level 1B full resolution product. As before mentioned in section 4.3.2, it contains 12 subgroups each of them corresponding to the antenna beam activated in the left or right swath, i.e. fore, mid and aft beam, and the transmitting and receiving polarisations used (i.e. vertical and horizontal). In addition, there is a group called grid, which contains all the information needed to define a 12.5 km regular grid.

4.3.5.1 Group Name: left_fore_VV

4.3.5.1.1 left_fore_VV: attributes

No left_fore_VV Group Attributes are currently envisaged.

4.3.5.1.2 left_fore_VV: dimensions

Table 17 describes the left_fore_VV Group Dimensions. The number of sample in the across direction is 340.

Dimension Name	Description	Range or Value
time	Number of samples in the along track direction (each sample is associated with the relative time instants corresponding to the leading edge of the transmitting pulse)	N (this number is related to the duration of the product, therefore it assumes a value which could differ from one file to another one; for a duration corresponding to a full orbit a representative figure is 24240 ²)
range	Number of samples in the across track direction for the fore and aft beams	340

Table 17: left_fore_VV (SCA-1B-SZF): dimensions.

4.3.5.1.3 left_fore_VV: variables

Table 18 describes the left_fore_VV Group Variables.

² For the estimation of such a value refer to Appendix A.

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Variables Name	Description	Type	Range or Value	Dimension
time	UTC time associated with each measurement	NC_DOUBLE		time
<i>long_name</i>	description of the variable	NC_STRING	"UTC time associated with each measurement"	
<i>units</i>	unit type	NC_STRING	"seconds since 2020-01-01 00:00:00.000"	
backscatter	Backscatter coefficient (also known as NRCS or sigma0)	NC_INT		[range, time]
<i>long_name</i>	description of the variable	NC_STRING	"backscatter coefficient (also known as NRCS or sigma0)"	
<i>scale_factor</i>	scale factor applied	NC_DOUBLE	1e-7	
<i>add_offset</i>	offset applied	NC_DOUBLE	0e0	
<i>missing_value</i>	missing value	NC_INT	-2 ³¹	
latitude	Geodetic latitude	NC_INT		[range, time]
<i>long_name</i>	description of the variable	NC_STRING	"geodetic latitude"	
<i>units</i>	unit type	NC_STRING	"degrees_north"	
<i>scale_factor</i>	scale factor applied	NC_DOUBLE	1e-6	
<i>add_offset</i>	offset applied	NC_DOUBLE	0e0	
<i>valid_min</i>	valid minimum of the geodetic latitude	NC_INT	-90000000	
<i>valid_max</i>	valid maximum of the geodetic latitude	NC_INT	89999999	
<i>missing_value</i>	missing value	NC_INT	-2 ³¹	
longitude	Longitude	NC_INT		[range, time]
<i>long_name</i>	description of the variable	NC_STRING	"longitude"	
<i>units</i>	unit type	NC_STRING	"degrees_east"	
<i>scale_factor</i>	scale factor applied	NC_DOUBLE	1e-6	
<i>add_offset</i>	offset applied	NC_DOUBLE	0e0	
<i>valid_min</i>	valid minimum of the longitude	NC_INT	-180000000	

EPS-SG SCA Level 1B Product Format Specification

Variables Name	Description	Type	Range or Value	Dimension
<i>valid_max</i>	valid maximum of the longitude	NC_INT	179999999	
<i>missing_value</i>	missing value	NC_INT	-2 ³¹	
<i>incidence_angle</i>	Incidence angle	NC_SHORT		[range, time]
<i>long_name</i>	description of the variable	NC_STRING	"incidence angle"	
<i>units</i>	unit type	NC_STRING	"degrees"	
<i>scale_factor</i>	scale factor applied	NC_DOUBLE	1e-2	
<i>add_offset</i>	offset applied	NC_DOUBLE	0e0	
<i>valid_min</i>	valid minimum of the incidence angle	NC_SHORT	0	
<i>valid_max</i>	valid maximum of the incidence angle	NC_SHORT	9000	
<i>missing_value</i>	missing value	NC_SHORT	-2 ¹⁵	
<i>azimuth_angle</i>	Azimuth angle	NC_USHORT		[range, time]
<i>long_name</i>	description of the variable	NC_STRING	"azimuth angle"	
<i>units</i>	unit type	NC_STRING	"degrees clockwise from North"	
<i>scale_factor</i>	scale factor applied	NC_DOUBLE	1e-2	
<i>add_offset</i>	offset applied	NC_DOUBLE	0e0	
<i>valid_min</i>	valid minimum of the azimuth angle	NC_USHORT	0	
<i>valid_max</i>	valid maximum of the azimuth angle	NC_USHORT	35999	
<i>missing_value</i>	missing value	NC_USHORT	2 ¹⁶ -1	
<i>lcr</i>	Land contribution ratio	NC_USHORT		[range, time]
<i>long_name</i>	description of the variable	NC_STRING	"land contribution ratio"	
<i>scale_factor</i>	scale factor applied	NC_DOUBLE	1e-4	
<i>add_offset</i>	offset applied	NC_DOUBLE	0e0	
<i>valid_min</i>	valid minimum of the land contribution ratio	NC_USHORT	0	
<i>valid_max</i>	valid maximum of the land contribution ratio	NC_USHORT	10000	
<i>missing_value</i>	missing value	NC_USHORT	2 ¹⁶ -1	
<i>flag_generic</i>	Processing flags	NC_UINT		[range, time]
<i>long_name</i>	description of the variable	NC_STRING	"processing flags"	

Variables Name	Description	Type	Range or Value	Dimension
flag_pass	Satellite pass direction at time of measurement(0 or 1)	NC_UBYTE		time
<i>long_name</i>	description of the variable	NC_STRING	“satellite pass direction at time of measurement (0 indicates ascending pass, 1 indicates descending pass)”	
<i>valid_min</i>	valid min of the flag	NC_UBYTE	0	
<i>valid_max</i>	valid maximum of the flag	NC_UBYTE	1	
flag_surface	Earth surface type at measurement location (0 or 1)	NC_UBYTE		[range, time]
<i>long_name</i>	description of the variable	NC_STRING	“Earth surface type at measurement location (0 indicates ocean, 1 indicates land)”	
<i>valid_min</i>	valid minimum of the flag	NC_UBYTE	0	
<i>valid_max</i>	valid maximum of the flag	NC_UBYTE	1	
flag_quality ³	Data quality flag (0, 1 or 2)	NC_UBYTE		[range, time]
<i>long_name</i>	description of the variable	NC_STRING	“data quality flag (0 indicates that data quality is nominal, 1 indicates that data quality is close to nominal, 2 indicates that data quality is far from nominal)”	
<i>valid_min</i>	valid minimum of the flag	NC_UBYTE	0	
<i>valid_max</i>	valid maximum of the flag	NC_UBYTE	2	

Table 18: left_fore_VV (SCA-1B-SZF): variables.

³ The “flag_quality” variable is set to 0 if the quality of sigma0 is nominal, set to 1 meaning if quality of sigma0 is slightly degraded (but the measurement is still considered usable, and set to 2 if the quality of sigma0 is severely degraded (and the measurement is not considered usable).

4.3.5.2 Group Name: left_mid_VV

4.3.5.2.1 left_mid_VV: attributes

No left_mid_VV Group Attributes are currently envisaged.

4.3.5.2.2 left_mid_VV: dimensions

Table 19 describes the left_mid_VV Group Dimensions. The number of sample in the across direction is 340.

Dimension Name	Description	Range or Value
time	Number of samples in the along track direction (each sample is associated with the relative time instants corresponding to the leading edge of the transmitting pulse)	N (this number is related to the duration of the product, therefore it assumes a value which could differ from one file to another one; for a duration corresponding to a full orbit a representative figure is 24240 ⁴⁾)
range	Number of samples in the across track direction for the mid beams	340

Table 19: left_mid_VV (SCA-1B-SZF): dimensions.

4.3.5.2.3 left_mid_VV: variables

The Variables for the left_mid_VV Group coincide with the ones listed in Table 18. However, their corresponding dimension values **must** be read in Table 19.

4.3.5.3 Group Name: left_mid_VH

4.3.5.3.1 left_mid_VH: attributes

No left_mid_VH Group Attributes are currently envisaged.

4.3.5.3.2 left_mid_VH: dimensions

Table 20 describes the left_mid_VH Group Dimensions. The number of sample in the across direction is 340.

Dimension Name	Description	Range or Value
time	Number of samples in the along track direction (each sample is associated with the relative time instants corresponding to the leading edge of the transmitting pulse)	N (this number is related to the duration of the product, therefore it assumes a value which could differ from one file to another one; for a duration corresponding to a full orbit a representative figure is 6060 ⁵⁾)
range	Number of samples in the across track direction for the mid beams	340

Table 20: left_mid_VH (SCA-1B-SZF): dimensions.

⁴ For the estimation of such a value refer to Appendix A.

⁵ For the estimation of such a value refer to Appendix A.

4.3.5.3.3 left_mid_VH: variables

The Variables for the left_mid_VH Group coincide with the ones listed in Table 18. However, their corresponding dimension values **must** be read in Table 20.

4.3.5.4 Group Name: left_mid_HV

4.3.5.4.1 left_mid_HV: attributes

No left_mid_HV Group Attributes are currently envisaged.

4.3.5.4.2 left_mid_HV: dimensions

Table 21 describes the left_mid_HV Group Dimensions. The number of sample in the across direction is 340.

Dimension Name	Description	Range or Value
time	Number of samples in the along track direction (each sample is associated with the relative time instants corresponding to the leading edge of the transmitting pulse)	N (this number is related to the duration of the product, therefore it assumes a value which could differ from one file to another one; for a duration corresponding to a full orbit a representative figure is 6060 ⁶)
range	Number of samples in the across track direction for the mid beams	340

Table 21: left_mid_HV (SCA-1B-SZF): dimensions.

4.3.5.4.3 left_mid_HV: variables

The Variables for the left_mid_HV Group coincide with the ones listed in Table 18. However, their corresponding dimension values **must** be read in Table 21.

4.3.5.5 Group Name: left_mid_HH

4.3.5.5.1 left_mid_HH: attributes

No left_mid_HH Group Attributes are currently envisaged.

4.3.5.5.2 left_mid_HH: dimensions

Table 22 describes the left_mid_HH Group Dimensions. The number of sample in the across direction is 340.

⁶ For the estimation of such a value refer to Appendix A.

Dimension Name	Description	Range or Value
time	Number of samples in the along track direction (each sample is associated with the relative time instants corresponding to the leading edge of the transmitting pulse)	N (this number is related to the duration of the product, therefore it assumes a value which could differ from one file to another one; for a duration corresponding to a full orbit a representative figure is 12120 ⁷)
range	Number of samples in the across track direction for the mid beams	340

Table 22: left_mid_HH (SCA-1B-SZF): dimensions.

4.3.5.5.3 left_mid_HH: variables

The Variables for the left_mid_HH Group coincide with the ones listed in Table 18. However, their corresponding dimension values **must** be read in Table 22.

4.3.5.6 Group Name: left_aft_VV

4.3.5.6.1 left_aft_VV: attributes

No left_aft_VV Group Attributes are currently envisaged.

4.3.5.6.2 left_aft_VV: dimensions

Table 23 describes the left_aft_VV Group Dimensions. The number of sample in the across direction is 340.

Dimension Name	Description	Range or Value
time	Number of samples in the along track direction (each sample is associated with the relative time instants corresponding to the leading edge of the transmitting pulse)	N (this number is related to the duration of the product, therefore it assumes a value which could differ from one file to another one; for a duration corresponding to a full orbit a representative figure is 24240 ⁸)
range	Number of samples in the across track direction for the fore and aft beams	340

Table 23: left_aft_VV (SCA-1B-SZF): dimensions.

4.3.5.6.3 left_aft_VV: variables

The Variables for the left_aft_VV Group coincide with the ones listed in Table 18. However, their corresponding dimension values **must** be read in Table 23.

4.3.5.7 Group Name: right_fore_VV

4.3.5.7.1 right_fore_VV: attributes

⁷ For the estimation of such a value refer to Appendix A.

⁸ For the estimation of such a value refer to Appendix A.

No right_fore_VV Group Attributes are currently envisaged.

4.3.5.7.2 right_fore_VV: dimensions

Table 24 describes the right_fore_VV Group Dimensions. The number of sample in the across direction is 340.

Dimension Name	Description	Range or Value
time	Number of samples in the along track direction (each sample is associated with the relative time instants corresponding to the leading edge of the transmitting pulse)	N (this number is related to the duration of the product, therefore it assumes a value which could differ from one file to another one; for a duration corresponding to a full orbit a representative figure is 24240 ⁹)
range	Number of samples in the across track direction for the fore and aft beams	340

Table 24: right_fore_VV (SCA-1B-SZF): dimensions.

4.3.5.7.3 right_fore_VV: variables

The Variables for the right_fore_VV Group coincide with the ones listed in Table 18. However, their corresponding dimension values **must** be read in Table 24.

4.3.5.8 Group Name: right_mid_VV

4.3.5.8.1 right_mid_VV: attributes

No right_mid_VV Group Attributes are currently envisaged.

4.3.5.8.2 right_mid_VV: dimensions

Table 25 describes the right_mid_VV Group Dimensions. The number of sample in the across direction is 340.

Dimension Name	Description	Range or Value
time	Number of samples in the along track direction (each sample is associated with the relative time instants corresponding to the leading edge of the transmitting pulse)	N (this number is related to the duration of the product, therefore it assumes a value which could differ from one file to another one; for a duration corresponding to a full orbit a representative figure is 24240 ¹⁰)
range	Number of samples in the across track direction for the mid beams	340

Table 25: right_mid_VV (SCA-1B-SZF): dimensions.

4.3.5.8.3 right_mid_VV: variables

⁹ For the estimation of such a value refer to Appendix A.

¹⁰ For the estimation of such a value refer to Appendix A.

The Variables for the right_mid_VV Group coincide with the ones listed in Table 18. However, their corresponding dimension values **must** be read in Table 25.

4.3.5.9 Group Name: right_mid_VH

4.3.5.9.1 right_mid_VH: attributes

No right_mid_VH Group Attributes are currently envisaged.

4.3.5.9.2 right_mid_VH: dimensions

Table 26 describes the right_mid_VH Group Dimensions. The number of sample in the across direction is 340.

Dimension Name	Description	Range or Value
time	Number of samples in the along track direction (each sample is associated with the relative time instants corresponding to the leading edge of the transmitting pulse)	N (this number is related to the duration of the product, therefore it assumes a value which could differ from one file to another one; for a duration corresponding to a full orbit a representative figure is 6060 ¹¹)
range	Number of samples in the across direction for the mid beams	340

Table 26: right_mid_VH (SCA-1B-SZF): dimensions.

4.3.5.9.3 right_mid_VH: variables

The Variables for the right_mid_VH Group coincide with the ones listed in Table 18. However, their corresponding dimension values **must** be read in Table 26.

4.3.5.10 Group Name: right_mid_HV

4.3.5.10.1 right_mid_HV: attributes

No right_mid_HV Group Attributes are currently envisaged.

4.3.5.10.2 right_mid_HV: dimensions

Table 27 describes the right_mid_HV Group Dimensions. The number of sample in the across direction is 340.

Dimension Name	Description	Range or Value
time	Number of samples in the along track direction (each sample is associated with the relative time instants corresponding to the leading edge of the transmitting pulse)	N (this number is related to the duration of the product, therefore it assumes a value which could differ from one file to another one; for a duration corresponding to a full orbit a representative figure is 6060 ¹²)

¹¹ For the estimation of such a value refer to Appendix A.

¹² For the estimation of such a value refer to Appendix A.

Dimension Name	Description	Range or Value
range	Number of samples in the across track direction for the mid beams	340

Table 27: right_mid_HV (SCA-1B-SZF): dimensions.

4.3.5.10.3 right_mid_HV: variables

The Variables for the right_mid_HV Group coincide with the ones listed in Table 18. However, their corresponding dimension values **must** be read in Table 27.

4.3.5.11 Group Name: right_mid_HH

4.3.5.11.1 right_mid_HH: attributes

No right_mid_HH Group Attributes are currently envisaged.

4.3.5.11.2 right_mid_HH: dimensions

Table 28 describes the right_mid_HH Group Dimensions. The number of sample in the across direction is 340.

Dimension Name	Description	Range or Value
time	Number of samples in the along track direction (each sample is associated with the relative time instants corresponding to the leading edge of the transmitting pulse)	N (this number is related to the duration of the product, therefore it assumes a value which could differ from one file to another one; for a duration corresponding to a full orbit a representative figure is 12120 ¹³)
range	Number of samples in the across track direction for the mid beams	340

Table 28: right_mid_HH (SCA-1B-SZF): dimensions.

4.3.5.11.3 right_mid_HH: variables

The Variables for the right_mid_HH Group coincide with the ones listed in Table 18. However, their corresponding dimension values **must** be read in Table 28.

4.3.5.12 Group Name: right_aft_VV

4.3.5.12.1 right_aft_VV: attributes

No right_aft_VV Group Attributes are currently envisaged.

4.3.5.12.2 right_aft_VV: dimensions

Table 29 describes the right_aft_VV Group Dimensions. The number of sample in the across direction is 340.

¹³ For the estimation of such a value refer to Appendix A.

Dimension Name	Description	Range or Value
time	Number of samples in the along track direction (each sample is associated with the relative time instants corresponding to the leading edge of the transmitting pulse)	N (this number is related to the duration of the product, therefore it assumes a value which could differ from one file to another one; for a duration corresponding to a full orbit a representative figure is 24240 ¹⁴)
range	Number of samples in the across track direction for the fore and aft beams	340

Table 29: right_aft_VV (SCA-1B-SZF): dimensions.

4.3.5.12.3 right_aft_VV: variables

The Variables for the right_aft_VV Group coincide with the ones listed in Table 18. However, their corresponding dimension values **must** be read in Table 29.

4.3.5.13 Group Name: grid

4.3.5.13.1 grid: attributes

No grid Group Attributes are currently envisaged.

4.3.5.13.2 grid: dimensions

Table 30 describes the grid Group Dimensions.

Dimension Name	Description	Range or Value
points_along_track	Number of grid point lines in the along-track direction	N (this number is related to the duration of the product, therefore it assumes a value which could differ from one file to another one; for a duration corresponding to a full orbit a representative figure is 3202 ¹⁵)
points_across_track	Number of points in the across direction covering each swath	53 ¹⁶

Table 30: grid (SCA-1B-SZF): dimensions.

4.3.5.13.3 grid: variables

The Variables for the grid Group are listed in Table 31.

¹⁴ For the estimation of such a value refer to Appendix A.

¹⁵ For the estimation of such a value refer to Appendix A.

¹⁶ For the estimation of such a value refer to Appendix A.

EPS-SG SCA Level 1B Product Format Specification

Variables Name	Description	Type	Range or Value	Dimension
latitude_left	Geodetic latitude at each point of the left hand swath	NC_INT		[points_across_track, points_along_track]
<i>long_name</i>	description of the variable	NC_STRING	"geodetic latitude at each point of the left hand swath"	
<i>units</i>	unit type	NC_STRING	"degrees_north"	
<i>scale_factor</i>	scale factor applied	NC_DOUBLE	1e-6	
<i>add_offset</i>	offset applied	NC_DOUBLE	0e0	
<i>valid_min</i>	valid minimum of the geodetic latitude	NC_INT	-90000000	
<i>valid_max</i>	valid maximum of the geodetic latitude	NC_INT	89999999	
<i>missing_value</i>	missing value	NC_INT	-2 ³¹	
longitude_left	Longitude at each point of the left hand swath	NC_INT		[points_across_track, points_along_track]
<i>long_name</i>	description of the variable	NC_STRING	"longitude at each point of the left hand swath"	
<i>units</i>	unit type	NC_STRING	"degrees_east"	
<i>scale_factor</i>	scale factor applied	NC_DOUBLE	1e-6	
<i>add_offset</i>	offset applied	NC_DOUBLE	0e0	
<i>valid_min</i>	valid minimum of the longitude	NC_INT	-180000000	
<i>valid_max</i>	valid maximum of the longitude	NC_INT	179999999	
<i>missing_value</i>	missing value	NC_INT	-2 ³¹	
latitude_right	Geodetic latitude at each point of the right hand swath	NC_INT		[points_across_track, points_along_track]
<i>long_name</i>	description of the variable	NC_STRING	"geodetic latitude at each point of the right hand swath"	

EPS-SG SCA Level 1B Product Format Specification

Variables Name	Description	Type	Range or Value	Dimension
<i>units</i>	unit type	NC_STRING	"degrees_north"	
<i>scale_factor</i>	scale factor applied	NC_DOUBLE	1.e-6	
<i>add_offset</i>	offset applied	NC_DOUBLE	0.e0	
<i>valid_min</i>	valid minimum of the geodetic latitude	NC_INT	-90000000	
<i>valid_max</i>	valid maximum of the geodetic latitude	NC_INT	89999999	
<i>missing_value</i>	missing value	NC_INT	-2 ³¹	
longitude_right	Longitude at each point of the right hand swath	NC_INT		[points_across_track, points_along_track]
<i>long_name</i>	description of the variable	NC_STRING	"longitude at each point of the right hand swath"	
<i>units</i>	unit type	NC_STRING	"degrees_east"	
<i>scale_factor</i>	scale factor applied	NC_DOUBLE	1.e-6	
<i>add_offset</i>	offset applied	NC_DOUBLE	0.e0	
<i>valid_min</i>	valid minimum of the longitude	NC_INT	-180000000	
<i>valid_max</i>	valid maximum of the longitude	NC_INT	179999999	
<i>missing_value</i>	missing value	NC_INT	-2 ³¹	
time	UTC time associated with each line of points in across track	NC_DOUBLE		points_along_track
<i>long_name</i>	description of the variable	NC_STRING	"UTC time associated with each line of points in across track"	
<i>units</i>	unit type	NC_STRING	"seconds since 2020-01-01 00:00:00.000"	

Table 31: grid (SCA-1B-SZF): variables.

4.3.6 Group Name: quality

This section describes the quality group for the SCA Level 1B full resolution product.

4.3.6.1 quality: attributes

For the quality Group Attributes of the SCA Level 1B full resolution product refer to Table 12.

4.3.6.2 quality: dimensions

Table 32 describes the quality Group Dimensions of the Level 1B full resolution product.

Dimension Name	Description	Range or Value
number_beams	Number derived from the combination of the possible antenna orientations (fore, mid, aft), the polarisation states (VV for the fore and aft beams; VV, VH, HV and HH for the mid beam) and the swath (left, right) ¹⁷	12
number_quality_values	Number representing the possible values the variable “flag_quality” can assume (i.e., 0, 1 and 2)	3

Table 32: quality: dimensions for SCA-1B-SZF product.

4.3.6.3 quality: variables

Table 33 describes the quality Group Variables of the Level 1B full resolution product. The variable “flag_generic_beam_summary” is an array whose elements refer to each beam. Each elements represents the logic “OR” of the variable “flag_generic” obtained considering all the measurements within each beam. The variable “flag_generic_summary” instead represents the logic “OR” of the variable “flag_generic” obtained considering all the measurements. Regarding the variable “count_quality”, each element has been obtained summing the number of occurrences where the relative flag defined in Table 18 has been set to 0, 1 and 2.

¹⁷ The “number_beams” dimension corresponds to the following beams: Left Fore VV, Left Mid VV, Left Mid HH, Left Aft VV, Right Fore VV, Right Mid VV, Right Mid HH, Right Aft VV, Left Mid VH, Left Mid HV, Right Mid VH, Right Mid HV.

Variables Name	Description	Type	Range or Value	Dimension
flag_quality ¹⁸	Summary of measurement quality in each beam	NC_UINT		[number_quality_values, number_beams]
<i>long_name</i>	description of the variable	NC_STRING	"summary of measurement quality in each beam"	
flag_generic	summary of generic flags in each beam	NC_UINT		[number_beams]
<i>long_name</i>	description of the variable	NC_STRING	"summary of generic flags in each beam"	
flag_summary	Summary of generic flags	NC_UINT		1
<i>long_name</i>	description of the variable	NC_STRING	"summary of generic flags"	

Table 33: quality variables for SCA-1B-SZF product.

¹⁸ The "flag_quality" is a 2D array whose first index corresponds to the possible values the "flag_usable" can assume (i.e, 0, 1 and 2) and the second index identifies the following beams: Left Fore VV, Left Mid VV, Left Mid HH, Left Aft VV, Right Fore VV, Right Mid VV, Right Mid HH, Right Aft VV, Left Mid VH, Left Mid HV, Right Mid VH, Right Mid HV.

4.4 Level 1B re-sampled

4.4.1 Product Summary Sheet

The table below provides a summary for the SCA Level 1B re-sampled product. The Level 1B re-sampled filename in Table 34 is defined according to the conventions described in the [GPFS]. For ease of consultation, some of the fields (spacecraft, environment, sensing_start, sensing_end, disposition_mode and processing_mode) in the filename description are expressed in terms of the corresponding possible entries reported in table 5 of the [GPFS]. The granularity (duration in sensing time) of the product (both for global and regional usage) is not yet defined.

Filename	W_XX-EUMETSAT-Darmstadt,SAT,SGB[1-3]-SCA-1B-SZR_ C_EUMT_YYYYMMDDhhmmss_[G R L]_[O V I D E]_YYYYMMDDhhmm mss_YYYYMMDDhhmmss_[T C O V]_[N R]____.nc
Product ID	SCA-1B-SZR
Product Description	SCA Level 1B re-sampled product
Format	netCDF-4
Size	Approx. 42 000 000 bytes per orbit
Duration	

Table 34: SCA Level 1B re-sampled product summary sheet.

4.4.2 Overall Group Structure

The overall structure of the SCA Level 1B re-sampled product follows in accordance with [GPFS], and it is shown in Figure 4-3.

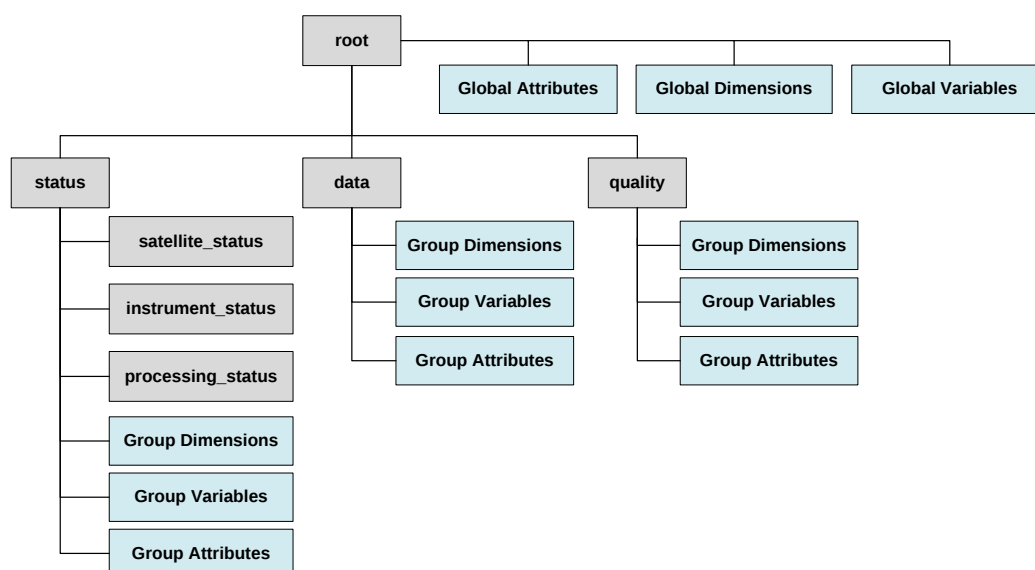


Figure 4-3: Overview of the groups in the SCA-1B-SZR product.

4.4.3 Group Name: root

4.4.3.1 Attributes (global)

Table 35 describes the Global Attributes for the SCA Level 1B re-sampled product in accordance with ones defined in [GPFS].

EPS-SG SCA Level 1B Product Format Specification

Attribute Name	Description	Type	Unit	Range or Value
Conventions	e.g. "CF-1.6"	NC_STRING	NA	"Latest version of "The Climate and Forecast (CF) Metadata Conventions"."
metadata_conventions	e.g. "Unidata Dataset Discovery v1.0"	NC_STRING	NA	"Applicable version of Unidata Dataset Discovery Conventions"
product_name	Product name formatted as set out in section 3.2	NC_STRING	NA	"W_XX-EUMETSAT-Darmstadt,SAT,SGB[1-3]-SCA-1B-SZR_C_EUMT_YYYYMMDDhhmmss_[G R L]_[O V I D E]_YYYYMMDDhhmmss_YYYYMMDDhhmmss_[T C O V]_[N R]____.nc"
title	Short description of the product	NC_STRING	NA	"EPS-SG SCA Level 1B re-sampled backscatter product"
summary	A summary of the product	NC_STRING	NA	Level 1B re-sampled product contains the backscattering coefficients re-sampled through spatial averaging on a swath-based grid with a 12.5 km x 12.5 km grid spacing and provided as quintuplets (fore-VV, mid-VV, aft-VV, mid-HH and mid-XX measurements). These quintuplets are localised on the Earth surface as a set of nodes on a grid along and across swath. Other important information provided for each quintuplet is the incidence angle, the azimuth angle, the measurement time, the geographical position of the node, the radiometric resolution (kp), as well as different flags and qualifiers.
doi	Digital Object Identifier	NC_STRING	NA	
keywords	Keywords related to the product.	NC_STRING	NA	"SCA EPS-SG Level 1B re-sampled collocated backscattering coefficient"
history	Reference to previous product handling	NC_STRING	NA	["original generated product" "aggregated product" "sub-setted product"]

EPS-SG SCA Level 1B Product Format Specification

Attribute Name	Description	Type	Unit	Range or Value
institution	Name of the originating organisation <i>Note: This field may be extended with other values should products be generated in other locations.</i>	NC_STRING	NA	"EUMETSAT"
spacecraft	Satellite identifier	NC_STRING	NA	"SGB"[1-3]
instrument	Instrument or product identifier and flight model number	NC_STRING	NA	"SCA"
product_level	Product level identifier	NC_STRING	NA	"1B"
type	Character string providing an indication of the type of product.	NC_STRING	NA	"SZR"
mission_type	Global, regional or local reception and processing	NC_STRING	NA	("Global" "Regional" "Local")
disposition_mode	Identification of the type of processing	NC_STRING	NA	("Test" "Commissioning" "Operational" "Validation")
sensing_start_time_utc	UTC time of start of sensing data formatted in CF date and time format with ms precision	NC_STRING	NA	"YYYYMMDDhhmmss.ddd"
sensing_end_time_utc	UTC time of end of sensing data formatted in CF date and time format with ms precision	NC_STRING	NA	"YYYYMMDDhhmmss.ddd"
environment	Environment where the processing takes place	NC_STRING	NA	("Operational" "Validation" "Integration & Verification" "Development" "Engineering")
references	Published web references describing the data and the methods used in the processing	NC_STRING	NA	"www.eumetsat.int"
orbit_start	Absolute orbit number at sensing_start_time_utc	NC_UINT	NA	
orbit_end	Absolute orbit number at sensing_end_time_utc	NC_UINT	NA	

Table 35: Global Attributes for SCA-1B-SZR product.

4.4.3.2 Dimensions (global)

No common Global Dimensions are currently envisaged.

4.4.3.3 Variables (global)

No common Global Variables are currently envisaged.

4.4.4 Group Name: status

The status group of the SCA Level 1B re-sampled product follows exactly the same structure and content of the status group described in section 4.2.4 for the Level 1A product. Thus, for more details the person who reads could refer to such section.

4.4.5 Group Name: data

This section describes the data group for the SCA Level 1B re-sampled product.

4.4.5.1 data: attributes

No data Group Attributes are currently envisaged.

4.4.5.2 data: dimensions

Table 36 describes the data Group Dimensions for the SCA Level 1B re-sampled product.

Dimension Name	Description	Range or Value
number_points	Number of grid points	N (this number is related to the duration of the product, and could differ from one file to another one; for a full orbit it is approximately 340,000 ¹⁹)
number_beams	Number derived from the combination of the possible antenna orientations (fore, mid, aft), the polarisation states (VV for the fore and aft beams; VV, XX and HH for the mid beam) for each individual swath. Note that the VH and HV measurements for the mid antenna beam have been combined and constitute the cross polarisation measurements (XX-pol) ²⁰ .	5

Table 36: data: dimensions for SCA-1B-SZR product.

4.4.5.2.1 data: variables

Table 37 describes the data Group Variables for the SCA Level 1B re-sampled product.

¹⁹ For the estimation of such a value refer to Appendix A.

²⁰ The “num_beams” dimension corresponds to the following beams: Fore VV, Mid VV, Aft VV, Mid HH, Mid XX.

Variables Name	Description	Type	Range or Value	Dimension
time	Time associated with each point	NC_DOUBLE		number_points
<i>long_name</i>	description of the variable	NC_STRING	"time associated with each point"	
<i>units</i>	unit type	NC_STRING	"UTC seconds since 2020-01-01 00:00:00.000"	
backscatter ²¹	Backscatter coefficient (also known as NRCS or sigma0) obtained by spatial averaging the full resolution data around the grid point for the fore VV, mid VV, aft VV, mid HH and mid cross-pol channels	NC_INT		[number_beams, number_points]
<i>long_name</i>	description of the variable	NC_STRING	"backscatter coefficient (also known as NRCS or sigma0) obtained by spatial averaging the full resolution data around the grid point for the fore VV, mid VV, aft VV, mid HH and mid cross-pol channels"	
<i>units</i>	unit type	NC_STRING	"dB"	
<i>scale_factor</i>	scale factor applied	NC_DOUBLE	1e-7	
<i>add_offset</i>	offset applied	NC_DOUBLE	0e0	
<i>missing_value</i>	missing value	NC_INT	-2 ³¹	
latitude	Geodetic latitude	NC_INT		number_points
<i>long_name</i>	description of the variable	NC_STRING	"geodetic latitude"	
<i>units</i>	unit type	NC_STRING	"degrees_north"	

²¹ The spatially averaged sigma0 is a 2D array whose indices identify the following measurements: Fore antenna VV sigma0, Mid antenna VV sigma0, Aft antenna VV sigma0, Mid antenna HH sigma0, Mid antenna XX sigma0. The second index represents the number of grid points.

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Variables Name	Description	Type	Range or Value	Dimension
<i>scale_factor</i>	scale factor applied	NC_DOUBLE	1e-6	
<i>add_offset</i>	offset applied	NC_DOUBLE	0e0	
<i>valid_min</i>	valid minimum of the geodetic latitude	NC_INT	-90000000	
<i>valid_max</i>	valid maximum of the geodetic latitude	NC_INT	89999999	
<i>missing_value</i>	missing value	NC_INT	-2 ³¹	
longitude	Longitude	NC_INT		number_points
<i>long_name</i>	description of the variable	NC_STRING	"longitude"	
<i>units</i>	unit type	NC_STRING	"degrees_east"	
<i>scale_factor</i>	scale factor applied	NC_DOUBLE	1e-6	
<i>add_offset</i>	offset applied	NC_DOUBLE	0e0	
<i>valid_min</i>	valid minimum of the longitude	NC_INT	-18000000	
<i>valid_max</i>	valid maximum of the longitude	NC_INT	17999999	
<i>missing_value</i>	missing value	NC_INT	-2 ³¹	
incidence_angle	Incidence angle	NC_SHORT		[number_beams, number_points]
<i>long_name</i>	description of the variable	NC_STRING	"incidence angle"	
<i>units</i>	unit type	NC_STRING	"degrees"	
<i>scale_factor</i>	scale factor applied	NC_DOUBLE	1e-2	
<i>add_offset</i>	offset applied	NC_DOUBLE	0e0	
<i>valid_min</i>	valid minimum of the incidence angle	NC_SHORT	0	
<i>valid_max</i>	valid maximum of the incidence angle	NC_SHORT	9000	1
<i>missing_value</i>	missing value	NC_SHORT	-2 ¹⁵	
azimuth_angle	Azimuth angle	NC_USHORT		[number_beams, number_points]
<i>long_name</i>	description of the variable	NC_STRING	"azimuth angle"	

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Variables Name	Description	Type	Range or Value	Dimension
<i>units</i>	unit type	NC_STRING	“degrees clockwise from North”	
<i>scale_factor</i>	scale factor applied	NC_DOUBLE	1e-2	
<i>add_offset</i>	offset applied	NC_DOUBLE	0e0	
<i>valid_min</i>	valid minimum of the azimuth angle	NC_USHORT	0	
<i>valid_max</i>	valid maximum of the azimuth angle	NC_USHORT	35999	
<i>missing_value</i>	missing value	NC_USHORT	2 ¹⁶ -1	
lcr	Land contribution ratio	NC_USHORT		[number_beams, number_points]
<i>long_name</i>	description of the variable	NC_STRING	“land contribution ratio”	
<i>scale_factor</i>	scale factor applied	NC_DOUBLE	1e-4	
<i>add_offset</i>	offset applied	NC_DOUBLE	0e0	
<i>valid_min</i>	valid minimum of the land contribution ratio	NC_USHORT	0	
<i>valid_max</i>	valid maximum of the land contribution ratio	NC_USHORT	10000	
<i>missing_value</i>	missing value	NC_USHORT	2 ¹⁶ -1	
corrected_cross_pol	Corrected cross pol backscatter	NC_INT		[number_points]
<i>long_name</i>	description of the variable	NC_STRING	“backscatter in the cross-pol channel after correction for the effects of Faraday rotation”	
<i>units</i>	unit type	NC_STRING	“dB”	
<i>scale_factor</i>	scale factor applied	NC_DOUBLE	1e-7	
<i>add_offset</i>	offset applied	NC_DOUBLE	0e0	
<i>missing_value</i>	missing value	NC_USHORT	-2 ³¹	
faraday_rotation_angle	Faraday rotation angle	NC_SHORT		[number_points]
<i>long_name</i>	description of the variable	NC_STRING	“Faraday rotation angle”	
<i>units</i>	unit type	NC_STRING	“degrees”	

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Variables Name	Description	Type	Range or Value	Dimension
<i>scale_factor</i>	scale factor applied	NC_DOUBLE	1e-2	
<i>add_offset</i>	offset applied	NC_DOUBLE	0e0	
<i>valid_min</i>	valid minimum of the Faraday rotation angle	NC_USHORT	-18000	
<i>valid_max</i>	valid maximum of the Faraday rotation angle	NC_USHORT	17999	
<i>missing_value</i>	missing value	NC_USHORT	-2 ¹⁵	
kp	Normalised error estimate in backscatter measurement (Kp)	NC_USHORT		[number_beams, number_points]
<i>long_name</i>	description of the variable	NC_STRING	"normalised error estimate in backscatter measurement (Kp)"	
<i>scale_factor</i>	scale factor applied	NC_DOUBLE	1e-4	
<i>add_offset</i>	offset applied	NC_DOUBLE	0e0	
<i>valid_min</i>	valid minimum of the normalised error estimate in backscatter measurement	NC_USHORT	0	
<i>valid_max</i>	valid maximum of the normalised error estimate in backscatter measurement	NC_USHORT	10000	
<i>missing_value</i>	missing value	NC_USHORT	2 ¹⁶ -1	
line_index	Absolute grid line index in along track	NC_UINT		number_points
<i>long_name</i>	description of the variable	NC_STRING	"absolute grid line index in along track"	
node_index	Grid index in across track (far left swath to far right swath)	NC_SHORT		number_points
<i>long_name</i>	description of the variable	NC_STRING	"grid index in across track (far left swath to far right swath)"	

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Variables Name	Description	Type	Range or Value	Dimension
<i>valid_min</i>	valid minimum of the radiometric resolution	NC_SHORT	-53	
<i>valid_max</i>	valid maximum of the radiometric resolution	NC_SHORT	53	
flag_generic	Processing flag	NC_UINT		[number_beams, number_points]
<i>long_name</i>	description of the variable	NC_STRING	"processing flags"	
flag_pass	Satellite pass direction of the data used in spatial averaging: ascending, descending or mixed (the latter due to the averaging of both ascending and descending measurements in the grid cell) (0, 1 or 2)	NC_UBYTE		[number_beams, number_points]
<i>long_name</i>	description of the variable	NC_STRING	"satellite pass direction of the data used in spatial averaging (0 indicates ascending pass, 1 indicates descending pass, 2 indicates a mixture of ascending and descending)"	
<i>valid_min</i>	valid minimum of the flag	NC_UBYTE	0	
<i>valid_max</i>	valid maximum of the flag	NC_UBYTE	2	
flag_surface	Earth surface type of the data used in spatial averaging: ocean, land or mixed (the latter due to the averaging of measurements occurring both over land and ocean in the grid cell) (0, 1 or 2)	NC_UBYTE		[number_beams, number_points]

Variables Name	Description	Type	Range or Value	Dimension
<i>long_name</i>	description of the variable	NC_STRING	“Earth surface type of the data used in the spatial averaging (0 indicates ocean, 1 indicates land, 2 indicates a mixture of ocean and land)”	
<i>valid_min</i>	valid minimum of the flag	NC_UBYTE	0	
<i>valid_max</i>	valid maximum of the flag	NC_UBYTE	2	
flag_quality ²²	Data quality flag: (0, 1 or 2)	NC_UBYTE		[number_beams, number_points]
<i>long_name</i>	description of the variable	NC_STRING	“data quality flag (0 indicates that data quality is nominal, 1 indicates that data quality is close to nominal, 2 indicates that data quality is far from nominal)”	
<i>valid_min</i>	valid minimum of the flag	NC_UBYTE	0	
<i>valid_max</i>	valid maximum of the flag	NC_UBYTE	2	

Table 37: data: variables for SCA-1B-SZR product.

²² The flag “flag_quality” is set to 0 if the quality of sigma0 is nominal, set to 1 if the quality of sigma0 is slightly degraded (but the measurement is still usable) and set to 2 if the quality of sigma0 is severely degraded (and the measurement is not usable).

4.4.6 Group Name: quality

This section describes the quality group for the SCA Level 1B re-sampled product.

4.4.6.1 quality: attributes

For the quality Group Attributes of the SCA Level 1B re-sampled product refer to Table 12.

4.4.6.2 quality: dimensions

Table 38 describes the quality Group Dimensions of the Level 1B re-sampled product.

Dimension Name	Description	Range or Value
number_beams	Number derived from the combination of the possible antenna orientations (fore, mid, aft), the polarisation states (VV for the fore and aft beams; VV, XX and HH for the mid beam) and the swath (left, right). Note that the VH and HV measurements for the mid antenna beam have been combined and constitute the cross polarisation measurements (XX-pol) ²³	10
number_quality_values	Number representing the possible values the variable “flag_quality” can assume (i.e., 0, 1 and 2)	3

Table 38: dimensions for SCA-1B-SZR product.

4.4.6.3 quality: variables

Table 39 describes the quality Group Variables for the SCA Level 1B re-sampled product.

²³ The “number_beams” dimension corresponds to the following beams: Left Fore VV, Left Mid VV, Left Aft VV, Left Mid HH, Left Mid XX, Right Fore VV, Right Mid VV, Right Aft VV, Right Mid HH, Right Mid XX.

Variables Name	Description	Type	Range or Value	Dimension
flag_summary	Summary of generic flags	NC_UINT		1
<i>long_name</i>	description of the variable	NC_STRING	"summary of generic flags"	
flag_generic	Summary flag in each beam	NC_UINT		number_of_beams
<i>long_name</i>	description of the variable	NC_STRING	"summary of generic flags in each beam"	1
flag_quality	Summary of quality in each beam	NC_INT		[number_quality_values, number_beams]
<i>long_name</i>	description of the variable	NC_STRING	"summary of measurement quality in each beam"	1
pentuplet_quality	Summary of pentuplet quality	NC_INT		[number_quality_values]
<i>long_name</i>	description of the variable	NC_STRING	"summary of pentuplet quality"	1
triplet_quality	Summary of triplet quality	NC_INT		[number_quality_values]
<i>long_name</i>	description of the variable	NC_STRING	"summary of triplet quality"	1

Table 39: quality: variables for SCA-1B-SZR product.

5 PRODUCT FORMAT VERSION CONTROL

As described in the [GPFS], each EPS-SG product contains a global attribute named *format_version* that gives the *Product Format Version Control Number*.

The product format version control number is incremented whenever there is a change in the format or content of a product. This could be a change in the format itself (e.g. element is deleted, added, resized, re-typed), a change in the contents of an element (e.g. scale factor change) or a change in the way that element has to be interpreted.

Table 40 shows the product format version control numbers for the SCA level 1 products. These are related to the applicable version of the SCA L1 PFS, which in turn specifies the applicable version of the GPFS.

Product ID	SCA L1 PFS version	GPFS version	Product format version control number
PRE, SZR & SZF	1A	1A	0.0
PRE, SZR & SZF	1B	1I	1.0
PRE, SZR & SZF	2	2	2.0
PRE, SZR & SZF	2A	2A	2.1
PRE, SZR & SZF	2B	3	2.2
PRE, SZR & SZF	2C	3B	2.3
PRE, SZR & SZF	3A	3D	3.1
PRE, SZR & SZF	4A	4A*	4.1

Table 40: SCA L1 Product Format Version Control Numbers.

* one exception, see roll/pitch yaw angles in section 4.2.4.1.3

APPENDIX A SIZE OF EPS-SG SCA LEVEL 1 PRODUCTS

This appendix estimates the size of the EPS-SG SCA Level 1 products.

A.1 PRE product containing monitoring information

For each source packet generated by the instrument the product contains the following variables:

name	type	bytes
time	double	8
tstamp	double	8
noise	double	8
power_gain	double	8
waveguide_loss	double	8
latitude	double	8
longitude	double	8
normalisation factor	double	8
flag_generic	int	4

This gives a total of 68 bytes per source packet.

If the orbit duration is 101 minutes and there are 32 source packets per second then this gives 193920 source packets per orbit.

The data size per orbit is then $68 \times 193920 = 13.2$ Mbytes.

Note that with the nominal SCA beam operation cycle there will be approximately

- 24,240 source packets per orbit from each of the LFVV, LMVV, LAVV, RFVV, RMVV, RAVV beams,
- 12,120 source packets per orbit from each of the LMHH and RMHH beams,
- 6,060 source packets per orbit from each of the LMHV, LMHV, RMHV, RMVH beams.

The time step between source packets is 0.25 seconds in the VV channels, 0.5 seconds in the HH channels, and 1 second in the HV and VH channels.

A.2 SZF product containing high resolution backscatter

For each instrument source packet the product contains the following variables

name	type	bytes
time	double	8
flag_pass	byte	1

and, for each of 340 points across the swath, the following variables

name	type	bytes
backscatter	int	4
longitude	int	4
latitude	int	4
incidence	short	2
azimuth	short	2
lcr	short	2
flag_generic	int	4
flag_quality	byte	1
flag_surface	byte	1

The total amount of data associated with each source packet is $9 + 340 \times 24 = 8169$ bytes.

If the orbit duration is 101 minutes and there are 32 source packets per second then this gives 193920 source packets per orbit.

The data size per orbit is then $8169 \times 193920 = 1584$ Mbytes.

A.3 SZR product containing low resolution backscatter pentuplets

The product contains a grid of points, each of which has the following set of variables:

name	type	bytes	dimension
time	double	1	1
backscatter	int	4	5
latitude	int	4	1
longitude	int	4	1
incidence	short	2	5
azimuth	short	2	5
lcr	short	2	5
corrected xpol	int	4	1
faraday rotation	short	2	1
kp	short	2	5
line_index	int	4	1
node_index	short	2	1
flag_generic	int	4	5
flag_quality	byte	1	5
flag_surface	byte	1	5
flag_pass	byte	1	5

which gives a total of 123 bytes per point.

The number of points in a grid row is 106.

There is one row every 12.5 kilometers around an orbit. So if the radius of the Earth is 6371 km then the number of rows around an orbit is $2 \times \pi \times 6371 / 12.5 = 3202$ rows.

The number of points per orbit is then $106 \times 3202 = 339412$.

The data size per orbit is then 123 bytes per point times 339412 points = 42 Mbytes

A.4 Summary of product sizes

Product ID	Product Description	Approx. Size (Bytes/Orbit)
SCA-1A-PRE	SCA Level 1A	13 200 000
SCA-1B-SZF	SCA Level 1B full resolution	1 584 000 000
SCA-1B-SZR	SCA Level 1B re-sampled	42 000 000

Table 41: Size of the SCA Level 1 Products.

APPENDIX B NCML DESCRIPTION OF EPS-SG SCA L1 PRODUCT FORMATS

The EPS-SG product NcML schema given in the [GPFS] provides a set of rules to which the EPS-SG product NcML descriptions must conform in order to be considered valid. There is one exception for roll/pitch/yaw angles. (see section 4.2.4.1.3)

The NcML descriptions of the SCA level 1 products are:



epssg-sca-l1a-pre-v
4a.xml



epssg-sca-l1b-szf-v
4a.xml



epssg-sca-l1b-szr-v
4a.xml

In case of contradiction between the text in this document and the attached NcML files then the text takes priority. In case of contradiction between this document and the GPFS then the GPFS takes priority.

APPENDIX C BUFR FORMAT DESCRIPTION

This BUFR specification for the SCA L1B products is given in the following attachment:



EPS-SG-PFS-to-BUFR-mappings-L1B-prc