



EPS-SG IASI-NG Level 1C Product Format Specification

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Document Change Record

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V Draft	15 January 2015	N/A	First Draft version
V0	11 February	N/A	Update for EPS-SG system PDR
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v.2	9 March 2017	N/A	Associated to DRC FT-171 Update for PDAP KO • Alignment with GPFS v.2.A : - ESP-SG overall structure - Definition of satellite status group and quality group - Minor changes in variables names and values, in attributes names and values • Preliminary description of measurement data group in L1C RAD product: - Measurement data variables, attributes and dimensions - Sub-groups Geolocation Information and Radiances Classification added • Preliminary description of L1C ENG product • Update of products volume estimation in Appendix A • Appendix C added to point at BUFR format specification for IASI-NG L1C products

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v.3	7 June 2017	N/A	Update for L1CPOP RR IAS-1C-RAD product: - variable alpha_scan_angle has been moved from the measurement data group to the geolocation information sub-group. - measurement data existing attributes have been renamed to specify that they concerned spectra data - two measurement data attributes have been added to describe the image band - the variable earth_satellite_distance has been added in the geolocation information sub-group - radiances classification sub-group has been enriched with more variables about radiances classification and pixel classification results - ancillary data sub-group has been created and a preliminary description of its content is provided - quality information sub-group has been updated, a preliminary description of its content is provided - processing flag sub-group has been updated, a preliminary description of its content is provided IAS-1C-ENG product: - measurement data group has been updated, new variables have been added.

<i>Issue / Revision</i>	<i>Date</i>	<i>DCN. No</i>	<i>Changed Pages / Paragraphs</i>
v.3.1	21 July 2017		Update for L1CPOP ITT - § 4.2.5.1.2: the type of the variable “image” changed from NC_SHORT to NC_FLOAT - § 4.2.5.1.3: the type of the attributes “image_band_limit_min” and “image_band_limit_max” changed from NC_INTEGER to NC_FLOAT - § 4.2.5.1.4.2 position of IASI-NG sounder pixel and imager is also provided with respect to VII product - § 4.2.5.1.5.2 homogeneity flag added - § 4.2.5.3.2: mathematical error flag added - § 4.3.5.3.2: quality indicators added

<i>Issue / Revision</i>	<i>Date</i>	<i>DCN. No</i>	<i>Changed Pages / Paragraphs</i>
v.3.2	12 October 2017		Associated to DRC FT-300 Update to align with GPFS V.3 - § 4.1: added a note clarifying that the root group does not explicitly appear in the XML file. - § 4.2.4.1 and 4.3.4.1: changes in manoeuvre information: - § 4.2.4.3 and 4.3.4.3: processor_name TBD removed, PROCESSOR_FULL_NAME removed from the sources list. - §4.2.5.1 and 4.3.5.1 added to move some dimensions from “measurement_data” group to “data group. - § 4.2.6.3 and 4.3.6.3: quality flags are all collected in the overall_quality_flag attribute; degraded_gap, degraded_manoeuvre and degraded_instrument attributes have been deleted. Other updates: - §4.2.5.2.4.2 sun angles and viewing angles encoding changed from NC_INT to NC_FLOAT. - §4.2.5.4.2 quality flags associated to each image/spectrum and not by line - §4.2.5.1, 4.2.5.2.4.1, 4.2.5.2.5.1, 4.2.5.2.6.1 as far as possible a numerical value has been associated to the group/sub-group dimensions - §4.2.5.2.5.2 class_gravity_centre angular coordinates encoding changed from NC_INT to NC_FLOAT - §4.3.5.4.2 quality indicators defined. NCML files have been aligned with the products description.

V.4.0	07 March 2018	Associated to DRC FT-390 Update for L1CPOP kick-off: - variables encoding (types, ranges, scale factors, offsets, units) has been refined throughout the document - §4.2/4.3: images and associated variables, dimensions, attributes have been transferred from L1CRAD to L1CENG - §4.2.3, 4.2.4, 4.3.3 and 4.3.4: Time variables (onboard_utc, sounder_pixel_vii_time, gap_start_time_utc and gap_end_time_utc) encoding has been updated to allow any time within the time range 2018 to 2050. - §4.2.5.4.2 / 4.3.5.4.2: - o new variable "general_quality_flags" collecting several quality flags. - o new variable "sounder_quality_flags" collecting all the sounder quality flags. - §4.2.5.5.2 / 4.3.5.5.2: new variable "imager_processing_modes" gathering the processing modes for geolocation, radiances classification, pixel classification - §4.3.5.2.2: correction of variable "alpha_scan_angle" erroneous dimension - Appendix A: Update of the size estimations of the IASI-NG Level 1C Products Updates to align with GPFS v.3A: - §4.2.3, 4.2.4, 4.3.3 and 4.3.4: all variables, attributes and dimensions in root and status groups have been updated. Updates to align with GPFS v.3B: - §4.2.3, 4.2.4, 4.3.3 and 4.3.4: variables manoeuvre_start_time, manoeuvre_end_time, creation_time_utc, mode_start_time and mode_end_time encoding has been updated to allow any time within the time range 2018 to 2050. - §4.2.4/4.3.4: the encoding of the variable manoeuvre_occurrence (for both L1CRAD and L1CENG products) has been updated - All units identified as "degree" changed to "degrees" - §4.2.4/4.3.4: the description variable state_vector_time has its description slightly modified NCML files have been aligned with the products description
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<i>Issue / Revision</i>	<i>Date</i>	<i>DCN. No</i>	<i>Changed Pages / Paragraphs</i>
V5.0	14 February 2019		Associated to DCR IASING-FT-0571: - § 4.2.5.2.5.2: variables cloud_mask and land_mask have been removed Associated to DCR IASING-FT-0618: - §4.2.5.2.5.1: values for n_class_channels, n_class, class_image_nl and class_image_nc have been updated - § 4.2.5.2.5.2: variable cloud_fraction has been replaced by the following 5 variables: meti_clear_fraction, meti_prob_clear_fraction, meti_prob_cloudy_fraction, meti_cloudy_fraction and meti_ash_fraction. Associated to DCR IASING-FT-0651: Minor changes during L1CPOP v1 development: - § 4.2.5.2.2: correction of the data type of the variable spectrum_real - §4.2.5.2.4.2: onboard_utc and sounder_pixel_VII_time ranges defined. - § 4.2.6.2 and 4.3.6.2: correction of the data type and description of some quality variables to comply with GPFS.

<i>Issue / Revision</i>	<i>Date</i>	<i>DCN. No</i>	<i>Changed Pages / Paragraphs</i>
<u>V5.1</u>	<u>05 June 2020</u>		<u>Associated to DCR IASING-FT-1043</u> - <u>§1.3: version of applicable documents updated</u> - <u>§3.2, §4.2.1 and 4.3.1: filename aligned with GPFS</u> - <u>§4.2.4.1.1 and 4.3.4.1.1: manoeuvre items dimension aligned with GPFS</u> - <u>§4.2.5.2.5.1 and 4.2.5.2.5.2: max of n class channels range and class channels id set to 20. Fill value set to 31.</u> - <u>§4.3.5.2.1: new dimension n_band, dimension n_spike removed</u> - <u>§4.3.5.2.2: definition of the variables spkco quality index, spkco quality flag, zpd f quality index, zpd f quality flag corrected</u> - <u>§4.3.6.2: the type of duration ... variables has been corrected</u> - <u>§5: applicable format updated</u> - <u>Appendix B: ncml aligned with PFS, few errors corrected and unsigned types precised.</u>

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1 INTRODUCTION

1.1 Purpose and Scope

This document is the Format Specification for EPS-SG IASI-NG Level 1C products generated centrally by the EPS-SG Ground Segment at the EUMETSAT Headquarters. It specifies the detailed format of the IASI-NG Level 1C 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. In particular, BUFR format – which is the EUMETCAST and GTS format dissemination for IASI-NG L1C RAD products - will be described in a TBW document.

1.2 Relation to other documents

The EPS-SG IASI-NG Level 1C Product Format Specification is a System document in the System Specification Tree. It is called up in [SRD], [OGSRD], all IASI-NG documents related to the L1C Product Operational Processing (POP) and EPS-SG System and Ground Segment documents including ICDs/IRDs wishing to convey information about the IASI-NG L1C products format and content.

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 v3D
[MCSD]	EPS-SG Mission Conventions and Standards Document	EUM/LEO-EPSSG/STD/14/745221 v.2E
[HQ-BAS]	EPS-SG Data and Products Generation, Archiving and Dissemination Baseline at EUMETSAT HQ	EUM/LEO-EPSSG/SPE/15/819557 v.1G
[DEV]	Development Logic for EPS-SG L0-L1-L2 Processing Specifications	EUM/LEO-EPSSG/TEN/14/763159 v.2B

1.4 Reference Documents

ID	Title	Reference
[SRD]	EPS-SG System Requirements Document	EUM/LEO-EPSSG/SPE/13/735903 v.6

[OGSRD]	EPS-SG Overall Ground Segment Requirements Document	EUM/LEO-EPSSG/REQ/13/725156 v.2A
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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
AOI	Area Of Interest
POP	Product Operational Processing
IASTEC	IASI-NG Technical Expertise Centre
ISRF	Instrument Spectral Response Function

1.6 Conventions and Terminology

Generic conventions and terminology used in this document for EPS-SG products are those described in the [GPFS]. Generic terms and definitions applicable to the EPS-SG Programme can be found in [MCSD].

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: Productidentifier 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	Estimated size of the product (MByte/Orbit).
Duration	Duration of product disseminated to the user (To be defined during Phase C)
Group Name	The name of the NetCDF group
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, must match the “valid_min”, “valid_max”, or “valid_range” attributes.
Unit	Unit type of variables or attributes, must coincide with “units” attribute.
Data Type or Type	Type of variables or attributes as defined in NetCDF Users Guide, 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 Assumptions

No assumptions made for compiling the current version of the document.

1.8 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:	A description of the main features and characteristics of the IASI-NG instrument is provided in this section, along with its acquisition modes generating data to be processed in the Ground Segment.
3	EPS-SG IASI-NG Level 1C Products Overview	A high-level overview on the IASI-NG Level 1C Products structure is presented in this section. The Product Tree and the Product Naming convention are also specified here.
4	EPS-SG IASI-NG Level 1C Product Detailed Format	The format of each IASI-NG Level 1C 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 IASI-NG Level 1C products	In this section the size of each IASI-NG Level 1C Products is provided.

APP B	<u>XML Description of EPS-SG IASI-NG L1C Products Format</u>	The .xml schemas for the IASI-NG Level 1C Products are provided in this section.
APP C	<u>IASI-NG LEVEL-1C BUFR product format specification</u>	In this section the title and reference of the document describing IASI-NG Level 1C Products BUFR format.

2 OVERVIEW OF THE INSTRUMENT: IASI-NG

2.1 Background Information

The mission of the Infrared Atmospheric Sounding Interferometer Next Generation (IASING) instrument is primarily to provide infra-red radiance spectra measurements with information on

- Atmospheric temperature profiles at high vertical resolution;
- Atmospheric water-vapour profiles at high vertical resolution;
- Surface temperature over sea, ice, and land surfaces;
- Cloud variables;
- A number of atmospheric trace gases;
- from the low-Earth orbit to continue and enhance the services offered by the EUMETSAT Polar System (EPS) instrument IASI. The objective of the IASI-NG system is to provide performance twice better than for IASI for spectral resolution and twice better for radiometric noise and absolute calibration.

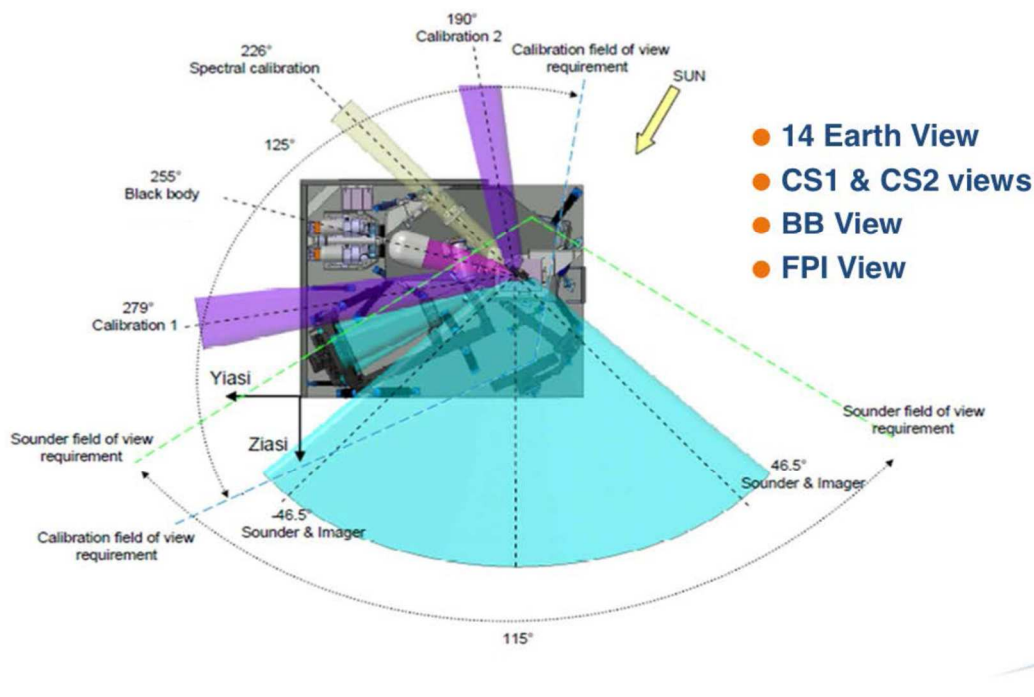


Figure 1. IASI-NG general instrument layout and viewing geometry.

2.2 Spectral characteristics of IASI-NG

IASI-NG is a Michelson interferometer with a Mertz field compensation. It covers the spectral range from 645 to 2760 cm^{-1} composed by 4 spectral bands as defined in the following table. The measurements have a spectral resolution of 0.25 cm^{-1} and are provided at a spectral sampling of 0.125 cm^{-1} , resulting in 16921 spectral samples.

	Band 1	Band 2	Band 3	Band 4
$\nu_{\min}$	645 cm^{-1}	1150 cm^{-1}	1950 cm^{-1}	2300 cm^{-1}
$\nu_{\max}$	1150 cm^{-1}	1950 cm^{-1}	2300 cm^{-1}	2760 cm^{-1}

Table 1. Spectral characteristics of IASI-NG

2.3 Description of the IASI-NG Measurement acquisition

This section provides additional information about the measurements (acquisition sequence, internal calibration measurements).

2.3.1 IASI-NG FOR

Each IASI-NG acquisition covers a Field of Regard (FOR) which consists of 16 Fields Of View (FOVs), whose centers are placed on a quasi-regular 4 by 4 grid (cf. [Figure 2](#)). The distance between FOVs within a given FOR is around 23.83 km at nadir. At nadir the FOVs are specified to be circular with a diameter of about 12km. They are called *sounder pixel*.

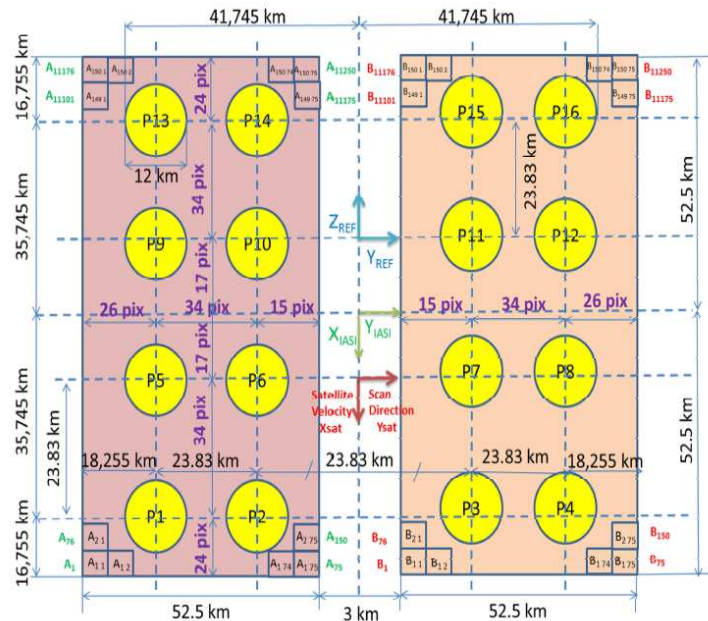


Figure 2. IASI-NG FOR with the 16 FOVs.

2.3.2 Acquisition sequence

The instrument performs continuous data acquisition throughout the mission lifetime. The optical axis of IASI-NG (center of the FOR) describes a line on the ground (swath) in a plane perpendicular to the satellite velocity (cf. [Figure 3](#)).

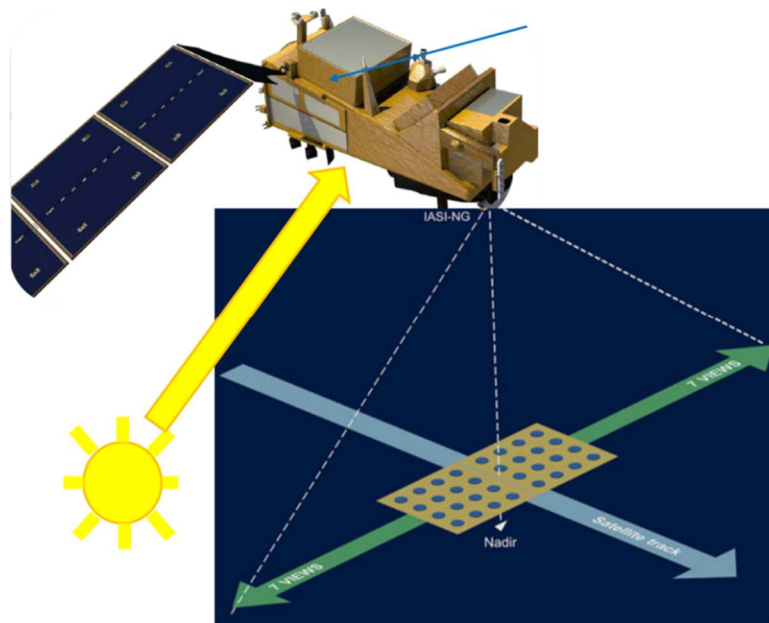


Figure 3. IASI-NG scanning.

The swath is covered during a so called Basic Repeat Cycle (BRC) which is repeated along the orbit. A typical observation sequence within this BRC consists in pointing the scan mirror successively towards the 14 Earth views to cover the required swath. It is then switched towards two successive radiometric calibration positions, one aiming at a reference Blackbody (BB, warm black body) and one aiming at the cold space (CS or cold black body). Considering 3 transitions between Earth View and calibration positions, a measurement cycle thus consists of 19 steps (cf. [Figure 4](#)). This cycle is then repeated automatically.

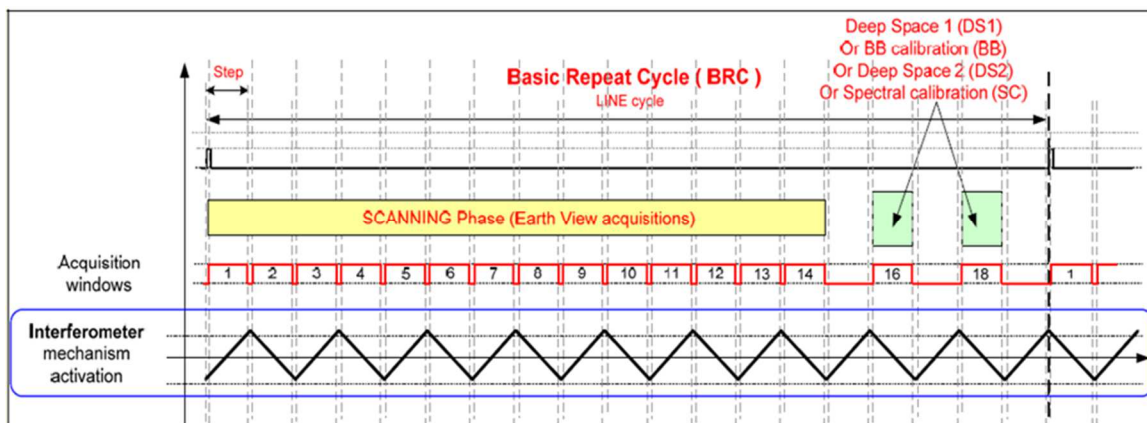


Figure 4. IASI-NG BRC details.

Note that the acquisitions are always performed in the same direction, with a sweeping scan angle from -46.5° to $+46.5^\circ$ (i.e. left to right according to in-flight direction). These different acquisition cycles are shown in [Figure 5](#).

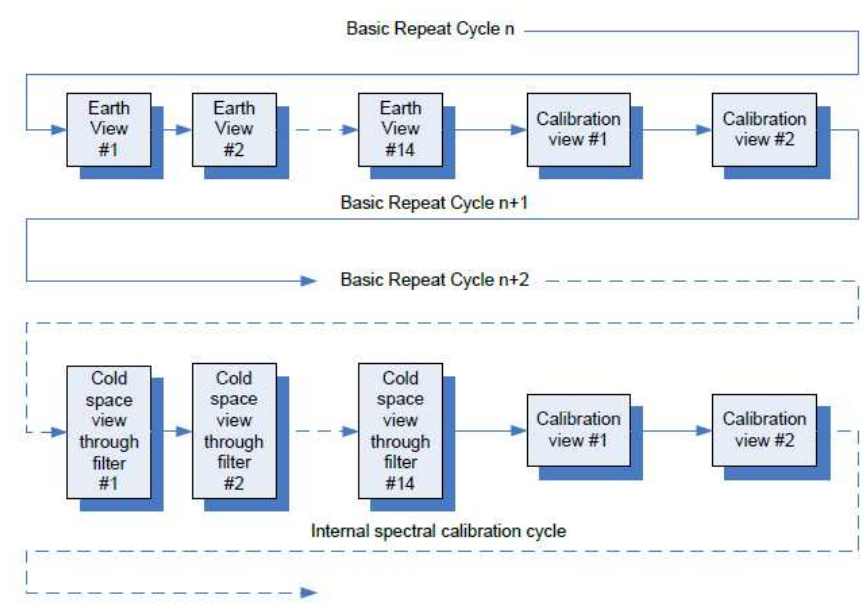


Figure 5. IASI-NG instrument sequencing flow.

Each IASI-NG scan line, or BRC, has duration of ~15.58 seconds.

3 EPS-SG IASI-NG LEVEL 1C PRODUCTS OVERVIEW

This section provides an overview of the Level 1C products generated centrally by the EPS-SG Ground Segment at the EUMETSAT Headquarters (also referred to as Mission Control Centre).

3.1 Product List

Product ID	Product Description	Usage
IAS-1C-RAD	IASI-NG L1C product contains : - Atmospheric geolocalised and calibrated spectra (spectrally and radiometrically) after ISRF substitution by a Gaussian function, with regular spectral sampling of 0.125 cm⁻¹ over the useful bandwidth. - All quality indicators (flags or parameters) - Any complementary information requested by users (cloud fraction, radiance classification, etc.)	User product
IAS-1C-ENG	It corresponds to Engineering data. Engineering data are a collection of data from IASI-NG L1C processing. They include all the sub-products of algorithm processing, a sample of L1C data, calibrated images and others.	Internal product They will be managed and archived by PDAP as a specific product and distributed to the IASI-NG Expertise Center.

Table 2: EPS-SG IASI-NG Level 1C Product List

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.

Example product filename (for illustrative purpose only):

W_XX-EUMETSAT-Darmstadt,SAT,SGA1-IAS-1C-
ENG_C_EUMT_20220101121212_G_O_20220101103000_20220101104000_C_N____

This is a global L1C product, generated in the context of the EPS-SG Global mission, for the IASI-NG instrument embarked on the Metop-SG/A1 satellite (SGA1).

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 during commissioning (C) in NRT (N) processing mode.

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

3.3 NetCDF-4 Data Types

The atomic external types supported by the netCDF interface are recalled in the table here below.

Data type	Coding
<u>NC_BYTE</u>	8-bit signed integer
<u>NC_UBYTE</u>	8-bit unsigned integer
<u>NC_CHAR</u>	8-bit character byte
<u>NC_SHORT</u>	16-bit signed integer
<u>NC_USHORT</u>	16-bit unsigned integer
<u>NC_INT</u> (or <u>NC_LONG</u>)	32-bit signed integer
<u>NC_UINT</u>	32-bit unsigned integer
<u>NC_INT64</u>	64-bit signed integer
<u>NC_UINT64</u>	64-bit unsigned integer
<u>NC_FLOAT</u>	32-bit floating point
<u>NC_DOUBLE</u>	64-bit floating point
<u>NC_STRING</u>	variable length character string

Table 3: NetCDF-4 data types

4 EPS-SG IASI-NG LEVEL 1C 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 Figure 6 and consists of a *root* group, holding global attributes defined in the [GPFS] and the following sub-groups: *status*, *data* and *quality*. No additional NetCDF-4 groups or sub-groups are foreseen for L1 products.

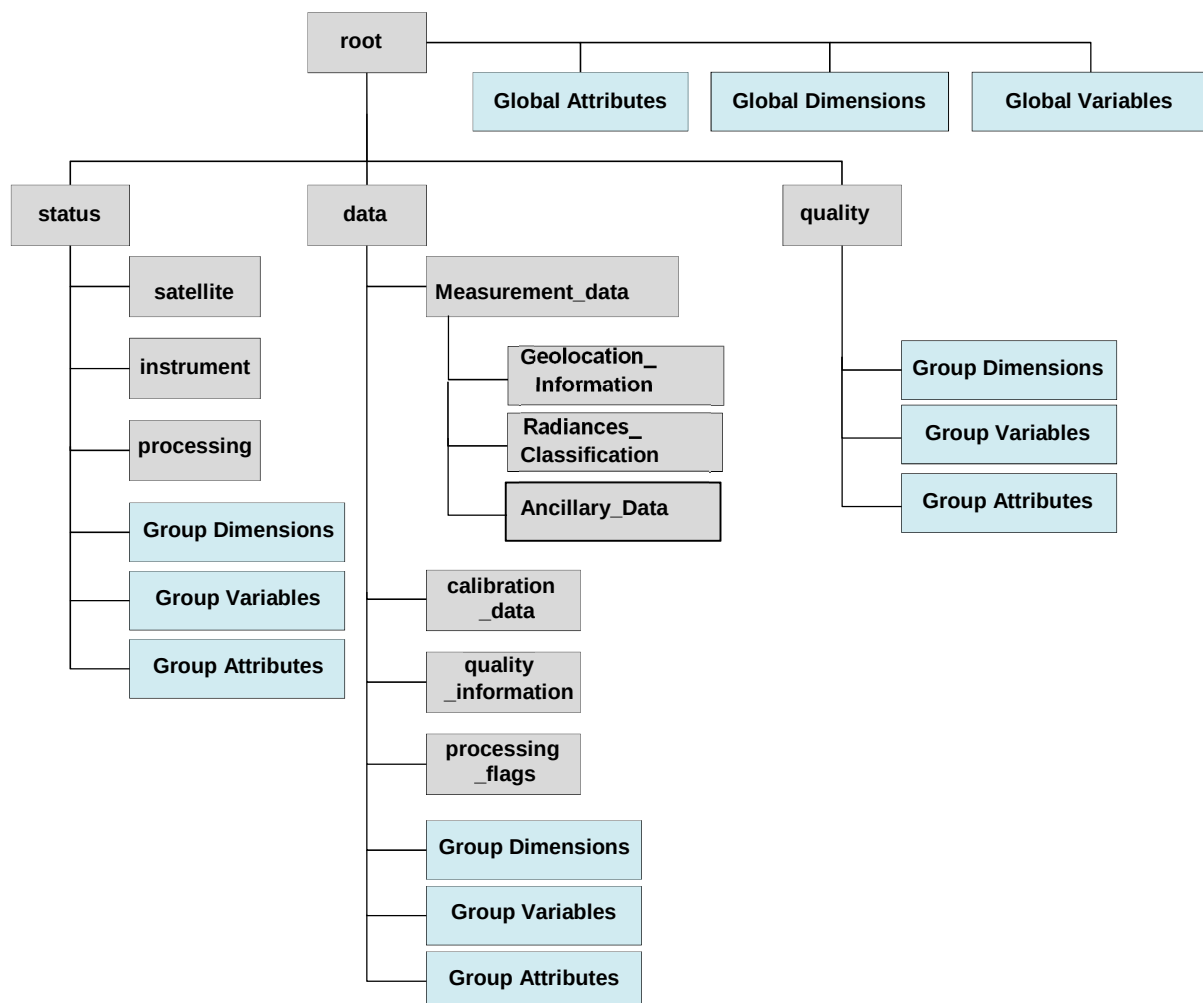


Figure 6: Overall Structure of EPS-SG Products

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

Note: The “root” group does not explicitly appear in the XML file attached in Appendix B, it is implicitly represented by the NetCDF file.

4.2 IASI-NG L1C RAD

4.2.1 Product Summary Sheet

Filename	W_XX-EUMETSAT-Darmstadt_SAT_SGA1-IAS-1C-RAD_C_EUMT_20220101121212_G_O_20220101103000_20220101104000_C_N____
Product name	IASI-NG L1C RAD
Product ID	IAS-1C-RAD
Product Description	IASI-NG L1C calibrated and geolocalised spectra
Format	netCDF-4
Size (MBytes/orbit)	Estimated at 5920
Duration	To be defined in Phase C

Table 4. IASI-NG L1C RAD product summary sheet.

4.2.2 Overall Group Structure

The overall structure of the IASI-NG L1C products is in accordance with [GPFS], as described in Sect. 4.1. Each product contains a Root and 3 groups (Status, Data and Quality).

4.2.3 Group Name: root

4.2.3.1 Global Attributes

The following global attributes are those common to all EPS-SG products.

Attribute name=	Data Type=	Meaning and/or value
Conventions	NC_STRING	e.g. "CF-1.6"
metadata_conventions	NC_STRING	e.g. "Unidata Dataset Discovery v1.0"
product_name	NC_STRING	Product name formatted as set out in section 3.2
title	NC_STRING	Short description of the product (IAS Level 1C RAD)
summary	NC_STRING	A summary as defined in the relevant product format specification
doi	NC_STRING	Digital Object Identifier
keywords	NC_STRING	As defined in the relevant product format specification.
history	NC_STRING	("original generated product" "aggregated product" "sub-setted product")
institution	NC_STRING	"EUMETSAT"
spacecraft	NC_STRING	Metop-SG A satellites: ("SGA"[1-3])
instrument	NC_STRING	Instrument or product identifier "IAS"

Attribute name=	Data Type=	Meaning and/or value
product_level	NC_STRING	Product processing level "1C" "1C" = for IAS: calibrated, apodised and geolocated radiance spectra with VII imagery added
type	NC_STRING	Character string providing an indication of the type of product: "RAD" - radiance
mission_type	NC_STRING	("Global" "Regional" "Local")
disposition_mode	NC_STRING	Identification of the type of processing ("Test" "Commissioning" "Operational" "Validation") Test = test data Commissioning = produced during commissioning Operational = expected quality as per requirements based on fully performed validation Validation = During validation of a new processor version during routine operations 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.
sensing_start_time_utc	NC_STRING	UTC time of start of sensing data formatted in CF date and time format with ms precision.
sensing_end_time_utc	NC_STRING	UTC time of end of sensing data formatted in CF date and time format with ms precision.
environment	NC_STRING	["Operational" "Validation" "Development" "Integration & Verification" "Engineering"]
references	NC_STRING	"www.eumetsat.int"
orbit_start	NC_UINT	Absolute orbit number at sensing_start_time_utc
orbit_end	NC_UINT	Absolute orbit number at sensing_end_time_utc

4.2.3.2 Global Dimensions

No common global dimensions are currently envisaged.

4.2.3.3 Global Variables

No common global variables are currently envisaged.

4.2.4 Group Name: status

4.2.4.1 Group Name: satellite status

The sub-group “satellite” within the “status” Group has a number of entries in common to all EPS-SG products and the structure/format is described in Sect. 5.2.6 of [GPFS]. No additional entries are currently envisaged.

4.2.4.1.1 satellite status Dimensions

Table 5: satellite status Dimensions

Dimension name=	Comment	Dimension length=
manoeuvre_items	Number of manoeuvres occurring between product start and end.	"" $0 \leq N$

4.2.4.1.2 satellite status Variables

Orbital elements, state vector, sub-satellite points are derived either from live orbit data provided by the satellites (if used at the time of the processing) or from on-ground predicted orbit information.

Manoeuvres parameters and attitude errors are only applicable to L1/L2 products and only set if live attitude data provided by the satellites is available and used at the time of the processing.

Table 6: satellite status Variables

Variable name=	Data Type type=	Attribute name="long_name" value=	Attribute name="units" value=
Orbit Parameters shape=1			
epoch_time_utc	NC_DOUBLE	“Epoch time in UTC of the orbital elements”	“seconds since 2020-01-01 00:00:00.000”
valid_min	NC_DOUBLE	-1.e9	
valid_max	NC_DOUBLE	1.e9	
_FillValue = missing_value	NC_DOUBLE	-9.e9	
semi_major_axis	NC_DOUBLE	“Semi major axis of the orbit at epoch time [TOD]”	“m”
valid_min	NC_DOUBLE	7.19e6	
valid_max	NC_DOUBLE	7.20e6	
_FillValue = missing_value	NC_DOUBLE	-9.e6	
eccentricity	NC_DOUBLE	“Eccentricity of the orbit at epoch time [TOD]”	“”
valid_min	NC_DOUBLE	0.1160e-2	
valid_max	NC_DOUBLE	0.1170e-2	
_FillValue = missing_value	NC_DOUBLE	-9.e2	
inclination	NC_DOUBLE	“Inclination of the orbit at epoch time [TOD]”	“degrees”
valid_min	NC_DOUBLE	98.65	

valid_max	NC_DOUBLE	98.75	
_FillValue = missing_value	NC_DOUBLE	-99.	
perigee_argument	NC_DOUBLE	"Argument of perigee of the orbit at epoch time [TOD]"	"degrees"
valid_min	NC_DOUBLE	0.	
valid_max	NC_DOUBLE	360.	
_FillValue = missing_value	NC_DOUBLE	-999.	
right_ascension	NC_DOUBLE	"Right ascension of the orbit at epoch time [TOD]"	"degrees"
valid_min	NC_DOUBLE	0.	
valid_max	NC_DOUBLE	360.	
_FillValue = missing_value	NC_DOUBLE	-999.	
mean_anomaly	NC_DOUBLE	"Mean anomaly of the orbit at epoch time [TOD]"	"degrees"
valid_min	NC_DOUBLE	0.	
valid_max	NC_DOUBLE	360.	
_FillValue = missing_value	NC_DOUBLE	-999.	
earth_sun_distance_ratio	NC_DOUBLE	"Ratio of current Earth-Sun distance to Mean Earth-Sun distance"	"
valid_min	NC_DOUBLE	0.983	
valid_max	NC_DOUBLE	1.017	
_FillValue = missing_value	NC_DOUBLE	-9999.	
Location Summary shape=1			
subsat_latitude_start	NC_DOUBLE	"Latitude of sub-satellite" point at start of the product"	"degrees"
valid_min	NC_DOUBLE	-90.	
valid_max	NC_DOUBLE	90.	
_FillValue = missing_value	NC_DOUBLE	-99.	
subsat_longitude_start	NC_DOUBLE	"Longitude of sub-satellite point at start of the product"	"degrees"
valid_min	NC_DOUBLE	0.	
valid_max	NC_DOUBLE	360.	
_FillValue = missing_value	NC_DOUBLE	-999.	
subsat_latitude_end	NC_DOUBLE	"Latitude of sub-satellite point at end of the product"	"degrees"
valid_min	NC_DOUBLE	-90.	
valid_max	NC_DOUBLE	90.	
_FillValue = missing_value	NC_DOUBLE	-99.	
subsat_longitude_end	NC_DOUBLE	"Longitude of sub-satellite point at end of the product"	"degrees"
valid_min	NC_DOUBLE	0.	
valid_max	NC_DOUBLE	360.	
_FillValue = missing_value	NC_DOUBLE	-999.	
State Vector and Attitude Parameters shape=1			

state_vector_time_utc	NC_DOUBLE	"Time of the state vector and attitude items"	"seconds since 2020-01-01 00:00:00.000"
valid_min	NC_DOUBLE	-1.e9	
valid_max	NC_DOUBLE	1.e9	
_FillValue = missing_value	NC_DOUBLE	-9.e9	
x_position	NC_DOUBLE	"X position of the orbital state vector [EARTH+FIXED]"	"m"
valid_min	NC_DOUBLE	-7.2.e6	
valid_max	NC_DOUBLE	7.2.e6	
_FillValue = missing_value	NC_DOUBLE	-9.e6	
y_position	NC_DOUBLE	"Y position of the orbital state vector [EARTH+FIXED]"	"m"
valid_min	NC_DOUBLE	-7.2.e6	
valid_max	NC_DOUBLE	7.2.e6	
_FillValue = missing_value	NC_DOUBLE	-9.e6	
z_position	NC_DOUBLE	"Z position of the orbital state vector [EARTH+FIXED]"	"m"
valid_min	NC_DOUBLE	-7.2.e6	
valid_max	NC_DOUBLE	7.2.e6	
_FillValue = missing_value	NC_DOUBLE	-9.e6	
x_velocity	NC_DOUBLE	"X velocity of the orbital state vector [EARTH+FIXED]"	"m/s"
valid_min	NC_DOUBLE	-8.3.e3	
valid_max	NC_DOUBLE	8.e3	
_FillValue = missing_value	NC_DOUBLE	-9.e3	
y_velocity	NC_DOUBLE	"Y velocity of the orbital state vector [EARTH+FIXED]"	"m/s"
valid_min	NC_DOUBLE	-8.3.e3	
valid_max	NC_DOUBLE	8.e3	
_FillValue = missing_value	NC_DOUBLE	-9.e3	
z_velocity	NC_DOUBLE	"Z velocity of the orbital state vector [EARTH+FIXED]"	"m/s"
valid_min	NC_DOUBLE	-8.3.e3	
valid_max	NC_DOUBLE	8.e3	
_FillValue = missing_value	NC_DOUBLE	-9.e3	
yaw_error	NC_DOUBLE	"Yaw attitude error"	"degrees"
valid_min	NC_DOUBLE	0.	
valid_max	NC_DOUBLE	360.	
_FillValue = missing_value	NC_DOUBLE	-999.	
roll_error	NC_DOUBLE	"Roll attitude error"	"degrees"
valid_min	NC_DOUBLE	0.	
valid_max	NC_DOUBLE	360.	
_FillValue = missing_value	NC_DOUBLE	-999.	
pitch_error	NC_DOUBLE	"Pitch attitude error"	"degrees"
valid_min	NC_DOUBLE	0.	
valid_max	NC_DOUBLE	360.	
_FillValue = missing_value	NC_DOUBLE	-999.	
Leap Second Information			

shape=1			
leap_second_time_utc	NC_DOUBLE	“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)”	“seconds since 2020-01-01 00:00:00”
valid_min	NC_DOUBLE	-1.e9	
valid_max	NC_DOUBLE	1.e9	
_FillValue = missing_value	NC_DOUBLE	-9.e9	
leap_second_value	NC_SHORT	“Value of leap second in product (1, 0, or -1)” 1 = increment -1 = decrement	“s”
valid_min	NC_SHORT	-1	
valid_max	NC_SHORT	1	
_FillValue = missing_value	NC_SHORT	-32768	
Manoeuvre Information shape=manoeuvre_items (included only in case of manoeuvre)			
manoeuvre_occurrence	NC_BYTE	“Occurrence of manoeuvres between start and end times of the product (1 or 2)” 1 = in-plane manoeuvre occurred 2 = out-of-plane manoeuvre occurred	“”
valid_min	NC_BYTE	1	
valid_max	NC_BYTE	2	
_FillValue = missing_value	NC_BYTE	-9	
manoeuvre_start_time_utc	NC_DOUBLE	“UTC time of start of manoeuvre”	“seconds since 2020-01-01 00:00:00.000”
valid_min	NC_DOUBLE	-1.e9	
valid_max	NC_DOUBLE	1.e9	
_FillValue = missing_value	NC_DOUBLE	-9.e9	
manoeuvre_end_time_utc	NC_DOUBLE	“UTC time of end of manoeuvre”	“seconds since 2020-01-01 00:00:00.000”
valid_min	NC_DOUBLE	-1.e9	
valid_max	NC_DOUBLE	1.e9	
_FillValue = missing_value	NC_DOUBLE	-9.e9	

4.2.4.2 Group Name: instrument status

The sub-group “instrument” within the “Status” Group has a number of entries in common to

all EPS-SG products and the structure/format described here follows the prescription in Sect. 5.2.7 of [GPFS]. No additional entries are currently envisaged.

4.2.4.2.1 instrument status: Dimensions

Dimension Name	Description	Dimension length
mode_items	Number of modes of the instrument assumed during product duration	"" $1 \leq N$

Table 7. Instrument Status Dimensions for IASI-NG L1C RAD product.

4.2.4.2.2 instrument status: Variables

Variables Name	Data Type	Attribute name="long_name"	Attribute name="units"
mode_start_time_utc	NC_DOUBLE	"Start time of the mode"	"seconds since 2020-01-01 00:00:00.000"
valid_min	NC_DOUBLE	-1.e9	
valid_max	NC_DOUBLE	1.e9	
_FillValue = missing_value	NC_DOUBLE	-9.e9	
mode_end_time_utc	NC_DOUBLE	"End time of the mode"	"seconds since 2020-01-01 00:00:00.000"
valid_min	NC_DOUBLE	-1.e9	
valid_max	NC_DOUBLE	1.e9	
_FillValue = missing_value	NC_DOUBLE	-9.e9	
instrument_mode	NC_STRING	"Name of the instrument mode assumed"	"OPER"
_FillValue = missing_value	NC_STRING	UNDEFINED MODE	

Table 8. Instrument Status Variables for IASI-NG L1C RAD product.

4.2.4.3 Group Name: processing status

The sub-group "processing" within the "status" Group has a number of entries in common to all EPS-SG products and the structure/format described here follows the prescription in Sect. 5.2.8 of [GPFS]. One additional entry has been added for the specific case of IASI-NG L1C products.

Attribute name	Data type	Description	Range or Value
processor_name	NC_STRING	"Name of the product processor"	IAS_L1C
processor_version	NC_STRING	"Version number of the processor"	v[n]
processing_mode	NC_STRING	Processing mode in which the product was generated	"NRT" or "Reprocessing"

Attribute name	Data type	Description	Range or Value
		["NRT" "Reprocessing"]	
format_version	NC_STRING	Product format version control number.	
pgs_reference_and_version	NC_STRING	"Reference and version of TBD"	TBD
pfs_reference_and_version	NC_STRING	"Reference and version of the PFS"	IASING-SP-4200-0272-CNES v[n]
atbd_reference_and_version	NC_STRING	"Reference and version of the ATBD"	IASING-NT-2000-0190-CNES v[n]
baseline (optional)	NC_STRING	"Climate data record collection version in reprocessed data – optional attribute"	
source	NC_STRING	A scalar string as particularised in the relevant product format specification, containing an array of bracketed strings of the form specified in as follows: (AUXILIARY_DATA_NAME)* (INPUT_PRODUCT_NAME)* where the asterisks indicate zero or more instances	List of all the inputs used for the L1C product generation

Table 9. Processing Status Attributes for IASI-NG L1C RAD product.

Variable name=	Data Type type=	Attribute name="long_name" value=	Attribute name="units" value=
Creation Time Information shape=1			
creation_time_utc	NC_DOUBLE	"UTC time of the start of the product creation"	"seconds since 2020-01-01 00:00:00"
valid_min	NC_DOUBLE	-1.e9	
valid_max	NC_DOUBLE	1.e9	
_FillValue = missing_value	NC_DOUBLE	-9.e9	

Table 10. Processing Status Variables for IASI-NG L1C RAD product.

4.2.5 Group Name: data

4.2.5.1 Data: Dimensions

Dimension Name	Description	Range or Value
n_lines	Number of considered lines (BRC) in the orbit	1 to 384
n_fov	Number of field of view (considered pixels) in the field of regard	1 to 16
n_for	Number of considered acquisitions in the BRC (calibration views excluded)	1 to 14

Table 11. Data Dimensions for IASI-NG L1C RAD product.

4.2.5.2 Group Name: measurement_data

This group contains the main outputs of L1CPOP processing chain : the spectra and the image. It also includes the auxiliary information organized into different sub-groups, which will contain for example:

- all the geolocation information which are not contained in the IASI-NG L0 product
- the radiances classification generated using VII L2 cloud mask product

For the moment only preliminary definition of data format is available. This section needs thus to be completed in detail in the future.

So it should be noted that the following information is purely indicative. The format of the measurement data will also evolve in the future versions of this document, refining the types associated to the variables and defining, where meaningful, their offset and scale factor.

4.2.5.2.1 Measurement Data: Dimensions

Dimension Name	Description	Range or Value
n_wn	Number of wavenumbers in the band	1 to 16921

Table 12. Measurement Data Dimensions for IASI-NG L1C RAD product.

4.2.5.2.2 Measurement Data: Variables

Variables Name	Description	Type	Range or Value	Dimension
fov_index	Pixel index according to space segment specification	NC_UBYTE	1 to 16 (step = 1)	n_fov
long_name	Description of variable	NC_STRING	"Pixel index in the FOR according to space segment specification"	-
units	Physical units	NC_STRING	-	-
valid_min		NC_UBYTE	1	
valid_max		NC_UBYTE	16	
_FillValue = missing_value		NC_UBYTE	31	

Variables Name	Description	Type	Range or Value	Dimension
for_index	Step index into BRC	NC_UBYTE	1 to 14 (step = 1)	n_for
long_name	Description of variable	NC_STRING	"Step index of FOR into BRC"	-
units	Physical units	NC_STRING	-	-
valid_min		NC_UBYTE	1	
valid_max		NC_UBYTE	14	
_FillValue = missing_value		NC_UBYTE	15	
wn	Wavenumber base	NC_USHORT	645 to 2760 (step = 1.25E-1)	n_wn
long_name	Description of variable	NC_STRING	"wavenumber base"	-
units	Physical units	NC_STRING	"cm ⁻¹ "	-
scale_factor		NC_FLOAT	0.032273324	
add_offset		NC_FLOAT	645.0	
valid_min		NC_USHORT	0	
valid_max		NC_USHORT	65534	
_FillValue = missing_value		NC_USHORT	65535	
spectrum_real	Real part of the spectrum	NC_INT	TBC: -9.000E-04 to 1.8000E-03 (step = 1.000E-09)	n_lines, n_for, n_fov, n_wn
long_name	Description of variable	NC_STRING	"real part of the spectrum"	-
units	Physical units	NC_STRING	"W/m2/sr/m-1"	-
scale_factor		NC_FLOAT	6.28643E-13	
add_offset		NC_FLOAT	0.00045	
valid_min		NC_INT	-2147483647	
valid_max		NC_INT	2147483647	
_FillValue = missing_value		NC_INT	-2147483648	

Table 13. Measurement Data Variables for IASI-NG L1C RAD product

4.2.5.2.3 Measurement Data: Attributes

Attribute Name	Description	Type	Unit	Range or Value
spectrum_sampling_ratio	Value of the spectrum sampling fraction	NC_FLOAT	cm ⁻¹	0.125
spectrum_band_limit_min	Limit minimum of the spectral band for the spectrum	NC_INTEGER	cm ⁻¹	645
spectrum_band_limit_max	Limit maximum of the spectral band for the spectrum	NC_INTEGER	cm ⁻¹	2760

Table 14. Measurement Data Attributes for IASI-NG L1C RAD product.

4.2.5.2.4 Sub-Group Name: Geolocation Information

This sub-group contains all the geolocation information which are estimated in L1C products generation.

4.2.5.2.4.1 Geolocation Information: Dimensions

No dimensions specific to this sub-group currently identified.

4.2.5.2.4.2 Geolocation Information: Variables

Variables Name	Description	Type	Range or Value	Dimension
onboard_utc	"on-board time in UTC for each FOR within BRC"	NC_DOUBLE	-1.0E+9 to 1.0E+9	n_lines, n_for
<i>long_name</i>	Description of variable	NC_STRING	"on-board time in UTC"	-
<i>units</i>	Physical units	NC_STRING	"seconds since 2020-01-01 00:00:00.000"	-
<i>valid_min</i>		NC_DOUBLE	-1.0E+9	
<i>valid_max</i>		NC_DOUBLE	1.0E+9	
<i>_FillValue = missing_value</i>		NC_DOUBLE	-9.0E+9	
alpha_scan_angle	Scan angle values	NC_INT	-50 to 279 (step = 1E-4)	n_lines, n_for
<i>long_name</i>	Description of variable	NC_STRING	"Scan angle values"	-
<i>units</i>	Physical units	NC_STRING	"degrees"	-
<i>scale_factor</i>		NC_FLOAT	7.66013E-08	
<i>add_offset</i>		NC_FLOAT	114.5	
<i>valid_min</i>		NC_INT	-2147483647	
<i>valid_max</i>		NC_INT	2147483647	
<i>_FillValue = missing_value</i>		NC_INT	-2147483648	
sounder_pixel_latitude	Latitude at sounder pixel centre	NC_SHORT	-90 to 90 (step = 1E-2)	n_lines, n_for, n_fov
<i>long_name</i>	Description of variable	NC_STRING	"latitude at sounder pixel centre"	-
<i>units</i>	Physical units	NC_STRING	"degrees_north"	-
<i>scale_factor</i>		NC_FLOAT	0.002746666	
<i>add_offset</i>		NC_FLOAT	0.0	
<i>valid_min</i>		NC_SHORT	-32767	
<i>valid_max</i>		NC_SHORT	32767	
<i>_FillValue = missing_value</i>		NC_SHORT	-32768	
sounder_pixel_longitude	Longitude at sounder pixel centre	NC_SHORT	-180 to 180 (step = 1E-2)	n_lines, n_for, n_fov

Variables Name	Description	Type	Range or Value	Dimension
<i>long_name</i>	Description of variable	NC_STRING	"longitude at sounder pixel centre"	-
<i>units</i>	Physical units	NC_STRING	"degrees_east"	-
<i>scale_factor</i>		NC_FLOAT	0.005493332	
<i>add_offset</i>		NC_FLOAT	0.0	
<i>valid_min</i>		NC_SHORT	-32767	
<i>valid_max</i>		NC_SHORT	32767	
<i>_FillValue = missing_value</i>		NC_SHORT	-32768	
sounder_pixel_VII_time	Position of sounder pixel centre in VII product (VII time)	NC_DOUBLE	-1.0E+9 to 1.0E+9	n_lines, n_for, n_fov
<i>long_name</i>	Description of variable	NC_STRING	"Position of sounder pixel centre in VII product (VII time in UTC)"	-
<i>units</i>	Physical units	NC_STRING	"seconds since 2020-01-01 00:00:00.000"	-
<i>valid_min</i>		NC_DOUBLE	-1.0E+9	
<i>valid_max</i>		NC_DOUBLE	1.0E+9	
<i>_FillValue = missing_value</i>		NC_DOUBLE	-9.0E+9	
sounder_pixel_VII_pixel	Position of sounder pixel centre in VII product (VII pixel)	NC_USHORT	0 to 3144 (step = 1)	n_lines, n_for, n_fov
<i>long_name</i>	Description of variable	NC_STRING	"Position of sounder pixel centre in VII product (VII pixel)"	-
<i>units</i>	Physical units	NC_STRING	"VII pixel index"	-
<i>valid_min</i>		NC_USHORT	0	
<i>valid_max</i>		NC_USHORT	3144	
<i>_FillValue = missing_value</i>		NC_USHORT	4095	
sounder_pixel_zenith	Measurement zenith angle for the sounder pixel	NC_UINT	0 to 90 (step = 1E-4)	n_lines, n_for, n_fov
<i>long_name</i>	Description of variable	NC_STRING	"measurement zenith angle at sounder pixel centre"	-
<i>units</i>	Physical units	NC_STRING	"degrees"	-
<i>scale_factor</i>		NC_FLOAT	2.09548E-08	

Variables Name	Description	Type	Range or Value	Dimension
<i>add_offset</i>		NC_FLOAT	0.0	
<i>valid_min</i>		NC_UINT	0	
<i>valid_max</i>		NC_UINT	4294967294	
<i>_FillValue = missing_value</i>		NC_UINT	4294967295	
sounder_pixel_azimuth	Measurement azimuth angle for the sounder pixel	NC_INT	-180 to 180 (step = 1E-4)	n_lines, n_for, n_fov
<i>long_name</i>	Description of variable	NC_STRING	"measurement azimuth angle at sounder pixel centre"	-
<i>units</i>	Physical units	NC_STRING	"degrees"	-
<i>scale_factor</i>		NC_FLOAT	8.3819E-08	
<i>add_offset</i>		NC_FLOAT	0.0	
<i>valid_min</i>		NC_INT	-2147483647	
<i>valid_max</i>		NC_INT	2147483647	
<i>_FillValue = missing_value</i>		NC_INT	-2147483648	
sounder_pixel_sun_zenith	Solar zenith angle at the surface for the sounder pixel	NC_UINT	0 to 90 (step = 1E-4)	n_lines, n_for, n_fov
<i>long_name</i>	Description of variable	NC_STRING	"solar zenith angle at sounder pixel centre"	-
<i>units</i>	Physical units	NC_STRING	"degrees"	-
<i>scale_factor</i>		NC_FLOAT	2.09548E-08	
<i>add_offset</i>		NC_FLOAT	0.0	
<i>valid_min</i>		NC_UINT	0	
<i>valid_max</i>		NC_UINT	4294967294	
<i>_FillValue = missing_value</i>		NC_UINT	4294967295	
sounder_pixel_sun_azimuth	Solar azimuth angle at the surface for the sounder pixel	NC_INT	-180 to 180 (step = 1E-4)	n_lines, n_for, n_fov
<i>long_name</i>	Description of variable	NC_STRING	"solar azimuth angle at sounder pixel centre"	-
<i>units</i>	Physical units	NC_STRING	"degrees"	-
<i>scale_factor</i>		NC_FLOAT	8.3819E-08	
<i>add_offset</i>		NC_FLOAT	0.0	
<i>valid_min</i>		NC_INT	-2147483647	
<i>valid_max</i>		NC_INT	2147483647	
<i>_FillValue = missing_value</i>		NC_INT	-2147483648	

Variables Name	Description	Type	Range or Value	Dimension
earth_satellite_distance	Distance of satellite from Earth centre	NC_UINT	TBC: 6000000 to 8000000 (step = 10)	1
long_name	Description of variable	NC_STRING	"Distance of satellite from Earth centre"	-
units	Physical units	NC_STRING	"m"	-
scale_factor		NC_UINT	10	
add_offset		NC_UINT	6000000	
valid_min		NC_UINT	0	
valid_max		NC_UINT	200000	
_FillValue = missing_value		NC_INT	262143	

Table 15. Geolocation Information Variables for IASI-NG L1C RAD product.

4.2.5.2.4.3 Geolocation Information: Attributes

No attributes specific to this sub-group currently identified.

4.2.5.2.5 Sub-Group Name: Radiances Classification

This section provides a preliminary description of the radiances classification results. For some variables, the description of the provided information in the particular case where VII-02-CLD is not available is still TBW.

4.2.5.2.5.1 Radiances Classification: Dimensions

Dimension Name	Description	Range or Value
n_class_channels	<u>Number</u> of VII channels or pseudo channels used for radiance analysis	1 to <u>20</u>
n_class	number of classes identified (6 classes + 1 for pixels not classified)	1 to 7
class_image_nl	number of lines of the image with the classes	1 to 150 if IASI-NG image is used for classification 1 to 115 if VII product is used for classification
class_image_nc	number of columns of the image with the classes	1 to 150 if IASI-NG image is used for classification 1 to 115 if VII product is used for classification

Table 16. Radiances Classification Dimensions for IASI-NG L1C RAD product.

4.2.5.2.5.2 Radiances Classification: Variables

Variables Name	Description	Type	Range or Value	Dimension
homogeneity_flag	Information on the homogeneity of the scene in IASI-NG FOV	NC_UBYTE	0 to 1 (step = 1)	n_lines, n_for, n_fov
<i>long_name</i>	Description of variable	NC_STRING	"Scene homogeneity flag: 0: homogeneous 1: non-homogeneous"	-
<i>units</i>	Physical units	NC_STRING	"_"	-
<i>valid_min</i>		NC_UBYTE	0	
<i>valid_max</i>		NC_UBYTE	1	
<i>_FillValue = missing_value</i>		NC_UBYTE	3	
meti_clear_fraction	Fraction in IASI-NG FOV of clear MET-Image pixels	NC_UBYTE	0 to 100 (step = 1)	n_lines, n_for, n_fov
<i>long_name</i>	Description of variable	NC_STRING	"Fraction in IASI-NG FOV of clear MET-Image pixels"	-
<i>units</i>	Physical units	NC_STRING	"%"	-
<i>valid_min</i>		NC_UBYTE	0	
<i>valid_max</i>		NC_UBYTE	100	
<i>_FillValue = missing_value</i>		NC_UBYTE	127	
meti_prob_clear_fraction	Fraction in IASI-NG FOV of probably clear MET-Image pixels	NC_UBYTE	0 to 100 (step = 1)	n_lines, n_for, n_fov
<i>long_name</i>	Description of variable	NC_STRING	"Fraction in IASI-NG FOV of probably clear MET-Image pixels"	-
<i>units</i>	Physical units	NC_STRING	"%"	-
<i>valid_min</i>		NC_UBYTE	0	
<i>valid_max</i>		NC_UBYTE	100	
<i>_FillValue = missing_value</i>		NC_UBYTE	127	
meti_prob_cloudy_fraction	Fraction in IASI-NG FOV of probably cloudy MET-Image pixels	NC_UBYTE	0 to 100 (step = 1)	n_lines, n_for, n_fov

Variables Name	Description	Type	Range or Value	Dimension
<i>long_name</i>	Description of variable	NC_STRING	"Fraction in IASI-NG FOV of probably cloudy MET-Image pixels"	-
<i>units</i>	Physical units	NC_STRING	"%"	-
<i>valid_min</i>		NC_UBYTE	0	
<i>valid_max</i>		NC_UBYTE	100	
<i>_FillValue = missing_value</i>		NC_UBYTE	127	
meti_cloudy_fraction	Fraction in IASI-NG FOV of cloudy MET-Image pixels	NC_UBYTE	0 to 100 (step = 1)	n_lines, n_for, n_fov
<i>long_name</i>	Description of variable	NC_STRING	"Fraction in IASI-NG FOV of cloudy MET-Image pixels"	-
<i>units</i>	Physical units	NC_STRING	"%"	-
<i>valid_min</i>		NC_UBYTE	0	
<i>valid_max</i>		NC_UBYTE	100	
<i>_FillValue = missing_value</i>		NC_UBYTE	127	
meti_ash_fraction	Ash fraction in IASI-NG FOV of MET-Image pixels	NC_UBYTE	0 to 100 (step = 1)	n_lines, n_for, n_fov
<i>long_name</i>	Description of variable	NC_STRING	"Fraction in IASI-NG FOV of ash MET-Image pixels"	-
<i>units</i>	Physical units	NC_STRING	"%"	-
<i>valid_min</i>		NC_UBYTE	0	
<i>valid_max</i>		NC_UBYTE	100	
<i>_FillValue = missing_value</i>		NC_UBYTE	127	
land_fraction		NC_UBYTE	1 to 100 (step = 1)	n_lines, n_for, n_fov
<i>long_name</i>	Description of variable	NC_STRING	"Land fraction in sounder pixel" (nominally from VII L2 Cloud)"	-
<i>units</i>	Physical units	NC_STRING	"%"	-
<i>valid_min</i>		NC_UBYTE	0	
<i>valid_max</i>		NC_UBYTE	100	
<i>_FillValue = missing_value</i>		NC_UBYTE	127	

Variables Name	Description	Type	Range or Value	Dimension
class_channels_id	Index of channels/pseudo-channels used for pixel classification	NC_UBYTE	1 to <u>20</u> (step = 1)	n_lines, n_class_channels
<i>long_name</i>	Description of variable	NC_STRING	"Channels used for pixel classification"	-
<i>units</i>	Physical units	NC_STRING	"-"	-
<i>valid_min</i>		NC_UBYTE	1	
<i>valid_max</i>		NC_UBYTE	<u>20</u>	
<i>_FillValue = missing_value</i>		NC_UBYTE	<u>31</u>	
class_number	Number of classes identified in sounder FOV	NC_UBYTE	1 to 7 (step = 1)	n_lines, n_for, n_fov
<i>long_name</i>	Description of variable	NC_STRING	"number of classes identified in the sounder pixel"	-
<i>units</i>	Physical units	NC_STRING	"-"	-
<i>valid_min</i>		NC_UBYTE	1	
<i>valid_max</i>		NC_UBYTE	7	
<i>_FillValue = missing_value</i>		NC_UBYTE	31	
class_fraction	% of sounder pixel covered by each class	NC_UBYTE	0 to 100 (step = 1)	n_lines, n_for, n_fov, n_class
<i>long_name</i>	Description of variable	NC_STRING	"class percentage in the sounder pixel"	-
<i>units</i>	Physical units	NC_STRING	"%"	-
<i>valid_min</i>		NC_UBYTE	0	
<i>valid_max</i>		NC_UBYTE	100	
<i>_FillValue = missing_value</i>		NC_UBYTE	127	
class_gravity_centre_y	y angular position of the centre of gravity in radiances analysis given wrt measurement angles (AC)	NC_SHORT	-0.008 to 0.008 (step = 6E-5)	n_lines, n_for, n_fov, n_class
<i>long_name</i>	Description of variable	NC_STRING	"Y angular position of gravity centre"	-
<i>units</i>	Physical units	NC_STRING	radians	-
<i>scale_factor</i>		NC_FLOAT	2.44148E-07	
<i>add_offset</i>		NC_FLOAT	0.0	

Variables Name	Description	Type	Range or Value	Dimension
<i>valid_min</i>		NC_SHORT	-32767	
<i>valid_max</i>		NC_SHORT	32767	
<i>_FillValue = missing_value</i>		NC_SHORT	-32768	
class_gravity_centre_z	z angular position of the centre of gravity in radiances analysis given wrt measurement angles (AC)	NC_SHORT	-0.008 to 0.008 (step = 6E-5)	n_lines, n_for, n_fov, n_class
<i>long_name</i>	Description of variable	NC_STRING	"Z angular position of gravity centre"	-
<i>units</i>	Physical units	NC_STRING	radians	-
<i>scale_factor</i>		NC_FLOAT	2.44148E-07	
<i>add_offset</i>		NC_FLOAT	0.0	
<i>valid_min</i>		NC_SHORT	-32767	
<i>valid_max</i>		NC_SHORT	32767	
<i>_FillValue = missing_value</i>		NC_SHORT	-32768	
class_channels_mean	Mean radiances in pixel classes for each channel/pseudo-channel	TBD	TBD	n_lines, n_for, n_fov, n_class, n_class_channels
<i>long_name</i>	Description of variable	NC_STRING	"Channels radiances averages in pixel classes"	-
<i>units</i>	Physical units	NC_STRING	TBD	-
<i>scale_factor</i>		NC_FLOAT	TBD	
<i>add_offset</i>		NC_FLOAT	TBD	
<i>valid_min</i>		TBD	TBD	
<i>valid_max</i>		TBD	TBD	
<i>_FillValue = missing_value</i>		TBD	TBD	
class_channels_std	Standard deviation of channels radiances in pixel classes	TBD	TBD	n_lines, n_for, n_fov, n_class, n_class_channels
<i>long_name</i>	Description of variable	NC_STRING	"Standard deviation of channels radiances in pixel classes"	-
<i>units</i>	Physical units	NC_STRING	TBD	-

Variables Name	Description	Type	Range or Value	Dimension
<i>scale_factor</i>		NC_FLOAT	TBD	
<i>add_offset</i>		NC_FLOAT	TBD	
<i>valid_min</i>		TBD	TBD	
<i>valid_max</i>		TBD	TBD	
<i>_FillValue = missing_value</i>		TBD	TBD	
<i>class_image</i>	image with the classes	NC_UBYTE	0 to 7 (step = 1)	n_lines, n_for, class_image_nl, class_image_nc,
<i>long_name</i>	Description of variable	NC_STRING	"Classes Image"	-
<i>units</i>	Physical units	NC_STRING	"_"	-
<i>valid_min</i>		NC_UBYTE	0	
<i>valid_max</i>		NC_UBYTE	7	
<i>_FillValue = missing_value</i>		NC_UBYTE	31	
<i>class_image_useful_line_nb</i>	Nb of useful lines in the image with the classes	NC_UBYTE	1 to 115 (step =1)	n_lines, n_for
<i>long_name</i>	Description of variable	NC_STRING	"Nb of useful lines in classes image"	-
<i>units</i>	Physical units	NC_STRING	"_"	-
<i>valid_min</i>		NC_UBYTE	1	
<i>valid_max</i>		NC_UBYTE	115	
<i>_FillValue = missing_value</i>		NC_UBYTE	255	
<i>class_image_useful_col_nb</i>	Nb of useful columns in the classes image	NC_UBYTE	1 to 115 (step =1)	n_lines, n_for
<i>long_name</i>	Description of variable	NC_STRING	"Nb of useful columns in classes image"	-
<i>units</i>	Physical units	NC_STRING	"_"	-
<i>valid_min</i>		NC_UBYTE	1	
<i>valid_max</i>		NC_UBYTE	115	
<i>_FillValue = missing_value</i>		NC_UBYTE	255	
<i>class_first_useful_line</i>	Index of first useful line in the classes image	NC_UBYTE	1 to 115 (step =1)	n_lines, n_for
<i>long_name</i>	Description of variable	NC_STRING	"Index of the first useful line in classes Image"	-
<i>units</i>	Physical units	NC_STRING	"_"	-
<i>valid_min</i>		NC_UBYTE	1	
<i>valid_max</i>		NC_UBYTE	115	

Variables Name	Description	Type	Range or Value	Dimension
<i>_FillValue = missing_value</i>		NC_UBYTE	255	
class_first_useful_col	Index of first useful column in the image with the classes	NC_UBYTE	1 to 115 (step =1)	n_lines, n_for
<i>long_name</i>	Description of variable	NC_STRING	"Index of the first useful column in classes Image"	-
<i>units</i>	Physical units	NC_STRING	"_"	-
<i>valid_min</i>		NC_UBYTE	1	
<i>valid_max</i>		NC_UBYTE	115	
<i>_FillValue = missing_value</i>		NC_UBYTE	255	
extreme_classes_flag	Boolean reporting if classes are of extreme type	NC_UBYTE	0 to 1 (step = 1)	n_lines, n_for, n_fov, n_class
<i>long_name</i>	Description of variable	NC_STRING	"1: classes of extreme type 0: no classes of extreme type"	-
<i>units</i>	Physical units	NC_STRING	"_"	-
<i>valid_min</i>		NC_UBYTE	0	
<i>valid_max</i>		NC_UBYTE	1	
<i>_FillValue = missing_value</i>		NC_UBYTE	3	

Table 17. Radiances Classification Variables for IASI-NG L1C RAD product.

This is a preliminary definition of the content of this sub-group, more variables will be added in the coming issues of the document (TBW).

4.2.5.2.5.3 Radiances Classification: Attributes

No attributes specific to this sub-group currently identified.

4.2.5.2.6 Sub-Group Name: ancillary_data

This sub-group contains a preliminary description of the ancillary data associated to L1C products and that can be useful to users to exploit the data.

4.2.5.2.6.1 Ancillary data: Dimensions

Dimension Name	Description	Range or Value
psf_subg_y	Y size of PSF grid for each pixel (TBC)	41 (TBC)

Dimension Name	Description	Range or Value
psf_subg_z	Z size of PSF grid for each pixel (TBC)	41 (TBC)
sounder_apod_grid	Number of values of sounder gaussian apodization function	131072 (=2 ¹⁷)

Table 18. Ancillary data dimensions for IASI-NG L1C RAD product.

4.2.5.2.6.2 Ancillary data: Variables

Variables Name	Description	Type	Range or Value	Dimension
sounder_apodization_function	Sounder Gaussian apodization function	NC_DOUBLE	-1 to 1 (step = 1E-16)	sounder_apod_grid
<i>long_name</i>	Description of variable	NC_STRING	"Sounder Gaussian apodization function"	-
<i>units</i>	Physical units	NC_STRING	"_"	-
<i>valid_min</i>		NC_DOUBLE	-1.0	
<i>valid_max</i>		NC_DOUBLE	1.0	
<i>_FillValue = missing_value</i>		NC_DOUBLE	-9.0E9	
sounder_psf	Sounder Point Spread Function	NC_USHORT	0 to 1 (step = 1E-4)	n_fov, psf_subg_y, psf_subg_z
<i>long_name</i>	Description of variable	NC_STRING	"sounder product spread function (PSF)"	-
<i>units</i>	Physical units	NC_STRING	"_"	-
<i>scale_factor</i>		NC_FLOAT	1.52593E-05	
<i>add_offset</i>		NC_FLOAT	0.0	
<i>valid_min</i>		NC_USHORT	0	
<i>valid_max</i>		NC_USHORT	65534	
<i>_FillValue = missing_value</i>		NC_USHORT	65535	
sounder_psf_line_nb	Number of lines for sounder PSF	NC_UBYTE	0 to 101 (step = 1)	n_fov
<i>long_name</i>	Description of variable	NC_STRING	"Number of lines for sounder PSF"	-
<i>units</i>	Physical units	NC_STRING	"_"	-
<i>valid_min</i>		NC_UBYTE	0	
<i>valid_max</i>		NC_UBYTE	101	
<i>_FillValue = missing_value</i>		NC_UBYTE	127	

Variables Name	Description	Type	Range or Value	Dimension
sounder_psf_col_nb	Number of columns for sounder PSF	NC_UBYTE	0 to 101 (step = 1)	n_fov
<i>long_name</i>	Description of variable	NC_STRING	"Number of columns for sounder PSF"	-
<i>units</i>	Physical units	NC_STRING	"_"	-
<i>valid_min</i>		NC_UBYTE	0	
<i>valid_max</i>		NC_UBYTE	101	
<i>_FillValue = missing_value</i>		NC_UBYTE	127	
sounder_psf_position_y	Y angular position of sounder PSF given wrt measurement angles (AC)	NC_SHORT	-0.008 to 0.008 (step = 6E-5)	n_fov, psf_subg_y
<i>long_name</i>	Description of variable	NC_STRING	"Y angular position of sounder PSF"	-
<i>units</i>	Physical units	NC_STRING	"rad"	-
<i>scale_factor</i>		NC_FLOAT	2.44148E-07	
<i>add_offset</i>		NC_FLOAT	0.0	
<i>valid_min</i>		NC_SHORT	-32767	
<i>valid_max</i>		NC_SHORT	32767	
<i>_FillValue = missing_value</i>		NC_SHORT	-32768	
sounder_psf_position_z	Z angular position of sounder PSF given wrt measurement angles (AC)	NC_SHORT	-0.008 to 0.008 (step = 6E-5)	n_fov, psf_subg_z
<i>long_name</i>	Description of variable	NC_STRING	"Z angular position of sounder PSF"	-
<i>units</i>	Physical units	NC_STRING	"rad"	-
<i>scale_factor</i>		NC_FLOAT	2.44148E-07	
<i>add_offset</i>		NC_FLOAT	0.0	
<i>valid_min</i>		NC_SHORT	-32767	
<i>valid_max</i>		NC_SHORT	32767	
<i>_FillValue = missing_value</i>		NC_SHORT	-32768	

Table 19. Ancillary data variables for IASI-NG L1C RAD product.

4.2.5.2.6.3 Ancillary data: Attributes

Attribute Name	Description	Type	Unit	Range or Value
sounder_apod_sampling_ratio	Value of the spectrum sampling fraction	NC_FLOAT	cm ⁻¹	TBD
sounder_apod_first	Number of first sample in spectral imager filter	NC_INT	cm ⁻¹	TBD
sounder_apod_last	Number of last sample in spectral imager filter	NC_INT	cm ⁻¹	TBD

Table 20. Ancillary data attributes for IASI-NG L1C RAD product.

4.2.5.3 Group Name: calibration_data

This group is currently empty. All the calibration data should be a priori in the IASI-NG L0 product and won't be copied in IASI-NG L1C RAD. This needs to be confirmed.

4.2.5.4 Group Name: quality_information

This group provides a preliminary description of the quality information provided with the product.

4.2.5.4.1 Quality Information: Dimensions

No dimensions specific to this group currently identified.

4.2.5.4.2 Quality Information: Variables

Variables Name	Description	Type	Range or Value	Dimension
general_quality_flags	Product quality flags per bit (from right to left bit): - bit1: general quality ¹ , - bit2: general sounder ² , - bit3: general imager, - bit4: imager geometric, - bit5: imager radiometric, - bit6: presence of mathematical errors	NC_UBYTE	Per bit: 0: product quality OK 1: product quality NOK (or presence of mathematical errors for bit2)	n_lines, n_for
long_name	Description of variable	NC_STRING	"Product quality flags per bit: bit1: general quality, bit2: presence of mathematical errors, bit3: imager, bit4: imager geometric, bit5: imager radiometric 0= ok, 1=nok"	-
units	Physical units	NC_STRING	"_"	-
valid_min		NC_UBYTE	0	
valid_max		NC_UBYTE	31	
_FillValue = missing_value		NC_UBYTE	63	

¹ general quality = 0 if all the other general_quality_flags = 0; general quality = 1 if at least one of all the other general_quality_flags = 1

² general sounder = 0 if the general sounder flags in the variable sounder_quality_flags = 0 for the 16 FOV; general sounder = 1 if the general sounder flags in the variable sounder_quality_flags is 1 for at least 1 FOV

Variables Name	Description	Type	Range or Value	Dimension
sounder_quality_flags	Sounder quality flags for sounder products per bit (from right to left bit): bit1: general sounder, bit2: sounder geometric, bit3: sounder radiometric, bit4: sounder spectral.	NC_UBYTE	Per bit: 0: quality OK 1: quality NOK	n_lines, n_for, n_fov
long_name	Description of variable	NC_STRING	"sounder product quality flags per bit: bit1: sounder, bit2: geometric, bit3: radiometric, bit4: spectral 0= ok, 1=nok "	-
units	Physical units	NC_STRING	"_"	-
valid_min		NC_UBYTE	0	
valid_max		NC_UBYTE	15	
_FillValue = missing_value		NC_UBYTE	31	

Table 21. Quality Information Variables for IASI-NG L1C RAD product.

4.2.5.4.3 Quality Information: Attributes

No attributes specific to this group currently identified.

4.2.5.5 Group Name: processing_flags

This is a preliminary definition of the processing flags, more information will be probably included in coming issues.

4.2.5.5.1 Processing Flags: Dimensions

No dimensions specific to this group currently identified.

4.2.5.5.2 Processing Flags: Variables

Variables Name	Description	Type	Range or Value	Dimension
imager_processing_modes	Flags to indicate, per bit (from right to left bit): bit1-2 what geolocation method and data have been used, bit3: what image has been used for radiances classification, bit4: what data have been used for cloud and land masks	NC_UBYTE	Per bit: Bit1-2: 0: coregistration IASI-NG image - METImage 1: geolocation initialization with NAVATT data 2: geolocation initialization with AUX_POFD data Bit3: 0: METImage channels and pseudochannels used 1: IASI-NG image used Bit4: 0: METImage Level-2 cloud product used 1: Land Sea Mask used (AC)	n_lines, n_for
long_name	Description of variable	NC_STRING	Bit1-2: "Geolocation mode: 0= IASI-NG image coregistration with METImage, 1=geolocation with NAVATT 2=geolocation with AUX_POFD" Bit3: « Classification mode: 0=METImage, 1=IASI-NG Imager » Bit4 : "Classification mode: 0=METImage, 1=static Land Sea Mask "	-
units	Physical units	NC_STRING	""	-
valid_min		NC_UBYTE	0	
valid_max		NC_UBYTE	15	
_FillValue = missing_value		NC_UBYTE	31	

Table 22. Processing Flags Variables for IASI-NG L1C RAD product.

4.2.5.5.3 Processing Flags: Attributes

No attributes specific to this group currently identified.

4.2.6 Group Name: quality

The sub-group “quality” within the “root” Group has a number of entries in common to all EPS-SG products and the structure/format described here follows the prescription in Sect. 5.2.9 of [GPFS].

4.2.6.1 quality: dimensions

Dimension name=	Comment	Dimension length=
gap_items	Number of gaps indentified during product duration. Note: it will not appear in the Product if degraded_gap overall_quality_flag bit 1 equals to 0.	"" $1 \leq N$

Table 23: quality dimensions

4.2.6.2 quality: variables

Variable name=	Data Type type=	Attribute name="long_name" value=	Attribute name="units" value=
Product Duration shape=1			
duration_of_product	NC_DOUBLE	"Entire duration of the product"	"s"
valid_min	NC_DOUBLE		0
duration_of_data_present	NC_DOUBLE	"Amount of data present in the product"	"s"
valid_min	NC_DOUBLE		0
duration_of_data_missing	NC_DOUBLE	"Amount of data missing in the product"	"s"
valid_min	NC_DOUBLE		0
duration_of_data_degraded	NC_DOUBLE	"Amount of data degraded in product"	"s"
valid_min	NC_DOUBLE		0
Gaps Information shape=gap_items			
gap_start_time_utc	NC_DOUBLE	"Gap start time in UTC" Note: it will not appear in the Product if	seconds since 2020-01-01 00:00:00.000

		degraded_gap overall_quality_flag bit 1 equals to 0.	
<i>range</i>	-	-	- 1000000000.00 to 1000000000.00 (step = 1E-3)
<i>valid_min</i>	NC_DOUBLE		-1.0E9
<i>valid_max</i>	NC_DOUBLE		1.0E9
<i>_FillValue = missing_value</i>	NC_DOUBLE		-9.0E9
gap_end_time_utc	NC_DOUBLE	“Gap end time in UTC” Note: it will not appear in the Product if degraded_gap overall_quality_flag bit 1 equals to 0.	seconds since 2020-01-01 00:00:00.000
<i>range</i>	-	-	- 1000000000.00 to 1000000000.00 (step = 1E-3)
<i>valid_min</i>	NC_DOUBLE		-1.0E9
<i>valid_max</i>	NC_DOUBLE		1.0E9
<i>_FillValue = missing_value</i>	NC_DOUBLE		-9.0E9

Table 24: quality variables

4.2.6.3 quality: attributes

Attribute name=	Data Type type=	Meaning /Value
overall_quality_flag	NC_USHORT	“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: degraded quality (set as 1 st bit of general_quality_flags variable in quality_information sub-group)

Table 25: quality attributes

4.3 IASI-NG L1C ENG

This product will allow for data analysis without using the spectra product, i.e. L1C RAD product. It should contain lots of flags, L1C RAD flags and also spatial segment flags. Its content will be defined after the L1C processing algorithm specification. This section is thus TBW.

4.3.1 Product Summary Sheet

Filename	W_XX-EUMETSAT-Darmstadt,SAT,SGA1-IAS-1C-ENG_C_EUMT_20220101121212_G_O_20220101103000_20220101104000_C_N_____
Product name	IASI-NG L1C ENG
Product ID	IAS-1C-ENG
Product Description	IASI-NG L1 engineering data product
Format	netCDF-4
Size (MBytes/orbit)	Estimated at 6800
Duration	To be defined in Phase C

Table 26. IASI-NG L1C ENG product summary sheet

4.3.2 Overall Group Structure

The overall structure of the IASI-NG L1C ENG products should be in accordance with [GPFS], as described in Sect. 4.1. Each product should contain a Root and 3 groups (Status, Data and Quality).

4.3.3 Group Name: root

4.3.3.1 Global Attributes

The following global attributes are those common to all EPS-SG products.

Attribute name=	Data Type=	Meaning and/or value
Conventions	NC_STRING	e.g. "CF-1.6"
metadata_conventions	NC_STRING	e.g. "Unidata Dataset Discovery v1.0"
product_name	NC_STRING	Product name formatted as set out in section 3.2
title	NC_STRING	Short description of the product (IAS Level 1C ENG)
summary	NC_STRING	A summary as defined in the relevant product format specification
doi	NC_STRING	Digital Object Identifier
keywords	NC_STRING	As defined in the relevant product format specification.
history	NC_STRING	("original generated product" "aggregated product" "sub-setted product")
institution	NC_STRING	"EUMETSAT"
spacecraft	NC_STRING	Metop-SG A satellites: ("SGA"[1-3])

Attribute name=	Data Type=	Meaning and/or value
instrument	NC_STRING	Instrument or product identifier "IAS"
product_level	NC_STRING	Product processing level "1C" "1C" = for IAS: calibrated, apodised and geolocated radiance spectra with VII imagery added
type	NC_STRING	Character string providing an indication of the type of product: "ENG" – engineering data
mission_type	NC_STRING	("Global" "Regional" "Local")
disposition_mode	NC_STRING	Identification of the type of processing ("Test" "Commissioning" "Operational" "Validation") Test = test data Commissioning = produced during commissioning Operational = expected quality as per requirements based on fully performed validation Validation = During validation of a new processor version during routine operations 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.
sensing_start_time_utc	NC_STRING	UTC time of start of sensing data formatted in CF date and time format with ms precision.
sensing_end_time_utc	NC_STRING	UTC time of end of sensing data formatted in CF date and time format with ms precision.
environment	NC_STRING	["Operational" "Validation" "Development" "Integration & Verification" "Engineering"]
references	NC_STRING	"www.eumetsat.int"
orbit_start	NC_UINT	Absolute orbit number at sensing_start_time_utc
orbit_end	NC_UINT	Absolute orbit number at sensing_end_time_utc

4.3.3.2 Global Dimensions

No common global dimensions are currently envisaged.

4.3.3.3 Global Variables

No common global variables are currently envisaged.

4.3.4 Group Name: status

4.3.4.1 Group Name: satellite status

The sub-group “satellite” within the “status” Group has a number of entries in common to all EPS-SG products and the structure/format is described in Sect. 5.2.6 of [GPFS]. No additional entries are currently envisaged.

4.3.4.1.1 satellite status Dimensions

Table 27: satellite status Dimensions

Dimension name=	Comment	Dimension length=
manoeuvre_items	Number of manoeuvres occurring between product start and end.	"" $0 \leq N$

4.3.4.1.2 satellite status Variables

Orbital elements, state vector, sub-satellite points are derived either from live orbit data provided by the satellites (if used at the time of the processing) or from on-ground predicted orbit information.

Manoeuvres parameters and attitude errors are only applicable to L1/L2 products and only set if live attitude data provided by the satellites is available and used at the time of the processing.

Table 28: satellite status Variables

Variable name=	Data Type type=	Attribute name="long_name" value=	Attribute name="units" value=
Orbit Parameters shape=1			
epoch_time_utc	NC_DOUBLE	“Epoch time in UTC of the orbital elements”	“seconds since 2020-01-01 00:00:00.000”
valid_min	NC_DOUBLE	-1.e9	
valid_max	NC_DOUBLE	1.e9	
_FillValue = missing_value	NC_DOUBLE	-9.e9	
semi_major_axis	NC_DOUBLE	“Semi major axis of the orbit at epoch time [TOD]”	“m”
valid_min	NC_DOUBLE	7.19e6	
valid_max	NC_DOUBLE	7.20e6	
_FillValue = missing_value	NC_DOUBLE	-9.e6	
eccentricity	NC_DOUBLE	“Eccentricity of the orbit at epoch time [TOD]”	“”
valid_min	NC_DOUBLE	0.1160e-2	
valid_max	NC_DOUBLE	0.1170e-2	
_FillValue = missing_value	NC_DOUBLE	-9.e2	
inclination	NC_DOUBLE	“Inclination of the orbit at epoch time [TOD]”	“degrees”
valid_min	NC_DOUBLE	98.65	

valid_max	NC_DOUBLE	98.75	
_FillValue = missing_value	NC_DOUBLE	-99.	
perigee_argument	NC_DOUBLE	"Argument of perigee of the orbit at epoch time [TOD]"	"degrees"
valid_min	NC_DOUBLE	0.	
valid_max	NC_DOUBLE	360.	
_FillValue = missing_value	NC_DOUBLE	-999.	
right_ascension	NC_DOUBLE	"Right ascension of the orbit at epoch time [TOD]"	"degrees"
valid_min	NC_DOUBLE	0.	
valid_max	NC_DOUBLE	360.	
_FillValue = missing_value	NC_DOUBLE	-999.	
mean_anomaly	NC_DOUBLE	"Mean anomaly of the orbit at epoch time [TOD]"	"degree"
valid_min	NC_DOUBLE	0.	
valid_max	NC_DOUBLE	360.	
_FillValue = missing_value	NC_DOUBLE	-999.	
earth_sun_distance_ratio	NC_DOUBLE	"Ratio of current Earth-Sun distance to Mean Earth-Sun distance"	"
valid_min	NC_DOUBLE	0.983	
valid_max	NC_DOUBLE	1.017	
_FillValue = missing_value	NC_DOUBLE	-9999.	
Location Summary shape=1			
subsat_latitude_start	NC_DOUBLE	"Latitude of sub-satellite" point at start of the product"	"degree"
valid_min	NC_DOUBLE	-90.	
valid_max	NC_DOUBLE	90.	
_FillValue = missing_value	NC_DOUBLE	-99.	
subsat_longitude_start	NC_DOUBLE	"Longitude of sub-satellite point at start of the product"	"degree"
valid_min	NC_DOUBLE	0.	
valid_max	NC_DOUBLE	360.	
_FillValue = missing_value	NC_DOUBLE	-999.	
subsat_latitude_end	NC_DOUBLE	"Latitude of sub-satellite point at end of the product"	"degree"
valid_min	NC_DOUBLE	-90.	
valid_max	NC_DOUBLE	90.	
_FillValue = missing_value	NC_DOUBLE	-99.	
subsat_longitude_end	NC_DOUBLE	"Longitude of sub-satellite point at end of the product"	"degree"
valid_min	NC_DOUBLE	0.	
valid_max	NC_DOUBLE	360.	
_FillValue = missing_value	NC_DOUBLE	-999.	
State Vector and Attitude Parameters shape=1			

state_vector_time_utc	NC_DOUBLE	"Time of the state vector and attitude items"	"seconds since 2020-01-01 00:00:00.000"
valid_min	NC_DOUBLE	-1.e9	
valid_max	NC_DOUBLE	1.e9	
_FillValue = missing_value	NC_DOUBLE	-9.e9	
x_position	NC_DOUBLE	"X position of the orbital state vector [EARTH+FIXED]"	"m"
valid_min	NC_DOUBLE	-7.2.e6	
valid_max	NC_DOUBLE	7.2.e6	
_FillValue = missing_value	NC_DOUBLE	-9.e6	
y_position	NC_DOUBLE	"Y position of the orbital state vector [EARTH+FIXED]"	"m"
valid_min	NC_DOUBLE	-7.2.e6	
valid_max	NC_DOUBLE	7.2.e6	
_FillValue = missing_value	NC_DOUBLE	-9.e6	
z_position	NC_DOUBLE	"Z position of the orbital state vector [EARTH+FIXED]"	"m"
valid_min	NC_DOUBLE	-7.2.e6	
valid_max	NC_DOUBLE	7.2.e6	
_FillValue = missing_value	NC_DOUBLE	-9.e6	
x_velocity	NC_DOUBLE	"X velocity of the orbital state vector [EARTH+FIXED]"	"m/s"
valid_min	NC_DOUBLE	-8.3.e3	
valid_max	NC_DOUBLE	8.e3	
_FillValue = missing_value	NC_DOUBLE	-9.e3	
y_velocity	NC_DOUBLE	"Y velocity of the orbital state vector [EARTH+FIXED]"	"m/s"
valid_min	NC_DOUBLE	-8.3.e3	
valid_max	NC_DOUBLE	8.e3	
_FillValue = missing_value	NC_DOUBLE	-9.e3	
z_velocity	NC_DOUBLE	"Z velocity of the orbital state vector [EARTH+FIXED]"	"m/s"
valid_min	NC_DOUBLE	-8.3.e3	
valid_max	NC_DOUBLE	8.e3	
_FillValue = missing_value	NC_DOUBLE	-9.e3	
yaw_error	NC_DOUBLE	"Yaw attitude error"	"degrees"
valid_min	NC_DOUBLE	0.	
valid_max	NC_DOUBLE	360.	
_FillValue = missing_value	NC_DOUBLE	-999.	
roll_error	NC_DOUBLE	"Roll attitude error"	"degrees"
valid_min	NC_DOUBLE	0.	
valid_max	NC_DOUBLE	360.	
_FillValue = missing_value	NC_DOUBLE	-999.	
pitch_error	NC_DOUBLE	"Pitch attitude error"	"degrees"
valid_min	NC_DOUBLE	0.	
valid_max	NC_DOUBLE	360.	
_FillValue = missing_value	NC_DOUBLE	-999.	
Leap Second Information			

shape=1			
leap_second_time_utc	NC_DOUBLE	“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)”	“seconds since 2020-01-01 00:00:00”
valid_min	NC_DOUBLE	-1.e9	
valid_max	NC_DOUBLE	1.e9	
_FillValue = missing_value	NC_DOUBLE	-9.e9	
leap_second_value	NC_BYTE	“Value of leap second in product (1, 0, or -1)” 1 = increment -1 = decrement	“s”
valid_min	NC_SHORT	-1	
valid_max	NC_SHORT	1	
_FillValue = missing_value	NC_SHORT	-32768	
Manoeuvre Information shape=manoeuvre_items (included only in case of manoeuvre)			
manoeuvre_occurrence	NC_BYTE	“Occurrence of manoeuvres between start and end times of the product (1 or 2)” 1 = in-plane manoeuvre occurred 2 = out-of-plane manoeuvre occurred	“”
valid_min	NC_BYTE	0	
valid_max	NC_BYTE	1	
_FillValue = missing_value	NC_BYTE	-9	
manoeuvre_start_time_utc	NC_DOUBLE	“UTC time of start of manoeuvre”	“seconds since 2020-01-01 00:00:00.000”
valid_min	NC_DOUBLE	0.e0	
valid_max	NC_DOUBLE	1.e9	
_FillValue = missing_value	NC_DOUBLE	-9.e9	
manoeuvre_end_time_utc	NC_DOUBLE	“UTC time of end of manoeuvre”	“seconds since 2020-01-01 00:00:00.000”
valid_min	NC_DOUBLE	0.e0	
valid_max	NC_DOUBLE	1.e9	
_FillValue = missing_value	NC_DOUBLE	-9.e9	

4.3.4.2 Group Name: instrument status

The sub-group “instrument” within the “Status” Group has a number of entries in common to

all EPS-SG products and the structure/format described here follows the prescription in Sect. 5.2.7 of [GPFS]. No additional entries are currently envisaged.

4.3.4.2.1 instrument status: Dimensions

Dimension Name	Description	Dimension length
mode_items	Number of modes of the instrument assumed during product duration	"" $1 \leq N$

Table 29. Instrument Status Dimensions for IASI-NG L1C ENG product.

4.3.4.2.2 instrument status: Variables

Variables Name	Data Type	Attribute name="long_name"	Attribute name="units"
mode_start_time_utc	NC_DOUBLE	"Start time of the mode"	"seconds since 2020-01-01 00:00:00.000"
valid_min	NC_DOUBLE	0.e0	
valid_max	NC_DOUBLE	1.e9	
_FillValue = missing_value	NC_DOUBLE	-9.e9	
mode_end_time_utc	NC_DOUBLE	"End time of the mode"	"seconds since 2020-01-01 00:00:00.000"
valid_min	NC_DOUBLE	0.e0	
valid_max	NC_DOUBLE	1.e9	
_FillValue = missing_value	NC_DOUBLE	-9.e9	
instrument_mode	NC_STRING		
"Name of the instrument mode assumed"	"OPER"		
_FillValue = missing_value	NC_STRING	UNDEFINED MODE	

Table 30. Instrument Status Variables for IASI-NG L1C ENG product.

4.3.4.3 Group Name: processing status

The sub-group "processing" within the "status" Group has a number of entries in common to all EPS-SG products and the structure/format described here follows the prescription in Sect. 5.2.8 of [GPFS]. One additional entry has been added for the specific case of IASI-NG L1C products.

Attribute name	Data type	Description	Range or Value
processor_name	NC_STRING	"Name of the product processor"	IAS_L1C
processor_version	NC_STRING	"Version number of the processor"	v[n]

processing_mode	NC_STRING	Processing mode in which the product was generated [“NRT” “Reprocessing”]	“NRT” or “Reprocessing”
format_version	NC_STRING	Product format version control number.	
pgs_reference_and_version	NC_STRING	“Reference and version of TBD”	TBD
pfs_reference_and_version	NC_STRING	“Reference and version of the PFS”	IASING-SP-4200-0272-CNES v[n]
atbd_reference_and_version	NC_STRING	“Reference and version of the ATBD”	IASING-NT-2000-0190-CNES v[n]
baseline (optional)	NC_STRING	“Climate data record collection version in reprocessed data – optional attribute”	
source	NC_STRING	As particularised in the relevant product format specification, an array of strings of the form specified in as follows: (AUXILIARY_DATA_NAME)* (INPUT_PRODUCT_NAME)* where the asterisks indicate zero or more instances	List of all the inputs used for the L1C product generation

Table 31. Processing Status Attributes for IASI-NG L1C ENG product.

Variable name=	Data Type type=	Attribute name=“long_name” value=	Attribute name=“units” value=
Creation Time Information shape=1			
creation_time_utc	NC_DOUBLE	“UTC time of the start of the product creation”	“seconds since 2020-01-01 00:00:00”
valid_min	NC_DOUBLE	-1.e0	
valid_max	NC_DOUBLE	1.e9	
_FillValue = missing_value	NC_DOUBLE	-9.e9	

Table 32. Processing Status Variables for IASI-NG L1C ENG product.

4.3.5 Group Name: data

4.3.5.1 Data: Dimensions

Dimension Name	Description	Range or Value
n_lines	Number of considered lines (BRC) in the orbit	1 to 384

Dimension Name	Description	Range or Value
n_fov	Number of field of view (considered pixels) in the field of regard	1 to 16
n_for	Number of considered acquisitions in the BRC	1 to 16
image_nl	Number of lines in IASI-NG image	1 to 150
image_nc	Number of columns in IASI-NG image	1 to 150

Table 33. Data Dimensions for IASI-NG L1C ENG product.

4.3.5.2 Group Name: measurement_data

For the moment only preliminary definition of the spectra data format is available. This section needs thus to be completed in detail in the future.

So it should be noted that the following information is purely indicative. The format of the measurement data will also evolve in the future versions of this document, refining the types associated to the variables and defining, where meaningful, their offset and scale factor.

4.3.5.2.1 Measurement Data: Dimensions

Dimension Name	Description	Range or Value
n_wn	Number of wavenumbers in the band	1 to 16921
n_band	IASI-NG band id	1 to 4
image_subg_nl	Number of lines in image subgrid	1 to 10
image_subg_nc	Number of columns in image subgrid	1 to 10
imager_isrf_grid	Number of values of imager ISRF function	TBD

Table 34. Measurement Data Dimensions for IASI-NG L1C ENG product.

4.3.5.2.2 Measurement Data: Variables

Variables Name	Description	Type	Range or Value	Dimension
alpha_scan_angle	Scan angle values	NC_INT	-50 to 279 (step = 1E-4)	n_lines, n_for
long_name	Description of variable	NC_STRING	"Scan angle values"	-
units	Physical units	NC_STRING	"degrees"	-
scale_factor		NC_FLOAT	7.66013E-08	
add_offset		NC_FLOAT	114.5	
valid_min		NC_INT	-2147483647	
valid_max		NC_INT	2147483647	

Variables Name	Description	Type	Range or Value	Dimension
_FillValue = missing_value		NC_INT	-2147483648	
fov_index	Pixel index according to space segment specification	NC_UBYTE	1 to 16 (step = 1)	n_fov
long_name	Description of variable	NC_STRING	"Pixel index in the FOR according to space segment specification"	-
units	Physical units	NC_STRING	-	-
valid_min		NC_UBYTE	1	
valid_max		NC_UBYTE	16	
_FillValue = missing_value		NC_UBYTE	31	
for_index	Step index into BRC	NC_UBYTE	1 to 14 (step = 1)	n_for
long_name	Description of variable	NC_STRING	"Step index of FOR into BRC"	-
units	Physical units	NC_STRING	-	-
valid_min		NC_UBYTE	1	
valid_max		NC_UBYTE	14	
_FillValue = missing_value		NC_UBYTE	15	
wn	Wavenumber base	NC_USHORT	645 to 2760 (step = 1.25E-1)	n_wn
long_name	Description of variable	NC_STRING	"wavenumber base"	-
units	Physical units	NC_STRING	"cm ⁻¹ "	-
scale_factor		NC_FLOAT	0.032273324	
add_offset		NC_FLOAT	645.0	
valid_min		NC_USHORT	0	
valid_max		NC_USHORT	65534	
_FillValue = missing_value		NC_USHORT	65535	
spectrum_imaginary	Imaginary part of the spectrum	NC_FLOAT	TBD	n_lines, n_for, n_fov, n_wn
long_name	Description of variable	NC_STRING	"imaginary part of the spectrum"	-
units	Physical units	NC_STRING	TBD	-
scale_factor		TBD	TBD	
add_offset		TBD	TBD	
valid_min		TBD	TBD	
valid_max		TBD	TBD	
_FillValue = missing_value		TBD	TBD	

Variables Name	Description	Type	Range or Value	Dimension
spkco_quality_index	Spike correction quality index. Provided only for the spectra where a spike has been detected (n_spikes > 0)	<u>NC_FLOAT</u>	TBD	n_lines, n_for, n_fov <u>n_band</u>
<i>long_name</i>	Description of variable	NC_STRING	"Spike correction quality index"	-
<i>units</i>	Physical units	NC_STRING	TBD	-
<i>scale_factor</i>		TBD	TBD	
<i>add_offset</i>		TBD	TBD	
<i>valid_min</i>		TBD	TBD	
<i>valid_max</i>		TBD	TBD	
<i>_FillValue = missing_value</i>		TBD	TBD	
spkco_quality_flag	Spike correction quality flag	NC_UBYTE	TBD	n_lines, n_for, n_fov, <u>n_band</u>
<i>long_name</i>	Description of variable	NC_STRING	"Spike correction quality flag"	-
<i>units</i>	Physical units	NC_STRING	TBD	-
<i>scale_factor</i>		TBD	TBD	
<i>add_offset</i>		TBD	TBD	
<i>valid_min</i>		TBD	TBD	
<i>valid_max</i>		TBD	TBD	
<i>_FillValue = missing_value</i>		TBD	TBD	
zpd_f_quality_index	ZPD determination quality index	<u>NC_FLOAT</u>	TBD	n_lines, n_for, n_fov, <u>n_band</u>
<i>long_name</i>	Description of variable	NC_STRING	"ZPD determination quality index"	-
<i>units</i>	Physical units	NC_STRING	TBD	-
<i>scale_factor</i>		TBD	TBD	
<i>add_offset</i>		TBD	TBD	
<i>valid_min</i>		TBD	TBD	
<i>valid_max</i>		TBD	TBD	
<i>_FillValue = missing_value</i>		TBD	TBD	
zpd_f_quality_flag	ZPD determination quality flag	NC_UBYTE	TBD	n_lines, n_for, n_fov, <u>n_band</u>

Variables Name	Description	Type	Range or Value	Dimension
<i>long_name</i>	Description of variable	NC_STRING	"ZPD determination quality flag"	-
<i>units</i>	Physical units	NC_STRING	TBD	-
<i>scale_factor</i>		TBD	TBD	
<i>add_offset</i>		TBD	TBD	
<i>valid_min</i>		TBD	TBD	
<i>valid_max</i>		TBD	TBD	
<i>_FillValue = missing_value</i>		TBD	TBD	
<i>image</i>	IASI-NG calibrated image	NC_FLOAT	TBD	n_lines, n_for, image_nl, image_nc
<i>long_name</i>	Description of variable	NC_STRING	"IASI-NG image"	-
<i>units</i>	Physical units	NC_STRING	W/m2/sr/m-1	-
<i>scale_factor</i>		TBD	TBD	
<i>add_offset</i>		TBD	TBD	
<i>valid_min</i>		TBD	TBD	
<i>valid_max</i>		TBD	TBD	
<i>_FillValue = missing_value</i>		TBD	TBD	
<i>image_variance</i>	Variance of IASI-NG Image	NC_FLOAT		n_lines, n_for
<i>long_name</i>	Description of variable	NC_STRING	"Variance of IASI-NG Image"	-
<i>units</i>	Physical units	NC_STRING	"W/(m ² sr m ⁻¹)"	-
<i>scale_factor</i>		TBD	TBD	
<i>add_offset</i>		TBD	TBD	
<i>valid_min</i>		TBD	TBD	
<i>valid_max</i>		TBD	TBD	
<i>_FillValue = missing_value</i>		TBD	TBD	
<i>image_average</i>	Average of IASI-NG Image	NC_FLOAT		n_lines, n_for
<i>long_name</i>	Description of variable	NC_STRING	"Average of IASI-NG Image"	-
<i>units</i>	Physical units	NC_STRING	"W/(m ² sr m ⁻¹)"	-
<i>scale_factor</i>		TBD	TBD	
<i>add_offset</i>		TBD	TBD	
<i>valid_min</i>		TBD	TBD	
<i>valid_max</i>		TBD	TBD	
<i>_FillValue = missing_value</i>		TBD	TBD	

Variables Name	Description	Type	Range or Value	Dimension
imager_latitude	Latitude for a subgrid of IASI-NG imager	NC_SHORT	-90 to 90 (step = 1E-2)	n_lines, n_for image_subg_ nl, image_subg_ nc
long_name	Description of variable	NC_STRING	"latitude for a subgrid of IASI-NG image"	-
units	Physical units	NC_STRING	"degrees_north"	-
scale_factor		NC_FLOAT	0.002746666	
add_offset		NC_FLOAT	0.0	
valid_min		NC_SHORT	-32767	
valid_max		NC_SHORT	32767	
_FillValue = missing_value		NC_SHORT	-32768	
imager_longitude	Longitude for a subgrid of IASI-NG imager	NC_SHORT	-180 to 180 (step = 1E-2)	n_lines, n_for image_subg_ nl, image_subg_ nc
long_name	Description of variable	NC_STRING	"longitude for a subgrid of IASI-NG image"	-
units	Physical units	NC_STRING	"degrees_east"	-
scale_factor		NC_FLOAT	0.005493332	
add_offset		NC_FLOAT	0.0	
valid_min		NC_SHORT	-32767	
valid_max		NC_SHORT	32767	
_FillValue = missing_value		NC_SHORT	-32768	
imager_VII_line	Position for a subgrid of IASI-NG imager in VII product (VII line)	NC_UINT	0 to 31436856 (step = 1)	n_lines, n_for image_subg_ nl, image_subg_ nc
long_name	Description of variable	NC_STRING	"Position for a subgrid of IASI-NG imager in VII product (VII line)"	-
units	Physical units	NC_STRING	"VII line index"	-
valid_min		NC_UINT	0	
valid_max		NC_UINT	31436856	
_FillValue = missing_value		NC_UINT	33554431	

Variables Name	Description	Type	Range or Value	Dimension
imager_VII_pixel	Position for a subgrid of IASI-NG imager in VII product (VII pixel)	NC_USHORT	0 to 3144 (step = 1)	n_lines, n_for image_subg_ nl, image_subg_ nc
long_name	Description of variable	NC_STRING	"Position for a subgrid of IASI-NG imager in VII product (VII pixel)"	-
units	Physical units	NC_STRING	"VII pixel index"	-
valid_min		NC_USHORT	0	
valid_max		NC_USHORT	3144	
_FillValue = missing_value		NC_USHORT	4095	
imager_zenith	Measurement zenith angle for a subgrid of IASI-NG imager	NC_UINT	0 to 90 (step = 1E-4)	n_lines, n_for image_subg_ nl, image_subg_ nc
long_name	Description of variable	NC_STRING	"measurement zenith angle for a subgrid of IASI-NG image"	-
units	Physical units	NC_STRING	"degrees"	-
scale_factor		NC_FLOAT	2.09548E-08	
add_offset		NC_FLOAT	0.0	
valid_min		NC_UINT	0	
valid_max		NC_UINT	4294967294	
_FillValue = missing_value		NC_UINT	4294967295	
imager_azimuth	Measurement azimuth angle for a subgrid of IASI-NG imager	NC_UINT	0 to 180 (step = 1E-4)	n_lines, n_for image_subg_ nl, image_subg_ nc
long_name	Description of variable	NC_STRING	"measurement azimuth angle for a subgrid of IASI-NG image"	-
units	Physical units	NC_STRING	"degrees"	-
scale_factor		NC_FLOAT	4.19095E-08	
add_offset		NC_FLOAT	0.0	
valid_min		NC_UINT	0	
valid_max		NC_UINT	4294967294	
_FillValue = missing_value		NC_UINT	4294967295	

Variables Name	Description	Type	Range or Value	Dimension
imager_sun_zenith	Solar zenith angle for a subgrid of IASI-NG imager	NC_UINT	0 to 90 (step = 1E-4)	n_lines, n_for image_subg_nl, image_subg_nc
long_name	Description of variable	NC_STRING	"solar zenith angle for a subgrid of IASI-NG image"	-
units	Physical units	NC_STRING	"degrees"	-
scale_factor		NC_FLOAT	2.09548E-08	
add_offset		NC_FLOAT	0.0	
valid_min		NC_UINT	0	
valid_max		NC_UINT	4294967294	
_FillValue = missing_value		NC_UINT	4294967295	
imager_sun_azimuth	Solar azimuth angle for a subgrid of IASI-NG imager	NC_INT	-180 to 180 (step = 1E-4)	n_lines, n_for image_subg_nl, image_subg_nc
long_name	Description of variable	NC_STRING	"solar azimuth angle for a subgrid of IASI-NG image"	-
units	Physical units	NC_STRING	"degrees"	-
scale_factor		NC_FLOAT	8.3819E-08	
add_offset		NC_FLOAT	0.0	
valid_min		NC_INT	-2147483647	
valid_max		NC_INT	2147483647	
_FillValue = missing_value		NC_INT	-2147483648	
imager_isrf	Imager spectral response function	TBD	0 to 1 (step = TBD)	imager_isrf_grid
long_name	Description of variable	NC_STRING	"Imager spectral response function"	-
units	Physical units	NC_STRING	"-"	-
scale_factor		TBD	TBD	
add_offset		TBD	TBD	
valid_min		TBD	TBD	
valid_max		TBD	TBD	
_FillValue = missing_value		TBD	TBD	

Table 35. Measurement Data Variables for IASI-NG L1C ENG product

4.3.5.2.3 Measurement Data: Attributes

Attribute Name	Description	Type	Unit	Range or Value
sounder_sampling_ratio	Value of the sampling fraction for sounder data	NC_FLOAT	cm ⁻¹	0.125
sounder_band_limit_min	Limit minimum of the spectral band for sounder data	NC_INTEGER	cm ⁻¹	645
sounder_band_limit_max	Limit maximum of the spectral band for sounder data	NC_INTEGER	cm ⁻¹	2760
image_band_limit_min	Limit minimum of the spectral band for the image	NC_FLOAT	μm	10.5
image_band_limit_max	Limit maximum of the spectral band for the image	NC_FLOAT	μm	12.5
imager_isrf_sampling_ratio	Value of the spectrum sampling fraction	NC_FLOAT	cm ⁻¹	TBD
imager_isrf_first	Number of first sample in spectral imager function	NC_INT	cm ⁻¹	TBD
imager_isrf_last	Number of last sample in spectral imager function	NC_INT	cm ⁻¹	TBD

Table 36. Measurement Data Attributes for IASI-NG L1C ENG product.

4.3.5.3 Group Name: calibration_data

This group is currently empty. All the calibration data should be a priori in the IASI-NG L0 product and won't be copied in IASI-NG L1C ENG. This needs to be confirmed.

4.3.5.4 Group Name: quality_information

This group provides a preliminary description of the quality information provided with the product.

4.3.5.4.1 Quality Information: Dimensions

No dimensions specific to this group currently identified.

4.3.5.4.2 Quality Information: Variables

Variables Name	Description	Type	Range or Value	Dimension
general_quality_flags	Product quality flags per bit (from right to left bit): - bit1: general quality ³ , - bit2: general sounder ⁴ , - bit3: general imager, - bit4: imager geometric, - bit5: imager radiometric, - bit6: presence of mathematical errors	NC_UBYTE	Per bit: 0: product quality OK 1: product quality NOK (or presence of mathematical errors for bit2)	n_lines, n_for
long_name	Description of variable	NC_STRING	"Product quality flags per bit: bit1: general quality, bit2: presence of mathematical errors, bit3: imager, bit4: imager geometric, bit5: imager radiometric 0= ok, 1=nok"	-
units	Physical units	NC_STRING	"_"	-
valid_min		NC_UBYTE	0	
valid_max		NC_UBYTE	31	
_FillValue = missing_value		NC_UBYTE	63	

³ general quality = 0 if all the other general_quality_flags = 0; general quality = 1 if at least one of all the other general_quality_flags = 1

⁴ general sounder = 0 if the general sounder flags in the variable sounder_quality_flags = 0 for the 16 FOV; general sounder = 1 if the general sounder flags in the variable sounder_quality_flags is 1 for at least 1 FOV

Variables Name	Description	Type	Range or Value	Dimension
sounder_quality_flags	Sounder quality flags for sounder products per bit (from right to left bit): bit1: general sounder, bit2: sounder geometric, bit3: sounder radiometric, bit4: sounder spectral.	NC_UBYTE	Per bit: 0: quality OK 1: quality NOK	n_lines, n_for, n_fov
long_name	Description of variable	NC_STRING	"sounder product quality flags per bit: bit1: sounder, bit2: geometric, bit3: radiometric, bit4: spectral 0= ok, 1=nok "	-
units	Physical units	NC_STRING	"_"	-
valid_min		NC_UBYTE	0	
valid_max		NC_UBYTE	15	
_FillValue = missing_value		NC_UBYTE	31	
imager_dead_pixels	Boolean image of imager dead pixels	NC_UBYTE	0: healthy pixel 1: dead pixel	image_nl, image_nc
long_name	Description of variable	NC_STRING	" 0=pixel ok, 1=dead pixel"	-
units	Physical units	NC_STRING	""	-
valid_min		NC_UBYTE	0	
valid_max		NC_UBYTE	1	
_FillValue = missing_value		NC_UBYTE	3	
imager_noise	Image of imager noise	NC_UINT	0 to 1 (step = 1E-6)	n_lines, n_for, image_nl, image_nc
long_name	Description of variable	NC_STRING	"Imager noise"	-
units	Physical units	NC_STRING	"K"	-
scale_factor		NC_FLOAT	2.32831E-10	
add_offset		NC_UINT	0	
valid_min		NC_UINT	0	
valid_max		NC_UINT	4294967294	
_FillValue = missing_value		NC_UINT	4294967295	

Table 37. Quality Information Variables for IASI-NG L1C ENG product.

4.3.5.4.3 Quality Information: Attributes

No attributes specific to this group currently identified.

4.3.5.5 Group Name: processing_flags

This is a preliminary definition of the processing flags, more information will be probably included in coming issues.

4.3.5.5.1 Processing Flags: Dimensions

No dimensions specific to this group currently identified.

4.3.5.5.2 Processing Flags: Variables

Variables Name	Description	Type	Range or Value	Dimension
imager_processing_modes	Flags to indicate, per bit (from right to left bit): bit1-2: what geolocation method and data have been used, bit3: what image has been used for radiances classification, bit4: what data have been used for cloud and land masks	NC_UBYTE	Per bit: Bit1-2: 0: coregistration IASI-NG image - METImage 1: geolocation initialization with NAVATT data 2: geolocation initialization with AUX_POFD data Bit3: 0: METImage channels and pseudochannels used 1: IASI-NG image used Bit4: 0: METImage Level-2 cloud product used 1: Land Sea Mask used (AC)	n_lines, n_for

Variables Name	Description	Type	Range or Value	Dimension
<i>long_name</i>	Description of variable	NC_STRING	Bit1-2: "Geolocation mode: 0= IASI-NG image coregistration with METImage, 1=geolocation with NAVATT 2=geolocation with AUX_POFD" Bit3: « Classification mode: 0=METImage, 1=IASI-NG Imager » Bit4 : "Classification mode: 0=METImage, 1=static Land Sea Mask "	-
<i>units</i>	Physical units	NC_STRING	""	-
<i>valid_min</i>		NC_UBYTE	0	
<i>valid_max</i>		NC_UBYTE	15	
<i>_FillValue = missing_value</i>		NC_UBYTE	31	

Table 38. Processing Flags Variables for IASI-NG L1C RAD product.

4.3.5.5.3 Processing Flags: Attributes

No attributes specific to this group currently identified.

4.3.6 Group Name: quality

The sub-group "quality" within the "root" Group has a number of entries in common to all EPS-SG products and the structure/format described here follows the prescription in Sect. 5.2.9 of [GPFS].

4.3.6.1 quality: dimensions

Dimension name=	Comment	Dimension length=
gap_items	Number of gaps identified during product duration. Note: it will not appear in the Product if degraded_gap overall_quality_flag bit 1 equals to 0.	"" $1 \leq N$

4.3.6.2 quality: variables

Variable name=	Data Type type=	Attribute name="long_name" value=	Attribute name="units" value=
Product Duration shape=1			

duration_of_product	<u>NC_DOUBLE</u>	"Entire duration of the product"	"s"
valid_min	<u>NC_DOUBLE</u>		0
duration_of_data_present	<u>NC_DOUBLE</u>	"Amount of data present in the product"	"s"
valid_min	<u>NC_DOUBLE</u>		0
duration_of_data_missing	<u>NC_DOUBLE</u>	"Amount of data missing in the product"	"s"
valid_min	<u>NC_DOUBLE</u>		0
duration_of_data_degraded	<u>NC_DOUBLE</u>	"Amount of data degraded in product"	"s"
valid_min	<u>NC_DOUBLE</u>		0
Gaps Information shape=gap_items			
gap_start_time_utc	NC_DOUBLE	"Gap start time in UTC" Note: it will not appear in the Product if degraded_gap overall_quality_flag bit 1 equals to 0.	seconds since 2020-01-01 00:00:00.000
range	-	-	-1000000000.00 to 1000000000.00 (step = 1E-3)
valid_min	NC_DOUBLE		-1.0E9
valid_max	NC_DOUBLE		1.0E9
_FillValue = missing_value	NC_DOUBLE		-9.0E9
gap_end_time_utc	NC_DOUBLE	"Gap end time in UTC" Note: it will not appear in the Product if degraded_gap overall_quality_flag bit 1 equals to 0.	seconds since 2020-01-01 00:00:00.000
range	-	-	-1000000000.00 to 1000000000.00 (step = 1E-3)
valid_min	NC_DOUBLE		-1.0E9

<i>valid_max</i>	NC_DOUBLE		1.0E9
<i>_FillValue = missing_value</i>	NC_DOUBLE		-9.0E9

4.3.6.3 quality: attributes

Attribute name=	Data Type type=	Meaning /Value
overall_quality_flag	NC_USHORT	"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: degraded quality (set as 1st bit of general_quality_flags variable in quality_information sub-group)
?		

5 PRODUCT FORMAT VERSION CONTROL

This section provides *Product Format Version Control Numbers* for each product defined within this document. This version is reflected in the following global attribute present in each EPS-SG mission product centrally generated as described in the [GPFS]:

format_version

Product ID	Product Format Version Control Number (format_version)	Product Format Specification Issue (pfs_reference_and_version)	Generic Product Format Specification Issue (gpfs_reference_and_version)
IAS-1C-RAD	1.0	5.1	3D
IAS-1C-ENG	1.0	5.1	3D

Table 39: Record Format Version Numbers

As described in the [GPFS], the *Product Format Version Control Number* is updated whenever there is a change in the format or contents of a product that requires an update to software that has to read the product or has to check the product. This could be a change in the format itself (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. Any such element update requires the product format version number to be incremented.

A recommended way to use *major.minor* versions of the product format version control number both is to issue minor updates for a change resulting from a PFS update, and major updates for a change resulting from GPFS updates that affect all products. Then a GPFS update would reset all products back to a new major of (say) 12.0, and then 12.1, 12.2 etc. versions would indicate PFS-only updates.

APPENDIX A SIZE OF EPS-SG IASI-NG LEVEL 1C PRODUCTS

Product ID	Product Description	Size (MB/Orbit)
IAS-1C-RAD	IASI-NG L1C calibrated and geolocalised spectra	5920
IAS-1C-ENG	IASI-NG L1 engineering data product	6800

Table 40: Size of the IASI-NG Level 1C Products

L1C product size has been estimated with an Excel spreadsheet which gathers all L1CRAD variables dimensioning and types. It is a worst case weight, considering in this estimation that all dimensions of the product are completely filled. This size does not consider any metadata weight (*i.e.* comments, attributes, declaration lines...), even though those elements can reasonably be regarded as negligible, compared to the GB of data.

Considering L1C ENG product, size estimation with an Excel spreadsheet cannot be performed at this time since several variables are not completely defined yet (ranges, steps). However, it seems reasonable to consider that its size should be comparable to IASI L1 engineering product to which it is added the volume of the imaginary part of the spectrum that is reported in this product instead that in L1C RAD product.

The size of the IASI engineering product is around 150 MB. The imaginary parts of the spectra, according to our estimations, is around 6.65 GB. The estimation of the L1 engineering product size is therefore around 6.8 GB per orbit.

APPENDIX B

XML DESCRIPTION OF EPS-SG IASI-NG L1C PRODUCTS FORMAT



IAS-1C-RAD-5IAS-1C-ENG-5

APPENDIX C IASI-NG LEVEL-1C BUFR PRODUCT FORMAT SPECIFICATION

BUFR Specification of the IASI-NG Level 1C Products is documented in the following document:

- Title: EPS-SG IASI-NG Level 1C BUFR Product Format Specification
- Reference: EUM/LEO-EPSSG/SPE/16/881663