

EPS-SG ICI Level 1B Product Format Specification

Doc.No. : EUM/LEO-EPSSG/SPE/14/771723
Issue : v3A e-signed
Date : 14 May 2020
WBS : LEO-EPSSG-925010

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Document Change Record

Issue / Revision	Date	DCN. No	Changed Pages / Paragraphs
V1	15 December 2014	N/A	Initial version
V1A	06 March 2015	N/A	Incorporating comments from internal review
V1B	15 September 2015	N/A	Update including quality control variables and type update for some variables.
V1C	9 November 2015	EUM-EPSSG-DCR-142	Update of the Applicable and Reference Document List. Updated document considering SAG advice (meetings #2 and #3), internal review and evolution of processing specifications.
V2A	17 November 2016	EPSG_D CR_525	<p>Added navigation_data group in order to rationalise data size without redundant information (e.g. geolocation provided per horn, added explanatory Table 1).</p> <p>Updated geolocation parameters considering processing updates.</p> <p>Updated size accordingly and taking into account latest industry manufacturer's input.</p> <p>Added appendix C (BUFR description).</p> <p>Removed XML dump in the document.</p> <p>Removed XML schema, now available in [GPFS].</p> <p>Updated XML description file (NcML).</p>
V2B	28 September 2017		<p>Sections 4.2.3.1.3: Updated Manoeuvre Information according to GPFS update.</p> <p>Updated Appendix A, updated data size estimation</p> <p>Added Appendix D on reconstruction of geolocation information from tie-points</p> <p>Updated XML according to changes.</p> <p>Updated global attributes in XML file description</p>
V2C	16 February 2018	EPSG_D CR_884	<p>Section 4.2.3.3.1: added the value "MWI_L1B" for the processor_name attribute. Removed "PROCESSOR_FULL_NAME" from the source attribute.</p> <p>Various sections: The minimum value for time variables referred to the 2020-01-01 epoch (sensing_start/end_time, gap_start/end_time, manoeuvre_start/end_time, etc.) are allowed to be negative. Value set as maximum value with negative sign.</p> <p>Section 4.2.4.1.3: added parameters delta</p>

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			<p>latitude and delta longitude to represent parallax shift due to orography w.r.t. geodetic coordinates on the ellipsoid.</p> <p>Updated appendix A (product size).</p> <p>Section 4.2.1: updated product size.</p> <p>Section 4.2.5.1: harmonized attributes with XML description.</p> <p>Section 4.2.5.1: updated overall_quality_flag</p> <p>Section 5 updated.</p> <p>Sections 4.2.3.1.1, 4.2.3.2.1, 4.2.3.2.2, 4.2.4.1.1, 4.2.4.2.1, 4.2.4.3.1, 4.2.4.4.1, 4.2.4.4.2, 4.2.4.5.1, 4.2.4.5.2: TBD instead of TBC.</p> <p>Table 34: removed second row.</p> <p>Update of the TBC/TBD Table.</p>
V3	25/03/2020	EPSG_D CR_1616	<p>Update of signature Table</p> <p>Minor changes to reflect GPFS updates in Section 4.2.2 and Section 4.2.3.</p> <p>Tables associated to Attributes and dimensioning that are not used have been removed (TBD closed) in multiple sections.</p> <p>Added Attributes to Group:navigation_data (Section 4.2.4.1), updated Group Dimensions.</p> <p>Updated subsampling description of Group: navigation data (Section 4.2.4.1.3, TBD to TBC).</p> <p>Updated scale factors and offsets of variables of Group: navigation data (Section 4.2.4.1.3). Changed latitude and longitude from SHORT to INT. Changed delta_lat and delta_lon from BYTE to SHORT. Added latitude and longitude of sub satellite point. Added sun elevation and azimuth angles in the instrument reference frame. Added roll, pitch, yaw angles. Removed moon flag as information is retained in the moon angle and threshold is given as attribute.</p> <p>Group measurement data (Section 4.2.4.2): radiance is provided according to channel main centre-frequency group instead of a single matrix to account for different scale factors with frequency. Band correction coefficients and centre_wavenumber for radiance to brightness temperature conversion added.</p> <p>Group calibration data (Section 4.2.4.3): added Group Attributes; updated group Dimensions, Sidelobe contribution variables moved from measurement data to calibration data. Warm and cold calibration counts variables added.</p>

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			<p>Non-linear calibration coefficients added.</p> <p>Updated PRTs/THMs temperature in output according to instrument development.</p> <p>Group quality_information (Section 4.2.4.4): ici_temperature_flag added. Output flags calibration-flag, navigation-status_flag, scan_quality_flag ici_data_quality_flag detailed with corresponding bit meaning and settings.</p> <p>Group processing_flags (Section 4.2.4.5): ici_processing_flags defined.</p> <p>Group quality (Section 4.2.5): minor changes to reflect GPFS updates.</p> <p>Appendix A updated for estimating size of ICI L1B product.</p> <p>Appendix B updated XML according with changes.</p> <p>Appendix D: equation for sample reconstruction updated in D1, reconstruction of Time of Earth samples added in D2.</p> <p>Added Appendix E for radiance to brightness temperature computation.</p> <p>Update of the TBC/TBD Table.</p>
V3A	14/05/2020		<p>Minor corrections to align status: satellite Variables to GPFS V3D.</p> <p>Minor adjustment of max value and scale factor of variable land_fraction</p> <p>Added note to dimension gaps_items, conditioned to overall_quality_flag, to align to GPFS V3D.</p> <p>Add note to manoeuvre information and manoeuvre_items to be included only in case of manoeuvre.</p> <p>Updated values of Group data dimensions n_samples, n_cold_samples, n_warm_samples to align to CCDB MOS-SS-ASE_ICI-0240 issue 5.0.</p> <p>Updated attribute type of sun_glint_angle_threshold and moon_angle_threshold from SHORT to STRING</p> <p>Updated value of navigation data attribute undersampling_step_last_samples to align to updated values of Group data dimensions n_samples, n_cold_samples, n_warm_samples.</p> <p>Updated scale_factor and valid_max attributes of group navigation_data variable land_fraction.</p> <p>Updated scale_factor and add_offset attributes of group measurement_data variables</p>

<i>Issue / Revision</i>	<i>Date</i>	<i>DCN. No</i>	<i>Changed Pages / Paragraphs</i>
			<p>ici_radiance_183, ici_radiance_243, ici_radiance_325, ici_radiance_448, ici_radiance_664</p> <p>Updated value of Group data dimension n_pnts_irp to align to CCDB MOS-SS-ASE_ICI-0240 issue 5.0.</p> <p>Update of attribute_long_name of group measurement_data variables bt_conversion_a and bt_conversion_b.</p> <p>Added missing scale_factor attribute to variable cold_counts_average_over_scans.</p> <p>Updated scale_factor of group calibration_data variables: calibration_offset_linear, nonlinear_second_order_calibration_parameter, nonlinear_third_order_calibration_parameter</p> <p>Change attribute missing_value to _FillValue of variable nonlinear_third_order_calibration_parameter.</p> <p>Minor refinement of description of quality flags.</p> <p>Update of XML to reflect changes of current document.</p> <p>Minor refinement of time sample reconstruction equation in Appendix D.2.</p> <p>Added Appendix D.3 for the reconstruction of orthorectified latitude and longitude.</p>

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1 INTRODUCTION

1.1 Purpose and Scope

This document describes the Format Specification for EPS-SG Ice Cloud Imager (ICI) Level 1B (L1B) products generated centrally by the EPS-SG Ground Segment at the EUMETSAT Headquarters. It specifies the detailed format of the ICI L1B products in agreement with the format and naming conventions set out in the Generic Product Format Specification [GPFS] applicable to all EPS-SG products.

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.

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].

1.2 Relation to other documents

The EPS-SG ICI Level 1B Product Format Specification [ICI-L1B-PFS] is a System document in the System Specification Tree. It is called up in [SRD], [OGSRD], ICI Level 1B Product Generation Specification [ICI-L1B-PGS] and EPS-SG System and Ground Segment documents including ICDs/IRDs wishing to convey information about the ICI Level 1B products format and content. The EPS-SG Image Navigation and Registration Specifications [INR-SPEC] provide information on the geolocation procedures applied to ICI.

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
[GPFS]	EPS-SG Generic Product Format Specification (GPFS)	EUM/LEO-EPSSG/SPE/13/702108
[MCSD]	EPS-SG Mission Conventions and Standards Document	EUM/LEO-EPSSG/STD/14/745221
[DEV]	Development Logic for EPS-SG L0-L1-L2 Processing Specifications	EUM/LEO-EPSSG/TEN/14/763159
[HQ-BAS]	EPS-SG Data and Products Generation, Archiving and Dissemination Baseline at EUMETSAT HQ	EUM/LEO-EPSSG/SPE/15/819557

1.4 Reference Documents

ID	Title	Reference
[SRD]	EPS-SG System Requirements Document	EUM/LEO-EPSSG/SPE/13/735903
[OGSRD]	EPS-SG Overall Ground Segment Requirements Document	EUM/LEO-EPSSG/REQ/13/725156
[ICI-L1B-PGS]	EPS-SG ICI Level 1B Product Generation Specification	EUM/LEO-EPSSG/SPE/14/756250
[ICI-L1B-ADS]	EPS-SG ICI Level 1B Auxiliary Data Specification	EUM/LEO-EPSSG/SPE/14/771726
[ICI-L1B-ATBD]	EPS-SG Ice Cloud Imager (ICI) Level1B Product Algorithm Theoretical Basis Document (ATBD)	EUM/LEO-EPSSG/SPE/13/716156
[INR-SPEC]	EPS-SG Image Navigation and Registration Specifications	EUM/LEO-EPSSG/SPE/15/814371
[L0PFS]	EPS-SG L0 Product Format Specification	EUM/LEO-EPSSG/SPE/13/703928
[INTERP]	Fundamentals of Inertial Navigation, Satellite-based Positioning and their integration. Chapter 2.	Noureldin, A., Karamat T.B., Georgy , J., (2013) Springer, New York, ISBN: 978-3-642-30465-1

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
ATBD	Algorithm Theoretical Basis Document
APC	Antenna Pattern Correction
CDPU	Control Data Processing Unit
EPS-SG	EUMETSAT Polar System – Second Generation
GPFS	Generic Product Format Specification
GS	Ground Segment
GTS	Global Telecommunication System
ICI	Ice Cloud Imager
ICU	Instrument Control Unit
MR	Main Reflector
MWI	Microwave Imager
netCDF	Network Common Data Form
NRT	Near Real Time

Acronym	Definition
OBCT	On Board Calibration Target
PRT	Platinum Resistance Thermistor
SVR	Space View Reflector
TBC	To Be Confirmed
TBD	To Be Defined
TBW	To Be Written
THM	Thermistor
TOD	True Of Date
UTC	Universal Time Coordinated
WMO	World Meteorological Organization
XML	eXtensible Markup Language
XSD	XML Schema Definition

1.6 Conventions and Terminology

Generic conventions and terminology used in this document for EPS-SG products are those described in the [GPFS]. 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: <ul style="list-style-type: none"> - Internal: Product/Data is for use within the EPS-SG system. It is not made available to the end-users. - User: the product is disseminated to the end-users.

1.7 Document structure

Section Number	Title	Content
1	Introduction	The Scope and Purpose of the PFS document is described in this section, along with Open Issues, Assumptions, Applicable and Reference documents.
2	Overview of the instrument: ICI	A description of the main features and characteristics of the ICI is provided in this section, along with its acquisition modes generating data to be processed in the Ground Segment.
3	EPS-SG ICI Level 1B Products Overview	A high-level overview on the ICI Level 1B Products structure is presented in this section. The Product Tree and the Product Naming convention are also specified here.
4	EPS-SG ICI Level 1B Product Detailed Format	The format of each ICI Level 1B 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 ICI Level 1B products	In this section the size of each ICI Level 1B Products is provided.

APP B	XML Description of EPS-SG ICI L1B Products Format	The .xml schemas for the ICI Level 1B Products are provided in this section.
APP C	Description of EPS-SG ICI L1B Product BUFR Format	The description of ICI L1B BUFR data format for dissemination over the GTS.
APP D	Geolocation Information from tie points	Description of the method to derive geolocation information from tie-points.
APP E	Radiance to brightness temperature conversion	Description of the method to compute brightness temperature from the radiance information.

2 OVERVIEW OF THE INSTRUMENT: ICI

A description of the main features and characteristics of the ICI is provided in the ICI L1B Product Generation Specification Document [ICI-L1B-PGS]. The [ICI-L1B-PGS] document also describes in detail the acquisition modes generating data to be processed in the Ground Segment. It is useful however to resume here the assignment of the ICI channels with respect to the instrument feed horns used here. This assignment is presented in Table 1.

Horn Number	Channel Number	Channel
1	1	ICI-1 V
	2	ICI-2 V
	3	ICI-3 V
2	4	ICI-4 V
3	5	ICI-4 H
4	6	ICI-5 V
	7	ICI-6 V
	8	ICI-7 V
5	9	ICI-8 V
	10	ICI-9 V
	11	ICI-10 V
6	12	ICI-11 V
7	13	ICI-11 H

Table 1: ICI channels assignment with respect to instrument feed horns.

Index assignment with respect to receivers types of Front-end and Back-end.

Front-end temperatures	
1	RFASSY_1
2	RFASSY_2
Back-end temperatures	
1	BE183
2	BE243
3	BE325
4	BE448
5	BE664

Table 2: Index assignment with respect to Front End and Back-end.

3 EPS-SG ICI LEVEL 1B PRODUCTS OVERVIEW

The ICI Level 1B Spectral Radiance product is generated centrally by the EPS-SG Ground Segment at the EUMETSAT Headquarters.

3.1 Product List

Product ID	Product Description	Usage	Mission type
<i>ICI-1B-RAD</i>	ICI Level 1B Spectral Radiance	User	Global/Regional

Table 3: EPS-SG ICI Level 1B 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.

The product name of the ICI L1B radiance products is according to the following convention:

(pflag) ‘_’ (productidentifier) ‘_’ (oflag) ‘_’ (originator) ‘_’
(YYYYMMDDhhmmss) ‘_’ (freeformat)

Where freeformat contains a number of product name fields separated by the underscore symbol “_” and explained in [GPFS].

4 EPS-SG ICI LEVEL 1B PRODUCT DETAILED FORMAT

4.1 Overall Structure of the EPS-SG ICI L1B product

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]. The EPS-SG ICI L1B Product high-level structure is presented in Figure 1 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.

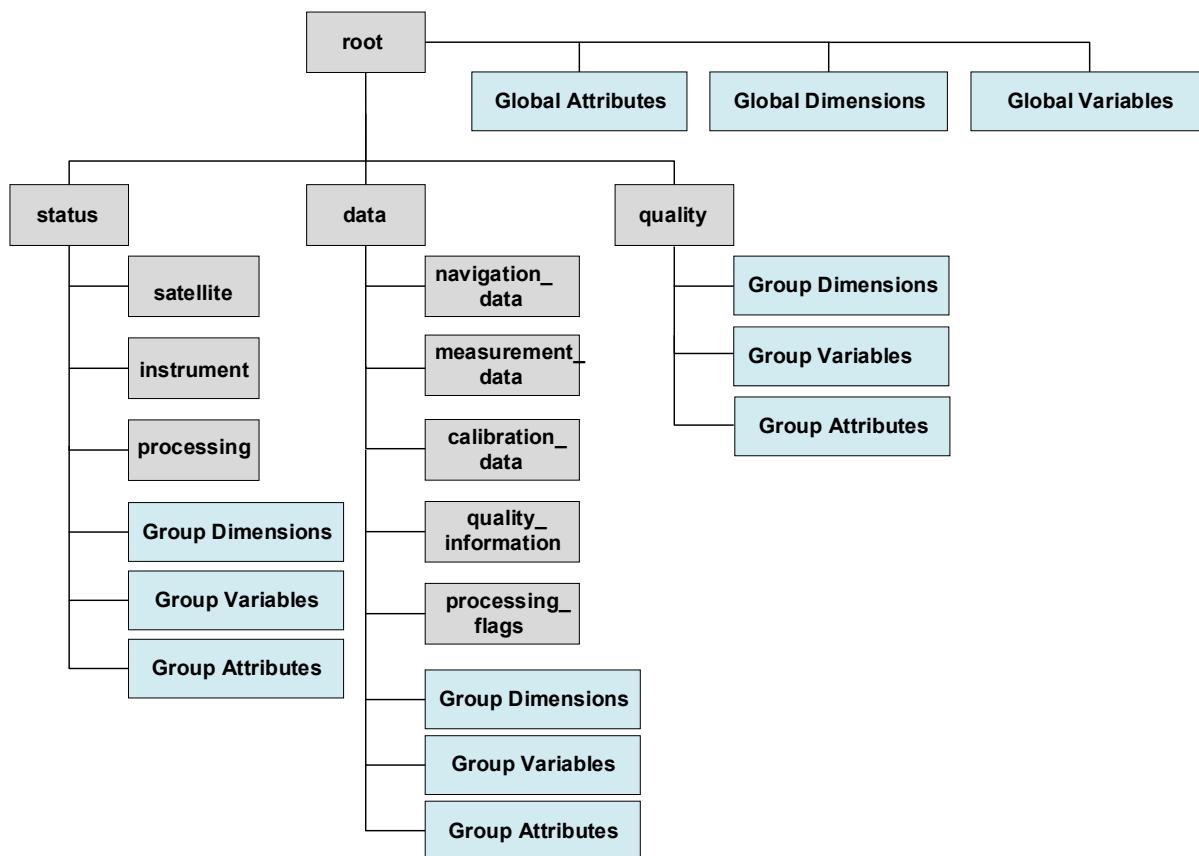


Figure 1: Overall Structure of EPS-SG ICI L1B Product.

In the following sections, the composition of the ICI L1B Spectral Radiance product is specified further.

4.2 ICI Level 1B Spectral Radiance Product

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

4.2.1 Product Summary Sheet

Table 4 provides a summary for the ICI L1B Spectral Radiance product. The ICI L1B filename is defined according to the conventions described in the [GPFS] and presented in Section 3.2 specifically for ICI.

Filename	W_XX-EUMETSAT-Darmstadt,SAT,SGB[1-3]-ICI-1B-RAD_C_EUMT_YYYYMMDDhhmmss__YYYYMMDDhhmmss_YY YYMMDDhhmmss_O_N____.nc
Product ID	ICI-1B-RAD
Product Description	TOA spectral radiances observed by the Ice Cloud Imager
Format	netCDF-4
Size (MBytes/orbit)	430.00 (see Appendix A)
Duration	To be defined in Phase C

Table 4: ICI L1B product summary sheet.

4.2.2 Group Name: root

4.2.2.1 Attributes (global)

Table 5 describes the global attributes for the ICI L1B Spectral Radiance product in accordance with [GPFS].

Attribute Name	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 as set out in Section 3.2
title	NC_STRING	ICI L1B spectral radiance
summary	NC_STRING	Product summary
doi	NC_STRING	Digital Object Identifier
keywords	NC_STRING	"ICI, Level 1B, EPS-SG, polar meteorological satellite, Metop-SG"
history	NC_STRING	("original generated product" "aggregated product" "sub-setted product")
institution	NC_STRING	"EUMETSAT"
spacecraft	NC_STRING	Metop-SG B satellites: "SGB"[1-3]
instrument	NC_STRING	"ICI"
product_level	NC_STRING	Product processing level "1B" Note: Calibrated and geolocated science data
type	NC_STRING	Character string providing an indication of the type of product:
	type	Meaning
	RAD	radiance

Attribute Name	Type	Meaning and/or value
mission_type	NC_STRING	(“Global” “Regional” “Local”)
disposition_mode	NC_STRING	<p>Identification of the type of processing (“Test” “Commissioning” “Operational” “Validation”)</p> <p>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</p>
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

Table 5: Global Attributes for the ICI L1B product.

4.2.2.2 Dimensions (global)

No common global dimensions are currently envisaged.

4.2.2.3 Variables (global)

No common global variables are currently envisaged.

4.2.3 Group Name: status

This section describes the Status Group for the ICI L1B Spectral Radiance product.

4.2.3.1 Group Name: satellite

4.2.3.1.1 satellite: Attributes

No satellite Group Attributes are currently envisaged.

4.2.3.1.2 satellite: Dimensions

Table 6 describes the satellite Group Dimensions for the ICI L1B Spectral Radiance product.

Dimension name=	Comment	Dimension length=
manoeuvre_items	Number of manoeuvres occurring between product start and end Note: (included only in case of manoeuvre)	""" $0 \leq N$

Table 6: satellite: Group Dimensions for ICI L1B product.

4.2.3.1.3 satellite: Variables

Table 7 describes the satellite Group Variables for the ICI L1B Spectral Radiance product with their specific attributes. The Cartesian Orbit State Vector fields contain the Cartesian Orbit State Vector in the Earth-Fixed ([EARTH+FIXED]) reference frame as defined in the EPS-SG Mission Conventions Document [MCSD].

Variables Name	Description	Type	Unit	Range or Value	Dimension
Orbit Parameters					
epoch_time_utc	Epoch time in UTC of the orbital elements	NC_DOUBLE	seconds since 2020-01-01 00:00:00.000	Valid_min to Valid_max	1
<i>long_name</i>	Description of variable	NC_STRING		Epoch time in UTC of the orbital elements	
<i>units</i>	Physical units	NC_STRING		seconds since 2020-01-01 00:00:00.000	
<i>Valid_min</i>	Valid minimum value	NC_DOUBLE		-1.e9	
<i>Valid_max</i>	Valid maximum value	NC_DOUBLE		1.e9	
<i>_FillValue</i>	fill value	NC_DOUBLE		-9.e9	
semi_major_axis	Semi major axis of the orbit at epoch time [TOD]	NC_DOUBLE	m	Valid_min to Valid_max	1
<i>long_name</i>	Description of variable	NC_STRING		Semi major axis of the orbit at epoch time [TOD]	
<i>units</i>	Physical units	NC_STRING		m	
<i>Valid_min</i>	Valid minimum value	NC_DOUBLE		7.19e6	
<i>Valid_max</i>	Valid maximum value	NC_DOUBLE		7.20e6	

Variables Name	Description	Type	Unit	Range or Value	Dimension
<i>_FillValue</i>	fill value	NC_DOUBLE		-9.e6	
eccentricity	Eccentricity of the orbit at epoch time [TOD]	NC_DOUBLE		Valid_min to Valid_max	1
<i>long_name</i>	Description of variable	NC_STRING		Eccentricity of the orbit at epoch time [TOD]	
<i>units</i>	Physical units	NC_STRING			
<i>Valid_min</i>	Valid minimum value	NC_DOUBLE		0.1160e-2	
<i>Valid_max</i>	Valid maximum value	NC_DOUBLE		0.1170e-2	
<i>_FillValue</i>	fill value	NC_DOUBLE		-9.e2	
inclination	Inclination of the orbit at epoch time [TOD]	NC_DOUBLE	degrees	Valid_min to Valid_max	1
<i>long_name</i>	Description of variable	NC_STRING		Inclination of the orbit at epoch time [TOD]	
<i>units</i>	Physical units	NC_STRING		degrees	
<i>Valid_min</i>	Valid minimum value	NC_DOUBLE		98.65	
<i>Valid_max</i>	Valid maximum value	NC_DOUBLE		98.75	
<i>_FillValue</i>	fill value	NC_DOUBLE		-99.	
perigee_argument	Argument of perigee of the orbit at epoch time [TOD]	NC_DOUBLE	degrees	Valid_min to Valid_max	1
<i>long_name</i>	Description of variable	NC_STRING		Argument of perigee of the orbit at epoch time [TOD]	
<i>units</i>	Physical units	NC_STRING		degrees	
<i>Valid_min</i>	Valid minimum value	NC_DOUBLE		0.	
<i>Valid_max</i>	Valid maximum value	NC_DOUBLE		360.	
<i>_FillValue</i>	fill value	NC_DOUBLE		-999.	
right_ascension	Right ascension of the orbit at epoch time [TOD]	NC_DOUBLE	degrees	Valid_min to Valid_max	1
<i>long_name</i>	Description of variable	NC_STRING		Right ascension of the orbit at epoch time [TOD]	
<i>units</i>	Physical units	NC_STRING		degrees	

Variables Name	Description	Type	Unit	Range or Value	Dimension
<i>Valid_min</i>	Valid minimum value	NC_DOUBLE		0.	
<i>Valid_max</i>	Valid maximum value	NC_DOUBLE		360.	
<i>_FillValue</i>	fill value	NC_DOUBLE		-999.	
mean_anomaly	Mean anomaly of the orbit at epoch time [TOD]	NC_DOUBLE	degrees	Valid_min to Valid_max	1
<i>long_name</i>	Description of variable	NC_STRING		Mean anomaly of the orbit at epoch time [TOD]	
<i>units</i>	Physical units	NC_STRING		degrees	
<i>Valid_min</i>	Valid minimum value	NC_DOUBLE		0.	
<i>Valid_max</i>	Valid maximum value	NC_DOUBLE		360.	
<i>_FillValue</i>	fill value	NC_DOUBLE		-999.	
earth_sun_distance_ratio	Ratio of current Earth-Sun distance to Mean Earth-Sun distance	NC_DOUBLE		Valid_min to Valid_max	1
<i>long_name</i>	Description of variable	NC_STRING		Ratio of current Earth-Sun distance to Mean Earth-Sun distance	
<i>Units</i>	Physical units	NC_STRING			
<i>Valid_min</i>	Valid minimum value	NC_DOUBLE		0.983	
<i>Valid_max</i>	Valid maximum value	NC_DOUBLE		1.017	
<i>_FillValue</i>	fill value	NC_DOUBLE		-999.	
Location Summary					
subsat_latitude_start	Latitude of sub-satellite point at start of the product	NC_DOUBLE	degrees_north	Valid_min to Valid_max	1
<i>long_name</i>	Description of variable	NC_STRING		Latitude of sub-satellite point at start of the product	
<i>Units</i>	Physical units	NC_STRING		degrees_north	
<i>Valid_min</i>	Valid minimum value	NC_DOUBLE		-90.	
<i>Valid_max</i>	Valid maximum value	NC_DOUBLE		90.	
<i>_FillValue</i>	fill value	NC_DOUBLE		-99.	

Variables Name	Description	Type	Unit	Range or Value	Dimension
subsat_longitude_start	Longitude of sub-satellite point at start of the product	NC_DOUBLE	degrees_east	Valid_min to Valid_max	1
<i>long_name</i>	Description of variable	NC_STRING		Longitude of sub-satellite point at start of the product	
<i>Units</i>	Physical units	NC_STRING		degrees_east	
<i>Valid_min</i>	Valid minimum value	NC_DOUBLE		0.	
<i>Valid_max</i>	Valid maximum value	NC_DOUBLE		360.	
<i>_FillValue</i>	fill value	NC_DOUBLE		-999.	
subsat_latitude_end	Latitude of sub-satellite point at end of the product	NC_DOUBLE	degrees_north	Valid_min to Valid_max	1
<i>long_name</i>	Description of variable	NC_STRING		Latitude of sub-satellite point at end of the product	
<i>units</i>	Physical units	NC_STRING		degrees_north	
<i>Valid_min</i>	Valid minimum value	NC_DOUBLE		-90.	
<i>Valid_max</i>	Valid maximum value	NC_DOUBLE		90.	
<i>_FillValue</i>	fill value	NC_DOUBLE		-99.	
subsat_longitude_end	Longitude of sub-satellite point at end of the product	NC_DOUBLE	degrees_east	Valid_min to Valid_max	1
<i>long_name</i>	Description of variable	NC_STRING		Longitude of sub-satellite point at end of the product	
<i>units</i>	Physical units	NC_STRING		degrees_east	
<i>Valid_min</i>	Valid minimum value	NC_DOUBLE		0.	
<i>Valid_max</i>	Valid maximum value	NC_DOUBLE		360.	
<i>_FillValue</i>	fill value	NC_DOUBLE		-999.	
State Vector and Attitude parameters					
state_vector_time_utc	Time of the state vector and attitude items	NC_DOUBLE	seconds since 2020-01-01 00:00:0.000	Valid_min to Valid_max	1

Variables Name	Description	Type	Unit	Range or Value	Dimension
<i>long_name</i>	Description of variable	NC_STRING		Time of the orbit state vector and attitude items	
<i>units</i>	Physical units	NC_STRING		seconds since 2020-01-01 00:00:00.000	
<i>Valid_min</i>	Valid minimum value	NC_DOUBLE		-1.e9	
<i>Valid_max</i>	Valid maximum value	NC_DOUBLE		1.e9	
<i>_FillValue</i>	fill value	NC_DOUBLE		-9.e9	
x_position	X position of the orbital state vector [EARTH+FIXED)	NC_DOUBLE	m	Valid_min to Valid_max	1
<i>long_name</i>	Description of variable	NC_STRING		X position of the orbital state vector [EARTH+FIXED)	
<i>units</i>	Physical units	NC_STRING		m	
<i>Valid_min</i>	Valid minimum value	NC_DOUBLE		-7.2e6	
<i>Valid_max</i>	Valid maximum value	NC_DOUBLE		7.2e6	
<i>_FillValue</i>	fill value	NC_DOUBLE		-9.e6	
y_position	Y position of the orbital state vector [EARTH+FIXED)	NC_DOUBLE	m	Valid_min to Valid_max	1
<i>long_name</i>	Description of variable	NC_STRING		Y position of the orbital state vector [EARTH+FIXED)	
<i>units</i>	Physical units	NC_STRING		M	
<i>Valid_min</i>	Valid minimum value	NC_DOUBLE		-7.2e6	
<i>Valid_max</i>	Valid maximum value	NC_DOUBLE		7.2e6	
<i>_FillValue</i>	fill value	NC_DOUBLE		-9.e6	
z_position	Z position of the orbital state vector [EARTH+FIXED)	NC_DOUBLE	m	Valid_min to Valid_max	1
<i>long_name</i>	Description of variable	NC_STRING		Z position of the orbital state vector [EARTH+FIXED)	
<i>units</i>	Physical units	NC_STRING		M	
<i>Valid_min</i>	Valid minimum value	NC_DOUBLE		-7.2e6	

Variables Name	Description	Type	Unit	Range or Value	Dimension
<i>Valid_max</i>	Valid maximum value	NC_DOUBLE		7.2e6	
<i>_FillValue</i>	fill value	NC_DOUBLE		-9.e6	
x_velocity	X velocity of the orbital state vector [EARTH+FIXED)	NC_DOUBLE	m/s	Valid_min to Valid_max	1
<i>long_name</i>	Description of variable	NC_STRING		X velocity of the orbital state vector [EARTH+FIXED)	
<i>units</i>	Physical units	NC_STRING		m/s	
<i>Valid_min</i>	Valid minimum value	NC_DOUBLE		-8.e3	
<i>Valid_max</i>	Valid maximum value	NC_DOUBLE		8.e3	
<i>_FillValue</i>	fill value	NC_DOUBLE		-9.e3	
y_velocity	Y velocity of the orbital state vector [EARTH+FIXED)	NC_DOUBLE	m/s	Valid_min to Valid_max	1
<i>long_name</i>	Description of variable	NC_STRING		Y velocity of the orbital state vector [EARTH+FIXED)	
<i>units</i>	Physical units	NC_STRING		m/s	
<i>Valid_min</i>	Valid minimum value	NC_DOUBLE		-8.e3	
<i>Valid_max</i>	Valid maximum value	NC_DOUBLE		8.e3	
<i>_FillValue</i>	fill value	NC_DOUBLE		-9.e3	
z_velocity	Z velocity of the orbital state vector [EARTH+FIXED)	NC_DOUBLE	m/s	Valid_min to Valid_max	1
<i>long_name</i>	Description of variable	NC_STRING		Z velocity of the orbital state vector [EARTH+FIXED)	
<i>units</i>	Physical units	NC_STRING		m/s	
<i>Valid_min</i>	Valid minimum value	NC_DOUBLE		-8.e3	
<i>Valid_max</i>	Valid maximum value	NC_DOUBLE		8.e3	
<i>_FillValue</i>	fill value	NC_DOUBLE		-9.e3	
yaw_error	Yaw attitude error	NC_DOUBLE	degrees	Valid_min to Valid_max	1
<i>long_name</i>	Description of variable	NC_STRING		Yaw attitude error. Note: Only applicable to L1/L2 products.	

Variables Name	Description	Type	Unit	Range or Value	Dimension
<i>units</i>	Physical units	NC_STRING		degrees	
<i>Valid_min</i>	Valid minimum value	NC_DOUBLE		0.	
<i>Valid_max</i>	Valid maximum value	NC_DOUBLE		360.	
<i>_FillValue</i>	fill value	NC_DOUBLE		-999.	
<i>roll_error</i>	Roll attitude error	NC_DOUBLE	degrees	Valid_min to Valid_max	1
<i>long_name</i>	Description of variable	NC_STRING		Roll attitude error Note: Only applicable to L1/L2 products.	
<i>units</i>	Physical units	NC_STRING		degrees	
<i>Valid_min</i>	Valid minimum value	NC_DOUBLE		0.	
<i>Valid_max</i>	Valid maximum value	NC_DOUBLE		360.	
<i>_FillValue</i>	fill value	NC_DOUBLE		-999.	
<i>pitch_error</i>	Pitch attitude error	NC_DOUBLE	degrees	Valid_min to Valid_max	1
<i>long_name</i>	Description of variable	NC_STRING		Pitch attitude error Note: Only applicable to L1/L2 products.	
<i>units</i>	Physical units	NC_STRING		degrees	
<i>Valid_min</i>	Valid minimum value	NC_DOUBLE		0.	
<i>Valid_max</i>	Valid maximum value	NC_DOUBLE		360.	
<i>_FillValue</i>	fill value	NC_DOUBLE		-999.	
Leap Second Information					

Variables Name	Description	Type	Unit	Range or Value	Dimension
leap_second_time_utc	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)"	NC_DOUBLE	seconds since 2020-01-01 00:00:00	Valid_min to Valid_max	1
<i>long_name</i>	Description of variable	NC_STRING		UTC time of occurrence of a leap second in this product (if leap second occurred in the product time window); it represents the time after the leap second occurrence (i.e. midnight of day after the leap second; no leap second results in 0)"	
<i>units</i>	Physical units	NC_STRING		seconds since 2020-01-01 00:00:00	
<i>Valid_min</i>	Valid minimum value	NC_DOUBLE		-1.e9	
<i>Valid_max</i>	Valid maximum value	NC_DOUBLE		1.e9	
<i>_FillValue</i>	fill value	NC_DOUBLE		-9.e9	
leap_second_value	Value of leap second in product (1, 0, or -1) 1 = increment, -1 = decrement	NC_SHORT	s	-1 to 1	1

Variables Name	Description	Type	Unit	Range or Value	Dimension
<i>long_name</i>	Description of variable	NC_STRING		Value of leap second in product (1, 0, or -1)	
<i>units</i>	Physical units	NC_STRING		s	
<i>Valid_min</i>	Valid minimum value	NC_SHORT		-1	
<i>Valid_max</i>	Valid maximum value	NC_SHORT		1	
<i>_FillValue</i>	fill value	NC_SHORT		-999	
Manoeuvre Information (included only in case of manoeuvre)					
manoeuvre_occurrence	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	NC_BYTE		1 or 2	manoeuvre_items
<i>long_name</i>	Description of variable	NC_STRING		Occurrence of manoeuvres between start and end times of the product (1 or 2)	
<i>Valid_min</i>	Valid minimum value	NC_BYTE		1	
<i>Valid_max</i>	Valid maximum value	NC_BYTE		2	
<i>_FillValue</i>	fill value	NC_BYTE		-9	
manoeuvre_start_time_utc	UTC time of start of manoeuvre	NC_DOUBLE	seconds since 2020-01-01 00:00:00.000	Valid_min to Valid_max	manoeuvre_items
<i>long_name</i>	Description of variable	NC_STRING		UTC time of start of manoeuvre	

Variables Name	Description	Type	Unit	Range or Value	Dimension
<i>units</i>	Physical units	NC_STRING		seconds since 2020-01-01 00:00:00.000	
<i>Valid_min</i>	Valid minimum value	NC_DOUBLE		-1.e9	
<i>Valid_max</i>	Valid maximum value	NC_DOUBLE		1.e9	
<i>_FillValue</i>	fill value	NC_DOUBLE		-9.e9	
manoeuvre_end_time_utc	UTC time of end of manoeuvre	NC_DOUBLE	seconds since 2020-01-01 00:00:00.000	Valid_min to Valid_max	manoeuvre_items
<i>long_name</i>	Description of variable	NC_STRING		UTC time of end of manoeuvre	
<i>units</i>	Physical units	NC_STRING		seconds since 2020-01-01 00:00:00.000	
<i>Valid_min</i>	Valid minimum value	NC_DOUBLE		-1.e9	
<i>Valid_max</i>	Valid maximum value	NC_DOUBLE		1.e9	
<i>_FillValue</i>	fill value	NC_DOUBLE		-9.e9	

Table 7: satellite: Variables for ICI L1B product.

4.2.3.2 Group Name: instrument

4.2.3.2.1 instrument: Attributes

No instrument Group Attributes are foreseen for the ICI L1B Spectral Radiance product.

4.2.3.2.2 instrument: Dimensions

This section describes the instrument Group Dimensions. Table 8 describes the instrument group Dimensions for the ICI 1B Spectral Radiance product.

Dimension name=	Comment	Dimension length=
mode_items	Number of modes the instrument assumed during product duration	,,, 1 ≤ N

Table 8: Instrument: Dimensions for ICI L1B product.

4.2.3.2.3 instrument: Variables

Table 9 describes the instrument group variables for the ICI L1B Spectral Radiance product with their specific attributes.

Variable name=	Data Type type=	Attribute name="long_name" value=	Attribute name="units" value=
Instrument Modes shape=mode_items			
mode_start_time_utc	NC_DOUBLE	“Start time of the mode”	“seconds since 2020-01-01 00:00:00.000”
mode_end_time_utc	NC_DOUBLE	“End time of the mode”	“seconds since 2020-01-01 00:00:00.000”
instrument_mode	NC_STRING	“Name of the instrument mode assumed” Note: valid modes are provided in [L0PFS]	“”

Table 9: instrument: Variables for ICI L1B product.

4.2.3.3 Group Name: processing

4.2.3.3.1 processing: Attributes

This section describes the processing Group Attributes for the ICI L1B Spectral Radiance product.

Attribute Name	Description	Type	Meaning and/or value
processor_name	Name of the product processor	NC_STRING	“ICI_L1B”
processor_version	Version number of the processor	NC_STRING	“v[n]”
processing_mode	Processing mode in which the product was generated: (“NRT” “Reprocessing”)	NC_STRING	“NRT” or “Reprocessing”
format_version	Product format version control number	NC_STRING	Refer to Table 32.
pgs_reference_and_version	Reference and version of the PGS	NC_STRING	“ EUM/LEO-EPSSG/SPE/14/756250 v[n]”
pfs_reference_and_version	Reference and version of the PFS	NC_STRING	“EUM/LEO-EPSSG/SPE/14/771723 v[n]”
atbd_reference_and_version	Reference and version of the ATBD	NC_STRING	“EUM/LEO-EPSSG/SPE/13/716156 v[n]”

Attribute Name	Description	Type	Meaning and/or value
source	It is 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	NC_STRING	Input Data – ICI LO File, NAVATT LO File, Input Auxiliary Data – ICI_1B_AUX_CNF_ ICI_1B_AUX_CCDB ICI_1B_AUX_DEM_ ICI_1B_AUX_LSM_ ICI_1B_AUX_APCM _____AUX_IBA_ _____AUX_POFD

Table 10: processing: Group Attributes for ICI L1B product.

4.2.3.3.2 processing: Dimensions

No common processing group dimensions are currently envisaged for the ICI L1B Spectral Radiance product.

4.2.3.3.3 processing: Variables

Table 11 describes the processing group Variables for the ICI L1B Spectral Radiance product with their specific attributes.

Variable name=	Type	Meaning	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 00:00:00.000”

Table 11: processing: Variables for ICI L1B product.

4.2.4 Group Name: data

The data Group Dimensions for the ICI L1B Spectral Radiance product are listed in Table 12.

Dimension Name	Description	Range or Value
n_scan	Number of scans in the product	[0-9999] (according to granule size selected)
n_channels	Number of channels of the ICI instrument including V and H polarization	13
n_samples	Number of Earth's samples for each channel per scan	784 [TBC]
n_cold_samples	Number of cold samples per scan	52 [TBC]
n_warm_samples	Number of warm samples per scan	33 [TBC]

Table 12: data: Dimensions for ICI L1B product.

4.2.4.1 Group Name: `navigation_data`

4.2.4.1.1 `navigation_data`: Attributes

Table 13 describes the `navigation_data` Attributes of the ICI L1B Spectral Radiance product.

Attribute	Description	Type	Range or Value
<code>sun_glint_angle_threshold</code>	Threshold for the sun, for which the data are flagged with sun glint.	NC_STRING	“2.0 2.0”
<code>moon_angle_threshold</code>	Threshold for the difference between the Moon angle and the antenna space view position, for which the data are flagged for moon intrusion in the cold space view.	NC_STRING	“2.0 2.0 2.0 2.0 2.0 2.0 2.0 2.0”
<code>undersampling_step_along_scan</code>	Spatially sub-sampled factor along scan for several geolocation variables (longitude, latitude, solar zenith, solar azimuth, observation zenith and observation azimuth)	NC_SHORT	5 [TBC]
<code>undersampling_step_last_samples</code>	Spatially sub-sampled factor between last two samples of scan for several geolocation variables (longitude, latitude, solar zenith, solar azimuth, observation zenith and observation azimuth)	NC_SHORT	3 [TBC]

Table 13: navigation data: Attributes for ICI L1B product.

4.2.4.1.2 `navigation_data`: Dimensions

The `navigation_data` Group Dimensions for the ICI L1B Spectral Radiance product are listed in Table 14.

Dimension Name	Description	Range or Value
<code>n_sun_glint_channels</code>	Number of ICI channels with sun glint angle calculation ICI channels at 243 GHz V and H: 1=ICI-4 V; 2=ICI-4 H	2
<code>n_horns</code>	Number of horns of the ICI instrument	7
<code>n_subs</code>	Number of samples at undersampled locations, along scan	158 [TBC]

Table 14: navigation_data: Dimensions for ICI L1B product

4.2.4.1.3 navigation_data: Variables

The navigation_data Group Variables for the ICI L1B Spectral Radiance product are described in Table 15 with their specific attributes. Colours are used to differentiate variable and attributes: variables in light blue and attributes in white with name right-aligned in *italics*. Latitude, longitude, OZA, azimuth, solar zenith and azimuth angusing the factors specified in the undersampling_step_along_scan and undersampling_step_last_samples attributes in Table 13. This is a strategy aiming at reducing the final size of the product reconstructing the geolocation information using the interpolation method presented in Appendix D.

Variables Name	Description	Type	Range or Value	Dimension
time_start_scan_utc	UTC time of start of Earth view scan	NC_DOUBLE	valid_min to valid_max	n_scan
<i>long_name</i>	Description of variable	NC_STRING	“UTC time of start of Earth view scan”	
<i>units</i>	Physical units	NC_STRING	“seconds since 2020-01-01 00:00:00.000”	
<i>valid_min</i>	minimum time	NC_DOUBLE	-1.e9	
<i>valid_max</i>	maximum time	NC_DOUBLE	1.e9	
<i>FillValue</i>	missing time value	NC_DOUBLE	-9.e9	
latitude	Geodetic latitude	NC_INT	valid_min to valid_max	n_scan, n_subs, n_horns
<i>long_name</i>	Description of the variable	NC_STRING	“geodetic latitude at subsampled location”	
<i>units</i>	Physical units	NC_STRING	“degrees north”	
<i>scale_factor</i>	Scale factor applied	NC_FLOAT	1.e-4	
<i>add_offset</i>	Offset applied	NC_FLOAT	0.0	
<i>valid_min</i>	Valid minimum value	NC_INT	-900000	
<i>valid_max</i>	Valid maximum value	NC_INT	900000	
<i>FillValue</i>	Fill value	NC_INT	-2 ³¹	
longitude	Geodetic longitude	NC_INT	valid_min to valid_max	n_scan, n_subs, n_horns
<i>long_name</i>	Description of the variable	NC_STRING	“geodetic longitude at subsampled location”	
<i>units</i>	Physical units	NC_STRING	“degrees east”	
<i>scale_factor</i>	Scale factor applied	NC_FLOAT	10 ⁻⁴	
<i>add_offset</i>	Offset applied	NC_FLOAT	0.0	
<i>valid_min</i>	Valid minimum value	NC_INT	-1800000	
<i>valid_max</i>	Valid maximum value	NC_INT	1800000	
<i>FillValue</i>	Fill value	NC_INT	-2 ³¹	

Variables Name	Description	Type	Range or Value	Dimension
ici_oza	ICI Observation Zenith Angle (incidence angle) at subsampled location	NC_SHORT	valid_min to valid_max	n_scan, n_subs, n_horns
<i>long_name</i>	Description of variable	NC_STRING	“ICI observation zenith angle at subsampled_location”	
<i>units</i>	Physical units	NC_STRING	“degrees”	
<i>scale_factor</i>	Scale factor applied	NC_FLOAT	1.e-2	
<i>add_offset</i>	Offset applied	NC_FLOAT	0.0	
<i>valid_min</i>	Valid minimum value	NC_SHORT	0	
<i>valid_max</i>	Valid maximum value	NC_SHORT	9000	
<i>FillValue</i>	fill value	NC_SHORT	-32768	
ici_azimuth	ICI azimuth angle	NC USHORT	valid_min to valid_max	n_scan, n_subs, n_horns
<i>long_name</i>	Description of variable	NC_STRING	“ICI observation azimuth angle at subsampled location”	
<i>units</i>	Physical units	NC_STRING	“degrees”	
<i>scale_factor</i>	Scale factor applied	NC_FLOAT	1.e-2	
<i>add_offset</i>	Offset applied	NC_FLOAT	0.0	
<i>valid_min</i>	Valid minimum value	NC USHORT	0	
<i>valid_max</i>	Valid maximum value	NC USHORT	36000	
<i>FillValue</i>	fill value	NC USHORT	65535	
land_fraction	Land fraction	NC_UBYTE	valid_min to valid_max	n_scan, n_samples, n_horns
<i>long_name</i>	Description of variable	NC_STRING	“Fraction of pixel covered by land”	
<i>scale_factor</i>	Scale factor applied	NC_FLOAT	0.01	
<i>add_offset</i>	Offset applied	NC_FLOAT	0.0	
<i>valid_min</i>	Valid minimum value	NC_UBYTE	0	
<i>valid_max</i>	Valid maximum value	NC_UBYTE	100	
<i>FillValue</i>	Fill value	NC_UBYTE	255	
ici_terrain_elevation	Average terrain elevation	NC_SHORT	valid_min to valid_max	n_scan, n_samples, n_horns
<i>long_name</i>	Description of variable	NC_STRING	“Average terrain elevation above reference ellipsoid”	
<i>units</i>	Physical units	NC_STRING	“metres”	
<i>scale_factor</i>	Scale factor applied	NC_FLOAT	1.0	
<i>add_offset</i>	Offset applied	NC_FLOAT	0.0	

Variables Name	Description	Type	Range or Value	Dimension
<i>valid_min</i>	Valid minimum value	NC_SHORT	-500	
<i>valid_max</i>	Valid maximum value	NC_SHORT	10000	
<i>FillValue</i>	Fill value	NC_SHORT	-32768	
<i>delta_latitude</i>	Parallax latitude shift	NC_SHORT	valid_min to valid_max	n_scan, n_samples, n_horns
<i>long_name</i>	Description of variable	NC_STRING	“Distance between latitude obtained using DEM and latitude on ellipsoid”	
<i>units</i>	Physical units	NC_STRING	“metres”	
<i>scale_factor</i>	Scale factor applied	NC_FLOAT	1.0	
<i>add_offset</i>	Offset applied	NC_FLOAT	0.0	
<i>valid_min</i>	Valid minimum value	NC_SHORT	-32767	
<i>valid_max</i>	Valid maximum value	NC_SHORT	32767	
<i>FillValue</i>	Fill value	NC_SHORT	-32768	
<i>delta_longitude</i>	Parallax longitude shift	NC_SHORT	valid_min to valid_max	n_scan, n_samples, n_horns
<i>long_name</i>	Description of variable	NC_STRING	“Distance between longitude obtained using DEM and longitude on ellipsoid”	
<i>units</i>	Physical units	NC_STRING	“metres”	
<i>scale_factor</i>	Scale factor applied	NC_FLOAT	1.0	
<i>add_offset</i>	Offset applied	NC_FLOAT	0.0	
<i>valid_min</i>	Valid minimum value	NC_SHORT	-32767	
<i>valid_max</i>	Valid maximum value	NC_SHORT	32767	
<i>FillValue</i>	Fill value	NC_SHORT	-32768	
<i>orbit_angle</i>	Angular position in the orbit, starting at zero when the satellite crosses the solar Ecliptic plane northbound.	NC_INT	valid_min to valid_max	n_scan
<i>long_name</i>	Description of variable	NC_STRING	“Angular position in the orbit, starting at zero when the satellite crosses the solar Ecliptic plane northbound”	
<i>units</i>	Physical units	NC_STRING	“degrees”	
<i>scale_factor</i>	Scale factor applied	NC_FLOAT	10^{-4}	

Variables Name	Description	Type	Range or Value	Dimension
<i>Valid_min</i>	Valid minimum value	NC_FLOAT	0.0	
<i>Valid_max</i>	Valid maximum value	NC_INT	3600000	
<i>FillValue</i>	Fill value	NC_INT	-2 ³¹	
spacecraft_altitude	Spacecraft altitude above reference ellipsoid	NC_SHORT	valid_min to valid_max	n_scan
<i>long_name</i>	Description of variable	NC_STRING	“Spacecraft altitude above reference ellipsoid”	
<i>units</i>	Physical units	NC_STRING	“km”	
<i>scale_factor</i>	Scale factor applied	NC_FLOAT	10 ⁻¹	
<i>add_offset</i>	Offset applied	NC_FLOAT	0.0	
<i>valid_min</i>	Valid minimum value	NC_SHORT	4000	
<i>Valid_max</i>	Valid maximum value	NC_SHORT	20000	
<i>FillValue</i>	Fill value	NC_SHORT	-32768	
latitude_ssp	Latitude of sub-satellite point	NC_INT	valid_min to valid_max	n_scan
<i>long_name</i>	Description of the variable	NC_STRING	“geodetic latitude of sub-satellite point at scan start”	
<i>units</i>	Physical units	NC_STRING	“degrees north”	
<i>scale_factor</i>	Scale factor applied	NC_FLOAT	10 ⁻⁴	
<i>add_offset</i>	Offset applied	NC_FLOAT	0.0	
<i>valid_min</i>	Valid minimum value	NC_INT	-900000	
<i>valid_max</i>	Valid maximum value	NC_INT	900000	
<i>FillValue</i>	Fill value	NC_INT	-2 ³¹	
longitude_ssp	Longitude of sub-satellite point	NC_INT	valid_min to valid_max	n_scan
<i>long_name</i>	Description of the variable	NC_STRING	“geodetic longitude of sub-satellite point at scan start”	
<i>units</i>	Physical units	NC_STRING	“degrees east”	
<i>scale_factor</i>	Scale factor applied	NC_FLOAT	10 ⁻⁴	
<i>add_offset</i>	Offset applied	NC_FLOAT	0.0	
<i>valid_min</i>	Valid minimum value	NC_INT	-1800000	
<i>valid_max</i>	Valid maximum value	NC_INT	1800000	
<i>FillValue</i>	Fill value	NC_INT	-2 ³¹	
ici_roll_angle	Roll angle between nominal yaw steering and instrument reference frame	NC_SHORT	valid_min to valid_max	n_scan

Variables Name	Description	Type	Range or Value	Dimension
<i>long_name</i>	Description of variable	NC_STRING	“Roll angle between nominal yaw steering and instrument reference frame”	
<i>units</i>	Physical units	NC_STRING	degrees	
<i>scale_factor</i>	Scale factor applied	NC_FLOAT	10^{-3}	
<i>add_offset</i>	Offset applied	NC_FLOAT	0.0	
<i>valid_min</i>	Valid minimum value	NC_SHORT	$-2^{15} + 1$	
<i>valid_max</i>	Valid maximum value	NC_SHORT	$2^{15} - 1$	
<i>Fillvalue</i>	Fill value	NC_SHORT	-2^{15}	
<i>ici_pitch_angle</i>	Pitch angle between nominal yaw steering and instrument reference frame	NC_SHORT	valid_min to valid_max	n_scan
<i>long_name</i>	Description of variable	NC_STRING	“Pitch angle between nominal yaw steering and instrument reference frame”	
<i>units</i>	Physical units	NC_STRING	degrees	
<i>scale_factor</i>	Scale factor applied	NC_FLOAT	10^{-3}	
<i>add_offset</i>	Offset applied	NC_FLOAT	0.0	
<i>valid_min</i>	Valid minimum value	NC_SHORT	$-2^{15} + 1$	
<i>valid_max</i>	Valid maximum value	NC_SHORT	$2^{15} - 1$	
<i>Fillvalue</i>	Fill value	NC_SHORT	-2^{15}	
<i>ici_yaw_angle</i>	Yaw angle between nominal yaw steering and instrument reference frame	NC_SHORT	valid_min to valid_max	n_scan
<i>long_name</i>	Description of variable	NC_STRING	“Yaw angle between nominal yaw steering and instrument reference frame”	
<i>units</i>	Physical units	NC_STRING	degrees	
<i>scale_factor</i>	Scale factor applied	NC_FLOAT	10^{-3}	
<i>add_offset</i>	Offset applied	NC_FLOAT	0.0	
<i>valid_min</i>	Valid minimum value	NC_SHORT	$-2^{15} + 1$	
<i>valid_max</i>	Valid maximum value	NC_SHORT	$2^{15} - 1$	
<i>Fillvalue</i>	Fill value	NC_SHORT	-2^{15}	
<i>sun_glint_angle</i>	Sun glint angle for channels ICI-4 V and ICI-4 H	NC USHORT	valid_min to valid_max	n_scan, n_samples, n_sun_glint_channels

Variables Name	Description	Type	Range or Value	Dimension
<i>long_name</i>	Description of variable	NC_STRING	“Sun glint angle for channels ICI-4 V and ICI-4 H”	
<i>units</i>	Physical units	NC_STRING	“degrees”	
<i>scale_factor</i>	Scale factor applied	NC_FLOAT	1.e-2	
<i>add_offset</i>	Offset applied	NC_FLOAT	0.0	
<i>valid_min</i>	Valid minimum value	NC USHORT	0	
<i>valid_max</i>	Valid maximum value	NC USHORT	18000	
<i>FillValue</i>	Fill value	NC USHORT	65535	
<i>sun_elevation_angle</i>	Sun elevation in the instrument reference frame	NC_SHORT	valid_min to valid_max	n_scan
<i>long_name</i>	Description of variable	NC_STRING	“Sun elevation angle in the instrument reference frame”	
<i>units</i>	Physical units	NC_STRING	“degrees”	
<i>scale_factor</i>	Scale factor applied	NC_FLOAT	1.e-2	
<i>add_offset</i>	Offset applied	NC_FLOAT	0.0	
<i>valid_min</i>	Valid minimum value	NC_SHORT	-9000	
<i>valid_max</i>	Valid maximum value	NC_SHORT	9000	
<i>Fillvalue</i>	Fill value	NC_SHORT	-32768	
<i>sun_azimuth_angle</i>	Sun azimuth in the instrument reference frame	NC USHORT	valid_min to valid_max	n_scan
<i>long_name</i>	Description of variable	NC_STRING	“Sun azimuth angle in the instrument reference frame”	
<i>units</i>	Physical units	NC_STRING	“degrees”	
<i>scale_factor</i>	Scale factor applied	NC_FLOAT	1.e-2	
<i>add_offset</i>	Offset applied	NC_FLOAT	0.0	
<i>valid_min</i>	Valid minimum value	NC USHORT	0	
<i>valid_max</i>	Valid maximum value	NC USHORT	36000	
<i>Fillvalue</i>	Fill value	NC USHORT	65535	
<i>ici_solar zenith angle</i>	ICI Solar zenith angle	NC USHORT	valid_min to valid_max	n_scan, n_subs, n_horns
<i>long_name</i>	Description of variable	NC_STRING	“Solar zenith angle at ICI subsampled locations”	
<i>units</i>	Physical units	NC_STRING	“degrees”	
<i>scale_factor</i>	Scale factor applied	NC_FLOAT	1.e-2	
<i>add_offset</i>	Offset applied	NC_FLOAT	0.0	

Variables Name	Description	Type	Range or Value	Dimension
<i>valid_min</i>	Valid minimum value	NC USHORT	0	
<i>valid_max</i>	Valid maximum value	NC USHORT	18000	
<i>FillValue</i>	Fill value	NC USHORT	65535	
<i>ici_solar_azimuth_angle</i>	ICI Solar azimuth angle	NC USHORT	valid_min to valid_max	n_scan, n_subs, n_horns
<i>long_name</i>	Description of variable	NC STRING	“Solar azimuth angle at ICI subsampled locations”	
<i>units</i>	Physical units	NC STRING	“degrees”	
<i>scale_factor</i>	Scale factor applied	NC FLOAT	10 ⁻²	
<i>add_offset</i>	Offset applied	NC FLOAT	0.0	
<i>valid_min</i>	Valid minimum value	NC USHORT	0	
<i>valid_max</i>	Valid maximum value	NC USHORT	36000	
<i>FillValue</i>	fill value	NC USHORT	65535	
<i>moon_angle</i>	Angle between the unit vector centred on the Moon and directed to the satellite and the unit vector pointing in the boresight direction of the Space View Reflector	NC USHORT	valid_min to valid_max	n_scan, n_cold_samples, n_horns
<i>long_name</i>	Description of variable	NC STRING	“Angle between Moon and individual space views”	
<i>units</i>	Physical units	NC STRING	“degrees”	
<i>scale_factor</i>	Scale factor applied	NC FLOAT	1.e-2	
<i>add_offset</i>	Offset applied	NC FLOAT	0.0	
<i>valid_min</i>	Valid minimum value	NC USHORT	0	
<i>valid_max</i>	Valid maximum value	NC USHORT	18000	
<i>Fill_value</i>	Fill value	NC USHORT	65535	

Table 15: navigation_data: Variables for ICI L1B product.

4.2.4.2 Group Name: measurement_data

4.2.4.2.1 measurement_data: Attributes

No measurement_data Group Attributes for the ICI L1B Spectral Radiance product are currently envisaged.

4.2.4.2.2 measurement_data: Dimensions

The measurement_data Group Dimensions for the ICI L1B Spectral Radiance product are listed in Table 16.

Dimension Name	Description	Range or Value
nedt_values	NEDT index for cold and warm target 1=warm target 2=cold target	2
n_183	number of 183 GHz channels (1 =ICI-1, 2 =ICI-2, 3=ICI-3)	3
n_243	number of 243 GHz channels (1 =V, 2 =H)	2
n_325	number of 325 GHz channels (1 =ICI-5, 2 =ICI-6, 3=ICI-7)	3
n_448	number of 448 GHz channels (1 =ICI-8, 2 =ICI-9, 3=ICI-10)	3
n_664	number of 664 GHz channels (1 =V, 2 =H)	2

Table 16: measurement_data: Dimensions for ICI L1B product.

4.2.4.2.3 measurement_data: Variables

The measurement_data Group Variables for the ICI L1B Spectral Radiance product are described in Table 17 with their specific attributes. Colours are used to differentiate variable and attributes: variables in light blue and attributes in white with name right-aligned in *italics*.

Variables Name	Description	Type	Range or Value	Dimension
ici_radiance_183	ICI Radiances of channels ICI-1 ICI-2 and ICI-3	NC USHORT	valid_min to valid_max	n_scan, n_samples, n_183
<i>long_name</i>	Description of variable	NC STRING	“ICI spectral radiances of channels at 183.31 GHz”	
<i>units</i>	Physical units	NC STRING	“mW·m ⁻² ·sr ⁻¹ ·(cm ⁻¹) ⁻¹ ”	
<i>scale_factor</i>	Scale factor applied	NC DOUBLE	1.51e-06	
<i>add_offset</i>	Offset applied	NC DOUBLE	0.008	
<i>valid_min</i>	Valid minimum value	NC USHORT	0	
<i>valid_max</i>	Valid maximum value	NC USHORT	65534	
<i>Fill_value</i>	missing value	NC USHORT	65535	

Variables Name	Description	Type	Range or Value	Dimension
ici_radiance_243	ICI Radiances of channels ICI-4 V and ICI-4 H	NC USHORT	valid_min to valid_max	n_scan, n_samples, n_243
<i>long_name</i>	Description of variable	NC STRING	“ICI spectral radiances of channels at 243.2 GHz”	
<i>units</i>	Physical units	NC STRING	“mW·m ⁻² ·sr ⁻¹ ·(cm ⁻¹) ⁻¹ ”	
<i>scale_factor</i>	Scale factor applied	NC DOUBLE	2.66e-6	
<i>add_offset</i>	Offset applied	NC DOUBLE	0.013	
<i>valid_min</i>	Valid minimum value	NC USHORT	0	
<i>valid_max</i>	Valid maximum value	NC USHORT	65534	
<i>Fill_value</i>	missing value	NC USHORT	65535	
ici_radiance_325	ICI Radiances of channels ICI-5 ICI-6 and ICI-7	NC USHORT	valid_min to valid_max	n_scan, n_samples, n_325
<i>long_name</i>	Description of variable	NC STRING	“ICI spectral radiances of channels at 325.15 GHz”	
<i>units</i>	Physical units	NC STRING	“mW·m ⁻² ·sr ⁻¹ ·(cm ⁻¹) ⁻¹ ”	
<i>scale_factor</i>	Scale factor applied	NC DOUBLE	4.75e-06	
<i>add_offset</i>	Offset applied	NC DOUBLE	0.022	
<i>valid_min</i>	Valid minimum value	NC USHORT	0	
<i>valid_max</i>	Valid maximum value	NC USHORT	65534	
<i>Fill_value</i>	missing value	NC USHORT	65535	
ici_radiance_448	ICI Radiances of channels ICI-8 ICI-9 and ICI-10	NC USHORT	valid_min to valid_max	n_scan, n_samples, n_448
<i>long_name</i>	Description of variable	NC STRING	“ICI spectral radiances of channels at 448 GHz”	
<i>units</i>	Physical units	NC STRING	“mW·m ⁻² ·sr ⁻¹ ·(cm ⁻¹) ⁻¹ ”	
<i>scale_factor</i>	Scale factor applied	NC DOUBLE	8.99e-06	
<i>add_offset</i>	Offset applied	NC DOUBLE	0.038	
<i>valid_min</i>	Valid minimum value	NC USHORT	0	
<i>valid_max</i>	Valid maximum value	NC USHORT	65534	
<i>Fill_value</i>	missing value	NC USHORT	65535	

Variables Name	Description	Type	Range or Value	Dimension
ici_radiance_664	ICI Radiances of channels ICI-11 V and ICI-11 H	NC USHORT	valid_min to valid_max	n_scan, n_samples, n_664
<i>long_name</i>	Description of variable	NC STRING	“ICI spectral radiances of channels at 664 GHz”	
<i>units</i>	Physical units	NC STRING	“mW·m ⁻² ·sr ⁻¹ ·(cm ⁻¹) ⁻¹ ”	
<i>scale_factor</i>	Scale factor applied	NC DOUBLE	1.97e-5	
<i>add_offset</i>	Offset applied	NC DOUBLE	0.068	
<i>valid_min</i>	Valid minimum value	NC USHORT	0	
<i>valid_max</i>	Valid maximum value	NC USHORT	65534	
<i>_Fill_value</i>	missing value	NC USHORT	65535	
ici_nedt	NEΔT	NC SHORT	valid_min to valid_max	n_scan, n_channels, nedt_values
<i>long_name</i>	Description of variable	NC STRING	“ICI channels radiometric sensitivity based on OBCT and cold view measurements”	
<i>units</i>	NEΔT units	NC STRING	“K”	
<i>scale_factor</i>	Scale factor applied	NC FLOAT	1.e-3	
<i>add_offset</i>	Offset applied	NC FLOAT	0.0	
<i>valid_min</i>	Valid minimum value	NC SHORT	0	
<i>valid_max</i>	Valid maximum value	NC SHORT	30000	
<i>_Fill_value</i>	missing value	NC SHORT	-32768	
bt_conversion_a	Band correction factor slope	NC DOUBLE		n_channels
<i>long_name</i>	Description of variable	NC STRING	“Brightness temperature conversion coefficient A”	
<i>units</i>	Physical units	NC STRING	“”	
bt_conversion_b	Band correction factor constant	NC DOUBLE		n_channels
<i>long_name</i>	Description of variable	NC STRING	“Brightness temperature conversion coefficient B”	
<i>units</i>	Physical units	NC STRING	“K”	

Variables Name	Description	Type	Range or Value	Dimension
centre_wavenumber	Channel centre wavenumber	NC_DOUBLE		n_channels
long_name	Description of variable	NC_STRING	“ICI channels centre frequency wavenumber”	
units	Physical units	NC_STRING	“cm-1”	

Table 17: measurement_data: Variables for ICI L1B product.

4.2.4.3 Group Name: calibration_data

4.2.4.3.1 calibration_data: Attributes

This section describes the calibration_data Group Attributes for the ICI L1B Spectral Radiance product. Common group attributes are provided in Table 18.

Attribute name	Description	Type	Range or Value
antenna_correction_version	Version of the antenna pattern correction	NC_STRING	v[1 – 1000]

Table 18: calibration_data: Attributes for ICI L1B product.

4.2.4.3.2 calibration_data: Dimensions

The calibration_data Group Dimensions for the ICI L1B Spectral Radiance product is presented in Table 19.

Dimension Name	Description	Range or Value
n_prt_s_obct	number of PRTs in the OBCT	3 [TBC]
n_samples_prt_s_obct	number of samples of each PRT in the OBCT	6 [TBC]
n_prt_s_svr	number of PRTs in the SVR	3 [TBC]
n_samples_prt_s_svr	number of samples of each PRT in the SVR	8 [TBC]
n_prt_s_mr	number of PRTs in the MR	3 [TBC]
n_prt_s_ss	number of PRTs in the sun shield structure	3 [TBC]
n_thms_be	number of PRTs Back-end 1	5 [TBC]
n_thms_fe	number of PRTs Front-end	2 [TBC]
n_prt_s_irp	number of PRTs Instrument Rotating Part	2 [TBC]

Dimension Name	Description	Range or Value
n_prt_s_ifp	number of PRTs Instrument Fixed Part	3 [TBC]
n_183	number of 183 GHz channels (1 =ICI-1, 2 =ICI-2, 3=ICI-3)	3
n_243	number of 243 GHz channels (1 =V, 2 =H)	2
n_325	number of 325 GHz channels (1 =ICI-5, 2 =ICI-6, 3=ICI-7)	3
n_448	number of 448 GHz channels (1 =ICI-8, 2 =ICI-9, 3=ICI-10)	3
n_664	number of 664 GHz channels (1 =V, 2 =H)	2

Table 19: Calibration Data: Dimensions for ICI L1B product.

4.2.4.3.3 Calibration Data: Variables

The calibration_data Group Variables for the ICI L1B Spectral Radiance product are described in Table 20 with their specific attributes. Colours are used to differentiate variable and attributes: variables in light blue and attributes in white with name right-aligned in *italics*.

Variables Name	Description	Type	Range or Value	Dimension
ici_sidelobe_18 3	Antenna sidelobe correction for channels ICI-1, ICI-2 and ICI-3	NC_UBYTE	valid_min to valid_max	n_scan, n_samples, n_183
<i>long_name</i>	Description of variable	NC_STRING	“Sidelobe antenna temperature correction for ICI-I ICI-2 and ICI-3”	
<i>units</i>	Physical units	NC_STRING	“K”	
<i>scale_factor</i>	Scale factor applied	NC_FLOAT	0.02	
<i>add_offset</i>	Offset applied	NC_FLOAT	0.0	
<i>valid_min</i>	Valid minimum value	NC_UBYTE	0	
<i>valid_max</i>	Valid maximum value	NC_UBYTE	254	
<i>FillValue</i>	Fill value	NC_UBYTE	255	
ici_sidelobe_24 3	Antenna sidelobe correction in V and H polarisation for channel ICI-4	NC_UBYTE	valid_min to valid_max	n_scan, n_samples, n_243
<i>long_name</i>	Description of variable	NC_STRING	“Sidelobe antenna temperature correction for ICI-4 V and ICI-4 H”	
<i>units</i>	Physical units	NC_STRING	“K”	
<i>scale_factor</i>	Scale factor applied	NC_FLOAT	0.02	

Variables Name	Description	Type	Range or Value	Dimension
<i>add_offset</i>	Offset applied	NC_FLOAT	0.0	
<i>valid_min</i>	Valid minimum value	NC_UBYTE	0	
<i>valid_max</i>	Valid maximum value	NC_UBYTE	254	
<i>FillValue</i>	Fill value	NC_UBYTE	255	
ici_sidelobe_32_5	Antenna sidelobe correction in V polarisation for channels ICI-5 to ICI-7	NC_UBYTE	valid_min to valid_max	n_scan, n_samples, n_325
<i>long_name</i>	Description of variable	NC_STRING	“Sidelobe antenna temperature correction for ICI-5 ICI-6 and ICI-7”	
<i>units</i>	Physical units	NC_STRING	“K”	
<i>scale_factor</i>	Scale factor applied	NC_FLOAT	0.02	
<i>add_offset</i>	Offset applied	NC_FLOAT	0.0	
<i>valid_min</i>	Valid minimum value	NC_UBYTE	0	
<i>valid_max</i>	Valid maximum value	NC_UBYTE	254	
<i>FillValue</i>	Fill value	NC_UBYTE	255	
ici_sidelobe_44_8	Antenna sidelobe correction in V polarisation for channels ICI-8 to ICI-10	NC_UBYTE	valid_min to valid_max	n_scan, n_samples, n_448
<i>long_name</i>	Description of variable	NC_STRING	“Sidelobe antenna temperature correction for ICI-8 ICI-9 and ICI-10”	
<i>units</i>	Physical units	NC_STRING	“K”	
<i>scale_factor</i>	Scale factor applied	NC_FLOAT	0.02	
<i>add_offset</i>	Offset applied	NC_FLOAT	0.0	
<i>valid_min</i>	Valid minimum value	NC_UBYTE	0	
<i>valid_max</i>	Valid maximum value	NC_UBYTE	254	
<i>FillValue</i>	Fill value	NC_UBYTE	255	
ici_sidelobe_66_4	Antenna sidelobe correction in V and H polarisation for channel ICI-11	NC_UBYTE	valid_min to valid_max	n_scan, n_samples, n_664
<i>long_name</i>	Description of variable	NC_STRING	“Sidelobe antenna temperature correction for channels ICI-11 V and H”	
<i>units</i>	Physical units	NC_STRING	“K”	
<i>scale_factor</i>	Scale factor applied	NC_FLOAT	0.02	
<i>add_offset</i>	Offset applied	NC_FLOAT	0.0	
<i>valid_min</i>	Valid minimum value	NC_UBYTE	0	

Variables Name	Description	Type	Range or Value	Dimension
<i>valid_max</i>	Valid maximum value	NC_UBYTE	254	
<i>FillValue</i>	Fill value	NC_UBYTE	255	
warm_calibration_counts	ICI OBCT view calibration counts	NC USHORT	valid_min to valid_max	n_scan, n_warm_samples, n_channels
<i>long_name</i>	Description of variable	NC_STRING	“ICI OBCT view calibration counts”	
<i>units</i>	Physical units	NC_STRING	””	
<i>valid_min</i>	Valid minimum value	NC USHORT	0	
<i>valid_max</i>	Valid maximum value	NC USHORT	65534	
<i>Fill_value</i>	Fill value	NC USHORT	65535	
cold_calibration_counts	ICI cold space view calibration counts	NC USHORT	valid_min to valid_max	n_scan, n_cold_samples, n_channels
<i>long_name</i>	Description of variable	NC_STRING	“ICI cold space view calibration counts”	
<i>units</i>	Physical units	NC_STRING	””	
<i>valid_min</i>	Valid minimum value	NC USHORT	0	
<i>valid_max</i>	Valid maximum value	NC USHORT	65534	
<i>Fill_value</i>	Fill value	NC USHORT	65535	
warm_counts_average_over_scans	Averaged over scans OBCT view counts used for calibration	NC_UINT	valid_min to valid_max	n_scan, n_channels
<i>long_name</i>	Description of variable	NC_STRING	“Averaged over scans OBCT view counts of current scan line”	
<i>units</i>	Physical units	NC_STRING	””	
<i>scale_factor</i>	Scale factor applied	NC_FLOAT	1.e-4	
<i>valid_min</i>	Valid minimum value	NC_UINT	0	
<i>valid_max</i>	Valid maximum value	NC_UINT	$2^{32} - 2$	
<i>Fill_value</i>	Fill value	NC_UINT	$2^{32} - 1$	
cold_counts_average_over_scans	Averaged over scans cold space view counts used for calibration	NC_UINT	valid_min to valid_max	n_scan, n_channels
<i>long_name</i>	Description of variable	NC_STRING	“Averaged over scans cold space view counts of current scan line”	
<i>units</i>	Physical units	NC_STRING	””	
<i>scale_factor</i>	Scale factor applied	NC_FLOAT	1.e-4	
<i>valid_min</i>	Valid minimum value	NC_UINT	0	

Variables Name	Description	Type	Range or Value	Dimension
<i>valid_max</i>	Valid maximum value	NC_UINT	$2^{32} - 2$	
<i>Fill_value</i>	Fill value	NC_UINT	$2^{32} - 1$	
inverse_nonlinear_calibration_gain	inverse nonlinear calibration gain	NC_INT	valid_min to valid_max	n_scan, n_channels
<i>long_name</i>	Description of variable	NC_STRING	“inverse nonlinear calibration gain expressed in mWm ⁻² sr ⁻¹ (cm ⁻¹) ⁻¹ counts ⁻¹ ”	
<i>units</i>	Physical units	NC_STRING	“mW·m ⁻² ·sr ⁻¹ ·(cm ⁻¹) ⁻¹ ”	
<i>scale_factor</i>	Scale factor applied	NC_DOUBLE	1.e-12	
<i>add_offset</i>	Offset applied	NC_DOUBLE	0.0	
<i>valid_min</i>	Valid minimum value	NC_INT	$-2^{31} + 1$	
<i>valid_max</i>	Valid maximum value	NC_INT	$2^{31} - 1$	
<i>Fill_value</i>	missing value	NC_INT	-2^{31}	
inverse_linear_calibration_gain	inverse linear calibration gain	NC_INT	valid_min to valid_max	n_scan, n_channels
<i>long_name</i>	Description of variable	NC_STRING	“inverse linear calibration gain expressed in mWm ⁻² sr ⁻¹ (cm ⁻¹) ⁻¹ counts ⁻¹ ”	
<i>units</i>	Physical units	NC_STRING	“mW·m ⁻² ·sr ⁻¹ ·(cm ⁻¹) ⁻¹ ”	
<i>scale_factor</i>	Scale factor applied	NC_DOUBLE	1.e-12	
<i>add_offset</i>	Offset applied	NC_DOUBLE	0.0	
<i>valid_min</i>	Valid minimum value	NC_INT	$-2^{31} + 1$	
<i>valid_max</i>	Valid maximum value	NC_INT	$2^{31} - 1$	
<i>Fill_value</i>	missing value	NC_INT	-2^{31}	
calibration_offset_nonlinear	Nonlinear calibration offset	NC_INT	valid_min to valid_max	n_scan, n_channels
<i>long_name</i>	Description of variable	NC_STRING	“Nonlinear calibration offset”	
<i>units</i>	Physical units	NC_STRING	“mW·m ⁻² ·sr ⁻¹ ·(cm ⁻¹) ⁻¹ ”	
<i>scale_factor</i>	Scale factor applied	NC_DOUBLE	1.e-7	
<i>add_offset</i>	Offset applied	NC_DOUBLE	0.0	
<i>valid_min</i>	Valid minimum value	NC_INT	$-2^{31} + 1$	

Variables Name	Description	Type	Range or Value	Dimension
<i>valid_max</i>	Valid maximum value	NC_INT	$2^{31} - 1$	
<i>Fill_value</i>	missing value	NC_INT	-2^{31}	
calibration_offset_linear	Linear calibration offset	NC_INT	valid_min to valid_max	n_scan, n_channels
<i>long_name</i>	Description of variable	NC_STRING	“Linear calibration offset”	
<i>units</i>	Physical units	NC_STRING	“mW·m-2·sr-1·(cm-1)-1”	
<i>scale_factor</i>	Scale factor applied	NC_DOUBLE	1.e-7	
<i>add_offset</i>	Offset applied	NC_DOUBLE	0.0	
<i>valid_min</i>	Valid minimum value	NC_INT	$-2^{31} + 1$	
<i>valid_max</i>	Valid maximum value	NC_INT	$2^{31} - 1$	
<i>Fill_value</i>	missing value	NC_INT	-2^{31}	
nonlinear_second_order_calibration_parameter	Nonlinear second order calibration parameter	NC_INT	valid_min to valid_max	n_scan, n_channels
<i>long_name</i>	Description of variable	NC_STRING	“Nonlinear second order calibration parameter expressed in mW·m-2·sr-1·(cm-1)-1·counts-2”	
<i>units</i>	Physical units	NC_STRING	“mW·m-2·sr-1·(cm-1)-1”	
<i>scale_factor</i>	Scale factor applied	NC_DOUBLE	1.e-19	
<i>add_offset</i>	Offset applied	NC_DOUBLE	0.0	
<i>valid_min</i>	Valid minimum value	NC_INT	$-2^{31} + 1$	
<i>valid_max</i>	Valid maximum value	NC_INT	$2^{31} - 1$	
<i>Fill_value</i>	missing value	NC_INT	-2^{31}	
nonlinear_third_order_calibration_parameter	Nonlinear third-order calibration parameter	NC_INT	valid_min to valid_max	n_scan, n_channels
<i>long_name</i>	Description of variable	NC_STRING	“Nonlinear third-order calibration parameter expressed in mW·m-2·sr-1·(cm-1)-1·counts-3”	
<i>units</i>	Physical units	NC_STRING	mW m-2 sr-1 (cm-1)-1	
<i>scale_factor</i>	Scale factor applied	NC_DOUBLE	1.e-24	
<i>add_offset</i>	Offset applied	NC_DOUBLE	0.0	

Variables Name	Description	Type	Range or Value	Dimension
<i>valid_min</i>	Valid minimum value	NC_INT	-2 ³¹ + 1	
<i>valid_max</i>	Valid maximum value	NC_INT	2 ³¹ - 1	
<i>Fill_value</i>	Missing value	NC_INT	-2 ³¹	
<i>obct_temperature</i>	OBCT temperature readings from PRTs	NC_SHORT	valid_min to valid_max	n_scan, n_samples_prt_s_obct , n_prt_s_obct
<i>long_name</i>	Description of variable	NC_STRING	“OBCT temperature readings from PRTs”	
<i>units</i>	Physical units	NC_STRING	“K”	
<i>scale_factor</i>	Scale factor applied	NC_FLOAT	1.e-2	
<i>add_offset</i>	Offset applied	NC_FLOAT	190.0	
<i>valid_min</i>	Valid minimum value	NC_SHORT	0	
<i>valid_max</i>	Valid maximum value	NC_SHORT	16500	
<i>Fill_value</i>	missing value	NC_SHORT	-9999	
<i>svr_temperature</i>	SVR temperature readings from thermistors	NC_SHORT	valid_min to valid_max	n_scan, n_samples_prt_s_svr, n_prt_s_svr
<i>long_name</i>	Description of variable	NC_STRING	“SVR temperature readings from PRTs”	
<i>units</i>	Physical units	NC_STRING	“K”	
<i>scale_factor</i>	Scale factor applied	NC_FLOAT	1.e-2	
<i>add_offset</i>	Offset applied	NC_FLOAT	190.0	
<i>valid_min</i>	Valid minimum value	NC_SHORT	0	
<i>valid_max</i>	Valid maximum value	NC_SHORT	16500	
<i>Fill_value</i>	missing value	NC_SHORT	-9999	
<i>mr_temperature</i>	MR temperature readings from PRTs	NC_SHORT	valid_min to valid_max	n_scan, n_prt_s_mr
<i>long_name</i>	Description of variable	NC_STRING	“MR scan average temperature readings of PRTs”	
<i>units</i>	Physical units	NC_STRING	“K”	
<i>scale_factor</i>	Scale factor applied	NC_FLOAT	1.e-2	
<i>add_offset</i>	Offset applied	NC_FLOAT	190.0	
<i>valid_min</i>	Valid minimum value	NC_SHORT	0	
<i>valid_max</i>	Valid maximum value	NC_SHORT	16500	
<i>Fill_value</i>	missing value	NC_SHORT	-9999	
<i>ss_temperature</i>	Sun shield temperature readings from PRTs	NC_SHORT	valid_min to valid_max	n_scan, n_prt_s_ss
<i>long_name</i>	Description of variable	NC_STRING	“Sun shield scan average temperature readings of PRTs”	
<i>units</i>	Physical units	NC_STRING	“K”	

Variables Name	Description	Type	Range or Value	Dimension
<i>scale_factor</i>	Scale factor applied	NC_FLOAT	1.e-2	
<i>add_offset</i>	Offset applied	NC_FLOAT	190.0	
<i>valid_min</i>	Valid minimum value	NC_SHORT	0	
<i>valid_max</i>	Valid maximum value	NC_SHORT	16500	
<i>Fill_value</i>	missing value	NC_SHORT	-9999	
be_temperature	Back-end temperature readings from THMs	NC_SHORT	valid_min to valid_max	n_scan, n_thms_be
<i>long_name</i>	Description of variable	NC_STRING	“Back-end scan average temperature readings of THMs”	
<i>units</i>	Physical units	NC_STRING	“K”	
<i>scale_factor</i>	Scale factor applied	NC_FLOAT	1.e-2	
<i>add_offset</i>	Offset applied	NC_FLOAT	190.0	
<i>valid_min</i>	Valid minimum value	NC_SHORT	0	
<i>valid_max</i>	Valid maximum value	NC_SHORT	16500	
<i>FillValue</i>	Fill value	NC_SHORT	-9999	
fe_temperature	Front-end temperature readings from THMs	NC_SHORT	valid_min to valid_max	n_scan, n_thms_fe
<i>long_name</i>	Description of variable	NC_STRING	“Front-end scan average temperature readings of THMs”	
<i>units</i>	Physical units	NC_STRING	“K”	
<i>scale_factor</i>	Scale factor applied	NC_FLOAT	1.e-2	
<i>add_offset</i>	Offset applied	NC_FLOAT	190.0	
<i>valid_min</i>	Valid minimum value	NC_SHORT	0	
<i>valid_max</i>	Valid maximum value	NC_SHORT	16500	
<i>FillValue</i>	Fill value	NC_SHORT	-9999	
irp_temperature	Instrument Rotating Part temperature readings from PRTs	NC_SHORT	valid_min to valid_max	n_scan, n_prts_irp
<i>long_name</i>	Description of variable	NC_STRING	“Instrument Rotating Part scan average temperature readings of PRTs”	
<i>units</i>	Physical units	NC_STRING	“K”	
<i>scale_factor</i>	Scale factor applied	NC_FLOAT	1.e-2	
<i>add_offset</i>	Offset applied	NC_FLOAT	190.0	
<i>valid_min</i>	Valid minimum value	NC_SHORT	0	
<i>valid_max</i>	Valid maximum value	NC_SHORT	16500	
<i>FillValue</i>	Fill value	NC_SHORT	-9999	
ifp_temperature	Instrument Fixed Part temperature readings from PRTs	NC_SHORT	valid_min to valid_max	n_scan, n_prts_ifp

Variables Name	Description	Type	Range or Value	Dimension
long_name	Description of variable	NC_STRING	“Instrument Fixed Part scan average temperature readings of PRTs”	
units	Physical units	NC_STRING	“K”	
scale_factor	Scale factor applied	NC_FLOAT	1.e-2	
add_offset	Offset applied	NC_FLOAT	190.0	
valid_min	Valid minimum value	NC_SHORT	0	
valid_max	Valid maximum value	NC_SHORT	16500	
_FillValue	Fill value	NC_SHORT	-9999	

Table 20: calibration_data: Variables for ICI L1B product.

4.2.4.4 Group Name: quality_information

4.2.4.4.1 quality_information: Attributes

No quality_information Group Attributes for the ICI L1B Spectral Radiance product are currently envisaged.

4.2.4.4.2 quality_information: Dimensions

No quality_information Group Dimensions for the ICI L1B Spectral Radiance product are currently envisaged.

4.2.4.4.3 quality_information: Variables

The quality_information Group Variables for the ICI L1B Spectral Radiance product are listed in

Table 21 with their specific attributes.

Variables Name	Description	Type	Range or Value	Dimension
ici_temperatures_flag	Temperatures quality flag. See Table 22	NC_UBYTE		n_scan
long_name	Description of variable	NC_STRING	“Flag to summarise the PRTs and THMs temperature status in the scan. Value = 0 if overall quality is good. Individual bits are set to 1 to indicate specific degraded cases.”	

Variables Name	Description	Type	Range or Value	Dimension
calibration_flag	Calibration quality flag. See Table 23.	NC USHORT		n_scan, n_channels
<i>long_name</i>	Description of variable	NC STRING	“Flag to summarise calibration quality for each channel and scan. Value = 0 if overall calibration quality is good. Individual bits are set to 1 to indicate specific degraded conditions.”	
scan_quality_flag	Scan quality flag See Table 24.	NC UBYTE		n_scan
<i>long_name</i>	Description of variable	NC STRING	“Flag to summarize scan quality. Value = 0 if overall scan quality is good. Individual bits are set to 1 to indicate specific degraded conditions.”	
ici_data_quality_flag	ICI radiance data quality flag. See Table 25.	NC UBYTE		n_scan, n_channels
<i>long_name</i>	Description of variable.	NC STRING	“Flag to summarise ICI radiance data quality for each channel and scan. Value = 0 if data quality is good. Individual bits are set to 1 to indicate specific degraded conditions.”	
navigation_status_flag	Navigation quality flag. See Table 26.	NC USHORT		n_scan
<i>long_name</i>	Description of variable	NC STRING	“Flag to summarise navigation quality for each scan. Value = 0 if navigation quality is good. Individual bits are set to 1 to indicate specific degraded conditions.”	

Table 21: quality_information: Variables for ICI L1B product.

Table 22 details the individual bit settings of the calibration_flag variable of the quality_information Group Variables for the MWI L1B Spectral Radiance product.

ici_temperatures_flag	
Bit	Meaning
0	PRTs or THMs temperatures are missing or with anomalous readings
1	PRT temperatures of OBCT used in the radiometric calibrations is missing or with anomalous readings
2	PRT temperatures of SVR used in the radiometric calibrations are missing or with anomalous readings
3	PRT temperatures of IRP and Sun Shield are missing or with anomalous readings
4	PRT temperatures of Instrument Fixed Part are missing or with anomalous readings
5	THMs temperature of Back-end are missing or with anomalous readings
6	THMs temperature of Front-end are missing or with anomalous readings
7	PRT temperatures of Main Reflector are missing or with anomalous readings

Table 22: Values of ici_temperatures_flag of the quality_information Group Variables.

Table 23 details the individual bit settings of the calibration_flag variable of the quality_information Group Variables for the ICI L1B Spectral Radiance product.

calibration_flag	
Bit	Meaning
0	Radiometric calibration failed or is degraded
1	OBCT view counts averaged value over scans is missing
2	Cold space view counts averaged value over scans is missing
3	OBCT view counts averaged value over scans is degraded due to missing or anomalous counts values
4	Cold space view counts averaged value over scans is degraded due to missing or anomalous counts values
5	OBCT view radiance averaged value over scans is missing
6	Cold space view radiance averaged value over scans is missing
7	OBCT view radiance averaged value over scans is degraded due to missing or anomalous values
8	Cold space view radiance averaged value over scans is degraded due to missing or anomalous values
9	PRTs or THMs temperatures of current scan are missing or with anomalous readings
10	Moon intrusion in cold space degraded calibration (less than N _{valid_c} samples are not affected by moon for the considered channel and scan)
11-15	can be set

Table 23: Values of calibration_flag of the quality_information Group Variables.

Table 24 details the individual bit settings of the scan_quality_flag variable of the quality_information Group Variables for the ICI L1B Spectral Radiance product.

scan_quality_flag	
Bit	Meaning
0	scan is degraded
1	Time sequence error
2	Current scan is acquired after a gap
3	Scan is in period of initialization of calibration of data averages over scans (because of cold start/cold end or data gaps).
4	Moon intrusion angle in space view below threshold for at least one channel
5	Moon correction is applied but is degraded for at least one channel
6	Sun glint angle below threshold for at least one channel
7	Satellite manoeuvre occurs in current scan

Table 24: Values of scan_quality_flag of the quality_information Group Variables.

Table 25 details the individual bit settings of the ici_data_quality_flag variable of the quality_information Group Variables for the ICI L1B Spectral Radiance product.

ici_data_quality_flag	
Bit	Meaning
0	ICI spectral radiance data of channel is missing or degraded
1	Earth view counts of channel within scan are missing or out of bounds
2	Radiometric calibration failed or is degraded
3	Geolocation of channel is erroneous or degraded
4	NEΔT of this data granule is above threshold
5	MR emissivity and spillover correction failed or degraded
6	MR sidelobe correction failed or degraded
7	Channel is defective

Table 25: Values of ici_data_quality_flag of the quality_information Group Variables.

Table 26 details the individual bit settings of the navigation_status_flag variable of the quality_information Group Variables for the ICI L1B Spectral Radiance product.

navigation_status_flag	
Bit	Meaning
0	geolocation of channels is erroneous or degraded
1	Time sequence error
2	Missing or corrupted NAVATT file lead to the use of predicted orbit files
3	NAVATT Attitude data is degraded
4	Time correlation error (Missing IERS Bulletin)
5	Invalid ephemeris or attitude data
6	Satellite manoeuvre occurs in current scan
7	Non-nominal attitude with yaw, pitch, roll error above threshold Delta_YPR (nominally these angles are 0.0 deg for YSM)
8	Sampling time not within prescribed limits

9	Scan velocity not within prescribed limits
10	Bad pointing (sensor LOS does not intersect ellipsoid or not compliant with observation azimuth/elevation limits)
11	Invalid solar azimuth/zenith angles computed
12	DEM geolocation not performed (with use_DEM_flag = 1)
13	Error in Land fraction computation
14	Predicted Orbit File not available
15	Can be set

Table 26: Values of navigation_status_flag of the quality_information Group Variables.

4.2.4.5 Group Name: processing_flags

4.2.4.5.1 processing_flags: Attributes

No processing_flags Group Attributes for the ICI Spectral Radiance product are currently envisaged.

4.2.4.5.2 processing_flags: Dimensions

No processing_flags Group Dimensions for the ICI Spectral Radiance product are currently envisaged.

4.2.4.5.3 Processing Flags: Variables

This section describes the processing_flags Group Variables for the ICI Spectral Radiance product with their specific attributes as given in Table 27.

Variables Name	Description	Type	Range or Value	Dimension
ici_processing_flag	ICI processing flag indicating the processing choices performed. See Table 28.	USHORT		1
long_name	Description of variable	NC_STRIN_G	"ICI processing flag indicating the processing choices performed."	

Table 27: processing_flags: Variables for ICI L1B product.

Table 28 details the individual bit settings of the ici_processing_flag variable of the quality_information Group Variables for the ICI L1B Spectral Radiance product.

ici_processing_flags

Bit	Meaning
0	Moon contamination correction on cold space view counts is not applied
1	MR spillover correction relative to emission by instrument platform is not applied
2	SVR spillover correction relative to emission by instrument platform is not applied
3	SVR sidelobe correction is not applied
4	Full cross-polarization correction including small angles correction is applied
5	Dynamic sidelobe correction is not applied for ICI-1
6	Dynamic sidelobe correction is not applied for ICI-2
7	Dynamic sidelobe correction is not applied for ICI-3
8	Dynamic sidelobe correction is not applied for ICI-4 V and ICI-4 H
9-15	can be set

Table 28: Values of ici_processing_flags of the quality_information Group Variables.

4.2.5 Group Name: quality

4.2.5.1 quality: Attributes

Table 29 describes the quality Group Attributes for the ICI L1B Spectral Radiance product.

Attribute name=	Type	Meaning and/or Value
overall_quality_flag	NC USHORT	<p>“0” if overall quality is OK</p> <p>Individual bits of the flag are set to indicate degraded conditions, the first four bits are set in case of:</p> <ul style="list-style-type: none"> 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 manoeuvre <p>Bits 6 to 15: can be set</p>

Table 29: quality: Attributes for ICI L1B product.

4.2.5.2 quality: Dimensions

This section describes the quality Group Dimensions for the ICI L1B Spectral Radiance product .

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

Table 30: quality: Dimensions for ICI L1B product.

4.2.5.3 quality: Variables

This section describes the quality Group Variables for the ICI L1B Spectral Radiance product with their specific attributes as given in Table 31. Colours are used to differentiate variable and attributes: variables in light blue and attributes in white with name right-aligned.

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”

duration_of_data_present	NC_DOUBLE	“Amount of data present in the product”	“s”
duration_of_data_missing	NC_DOUBLE	“Amount of data missing in the product”	“s”
duration_of_data_degraded	NC_DOUBLE	“Amount of data degraded in product”	“s”
Gaps Information shape=gap_items			
gap_start_time_utc	NC_DOUBLE	“Gap start time in UTC” Note: will not appear in the Product if overall_quality_flag bit 1 equals 0. CF date and time format.	seconds since 2020-01-01 00:00:00.000
gap_end_time_utc	NC_DOUBLE	“Gap end time in UTC” Note: will not appear in the Product if overall_quality_flag bit 1 equals 0. CF date and time format.	seconds since 2020-01-01 00:00:00.000

Table 31: quality: Variables for ICI L1B product.

5 PRODUCT FORMAT VERSION CONTROL

Table 32 provides the Product Format Version Control Numbers of the ICI L1B Product defined within this document, as described in the [GPFS]. The Product Format Version Control Number is updated according the guidelines described in the [GPFS].

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)
<i>ICI L1B radiance</i>	0.0	1B	1G
<i>ICI-1B-RAD</i>	1.0	1C	1H
<i>ICI-1B-RAD</i>	2.0	2A	2A
<i>ICI-1B-RAD</i>	2.3	2C	3B
<i>ICI-1B-RAD</i>	3.0	3	3D
<i>ICI-1B-RAD</i>	3.0	3A	3D

Table 32: Record Format Version Numbers

APPENDIX A
SIZE OF EPS-SG ICI LEVEL 1B PRODUCTS

This appendix provides an estimated size (in Mbytes/orbit, 1 Mbytes= 10^6 bytes) of the EPS-SG ICI Level 1B product, given in Table 33. The estimation was made considering only the information in the group Data. The number of Earth samples per scan is 784 [TBC] is computed considering the declared instrument integration time over a single sample of 0.661 ms [TBC]. The number of cold sky view samples per scan is 47 [TBC] and the number of OBCT views per scan is 33 [TBC]. The number of the various PRTs of the instrument are provided in Table 19.

The assumed size of the considered parameters (in bytes) is presented in Table 33.

An undersampling factor of 5 [TBC], specified in the undersampling_step_along_scan attribute in Table 13 is applied to the latitude and longitude information. The same sub-sampling is applied to solar zenith, solar azimuth, ici observation zenith and observation azimuth angles. The assumption is that the geolocation information can be re-computed using the interpolation technique presented in Appendix D. Geolocation information is stored per feed horn (see Table 1), according to the 7 horns of the ICI instrument. The number of samples assumed (without interpolation) for the geolocation information is $7*784= 5488$ samples [TBC]. The number of samples assumed for the geolocation subsampled information is $7*(784/5 +1)= 7*158=1106$ samples [TBC].

Processing flags and (overall) Quality flags attached to the product (last two sections of) are not considered in the computation.

Mean duration D of one orbit was assumed to be (in minutes):

$$D=R \cdot Day_minutes / N_orbits$$

With R: Repeat cycle (29 days); Day_minutes: Number of minutes per day (1440 minutes), N_orbits: number of orbits in a repeat cycle (412).

Thus $D=101.36$ minutes/orbit.

With a scan every 1.33 s (scanning at 45 RPM) this implies 4573 scans per orbit. This value is considered in the size estimation.

Product ID	Product Description	Size (MB/Orbit)
ICI L1B product	ICI L1B product (including geolocation information compression)	430.00

Table 33: Size of the ICI Level 1B Product

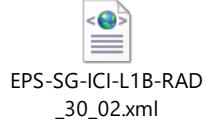
Applicability	Parameter	samples per scan	bytes
Navigation			
ICI-1 to ICI-11 (horns)	time_start_scan_utc	1	8
ICI-1 to ICI-11 (horns)	Geodetic latitude	1106	4
ICI-1 to ICI-11 (horns)	Geodetic longitude	1106	4
ICI-1 to ICI-11 (horns)	ici_oza	1106	2
ICI-1 to ICI-11 (horns)	ici_azimuth	1106	2
ICI-1 to ICI-11 (horns)	land_fraction	5495	1
ICI-1 to ICI-11 (horns)	delta_latitude	5495	2
ICI-1 to ICI-11 (horns)	delta_longitude	5495	2
ICI-1 to ICI-11 (horns)	ici_terrain_elevation	5495	2
ICI-4 H&V	sun_glint_angle	1570	2
For each scan	orbit_angle	1	2
For each scan	latitude_ssp	1	4
For each scan	longitude_ssp	1	4
For each scan	spacecraft_altitude	1	2
For each scan	ici_roll_angle	1	2
For each scan	ici_pitch_angle	1	2
For each scan	ici_yaw_angle	1	2
For each scan	sun_elevation_angle	1	2
For each scan	sun_azimuth_angle	1	2
ICI-1 to ICI-11 (horns)	solar zenith angle	1106	2
ICI-1 to ICI-11 (horns)	solar_azimuth_angle	1106	2
ICI-1 to ICI-11 (horns)	moon_angle	357	2
Measurement data			
ICI-1 to ICI-11	ici_radiances	10205	2
ICI-1 to ICI-11	nedt (HOT LOAD+COLD LOAD)	26	2
Calibration			
ICI-1 to ICI-11	ici sidelobe corrections	10205	1
ICI-1 to ICI-11	warm_calibration_counts	442	2
ICI-1 to ICI-11	cold_calibration_counts	663	2
For each scan	Averaged warm counts	13	4
For each scan	Averaged cold counts	13	4

ICI-1 to ICI-11	inverse linear calibration gain	13	4
ICI-1 to ICI-11	linear calibration offset	13	4
ICI-1 to ICI-11	inverse nonlinear calibration gain	13	4
ICI-1 to ICI-11	nonlinear calibration offset	13	4
ICI-1 to ICI-11	nonlinear_second_order_calibration_parameter	13	4
ICI-1 to ICI-11	nonlinear_third_order_calibration_parameter	13	4
For each scan	OBCT Temperature	18	2
For each scan	SVR Temperature	24	2
For each scan	Sun Shield Temperature	3	2
For each scan	MR temperature	3	2
For each scan	BE Temperatures	5	2
For each scan	FE Temperature	2	2
For each scan	IRP temperatures	3	2
For each scan	IFP temperatures	3	2
Quality information			
For each scan	ici_temperatures_flag	1	1
ICI-1 to ICI-11	calibration_flag	13	2
For each scan	scan_quality_flag	1	1
ICI-1 to ICI-11	ici_data_quality_flag	13	1
For each scan	geolocation_quality_flag	1	2
Processing flags			
For the whole product	ici_processing_flags	1	2
Quality			
For the whole product	overall_quality_flag	1	1
For the whole product	duration_of_product	1	4
For the whole product	time_of_data_present	1	4
For the whole product	time_of_data_missing	1	4
For the whole product	time_of_data_degraded	1	4

Table 34: Assumed size of the ICI Level 1B Product variables.

APPENDIX B**XML DESCRIPTION OF EPS-SG ICI L1B PRODUCTS FORMAT**

The XML description of the NetCDF-4 EPS-SG ICI L1B product is attached in the file EPS-SG-ICI-L1B-RAD_30_02.xml:



APPENDIX C DESCRIPTION OF EPS-SG ICI L1B PRODUCT BUFR FORMAT

The description of the EPS-SG ICI L1B BUFR product is provided in Table 35.
 The size is estimated to be as follows:

$$\text{ICI-1B-RAD} = 580 \text{ MB/orbit}$$

Table 35: Description of the BUFR format for the ICI-1B-RAD products.

References	Element	Variable(s) from NetCDF
Navigation data		
0 01 033	Identification of originating/generating centre	254
0 01 034	Identification of originating/generating sub-centre	0
0 01 007	Satellite identifier	/spacecraft
0 02 048	Satellite instruments	/instrument
0 05 040	Orbit number	/orbit_start
2 01 133	<i>Change data width</i>	
0 05 041	Scan line number	n_scans index
2 01 000	<i>Change data width</i>	
301011	Year, month, day	Computed as in EUM/LEO-EPSSG/SPE/14/767115 D.2
301012	Hour, minute	Computed as in EUM/LEO-EPSSG/SPE/14/767115 D.2
207003	<i>Increase scale, reference value and data width</i>	
004006	Second	Computed as in EUM/LEO-EPSSG/SPE/14/767115 D.2
207000	<i>Increase scale, reference value and data width</i>	
2 02 126	<i>Change scale</i>	
0 07 001	Height of station	/data/navigation_data/spacecraft_altitude
2 02 000	<i>Change scale</i>	
0 07 XXX	Solar zenith angle in instrument reference frame	/data/navigation_data/sun_zenith_angle
0 05 XXX	Solar azimuth in instrument reference frame	/data/navigation_data/sun_azimuth_angle
0 07 XXX	Orbit angle	/data/navigation_data/orbit_angle
Quality information		
0 33 XXX	ICI temperatures flag	/data/quality_information/ici_temperatures_flag
0 33 XXX	ICI scan quality flag	/data/quality_information/scan_quality_flag

0 33 XXX	ICI navigation status flag	/data/quality_information/navigation_status_flag
0 33 XXX	ICI processing flags	/data/processing_flags/ici_processing_flags
Per-horn variables		
1 07 007	Repeat 7 descriptors 7 times	
0 05 001	Latitude (high accuracy)	/data/navigation_data/latitude
0 06 001	Longitude (high accuracy)	/data/navigation_data/longitude
0 07 024	Satellite zenith angle	/data/navigation_data/ici_oza
0 05 021	Bearing or azimuth	/data/navigation_data/ici_azimuth
0 07 025	Solar zenith angle	/data/navigation_data/ici_solar_zenith_angle
0 05 022	Solar azimuth	/data/navigation_data/ici_solar_azimuth_angle
0 07 XXX	Angle between moon and space view	/data/navigation_data/moon_angle
Spectral radiances in horn		
1 15 003	<i>Repeat next 15 descriptors 3 times (Channel group 1)</i>	
0 05 042	Channel number	Channel number of observation
2 02 131	<i>Change scale</i>	
0 02 153	Satellite channel centre frequency	/data/measurement_data/centre_wavenumber
0 02 154	Satellite channel band width	Band width of channel
2 02 000	<i>Change scale</i>	
0 33 XXX	ICI calibration flag	/data/quality_information/calibration_flag
0 33 XXX	ICI data quality flag	/data/quality_information/ici_data_quality_flag
0 02 104	Antenna polarization	Polarisation of channel
2 01 134	<i>Change width (11 + 6 = 17)</i>	
2 02 137	<i>Change scale (0 + 9 = 9)</i>	
0 14 045	Channel radiance (0 to 0.131070 +/- 0.000001 mW m ⁻² sr ⁻¹ cm)	Spectral radiances from /data/measurement_data variables
2 02 000	<i>Change scale (reset to 0)</i>	
2 01 000	<i>Change width (reset to 11)</i>	
0 12 158	Noise-equivalent delta temperature while viewing cold target	/data/calibration/measurement_data/ici_nedt
0 12 159	Noise-equivalent delta temperature while viewing warm target	/data/calibration/measurement_data/ici_nedt
1 15 002	<i>Repeat next 15 descriptors 2 times (Channel group 2)</i>	
0 05 042	Channel number	Channel number of observation
2 02 131	<i>Change scale</i>	
0 02 153	Satellite channel centre frequency	/data/measurement_data/centre_wavenumber
0 02 154	Satellite channel band width	Band width of channel

<i>2 02 000</i>	<i>Change scale</i>	
0 33 XXX	ICI calibration flag	/data/quality_information/calibration_flag
0 33 XXX	ICI data quality flag	/data/quality_information/ici_data_quality_flag
0 02 104	Antenna polarization	Polarisation of channel
<i>2 01 135</i>	<i>Change width (11 + 7 = 18)</i>	
<i>2 02 137</i>	<i>Change scale (0 + 9 = 9)</i>	
0 14 045	Channel radiance (0 to 0.262142 +/- 0.000001 mW m^-2 sr^-1 cm)	Spectral radiances from /data/measurement_data variables
<i>2 02 000</i>	<i>Change scale (reset to 0)</i>	
<i>2 01 000</i>	<i>Change width (reset to 11)</i>	
0 12 158	Noise-equivalent delta temperature while viewing cold target	/data/calibration/measurement_data/ici_nedt
0 12 159	Noise-equivalent delta temperature while viewing warm target	/data/calibration/measurement_data/ici_nedt
<i>1 15 003</i>	<i>Repeat next 15 descriptors 3 times (Channel group 3)</i>	
0 05 042	Channel number	Channel number of observation
<i>2 02 131</i>	<i>Change scale</i>	
0 02 153	Satellite channel centre frequency	/data/measurement_data/centre_wavenumber
0 02 154	Satellite channel band width	Band width of channel
<i>2 02 000</i>	<i>Change scale</i>	
0 33 XXX	ICI calibration flag	/data/quality_information/calibration_flag
0 33 XXX	ICI data quality flag	/data/quality_information/ici_data_quality_flag
0 02 104	Antenna polarization	Polarisation of channel
<i>2 01 136</i>	<i>Change width (11 + 8 = 19)</i>	
<i>2 02 137</i>	<i>Change scale (0 + 9 = 9)</i>	
0 14 045	Channel radiance (0 to 0.524286 +/- 0.000001 mW m^-2 sr^-1 cm)	Spectral radiances from /data/measurement_data variables
<i>2 02 000</i>	<i>Change scale (reset to 0)</i>	
<i>2 01 000</i>	<i>Change width (reset to 11)</i>	
0 12 158	Noise-equivalent delta temperature while viewing cold target	/data/calibration/measurement_data/ici_nedt
0 12 159	Noise-equivalent delta temperature while viewing warm target	/data/calibration/measurement_data/ici_nedt
<i>1 15 003</i>	<i>Repeat next 15 descriptors 3 times (Channel group 4)</i>	
0 05 042	Channel number	Channel number of observation
<i>2 02 131</i>	<i>Change scale</i>	
0 02 153	Satellite channel centre frequency	/data/measurement_data/centre_wavenumber
0 02 154	Satellite channel band width	Band width of channel
<i>2 02 000</i>	<i>Change scale</i>	

0 33 XXX	ICI calibration flag	/data/quality_information/calibration_flag
0 33 XXX	ICI data quality flag	/data/quality_information/ici_data_quality_flag
0 02 104	Antenna polarization	Polarisation of channel
2 01 134	<i>Change width (11 + 6 = 17)</i>	
2 02 136	<i>Change scale (0 + 8 = 8)</i>	
0 14 045	Channel radiance (0 to 1.31070 +/- 0.00001 mW m ⁻² sr ⁻¹ cm)	Spectral radiances from /data/measurement_data variables
2 02 000	<i>Change scale (reset to 0)</i>	
2 01 000	<i>Change width (reset to 11)</i>	
0 12 158	Noise-equivalent delta temperature while viewing cold target	/data/calibration/measurement_data/ici_nedt
0 12 159	Noise-equivalent delta temperature while viewing warm target	/data/calibration/measurement_data/ici_nedt
1 15 002	<i>Repeat next 15 descriptors 2 times (Channel group 5)</i>	
0 05 042	Channel number	Channel number of observation
2 02 131	<i>Change scale</i>	
0 02 153	Satellite channel centre frequency	/data/measurement_data/centre_wavenumber
0 02 154	Satellite channel band width	Band width of channel
2 02 000	<i>Change scale</i>	
0 33 XXX	ICI calibration flag	/data/quality_information/calibration_flag
0 33 XXX	ICI data quality flag	/data/quality_information/ici_data_quality_flag
0 02 104	Antenna polarization	Polarisation of channel
2 01 135	<i>Change width (11 + 7 = 18)</i>	
2 02 136	<i>Change scale (0 + 8 = 8)</i>	
0 14 045	Channel radiance (0 to 2.62142 +/- 0.00001 mW m ⁻² sr ⁻¹ cm)	Spectral radiances from /data/measurement_data variables
2 02 000	<i>Change scale (reset to 0)</i>	
2 01 000	<i>Change width (reset to 11)</i>	
0 12 158	Noise-equivalent delta temperature while viewing cold target	/data/calibration/measurement_data/ici_nedt
0 12 159	Noise-equivalent delta temperature while viewing warm target	/data/calibration/measurement_data/ici_nedt

APPENDIX D
RECONSTRUCTION OF TIME AND GEOLOCATION INFORMATION
D.1 Geolocation of all samples from tie points

In order to reduce the product size the geolocation information is assigned to prescribed groups, as discussed in Section 2. Moreover, the geodetic latitude/longitude information, as well as OZA and azimuth and solar zenith and azimuth angles are provided only for selected tie-points over each scan since it is possible to reconstruct this information for the intermediate points. This appendix describes the procedure in detail.

For latitude/longitude the procedure is based on the method described in [INTERP]. The method is based on a simple linear interpolation of tie-points after a transformation from geodetic latitude/longitude coordinates into Cartesian Coordinates in the Earth-Centred Earth-Fixed (ECEF). The advantage of this approach is that interpolating on position vectors introduces errors which do not depend on latitude and do not need special treatment for latitude or longitude discontinuities. The geolocation error resulting from the interpolation is depending on the number of footprint between the tie points, as shown in the table below.

Sub sampling Factor	Maximal position error over one orbit [m]
3	15
5	30

The steps are as follows:

- 1) Conversion from Geodetic to Cartesian Coordinates in the ECEF Frame

Two neighbouring tie-points are selected in the scan, and their latitude/longitude coordinates are transformed using the following transformation:

$$\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} N \cdot \cos\varphi \cdot \cos\lambda \\ N \cdot \cos\varphi \cdot \sin\lambda \\ N \cdot (1 - e^2) \cdot \sin\varphi \end{bmatrix}$$

Where:

(x, y, z) are the ECEF Frame Cartesian coordinates of each point;

λ is the geodetic longitude;

φ is the geodetic latitude;

a is the semi-major ellipsoid axis (equatorial radius, = 6378137.0 m);

b is the semi-minor ellipsoid axis ($b = 6356752.3142$ m).

e is the eccentricity of ellipsoid defined as:

$$e = \sqrt{\frac{a^2 - b^2}{a^2}}$$

N is the radius of curvature in the prime vertical:

$$N = \frac{a}{\sqrt{1 - e^2 \cdot (\sin \varphi)^2}}$$

2) Interpolation of tie-points in Cartesian Coordinates in the ECEF Frame.

Given two tie-points, $p_1(t_1) = (\varphi_1, \lambda_1)$ and $p_2(t_2) = (\varphi_2, \lambda_2)$, and being (x_1, y_1, z_1) and (x_2, y_2, z_2) the cartesian coordinates of the two tie points transformed according step 1, any point in between can be calculated as:

$$\begin{aligned} x &= x_1 + t * (x_2 - x_1) / (t_2 - t_1) \\ y &= y_1 + t * (y_2 - y_1) / (t_2 - t_1) \\ z &= z_1 + t * (z_2 - z_1) / (t_2 - t_1) \end{aligned}$$

where t is the time associated to the selected footprint between the two tie-points, and t_1 and t_2 are the scan time at tie-points. Assuming a constant scan rate the time elapsed within the scan is computed as:

$$t = \Delta T \cdot (i - 1)$$

where ΔT is the integration time associated to each channel and i is the scan index, with i going from 1 to $N_{samples}$. Taking into account the parameters in Table 13, any point in between two tie points can be calculated as follows:

$$\begin{aligned} x(k) &= x_1 + (k/f) * (x_2 - x_1) \\ y(k) &= y_1 + (k/f) * (y_2 - y_1) \\ z(k) &= z_1 + (k/f) * (z_2 - z_1) \end{aligned}$$

where f is equal to undersampling_step_along_scan for all samples except for those between the last two tie points of the scan, for which f is equal to undersampling_step_last_samples. The index k goes from 1 to undersampling_step_along_scan or undersampling_step_last_samples, respectively.

3) Transformation from Cartesian Coordinates in the ECEF Frame to Geodetic Coordinates.

Each triplet (x, y, z) in the ECEF Frame Cartesian coordinates associated to each footprint is transformed back in geodetic latitude and longitude coordinates using the following closed-form transformation.

Longitude is computed as:

$$\lambda = \text{atan2}(y, x)$$

Latitude is:

$$\varphi = \text{atan2}(z + e2p \cdot b \cdot (\sin \theta)^3, p - e^2 \cdot a \cdot (\cos \theta)^3)$$

Where:

$$e2p = \frac{a^2}{b^2} - 1$$

$$p = \sqrt{x^2 + y^2}$$

$$\theta = \text{atan}2(z \cdot a, p \cdot b)$$

In atan2, signs of both inputs are known to it, so it can compute the correct quadrant for the angle.

The procedure for the reconstruction of ICI observation zenith angle OZA_{ICI} and azimuth AZI_{ICI} (as well as for solar zenith and azimuth angles) is slightly different from that applied above to latitude and longitude. The method is based on a simple linear interpolation of tie-points after a transformation from spherical coordinates (R_N , OZA_{ICI} , AZI_{ICI}) into Cartesian Coordinates (x_A, y_A, z_A). In such cases, it holds:

- 1) Conversion to Cartesian Coordinates:

$$\begin{bmatrix} x_A \\ y_A \\ z_A \end{bmatrix} = \begin{bmatrix} R_N \cdot \sin(OZA_{ICI}) \cdot \cos(AZI_{ICI}) \\ R_N \cdot \sin(OZA_{ICI}) \cdot \sin(AZI_{ICI}) \\ R_N \cdot \cos(OZA_{ICI}) \end{bmatrix}$$

Where (x_A y_A , z_A) are Cartesian coordinates of each point and R_N is the earth radius.

- 2) Interpolation of tie-points in Cartesian Coordinates as described in point 2) of the latitude/longitude reconstruction, to reconstruct any point $(x_{int_ICI}, y_{int_ICI}, z_{int_ICI})$ in between two tie points.
- 3) Transformation from Cartesian Coordinates to spherical coordinates:

$$\begin{bmatrix} OZA_{ICI} \\ AZI_{ICI} \end{bmatrix} = \begin{bmatrix} \text{atan}\left(\frac{p_{ICI}}{z_{int_ICI}}\right) \\ \text{atan}\left(\frac{y_{int_ICI}}{x_{int_ICI}}\right) \end{bmatrix}$$

Where:

$$p_{ICI} = \sqrt{x_{int_ICI}^2 + y_{int_ICI}^2}$$

D.2 Time of Earth samples reconstruction

In the navigation_data group, the variable time_start_scan_utc is provided for each scan i. It corresponds to the UTC time of the first Earth view sample of ICI-1 provided for each scan. The UTC time corresponding to each sample k (1 to 784) and channel j (1 to 13) can be computed as follows:

$$time_sample(i, j, k) = time_start_scan_utc(i) - t_{offset}(1) + t_{offset}(j) + T_{int} \cdot (k - 1)$$

where T_{int} is the ICI integration time over a single sample of 0.661045 ms [TBC].

Channel number	ICI channel	t_{offset} (ms)
1	ICI-1	0.210232
2	ICI-2	0.223796
3	ICI-3	0.237359
4	ICI-4 V	0.250922
5	ICI-4 H	0.264486
6	ICI-5	0.278049
7	ICI-6	0.291612
8	ICI-7	0.305176
9	ICI-8	0.318739
10	ICI-9	0.332303
11	ICI-10	0.345866
12	ICI-11 V	0.359429
13	ICI-11 H	0.372992

D.3 Reconstruction of orthorectified latitudes and longitudes

The reconstruction of the orthorectified latitudes and longitudes from the can be done by applying the following equations

$$\varphi' = \varphi + \frac{\delta N}{r_{NS}(\varphi)}$$

$$\lambda' = \lambda + \frac{\delta E}{r_{EW}(\varphi)}$$

φ = geodetic latitude [rad]

λ = geodetic longitude [rad]

φ' = orthorectified geodetic latitude [rad]

λ' = orthorectified geodetic longitude [rad]

δN = as per L1b product “delta_lat_N_dem - Distance in m (N) between latitude orthorectified using DEM and latitude on WGS84 ellipsoid”

δE = as per L1b product “delta_lon_E_dem - Distance in m (E) between latitude orthorectified using DEM and latitude on WGS84 ellipsoid”

The following approximations are used:

$$r_{NS}(\varphi) = R_{AV}$$

$$r_{EW}(\varphi) = R_{AV} \cdot \cos(\varphi)$$

Also, special care has to be taken for the 0-2pi rad transition, again an example on how to deal with it in degrees as unit:

If $\varphi' \geq 360$

$$\varphi' = \varphi' - 360$$

Else if $\varphi' < 0$

$$\varphi' = 360 + \varphi'$$

At the poles, $r_{EW}(\varphi)$ becomes zero. To avoid division by zero:

If $r_{EW}(\varphi) < zeroThreshold$

$$\lambda' = \lambda$$

nonlinear_third_order_calibration_parameter R_{AV} is the average Earth radius [m]

APPENDIX E
BRIGHTNESS TEMPERATURE COMPUTATION FROM ICI SPECTRAL RADIANCES

Earth view radiances R of channel i can be converted to brightness temperature T_B as follows:

$$T_B(\nu_{ci}, R) = \left[\frac{c_2 \nu_{ci}}{\ln \left(1 + \frac{c_1 \nu_c^3}{R} \right)} \right] \cdot A_i + B_i$$

where R is provided $\text{mW}\cdot\text{m}^{-2}\cdot\text{sr}^{-1}\cdot(\text{cm}^{-1})^{-1}$

The parameters required for the actual calculation of the brightness temperature are:

	Description	Reference
ν_{ci}	Central frequency wave number (μm)	Included in the product
A_i	Band Correction Coefficient (Unitless)	
B_i	Band Correction Coefficient (K)	
c	Speed of Light (m s^{-1})	299792458 m s^{-1}
$c_1 = 2hc^2$	$\text{mW}/(\text{sr m}^2 \text{ cm}^{-4})$	$1.191042 \cdot 10^{-5}$
$c_2 = hc/k$	K cm	1.4387752
k	Boltzmann constant ($\text{m}^2 \text{ kg s}^{-2} \text{ K}^{-1}$)	$1.38065 \cdot 10^{-23} \text{ m}^2 \text{ kg s}^{-2} \text{ K}^{-1} (\text{JK}^{-1})$
h	Planck constant ($\text{m}^2 \text{ kg s}^{-1}$)	$6.626069 \cdot 10^{-34} \text{ m}^2 \text{ kg s}^{-1} (\text{Js})$

Appendix: TBC and TBD Items

The following table presents the TBDs affecting the current version of the document.

ID	Section	Title	Text
TBD-1.-			
TBD-2.	4.2.3.1.1, 4.2.3.2.1, 4.2.3.3.2	Attributes #1	Attributes of some parameters are TBD pending further development of processing and information from instrument manufacturer
TBD-3.	4.2.4.1.1, 4.2.4.1.2, 4.2.4.2.1	Attributes and dimensions #2	Attributes and dimensioning of some parameters are TBD pending further development of processing and information from instrument manufacturer
TBD-4.	4.2.4.3.1, 4.2.4.3.2	Attributes and dimensions #3	Attributes and dimensioning of some parameters are TBD pending further development of processing and information from instrument manufacturer
TBD-5.	4.2.4.4.1, 4.2.4.4.2, 4.2.4.4.3,	Attributes and dimensions #4	Attributes and dimensioning of some parameters are TBD pending further development of processing and information from instrument manufacturer
TBD-6.	4.2.4.5.1, 4.2.4.5.2	Attributes and dimensions #5	Attributes and dimensioning of some parameters are TBD pending further development of processing and information from instrument manufacturer

The following table presents the TBCs affecting the current version of the document.

ID	Section	Title	Text
TBC-1.		Instrument monitoring variables	It is unclear whether instrument monitoring variables are only diagnostic variables resulting from L0 processing, or are also instrument parameters (e.g. receiver temperature). This kind of information could also be included in the auxiliary files, if not needed by the users.
TBC-2.	Multiple sections	Structure and content	First consolidation performed, further updates expected.
TBC-3.-	Appendix A	Product Size	Data size is based on current estimated number of samples and on assessment of output variables.
TBC-4.	Multiple sections	Attributes and dimensions	Attributes and dimensioning of some parameters are TBC pending further development of processing and information from instrument manufacturer.
TBC-5.	4.2.4.3.3	Non-linearity parameters	Non-linearity parameters in output need to be finalized after discussion/measurements
TBC-6.	4.2.3.2	Instrument status	Instrument status (attributes, dimension, variables) will need updating when the instrument details will be available
TBC-7.	4.2.4.2	Grouping of radiance data	Grouping of radiance measurements data is based on dynamic range assessment in order to minimize memory needs using appropriate data types.
TBC-8.	Appendix A	Undersampling of geolocation information	Undersampling of geolocation information by a factor 5 is assumed in order to reduce product size.
TBC-9.	Multiple sections	Number of samples	Number of samples per scan is assumed for each channel. This is TBC depending on further details on instrument design.

TBC-10.	4.2.4.4	Quality flag bit meaning	Meaning of quality flags bit settings need to be further consolidated
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