
CRYOSAT Ground Segment

Instrument Processing Facility L1B

CryoSat Ice netCDF L1B

Product Format Specification

[PFS-I-L1B]

C2-RS-ACS-ESL-5364

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Document Change Record

Issue/Rev.	Class (R=Review /A=Approval)	Date	Reason for Change	Changed Pages/Paragraphs
1.0draft	R	02/05/2016	First Issue	All
1.0	R	04/08/2016	First Official Issue	All
1.1	R	15/09/2016	Implementation of ESA comments The following variables names have been introduced: ant_bench_pitch_20_ku (time_20_ku) ant_bench_roll_20_ku(t ime_20_ku) ant_bench_yaw_20_ku(time_20_ku) dop_angle_start _20_ku(time_20_ku) dop_angle_stop _20_ku(time_20_ku) echo_scale_pwr_20_ku (time_20_ku) instr_ext_ph_cor_20_k u(time_20_ku) flag_cor_err_01(time_c or_01) flag_cor_status_01(tim e_cor_01) flag_echo_01(time_avg _01) flag_instr_conf_rx_bwd t_20_ku(time_20_ku) flag_instr_conf_rx_flags _20_ku(time_20_ku) flag_instr_conf_rx_in_u se_20_ku(time_20_ku) flag_instr_conf_rx_str_i n_use_20_ku(time_20_ ku) flag_instr_conf_rx_trk_ mode_20_ku(time_20_ ku) flag_instr_mode_att_ctr l_20_ku(time_20_ku) flag_instr_mode_flags_ 20_ku(time_20_ku) flag_instr_mode_op_20 _ku(time_20_ku) instr_cor_gain_rx_20_k u(time_20_ku) instr_cor_gain_tx_rx_2 0_ku(time_20_ku)	Section 3, appendix A

			instr_cor_range_rx_20_ku(time_20_ku) instr_cor_range_tx_rx_20_ku(time_20_ku) instr_seq_count_20_ku(time_20_ku) instr_int_ph_cor_20_ku(time_20_ku) lat_01(time_avg_01) lon_avg_01_ku(time_avg_01_ku) ph_diff_waveform_20_ku(time_20_ku, ns_20_ku) pole_tide_01 pwr_waveform_01(time_avg_ku, ns_avg_01_ku) pwr_waveform_20_ku(time_20_ku, ns_20_ku) flag_surf_type_01(time_cor_01) time_avg_01(time_avg_01) flag_trk_cycle_20_ku(time_20_ku) window_del_01(time_avg_01) Unused variable types have been removed attribute comment added to each CDL dump Appendix B and C have been added, former appendix B is now appendix D CDL dump of FBR variables added	Section 2.3 Section 3.3 Appendices B,C and D Section 3.3
1.2	R	19/09/2016	Harmonisation of variable names The following variables have been renamed: lon_01_ku(time_avg_01_ku) -> lon_avg_01_ku(time_avg_01_ku) pwr_waveform_01(time_avg_ku, ns_01_ku) ->	Section 2.3, 3.1, 3.2, 3.3. and Appendix A and B

			pwr_waveform_01(time_avg_ku, ns_avg_01_ku) time_20_ku -> time_tai_20_ku time_21_ku-> time_tai_21_ku time_85_ku-> time_tai_85_ku time_avg_01_ku->time_tai_avg_01_ku time_cor_01_ku->time_tai_cor_01_ku The following dimension has been renamed: ns_01_ku-> ns_avg_01_ku Use of coordinate variables deleted Corrected table to give evidence of the unlimited variables used in the product Attributes "source" and "institution" added to geophysical correction variables when available	Section 2.3, 3.1, 3.2, 3.3. and Appendix A and B Section 2.2 Section 2.3 Section 3.3
1.3	R	03/10/2016	Appendix title added into description of the document structure Use of coordinate variables reintroduced Missing descriptions of global attributes have been added The following variables have been renamed: time_tai_20_ku-> time_20_ku time_tai_21_ku ->	Section 1.2 Section 2.2 Section 2.3 Section 3.1, 3.2, 3.3.153->3.3.157 and Appendix A and B

			time_21_ku time_tai_85_ku -> time_85_ku time_tai_avg_01_ku -> time_avg_01_ku time_tai_cor_01_ku-> time_cor_01_ku trasmit_pwr_XX_ku-> transmit_pwr_XX_ku The dimension space_3d_ku has been renamed to space_3d. Type of cplx_waveforms changed from int to byte Attribute comment of variables flag_instr_mode_op_XX has been corrected Attributes "source", "institution" and "comment" of the variable flag_surf_type have been modified type (f) removed from values of add_offset and scale_factor	Section 2.3, 3.1, 3.2, 3.3.153->3.3.157 and Appendix A and B Section 3.3.21->3.3.26 and appendix B Section 3.3.67->3.3.69 Section 3.3.73 Section 3.3
1.4	R	10/10/2016	incorrect meas_noise_pwr replaced by noise_power in tables Explanation how to link 20Hz records to 1-Hz ones added Implementation of ESA's comments	Section 3.1.2 and 3.2.2 Section 3.1 Section 1.4, 3.3.8, 3.3.11->13, 3.3.21->26, 3.3.29->31, 3.3.47->53, 3.3.55->63, 3.3.78->84, 3.3.91->96, 3.3.99, 3.3.104, 3.3.110->113, 3.3.115->118, 3.3.120, 3.3.121, 3.3.144, 3.3.145, 3.3.147, 3.3.148, 3.3.152, 3.3.154, 3.3.155, 3.3.170, 3.3.173

1.5	R	27/01/2017	The variable: seq_count_20_ku is put in every L1b product CDL dumps reviewed to assure homogeneity among products	Appendix A Section 3
1.6	R	25/05/2017	Type error comment corrected in comment Reference to CoG or Centre of Mass replaced with CoM Variables: agc_1_21_ku and agc_2_21_ku added Variables: agc_ch1_85_ku and agc_ch2_85_ku changed in agc_1_85_ku and agc_2_85_ku Variables "long_name" modified Variables "comment" modified	Sections 3.3.21 ->3.3.35 Section 3.3.38 Sections 3.3.42 ->3.3.44 Section 3.3.46 ->3.3.54 Section 3.3.74 Sections 3.3.119 ->3.3.123 Section 3.3.133 Section 3.3.135 Sections 3.3.144 ->3.3.152 Sections 3.1.1, 3.1.4, 3.2.1, 3.3.7->3.3.10, 3.3.90->3.3.92, 3.3.125, 3.3.126, 3.3.171 abd 3.3.172 Sections 3.3.1 and 3.3.3 added Sections 3.3.2 and 3.3.4 Sections 3.3.22, 3.3.30 -> 3.3.32, 3.3.40, 3.3.43, 3.3.100, 3.3.102, 3.3.107, 3.3.114, 3.3.119, 3.3.120, 3.3.124 -> 3.3.126, 3.3.130, 3.3.133 -> 3.3.135, 3.3.142 and 3.3.170 -> 3.3.173 3.3.5 -> 3.3.13, 3.3.15 -> 3.3.17, 3.3.29, 3.3.32, 3.3.37, 3.3.40, 3.3.41, 3.3.43 -> 3.3.51, 3.3.55 -> 3.3.69, 3.3.80 -> 3.3.89, 3.3.95 -> 3.3.111, 3.3.114 -> 3.3.120, 3.3.124 -> 3.3.126, 3.3.130, 3.3.133 -> 3.3.139, 3.3.142, 3.3.147, 3.3.153 -> 3.3.157 and 3.3.168 -> 3.3.173,
1.7	R	06/06/2017	Variables "comment" modified	Sections 3.3.24, 3.3.25, 3.3.87 -> 3.3.89, 3.3.112 and 3.3.113
1.8	R	04/12/2018	Release for Baseline D implementation	Front page: document ID fixed in C2-RS-ACS-ESL-5364

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			Global Attributes nomenclature aligned to COP Processor specification New fields added to track measurement index: ind_first_meas_20hz_0 1 and ind_meas_1hz_20_ku C2-MN-ACS-ESL-5376 "CS2 Baseline D Pre-acceptance Minutes of Meeting" Section 3.4 Added All Section doi global attribute added in Global Attributes	CCN#5 implementation Section 3.4 Section 3 Appendix D: XML Header Product File rationale clarified and details for field description provided Flag meaning definition reported from EEF Format documentation CS-RS-ACS-GS-5106 Issue: 6.4 Coordinates attribute added for all the variables Section 6.3
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1 INTRODUCTION

This document specifies the netCDF format of the Level-1B products generated by the CryoSat ice processing chains. This new specification is called CONFORM: CryOsat Netcdf FORMat.

1.1 PURPOSE AND SCOPE

The purpose of the document is to specify the netCDF product structure and content of the Level-1B products generated by the CryoSat ice processor.

Since the beginning of the mission (2010), all CryoSat products had been generated in Earth Explorer (EE) bespoke format devised for the CryoSat products at the time of the CryoSat-1 mission and derived from the ENVISAT products format with the purpose to maximise the reuse of decoding/analysis tools developed for this mission. In 2015 the Agency decided to migrate from this Earth Explorer format to the more flexible and up-to-date netCDF model for those products that are intended to be distributed to the users.

This new format is called CONFORM (CryOsat Netcdf FORMat) and is applicable to the following ice products:

- LRM Level 1B
- SAR Level 1B
- SARIn Level 1B
- SAR FBR
- SARIn FBR

The FDM Level 1B product is decommissioned since Baseline D installation (CRYO-IDE-270)

The first product baseline available in netCDF for all users is Baseline-D.

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1.2 DOCUMENT STRUCTURE

The document includes the following sections:

Section 1 – Introduction	Introduction to the whole document
Section 2 - General Overview	This section gives an overview of the CryoSat IPF1 ice production as well as a short introduction to the netCDF.
Section 3 - Product Format Specification	This section contains the specification of the FBR and L1B ice CONFORM products. In particular: • Section 3.1 lists the variables of the L1B products and links each of them to the relevant CDL dump • Section 3.2 lists the variables of the FBR products and links each of them to the relevant CDL dump • Section 3.3 contains the CDL dump of each variable • Section 3.4 specifies the global attributes of each product
Section 4- CryoSat Level-1B CONFORM Products	Here is the list of the L1B CONFORM ice products
Appendix A – Variables to Products Mapping	This section provides a variable name list ordered alphabetically and showing for each variable which product types it can be found in.
Appendix B: Default Setting of the Attribute: _FillValue	This section lists the _FillValues for each variable type
Appendix C: Timestamps Data Type	This section describes the timestamps used in the CONFORM products are reliable till January 2034
Appendix D - EE to netCDF Migration	This section contains a short description of the general rules followed to migrate from the EE format to CONFORM

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1.3 APPLICABLE & REFERENCE DOCUMENTS

1.3.1 Applicable Documents

Document Title	Identifier	Reference
CCN #3: CONFORM [IPF1-CCN3] Issue 1.0	C2-CN-ACS-GS-5343	[CCN3-TN]
Minute of CCN#3 and CCN#4 KO meeting	C2-MN-ACS-GS-5248	[CCN3-KO]

1.3.2 Reference Documents

Document Title	Identifier	Reference
IPF1 Detailed Processing Model Issue 4.2, April 2015	CS-TN-ACS-GS-5105	[IPF1-DPM]
Level 0 Products Specification Format Issue 3.1, November 2007	CS-ID-ACS-GS-0119	[L0-FMT]
IEEE Standard for Binary Floating-Point Arithmetic. ANSI/IEEE Std 754-1985 Institute of Electrical and Electronics Engineers Issued 1985	IEEE-754	[IEEE]
CCSDS Recommendation Time Code Formats Blue Book Issue 2.0, April 1990	CCSDS 301.0-B-2	[CCSDS-TIMEGUIDE]
CCSDS Recommendation Advanced Orbiting System, Networks and Data Links Architectural Specification Blue Book Issue 3.0, June 2001	CCSDS 701.0-B-3	[CCSDS-AOS]

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1.4 ACRONYMS AND ABBREVIATIONS

ACS	Advanced Computer Systems S.p.A.
AGC	Automatic Gain Control
CAL	Calibration
CCAL	Complex Calibration
CCSDS	Consultative Committee for Space Data Systems
CONFORM	CryoSat Netcdf FORMat
DFCB	Data Format Control Book
DSR	Data Set Record
DOI	Digital Object Identifier
EE	Earth Explorer
ESA	European Space Agency
FOS	Flight Operations Segment
FBR	Full Bit Rate
GS	Ground Segment
HK/TM	Housekeeping/Telemetry data
ID	IDentifier
IPF	Instrument Processing Facility
ISP	Instrument Source Packet
L1B	Level 1B
LRM	Low Rate Mode
MDS	Measurement Data Set
MDSR	Measurement Data Set Record
MON	Monitoring
MPH	Main Product Header
NetCDF	Network Common Data Form
NPM	Noise Power Measurement
PDS	Payload Data System
PFS	Product Format Specification
RC	Radar Cycle
SAR	Synthetic Aperture Radar
SARIn	Synthetic Aperture Radar Interferometry
SIRAL	Synthetic Interferometric Radar ALtitude
SPH	Specific Product Header
STR	Star Tracker
S6 GPP	Sentinel 6 Ground Processing Prototype
TAI	International Atomic Time Reference
TBD	To Be Defined
TRK	TRacking
UTC	Universal Time Co-ordinates
WGS84	World Geodetic System 1984

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2 GENERAL OVERVIEW

2.1 OVERVIEW OF THE IPF1 ICE PRODUCTION

The Level 1 products are generated from the SIRAL instrument Level 0 data by applying the IPF1 processing algorithms defined in the IPF1 system of PDS.

The IPF1 processing chains provide four types of Level 1 products:

☐ **Level 1B (L1B)**

The L1B data is the main product output from the IPF1. In the case of SAR and SARIn modes of SIRAL, the L1B data are strongly compressed in size following the application of SAR/SARIn algorithms and multilook for speckle reduction.

☐ **Level 1B Calibration (CAL)**

CAL1 and CAL2 products also belong to the L1B class. CAL1 data are available for LRM/SAR/SARIn modes, while CAL2 data are available only for SAR/SARIn modes.

☐ **Full Bit Rate (FBR)**

The FBR product is output at an intermediate stage before the L1B processing is complete. This is the highest processing stage reached before information compression occurs. In particular the FBR data for SAR and SARIn modes still contain the echo data as complex numbers.

☐ **Monitoring (MON)**

Monitoring data is a systematic product aiming to provide timely information on the health of the instrument. It consists of a set of instrument parameters which may be produced rapidly and routinely starting from LRM/TRK SIRAL data, SAR or SARIn data.

The IPF1 has as output the following products:

- **Level 1B Science Data**

- LRM Level 1B generated and distributed in CONFORM
-
- SAR Level 1B generated and distributed in CONFORM
- SARIn Level 1B generated and distributed in CONFORM

- **FBR Science Data**

- LRM FBR generated, but no more distributed, in Earth Explorer format
-
- SAR FBR generated and distributed in CONFORM

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- SARIn FBR generated and distributed in CONFORM
- **Auxiliary Calibration Data**
 - CAL1 LRM generated and distributed in Earth Explorer format
 - CAL1 SAR generated and distributed in Earth Explorer format
 - CAL1 SARIn generated and distributed in Earth Explorer format
 - CAL2 SAR generated and distributed in Earth Explorer format
 - CAL2 SARIn generated and distributed in Earth Explorer format
 - Complex CAL1 SARIn generated and distributed in Earth Explorer format
- **Monitoring Products**
 - MON LRM/TRK generated and distributed in Earth Explorer format
 - MON SAR generated and distributed in Earth Explorer format
 - MON SARIn generated and distributed in Earth Explorer format

The Earth Explorer format of the products is specified in [PROD-FMT].

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2.2 OVERVIEW OF THE NETCDF

NetCDF (Network Common Data Form) is a set of software libraries and self-describing, machine-independent data formats that support the creation, access, and sharing of array-oriented scientific data.

The version of the netCDF libraries used for the CryoSat ice production is **NetCDF-4 CF compliant** and consists of the following elements:

- **DIMENSIONS:**
A dimension is used to represent a real physical dimension (for example, time, latitude, longitude, and height) or to index other quantities (for example number of records or waveforms or samples). A dimension can also be used to index other quantities (waveforms index for example). A netCDF dimension has both a name and a length and can be limited or unlimited (i.e. a dimension that can be appended to).
- **VARIABLES:**
Variables are used to store the bulk of the data in a netCDF dataset. A variable represents an array of values of the same type. A scalar value is treated as a 0-dimensional array. A variable has a name, a data type, and a shape described by its list of dimensions specified when the variable is created. A variable may also have associated attributes, which may be added, deleted or changed after the variable is created.
- **COORDINATE VARIABLES:**
A variable can have the same name as a dimension and in this case the variable is called a coordinate variable. It typically defines a physical coordinate corresponding to that dimension. If a dimension has a corresponding coordinate variable, then this provides an alternative, and often more convenient, means of specifying a position along it. Current application packages that make use of coordinate variables commonly assume they are numeric vectors and strictly monotonic (all values are different and either increasing or decreasing).
- **ATTRIBUTES:**
Attributes are used to store information about the data (ancillary data or metadata). Most attributes provide information about a specific variable. These are identified by the name (or ID) of that variable, together with the name of the attribute.
- **GLOBAL ATTRIBUTES:**
Some attributes provide information about the dataset as a whole and are called global attributes. In particular, the global attributes used in the CryoSat products contains the information that was present in the EE header (see [PROD-FMT]).

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2.3 NETCDF PRIMITIVES

The following **dimensions** are used in the CryoSat ice Level-1B CONFORM products:

Dimensions					
Name	Description	Size	Units	Type	Limited/ Unlimited
time_20_ku	Timestamps of 20 Hz power waveforms in the L1B product file (L1B only)	Number of 20 Hz power waveforms in the product file	seconds since 2000-01-01 00:00:00.0	double	Unlimited
time_21_ku	Timestamps of 21 Hz Complex echo waveforms in the SARIn FBR product file (FBR only)	Number of 21 Hz Complex echo waveforms in the SARIn FBR product file	seconds since 2000-01-01 00:00:00.0	double	Unlimited
time_85_ku	Timestamps of 85 Hz Complex echo waveforms in the SAR FBR product file (FBR only)	Number of 85 Hz Complex echo waveforms in the SAR FBR product file	seconds since 2000-01-01 00:00:00.0	double	Unlimited
time_avg_01_ku	Timestamps of 1 Hz power waveforms in the L1b product file (L1B only)	Number of 1 Hz power waveforms in the product file	seconds since 2000-01-01 00:00:00.0	double	Unlimited
time_cor_01	Timestamps of 1 Hz Geophysical corrections in the product file	Number of 1 Hz Geophysical corrections in the product file	seconds since 2000-01-01 00:00:00.0	double	Unlimited
np_ku	Number of pulses in 1 burst of complex echo waveforms (FBR only)	Number of pulses in 1 burst of complex echo waveforms	count	short	Limited
ns_ku	Number of samples in 1 complex echo waveform (FBR only)	Number of samples in 1 complex echo waveform	count	short	Limited
ns_20_ku	Number of samples in a 20Hz waveform (L1B only)	Number of samples in a 20Hz waveform	count	short	Limited
ns_avg_01_ku	Number of samples in a 1Hz averaged waveform (L1B only)	Number of samples in a 1Hz averaged waveform	count	short	Limited
space_3d	3 dimensions of space (x,y,z)	3	count	short	Limited

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The following **variables** are used in the CryoSat ice Level-1b CONFORM products:

Variables	
Name	Description
byte	8-bit data signed
short	16-bit signed integer
ushort	16-bit unsigned integer
int	32-bit signed integer
int64	64-bit signed integer
double	IEEE double precision floating point (64 bits)

The following **attributes** are used in the CryoSat ice Level-1b CONFORM products:

Variable Attributes	
Name	Description
add_offset	According to the netCDF standard, the value in the specified unit is computed as: value_unit = (value_product * scale_factor) + add_offset
scale_factor	
calendar	Reference time calendar
comment	The "comment" attribute allows for miscellaneous information about the dataset.
_FillValue	A value used to represent missing or undefined data add_offset If present, this number is to be added to the date
flag_meanings	Use in conjunction with flag_values to provide descriptive words or phrase for each flag value.
flag_values	Provide a list of the flag values. Use in conjunction with flag_meanings.
institution	Institution which provides the data
long_name	A long descriptive name for the variable (not necessarily from a controlled vocabulary).
source	Data source (model features, or observation)

Variable Attributes	
Name	Description
standard_name	A long descriptive name for the variable taken from a controlled vocabulary of variable names (when applicable)
units	The units of the variables data values. This attributes value should be a valid units string.

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3 PRODUCT FORMAT SPECIFICATION

3.1 L1B PRODUCT SPECIFICATION – LIST OF VARIABLES

The contents of the CryoSat science products can be logically grouped in:

1. Time and Orbit Information
2. Measurements
3. External Corrections
4. Average Waveforms
5. Waveforms

This logical classification could be implemented in the netCDF 4.0 model by means of a specific structure called **group**, however this feature is not used in the CryoSat products because users could be forced to update their existing analysis/visualisation tools in order to keep up with these new netCDF features.

Nevertheless, the logic behind this grouping is kept in the definition of the products and the rest of this section will follow this hierarchy for the format specification.

Another difference to the EE format to highlight is that the CryoSat netCDF products don't contain the blank records that were needed in the EE format to keep the binary structure consistent.

This means that there are no longer exactly 20 x 20 Hz records for every 1 Hz record and therefore the only way to associate 1 Hz to 20 Hz quantities is by means of the time stamps: the record whose 20 Hz time stamp holds the same as the 1 Hz time stamp is the first record in a group of up to 20 x 20 Hz records.

Before entering the details of the Product Format Definition please bear in mind that:

- Only signed types are used unless strictly required otherwise.
- The long-name has been kept from the field description in [PROD-FMT]

3.1.1 Time and Orbit Group

Time and Orbit Group				
ID	Variable Name (dim1,...,dim N) <i>long_name</i>	units	Standard_name	EE Field
1.	time_20_ku(time_20_ku) <i>time in TAI: seconds since 1 Jan 2000</i>	s	time	Data Record Time (MDSR Time Stamp)
2.	uso_cor_20_ku(time_20_ku) <i>uso correction applied to window delay (2-way)</i>			USO correction factor
3.	flag_instr_mode_op_20_ku(time_20_ku) <i>mode id - identifies the siral instrument measurement mode</i>	FLAG		Mode ID – ID 1
4.	flag_instr_mode_att_ctrl_20_ku(time_20_ku) <i>mode id: Platform Attitude Control</i>	FLAG		Mode ID – ID 5
5.	flag_instr_mode_flags_20_ku(time_20_ku) <i>mode id - identifies the sarin degraded case and the CAL4 flag</i>	FLAG		Mode ID – ID 2, ID 4
6.	seq_count_20_ku(time_20_ku) <i>Source Sequence Counter</i>	count		Source Sequence Counter
7.	flag_instr_conf_rx_in_use_20_ku(time_20_ku) <i>instrument configuration rx chain in use</i>	FLAG		Instrument Configuration
8.	flag_instr_conf_rx_bwdbt_20_ku(time_20_ku) <i>instrument configuration: acquisition band</i>	FLAG		Instrument Configuration

Time and Orbit Group				
ID	Variable Name (dim1,...,dim N) <i>long_name</i>	units	Standard_name	EE Field
9.	flag_instr_conf_rx_trk_mode_20_ku(time_20_ku) <i>instrument configuration: tracking mode</i>	FLAG		Instrument Configuration
10.	flag_instr_conf_rx_str_in_use_20_ku(time_20_ku) <i>instrument configuration: str in use</i>	FLAG		Instrument Configuration
11.	flag_instr_conf_rx_flags_20_ku(time_20_ku) <i>instrument configuration flags</i>	FLAG		Instrument Configuration
12.	rec_count_20_ku(time_20_ku) <i>record counter</i>	count		Burst counter
13.	lat_20_ku(time_20_ku) <i>20 Hz latitude</i>	deg_north	latitude	Latitude of measurement
14.	lon_20_ku(time_20_ku) <i>20 Hz longitude</i>	deg_east	longitude	Longitude of measurement
15.	alt_20_ku(time_20_ku) <i>altitude of the Satellite CoM above reference ellipsoid.</i>	m	height_above_reference_ellipsoid	Altitude of CoG above reference ellipsoid
16.	orb_alt_rate_20_ku(time_20_ku) <i>Altitude rate of the Satellite CoM with respect to the reference ellipsoid</i>	m/s		Instantaneous altitude rate derived from orbit Satellite velocity vector

Time and Orbit Group				
ID	Variable Name (dim1,...,dim N) <i>long_name</i>	units	Standard_name	EE Field
17.	sat_vel_vec_20_ku(time_20_ku,space_3d) <i>velocity vector in itr</i>	m/s		Satellite velocity vector[3] (in ITRF)
18.	beam_dir_vec_20_ku(time_20_ku,space_3d) <i>real beam direction vector in CRF</i>	m		Real beam direction vector[3] (in CRF)
19.	inter_base_vec_20_ku(time_20_ku,space_3d) <i>interferometric baseline direction vector in CRF</i>	m		Interferometer baseline vector[3] (in CRF)
20.	off_nadir_roll_angle_str_20_ku(time_20_ku) <i>antenna bench roll angle</i>	deg		Antenna Bench Roll Angle
21.	off_nadir_pitch_angle_str_20_ku(time_20_ku) <i>antenna bench pitch angle</i>	deg		Antenna Bench Pitch Angle
22.	off_nadir_yaw_angle_str_20_ku(time_20_ku) <i>antenna bench yaw angle</i>	deg		Antenna Bench Yaw Angle
23.	flag_mcd_20_ku (time_20_ku) <i>measurement confidence flags</i>	FLAG		Level 1b Measurement Confidence Data (flag word)
24.	ind_first_meas_20hz_01(time_cor_01) <i>index of the first 20Hz measurement: 1 Hz</i>	count		

Time and Orbit Group				
ID	Variable Name (dim1,...,dim N) <i>long_name</i>	units	Standard_name	EE Field
25.	ind_meas_1hz_20_ku(time_20_ku) <i>index of the 1Hz measurement: 20 Hz ku band</i>	count		

3.1.2 Measurements Group

Measurements Group				
ID	Variable Name (dim1,...,dim N) <i>long_name</i>	units	Standard_name	EE Field
1.	window_del_20_ku(time_20_ku) <i>calibrated window delay (2way)</i>	s		Window Delay (2way) corrected for instrument delays
2.	h0_applied_20_ku(time_20_ku) <i>h0 initial height word</i>	s		H0 Initial Height Word
3.	cor2_applied_20_ku(time_20_ku) <i>cor2 height rate</i>	s		COR2 Height Rate
4.	h0_lai_word_20_ku(time_20_ku) <i>coarse range word lai</i>	s		Coarse Range word LAI
5.	h0_fai_word_20_ku(time_20_ku) <i>fine word fai</i>	s		Fine Range word FAI
6.	agc_ch1_20_ku(time_20_ku) <i>agc gain applied on rx channel 1. gain calibration corrections are applied</i>	dB		AGC Channel 1 (corrected)
7.	agc_ch2_20_ku(time_20_ku) <i>agc gain applied on rx channel 2. gain calibration corrections are applied</i>	dB		AGC Channel 2 (corrected)
8.	tot_gain_ch1_20_ku(time_20_ku) <i>total fixed gain on channel 1</i>	dB		Total Fixed Gain Rx 1
9.	tot_gain_ch2_20_ku(time_20_ku) <i>total fixed gain on channel 2</i>	dB		Total Fixed Gain Rx 2
10.	transmit_pwr_20_ku(time_20_ku) <i>transmitted power</i>	Watt		Transmit Power

Measurements Group				
ID	Variable Name (dim1,...,dim N) <i>long_name</i>	units	Standard_name	EE Field
11.	dop_cor_20_ku(time_20_ku) <i>doppler range correction</i>	m		Doppler range correction (Radial component)
12.	instr_cor_range_tx_rx_20_ku(time_20_ku) <i>2-way instrument range correction (tx-rx chain)</i>	m		Instrument Range Correction tx-rx antenna
13.	instr_cor_range_rx_20_ku(time_20_ku) <i>2-way instrument range correction (rx only chain)</i>	m		Instrument Range Correction rx only antenna
14.	instr_cor_gain_tx_rx_20_ku(time_20_ku) <i>instrument gain correction (tx-rx chain)</i>	dB		Instrument Gain Correction tx-rx antenna
15.	instr_cor_gain_rx_20_ku(time_20_ku) <i>instrument gain correction (rx only chain)</i>	dB		Instrument Gain Correction rx only antenna
16.	instr_int_ph_cor_20_ku(time_20_ku) <i>internal phase correction computed from the cal-4 (FillValue in LRM and SAR cases)</i>	rad		Internal Phase Correction
17.	instr_ext_ph_cor_20_ku(time_20_ku) <i>external phase correction taken from the ipfdb file (FillValue in LRM and SAR cases)</i>	rad		External Phase Correction

Measurements Group				
ID	Variable Name (dim1,...,dim N) <i>long_name</i>	units	Standard_name	EE Field
18.	noise_power_20_ku(time_20_ku) <i>noise power measurement</i>	dB		Noise power measurement
19.	ph_slope_cor_20_ku(time_20_ku) <i>phase slope correction</i> <i>(FillValue in LRM and SAR cases)</i>	rad		Phase Slope Correction

3.1.3 External Corrections Group

Corrections Group				
ID	Variable Name(dim1,..,dim N) <i>long_name</i>	units	Standard_name	EE Field
1.	time_cor_01(time_cor_01) <i>time in TAI: seconds since 1 Jan 2000</i>	s	time	
2.	mod_dry_tropo_cor_01(time_cor_01) <i>dry tropospheric correction (1-way)</i>	m	altimeter_range_correction_due_to_dry_troposphere	Dry Tropospheric Correction
3.	mod_wet_tropo_cor_01(time_cor_01) <i>wet tropospheric correction (1-way)</i>	m	altimeter_range_correction_due_to_wet_troposphere	Wet Tropospheric Correction
4.	inv_bar_cor_01(time_cor_01) <i>inverse barometric correction (1-way)</i>	m	sea_surface_height_correction_due_to_air_pressure_at_low_frequency	Inverse Barometric Correction
5.	hf_fluct_total_cor_01(time_cor_01) <i>1-way dynamic atmospheric correction</i>	m	sea_surface_height_correction_due_to_air_pressure_and_wind_at_high_frequency	Dynamic Atmospheric Correction
6.	iono_cor_gim_01(time_cor_01) <i>gim ionospheric correction (1-way)</i>	m	altimeter_range_correction_due_to_ionosphere	GIM Ionospheric Correction
7.	iono_cor_01(time_cor_01) <i>model ionospheric correction (1-way)</i>	m	altimeter_range_correction_due_to_ionosphere	Model Ionospheric Correction
8.	ocean_tide_01 (time_cor_01) <i>elastic ocean tide (1-way)</i>	m	sea_surface_height_amplitude_due_to_geocentric_ocean_tide	Elastic Ocean Tide

Corrections Group				
ID	Variable Name(dim1,..,dim N) <i>long_name</i>	units	Standard_name	EE Field
9.	ocean_tide_eq_01(time_cor_01) <i>long period ocean tide (1-way)</i>	m	sea_surface_height_a amplitude_due_to_equil ibrium_ocean_tide	Long Period Ocean Tide
10.	load_tide_01(time_cor_01) <i>ocean loading tide (1-way)</i>	m		Ocean Loading Tide
11.	solid_earth_tide_01(time_cor_01) <i>solid earth tide (1-way)</i>	m	sea_surface_height_a amplitude_due_to_eart h_tide	Solid Earth Tide
12.	pole_tide_01(time_cor_01) <i>geocentric polar tide (1-way)</i>	m	sea_surface_height_a amplitude_due_to_pole _tide	Geocentric Polar Tide
13.	surf_type_01(time_cor_01) <i>surface type: 1 Hz</i>	count		Surface type flag
14.	flag_cor_status_01(time_cor_01) <i>correction status flags</i>	FLAG		Correction status flags
15.	flag_cor_err_01(time_cor_01) <i>correction error flags</i>	FLAG		Correction error flags

3.1.4 Average Waveforms Group

Average Waveform group				
ID	Variable Name (dim1,...,dim N) <i>long_name</i>	units	Standard_name	EE Field
1	time_avg_01_ku(time_avg_01_ku) <i>time in TAI: seconds since 1 Jan 2000</i>	s	time	Data Record Time (MDSR Time Stamp)
2	uso_cor_avg_01_ku(time_avg_01_ku) <i>uso correction applied to window delay (2-way)</i>	s		
3	lat_avg_01_ku(time_avg_01_ku) <i>latitude of measurement</i>	degree s_north	latitude	Latitude of measurement
4	lon_avg_01_ku(time_avg_01_ku) <i>longitude of measurement</i>	degree s_east	longitude	Longitude of measurement
5	alt_avg_01_ku(time_avg_01_ku) <i>altitude of the Satellite CoM above reference ellipsoid</i>	m	height_above_reference_ellipsoid	Altitude of CoM above reference ellipsoid (interpolated value)
6	window_del_avg_01_ku(time_avg_01_ku) <i>calibrated window delay (2-way)</i>	s		Window Delay (2way) corrected for instrument delays
7	pwr_waveform_avg_01_ku(time_avg_01_ku,ns_avg_01_ku) <i>1hz l1b power waveform scaled 0-65535</i>	count		1 Hz Averaged Power Echo Waveform
8	echo_scale_factor_avg_01_ku(time_avg_01_ku) <i>echo scale factor (to scale echo to watts)</i>	count		Echo Scale Factor (to scale echo to watts)

Average Waveform group				
ID	Variable Name (dim1,...,dim N) <i>long_name</i>	units	Standard_name	EE Field
9	echo_scale_pwr_avg_01_ku(time_avg_01_ku) <i>echo scale power (a power of 2)</i>	count		Echo Scale Power (a power of 2)
10	echo_numval_avg_01_ku(time_avg_01_ku) <i>number of echoes averaged</i>	count		Number of echoes averaged
11	flag_echo_avg_01_ku(time_avg_01_ku) <i>flags for errors or information about 1hz average power waveform</i>	FLAG		Flags

11.1.1 Waveforms Group

Waveform group				
ID	Variable Name (dim1,...,dim N) <i>long_name</i>	units	Standard_name	EE Field
1	pwr_waveform_20_ku(time_20_ku,ns_20_ku) <i>l1b power waveform scaled 0-65535</i>	count		Averaged Power Echo Waveform [128]
2	echo_scale_factor_20_ku(time_20_ku) <i>echo scale factor (to scale echo to watts)</i>	count		Echo Scale Factor (to scale echo to watts)
3	echo_scale_pwr_20_ku(time_20_ku) <i>echo scale power (a power of 2)</i>	count		Echo Scale Power (a power of 2)
4	echo_numval_20_ku(time_20_ku) <i>number of echoes averaged</i>	count		Number of echoes averaged
5	flag_echo_20_ku(time_20_ku) <i>flags for errors or information about L1b 20Hz power waveform</i>	FLAG		Flags
6	flag_trk_cycle_20_ku(time_20_ku) <i>trk cycle report (as extracted from the L0) LRM only</i>	count		TRK Report
7	stack_std_20_ku (time_20_ku) <i>Gaussian power fitting: std wrt beam number (FillValue in LRM case)</i>	count		Beam behaviour parameter
8	stack_centre_20_ku (time_20_ku) <i>gaussian power fitting: center wrt beam number (FillValue in LRM case)</i>	count		

Waveform group				
ID	Variable Name (dim1,...,dim N) <i>long_name</i>	units	Standard_name	EE Field
9	stack_scaled_amplitude_20_ku(time_20_ku) <i>gaussian power fitting: amplitude</i> <i>(FillValue in LRM case)</i>	dB		
10	stack_skewness_20_ku(time_20_ku) <i>gaussian power fitting: skewness wrt beam number</i> <i>(FillValue in LRM case)</i>	count		
11	stack_kurtosis_20_ku(time_20_ku) <i>gaussian power fitting: kurtosis wrt beam number</i> <i>(FillValue in LRM case)</i>	count		
12	stack_std_angle_20_ku(time_20_ku) <i>gaussian power fitting: std wrt boresight angle</i> <i>(FillValue in LRM case)</i>	rad		
13	stack_centre_angle_20_ku(time_20_ku) <i>gaussian power fitting: center wrt boresight angle</i> <i>(FillValue in LRM case)</i>	rad		
14	stack_centre_look_angle_20_ku(time_20_ku) <i>gaussian power fitting: center wrt look angle</i> <i>(FillValue in LRM case)</i>	rad		

Waveform group				
ID	Variable Name (dim1,...,dim N) <i>long_name</i>	units	Standard_name	EE Field
15	stack_gaussian_fitting_residuals_20_ku(time_20_ku) <i>gaussian power fitting: residuals fitting</i> <i>(FillValue in LRM case)</i>	rad		
16	dop_angle_start_20_ku(time_20_ku) <i>doppler angle start</i> <i>(FillValue in LRM case)</i>	Rad		
17	dop_angle_stop_20_ku(time_20_ku) <i>doppler angle stop</i> <i>(FillValue in LRM case)</i>	rad		
18	look_angle_start_20_ku(time_20_ku) <i>look angle start</i> <i>(FillValue in LRM case)</i>	rad		
19	look_angle_stop_20_ku(time_20_ku) <i>look angle stop</i> <i>(FillValue in LRM case)</i>	rad		
20	stack_number_after_weighting_20_ku(time_20_ku) <i>number of contributing beams in the stack after weighting</i> <i>(FillValue in LRM case)</i>	count		Beam behaviour parameter
21	stack_number_before_weighting_20_ku(time_20_ku) <i>number of contributing beams in the stack before weighting</i> <i>(FillValue in LRM case)</i>	count		Beam behaviour parameter

Waveform group				
ID	Variable Name (dim1,...,dim N) <i>long_name</i>	units	Standard_name	EE Field
22	stack_peakiness_20_ku(time_20_ku) <i>Stack peakiness</i>	count		
23	coherence_waveform_20_ku(time_20_ku,ns_20_ku) <i>l1b coherence waveform</i> <i>(FillValue in LRM and SAR cases)</i>	Count		Coherence [1024]
24	ph_diff_waveform_20_ku(time_20_ku,ns_20_ku) <i>l1b Phase Difference waveform</i> <i>(FillValue in LRM and SAR cases)</i>	rad		Phase difference [1024]

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24.1 FBR PRODUCT SPECIFICATION – LIST OF VARIABLES

The contents of the CryoSat FBR products can be logically grouped in:

1. Time and Orbit Information
2. Measurements
3. External Corrections
4. Waveforms

This logical classification could be implemented in the netCDF 4.0 model by means of a specific structure called **group**, however this feature is not used in the CryoSat products in order to assure the back compatibility with previous versions of the netCDF models.

Nevertheless the logic behind this grouping is kept in the definition of the products and the remaining of this section will follow this hierarchy for the format specification.

Note: all the FBR variables are written in lowercase and have the suffix **_x** where **_x** indicates the frequency and it is set to **21** for SARIn (01 for corrections) and **85** for SAR (04 for corrections).

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24.1.1 Time and Orbit Group

Time and Orbit Group				
ID	Variable Name (dim1,...,dim N) <i>long_name</i>	units	Standard_name	EE Field
1	time_x_ku(time_x_ku) <i>time in TAI: seconds since 1 Jan 2000</i>	s		Data Record Time (MDSR Time Stamp)
2	uso_cor_x_ku(time_x_ku) <i>uso correction (2-way)</i>			USO correction factor
3	flag_instr_mode_op_x_ku(time_x_ku) <i>mode id - identifies the siral instrument measurement mode</i>	FLAG		Mode ID – ID 1
4	flag_instr_mode_att_ctr_x_ku(time_x_ku) <i>mode id - platform attitude control</i>	FLAG		Mode ID – ID 5
5	flag_instr_mode_flags_x_ku(time_x_ku) <i>mode id - identifies the sarin degraded case and the CAL4 flag</i>	FLAG		Mode ID – ID 2, ID 4
	seq_count_x_ku(time_x_ku) <i>Source Sequence Counter</i>	count		Source Sequence Counter
6	flag_instr_conf_rx_in_use_x_ku (time_x_ku) <i>instrument configuration flags</i>	FLAG		Instrument Configuration
7	flag_instr_conf_rx_bwdt_x_ku (time_x_ku) <i>instrument configuration: tracking bandwidth</i>	FLAG		Instrument Configuration
8	flag_instr_conf_rx_trk_mode_x_ku (time_x_ku) <i>instrument configuration : tracking mode</i>	FLAG		Instrument Configuration

Time and Orbit Group				
ID	Variable Name (dim1,...,dim N) <i>long_name</i>	units	Standard_name	EE Field
9	flag_instr_conf_rx_str_in_use_x_ku(time_x_ku) <i>instrument configuration:str in use</i>	FLAG		Instrument Configuration
10	flag_instr_conf_rx_flags_x_ku(time_x_ku) <i>instrument configuration flags</i>	FLAG		Instrument Configuration
11	rec_count_x_ku (ns_x_ku) <i>record counter</i>	count		Burst counter
12	lat_x_ku (time_x_ku) <i>20 Hz latitude</i>	deg	latitude	Latitude of measurement
13	lon_x_ku (time_x_ku) <i>20 Hz longitude</i>	deg	longitude	Longitude of measurement
14	alt_x_ku (time_x_ku) <i>Altitude of the Satellite CoM above reference ellipsoid</i>	m	height_above_reference_ellipsoid	Altitude of CoM above reference ellipsoid
15	orb_alt_rate_x_ku (time_x_ku) <i>Altitude rate of the Satellite CoM with respect to the reference ellipsoid</i>	m/s		Instantaneous altitude rate derived from orbit Satellite velocity vector
16	sat_vel_vec_x_ku(time_x_ku,space_3d) <i>velocity vector in itr</i>	m/s		Satellite velocity vector[3] (in ITRF)
17	beam_dir_vec_20_x_ku(time_x_ku,space_3d) <i>real beam direction vector in CRF</i>	m		Real beam direction vector[3] (in CRF)

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Time and Orbit Group				
ID	Variable Name (dim1,...,dim N) <i>long_name</i>	units	Standard_name	EE Field
18	inter_base_vec_x_ku(time_x_ku,space_3d) <i>interferometric baseline direction vector in CRF</i>	m		Interferometer baseline vector[3] (in CRF)
19	flag_mcd_x_ku(time_x_ku) <i>measurement confidence flags</i>	FLAG		FBR Measurement Confidence Data (flag word)

19.1.1 Measurements Group

Measurements Group				
ID	Variable Name (dim1,...,dim N) <i>long_name</i>	units	Standard_name	EE Field
20	window_del_x_ku(time_x_ku) <i>window delay (2-way)</i>	s		Window Delay (2way) corrected for instrument delays
21	h0_applied_x_ku (time_x_ku) <i>h0 initial height word</i>	s		H0 Initial Height Word
22	cor2_applied_x_ku (time_x_ku) <i>cor2 height rate</i>	s		COR2 Height Rate
23	h0_lai_word_x_ku (time_x_ku) <i>coarse range word lai</i>	s		Coarse Range word LAI
24	h0_fai_word_x_ku (time_x_ku) <i>fine word fai</i>	s		Fine Range word FAI
25	agc_1_x_ku (time_x_ku) uncorrected agc command value for stage 1	dB		AGC Channel 1 (corrected)
26	agc_2_x_ku (time_x_ku) uncorrected agc command value for stage 2	dB		AGC Channel 2 (corrected)
27	tot_gain_ch1_x_ku (time_x_ku) <i>total fixed gain on channel 1</i>	dB		Total Fixed Gain Rx 1
28	tot_gain_ch2_x_ku (time_x_ku) <i>total fixed gain on channel 2</i>	dB		Total Fixed Gain Rx 2
1	transmit_pwr_x_ku (time_x_ku) <i>transmitted power</i>	Watt		Transmit Power

Measurements Group				
ID	Variable Name (dim1,...,dim N) <i>long_name</i>	units	Standard_name	EE Field
2	dop_cor_x_ku (time_x_ku) <i>doppler range correction</i>	m		Doppler range correction (Radial component)
3	instr_cor_range_tx_rx_x_ku(time_x_ku) <i>2-way instrument range correction (tx-rx chain)</i>	m		Instrument Range Correction tx-rx antenna
4	instr_cor_range_rx_x_ku (time_x_ku) <i>2-way instrument range correction (rx only chain)</i>	m		Instrument Range Correction rx only antenna
5	instr_cor_gain_tx_rx_x_ku (time_x_ku) <i>instrument gain correction (tx-rx chain)</i>	dB		Instrument Gain Correction tx-rx antenna
6	instr_cor_gain_rx_x_ku (time_x_ku) <i>instrument gain correction (rx only chain)</i>	dB		Instrument Gain Correction rx only antenna
7	instr_int_ph_cor_x_ku (time_x_ku) <i>internal phase correction computed from the cal-4</i> <i>(FillValue in SAR case)</i>	rad		Internal Phase Correction
8	instr_ext_ph_cor_x_ku(time_x_ku) <i>external phase correction taken from the ipfdb file</i> <i>(FillValue in SAR case)</i>	rad		External Phase Correction
9	noise_power_x_ku(time_x_ku) <i>noise power measurement</i>	dB		Noise power measurement

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Measurements Group				
ID	Variable Name (dim1,...,dim N) <i>long_name</i>	units	Standard_name	EE Field
10	ph_slope_cor_x_ku(time_x_ku) <i>phase slope correction</i> <i>(FillValue in SAR case)</i>	rad		Phase Slope Correction

10.1.1 External Corrections Group

Corrections Group				
ID	Variable Name(dim1,..,dim N) <i>long_name</i>	units	Standard_name	EE Field
1	time_cor_01(time_cor_01) <i>time in TAI: seconds since 1 Jan 2000</i>	s	time	Data Record Time (MDSR Time Stamp)
2	mod_dry_tropo_cor_01(time_cor_01) <i>dry tropospheric correction (1-way)</i>	m	altimeter_range_c orrection_due_to_ dry_troposphere	Dry Tropospheric Correction
3	mod_wet_tropo_cor_01(time_cor_01) <i>wet tropospheric correction (1-way)</i>	m	altimeter_range_c orrection_due_to_ wet_troposphere	Wet Tropospheric Correction
4	inv_bar_cor_01(time_cor_01) <i>inverse barometric correction (1-way)</i>	m		Inverse Barometric Correction
5	hf_fluct_total_cor_01(time_cor_01) <i>1-way dynamic atmospheric correction</i>	m		Dynamic Atmospheric Correction
6	iono_cor_gim_01_ku(time_cor_01) <i>gim ionospheric correction (1-way)</i>	m	altimeter_range_c orrection_due_to_ ionosphere	GIM Ionospheric Correction
7	iono_cor_01_ku(time_cor_01) <i>model ionospheric correction (1-way)</i>	m	altimeter_range_c orrection_due_to_ ionosphere	Model Ionospheric Correction
8	ocean_tide_01(time_cor_01) <i>elastic ocean tide (1-way)</i>	m		Elastic Ocean Tide
9	ocean_tide_eq_01(time_cor_01) <i>long period ocean tide (1-way)</i>	m		Long Period Ocean Tide

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Corrections Group				
ID	Variable Name(dim1,..,dim N) <i>long_name</i>	units	Standard_name	EE Field
10	load_tide_01(time_cor_01) <i>ocean loading tide (1-way)</i>	m		Ocean Loading Tide
11	solid_earth_tide_01(time_cor_01) <i>solid earth tide (1-way)</i>	m		Solid Earth Tide
12	pole_tide_01(time_cor_01) <i>geocentric polar tide (1-way)</i>	m		Geocentric Polar Tide
13	surf_type_01(time_cor_01) <i>surface type: 1 Hz</i>	count		Surface type flag
14	flag_cor_status_01(time_cor_01) <i>correction status flags</i>	m		Correction status flags
15	flag_cor_err_01(time_cor_01) <i>correction error flags</i>	m		Correction error flags

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15.1.1 Waveforms Group

Waveform group – SAR case				
ID	Variable Name (dim1,...,dim N) <i>long_name</i>	units	Standard_name	EE Field
1	cplx_waveform_ch1_i_85_ku(time_85_ku, np_ku, ns_ku) <i>fbr sar complex waveforms i samples</i>	count		Complex Echo Waveform [64,128]
2	cplx_waveform_ch1_q_85_ku(time_85_ku, np_ku, ns_ku) <i>fbr sar complex waveforms q samples</i>	count		Complex Echo Waveform [64,128]
3	echo_numval_85_ku(time_85_ku) <i>number of echoes in a burst</i>	count		Number of pulses in burst
4	flag_echo_85_ku(time_85_ku) <i>flags for errors or information about FBR 20Hz power waveform</i>	FLAG		Flags

Waveform group – SARIn case				
ID	Variable Name (dim1,...,dim N) <i>long_name</i>	units	Standard_name	EE Field
1	cplx_waveform_ch1_i_21_ku(time_21_ku,n p_ku,ns_ku) <i>fbr sarin rx1 complex waveforms i samples</i>	count		Complex Echo Waveform [64,128] antenna 1 (Tx-Rx)
2	cplx_waveform_ch1_q_21_ku(time_21_ku, np_ku,ns_ku) <i>fbr sarin rx1 complex waveforms q samples</i>	count		Complex Echo Waveform [64,128] antenna 1 (Tx-Rx)
3	cplx_waveform_ch2_i_21_ku(time_21_ku,n p_ku,ns_ku) <i>fbr sarin rx2 complex waveforms i samples</i>	count		Complex Echo Waveform [64,128] antenna 2 (Rx only)
4	cplx_waveform_ch2_q_21_ku(time_21_ku, np_ku,ns_ku) <i>fbr sarin rx2 complex waveforms q samples</i>	count		Complex Echo Waveform [64,128] antenna 2 (Rx only)
5	echo_numval_21_ku(time_21_ku) <i>number of echoes in a burst</i>	count		Number of pulses in burst
6	flag_echo_21_ku(time_21_ku) <i>flags for errors or information about fbr complex waveforms</i>	FLAG		Flags

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6.1 L1B / FBR PRODUCT SPECIFICATION – CDL DUMP

agc_1_21_ku(time_21_ku)

```
int agc_1_21_ku(time_21_ku) ;
    agc_1_21_ku:_FillValue = -2147483648 ;
    agc_1_21_ku:units = "dB" ;
    agc_1_21_ku:long_name = "uncorrected AGC command value for stage 1" ;
    agc_1_21_ku:comment = "Gain command for the AGC stage 1 for both the Rx
                           channels. It does not include the
                           calibration corrections that are specific
                           for each Rx channel" ;
    agc_1_21_ku:coordinates = "lon_21_ku lat_21_ku";
    agc_1_21_ku:add_offset = 0.0 ;
    agc_1_21_ku:scale_factor = 0.01 ;
```

agc_1_85_ku(time_85_ku)

```
int agc_1_85_ku(time_85_ku) ;
    agc_1_85_ku:_FillValue = -2147483648 ;
    agc_1_85_ku:units = "dB" ;
    agc_1_85_ku:long_name = "uncorrected AGC command value for stage 1" ;
    agc_1_85_ku:comment = "Gain command for the AGC stage 1 for both the Rx
                           channels. It does not include the
                           calibration corrections that are specific
                           for each Rx channel." ;
    agc_1_85_ku:coordinates = "lon_85_ku lat_85_ku";
    agc_1_85_ku:add_offset = 0.0 ;
    agc_1_85_ku:scale_factor = 0.01 ;
```

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agc_2_21_ku(time_21_ku)

```

int agc_2_21_ku(time_21_ku) ;
    agc_2_21_ku:_FillValue = -2147483648 ;
    agc_2_21_ku:units = "dB" ;
    agc_2_21_ku:long_name = "uncorrected AGC command value for stage 2" ;
    agc_2_21_ku:comment = "Gain command for the AGC stage 2 for both the Rx
                           channels. It does not include the calibration
                           corrections that are specific for each Rx
                           channel." ;
    agc_2_21_ku:coordinates = "lon_21_ku lat_21_ku";
    agc_2_21_ku:add_offset = 0.0 ;
    agc_2_21_ku:scale_factor = 0.01 ;

```

agc_2_85_ku(time_85_ku)

```

int agc_2_85_ku(time_85_ku) ;
    agc_2_85_ku:_FillValue = -2147483648 ;
    agc_2_85_ku:units = "dB" ;
    agc_2_85_ku:long_name = "uncorrected AGC command value for stage 2" ;
    agc_2_85_ku:comment = "Gain command for the AGC stage 2 for both the Rx
                           channels. It does not include the calibration
                           corrections that are specific for each Rx
                           channel." ;
    agc_2_85_ku:coordinates = "lon_85_ku lat_85_ku";
    agc_2_85_ku:add_offset = 0.0 ;
    agc_2_85_ku:scale_factor = 0.01 ;

```

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agc_ch1_20_ku(time_20_ku)

```

int agc_ch1_20_ku(time_20_ku) ;
    agc_ch1_20_ku:_FillValue = -2147483648;
    agc_ch1_20_ku:units = "dB" ;
    agc_ch1_20_ku:long_name = "AGC gain applied on rx channel 1. Gain
                                calibration corrections are applied" ;
    agc_ch1_20_ku:comment = "Calibrated AGC gain applied on Rx channel 1.
                                This is the sum of AGC stages 1 and 2 plus
                                the corresponding AGC calibration
                                corrections" ;
    agc_ch1_20_ku:coordinates = "lon_20_ku lat_20_ku";
    agc_ch1_20_ku:add_offset = 0.0 ;
    agc_ch1_20_ku:scale_factor = 0.01 ;

```

agc_ch2_20_ku(time_20_ku)

```

int agc_ch2_20_ku(time_20_ku) ;
    agc_ch2_20_ku:_FillValue = -2147483648 ;
    agc_ch2_20_ku:units = "dB" ;
    agc_ch2_20_ku:long_name = "AGC gain applied on rx channel 2. Gain
                                calibration corrections are applied" ;
    agc_ch2_20_ku:comment = " Calibrated AGC gain applied on Rx channel 2. This
is the sum of AGC stages 1 and 2 plus the corresponding AGC calibration corrections"
;
    agc_ch2_20_ku:coordinates = "lon_20_ku lat_20_ku";
    agc_ch2_20_ku:add_offset = 0.0 ;
    agc_ch2_20_ku:scale_factor = 0.01 ;

```

		<i>Instrument Processing Facility L1b</i> <i>Cryosat Ice netCDF L1b PFS</i> Doc. No.: C2-RS-ACS-ESL-5364 Issue: 1.8 Date: 04/12/2018 Page: 57
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alt_20_ku(time_20_ku)

```

int alt_20_ku(time_20_ku) ;
    alt_20_ku:_FillValue = -2147483648 ;
    alt_20_ku:units = "m" ;
    alt_20_ku:long_name = "Altitude of CoM above the reference ellipsoid" ;
    alt_20_ku:standard_name = "height_above_reference_ellipsoid" ;
    alt_20_ku:comment = "Altitude of the Satellite CoM above the reference
                        ellipsoid." ;
    alt_20_ku:coordinates = "lon_20_ku lat_20_ku";
    alt_20_ku:add_offset = 0.0 ;
    alt_20_ku:scale_factor = 0.001 ;

```

alt_21_ku(time_21_ku)

```

int alt_21_ku(time_21_ku) ;
    alt_21_ku:_FillValue = -2147483648 ;
    alt_21_ku:units = "m" ;
    alt_21_ku:long_name = " Altitude of the Satellite CoM above the reference
ellipsoid" ;
    alt_21_ku:standard_name = "height_above_reference_ellipsoid" ;
    alt_21_ku:comment = "Altitude of the Satellite CoM above the reference
                        ellipsoid [WGS84] corresponding to the MDSR Time
                        Stamp - FBR SARIn." ;
    alt_21_ku:coordinates = "lon_21_ku lat_21_ku";
    alt_21_ku:add_offset = 0. ;
    alt_21_ku:scale_factor = 0.001 ;

```

alt_85_ku(time_85_ku)

```

int alt_85_ku(time_85_ku) ;
    alt_85_ku:_FillValue = -2147483648 ;
    alt_85_ku:units = "m" ;
    alt_85_ku:long_name = " Altitude of the Satellite CoM above the reference
ellipsoid" ;
    alt_85_ku:standard_name = "height_above_reference_ellipsoid" ;

```

		<i>Instrument Processing Facility L1b</i> <i>Cryosat Ice netCDF L1b PFS</i> Doc. No.: <i>C2-RS-ACS-ESL-5364</i> Issue: <i>1.8</i> Date: <i>04/12/2018</i> Page: <i>58</i>
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```

alt_85_ku:comment = "Altitude of the Satellite CoM above reference
                    ellipsoid [WGS84] corresponding to the MDSR Time
                    Stamp - FBR SAR." ;

alt_85_ku:coordinates = "lon_85_ku lat_85_ku";

alt_85_ku:add_offset = 0.0 ;

alt_85_ku:scale_factor = 0.001 ;

```

alt_avg_01_ku(time_avg_01_ku)

```

int alt_avg_01_ku(time_avg_01_ku) ;

alt_avg_01_ku:_FillValue = -2147483648 ;

alt_avg_01_ku:units = "m" ;

alt_avg_01_ku:long_name = "Altitude of the Satellite CoM above reference
                        ellipsoid" ;

alt_avg_01_ku:comment = "Altitude of the Satellite CoM above reference
                        ellipsoid [WGS84] corresponding to the MDSR Time Stamp for L1B 1Hz average power
                        waveform." ;

alt_avg_01_ku:coordinates = "lon_avg_01_ku lat_avg_01_ku";

alt_avg_01_ku:add_offset = 0.0 ;

alt_avg_01_ku:scale_factor = 0.001 ;

```

beam_dir_vec_20_ku(time_20_ku,space_3d)

```

int beam_dir_vec_20_ku(time_20_ku, space_3d) ;

beam_dir_vec_20_ku:_FillValue = -2147483648 ;

beam_dir_vec_20_ku:units = "m" ;

beam_dir_vec_20_ku:long_name = "real beam direction vector in CRF" ;

beam_dir_vec_20_ku:comment = "Real beam direction vector described in the
                        CryoSat Reference Frame. The 3 components are given
                        according to the 'space_3d' dimension: [1] x, [2]
                        y, [3] z." ;

beam_dir_vec_20_ku:coordinates = "lon_20_ku lat_20_ku";

beam_dir_vec_20_ku:add_offset = 0.0 ;

beam_dir_vec_20_ku:scale_factor = 1.e-06 ;

```

		<i>Instrument Processing Facility L1b</i> <i>Cryosat Ice netCDF L1b PFS</i> Doc. No.: <i>C2-RS-ACS-ESL-5364</i> Issue: <i>1.8</i> Date: <i>04/12/2018</i> Page: <i>59</i>
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beam_dir_vec_21_ku(time_21_ku,space_3d)

```

int beam_dir_vec_21_ku(time_21_ku, space_3d) ;
beam_dir_vec_21_ku:_FillValue = -2147483648 ;
beam_dir_vec_21_ku:units = "m" ;
beam_dir_vec_21_ku:long_name = "real beam direction vector in CRF" ;
beam_dir_vec_21_ku:comment = "Real beam direction vector described in the
                                CryoSat Reference Frame. The 3 components are given
                                according to the 'space_3d' dimension: [1] x, [2]
                                y, [3] z - FBR SARIn Mode." ;
beam_dir_vec_21_ku:coordinates = "lon_21_ku lat_21_ku";
beam_dir_vec_21_ku:add_offset = 0.0 ;
beam_dir_vec_21_ku:scale_factor = 1.e-06 ;

```

beam_dir_vec_85_ku(time_85_ku,space_3d)

```

int beam_dir_vec_85_ku(time_85_ku, space_3d) ;
beam_dir_vec_85_ku:_FillValue = -2147483648 ;
beam_dir_vec_85_ku:units = "m" ;
beam_dir_vec_85_ku:long_name = "real beam direction vector in CRF" ;
beam_dir_vec_85_ku:comment = "Real beam direction vector described in the
                                CryoSat Reference Frame. The 3 components are given
                                according to the 'space_3d' dimension: [1] x, [2]
                                y, [3] z - FBR SAR Mode." ;
beam_dir_vec_85_ku:coordinates = "lon_85_ku lat_85_ku";
beam_dir_vec_85_ku:add_offset = 0.0 ;
beam_dir_vec_85_ku:scale_factor = 1.e-06 ;

```

		<i>Instrument Processing Facility L1b</i> <i>Cryosat Ice netCDF L1b PFS</i> Doc. No.: C2-RS-ACS-ESL-5364 Issue: 1.8 Date: 04/12/2018 Page: 60
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coherence_waveform_20_ku(time_20_ku, ns_20_ku)

```

short coherence_waveform_20_ku(time_20_ku, ns_20_ku) ;
    coherence_waveform_20_ku:_FillValue = -32768s ;
    coherence_waveform_20_ku:units = "count" ;
    coherence_waveform_20_ku:long_name = "l1b coherence waveform" ;
    coherence_waveform_20_ku:comment = "The L1b 20Hz coherence waveform is a
                                         fully-calibrated, high resolution, multilooked
                                         coherence computed from the complex echoes on the
                                         two receiving channels (SARIn only)." ;
    coherence_waveform_20_ku:coordinates = "lon_20_ku lat_20_ku";
    coherence_waveform_20_ku:add_offset = 0.0 ;
    coherence_waveform_20_ku:scale_factor = 0.001 ;

```

cor2_applied_20_ku(time_20_ku)

```

int cor2_applied_20_ku(time_20_ku) ;
    cor2_applied_20_ku:_FillValue = -2147483648 ;
    cor2_applied_20_ku:units = "seconds/rc" ;
    cor2_applied_20_ku:long_name = "cor2 height rate" ;
    cor2_applied_20_ku:comment = "COR2 is the 2-way on-board tracker height
                                   rate over the radar cycle, forwarded from
                                   telemetry." ;
    cor2_applied_20_ku:coordinates = "lon_20_ku lat_20_ku";
    cor2_applied_20_ku:add_offset = 0.0 ;
    cor2_applied_20_ku:scale_factor = 3.05e-12 ;

```

cor2_applied_21_ku(time_21_ku)

```

int cor2_applied_21_ku(time_21_ku) ;
    cor2_applied_21_ku:_FillValue = -2147483648 ;
    cor2_applied_21_ku:units = "seconds/rc" ;
    cor2_applied_21_ku:long_name = "cor2 height rate" ;
    cor2_applied_21_ku:comment = "COR2 is the 2-way on-board tracker height
                                   rate over the radar cycle, forwarded from telemetry
                                   - FBR SARIn." ;
    cor2_applied_21_ku:coordinates = "lon_21_ku lat_21_ku";

```

		<i>Instrument Processing Facility L1b</i> <i>Cryosat Ice netCDF L1b PFS</i> Doc. No.: C2-RS-ACS-ESL-5364 Issue: 1.8 Date: 04/12/2018 Page: 61
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```
cor2_applied_21_ku:add_offset = 0.0 ;
cor2_applied_21_ku:scale_factor = 3.05e-12 ;
```

cor2_applied_85_ku(time_85_ku)

```
int cor2_applied_85_ku(time_85_ku) ;
cor2_applied_85_ku:_FillValue = -2147483648 ;
cor2_applied_85_ku:units = "seconds/rc" ;
cor2_applied_85_ku:long_name = "cor2 height rate" ;
cor2_applied_85_ku:comment = "COR2 is the 2-way on-board tracker height
                             rate over the radar cycle, forwarded from telemetry
                             - FBR SAR." ;
cor2_applied_85_ku:coordinates = "lon_85_ku lat_85_ku";
cor2_applied_85_ku:add_offset = 0.0 ;
cor2_applied_85_ku:scale_factor = 3.05e-12 ;
```

cplx_waveform_ch1_i_21_ku(time_21_ku,np_ku,ns_ku)

```
byte cplx_waveform_ch1_i_21_ku(time_21_ku, np_ku,ns_ku) ;
cplx_waveform_ch1_i_21_ku:units = "count" ;
cplx_waveform_ch1_i_21_ku:long_name = "fbr sarin rx1 complex waveforms i
samples" ;
cplx_waveform_ch1_i_21_ku:add_offset = 0b ;
cplx_waveform_ch1_i_21_ku:scale_factor = 1b ;
cplx_waveform_ch1_i_21_ku:comment = "The in-phase component of each
complex echo waveform in the burst received by antenna 1 (Tx-Rx). Instrument
calibrations not applied." ;
cplx_waveform_ch1_i_21_ku:coordinates = "lon_21_ku lat_21_ku";
```

cplx_waveform_ch1_i_85_ku(time_85_ku,np_ku, ns_ku)

```
byte cplx_waveform_ch1_i_85_ku(time_85_ku, np_ku, ns_ku) ;
cplx_waveform_ch1_i_85_ku:units = "count" ;
cplx_waveform_ch1_i_85_ku:long_name = " fbr sar complex waveforms i
samples" ;
cplx_waveform_ch1_i_85_ku:add_offset = 0b ;
cplx_waveform_ch1_i_85_ku:scale_factor = 1b ;
```

		<i>Instrument Processing Facility L1b</i> <i>Cryosat Ice netCDF L1b PFS</i> Doc. No.: C2-RS-ACS-ESL-5364 Issue: 1.8 Date: 04/12/2018 Page: 62
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```

cplx_waveform_ch1_i_85_ku:comment = "The in-phase component of each
complex echo waveform in the burst received by antenna 1 (Tx-Rx). Instrument
calibrations not applied." ;

```

```

cplx_waveform_ch1_i_85_ku:coordinates = "lon_85_ku lat_85_ku";

```

cplx_waveform_ch1_q_21_ku(time_21_ku,np_ku, ns_ku)

```

byte cplx_waveform_ch1_q_21_ku(time_21_ku, np_ku, ns_ku) ;
cplx_waveform_ch1_q_21_ku:units = "count" ;
cplx_waveform_ch1_q_21_ku:long_name = "fbr sarin rx1 complex waveforms q
samples" ;
cplx_waveform_ch1_q_21_ku:add_offset = 0b ;
cplx_waveform_ch1_q_21_ku:scale_factor = 1b ;
cplx_waveform_ch1_q_21_ku:comment = "The quadrature component of each
complex echo waveform in the burst received by antenna 1 (Tx-Rx). Instrument
calibrations not applied." ;

```

```

cplx_waveform_ch1_q_21_ku:coordinates = "lon_21_ku lat_21_ku";

```

cplx_waveform_ch1_q_85_ku(time_85_ku,np_ku, ns_ku)

```

byte cplx_waveform_ch1_q_85_ku(time_85_ku, np_ku, ns_ku) ;
cplx_waveform_ch1_q_85_ku:units = "count" ;
cplx_waveform_ch1_q_85_ku:long_name = "fbr sar complex waveforms q
samples" ;
cplx_waveform_ch1_q_85_ku:add_offset = 0b ;
cplx_waveform_ch1_q_85_ku:scale_factor = 1b ;
cplx_waveform_ch1_q_85_ku:comment = "The quadrature component of each
complex echo waveform in the burst received by antenna 1 (Tx-Rx). Instrument
calibrations not applied." ;

```

```

cplx_waveform_ch1_q_85_ku:coordinates = "lon_85_ku lat_85_ku";

```

cplx_waveform_ch2_i_21_ku(time_21_ku,np_ku, ns_ku)

```

byte cplx_waveform_ch2_i_21_ku(time_21_ku, np_ku, ns_ku) ;
cplx_waveform_ch2_i_21_ku:units = "count" ;
cplx_waveform_ch2_i_21_ku:long_name = "fbr sarin complex waveforms i
samples" ;

```

		<i>Instrument Processing Facility L1b</i> <i>Cryosat Ice netCDF L1b PFS</i> Doc. No.: <i>C2-RS-ACS-ESL-5364</i> Issue: <i>1.8</i> Date: <i>04/12/2018</i> Page: <i>63</i>
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```

cplx_waveform_ch2_i_21_ku:add_offset = 0b ;

cplx_waveform_ch2_i_21_ku:scale_factor = 1b ;

cplx_waveform_ch2_i_21_ku:comment = "The in-phase component of each
complex echo waveform in the burst received by antenna 2 (Rx only). Instrument
calibrations not applied." ;

cplx_waveform_ch2_i_21_ku:coordinates = "lon_21_ku lat_21_ku";

```

cplx_waveform_ch2_q_21_ku(time_21_ku,np_ku, ns_ku)

```

byte cplx_waveform_ch2_q_21_ku(time_21_ku, np_ku, ns_ku) ;

cplx_waveform_ch2_q_21_ku:units = "count" ;

cplx_waveform_ch2_q_21_ku:long_name = "fbr sarin rx2 complex waveforms q
samples" ;

cplx_waveform_ch2_q_21_ku:add_offset = 0b ;

cplx_waveform_ch2_q_21_ku:scale_factor = 1b ;

cplx_waveform_ch2_q_21_ku:comment = "The quadrature component of each
complex echo waveform in the burst received by antenna 2 (Rx only). Instrument
calibrations not applied." ;

cplx_waveform_ch2_q_21_ku:coordinates = "lon_21_ku lat_21_ku";

```

dop_angle_start_20_ku(time_20_ku)

```

int dop_angle_start_20_ku(time_20_ku) ;

dop_angle_start_20_ku:_FillValue = -2147483648 ;

dop_angle_start_20_ku:units = "rad" ;

dop_angle_start_20_ku:long_name = "doppler angle start" ;

dop_angle_start_20_ku:add_offset = 0.0 ;

dop_angle_start_20_ku:scale_factor = 1.e-07 ;

dop_angle_start_20_ku:comment = "Value of Doppler Angle for the first
                                single look echo in the stack. It is the angle
                                between: (a) direction perpendicular to the
                                velocity vector, (b) direction from satellite to
                                surface location. The Doppler angle depends on
                                velocity vector and on geometry. SAR/SARIn only."
                                ;

dop_angle_start_20_ku:coordinates = "lon_20_ku lat_20_ku";

```

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dop_angle_stop_20_ku(time_20_ku)

```
int dop_angle_stop_20_ku(time_20_ku) ;
    dop_angle_stop_20_ku:_FillValue = -2147483648 ;
    dop_angle_stop_20_ku:units = "rad" ;
    dop_angle_stop_20_ku:long_name = "doppler angle stop" ;
    dop_angle_stop_20_ku:add_offset = 0.0;
    dop_angle_stop_20_ku:scale_factor = 1.e-07 ;
    dop_angle_stop_20_ku:comment = "Value of Doppler Angle for the last single
                                   look echo in the stack. It is the angle between:
                                   (a) direction perpendicular to the velocity
                                   vector, (b) direction from satellite to surface
                                   location. The Doppler angle depends on velocity
                                   vector and on geometry. SAR/SARIn only." ;
    dop_angle_stop_20_ku:coordinates = "lon_20_ku lat_20_ku";
```

dop_cor_20_ku(time_20_ku)

```
int dop_cor_20_ku(time_20_ku) ;
    dop_cor_20_ku:_FillValue = -2147483648 ;
    dop_cor_20_ku:units = "m" ;
    dop_cor_20_ku:long_name = "doppler range correction" ;
    dop_cor_20_ku:comment = "This is the Doppler range correction due to the
                             satellite altitude rate. It is computed for the
                             component of satellite velocity in the nadir
                             direction. Correction applied to L1B LRM waveforms
                             only." ;
    dop_cor_20_ku:coordinates = "lon_20_ku lat_20_ku";
    dop_cor_20_ku:add_offset = 0.0 ;
    dop_cor_20_ku:scale_factor = 0.001 ;
```

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dop_cor_21_ku(time_21_ku)

```

int dop_cor_21_ku(time_21_ku) ;
dop_cor_21_ku:_FillValue = -2147483648 ;
dop_cor_21_ku:units = "m" ;
dop_cor_21_ku:long_name = "doppler range correction" ;
dop_cor_21_ku:comment = "This is the Doppler range correction due to the
                           satellite altitude rate. It is computed for the
                           component of satellite velocity in the nadir
                           direction. Not used by the SAR processor - FBR
                           SARIn.";
dop_cor_21_ku:coordinates = "lon_21_ku lat_21_ku";
dop_cor_21_ku:add_offset = 0. ;
dop_cor_21_ku:scale_factor = 0.001 ;

```

dop_cor_85_ku(time_85_ku)

```

int dop_cor_85_ku(time_85_ku) ;
dop_cor_85_ku:_FillValue = -2147483648 ;
dop_cor_85_ku:units = "m" ;
dop_cor_85_ku:long_name = "doppler range correction" ;
dop_cor_85_ku:comment = "This is the Doppler range correction due to the
                           satellite altitude rate. It is computed for the
                           component of satellite velocity in the nadir
                           direction. Not used by the SAR processor - FBR SAR.";
dop_cor_85_ku:coordinates = "lon_85_ku lat_85_ku";
dop_cor_85_ku:add_offset = 0. ;
dop_cor_85_ku:scale_factor = 0.001 ;

```

		<i>Instrument Processing Facility L1b</i> <i>Cryosat Ice netCDF L1b PFS</i> Doc. No.: C2-RS-ACS-ESL-5364 Issue: 1.8 Date: 04/12/2018 Page: 66
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echo_numval_20_ku(time_20_ku)

```

short echo_numval_20_ku(time_20_ku) ;
    echo_numval_20_ku:_FillValue = -32768s ;
    echo_numval_20_ku:units = "count" ;
    echo_numval_20_ku:long_name = "number of echoes averaged" ;
    echo_numval_20_ku:add_offset = 0s ;
    echo_numval_20_ku:scale_factor = 1s ;
    echo_numval_20_ku:comment = "For LRM this is the number of echoes averaged
                                to compute the corresponding L1B 20Hz power waveform.
                                For SAR/SARIn this is the number of single look echoes
                                in the Surface Sample Stack that have been multilooked
                                to compute the corresponding L1B 20Hz power waveform.
                                This variable includes only one receiving channel
                                however, in SARIn, single looks from both channels
                                are averaged in order to reduce the SNR.";
    echo_numval_20_ku:coordinates = "lon_20_ku lat_20_ku";

```

echo_numval_21_ku(time_21_ku)

```

short echo_numval_21_ku(time_21_ku) ;
    echo_numval_21_ku:_FillValue = -32768s ;
    echo_numval_21_ku:units = "count" ;
    echo_numval_21_ku:long_name = "number of echoes in a burst" ;
    echo_numval_21_ku:add_offset = 0s ;
    echo_numval_21_ku:scale_factor = 1s ;
    echo_numval_21_ku:comment = "Number of echoes in a burst. It is expected
                                to be equal to 64: if lower some of the echoes the
                                corresponding burst are filled with zeroes." ;
    echo_numval_21_ku:coordinates = "lon_21_ku lat_21_ku";

```

		<i>Instrument Processing Facility L1b</i> <i>Cryosat Ice netCDF L1b PFS</i> Doc. No.: C2-RS-ACS-ESL-5364 Issue: 1.8 Date: 04/12/2018 Page: 67
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echo_numval_85_ku(time_85_ku)

```

short echo_numval_85_ku(time_85_ku) ;
    echo_numval_85_ku:_FillValue = -32768s ;
    echo_numval_85_ku:units = "count" ;
    echo_numval_85_ku:long_name = "number of echoes in a burst" ;
    echo_numval_85_ku:add_offset = 0s ;
    echo_numval_85_ku:scale_factor = 1s ;
    echo_numval_85_ku:comment = "Number of echoes in a burst. It is expected
                                to be equal to 64: if lower some of the echoes the
                                corresponding burst are filled with zeroes." ;
    echo_numval_85_ku:coordinates = "lon_85_ku lat_85_ku";

```

echo_numval_avg_01_ku(time_avg_01_ku)

```

short echo_numval_avg_01_ku(time_avg_01_ku) ;
    echo_numval_avg_01_ku:_FillValue = -32768s ;
    echo_numval_avg_01_ku:units = "count" ;
    echo_numval_avg_01_ku:long_name = "number of echoes averaged" ;
    echo_numval_avg_01_ku:add_offset = 0s ;
    echo_numval_avg_01_ku:scale_factor = 1s ;
    echo_numval_avg_01_ku:comment = "Number of echoes averaged to obtain the
                                corresponding L1B 1Hz average power waveform. In
                                SARIn it accounts for the two Rx channels" ;
    echo_numval_avg_01_ku:coordinates = "lon_avg_01_ku lat_avg_01_ku";

```

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echo_scale_factor_20_ku(time_20_ku)

```

int  echo_scale_factor_20_ku(time_20_ku) ;

    echo_scale_factor_20_ku:_FillValue = -2147483648;

    echo_scale_factor_20_ku:units = "count" ;

    echo_scale_factor_20_ku:long_name = "echo scale factor (to scale
echo to watts)" ;

    echo_scale_factor_20_ku:add_offset = 0.0 ;

    echo_scale_factor_20_ku:scale_factor = 1.e-09;

    echo_scale_factor_20_ku:comment = "The 20Hz power waveform scaling
factor, computed in order to best fit each
waveform within 2 bytes. The scaling, needed to
convert the L1B 1Hz average power waveform into
Watts, is applied as follows:
pwr_waveform_20_ku(time_20_ku,ns_20_ku)
*echo_scale_factor_20_ku(time_20_ku)*2^echo_s
cale_pwr_20_ku(time_20_ku)." ;

    echo_scale_factor_20_ku:coordinates = "lon_20_ku lat_20_ku";

```

echo_scale_factor_avg_01_ku(time_avg_01_ku)

```

int  echo_scale_factor_avg_01_ku(time_avg_01_ku) ;

    echo_scale_factor_avg_01_ku:_FillValue = -2147483648;

    echo_scale_factor_avg_01_ku:units = "count" ;

    echo_scale_factor_avg_01_ku:long_name = "echo scale factor (to scale echo
to watts)" ;

    echo_scale_factor_avg_01_ku:add_offset = 0. ;

    echo_scale_factor_avg_01_ku:scale_factor = 1.e-09 ;

    echo_scale_factor_avg_01_ku:comment = "The 1Hz average power waveform
scaling factor, computed in order to best fit each
waveform within 2 bytes. The scaling, needed to
convert the L1B 1Hz average power waveform into Watts,
is applied as follows:
pwr_waveform_avg_01_ku(time_avg_01_ku,ns_avg_01_ku)
*echo_scale_factor_avg_01_ku(time_avg_01_ku)*2^echo_
scale_pwr_avg_01_ku(time_avg_01_ku)." ;

    echo_scale_factor_avg_01_ku:coordinates = "lon_avg_01_ku
lat_avg_01_ku";

```

		<i>Instrument Processing Facility L1b</i> <i>Cryosat Ice netCDF L1b PFS</i> Doc. No.: C2-RS-ACS-ESL-5364 Issue: 1.8 Date: 04/12/2018 Page: 69
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echo_scale_pwr_20_ku(time_20_ku)

```
int echo_scale_pwr_20_ku(time_20_ku) ;
    echo_scale_pwr_20_ku:_FillValue = -2147483648 ;
    echo_scale_pwr_20_ku:units = "count" ;
    echo_scale_pwr_20_ku:long_name = "echo scale power (a power of 2)" ;
    echo_scale_pwr_20_ku:add_offset = 0 ;
    echo_scale_pwr_20_ku:scale_factor = 1 ;
    echo_scale_pwr_20_ku:comment = "The 20Hz power waveform power scaling
                                   factor, computed in order to best fit each
                                   waveform within 2 bytes. The scaling, needed to
                                   convert the L1B 1Hz average power waveform into
                                   Watts, is applied as follows:
                                   pwr_waveform_20_ku(time_20_ku,ns_20_ku)
                                   *echo_scale_factor_20_ku(time_20_ku)*2^echo_s
                                   cale_pwr_20_ku(time_20_ku).\" ;
    echo_scale_pwr_20_ku:coordinates = \"lon_20_ku lat_20_ku\";
```

echo_scale_pwr_avg_01_ku(time_avg_01_ku)

```
int echo_scale_pwr_avg_01_ku(time_avg_01_ku) ;
    echo_scale_pwr_avg_01_ku:_FillValue = -2147483648 ;
    echo_scale_pwr_avg_01_ku:units = "count" ;
    echo_scale_pwr_avg_01_ku:long_name = "echo scale power (a power of 2)";
    echo_scale_pwr_avg_01_ku:add_offset = 0 ;
    echo_scale_pwr_avg_01_ku:scale_factor = 1 ;
    echo_scale_pwr_avg_01_ku:comment = "The 1Hz average power waveform power
                                   scaling factor, computed in order to best fit each waveform
                                   within 2 bytes. The scaling, needed to convert the L1B 1Hz
                                   average power waveform into Watts, is applied as follows:
                                   pwr_waveform_avg_01_ku(time_avg_01_ku,ns_avg_01_ku)
                                   *echo_scale_factor_avg_01_ku(time_avg_01_ku)*2^echo_scale_p
                                   wr_avg_01_ku(time_avg_01_ku).\" ;
    echo_scale_pwr_avg_01_ku:coordinates = \"lon_avg_01_ku lat_avg_01_ku\";
```

		<i>Instrument Processing Facility L1b</i> <i>Cryosat Ice netCDF L1b PFS</i> Doc. No.: C2-RS-ACS-ESL-5364 Issue: 1.8 Date: 04/12/2018 Page: 70
---	---	---

flag_cor_err_01(time_cor_01)

Note: refer to section 6.2 for the flag meaning definition

```
int flag_cor_err_01(time_cor_01) ;

flag_cor_err_01:_FillValue = -1 ;

flag_cor_err_01:long_name = "correction error flags" ;

flag_cor_err_01:flag_masks = 2048, 1024, 512, 256, 128, 64, 32, 16, 8, 4,
                             2, 1;

flag_cor_err_01:flag_meanings = "model_dry_error    model_wet_error
                                inv_bar_error
                                hf_fluctuations_error
                                iono_gim_error
                                iono_model_error
                                ocean_tide_error
                                ocean_tide_equil_error
                                load_tide_error
                                solid_earth_error
                                pole_tide_error
                                surface_type_error" ;

flag_cor_err_01:comment = "Correction error flags. This flag shows whether the
correction algorithm returned an error. Position is [lat_20_ku] and [lon_20_ku]
accessed through the [ind_first_meas_20hz_01] index" ;
```

flag_cor_status_01(time_cor_01)

Note: refer to section 6.2 for the flag meaning definition

```
int flag_cor_status_01(time_cor_01) ;

flag_cor_status_01:_FillValue = -1 ;

flag_cor_status_01:long_name = "correction status flags" ;

flag_cor_status_01:flag_masks = 2048, 1024, 512, 256, 128, 64, 32, 16, 8,
                                4, 2, 1;

flag_cor_status_01:flag_meanings = "model_dry_called  model_wet_called
                                    inv_bar_called
                                    hf_fluctuations_called
                                    iono_gim_called
                                    iono_model_called
                                    ocean_tide_called
                                    ocean_tide_equil_called
```

		<i>Instrument Processing Facility L1b</i> <i>Cryosat Ice netCDF L1b PFS</i> Doc. No.: <i>C2-RS-ACS-ESL-5364</i> Issue: <i>1.8</i> Date: <i>04/12/2018</i> Page: <i>71</i>
---	---	--

```

load_tide_called
solid_earth_called
pole_tide_called
surface_type_called" ;

flag_cor_status_01:comment = "Correction status flags- showing which
                             correction algorithms have been called.
                             Position is [lat_20_ku] and [lon_20_ku]
                             accessed through the [ind_first_meas_20hz_01]
                             index " ;

```

flag_echo_20_ku(time_20_ku)

Note: refer to section 6.2 for the flag meaning definition

```

short flag_echo_20_ku(time_20_ku) ;

flag_echo_20_ku:_FillValue = -1s;

flag_echo_20_ku:long_name = "flags for errors or information about L1b
                             20Hz power waveform" ;

flag_echo_20_ku:flag_masks = -32768s, 16384s, 8192s, 4096s, 2048s, 1024s,
                             512s, 256s;

flag_echo_20_ku:flag_meanings =
    "approx_beam_steering
    exact_beam_steering
    doppler_weighting_computed
    doppler_weighting_applied
    multi_look_incomplete
    beam_angle_steering_error
    anti_aliasing_power_echoes
    auto_beam_steering" ;

flag_echo_20_ku:comment = "Flags for errors or information about
                             SAR/SARIn L1b 20Hz power waveform. SAR/SARIn
                             only." ;

flag_echo_20_ku:coordinates = "lon_20_ku lat_20_ku";

```

flag_echo_21_ku(time_21_ku)

```

short flag_echo_21_ku(time_21_ku) ;

flag_echo_21_ku:_FillValue = -1s;

```

		<i>Instrument Processing Facility L1b</i> <i>Cryosat Ice netCDF L1b PFS</i> Doc. No.: C2-RS-ACS-ESL-5364 Issue: 1.8 Date: 04/12/2018 Page: 72
---	---	--

```

flag_echo_21_ku:long_name = "flags for errors or information about fbr
                             complex waveforms" ;

flag_echo_21_ku:comment = "Flags for errors or information about FBR
                             SARIn 21Hz complex echo waveforms. Currently
                             not used. Reserved for future use" ;

flag_echo_21_ku:coordinates = "lon_21_ku lat_21_ku";

```

flag_echo_85_ku(time_85_ku)

```

short flag_echo_85_ku(time_85_ku) ;

flag_echo_85_ku:_FillValue = -1s;

flag_echo_85_ku:long_name = "flags for errors or information about L1b
                             20Hz power waveform" ;

flag_echo_85_ku:comment = "Flags for errors or information about fbr
                             complex waveforms. Currently not used.
                             Reserved for future use " ;

flag_echo_85_ku:coordinates = "lon_85_ku lat_85_ku";

```

flag_echo_avg_01_ku(time_avg_01_ku)

Note: refer to section 6.2 for the flag meaning definition

```

short flag_echo_avg_01_ku(time_avg_01_ku) ;

flag_echo_avg_01_ku:_FillValue = -1s;

flag_echo_avg_01_ku:long_name = "flags for errors or information about
                             1Hz average power waveform" ;

flag_echo_avg_01_ku:flag_masks = -32768s, 1s;

flag_echo_avg_01_ku:flag_meanings = "1_hz_echo_error_not_computed
                                     mispointing_bad_angles" ;

flag_echo_avg_01_ku:comment = "Flags for errors or information about L1B
                             1Hz average power waveform." ;

flag_echo_avg_01_ku:coordinates = "lon_avg_01_ku lat_avg_01_ku";

```

		<i>Instrument Processing Facility L1b</i> <i>Cryosat Ice netCDF L1b PFS</i> Doc. No.: C2-RS-ACS-ESL-5364 Issue: 1.8 Date: 04/12/2018 Page: 73
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flag_instr_conf_rx_bwdt_20_ku(time_20_ku)

```

byte flag_instr_conf_rx_bwdt_20_ku(time_20_ku) ;
    flag_instr_conf_rx_bwdt_20_ku:FillValue = -128b;
    flag_instr_conf_rx_bwdt_20_ku:long_name = "instrument configuration:
                                              acquisition band" ;
    flag_instr_conf_rx_bwdt_20_ku:flag_values = 0b, 1b, 2b ;
    flag_instr_conf_rx_bwdt_20_ku:flag_meanings = "unknown 320_mhz 40_mhz" ;
    flag_instr_conf_rx_bwdt_20_ku:comment = "This flag contains the
                                              acquisition band of the SIRAL instrument." ;
    flag_instr_conf_rx_bwdt_20_ku:coordinates = "lon_20_ku lat_20_ku";

```

flag_instr_conf_rx_bwdt_21_ku(time_21_ku)

```

byte flag_instr_conf_rx_bwdt_21_ku(time_21_ku) ;
    flag_instr_conf_rx_bwdt_21_ku:FillValue = -128b;
    flag_instr_conf_rx_bwdt_21_ku:long_name = "instrument configuration :
                                              tracking bandwidth" ;
    flag_instr_conf_rx_bwdt_21_ku:flag_values = 0b, 1b, 2b ;
    flag_instr_conf_rx_bwdt_21_ku:flag_meanings = "unknown 320_mhz 40_mhz" ;
    flag_instr_conf_rx_bwdt_21_ku:comment = "This flag contains the tracking
                                              bandwidth of the SIRAL instrument - FBR
                                              SARIn." ;
    flag_instr_conf_rx_bwdt_21_ku:coordinates = "lon_21_ku lat_21_ku";

```

flag_instr_conf_rx_bwdt_85_ku(time_85_ku)

```

byte flag_instr_conf_rx_bwdt_85_ku(time_85_ku) ;
    flag_instr_conf_rx_bwdt_85_ku:FillValue = -128b;
    flag_instr_conf_rx_bwdt_85_ku:long_name = "instrument configuration:
                                              tracking bandwidth" ;
    flag_instr_conf_rx_bwdt_85_ku:flag_values = 0b, 1b, 2b ;
    flag_instr_conf_rx_bwdt_85_ku:flag_meanings = "unknown 320_mhz 40_mhz" ;
    flag_instr_conf_rx_bwdt_85_ku:comment = "This flag contains the tracking
                                              bandwidth of the SIRAL instrument - FBR SAR."
;

```

		<i>Instrument Processing Facility L1b</i> <i>Cryosat Ice netCDF L1b PFS</i> Doc. No.: C2-RS-ACS-ESL-5364 Issue: 1.8 Date: 04/12/2018 Page: 74
---	---	--

```
flag_instr_conf_rx_bwdt_85_ku:coordinates = "lon_85_ku lat_85_ku";
```

flag_instr_conf_rx_flags_20_ku(time_20_ku)

Note: refer to section 6.2 for the flag meaning definition

```
byte flag_instr_conf_rx_flags_20_ku(time_20_ku) ;

flag_instr_conf_rx_flags_20_ku:long_name = "instrument configuration
                                           flags" ;

flag_instr_conf_rx_flags_20_ku:flag_masks = -128b, 64b, 32b, 16b, 8b, 4b,
                                           2b, 1b ;

flag_instr_conf_rx_flags_20_ku:flag_meanings = "siral_redundant
external_cal      open_loop
loss_of_echo  real_time_error
echo_saturation
rx_band_attenuated
cycle_report_error" ;

flag_instr_conf_rx_flags_20_ku:comment = "This flag contains the status
                                           of the SIRAL instrument acquisition." ;

flag_instr_conf_rx_flags_20_ku:coordinates = "lon_20_ku lat_20_ku";
```

flag_instr_conf_rx_flags_21_ku(time_21_ku)

```
byte flag_instr_conf_rx_flags_21_ku(time_21_ku) ;

flag_instr_conf_rx_flags_21_ku:long_name = "instrument configuration
                                           flags" ;

flag_instr_conf_rx_flags_21_ku:flag_masks = -128b, 64b, 32b, 16b, 8b, 4b,
                                           2b, 1b ;

flag_instr_conf_rx_flags_21_ku:flag_meanings = "siral_redundant
external_cal      open_loop
loss_of_echo  real_time_error
echo_saturation
rx_band_attenuated
cycle_report_error" ;

flag_instr_conf_rx_flags_21_ku:comment = "This flag contains the status
                                           of the SIRAL instrument tracking - FBR SARIn."
                                           ;

flag_instr_conf_rx_flags_21_ku:coordinates = "lon_21_ku lat_21_ku";
```

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flag_instr_conf_rx_flags_85_ku(time_85_ku)

```

byte flag_instr_conf_rx_flags_85_ku(time_85_ku) ;
    flag_instr_conf_rx_flags_85_ku:long_name = "instrument configuration
                                              flags" ;
    flag_instr_conf_rx_flags_85_ku:flag_masks = -128b, 64b, 32b, 16b, 8b, 4b,
                                              2b, 1b ;
    flag_instr_conf_rx_flags_85_ku:flag_meanings = "siral_redundant
                                                    external_cal      open_loop
                                                    loss_of_echo  real_time_error
                                                    echo_saturation
                                                    rx_band_attenuated
                                                    cycle_report_error" ;
    flag_instr_conf_rx_flags_85_ku:comment = "This flag contains the status
                                              of the SIRAL instrument tracking - FBR SAR."
                                              ;
    flag_instr_conf_rx_flags_85_ku:coordinates = "lon_85_ku lat_85_ku";

```

flag_instr_conf_rx_in_use_20_ku(time_20_ku)

```

byte flag_instr_conf_rx_in_use_20_ku(time_20_ku) ;
    flag_instr_conf_rx_in_use_20_ku:_FillValue = -128b ;
    flag_instr_conf_rx_in_use_20_ku:long_name = "instrument configuration :
                                              rx chain in use" ;
    flag_instr_conf_rx_in_use_20_ku:flag_values = 0b, 1b, 2b, 3b ;
    flag_instr_conf_rx_in_use_20_ku:flag_meanings = "unknown rx1 rx2 both" ;
    flag_instr_conf_rx_in_use_20_ku:comment = "This flag contains the SIRAL
                                              instrument channel in use." ;
    flag_instr_conf_rx_in_use_20_ku:coordinates = "lon_20_ku lat_20_ku";

```

		<i>Instrument Processing Facility L1b</i> <i>Cryosat Ice netCDF L1b PFS</i> Doc. No.: C2-RS-ACS-ESL-5364 Issue: 1.8 Date: 04/12/2018 Page: 76
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flag_instr_conf_rx_in_use_21_ku(time_21_ku)

```

byte  flag_instr_conf_rx_in_use_21_ku(time_20_ku) ;
      flag_instr_conf_rx_in_use_21_ku:_FillValue      = -128b ;
      flag_instr_conf_rx_in_use_21_ku:long_name        = "instrument configuration:
                                                         rx channel in use" ;
      flag_instr_conf_rx_in_use_21_ku:flag_values      = 0b, 1b, 2b, 3b ;
      flag_instr_conf_rx_in_use_21_ku:flag_meanings    = "unknown rx1 rx2 both" ;

      flag_instr_conf_rx_in_use_21_ku:comment          = "This flag contains the
                                                         SIRAL instrument channel in
                                                         use in FBR SARIn" ;

      flag_instr_conf_rx_in_use_21_ku:coordinates =
"lon_21_ku lat_21_ku";

```

flag_instr_conf_rx_in_use_85_ku(time_85_ku)

```

byte  flag_instr_conf_rx_in_use_85_ku(time_85_ku) ;
      flag_instr_conf_rx_in_use_85_ku:_FillValue = -128b;
      flag_instr_conf_rx_in_use_85_ku:long_name  = "instrument  configuration
                                                         flags" ;
      flag_instr_conf_rx_in_use_85_ku:flag_values = 0b, 1b, 2b, 3b ;
      flag_instr_conf_rx_in_use_85_ku:flag_meanings = "unknown rx1 rx2 both" ;
      flag_instr_conf_rx_in_use_85_ku:comment = "This flag contains the SIRAL
                                                         instrument channel in use in FBR SAR." ;
      flag_instr_conf_rx_in_use_85_ku:coordinates = "lon_85_ku lat_85_ku";

```

		<i>Instrument Processing Facility L1b</i> <i>Cryosat Ice netCDF L1b PFS</i> Doc. No.: C2-RS-ACS-ESL-5364 Issue: 1.8 Date: 04/12/2018 Page: 77
---	---	--

flag_instr_conf_rx_str_in_use_20_ku(time_20_ku)

```

byte flag_instr_conf_rx_str_in_use_20_ku(time_20_ku) ;

flag_instr_conf_rx_str_in_use_20_ku:_FillValue = -128b ;

flag_instr_conf_rx_str_in_use_20_ku:long_name      =      "instrument
configuration: str in
use" ;

flag_instr_conf_rx_str_in_use_20_ku:flag_values = 0b, 1b, 2b, 3b, 4b ;

flag_instr_conf_rx_str_in_use_20_ku:flag_meanings =      "no_str_tracker
tracker_1 tracker_2
tracker_3
attref_file" ;

flag_instr_conf_rx_str_in_use_20_ku:comment      =      "Star      tracker
identification flag showing the
source of the platform pointing. 0:
No Star Tracker data used. 1: Data
from Star Tracker 1 used. 2: Data from
Star Tracker 2 used. 3: Data from Star
Tracker 3 used. 4: Data from the Star
Tracker selected on board by AOCS
used." ;

flag_instr_conf_rx_str_in_use_20_ku:coordinates = "lon_20_ku
lat_20_ku";

```

		<i>Instrument Processing Facility L1b</i> <i>Cryosat Ice netCDF L1b PFS</i> Doc. No.: C2-RS-ACS-ESL-5364 Issue: 1.8 Date: 04/12/2018 Page: 78
---	---	---

flag_instr_conf_rx_str_in_use_21_ku(time_21_ku)

```

byte flag_instr_conf_rx_str_in_use_21_ku(time_21_ku) ;

flag_instr_conf_rx_str_in_use_21_ku:_FillValue = -128b ;

flag_instr_conf_rx_str_in_use_21_ku:long_name      =      "instrument
configuration: str in
use" ;

flag_instr_conf_rx_str_in_use_21_ku:flag_values = 0b, 1b, 2b, 3b, 4b ;
flag_instr_conf_rx_str_in_use_21_ku:flag_meanings  =      "no_str_tracker
tracker_1 tracker_2
tracker_3
attref_file" ;

flag_instr_conf_rx_str_in_use_21_ku:comment      =      "Star      tracker
identification flag showing the
source of the platform pointing. 0:
No Star Tracker data used. 1: Data
from Star Tracker 1 used. 2: Data from
Star Tracker 2 used. 3: Data from Star
Tracker 3 used. 4: Data from the Star
Tracker selected on board by AOCS used
- FBR SARIn." ;

flag_instr_conf_rx_str_in_use_21_ku:coordinates = "lon_21_ku
lat_21_ku";

```

flag_instr_conf_rx_str_in_use_85_ku(time_85_ku)

```

byte flag_instr_conf_rx_str_in_use_85_ku(time_85_ku) ;

flag_instr_conf_rx_str_in_use_85_ku:_FillValue = -128b ;

flag_instr_conf_rx_str_in_use_85_ku:long_name      =      "instrument
configuration: str in
use" ;

flag_instr_conf_rx_str_in_use_85_ku:flag_values = 0b, 1b, 2b, 3b, 4b ;
flag_instr_conf_rx_str_in_use_85_ku:flag_meanings  =      "no_str_tracker
tracker_1 tracker_2
tracker_3
attref_file" ;

flag_instr_conf_rx_str_in_use_85_ku:comment      =      "Star      tracker
identification flag showing which the

```

		<i>Instrument Processing Facility L1b</i> <i>Cryosat Ice netCDF L1b PFS</i> Doc. No.: C2-RS-ACS-ESL-5364 Issue: 1.8 Date: 04/12/2018 Page: 79
---	---	--

source of the platform pointing. 0:
No Star Tracker data used. 1: Data
from Star Tracker 1 used. 2: Data from
Star Tracker 2 used. 3: Data from Star
Tracker 3 used. 4: Data from the Star
Tracker selected on board by AOCS used
- FBR SAR." ;

```
flag_instr_conf_rx_str_in_use_85_ku:coordinates = "lon_85_ku
lat_85_ku";
```

flag_instr_conf_rx_trk_mode_20_ku(time_20_ku)

```
byte flag_instr_conf_rx_trk_mode_20_ku(time_20_ku) ;
flag_instr_conf_rx_trk_mode_20_ku:_FillValue = -128b ;
flag_instr_conf_rx_trk_mode_20_ku:long_name = "instrument configuration:
tracking mode" ;
flag_instr_conf_rx_trk_mode_20_ku:flag_values = 0b, 1b, 2b, 3b ;
flag_instr_conf_rx_trk_mode_20_ku:flag_meanings = "unknown lrm sar sarin"
;
flag_instr_conf_rx_trk_mode_20_ku:comment = "This flag indicates the
tracking mode of the SIRAL instrument." ;
flag_instr_conf_rx_trk_mode_20_ku:coordinates = "lon_20_ku lat_20_ku";
```

		<i>Instrument Processing Facility L1b</i> <i>Cryosat Ice netCDF L1b PFS</i> Doc. No.: C2-RS-ACS-ESL-5364 Issue: 1.8 Date: 04/12/2018 Page: 80
---	---	---

flag_instr_conf_rx_trk_mode_21_ku(time_21_ku)

```

byte flag_instr_conf_rx_trk_mode_21_ku(time_21_ku) ;
    flag_instr_conf_rx_trk_mode_21_ku:_FillValue = -128b ;
    flag_instr_conf_rx_trk_mode_21_ku:long_name = "instrument configuration:
                                                tracking mode" ;
    flag_instr_conf_rx_trk_mode_21_ku:flag_values = 0b, 1b, 2b, 3b ;
    flag_instr_conf_rx_trk_mode_21_ku:flag_meanings = "unknown lrm sar sarin"
                                                ;
    flag_instr_conf_rx_trk_mode_21_ku:comment = "This flag indicates the
tracking mode of the SIRAL instrument - FBR SARIn." ;
    flag_instr_conf_rx_trk_mode_21_ku:coordinates = "lon_21_ku lat_21_ku";

```

flag_instr_conf_rx_trk_mode_85_ku(time_85_ku)

```

byte flag_instr_conf_rx_trk_mode_85_ku(time_85_ku) ;
    flag_instr_conf_rx_trk_mode_85_ku:_FillValue = -128b ;
    flag_instr_conf_rx_trk_mode_85_ku:long_name = "instrument configuration:
                                                tracking mode" ;
    flag_instr_conf_rx_trk_mode_85_ku:flag_values = 0b, 1b, 2b, 3b ;
    flag_instr_conf_rx_trk_mode_85_ku:flag_meanings = "unknown lrm sar sarin"
                                                ;
    flag_instr_conf_rx_trk_mode_85_ku:comment = "This flag indicates the
tracking mode of the SIRAL instrument - FBR SAR." ;
    flag_instr_conf_rx_trk_mode_85_ku:coordinates = "lon_85_ku lat_85_ku";

```

		<i>Instrument Processing Facility L1b</i> <i>Cryosat Ice netCDF L1b PFS</i> Doc. No.: C2-RS-ACS-ESL-5364 Issue: 1.8 Date: 04/12/2018 Page: 81
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flag_instr_mode_att_ctrl_20_ku(time_20_ku)

```

byte flag_instr_mode_att_ctrl_20_ku (time_20_ku) ;
    flag_instr_mode_att_ctrl_20_ku:_FillValue = -128b ;
    flag_instr_mode_att_ctrl_20_ku:long_name = "mode id: platform attitude
                                                control" ;
    flag_instr_mode_att_ctrl_20_ku:flag_values = 0b, 1b, 2b ;
    flag_instr_mode_att_ctrl_20_ku:flag_meanings      =      "unknown
                                                                local_normal_pointing
                                                                yaw_steering";
    flag_instr_mode_att_ctrl_20_ku:comment = "Platform attitude control mode
                                                from instrument configuration
                                                bits in L0." ;
    flag_instr_mode_att_ctrl_20_ku:coordinates = "lon_20_ku lat_20_ku";

```

flag_instr_mode_att_ctrl_21_ku(time_21_ku)

```

byte flag_instr_mode_att_ctrl_21_ku (time_21_ku) ;
    flag_instr_mode_att_ctrl_21_ku:_FillValue = -128b ;
    flag_instr_mode_att_ctrl_21_ku:long_name = "mode id: platform attitude
                                                control" ;
    flag_instr_mode_att_ctrl_21_ku:flag_values = 0b, 1b, 2b ;
    flag_instr_mode_att_ctrl_21_ku:flag_meanings      =      "unknown
                                                                local_normal_pointing
                                                                yaw_steering";
    flag_instr_mode_att_ctrl_21_ku:comment = "Platform attitude control mode
                                                from instrument configuration
                                                bits in L0." ;
    flag_instr_mode_att_ctrl_21_ku:coordinates = "lon_21_ku lat_21_ku";

```

		<i>Instrument Processing Facility L1b</i> <i>Cryosat Ice netCDF L1b PFS</i> Doc. No.: C2-RS-ACS-ESL-5364 Issue: 1.8 Date: 04/12/2018 Page: 82
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flag_instr_mode_att_ctrl_85_ku(time_85_ku)

```
byte flag_instr_mode_att_ctrl_85_ku (time_85_ku) ;
    flag_instr_mode_att_ctrl_85_ku:_FillValue = -128b ;
    flag_instr_mode_att_ctrl_85_ku:long_name = "mode id: platform attitude
                                                control" ;
    flag_instr_mode_att_ctrl_85_ku:flag_values = 0b, 1b, 2b ;
    flag_instr_mode_att_ctrl_85_ku:flag_meanings = "unknown
                                                local_normal_pointing
                                                yaw_steering" ;
    flag_instr_mode_att_ctrl_85_ku:comment = "Platform attitude control mode
                                                from instrument configuration
                                                bits in L0." ;
    flag_instr_mode_att_ctrl_85_ku:coordinates = "lon_85_ku lat_85_ku";
```

flag_instr_mode_flags_20_ku(time_20_ku)

```
byte flag_instr_mode_flags_20_ku(time_20_ku) ;
    flag_instr_mode_flags_20_ku:_FillValue = -128b ;
    flag_instr_mode_flags_20_ku:long_name = "mode id - identifies the sarin degraded
                                                case and the CAL4 flag " ;
    flag_instr_mode_flags_20_ku:flag_masks = 2b, 1b ;
    flag_instr_mode_flags_20_ku:flag_meanings = "sarin_degraded_case
                                                cal4_packet_detection";
    flag_instr_mode_flags_20_ku:comment = "Flags related to sub-modes of
                                                SARIn mode from instrument
                                                configuration bits in L0." ;
    flag_instr_mode_flags_20_ku:coordinates = "lon_20_ku lat_20_ku";
```

		<i>Instrument Processing Facility L1b</i> <i>Cryosat Ice netCDF L1b PFS</i> Doc. No.: C2-RS-ACS-ESL-5364 Issue: 1.8 Date: 04/12/2018 Page: 83
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flag_instr_mode_flags_21_ku(time_21_ku)

```

byte flag_instr_mode_flags_21_ku(time_21_ku) ;
    flag_instr_mode_flags_21_ku:_FillValue = -128b ;
    flag_instr_mode_flags_21_ku:long_name = "mode id - identifies the sarin degraded
                                           case and the CAL4 flag" ;

    flag_instr_mode_flags_21_ku:flag_masks = 2b, 1b ;
    flag_instr_mode_flags_21_ku:flag_meanings = "sarin_degraded_case
                                                cal4_packet_detection" ;
    flag_instr_mode_flags_21_ku:comment = "Flags related to sub-modes of
                                           SARIn mode from instrument
                                           configuration bits in L0 - FBR
                                           SARIn."
                                           ;flag_instr_mode_flags_21_ku:coord
                                           inates = "lon_21_ku lat_21_ku";

```

flag_instr_mode_flags_85_ku(time_85_ku)

```

byte flag_instr_mode_flags_85_ku(time_85_ku) ;
    flag_instr_mode_flags_85_ku:_FillValue = -128b ;
    flag_instr_mode_flags_85_ku:long_name = "mode id - identifies the sarin degraded
                                           case and the CAL4 flag" ;

    flag_instr_mode_flags_85_ku:flag_masks = 2b, 1b ;
    flag_instr_mode_flags_85_ku:flag_meanings = "sarin_degraded_case
                                                cal4_packet_detection";
    flag_instr_mode_flags_85_ku:comment = "Flags related to sub-modes of
                                           SARIn mode from instrument
                                           configuration bits in L0 - FBR
                                           SAR." ;
    flag_instr_mode_flags_85_ku:coordinates = "lon_85_ku lat_85_ku";

```

		<i>Instrument Processing Facility L1b</i> <i>Cryosat Ice netCDF L1b PFS</i> Doc. No.: C2-RS-ACS-ESL-5364 Issue: 1.8 Date: 04/12/2018 Page: 84
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flag_instr_mode_op_20_ku(time_20_ku)

```

byte flag_instr_mode_op_20_ku(time_20_ku) ;
    flag_instr_mode_op_20_ku:_FillValue = -128b ;
    flag_instr_mode_op_20_ku:long_name = "mode id - identifies the siral
                                         instrument measurement mode" ;
    flag_instr_mode_op_20_ku:flag_values = 1b, 2b, 3b ;
    flag_instr_mode_op_20_ku:flag_meanings = "lrm sar sarin" ;
    flag_instr_mode_op_20_ku:comment = "Instrument measurement mode derived
                                         from configuration bits in L0." ;
    flag_instr_mode_op_20_ku:coordinates = "lon_20_ku lat_20_ku";

```

flag_instr_mode_op_21_ku(time_21_ku)

```

byte flag_instr_mode_op_21_ku(time_21_ku) ;
    flag_instr_mode_op_21_ku:_FillValue = -128b ;
    flag_instr_mode_op_21_ku:long_name = "mode id - identifies the siral
                                         instrument measurement mode" ;
    flag_instr_mode_op_21_ku:flag_values = 1b, 2b, 3b ;
    flag_instr_mode_op_21_ku:flag_meanings = "lrm sar sarin" ;
    flag_instr_mode_op_21_ku:comment = "Instrument measurement mode derived
                                         from configuration bits in L0 - FBR
                                         SARIn." ;
    flag_instr_mode_op_21_ku:coordinates = "lon_21_ku lat_21_ku";

```

flag_instr_mode_op_85_ku(time_85_ku)

```

byte flag_instr_mode_op_85_ku(time_85_ku) ;
    flag_instr_mode_op_85_ku:_FillValue = -128b ;
    flag_instr_mode_op_85_ku:long_name = "mode id - identifies the siral
                                         instrument measurement mode" ;
    flag_instr_mode_op_85_ku:flag_values = 1b, 2b, 3b ;
    flag_instr_mode_op_85_ku:flag_meanings = "lrm sar sarin" ;
    flag_instr_mode_op_85_ku:comment = "Instrument measurement mode derived
                                         from configuration bits in L0 - FBR
                                         SAR." ;
    flag_instr_mode_op_85_ku:coordinates = "lon_85_ku lat_85_ku";

```

		<i>Instrument Processing Facility L1b</i> <i>Cryosat Ice netCDF L1b PFS</i> Doc. No.: C2-RS-ACS-ESL-5364 Issue: 1.8 Date: 04/12/2018 Page: 85
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flag_mcd_20_ku(time_20_ku)

Note: refer to section 6.2 for the flag meaning definition **Error! Bookmark not defined.**

```

int flag_mcd_20_ku(time_20_ku) ;

flag_mcd_20_ku:_FillValue = -1 ;

flag_mcd_20_ku:long_name = "measurement confidence flags" ;

flag_mcd_20_ku:flag_masks = -2147483648, 1073741824, 536870912,
                             268435456, 134217728, 67108864, 33554432,
                             16777216, 8388608, 4194304, 2097152,
                             1048576, 524288, 262144, 131072, 65536,
                             32768, 16384, 8192, 4096, 2048, 128, 64, 32,
                             16, 8, 1 ;

flag_mcd_20_ku:flag_meanings = "block_degraded blank_block
                                datation_degraded orbit_prop_error
                                orbit_file_change orbit_gap echo_saturated
                                other_echo_error sarin_rx1_error
                                sarin_rx2_error window_delay_error
                                agc_error call_missing call_default
                                doris_uso_missing ccall_default
                                trk_echo_error echo_rx1_error
                                echo_rx2_error npm_error call_pwr_corr_type
                                phase_pert_cor_missing cal2_missing
                                cal2_default power_scale_error
                                attitude_cor_missing
                                phase_pert_cor_default" ;

flag_mcd_20_ku:comment = "Measurement confidence flags. Generally the MCD
                           flags indicate problems when set. If the whole
                           MCD is 0 then no problems or non-nominal
                           conditions were detected. Serious errors are
                           indicated by setting the most significant bit,
                           i.e. block_degraded, in which case the block
                           must not be processed. Other error settings can
                           be regarded as warnings." ;

flag_mcd_20_ku:coordinates = "lon_20_ku lat_20_ku";

```

		<i>Instrument Processing Facility L1b</i> <i>Cryosat Ice netCDF L1b PFS</i> Doc. No.: <i>C2-RS-ACS-ESL-5364</i> Issue: <i>1.8</i> Date: <i>04/12/2018</i> Page: <i>86</i>
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flag_mcd_21_ku(time_21_ku)

Note: refer to section 6.2 for the flag meaning definition

```

int flag_mcd_21_ku(time_21_ku) ;

flag_mcd_21_ku:_FillValue = -1 ;

flag_mcd_21_ku:long_name = "measurement confidence flags" ;

flag_mcd_21_ku:flag_masks = -2147483648, 1073741824, 536870912,
                             268435456, 134217728, 67108864, 33554432,
                             16777216, 8388608, 4194304, 2097152,
                             1048576, 524288, 262144, 131072, 65536,
                             32768, 16384, 8192, 4096, 2048, 128, 64, 32,
                             16, 8, 1 ;

flag_mcd_21_ku:flag_meanings = "block_degraded blank_block
                                datation_degraded orbit_prop_error
                                orbit_file_change orbit_gap echo_saturated
                                other_echo_error sarin_rx1_error
                                sarin_rx2_error window_delay_error
                                agc_error call_missing call_default
                                doris_uso_missing ccall_default
                                trk_echo_error echo_rx1_error
                                echo_rx2_error npm_error
                                attitude_cor_missing call_pwr_corr_type " ;

flag_mcd_21_ku:comment = "Measurement confidence flags. Generally the MCD
                           flags indicate problems when set. If the whole
                           MCD is 0 then no problems or non-nominal
                           conditions were detected. Serious errors are
                           indicated by setting the most significant bit,
                           i.e. block_degraded, in which case the block
                           must not be processed. Other error settings can
                           be regarded as warnings - FBR SARIn." ;

flag_mcd_21_ku:coordinates = "lon_21_ku lat_21_ku";

```

		<i>Instrument Processing Facility L1b</i> <i>Cryosat Ice netCDF L1b PFS</i> Doc. No.: <i>C2-RS-ACS-ESL-5364</i> Issue: <i>1.8</i> Date: <i>04/12/2018</i> Page: <i>87</i>
---	---	--

flag_mcd_85_ku(time_85_ku)

Note: refer to section 6.2 for the flag meaning definition

```

int flag_mcd_85_ku(time_85_ku) ;

flag_mcd_85_ku:_FillValue = -1 ;

flag_mcd_85_ku:long_name = "measurement confidence flags" ;

flag_mcd_85_ku:flag_masks = -2147483648, 1073741824, 536870912,
                             268435456, 134217728, 67108864, 33554432,
                             16777216, 8388608, 4194304, 2097152,
                             1048576, 524288, 262144, 131072, 65536,
                             32768, 16384, 8192, 4096, 2048, 128, 64, 32,
                             16, 8, 1 ;

flag_mcd_85_ku:flag_meanings = "block_degraded blank_block
                                datation_degraded orbit_prop_error
                                orbit_file_change orbit_gap echo_saturated
                                other_echo_error sarin_rx1_error
                                sarin_rx2_error window_delay_error
                                agc_error call_missing call_default
                                doris_uso_missing ccall_default
                                trk_echo_error echo_rx1_error
                                echo_rx2_error npm_error
                                attitude_cor_missing call_pwr_corr_type " ;

flag_mcd_85_ku:comment = "Measurement confidence flags. Generally the MCD
                           flags indicate problems when set. If the whole
                           MCD is 0 then no problems or non-nominal
                           conditions were detected. Serious errors are
                           indicated by setting the most significant bit,
                           i.e. block_degraded, in which case the block
                           must not be processed. Other error settings can
                           be regarded as warnings - FBR SAR." ;

flag_mcd_85_ku:coordinates = "lon_85_ku lat_85_ku";

```

		<i>Instrument Processing Facility L1b</i> <i>Cryosat Ice netCDF L1b PFS</i> Doc. No.: C2-RS-ACS-ESL-5364 Issue: 1.8 Date: 04/12/2018 Page: 88
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flag_trk_cycle_20_ku(time_20_ku)

```

short flag_trk_cycle_20_ku(time_20_ku) ;
    flag_trk_cycle_20_ku:long_name = "trk cycle report (as extracted from the
                                     L0)" ;
    flag_trk_cycle_20_ku:_FillValue = -32768 ;
    flag_trk_cycle_20_ku:flag_values = 0s, 1s, 2s, 3s, 7s ;
    flag_trk_cycle_20_ku:flag_meanings = "no_errors      loss_of_echo
                                         run_time_error    echo_saturation_error
                                         unknown_error" ;
    flag_trk_cycle_20_ku:comment = "Flags for errors or information about
                                     L1b 20Hz power waveform for LRM/FDM case." ;
    flag_trk_cycle_20_ku:coordinates = "lon_20_ku lat_20_ku";

```

h0_applied_20_ku(time_20_ku)

```

int h0_applied_20_ku(time_20_ku) ;
    h0_applied_20_ku:_FillValue = -2147483648 ;
    h0_applied_20_ku:units = "seconds" ;
    h0_applied_20_ku:long_name = "h0 initial height word" ;
    h0_applied_20_ku:add_offset = 0. ;
    h0_applied_20_ku:scale_factor = 4.88e-11 ;
    h0_applied_20_ku:comment = "The H0 (initial altitude instruction)
                                forwarded from telemetry." ;
    h0_applied_20_ku:coordinates = "lon_20_ku lat_20_ku";

```

h0_applied_21_ku(time_21_ku)

```

int h0_applied_21_ku(time_21_ku) ;
    h0_applied_21_ku:_FillValue = -2147483648 ;
    h0_applied_21_ku:units = "seconds" ;
    h0_applied_21_ku:long_name = "h0 initial height word" ;
    h0_applied_21_ku:add_offset = 0. ;
    h0_applied_21_ku:scale_factor = 4.88e-11 ;
    h0_applied_21_ku:comment = "The H0 (initial altitude instruction)
                                forwarded from telemetry - FBR SARIn." ;
    h0_applied_21_ku:coordinates = "lon_21_ku lat_21_ku";

```

		<i>Instrument Processing Facility L1b</i> <i>Cryosat Ice netCDF L1b PFS</i> Doc. No.: C2-RS-ACS-ESL-5364 Issue: 1.8 Date: 04/12/2018 Page: 89
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h0_applied_85_ku(time_85_ku)

```

int h0_applied_85_ku(time_85_ku) ;
    h0_applied_85_ku:_FillValue = -2147483648 ;
    h0_applied_85_ku:units = "seconds" ;
    h0_applied_85_ku:long_name = "h0 initial height word" ;
    h0_applied_85_ku:add_offset = 0. ;
    h0_applied_85_ku:scale_factor = 4.88e-11 ;
    h0_applied_85_ku:comment = "The H0 (initial altitude instruction)
                                forwarded from telemetry - FBR SAR." ;
    h0_applied_85_ku:coordinates = "lon_85_ku lat_85_ku";

```

h0_fai_word_20_ku(time_20_ku)

```

int h0_fai_word_20_ku(time_20_ku) ;
    h0_fai_word_20_ku:_FillValue = -2147483648 ;
    h0_fai_word_20_ku:units = "seconds" ;
    h0_fai_word_20_ku:long_name = "fine word fai" ;
    h0_fai_word_20_ku:add_offset = 0. ;
    h0_fai_word_20_ku:scale_factor = 4.88e-11 ;
    h0_fai_word_20_ku:comment = "This is the Fine Altitude Instruction (FAI),
                                computed from H0 and COR2." ;
    h0_fai_word_20_ku:coordinates = "lon_20_ku lat_20_ku";

```

h0_fai_word_21_ku(time_21_ku)

```

int h0_fai_word_21_ku(time_21_ku) ;
    h0_fai_word_21_ku:_FillValue = -2147483648 ;
    h0_fai_word_21_ku:units = "seconds" ;
    h0_fai_word_21_ku:long_name = "fine word fai" ;
    h0_fai_word_21_ku:add_offset = 0. ;
    h0_fai_word_21_ku:scale_factor = 4.88e-11 ;
    h0_fai_word_21_ku:comment = "This is the Fine Altitude Instruction (FAI),
                                computed from H0 and COR2 - FBR SARIn." ;
    h0_fai_word_21_ku:coordinates = "lon_21_ku lat_21_ku";

```

		<i>Instrument Processing Facility L1b</i> <i>Cryosat Ice netCDF L1b PFS</i> Doc. No.: <i>C2-RS-ACS-ESL-5364</i> Issue: <i>1.8</i> Date: <i>04/12/2018</i> Page: <i>90</i>
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h0_fai_word_85_ku(time_85_ku)

```

int h0_fai_word_85_ku(time_85_ku) ;
h0_fai_word_85_ku:_FillValue = -2147483648 ;
h0_fai_word_85_ku:units = "seconds" ;
h0_fai_word_85_ku:long_name = "fine word fai" ;
h0_fai_word_85_ku:add_offset = 0. ;
h0_fai_word_85_ku:scale_factor = 4.88e-11 ;
h0_fai_word_85_ku:comment = "This is the Fine Altitude Instruction (FAI),
                           computed from H0 and COR2 - FBR SAR." ;
h0_fai_word_85_ku:coordinates = "lon_85_ku lat_85_ku";

```

h0_lai_word_20_ku(time_20_ku)

```

int h0_lai_word_20_ku(time_20_ku) ;
h0_lai_word_20_ku:_FillValue = -2147483648 ;
h0_lai_word_20_ku:units = "seconds" ;
h0_lai_word_20_ku:long_name = "coarse range word lai" ;
h0_lai_word_20_ku:add_offset = 0. ;
h0_lai_word_20_ku:scale_factor = 1.25e-08 ;
h0_lai_word_20_ku:comment = "This is the Coarse Altitude Instruction
                           (LAI), computed from H0 and COR2." ;
h0_lai_word_20_ku:coordinates = "lon_20_ku lat_20_ku";

```

h0_lai_word_21_ku(time_21_ku)

```

int h0_lai_word_21_ku(time_21_ku) ;
h0_lai_word_21_ku:_FillValue = -2147483648 ;
h0_lai_word_21_ku:units = "seconds" ;
h0_lai_word_21_ku:long_name = "coarse range word lai" ;
h0_lai_word_21_ku:add_offset = 0. ;
h0_lai_word_21_ku:scale_factor = 1.25e-08 ;
h0_lai_word_21_ku:comment = "This is the Coarse Altitude Instruction
                           (LAI), computed from H0 and COR2 - FBR SARIn." ;
h0_lai_word_21_ku:coordinates = "lon_21_ku lat_21_ku";

```

		<i>Instrument Processing Facility L1b</i> <i>Cryosat Ice netCDF L1b PFS</i> Doc. No.: <i>C2-RS-ACS-ESL-5364</i> Issue: <i>1.8</i> Date: <i>04/12/2018</i> Page: <i>91</i>
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h0_lai_word_85_ku(time_85_ku)

```

int h0_lai_word_85_ku(time_85_ku) ;
    h0_lai_word_85_ku:_FillValue = -2147483648 ;
    h0_lai_word_85_ku:units = "seconds" ;
    h0_lai_word_85_ku:long_name = "coarse range word lai" ;
    h0_lai_word_85_ku:add_offset = 0. ;
    h0_lai_word_85_ku:scale_factor = 1.25e-08 ;
    h0_lai_word_85_ku:comment = "This is the Coarse Altitude Instruction
                                (LAI), computed from H0 and COR2 - FBR SAR." ;
    h0_lai_word_85_ku:coordinates = "lon_85_ku lat_85_ku";

```

		<i>Instrument Processing Facility L1b</i> <i>Cryosat Ice netCDF L1b PFS</i> Doc. No.: C2-RS-ACS-ESL-5364 Issue: 1.8 Date: 04/12/2018 Page: 92
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hf_fluct_total_cor_01(time_cor_01)

```

int hf_fluct_total_cor_01(time_cor_01) ;
    hf_fluct_total_cor_01:_FillValue = -2147483648 ;
    hf_fluct_total_cor_01:units = "m" ;
    hf_fluct_total_cor_01:long_name = "1-way dynamic atmospheric correction"
;

    hf_fluct_total_cor_01:standard_name =
"sea_surface_height_correction_due_to_air_pressure_and_wind_at_high_frequency" ;
    hf_fluct_total_cor_01:add_offset = 0. ;
    hf_fluct_total_cor_01:scale_factor = 0.001 ;
    hf_fluct_total_cor_01:comment = "High frequency fluctuations of the sea
                                     surface topography due to high frequency air
                                     pressure and wind effects. Also known as DAC
                                     (Dynamical Atmospheric Correction). This 1-way
                                     correction is computed at the altimeter
                                     [time_cor_01] time-tag from the interpolation of 2
                                     meteorological fields that surround the altimeter
                                     time-tag. The inverse barometric correction
                                     [inv_bar_cor_01] is included in this field. This
                                     correction is to be accounted for during the
                                     computation of height in order to account for both
                                     the depression of the ocean surface caused by the
                                     local barometric pressure and the high-frequency
                                     effects caused by wind forcing. This correction is
                                     an alternative to [inv_bar_cor_01] and therefore
                                     only one should be used. Position is [lat_20_ku] and
                                     [lon_20_ku] accessed through the
                                     [ind_first_meas_20hz_01] index " ;
    hf_fluct_total_cor_01:source = "MOG2D 2.1.0" ;
    hf_fluct_total_cor_01:institution = "LEGOS/CLS/CNES" ;

```

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ind_first_meas_20hz_01 (time_cor_01)

```
int ind_first_meas_20hz_01(time_cor_01) ;

ind_first_meas_20hz_01:_FillValue = -2147483648 ;

ind_first_meas_20hz_01:comment = "Index of the first 20Hz measurement of
the 1Hz packet. Position is [lat_20_ku] and [lon_20_ku] accessed through the
[ind_first_meas_20hz_01] index " ;

ind_first_meas_20hz_01:long_name = "index of the first 20Hz measurement:
1 Hz" ;

ind_first_meas_20hz_01:units = "count" ;
```

ind_meas_1hz_20_ku (time_20_ku)

```
short ind_meas_1hz_20_ku(time_20_ku) ;

ind_meas_1hz_20_ku:_FillValue = -32768s ;

ind_meas_1hz_20_ku:comment = "Index of the 1Hz measurement to which belongs the
20Hz measurement." ;

ind_meas_1hz_20_ku:coordinates = "lon_20_ku lat_20_ku";

ind_meas_1hz_20_ku:long_name = "index of the 1Hz measurement: 20 Hz ku band" ;

ind_meas_1hz_20_ku:units = "count" ;
```

instr_cor_gain_rx_20_ku(time_20_ku)

```
int instr_cor_gain_rx_20_ku(time_20_ku) ;

instr_cor_gain_rx_20_ku:_FillValue = -2147483648 ;

instr_cor_gain_rx_20_ku:units = "dB" ;

instr_cor_gain_rx_20_ku:long_name = "instrument gain correction (rx only
chain)" ;

instr_cor_gain_rx_20_ku:add_offset = 0. ;

instr_cor_gain_rx_20_ku:scale_factor = 0.01 ;

instr_cor_gain_rx_20_ku:comment = "Instrument Gain Correction (Rx only
chain). It includes the power variation from CAL1 and the AGC
calibration values." ;

instr_cor_gain_rx_20_ku:coordinates = "lon_20_ku lat_20_ku";
```

instr_cor_gain_rx_21_ku(time_21_ku)

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```

int instr_cor_gain_rx_21_ku(time_21_ku) ;
    instr_cor_gain_rx_21_ku:_FillValue = -2147483648 ;
    instr_cor_gain_rx_21_ku:units = "dB" ;
    instr_cor_gain_rx_21_ku:long_name = "instrument gain correction (rx only
                                     chain)" ;
    instr_cor_gain_rx_21_ku:add_offset = 0. ;
    instr_cor_gain_rx_21_ku:scale_factor = 0.01 ;
    instr_cor_gain_rx_21_ku:comment = "Instrument Gain Correction (Rx only
                                     chain). It includes the power variation from CAL1 and the AGC
                                     calibration values - FBR SARIn." ;
    instr_cor_gain_rx_21_ku:coordinates = "lon_21_ku lat_21_ku";

```

instr_cor_gain_rx_85_ku(time_85_ku)

```

int instr_cor_gain_rx_85_ku(time_85_ku) ;
    instr_cor_gain_rx_85_ku:_FillValue = -2147483648;
    instr_cor_gain_rx_85_ku:units = "dB" ;
    instr_cor_gain_rx_85_ku:long_name = "instrument gain correction (rx only
                                     chain)" ;
    instr_cor_gain_rx_85_ku:add_offset = 0. ;
    instr_cor_gain_rx_85_ku:scale_factor = 0.01 ;
    instr_cor_gain_rx_85_ku:comment = "Instrument Gain Correction (Rx only
                                     chain). It includes the power variation from CAL1 and the AGC
                                     calibration values - FBR SAR." ;
    instr_cor_gain_rx_85_ku:coordinates = "lon_85_ku lat_85_ku";

```

instr_cor_gain_tx_rx_20_ku(time_20_ku)

```

int instr_cor_gain_tx_rx_20_ku(time_20_ku) ;
    instr_cor_gain_tx_rx_20_ku:_FillValue = -2147483648 ;
    instr_cor_gain_tx_rx_20_ku:units = "dB" ;
    instr_cor_gain_tx_rx_20_ku:long_name = "instrument gain correction (tx-
                                     rx chain)" ;
    instr_cor_gain_tx_rx_20_ku:add_offset = 0. ;
    instr_cor_gain_tx_rx_20_ku:scale_factor = 0.01 ;

```

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```
instr_cor_gain_tx_rx_20_ku:comment = "Instrument Gain Correction (Tx-Rx
chain). It includes the power variation from CAL1 and the AGC
calibration values." ;
```

```
instr_cor_gain_tx_rx_20_ku:coordinates = "lon_20_ku lat_20_ku";
```

instr_cor_gain_tx_rx_21_ku(time_21_ku)

```
int instr_cor_gain_tx_rx_21_ku(time_21_ku) ;
instr_cor_gain_tx_rx_21_ku:_FillValue = -2147483648 ;
instr_cor_gain_tx_rx_21_ku:units = "dB" ;
instr_cor_gain_tx_rx_21_ku:long_name = "instrument gain correction (tx-
rx chain)" ;
instr_cor_gain_tx_rx_21_ku:add_offset = 0. ;
instr_cor_gain_tx_rx_21_ku:scale_factor = 0.01 ;
instr_cor_gain_tx_rx_21_ku:comment = "Instrument Gain Correction (Tx-Rx
chain). It includes the power variation from CAL1 and the AGC
calibration values - FBR SARIn." ;
instr_cor_gain_tx_rx_21_ku:coordinates = "lon_21_ku lat_21_ku";
```

instr_cor_gain_tx_rx_85_ku(time_85_ku)

```
int instr_cor_gain_tx_rx_85_ku(time_85_ku) ;
instr_cor_gain_tx_rx_85_ku:_FillValue = -2147483648 ;
instr_cor_gain_tx_rx_85_ku:units = "dB" ;
instr_cor_gain_tx_rx_85_ku:long_name = "instrument gain correction (tx-
rx chain)" ;
instr_cor_gain_tx_rx_85_ku:add_offset = 0. ;
instr_cor_gain_tx_rx_85_ku:scale_factor = 0.01 ;
instr_cor_gain_tx_rx_85_ku:comment = "Instrument Gain Correction (Tx-Rx
chain). It includes the power variation from CAL1 and the AGC
calibration values - FBR SAR." ;
instr_cor_gain_tx_rx_85_ku:coordinates = "lon_85_ku lat_85_ku";
```

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instr_cor_range_rx_20_ku(time_20_ku)

```

int instr_cor_range_rx_20_ku(time_20_ku) ;
    instr_cor_range_rx_20_ku:_FillValue = -2147483648 ;
    instr_cor_range_rx_20_ku:units = "m" ;
    instr_cor_range_rx_20_ku:long_name = "2-way instrument range correction
                                         (rx only chain)" ;
    instr_cor_range_rx_20_ku:add_offset = 0. ;
    instr_cor_range_rx_20_ku:scale_factor = 0.001 ;
    instr_cor_range_rx_20_ku:comment = "2-way instrument Range Correction (Rx
                                         only chain). It includes: the internal path delay from CAL1,
                                         the external group delay from ground characterisation and the
                                         vertical component of CoM - Antenna distance." ;
    instr_cor_range_rx_20_ku:coordinates = "lon_20_ku lat_20_ku";

```

instr_cor_range_rx_21_ku(time_21_ku)

```

int instr_cor_range_rx_21_ku(time_21_ku) ;
    instr_cor_range_rx_21_ku:_FillValue = -2147483648 ;
    instr_cor_range_rx_21_ku:units = "m" ;
    instr_cor_range_rx_21_ku:long_name = "2-way instrument range correction
                                         (rx only chain)" ;
    instr_cor_range_rx_21_ku:add_offset = 0. ;
    instr_cor_range_rx_21_ku:scale_factor = 0.001 ;
    instr_cor_range_rx_21_ku:comment = "2-way instrument Range Correction (Rx
                                         only chain). It includes: the internal path delay from CAL1,
                                         the external group delay from ground characterisation and the
                                         vertical component of the CoM - Antenna distance - FBR SARIn."
    ;
    instr_cor_range_rx_21_ku:coordinates = "lon_21_ku lat_21_ku";

```

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instr_cor_range_rx_85_ku(time_85_ku)

```

int instr_cor_range_rx_85_ku(time_85_ku) ;
    instr_cor_range_rx_85_ku:_FillValue = -2147483648 ;
    instr_cor_range_rx_85_ku:units = "m" ;
    instr_cor_range_rx_85_ku:long_name = "2-way instrument range correction
                                         (rx only chain)" ;

    instr_cor_range_rx_85_ku:add_offset = 0. ;
    instr_cor_range_rx_85_ku:scale_factor = 0.001 ;
    instr_cor_range_rx_85_ku:comment = "2-way instrument Range Correction (Rx
                                         only chain). It includes: the internal path delay from CAL1,
                                         the external group delay from ground characterisation and the
                                         vertical component of the CoM- Antenna distance - FBR SAR."
    ;

    instr_cor_range_rx_85_ku:coordinates = "lon_85_ku lat_85_ku";

```

instr_cor_range_tx_rx_20_ku(time_20_ku)

```

int instr_cor_range_tx_rx_20_ku(time_20_ku) ;
    instr_cor_range_tx_rx_20_ku:_FillValue = -2147483648 ;
    instr_cor_range_tx_rx_20_ku:units = "m" ;
    instr_cor_range_tx_rx_20_ku:long_name = "2-way instrument range
                                         correction (tx-rx chain)" ;

    instr_cor_range_tx_rx_20_ku:add_offset = 0. ;
    instr_cor_range_tx_rx_20_ku:scale_factor = 0.001 ;
    instr_cor_range_tx_rx_20_ku:comment = "Instrument Range Correction (Tx-
                                         Rx chain) - Calibration correction to range on channel 1
                                         applied at L1B. It includes the internal path delay from CAL1,
                                         the external group delay from ground characterisation and the
                                         CoM - Antenna distance." ;

    instr_cor_range_tx_rx_20_ku:coordinates = "lon_20_ku lat_20_ku";

```

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instr_cor_range_tx_rx_21_ku(time_21_ku)

```

int instr_cor_range_tx_rx_21_ku(time_21_ku) ;
instr_cor_range_tx_rx_21_ku:_FillValue = -2147483648 ;
instr_cor_range_tx_rx_21_ku:units = "m" ;
instr_cor_range_tx_rx_21_ku:long_name = "2-way instrument range
                                         correction (tx-rx chain)" ;
instr_cor_range_tx_rx_21_ku:add_offset = 0. ;
instr_cor_range_tx_rx_21_ku:scale_factor = 0.001 ;
instr_cor_range_tx_rx_21_ku:comment = "Instrument Range Correction (Tx-
                                         Rx chain) - Calibration correction to range on channel 1
                                         applied at L1B. It includes the internal path delay from CAL1,
                                         the external group delay from ground characterisation and the
                                         CoM - Antenna distance - FBR SARIn." ;
instr_cor_range_tx_rx_21_ku:coordinates = "lon_21_ku lat_21_ku";

```

instr_cor_range_tx_rx_85_ku(time_85_ku)

```

int instr_cor_range_tx_rx_85_ku(time_85_ku) ;
instr_cor_range_tx_rx_85_ku:_FillValue = -2147483648 ;
instr_cor_range_tx_rx_85_ku:units = "m" ;
instr_cor_range_tx_rx_85_ku:long_name = "2-way instrument range
                                         correction (tx-rx chain)" ;
instr_cor_range_tx_rx_85_ku:add_offset = 0. ;
instr_cor_range_tx_rx_85_ku:scale_factor = 0.001 ;
instr_cor_range_tx_rx_85_ku:comment = "Instrument Range Correction (Tx-
                                         Rx chain) - Calibration correction to range on channel 1
                                         applied at L1B. It includes the internal path delay from CAL1,
                                         the external group delay from ground characterisation and the
                                         CoM - Antenna distance - FBR SAR." ;
instr_cor_range_tx_rx_85_ku:coordinates = "lon_85_ku lat_85_ku";

```

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instr_ext_ph_cor_20_ku(time_20_ku)

```

int instr_ext_ph_cor_20_ku(time_20_ku) ;
    instr_ext_ph_cor_20_ku:_FillValue = -2147483648 ;
    instr_ext_ph_cor_20_ku:units = "rad" ;
    instr_ext_ph_cor_20_ku:long_name = "external phase correction taken from
                                        the ipfdb file" ;

    instr_ext_ph_cor_20_ku:add_offset = 0. ;
    instr_ext_ph_cor_20_ku:scale_factor = 1.e-06 ;
    instr_ext_ph_cor_20_ku:comment = "External phase correction taken from
                                        the IPFDB file (SARIn only) to be added
                                        to the internal phase correction term. The
                                        external phase correction is the
                                        temperature-averaged component of
                                        external inter-channel phase difference
                                        derived from phase difference sensitive
                                        antenna subsystem, waveguides and
                                        instrument waveguide switches. The
                                        external phase correction doesn't contain
                                        internal instrument effects of
                                        calibration coupler and duplexer which
                                        are included in the internal phase
                                        difference correction." ;

    instr_ext_ph_cor_20_ku:coordinates = "lon_20_ku lat_20_ku";

```

instr_ext_ph_cor_21_ku(time_21_ku)

```

int instr_ext_ph_cor_21_ku(time_21_ku) ;
    instr_ext_ph_cor_21_ku:_FillValue = -2147483648 ;
    instr_ext_ph_cor_21_ku:units = "rad" ;
    instr_ext_ph_cor_21_ku:long_name = "external phase correction taken from
                                        the ipfdb file" ;

    instr_ext_ph_cor_21_ku:add_offset = 0. ;
    instr_ext_ph_cor_21_ku:scale_factor = 1.e-06 ;
    instr_ext_ph_cor_21_ku:comment = "External phase correction taken from
                                        the IPFDB file (SARIn only) to be added
                                        to the internal phase correction term. The

```

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external phase correction is the temperature-averaged component of external inter-channel phase difference derived from phase difference sensitive antenna subsystem, waveguides and instrument waveguide switches. The external phase correction doesn't contain internal instrument effects of calibration coupler and duplexer which are included in the internal phase difference correction - FBR SARIn." ;

```
instr_ext_ph_cor_21_ku:coordinates = "lon_21_ku lat_21_ku";
```

instr_int_ph_cor_20_ku(time_20_ku)

```
int instr_int_ph_cor_20_ku(time_20_ku) ;
instr_int_ph_cor_20_ku:_FillValue = -2147483648 ;
instr_int_ph_cor_20_ku:units = "rad" ;
instr_int_ph_cor_20_ku:long_name = "internal phase correction computed
from the CAL-4" ;
instr_int_ph_cor_20_ku:add_offset = 0. ;
instr_int_ph_cor_20_ku:scale_factor = 1.e-06 ;
instr_int_ph_cor_20_ku:comment = "Internal phase difference correction
computed from the CAL-4 packets. It is
set from the latest available CAL-4
packet. Applicable to SARIn only." ;
instr_int_ph_cor_20_ku:coordinates = "lon_20_ku lat_20_ku";
```

instr_int_ph_cor_21_ku(time_21_ku)

```
int instr_int_ph_cor_21_ku(time_21_ku) ;
instr_int_ph_cor_21_ku:_FillValue = -2147483648 ;
instr_int_ph_cor_21_ku:units = "rad" ;
instr_int_ph_cor_21_ku:long_name = "internal phase correction computed
from the cal-4" ;
instr_int_ph_cor_21_ku:add_offset = 0. ;
instr_int_ph_cor_21_ku:scale_factor = 1.e-06 ;
```

		<i>Instrument Processing Facility L1b</i> <i>Cryosat Ice netCDF L1b PFS</i> Doc. No.: C2-RS-ACS-ESL-5364 Issue: 1.8 Date: 04/12/2018 Page: 101
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```
instr_int_ph_cor_21_ku:comment = "Internal phase difference correction
                                computed from the CAL-4 packets. Set to
                                zero in FBR. Applicable to SARin only -
                                FBR SARIn." ;

instr_int_ph_cor_21_ku:coordinates = "lon_21_ku lat_21_ku";
```

inter_base_vec_20_ku(time_20_ku,space_3d)

```
int inter_base_vec_20_ku(time_20_ku, space_3d) ;

inter_base_vec_20_ku:_FillValue = -2147483648 ;

inter_base_vec_20_ku:units = "m" ;

inter_base_vec_20_ku:long_name = "interferometric baseline direction
                                vector in CRF" ;

inter_base_vec_20_ku:add_offset = 0. ;

inter_base_vec_20_ku:scale_factor = 1.e-06 ;

inter_base_vec_20_ku:comment = "Interferometer baseline direction vector.
                                This is the direction vector from Tx-Rx
                                antenna reference point to Rx only
                                antenna reference point described in the
                                CryoSat Reference Frame. The 3
                                components are given according to the
                                'space_3d' dimension: [1] x, [2] y, [3]
                                z." ;

inter_base_vec_20_ku:coordinates = "lon_20_ku lat_20_ku";
```

inter_base_vec_21_ku(time_21_ku,space_3d)

```
int inter_base_vec_21_ku(time_21_ku, space_3d) ;

inter_base_vec_21_ku:_FillValue = -2147483648 ;

inter_base_vec_21_ku:units = "m" ;

inter_base_vec_21_ku:long_name = "interferometric baseline direction
                                vector in CRF" ;

inter_base_vec_21_ku:add_offset = 0. ;

inter_base_vec_21_ku:scale_factor = 1.e-06 ;

inter_base_vec_21_ku:comment = "Interferometric Baseline direction
                                vector. This is the direction vector
                                from Tx-Rx antenna reference point to Rx
```

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only antenna reference point described in the CryoSat Reference Frame. The 3 components are given according to the 'space_3d' dimension: [1] x, [2] y, [3] z - FBR SARIn." ;

```
inter_base_vec_21_ku:coordinates = "lon_21_ku lat_21_ku";
```

inter_base_vec_85_ku(time_85_ku,space_3d)

```
int inter_base_vec_85_ku(time_85_ku, space_3d) ;
inter_base_vec_85_ku:_FillValue = -2147483648 ;
inter_base_vec_85_ku:units = "m" ;
inter_base_vec_85_ku:long_name = "interferometric baseline direction
                                vector in CRF" ;
inter_base_vec_85_ku:add_offset = 0. ;
inter_base_vec_85_ku:scale_factor = 1.e-06 ;
inter_base_vec_85_ku:comment = "Interferometric Baseline direction
                                vector. This is the direction vector
                                from Tx-Rx antenna reference point to Rx
                                only antenna reference point described
                                in the CryoSat Reference Frame. The 3
                                components are given according to the
                                'space_3d' dimension: [1] x, [2] y, [3]
                                z - FBR SAR." ;
inter_base_vec_85_ku:coordinates = "lon_85_ku lat_85_ku";
```

inv_bar_cor_01(time_cor_01)

```
int inv_bar_cor_01(time_cor_01) ;
inv_bar_cor_01:_FillValue = -2147483648;
inv_bar_cor_01:units = "m" ;
inv_bar_cor_01:long_name = "inverse barometric correction (1-way)";
inv_bar_cor_01:standard_name =
"sea_surface_height_correction_due_to_air_pressure_at_low_frequency" ;
inv_bar_cor_01:add_offset = 0. ;
inv_bar_cor_01:scale_factor = 0.001 ;
```

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```

inv_bar_cor_01:comment = "Inverse Barometric Correction. This 1-way
                           correction is computed at the altimeter
                           [time_cor_01] time-tag from the interpolation of
                           2 meteorological fields that surround the
                           altimeter time-tag. This correction is to be
                           accounted for during the computation of height in
                           order to correct this range measurement for the
                           depression of the ocean surface caused by the
                           local barometric pressure. This correction is an
                           alternative to [hf_fluct_total_cor_01] and only
                           one should be used. (1-way correction). Position
                           is [lat_20_ku] and [lon_20_ku] accessed through
                           the [ind_first_meas_20hz_01] index " ;

inv_bar_cor_01:source = "European Centre for Medium Range Weather
                           Forecasting" ;

inv_bar_cor_01:institution = "ECMWF" ;

```

iono_cor_01(time_cor_01)

```

int iono_cor_01(time_cor_01) ;
iono_cor_01:_FillValue = -2147483648 ;
iono_cor_01:units = "m" ;
iono_cor_01:long_name = "model ionospheric correction (1-way)" ;
iono_cor_01:standard_name =
"altimeter_range_correction_due_to_ionosphere" ;
iono_cor_01:add_offset = 0. ;
iono_cor_01:scale_factor = 0.001 ;
iono_cor_01:comment = "Model Ionospheric Correction. This correction is
                           to be accounted for during the computation of height in
                           order to correct this range measurement for ionospheric
                           range delays of the radar pulse. This correction is an
                           alternative to [iono_cor_gim_01_ku] and only one should be
                           used. See S. K. Llewellyn, R. B. Bent, A. S. C. I. H. B.
                           FL, U. S. N. T. I. Service, Space and Missile Systems
                           Organization (U.S.), Documentation and Description of the
                           Bent Ionospheric Model. U.S. Department of Commerce,
                           National Technical Information Service, 1973. Position is

```

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```

[lat_20_ku] and [lon_20_ku] accessed through the
[ind_first_meas_20hz_01] index " ;

iono_cor_01:source = "Bent" ;
iono_cor_01:institution = "Bent" ;

```

iono_cor_gim_01(time_cor_01)

```

int iono_cor_gim_01(time_cor_01) ;
iono_cor_gim_01:_FillValue = -2147483648 ;
iono_cor_gim_01:units = "m" ;
iono_cor_gim_01:long_name = "gim ionospheric correction (1-way)" ;
iono_cor_gim_01:standard_name =
"altimeter_range_correction_due_to_ionosphere" ;
iono_cor_gim_01:add_offset = 0. ;
iono_cor_gim_01:scale_factor = 0.001 ;
iono_cor_gim_01:comment = "GIM Ionospheric Correction. This correction is
to be accounted for during the computation
of height in order to correct this range
measurement for ionospheric range delays of
the radar pulse. This correction is an
alternative to [iono_cor_01_ku] and only
one should be used. Position is [lat_20_ku]
and [lon_20_ku] accessed through the
[ind_first_meas_20hz_01] index " ;

iono_cor_gim_01:source = "GIM" ;
iono_cor_gim_01:institution = "NASA/JPL" ;

```

lat_20_ku(time_20_ku)

```

int lat_20_ku(time_20_ku) ;
lat_20_ku:units = "degrees_north" ;
lat_20_ku:_FillValue = -2147483648 ;
lat_20_ku:long_name = "20 Hz latitude" ;
lat_20_ku:standard_name = "latitude" ;
lat_20_ku:scale_factor = 1.e-07 ;
lat_20_ku:add_offset = 0. ;

```

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```

lat_20_ku:comment = "Latitude of nadir location [-90,+90]. Positive
                    latitude is North latitude, negative latitude is
                    South latitude. Note the scale factor." ;

lat_20_ku:coordinates = "lon_20_ku lat_20_ku";

```

lat_21_ku(time_21_ku)

```

int lat_21_ku(time_21_ku) ;

lat_21_ku:units = "degrees_north" ;

lat_21_ku:_FillValue = -2147483648 ;

lat_21_ku:long_name = "20 Hz latitude" ;

lat_21_ku:standard_name = "latitude" ;

lat_21_ku:scale_factor = 1.e-07 ;

lat_21_ku:add_offset = 0. ;

lat_21_ku:comment = "Latitude of nadir location [-90,+90]. Positive
                    latitude is North latitude, negative latitude is
                    South latitude. Note the scale factor - FBR
                    SARIn." ;

lat_21_ku:coordinates = "lon_21_ku lat_21_ku";

```

lat_85_ku(time_85_ku)

```

int lat_85_ku(time_85_ku) ;

lat_85_ku:units = "degrees_north" ;

lat_85_ku:_FillValue = -2147483648 ;

lat_85_ku:long_name = "20 Hz latitude" ;

lat_85_ku:standard_name = "latitude" ;

lat_85_ku:scale_factor = 1.e-07 ;

lat_85_ku:add_offset = 0. ;

lat_85_ku:comment = "Latitude of nadir location [-90,+90]. Positive
                    latitude is North latitude, negative latitude is
                    South latitude. Note the scale factor - FBR SAR."
                    ;

lat_85_ku:coordinates = "lon_85_ku lat_85_ku";

```

lat_avg_01_ku(time_avg_01_ku)

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```

int lat_avg_01_ku(time_avg_01_ku) ;
    lat_avg_01_ku:_FillValue = -2147483648 ;
    lat_avg_01_ku:units = "degrees_north" ;
    lat_avg_01_ku:long_name = "latitude of measurement" ;
    lat_avg_01_ku:standard_name = "latitude" ;
    lat_avg_01_ku:add_offset = 0. ;
    lat_avg_01_ku:scale_factor = 1.e-07 ;
    lat_avg_01_ku:comment = "Latitude of nadir location [-90,+90]. Positive
                             latitude is North latitude, negative latitude is South
                             latitude. Note the scale factor." ;
    lat_avg_01_ku:coordinates = "lon_avg_01_ku lat_avg_01_ku";

```

load_tide_01(time_cor_01)

```

int load_tide_01(time_cor_01) ;
    load_tide_01:_FillValue = -2147483648 ;
    load_tide_01:units = "m" ;
    load_tide_01:long_name = "ocean loading tide (1-way)" ;
    load_tide_01:add_offset = 0. ;
    load_tide_01:scale_factor = 0.001 ;
    load_tide_01:comment = "Ocean loading tide. This correction is to be
                             accounted for during the computation of height to remove the
                             effect of local tidal distortion to the Earth's crust, caused by
                             increasing weight of ocean as local water tide rises. Position is
                             [lat_20_ku] and [lon_20_ku] accessed through the
                             [ind_first_meas_20hz_01] index " ;
    load_tide_01:source = "FES2004" ;
    load_tide_01:institution = "GSFC" ;

```

lon_20_ku(time_20_ku)

```

int lon_20_ku (time_20_ku) ;
    lon_20_ku:units = "degrees_east" ;
    lon_20_ku:_FillValue = -2147483648 ;
    lon_20_ku:long_name = "20 Hz longitude" ;
    lon_20_ku:standard_name = "longitude" ;

```

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```
lon_20_ku:scale_factor = 1.e-07 ;
lon_20_ku:add_offset = 0. ;
lon_20_ku:comment = "Longitude of nadir location [-180,+180]. Positive
                    longitude is East relative to Greenwich meridian.
                    Note the scale factor." ;
lon_20_ku:coordinates = "lon_20_ku lat_20_ku";
```

lon_21_ku(time_21_ku)

```
int lon_21_ku (time_21_ku) ;
lon_21_ku:units = "degrees_east" ;
lon_21_ku:_FillValue = -2147483648 ;
lon_21_ku:long_name = "20 Hz longitude" ;
lon_21_ku:standard_name = "longitude" ;
lon_21_ku:scale_factor = 1.e-07 ;
lon_21_ku:add_offset = 0. ;
lon_21_ku:comment = " Longitude of nadir location [-180,+180]. Positive
                    longitude is East relative to Greenwich meridian.
                    Note the scale factor - FBR SARIn." ;
lon_21_ku:coordinates = "lon_21_ku lat_21_ku";
```

lon_85_ku(time_85_ku)

```
int lon_85_ku (time_85_ku) ;
lon_85_ku:units = "degrees_east" ;
lon_85_ku:_FillValue = -2147483648 ;
lon_85_ku:long_name = "20 Hz longitude" ;
lon_85_ku:standard_name = "longitude" ;
lon_85_ku:scale_factor = 1.e-07 ;
lon_85_ku:add_offset = 0. ;
lon_85_ku:comment = " Longitude of nadir location [-180,+180]. Positive
                    longitude is East relative to Greenwich meridian.
                    Note the scale factor - FBR SAR." ;
lon_85_ku:coordinates = "lon_85_ku lat_85_ku";
```

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lon_avg_01_ku(time_avg_01_ku)

```

int lon_avg_01_ku(time_avg_01_ku) ;
    lon_avg_01_ku:_FillValue = -2147483648 ;
    lon_avg_01_ku:units = "degrees_east" ;
    lon_avg_01_ku:long_name = "longitude of measurement" ;
    lon_avg_01_ku:standard_name = "longitude" ;
    lon_avg_01_ku:add_offset = 0. ;
    lon_avg_01_ku:scale_factor = 1.e-07 ;
    lon_avg_01_ku:comment = "Longitude of nadir location [-180,+180].
        Positive longitude is East relative to Greenwich meridian. Note
        the scale factor." ;
    lon_avg_01_ku:coordinates = "lon_avg_01_ku lat_avg_01_ku";

```

look_angle_start_20_ku(time_20_ku)

```

int look_angle_start_20_ku(time_20_ku) ;
    look_angle_start_20_ku:_FillValue = -2147483648 ;
    look_angle_start_20_ku:units = "rad" ;
    look_angle_start_20_ku:long_name = "look angle start" ;
    look_angle_start_20_ku:add_offset = 0. ;
    look_angle_start_20_ku:scale_factor = 1.e-07 ;
    look_angle_start_20_ku:comment = "Value of Look Angle for the first single
        look echo in the stack. It is the angle between: (a) nadir
        direction from the satellite CoM to the surface, (b) direction
        from satellite to surface location. The look angle depends purely
        on geometry . SAR/SARIn only." ;
    look_angle_start_20_ku:coordinates = "lon_20_ku lat_20_ku";

```

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look_angle_stop_20_ku(time_20_ku)

```
int look_angle_stop_20_ku(time_20_ku) ;
    look_angle_stop_20_ku:_FillValue = -2147483648 ;
    look_angle_stop_20_ku:units = "rad" ;
    look_angle_stop_20_ku:long_name = " look angle stop" ;
    look_angle_stop_20_ku:add_offset = 0. ;
    look_angle_stop_20_ku:scale_factor = 1.e-07 ;
    look_angle_stop_20_ku:comment = "Value of Look Angle for the last single
        look echo in the stack. It is the angle between: (a) nadir
        direction from the satellite CoM to the surface, (b) direction
        from satellite to surface location. The look angle depends
        purely on geometry. SAR/SARIn only." ;
    look_angle_stop_20_ku:coordinates = "lon_20_ku lat_20_ku";
```

mod_dry_tropo_cor_01(time_cor_01)

```
int mod_dry_tropo_cor_01(time_cor_01) ;
    mod_dry_tropo_cor_01:_FillValue = -2147483648 ;
    mod_dry_tropo_cor_01:units = "m" ;
    mod_dry_tropo_cor_01:long_name = "dry tropospheric correction (1-way)" ;
    mod_dry_tropo_cor_01:standard_name =
"altimeter_range_correction_due_to_dry_troposphere" ;
    mod_dry_tropo_cor_01:add_offset = 0. ;
    mod_dry_tropo_cor_01:scale_factor = 0.001 ;
    mod_dry_tropo_cor_01:comment = "Model Dry Tropospheric Correction. This
        1-way correction is computed at the
        [time_cor_01] altimeter time-tag from the
        interpolation of 2 meteorological fields
        that surround the altimeter time-tag. This
        correction is to be accounted for during
        the computation of height in order to
        correct for the propagation delay to the
        radar pulse, caused by the dry-gas
        component of the Earth's atmosphere.
        Position is [lat_20_ku] and [lon_20_ku]
```

		<i>Instrument Processing Facility L1b</i> <i>Cryosat Ice netCDF L1b PFS</i> Doc. No.: <i>C2-RS-ACS-ESL-5364</i> Issue: <i>1.8</i> Date: <i>04/12/2018</i> Page: <i>110</i>
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```

                                accessed          through          the
                                [ind_first_meas_20hz_01] index " ;

mod_dry_tropo_cor_01:source = "European Centre for Medium Range Weather
                                Forecasting" ;

mod_dry_tropo_cor_01:institution = "ECMWF" ;

```

mod_wet_tropo_cor_01(time_cor_01)

```

int mod_wet_tropo_cor_01(time_cor_01) ;
    mod_wet_tropo_cor_01:_FillValue = -2147483648 ;
    mod_wet_tropo_cor_01:units = "m" ;
    mod_wet_tropo_cor_01:long_name = "wet tropospheric correction (1-way)" ;
    mod_wet_tropo_cor_01:standard_name
    "altimeter_range_correction_due_to_wet_troposphere" ;
    mod_wet_tropo_cor_01:add_offset = 0.0 ;
    mod_wet_tropo_cor_01:scale_factor = 0.001 ;
    mod_wet_tropo_cor_01:comment = "Model Wet Tropospheric Correction. This
                                1-way correction is computed at the
                                time_cor_01 altimeter time-tag from the
                                interpolation of 2 meteorological fields
                                that surround the altimeter time-tag. This
                                correction is to be accounted for during the
                                computation of height in order to correct
                                for the propagation delay to the radar pulse,
                                caused by the H2O component of the Earth's
                                atmosphere. Position is [lat_20_ku] and
                                [lon_20_ku] accessed through the
                                [ind_first_meas_20hz_01] index " ;

    mod_wet_tropo_cor_01:source = "European Centre for Medium Range Weather
                                Forecasting" ;

    mod_wet_tropo_cor_01:institution = "ECMWF" ;

```



noise_power_20_ku(time_20_ku)

```
int noise_power_20_ku(time_20_ku) ;  
noise_power_20_ku:_FillValue = -2147483648 ;  
noise_power_20_ku:units = "dB" ;  
noise_power_20_ku:long_name = "noise power measurement" ;  
noise_power_20_ku:add_offset = 0.0 ;  
noise_power_20_ku:scale_factor = 0.01 ;  
noise_power_20_ku:comment = "Noise power measurement to be the noise floor  
of measurement echoes. In SAR/SARIn it is estimated on the L1B  
20Hz multilooked power waveform. In LRM it is converted from  
telemetry units and scaled according to the proper AGC value.  
This field is set to the default value equal to -9999.99 when  
the telemetry contains zero." ;  
noise_power_20_ku:coordinates = "lon_20_ku lat_20_ku";
```

noise_power_21_ku(time_21_ku)

```
int noise_power_21_ku(time_21_ku) ;  
noise_power_21_ku:_FillValue = -2147483648 ;  
noise_power_21_ku:units = "dB" ;  
noise_power_21_ku:long_name = "noise power measurement" ;  
noise_power_21_ku:add_offset = 0.0 ;  
noise_power_21_ku:scale_factor = 0.01 ;  
noise_power_21_ku:comment = "Noise power measurement to be the noise floor  
of FBR measurement echoes. In SARIn it is estimated on the L1B  
20Hz multilooked power waveform. This field is set to the  
default value equal to -9999.99 when the telemetry contains  
zero - FBR SARIn." ;  
noise_power_21_ku:coordinates = "lon_21_ku lat_21_ku";
```

noise_power_85_ku(time_85_ku)

```
int noise_power_85_ku(time_85_ku) ;  
noise_power_85_ku:_FillValue = -2147483648 ;  
noise_power_85_ku:units = "dB" ;  
noise_power_85_ku:long_name = "noise power measurement" ;
```

		<i>Instrument Processing Facility L1b</i> <i>Cryosat Ice netCDF L1b PFS</i> Doc. No.: <i>C2-RS-ACS-ESL-5364</i> Issue: <i>1.8</i> Date: <i>04/12/2018</i> Page: <i>112</i>
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```

noise_power_85_ku:add_offset = 0.0 ;
noise_power_85_ku:scale_factor = 0.01 ;
noise_power_85_ku:comment = "Noise power to be the noise floor of FBR
measurement echoes. In SAR it is estimated on the L1B 20Hz
multilooked power waveform. This field is set to the default
value equal to -9999.99 when the telemetry contains zero - FBR
SAR." ;
noise_power_85_ku:coordinates = "lon_85_ku lat_85_ku";

```

ocean_tide_01(time_cor_01)

```

int ocean_tide_01(time_cor_01) ;
ocean_tide_01:_FillValue = -2147483648 ;
ocean_tide_01:units = "m" ;
ocean_tide_01:long_name = "elastic ocean tide (1-way)" ;
ocean_tide_01:standard_name =
"sea_surface_height_amplitude_due_to_elastic_ocean_tide" ;
ocean_tide_01:add_offset = 0. ;
ocean_tide_01:scale_factor = 0.001 ;
ocean_tide_01:comment = "Ocean Tide. This correction is to be accounted
for during the computation of height to remove the effect of
local tide and adjust the measurement to the mean sea
surface. This is the pure ocean tide, not including the
corresponding loading tide [load_tide_01] or the equilibrium
long-period ocean tide height [ocean_tide_eq_01]. The
permanent tide (zero frequency) is not included in this
parameter because it is included in the geoid [geoid_01] and
mean sea surface [mean_sea_surf_sea_ice_01]. Position is
[lat_20_ku] and [lon_20_ku] accessed through the
[ind_first_meas_20hz_01] index " ;
ocean_tide_01:source = "FES2004" ;
ocean_tide_01:institution = "LEGOS/CNES" ;

```

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ocean_tide_eq_01(time_cor_01)

```

int ocean_tide_eq_01(time_cor_01) ;
    ocean_tide_eq_01:_FillValue = -2147483648 ;
    ocean_tide_eq_01:units = "m" ;
    ocean_tide_eq_01:long_name = "long period equilibrium ocean tide (1-way)"
;

    ocean_tide_eq_01:standard_name =
"sea_surface_height_amplitude_due_to_equilibrium_ocean_tide" ;
    ocean_tide_eq_01:add_offset = 0. ;
    ocean_tide_eq_01:scale_factor = 0.001 ;
    ocean_tide_eq_01:comment = "Long Period Equilibrium Ocean Tide. This
                                correction is to be accounted for during the computation of
                                height to remove the effect of the oceanic response to the
                                single tidal forcing. Position is [lat_20_ku] and
                                [lon_20_ku] accessed through the [ind_first_meas_20hz_01]
                                index " ;
    ocean_tide_eq_01:source = "FES2004" ;
    ocean_tide_eq_01:institution = "LEGOS/CNES" ;

```

off_nadir_pitch_angle_str_20_ku(time_20_ku)

```

int off_nadir_pitch_angle_str_20_ku(time_20_ku) ;
    off_nadir_pitch_angle_str_20_ku:_FillValue = -2147483648 ;
    off_nadir_pitch_angle_str_20_ku:units = "degrees" ;
    off_nadir_pitch_angle_str_20_ku:long_name = "antenna bench pitch angle";
    off_nadir_pitch_angle_str_20_ku:comment = "Pitch angle with respect to
                                                the nadir pointing, measured by the STRs and post-
                                                processed by the ground facility." ;
    off_nadir_pitch_angle_str_20_ku:coordinates = "lon_20_ku lat_20_ku";
    off_nadir_pitch_angle_str_20_ku:add_offset = 0.0 ;
    off_nadir_pitch_angle_str_20_ku:scale_factor = 1.e-07;

```

		<i>Instrument Processing Facility L1b</i> <i>Cryosat Ice netCDF L1b PFS</i> Doc. No.: C2-RS-ACS-ESL-5364 Issue: 1.8 Date: 04/12/2018 Page: 114
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off_nadir_roll_angle_str_20_ku(time_20_ku)

```
int off_nadir_roll_angle_str_20_ku(time_20_ku) ;
off_nadir_roll_angle_str_20_ku:_FillValue = -2147483648 ;
off_nadir_roll_angle_str_20_ku:units = "degrees" ;
off_nadir_roll_angle_str_20_ku:long_name = "antenna bench roll angle";
off_nadir_roll_angle_str_20_ku:comment = "Roll angle with respect to the
nadir pointing, measured by the STRs and post-
processed by the ground facility." ;
off_nadir_roll_angle_str_20_ku:coordinates = "lon_20_ku lat_20_ku";
off_nadir_roll_angle_str_20_ku:add_offset = 0.0 ;
off_nadir_roll_angle_str_20_ku:scale_factor = 1.e-07 ;
```

off_nadir_yaw_angle_str_20_ku(time_20_ku)

```
int off_nadir_yaw_angle_str_20_ku(time_20_ku) ;
off_nadir_yaw_angle_str_20_ku:_FillValue = -2147483648 ;
off_nadir_yaw_angle_str_20_ku:units = "degrees" ;
off_nadir_yaw_angle_str_20_ku:long_name = "antenna bench yaw angle";
off_nadir_yaw_angle_str_20_ku:comment = "Yaw angle with respect to the
nadir pointing, measured by the STRs and post-
processed by the ground facility." ;
off_nadir_yaw_angle_str_20_ku:coordinates = "lon_20_ku lat_20_ku";
off_nadir_yaw_angle_str_20_ku:add_offset = 0.0 ;
off_nadir_yaw_angle_str_20_ku:scale_factor = 1.e-07 ;
```

		<i>Instrument Processing Facility L1b</i> <i>Cryosat Ice netCDF L1b PFS</i> Doc. No.: C2-RS-ACS-ESL-5364 Issue: 1.8 Date: 04/12/2018 Page: 115
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orb_alt_rate_20_ku(time_20_ku)

```
int orb_alt_rate_20_ku(time_20_ku) ;
    orb_alt_rate_20_ku:_FillValue = -2147483648 ;
    orb_alt_rate_20_ku:units = "m/s" ;
    orb_alt_rate_20_ku:long_name = "altitude rate of the Satellite CoM with
                                   respect to the reference ellipsoid" ;
    orb_alt_rate_20_ku:add_offset = 0. ;
    orb_alt_rate_20_ku:scale_factor = 0.001 ;
    orb_alt_rate_20_ku:comment = "Instantaneous altitude rate at the
                                   satellite CoM with respect to the reference ellipsoid
                                   [WGS84]." ;
    orb_alt_rate_20_ku:coordinates = "lon_20_ku lat_20_ku";
```

orb_alt_rate_21_ku(time_21_ku)

```
int orb_alt_rate_21_ku(time_21_ku) ;
    orb_alt_rate_21_ku:_FillValue = -2147483648 ;
    orb_alt_rate_21_ku:units = "m/s" ;
    orb_alt_rate_21_ku:long_name = "altitude rate of the Satellite CoM with
                                   respect to the reference ellipsoid" ;
    orb_alt_rate_21_ku:add_offset = 0. ;
    orb_alt_rate_21_ku:scale_factor = 0.001 ;
    orb_alt_rate_21_ku:comment = "Instantaneous altitude rate of the
                                   satellite CoM with respect to the reference ellipsoid [WGS84]
                                   - FBR SARIn." ;
    orb_alt_rate_21_ku:coordinates = "lon_21_ku lat_21_ku";
```

		<i>Instrument Processing Facility L1b</i> <i>Cryosat Ice netCDF L1b PFS</i> Doc. No.: <i>C2-RS-ACS-ESL-5364</i> Issue: <i>1.8</i> Date: <i>04/12/2018</i> Page: <i>116</i>
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orb_alt_rate_85_ku(time_85_ku)

```

int orb_alt_rate_85_ku(time_85_ku) ;
    orb_alt_rate_85_ku:_FillValue = -2147483648 ;
    orb_alt_rate_85_ku:units = "m/s" ;
    orb_alt_rate_85_ku:long_name = "altitude rate of the Satellite CoM with
                                   respect to the reference ellipsoid" ;
    orb_alt_rate_85_ku:add_offset = 0. ;
    orb_alt_rate_85_ku:scale_factor = 0.001 ;
    orb_alt_rate_85_ku:comment = "Instantaneous altitude rate of the
                                   satellite CoM with respect to the reference ellipsoid [WGS84]
                                   - FBR SAR." ;
    orb_alt_rate_85_ku:coordinates = "lon_85_ku lat_85_ku";

```

ph_diff_waveform_20_ku(time_20_ku, ns_20_ku)

```

int ph_diff_waveform_20_ku(time_20_ku, ns_20_ku) ;
    ph_diff_waveform_20_ku:_FillValue = -2147483648 ;
    ph_diff_waveform_20_ku:units = "rad" ;
    ph_diff_waveform_20_ku:long_name = "L1b Phase Difference waveform" ;
    ph_diff_waveform_20_ku:add_offset = 0. ;
    ph_diff_waveform_20_ku:scale_factor = 1.e-06 ;
    ph_diff_waveform_20_ku:comment = "The L1b 20Hz phase difference waveform
                                   is a fully-calibrated, high
                                   resolution, multilooked phase
                                   difference computed from the complex
                                   echoes on the two receiving channels
                                   (SARIn only)." ;
    ph_diff_waveform_20_ku:coordinates = "lon_20_ku lat_20_ku";

```

		<i>Instrument Processing Facility L1b</i> <i>Cryosat Ice netCDF L1b PFS</i> Doc. No.: C2-RS-ACS-ESL-5364 Issue: 1.8 Date: 04/12/2018 Page: 117
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ph_slope_cor_20_ku(time_20_ku)

```

int ph_slope_cor_20_ku(time_20_ku) ;
    ph_slope_cor_20_ku:_FillValue = -2147483648 ;
    ph_slope_cor_20_ku:units = "rad" ;
    ph_slope_cor_20_ku:long_name = "phase slope correction" ;
    ph_slope_cor_20_ku:add_offset = 0. ;
    ph_slope_cor_20_ku:scale_factor = 1.e-06 ;
    ph_slope_cor_20_ku:comment = "Differential group delay phase difference
                                slope correction across the whole bandwidth (SARIn only). It
                                is composed by fixed contributions from IPFDB and by variable
                                contributions covering differences between the CAL-1 and
                                CAL-4 paths. Applied in L1B SARIn products." ;
    ph_slope_cor_20_ku:coordinates = "lon_20_ku lat_20_ku";

```

ph_slope_cor_21_ku(time_21_ku)

```

int ph_slope_cor_21_ku(time_21_ku) ;
    ph_slope_cor_21_ku:_FillValue = -2147483648 ;
    ph_slope_cor_21_ku:units = "rad" ;
    ph_slope_cor_21_ku:long_name = "phase slope correction" ;
    ph_slope_cor_21_ku:add_offset = 0. ;
    ph_slope_cor_21_ku:scale_factor = 1.e-06 ;
    ph_slope_cor_21_ku:comment = "Differential group delay phase difference
                                slope correction across the whole bandwidth (SARIn only). It
                                is composed by fixed contributions from IPFDB and by variable
                                contributions covering differences between the CAL-1 and
                                CAL-4 paths - FBR SARIn" ;
    ph_slope_cor_21_ku:coordinates = "lon_21_ku lat_21_ku";

```

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pole_tide_01(time_cor_01)

```

int pole_tide_01(time_cor_01) ;
    pole_tide_01:_FillValue = -2147483648 ;
    pole_tide_01:units = "m" ;
    pole_tide_01:long_name = "geocentric polar tide (1-way)" ;
    pole_tide_01:add_offset = 0. ;
    pole_tide_01:scale_factor = 0.001 ;
    pole_tide_01:comment = "Geocentric polar tide. This correction is to be
        accounted for during the computation of height to remove a
        long-period distortion of the Earth's crust. Although called
        a 'tide' this is in fact caused by variations in centrifugal
        force as the Earth's rotational axis moves its geographic
        location. Position is [lat_20_ku] and [lon_20_ku] accessed
        through the [ind_first_meas_20hz_01] index " ;
    pole_tide_01:source = "Wahr [1985] Deformation of the Earth induced by
        polar motion - J. Geophys. Res. (Solid Earth), 90, 9363-9368."
        ;
    pole_tide_01:institution = "IERS/CNES" ;

```

pwr_waveform_20_ku(time_20_ku, ns_20_ku)

```

ushort pwr_waveform_20_ku(time_20_ku, ns_20_ku) ;
    pwr_waveform_20_ku:units = "count" ;
    pwr_waveform_20_ku:long_name = "l1b power waveform scaled 0-65535" ;
    pwr_waveform_20_ku:add_offset = 0us ;
    pwr_waveform_20_ku:scale_factor = 1us ;
    pwr_waveform_20_ku:comment = "The L1B 20Hz power waveform is a fully-
        calibrated waveform. For LRM it is a low
        resolution pulse limited waveform. For
        SAR/SARIn it is a high resolution multilooked
        waveform. Units are counts scaled to fit in the
        range 0-65535." ;
    pwr_waveform_20_ku:coordinates = "lon_20_ku lat_20_ku";

```

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pwr_waveform_avg_01_ku(time_avg_01_ku, ns_avg_01_ku)

```

ushort pwr_waveform_avg_01_ku(time_avg_01_ku, ns_avg_01_ku) ;

pwr_waveform_avg_01_ku:units = "count" ;

pwr_waveform_avg_01_ku:long_name = "1hz l1b power waveform scaled 0-
                                   65535" ;

pwr_waveform_avg_01_ku:add_offset = 0us ;

pwr_waveform_avg_01_ku:scale_factor = 1us ;

pwr_waveform_avg_01_ku:comment = "The L1B 1Hz averaged power waveform is
                                   a fully-calibrated low resolution pulse limited power
                                   waveform. For SAR/SARIn it is a Pseudo-LRM power waveform
                                   obtained by averaging all individual L0 echoes covering approx
                                   1 second after range compression. Units are counts scaled to
                                   fit in the range 0-65535." ;

pwr_waveform_avg_01_ku:coordinates = "lon_avg_01_ku lat_avg_01_ku";

```

rec_count_20_ku(time_20_ku)

```

int rec_count_20_ku(time_20_ku) ;

rec_count_20_ku:units = "count" ;

rec_count_20_ku:long_name = "record counter" ;

rec_count_20_ku:comment = "Record counter - progressive counter
                           incremented by 1 for each record. Surface
                           Sample counter for SAR/SARIn L1B products."
                           ;

rec_count_20_ku:coordinates = "lon_20_ku lat_20_ku";

```

rec_count_21_ku(time_21_ku)

```

int rec_count_21_ku(time_21_ku) ;

rec_count_21_ku:units = "count" ;

rec_count_21_ku:long_name = "record counter" ;

rec_count_21_ku:comment = "Record counter - progressive counter
                           incremented by 1 for each record. Burst
                           counter for FBR SARIn products." ;

rec_count_21_ku:coordinates = "lon_21_ku lat_21_ku";

```

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rec_count_85_ku(time_85_ku)

```

int rec_count_85_ku(time_85_ku) ;
rec_count_85_ku:units = "count" ;
rec_count_85_ku:long_name = "record counter" ;
rec_count_85_ku:comment = "Record counter - progressive counter
                           incremented by 1 for each record. Burst
                           counter for FBR SAR products." ;
rec_count_85_ku:coordinates = "lon_85_ku lat_85_ku";

```

sat_vel_vec_20_ku(time_20_ku,space_3d)

```

int sat_vel_vec_20_ku(time_20_ku, space_3d) ;
sat_vel_vec_20_ku:_FillValue = -2147483648 ;
sat_vel_vec_20_ku:units = "m/s" ;
sat_vel_vec_20_ku:long_name = "velocity vector in itrfr" ;
sat_vel_vec_20_ku:add_offset = 0. ;
sat_vel_vec_20_ku:scale_factor = 0.001 ;
sat_vel_vec_20_ku:comment = "Satellite velocity vector, described in the
                           International Terrestrial Reference Frame in
                           the International Earth Fixed System. This
                           is not a unit vector as the velocity
                           magnitude is also required. The 3 components
                           are given according to the 'space_3d'
                           dimension: [1] x, [2] y, [3] z.";
sat_vel_vec_20_ku:coordinates = "lon_20_ku lat_20_ku";

```

sat_vel_vec_21_ku(time_21_ku,space_3d)

```

int sat_vel_vec_21_ku(time_21_ku, space_3d) ;
sat_vel_vec_21_ku:_FillValue = -2147483648 ;
sat_vel_vec_21_ku:units = "m/s" ;
sat_vel_vec_21_ku:long_name = "velocity vector in itrfr" ;
sat_vel_vec_21_ku:add_offset = 0. ;
sat_vel_vec_21_ku:scale_factor = 0.001 ;
sat_vel_vec_21_ku:comment = "Satellite velocity vector, described in the
                           International Terrestrial Reference

```

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Frame in the International Earth Fixed System. This is not a unit vector as the velocity magnitude is also required. The 3 components are given according to the 'space_3d' dimension:
[1] x, [2] y, [3] z - FBR SARIn." ;

```
sat_vel_vec_21_ku:coordinates = "lon_21_ku lat_21_ku";
```

sat_vel_vec_85_ku(time_85_ku,space_3d)

```
int sat_vel_vec_85_ku(time_85_ku, space_3d) ;
sat_vel_vec_85_ku:_FillValue = -2147483648 ;
sat_vel_vec_85_ku:units = "m/s" ;
sat_vel_vec_85_ku:long_name = "velocity vector in itrfr" ;
sat_vel_vec_85_ku:add_offset = 0. ;
sat_vel_vec_85_ku:scale_factor = 0.001 ;
sat_vel_vec_85_ku:comment = "Satellite velocity, described in the
International Terrestrial Reference
Frame in the International Earth Fixed
System. This is not a unit vector as
the velocity magnitude is also
required. The 3 components are given
according to the 'space_3d' dimension:
[1] x, [2] y, [3] z - FBR SAR." ;
sat_vel_vec_85_ku:coordinates = "lon_85_ku lat_85_ku";
```

seq_count_20_ku(time_20_ku)

```
short seq_count_20_ku(time_20_ku) ;
seq_count_20_ku:units = "count" ;
seq_count_20_ku:long_name = "Source Sequence Counter" ;
seq_count_20_ku:add_offset = 0s ;
seq_count_20_ku:scale_factor = 1s ;
seq_count_20_ku:comment = "Source Sequence Counter read from the L0 echo
telemetry packet.";
seq_count_20_ku:coordinates = "lon_20_ku lat_20_ku";
```

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seq_count_21_ku(time_21_ku)

```

short seq_count_21_ku(time_21_ku) ;
    seq_count_21_ku:units = "count" ;
    seq_count_21_ku:long_name = "Source Sequence Counter" ;
    seq_count_21_ku:add_offset = 0s ;
    seq_count_21_ku:scale_factor = 1s ;
    seq_count_21_ku:comment = "Source Sequence Counter read from the L0 echo
                                telemetry packet - FBR SARIn." ;
    seq_count_21_ku:coordinates = "lon_21_ku lat_21_ku";

```

seq_count_85_ku(time_85_ku)

```

short seq_count_85_ku(time_85_ku) ;
    seq_count_85_ku:units = "count" ;
    seq_count_85_ku:long_name = "Source Sequence Counter" ;
    seq_count_85_ku:add_offset = 0s ;
    seq_count_85_ku:scale_factor = 1s ;
    seq_count_85_ku:comment = "Source Sequence Counter read from the L0 echo
                                telemetry packet - FBR SAR." ;
    seq_count_85_ku:coordinates = "lon_85_ku lat_85_ku";

```

solid_earth_tide_01(time_cor_01)

```

int solid_earth_tide_01(time_cor_01) ;
    solid_earth_tide_01:_FillValue = -2147483648 ;
    solid_earth_tide_01:units = "m" ;
    solid_earth_tide_01:long_name = "solid earth tide (1-way)" ;
    solid_earth_tide_01:standard_name="sea_surface_height_amplitude_due_to_
earth_tide" ;
    solid_earth_tide_01:add_offset = 0. ;
    solid_earth_tide_01:scale_factor = 0.001 ;
    solid_earth_tide_01:comment = "Solid Earth. This correction is to be
                                accounted for during the computation of height to remove the
                                effect of local tidal distortion to the Earth's crust, in
                                particular by the sun and moon. Position is [lat_20_ku] and

```

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```
[lon_20_ku] accessed through the [ind_first_meas_20hz_01]
index " ;
```

```
solid_earth_tide_01:source = "Cartwright and Edden [1973] Corrected
tables of tidal harmonics - J. Geophys. J. R. Astr. Soc., 33,
253-264." ;
```

stack_centre_20_ku(time_20_ku)

```
short stack_centre_20_ku(time_20_ku) ;
    stack_centre_20_ku:units = "count" ;
    stack_centre_20_ku:_FillValue = -32768s ;
    stack_centre_20_ku:long_name = "gaussian power fitting: center wrt beam
                                number" ;
    stack_centre_20_ku:add_offset = 0. ;
    stack_centre_20_ku:scale_factor = 0.01 ;
    stack_centre_20_ku:comment = "Position of the centre of Gaussian that
                                fits the range integrated power of the
                                single look echoes within a stack. Stack
                                centre as function of stack beam number.
                                Applicable to SAR/SARIn only." ;
    stack_centre_20_ku:coordinates = "lon_20_ku lat_20_ku";
```

stack_centre_angle_20_ku(time_20_ku)

```
short stack_centre_angle_20_ku(time_20_ku) ;
    stack_centre_angle_20_ku:_FillValue = -32768s ;
    stack_centre_angle_20_ku:units = "rad" ;
    stack_centre_angle_20_ku:long_name = "gaussian power fitting: center wrt
                                boresight angle" ;
    stack_centre_angle_20_ku:add_offset = 0. ;
    stack_centre_angle_20_ku:scale_factor = 1.e-06 ;
    stack_centre_angle_20_ku:comment = "Position of the centre of Gaussian
                                that fits the range integrated power
                                of the single look echoes within a
                                stack. Centre as function of the
                                boresight angle, that is the angle
                                between: (a) antenna boresight
```

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direction, (b) direction from satellite to surface location. The pointing angle depends on geometry and attitude (roll and pitch). Applicable to SAR/SARIn only.";;

```
stack_centre_angle_20_ku:coordinates = "lon_20_ku lat_20_ku";
```

stack_centre_look_angle_20_ku(time_20_ku)

```
short stack_centre_look_angle_20_ku(time_20_ku) ;
    stack_centre_look_angle_20_ku:_FillValue = -32768s ;
    stack_centre_look_angle_20_ku:add_offset = 0. ;
    stack_centre_look_angle_20_ku:comment = "Position of the centre of
                                            Gaussian that fits the range
                                            integrated power of the single look
                                            echoes within a stack. Centre as
                                            function of the look angle, that is
                                            the angle between: (a) nadir
                                            direction from the satellite CoM to
                                            the surface, (b) direction from
                                            satellite to surface location.
                                            Applicable to SAR/SARIn only. See
                                            \'Pitch Estimation for CryoSat by
                                            Analysis of Stacks of Single-Look
                                            Echoes\' - M. Scagliola, M. Fornari
                                            and N. Tagliani - IEEE Geoscience
                                            and Remote Sensing Letters, vol. 12,
                                            no. 7, pp. 1561-1565, July 2015.
                                            doi: 10.1109/LGRS.2015.2413135" ;
    stack_centre_look_angle_20_ku:coordinates = "lon_20_ku lat_20_ku";
    stack_centre_look_angle_20_ku:long_name = "gaussian power fitting: centre
                                            wrt look angle" ;
    stack_centre_look_angle_20_ku:scale_factor = 1.e-06 ;
    stack_centre_look_angle_20_ku:units = "rad" ;
```

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stack_gaussian_fitting_residuals_20_ku(time_20_ku)

```

short stack_gaussian_fitting_residuals_20_ku(time_20_ku) ;
stack_gaussian_fitting_residuals_20_ku:_FillValue = -32768s ;
stack_gaussian_fitting_residuals_20_ku:add_offset = 0. ;
stack_gaussian_fitting_residuals_20_ku:comment = "Residuals of Gaussian
that fits the range integrated power
of the single look echoes within a
stack. It is the root mean squared
error between the Gaussian fitting
and the range integrated power of
the single look echoes within a
stack. Applicable to SAR/SARIn
only." ;
stack_gaussian_fitting_residuals_20_ku:coordinates = "lon_20_ku
lat_20_ku";
stack_gaussian_fitting_residuals_20_ku:long_name = "gaussian power
fitting: residuals fitting" ;
stack_gaussian_fitting_residuals_20_ku:scale_factor = 0.01 ;
stack_gaussian_fitting_residuals_20_ku:units = "dbW" ;

```

stack_kurtosis_20_ku(time_20_ku)

```

short stack_kurtosis_20_ku(time_20_ku) ;
stack_kurtosis_20_ku:_FillValue = -999s ;
stack_kurtosis_20_ku:units = "count" ;
stack_kurtosis_20_ku:long_name = "gaussian power fitting: kurtosis wrt
beam number" ;
stack_kurtosis_20_ku:add_offset = 0. ;
stack_kurtosis_20_ku:scale_factor = 0.01 ;
stack_kurtosis_20_ku:comment = "4th central moment computed on the range
integrated power of the single look
echoes within a stack. Kurtosis as
function of stack beam number.
Applicable to SAR/SARIn only." ;
stack_kurtosis_20_ku:coordinates = "lon_20_ku lat_20_ku";

```

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stack_number_after_weighting_20_ku(time_20_ku)

```

short stack_number_after_weighting_20_ku(time_20_ku) ;
    stack_number_after_weighting_20_ku:_FillValue = -32768s ;
    stack_number_after_weighting_20_ku:units = "count" ;
    stack_number_after_weighting_20_ku:long_name = "number of contributing
        beams in the stack after weighting" ;
    stack_number_after_weighting_20_ku:add_offset = 0s ;
    stack_number_after_weighting_20_ku:scale_factor = 1s ;
    stack_number_after_weighting_20_ku:comment = "Number of contributing
        beams in the stack after weighting:
        number of single look echoes in the stack
        after the Surface Sample Stack weighting
        is applied. Applicable to SAR/SARIn
        only." ;
    stack_number_after_weighting_20_ku:coordinates = "lon_20_ku lat_20_ku";

```

stack_number_before_weighting_20_ku(time_20_ku)

```

short stack_number_before_weighting_20_ku(time_20_ku) ;
    stack_number_before_weighting_20_ku:_FillValue = -32768s ;
    stack_number_before_weighting_20_ku:units = "count" ;
    stack_number_before_weighting_20_ku:long_name = "number of contributing
        beams in the stack before weighting" ;
    stack_number_before_weighting_20_ku:add_offset = 0s ;
    stack_number_before_weighting_20_ku:scale_factor = 1s ;
    stack_number_before_weighting_20_ku:comment = "Number of contributing
        beams in the stack before weighting:
        number of single look echoes in the
        stack before the Surface Sample
        Stack weighting is applied.
        Applicable to SAR/SARIn only." ;
    stack_number_before_weighting_20_ku:coordinates = "lon_20_ku lat_20_ku";

```

		<i>Instrument Processing Facility L1b</i> <i>Cryosat Ice netCDF L1b PFS</i> Doc. No.: C2-RS-ACS-ESL-5364 Issue: 1.8 Date: 04/12/2018 Page: 127
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stack_peakiness_20_ku (time_20_ku)

```

short stack_peakiness_20_ku(time_20_ku) ;
stack_peakiness_20_ku:_FillValue = -32768s ;
stack_peakiness_20_ku:add_offset = 0.0 ;
stack_peakiness_20_ku:comment = "Stack peakiness computed from the range
                                integrated power of the single look
                                echoes within a stack. Stack
                                peakiness is defined as the inverse
                                of the average of the range
                                integrated power normalized for the
                                power at zero look angle. Applicable
                                to SAR/SARIn only. See M. Passaro,
                                F. L. Müller, D. Dettmering, Lead
                                detection using Cryosat-2 delay-
                                doppler processing and Sentinel-1
                                SAR images, In Advances in Space
                                Research, 2017" ;
stack_peakiness_20_ku:coordinates = "lon_20_ku lat_20_ku";
stack_peakiness_20_ku:long_name = "Stack peakiness" ;
stack_peakiness_20_ku:scale_factor = 0.01 ;
stack_peakiness_20_ku:units = "count" ;

```

stack_scaled_amplitude_20_ku(time_20_ku)

```

short stack_scaled_amplitude_20_ku(time_20_ku) ;
stack_scaled_amplitude_20_ku:_FillValue = -32768s ;
stack_scaled_amplitude_20_ku:units = "dB" ;
stack_scaled_amplitude_20_ku:long_name = "gaussian power fitting:
                                amplitude" ;
stack_scaled_amplitude_20_ku:add_offset = 0. ;
stack_scaled_amplitude_20_ku:scale_factor = 0.01 ;
stack_scaled_amplitude_20_ku:comment = "Amplitude of Gaussian that fits
                                the range integrated power of the
                                single look echoes within a stack.
                                Applicable to SAR/SARIn only." ;
stack_scaled_amplitude_20_ku:coordinates = "lon_20_ku lat_20_ku";

```

		<i>Instrument Processing Facility L1b</i> <i>Cryosat Ice netCDF L1b PFS</i> Doc. No.: C2-RS-ACS-ESL-5364 Issue: 1.8 Date: 04/12/2018 Page: 128
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stack_skewness_20_ku(time_20_ku)

```

short stack_skewness_20_ku(time_20_ku) ;
    stack_skewness_20_ku:_FillValue = -999s ;
    stack_skewness_20_ku:units = "count" ;
    stack_skewness_20_ku:long_name = "gaussian power fitting: skewness wrt
                                     beam number" ;
    stack_skewness_20_ku:add_offset = 0.0 ;
    stack_skewness_20_ku:scale_factor = 0.01 ;
    stack_skewness_20_ku:comment = "3rd central moment computed on the range
                                     integrated power of the single look
                                     echoes within a stack. Skewness as
                                     function of stack beam number.
                                     Applicable to SAR/SARIn only."
    ;stack_skewness_20_ku:coordinates =
    "lon_20_ku lat_20_ku";

```

stack_std_20_ku(time_20_ku)

```

short stack_std_20_ku(time_20_ku) ;
    stack_std_20_ku:units = "count" ;
    stack_std_20_ku:_FillValue = -32768s ;
    stack_std_20_ku:long_name = "Gaussian power fitting: std dev wrt beam
                                     number" ;
    stack_std_20_ku:add_offset = 0. ;
    stack_std_20_ku:scale_factor = 0.01 ;
    stack_std_20_ku:comment = "Standard deviation of Gaussian that fits the
                                     range integrated power of the single look
                                     echoes within a stack. Standard deviation as
                                     function of stack beam number. Applicable to
                                     SAR/SARIn only." ;
    stack_std_20_ku:coordinates = "lon_20_ku lat_20_ku";

```

stack_std_angle_20_ku(time_20_ku)

```

short stack_std_angle_20_ku(time_20_ku) ;
    stack_std_angle_20_ku:_FillValue = -32768s ;

```

		<i>Instrument Processing Facility L1b</i> <i>Cryosat Ice netCDF L1b PFS</i> Doc. No.: <i>C2-RS-ACS-ESL-5364</i> Issue: <i>1.8</i> Date: <i>04/12/2018</i> Page: <i>129</i>
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```

stack_std_angle_20_ku:units = "rad" ;

stack_std_angle_20_ku:long_name = "gaussian power fitting: std dev wrt
                                   boresight angle" ;

stack_std_angle_20_ku:add_offset = 0. ;

stack_std_angle_20_ku:scale_factor = 1.e-06 ;

stack_std_angle_20_ku:comment = "Standard deviation of Gaussian that fits
                                   the range integrated power of the single look
                                   echoes within a stack. Standard deviation as
                                   function of the boresight angle, that is the angle
                                   between: (a) antenna boresight direction, (b)
                                   direction from satellite to surface location. The
                                   boresight angle depends on geometry and attitude
                                   (roll and pitch). Applicable to SAR/SARIn only." ;

stack_std_angle_20_ku:coordinates = "lon_20_ku lat_20_ku";

```

surf_type_01(time_cor_01)

```

byte surf_type_01(time_cor_01) ;

surf_type_01:_FillValue = -128b ;

surf_type_01:long_name = "surface type flag" ;

surf_type_01:flag_values = 0b, 1b, 2b, 3b ;

surf_type_01:flag_meanings = "ocean lake_enclosed_sea ice land" ;

surf_type_01:source = "GMT, GlobCover, Modis Mosaic of Antarctica, and
Water body outlines from LEGOS";

surf_type_01:institution = "CLS/CNES" ;

surf_type_01:comment = "A 4-state surface type mask for Cryosat2 data for
the surface type at the nadir location. Computed by combining data from different
sources: GMT, GlobCover, Modis Mosaic of Antarctica, and Water body outlines from
LEGOS. Position is [lat_20_ku] and [lon_20_ku] accessed through the
[ind_first_meas_20hz_01] index " ;

```

time_20_ku(time_20_ku)

```

double time_20_ku(time_20_ku) ;

time_20_ku:units = "seconds since 2000-01-01 00:00:00.0" ;

time_20_ku:long_name = "time in TAI: seconds since 1 Jan 2000" ;

time_20_ku:standard_name = "time" ;

```

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```

time_20_ku:calendar = "gregorian" ;

time_20_ku:comment = "TAI time counted in seconds since 2000-01-01
                      00:00:00. Time refers to the instant the L1B
                      20Hz power waveform touches the surface." ;

time_20_ku:coordinates = "lon_20_ku lat_20_ku";

```

time_21_ku(time_21_ku)

```

double time_21_ku(time_21_ku) ;

time_21_ku:units = "seconds since 2000-01-01 00:00:00.0" ;

time_21_ku:long_name = "time in TAI: seconds since 1 Jan 2000" ;

time_21_ku:standard_name = "time" ;

time_21_ku:calendar = "gregorian" ;

time_21_ku:comment = "TAI time counted in seconds since 2000-01-01
                      00:00:00. Time corresponding to ground bounce
                      time of the middle of the burst - FBR SARIn."
                      ;

time_21_ku:coordinates = "lon_21_ku lat_21_ku";

```

time_85_ku(time_85_ku)

```

double time_85_ku(time_85_ku) ;

time_85_ku:units = "seconds since 2000-01-01 00:00:00.0" ;

time_85_ku:long_name = "time in TAI: seconds since 1 Jan 2000" ;

time_85_ku:standard_name = "time" ;

time_85_ku:calendar = "gregorian" ;

time_85_ku:comment = "TAI time counted in seconds since 2000-01-01
                      00:00:00. Time corresponding to ground bounce
                      time of the middle of the burst - FBR SAR." ;

time_85_ku:coordinates = "lon_85_ku lat_85_ku";

```

time_avg_01_ku(time_avg_01_ku)

```

double time_avg_01_ku(time_avg_01_ku) ;

time_avg_01_ku:units = "seconds since 2000-01-01 00:00:00.0" ;

time_avg_01_ku:calendar = "gregorian" ;

time_avg_01_ku:long_name = "time in TAI: seconds since 1 Jan 2000" ;

```

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```

time_avg_01_ku:standard_name = "time" ;

time_avg_01_ku:comment = "TAI time counted in seconds since 2000-01-01
                          00:00:00. Time refers to the instant the L1B
                          1Hz average power waveform touches the
                          surface." ;

time_avg_01_ku:coordinates = "lat_avg_01_ku lon_20_avg_01_ku";

```

time_cor_01(time_cor_01)

```

double time_cor_01(time_cor_01) ;

time_cor_01:units = "seconds since 2000-01-01 00:00:00.0" ;

time_cor_01:long_name = "time in TAI: seconds since 1 Jan 2000" ;

time_cor_01:standard_name = "time" ;

time_cor_01:calendar = "gregorian" ;

time_cor_01:comment = "TAI time counted in seconds since 2000-01-01
                      00:00:00. Time refers to the instant which the
                      corrections are referred to. Position is
                      [lat_20_ku] and [lon_20_ku] accessed through
                      the [ind_first_meas_20hz_01] index " ;

```

tot_gain_ch1_20_ku(time_20_ku)

```

int tot_gain_ch1_20_ku(time_20_ku) ;

tot_gain_ch1_20_ku:_FillValue = -2147483648 ;

tot_gain_ch1_20_ku:units = "dB" ;

tot_gain_ch1_20_ku:long_name = "total fixed gain on channel 1" ;

tot_gain_ch1_20_ku:add_offset = 0. ;

tot_gain_ch1_20_ku:scale_factor = 0.01 ;

tot_gain_ch1_20_ku:comment = "Total Fixed Gain On Channel 1 - total fixed
                              instrument gain applied on channel 1, this is
                              the gain applied by the RF unit. Applied in
                              L1B." ;

tot_gain_ch1_20_ku:coordinates = "lon_20_ku lat_20_ku";

```

tot_gain_ch1_21_ku(time_21_ku)

```

int tot_gain_ch1_21_ku(time_21_ku) ;

```

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```

tot_gain_ch1_21_ku:_FillValue = -2147483648 ;
tot_gain_ch1_21_ku:units = "dB" ;
tot_gain_ch1_21_ku:long_name = "total fixed gain on channel 1" ;
tot_gain_ch1_21_ku:add_offset = 0. ;
tot_gain_ch1_21_ku:scale_factor = 0.01 ;
tot_gain_ch1_21_ku:comment = "Total Fixed Gain On Channel 1 - total fixed
                                instrument gain to be applied on channel 1,
                                this is the gain applied by the RF unit- FBR
                                SARIn." ;
tot_gain_ch1_21_ku:coordinates = "lon_21_ku lat_21_ku";

```

tot_gain_ch1_85_ku(time_85_ku)

```

int tot_gain_ch1_85_ku(time_85_ku) ;
tot_gain_ch1_85_ku:_FillValue = -2147483648 ;
tot_gain_ch1_85_ku:units = "dB" ;
tot_gain_ch1_85_ku:long_name = "total fixed gain on channel 1" ;
tot_gain_ch1_85_ku:add_offset = 0. ;
tot_gain_ch1_85_ku:scale_factor = 0.01 ;
tot_gain_ch1_85_ku:comment = "Total Fixed Gain On Channel 1 - total fixed
                                instrument gain to be applied on channel 1,
                                this is the gain applied by the RF unit - FBR
                                SAR." ;
tot_gain_ch1_85_ku:coordinates = "lon_85_ku lat_85_ku";

```

tot_gain_ch2_20_ku(time_20_ku)

```

int tot_gain_ch2_20_ku(time_20_ku) ;
tot_gain_ch2_20_ku:_FillValue = -2147483648 ;
tot_gain_ch2_20_ku:units = "dB" ;
tot_gain_ch2_20_ku:long_name = "total fixed gain on channel 2" ;
tot_gain_ch2_20_ku:add_offset = 0. ;
tot_gain_ch2_20_ku:scale_factor = 0.01 ;
tot_gain_ch2_20_ku:comment = "Total Fixed Gain On Channel 2 - total fixed
                                instrument gain applied on channel 2, this is

```

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the gain applied by the RF unit. Applied in
L1B." ;

`tot_gain_ch2_20_ku:coordinates = "lon_20_ku lat_20_ku";`

tot_gain_ch2_21_ku(time_21_ku)

```
int tot_gain_ch2_21_ku(time_21_ku) ;
tot_gain_ch2_21_ku:_FillValue = -2147483648 ;
tot_gain_ch2_21_ku:units = "dB" ;
tot_gain_ch2_21_ku:long_name = "total fixed gain on channel 2" ;
tot_gain_ch2_21_ku:add_offset = 0. ;
tot_gain_ch2_21_ku:scale_factor = 0.01 ;
tot_gain_ch2_21_ku:comment = "Total Fixed Gain On Channel 2 - total fixed
                              instrument gain to be applied on channel 2,
                              this is the gain applied by the RF unit - FBR
                              SARIn." ;
tot_gain_ch2_21_ku:coordinates = "lon_21_ku lat_21_ku";
```

tot_gain_ch2_85_ku(time_85_ku)

```
int tot_gain_ch2_85_ku(time_85_ku) ;
tot_gain_ch2_85_ku:_FillValue = -2147483648 ;
tot_gain_ch2_85_ku:units = "dB" ;
tot_gain_ch2_85_ku:long_name = "total fixed gain on channel 2" ;
tot_gain_ch2_85_ku:add_offset = 0. ;
tot_gain_ch2_85_ku:scale_factor = 0.01 ;
tot_gain_ch2_85_ku:comment = "Total Fixed Gain On Channel 2 - total fixed
                              instrument gain to be applied on channel 2,
                              this is the gain applied by the RF unit - FBR
                              SAR." ;
tot_gain_ch2_85_ku:coordinates = "lon_85_ku lat_85_ku";
```

transmit_pwr_20_ku(time_20_ku)

```
int transmit_pwr_20_ku(time_20_ku) ;
transmit_pwr_20_ku:_FillValue = -2147483648 ;
transmit_pwr_20_ku:units = "Watt" ;
```

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```

transmit_pwr_20_ku:long_name = "transmitted power" ;
transmit_pwr_20_ku:add_offset = 0. ;
transmit_pwr_20_ku:scale_factor = 1.e-06 ;
transmit_pwr_20_ku:comment = "The altimeter transmit power." ;
transmit_pwr_20_ku:coordinates = "lon_20_ku lat_20_ku";

```

transmit_pwr_21_ku(time_21_ku)

```

int  transmit_pwr_21_ku(time_21_ku) ;
transmit_pwr_21_ku:_FillValue = -2147483648 ;
transmit_pwr_21_ku:units = "Watt" ;
transmit_pwr_21_ku:long_name = "transmitted power" ;
transmit_pwr_21_ku:add_offset = 0. ;
transmit_pwr_21_ku:scale_factor = 1.e-06 ;
transmit_pwr_21_ku:comment = "The altimeter transmit power - FBR SARIn."
transmit_pwr_21_ku:coordinates = "lon_21_ku lat_21_ku";

```

transmit_pwr_85_ku(time_85_ku)

```

int  transmit_pwr_85_ku(time_85_ku) ;
transmit_pwr_85_ku:_FillValue = -2147483648 ;
transmit_pwr_85_ku:units = "Watt" ;
transmit_pwr_85_ku:long_name = "transmitted power" ;
transmit_pwr_85_ku:add_offset = 0. ;
transmit_pwr_85_ku:scale_factor = 1.e-06 ;
transmit_pwr_85_ku:comment = "The altimeter transmit power - FBR SAR.";
transmit_pwr_85_ku:coordinates = "lon_85_ku lat_85_ku";

```

uso_cor_20_ku(time_20_ku)

```

int  uso_cor_20_ku(time_20_ku) ;
uso_cor_20_ku:_FillValue = 2147483647 ;
uso_cor_20_ku:add_offset = 0. ;

uso_cor_20_ku:comment = "USO correction defined as the additive correction to
window delay referred to L1B 20Hz average waveform. This correction has been applied.
This correction accounts for the difference between the nominal frequency provided

```

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in the IPFDB and the modelled frequency deviation provided by the DORIS USO drift file." ;

```

uso_cor_20_ku:coordinates = "lon_20_ku lat_20_ku";
uso_cor_20_ku:long_name = "uso correction applied to window delay (2-way)" ;
uso_cor_20_ku:scale_factor = 1.e-12 ;
uso_cor_20_ku:units = "seconds" ;

```

uso_cor_avg_01_ku(time_avg_01_ku)

```

int uso_cor_avg_01_ku(time_avg_01_ku) ;
uso_cor_avg_01_ku:_FillValue = 2147483647 ;
uso_cor_avg_01_ku:add_offset = 0. ;
uso_cor_avg_01_ku:comment = "USO correction defined as the additive
                             correction to window delay referred to L1B 1Hz
                             average power waveform. This correction has
                             been applied. This correction accounts for the
                             difference between the nominal frequency
                             provided in the IPFDB and the modelled
                             frequency deviation provided by the DORIS USO
                             drift file." ;

uso_cor_avg_01_ku:coordinates = "lon_avg_01_ku lat_avg_01_ku";
uso_cor_avg_01_ku:long_name = "uso correction applied to window delay (2-
                             way)" ;
uso_cor_avg_01_ku:scale_factor = 1.e-12 ;
uso_cor_avg_01_ku:units = "seconds" ;

```

uso_cor_21_ku(time_21_ku)

```

int uso_cor_21_ku(time_21_ku) ;
uso_cor_21_ku:_FillValue = 2147483647 ;
uso_cor_21_ku:long_name = "uso correction (2-way)" ;
uso_cor_21_ku:add_offset = 0. ;
uso_cor_21_ku:scale_factor = 1.e-12 ;
uso_cor_21_ku:comment = "USO correction factor defined as the ratio
                         between the nominal and the modelled value.
                         This correction accounts for the difference
                         between the nominal frequency provided in the
                         IPFDB and the modelled frequency deviation

```

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provided by the DORIS USO drift file.
Correction to be applied by the user - FBR
SARIn." ;

```
uso_cor_20_ku:units = "seconds" ;
uso_cor_21_ku:coordinates = "lon_21_ku lat_21_ku";
```

uso_cor_85_ku(time_85_ku)

```
int uso_cor_85_ku(time_85_ku) ;
uso_cor_85_ku:_FillValue = 2147483647 ;
uso_cor_85_ku:long_name = "uso correction (2-way)" ;
uso_cor_85_ku:add_offset = 0. ;
uso_cor_85_ku:scale_factor = 1.e-12 ;
uso_cor_85_ku:comment = "USO correction factor defined as the ratio
                        between the nominal and the modelled value.
                        This correction accounts for the difference
                        between the nominal frequency provided in the
                        IPFDB and the modelled frequency deviation
                        provided by the DORIS USO drift file.
                        Correction to be applied by the user - FBR SAR."
                        ;uso_cor_85_ku:units = "seconds" ;
uso_cor_85_ku:coordinates = "lon_85_ku lat_85_ku";
```

window_del_20_ku(time_20_ku)

```
int64 window_del_20_ku(time_20_ku) ;
window_del_20_ku:_FillValue = -9223372036854775808L ;
window_del_20_ku:units = "seconds" ;
window_del_20_ku:long_name = "calibrated window delay (2-way)" ;
window_del_20_ku:add_offset = 0.0 ;
window_del_20_ku:scale_factor = 1.e-12 ;
window_del_20_ku:comment = "Calibrated 2-way window delay: distance from
                        CoM to middle range window (at sample ns/2 from 0). It includes
                        all the range corrections given in the variable
                        instr_cor_range_tx_rx for all the modes and in the variable
```

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instr_cor_range_rx for SARIn only. This is a 2-way time and 2-way corrections are applied." ;

window_del_20_ku:coordinates = "lon_20_ku lat_20_ku";

window_del_21_ku(time_21_ku)

```
int64 window_del_21_ku(time_21_ku) ;
window_del_21_ku:_FillValue = -9223372036854775808L ;
window_del_21_ku:units = "seconds" ;
window_del_21_ku:long_name = "window delay (2-way)" ;
window_del_21_ku:add_offset = 0.0 ;
window_del_21_ku:scale_factor = 1.e-12 ;
window_del_21_ku:comment = "2-way window: distance from CoM to middle
range window (at sample ns/2 from 0). It does not include range
corrections, which are given in the variable
instr_cor_range_tx_rx for channel 1 and in the variable
instr_cor_range_rx for channel 2 - FBR SARIn."
;window_del_21_ku:coordinates = "lon_21_ku lat_21_ku";
```

window_del_85_ku(time_85_ku)

```
int64 window_del_85_ku(time_85_ku) ;
window_del_85_ku:_FillValue = -9223372036854775808L ;
window_del_85_ku:units = "seconds" ;
window_del_85_ku:long_name = "window delay (2-way)" ;
window_del_85_ku:add_offset = 0.0 ;
window_del_85_ku:scale_factor = 1.e-12 ;
window_del_85_ku:comment = "2-way window delay: distance from CoM to
middle range window (at sample ns/2 from 0). It
does not include range corrections, which are
given in the variable instr_cor_range_tx_rx -
FBR SAR." ;
window_del_85_ku:coordinates = "lon_85_ku lat_85_ku";
```

		<i>Instrument Processing Facility L1b</i> <i>Cryosat Ice netCDF L1b PFS</i> Doc. No.: C2-RS-ACS-ESL-5364 Issue: 1.8 Date: 04/12/2018 Page: 138
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window_del_avg_01_ku(time_avg_01_ku)

```

int64 window_del_avg_01_ku(time_avg_01_ku) ;
    window_del_avg_01_ku:_FillValue = -9223372036854775808L ;
    window_del_avg_01_ku:units = "seconds" ;
    window_del_avg_01_ku:long_name = "calibrated window delay (2-way)" ;
    window_del_avg_01_ku:add_offset = 0.d ;
    window_del_avg_01_ku:scale_factor = 1.e-12d ;
    string window_del_avg_01_ku:comment = "Calibrated 2-way window delay:
                                         distance from CoM to middle range window (at
                                         sample ns/2 from 0). It includes all range
                                         corrections given in the variable
                                         instr_cor_range_tx_rx for all the modes and in
                                         the variable instr_cor_range_rx for SARIn only.
                                         This is a 2-way time and 2-way corrections are
                                         applied." ;
    window_del_avg_01_ku:coordinates = "lon_avg_01_ku lat_avg_01_ku";

```

6.2 FLAG MEANING TABLES

6.2.1 flag_cor_err_01 flag meaning:

ID	Flag Name	Definition	Setting
1.	model_dry_error	Dry Tropospheric Correction Error	0 = OK, 1 = error
2.	model_wet_error	Wet Tropospheric Correction Error	0 = OK, 1 = error
3.	inv_bar_error	Inverse Barometric Correction Error	0 = OK, 1 = error
4.	hf_fluctuations_error	Dynamic Atmospheric Correction Error	0 = OK, 1 = error
5.	iono_gim_error	GIM Ionospheric Correction Error	0 = OK, 1 = error
6.	iono_model_error	Model Ionospheric Correction Error	0 = OK, 1 = error
7.	ocean_tide_error	Ocean Equilibrium Tide Error	0 = OK, 1 = error
8.	ocean_tide_equil_error	Ocean Long Period Tide Error	0 = OK, 1 = error
9.	load_tide_error	Ocean Loading Tide Error	0 = OK, 1 = error
10.	solid_earth_error	Solid Earth Tide Error	0 = OK, 1 = error
11.	pole_tide_error	Geocentric Polar Tide Error	0 = OK, 1 = error
12.	surface_type_error	Surface type flag Error	0 = OK, 1 = error

6.2.2 flag_cor_status_01 flag meaning:

ID	Flag Name	Definition	Setting
1.	model_dry_called	Dry Tropospheric Correction Called	0 = no, 1 = yes
2.	model_wet_called	Wet Tropospheric Correction Called	0 = no, 1 = yes
3.	inv_bar_called	Inverse Barometric Correction Called	0 = no, 1 = yes
4.	hf_fluctuations_called	Dynamic Atmospheric Correction Called	0 = no, 1 = yes
5.	iono_gim_called	GIM Ionospheric Correction Called	0 = no, 1 = yes
6.	iono_model_called	Model Ionospheric Correction Called	0 = no, 1 = yes
7.	ocean_tide_called	Ocean Equilibrium Tide Called	0 = no, 1 = yes

8.	ocean_tide_equil_called	Ocean Long Period Tide Called	0 = no, 1 = yes
9.	load_tide_called	Ocean Loading Tide Called	0 = no, 1 = yes
10.	solid_earth_called	Solid Earth Tide Called	0 = no, 1 = yes
11.	pole_tide_called	Geocentric Polar Tide Called	0 = no, 1 = yes
12.	surface_type_called	Surface type flag Called	0 = no, 1 = yes

6.2.3 flag_echo_20_ku flag meaning:

ID	Flag name	Definition	Setting
1	approx_beam_steering	Approximate beam steering	0 = no, 1 = approximate steering used
2	exact_beam_steering	Exact beam steering	0 = no, 1 = exact steering used
3	doppler_weighting_computed	Doppler weighting computed	0 = not computed, 1 = computed
4	doppler_weighting_applied	Doppler weighting applied before stack	0 = not applied, 1 = applied
5	multi_look_incomplete	Multi look incomplete	0 = no (i.e. complete), 1 = incomplete
6	beam_angle_steering_error	Beam angle steering error	0 = OK, 1 = error
7	anti_aliased_power_echoes	Anti aliased power echoes	0 = no, 1 = anti aliased
8	auto_beam_steering	Auto beam steering	0 = no, 1 = auto beam steering used. Beam steering method is chosen based on the on-board tracker height variation.

6.2.4 flag_echo_avg_01_ku flag meaning:

ID	Flag Name	Definition	Setting
1.	1_hz_echo_error_not_computed	1 Hz Echo Error	0 = 1Hz Echo Computed 1 = 1Hz Echo Not Computed
2.	mispointing_bad_angles	Mispointing error	1=bad angles 0=no error

6.2.5 flag_instr_conf_rx_flags_20_ku flag meaning:

ID	Flag Name	Definition	Setting
1.	siral_redundant	SIRAL_Identifier	0 = Nominal 1 = Redundant
2.	external_cal	External Calibration	0 = no 1 = External Calibration
3.	open_loop	Loop Status	0 = closed loop 1 = open loop
4.	loss_of_echo	Loss of Echo (from Cycle Report)	0 = OK 1 = Loss of Echo
5.	real_time_error	Real Time Error (from Cycle Report)	0 = OK 1 = Real Time Computation Error
6.	echo_saturation	Echo Saturation Error (from Cycle Report)	0 = OK 1 = Echo Saturation Error
7.	rx_band_attenuated	Rx Band Attenuation	0 = not applied 1 = applied
8.	cycle_report_error	Cycle Report General Error	0 = Cycle Report is 0 1 = Cycle Report is not 0

6.2.6 L1B flag_mcd_20_ku flag meaning:

ID	Flag Name	Definition	Setting
1.	block_degraded	Block Degraded	0 = OK 1 = Degraded

ID	Flag Name	Definition	Setting
			(set if the block should not be processed – indicated by bold typeface)
2.	blank_block	Blank Block	0 = OK 1 = Blank Block inserted for record padding
3.	datation_degraded	Datation Degraded	0 = OK 1 = Datation is bad or not set
4.	orbit_prop_error	Orbit Propagation Error	0 = OK 1 = Error (returned by CFI or independent check)
5.	orbit_file_change	Orbit File Change	0 = OK 1 = Orbit file has changed wrt previous record
6.	orbit_gap	Orbit Discontinuity	0 = OK 1 = discontinuity (e.g. gap)
7.	echo_saturated	Echo Saturation (from Cycle Report)	0 = OK 1 = Saturated
8.	other_echo_error	Other Echo Error	0 = OK 1 = Echo Error (bit fields Tracking Echo Error or Echo Rx1 Error or Echo Rx2 Error set to 1)
9.	sarin_rx1_error	Rx 1 Channel Error for SARIN	0 = OK 1 = degraded or missing
10.	sarin_rx2_error	Rx 2 Channel error for SARIN	0 = OK 1 = degraded or missing
11.	window_delay_error	Window Delay Inconsistency	0 = OK (value is in range) 1 = value out of range or computation error
12.	agc_error	AGC Inconsistency	0 = OK (value is in range) 1 = value out of range or computation error
13.	cal1_missing	CAL1 Correction Missing	0 = correction applied 1 = correction not applied
14.	cal1_default	CAL1 Correction from IPF DB	0 = correction from CAL1 product used 1 = correction from IPF DB used
15.	doris_uso_missing	DORIS USO Correction	0 = USO Correction Factor is available 1 = USO Correction Factor is not available
16.	ccal1_default	complex CAL1 Correction from IPF DB	0 = correction from Complex CAL1 Product used 1 = correction from IPF DB used

ID	Flag Name	Definition	Setting
17.	trk_echo_error	TRK Echo Error	0 = OK 1 = empty (or null) tracking echo
18.	echo_rx1_error	Echo Rx 1 Error	0 = OK 1 = empty (or null) raw echo
19.	echo_rx2_error	Echo Rx2 Error	0 = OK 1 = empty (or null) raw echo
20.	npm_error	NPM Inconsistency	0 = OK 1 = value out of range or computation error
21.	cal1_pwr_corr_type	CAL 1 Correction Type	0 = Peak Power used for CAL 1 correction 1 = Integrated Power used for CAL1 correction
23.	phase_pert_cor_missing	Phase Perturbation Correction application	0 = applied 1 = not applied
24.	cal2_missing	CAL2 Correction Missing	0 = correction applied 1 = correction not applied
25.	cal2_default	CAL2 Correction from IPF DB	0 = correction from CAL2 product used 1 = correction from IPF DB used
26.	power_scale_error	Power Scaling Error (for LRM/FDM only)	0 = OK (echo has been power scaled) 1 = Error in scaling (L1B waveform is null) Used only for LRM L1B and FDM L1B
27.	attitude_cor_missing	Attitude Correction Missing	0 = OK, Correction Applied 1 = Not Corrected
28.	phase_pert_cor_default	Phase Perturbation Correction mode	0 = computed by CCAL1 1 = default from IPF DB used (applicable only to SARin data)

6.2.7 FBR flag_mcd_xx_ku flag meaning:

ID	Flag Name	Definition	Setting
1.	block_degraded	Block Degraded	0 = OK 1 = Degraded (set if the block should not be processed – indicated by bold typeface)
2.	blank_block	Blank Block	0 = OK

ID	Flag Name	Definition	Setting
			1 = Blank Block inserted for record padding
3.	datation_degraded	Datation Degraded	0 = OK 1 = Datation is bad or not set
4.	orbit_prop_error	Orbit Propagation Error	0 = OK 1 = Error (returned by CFI or independent check)
5.	orbit_file_change	Orbit File Change	0 = OK 1 = Orbit file has changed wrt previous record
6.	orbit_gap	Orbit Discontinuity	0 = OK 1 = discontinuity (e.g. gap)
7.	echo_saturated	Echo Saturation (from Cycle Report)	0 = OK 1 = Saturated
8.	other_echo_error	Other Echo Error	0 = OK 1 = Echo Error (bit fields Tracking Echo Error or Echo Rx1 Error or Echo Rx2 Error set to 1)
9.	sarin_rx1_error	Rx 1 Channel Error for SARIN	0 = OK 1 = degraded or missing
10.	sarin_rx2_error	Rx 2 Channel error for SARIN	0 = OK 1 = degraded or missing
11.	window_delay_error	Window Delay Inconsistency	0 = OK (value is in range) 1 = value out of range or computation error
12.	agc_error	AGC Inconsistency	0 = OK (value is in range) 1 = value out of range or computation error
13.	cal1_missing	CAL1 Correction Missing	0 = correction applied 1 = correction not applied
14.	cal1_default	CAL1 Correction from IPF DB	0 = correction from CAL1 Product used 1 = correction from IPF DB used
15.	doris_uso_missing	DORIS USO Correction	0 = USO Correction Factor is available 1 = USO Correction Factor is not available
16.	ccal1_default	Complex CAL1 Correction from IPF DB	0 = correction from Complex CAL1 Product used 1 = correction from IPF DB used
17.	trk_echo_error	TRK Echo Error	0 = OK 1 = empty (or null) tracking echo
18.	echo_rx1_error	Echo Rx 1 Error	0 = OK 1 = empty (or null) raw echo

ID	Flag Name	Definition	Setting
19.	echo_rx2_error	Echo Rx2 Error	0 = OK 1 = empty (or null) raw echo
20.	npm_error	NPM Inconsistency	0 = OK 1 = value out of range or computation error
22.	attitude_cor_missing	Attitude Correction Missing	0 = OK, attitude correction applied 1 = missing, correction not applied.
23.	cal1_pwr_corr_type	CAL 1 Correction Type	0 = Peak Power used for CAL 1 correction 1= Integrated Power used for CAL1 correction

6.3 GLOBAL ATTRIBUTES

The global attributes contain general information about the product and are listed in this section.

Each attribute is described here for the sake of clarity and to provide traceability back to the corresponding EE Header field where the attribute comes from.

In reality the attributes are not grouped but simply listed inside the CONFORM product.

Product Identification Information		
Attribute Name	Description	Values
product_name	Product File Name	any string
processing_stage	Processing stage code identifier.	RPRO = Reprocessing OFFL = Routine Operation NRT_ = Near Real Time TEST = Test LTA_ = Long Term Archive
reference_document	Reference DFCB Document describing the product	any string
doi	Digital Object Identifier	any string
acquisition_station	Acquisition Station	any string
mission	Mission Name	Cryosat

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Product Identification Information		
Attribute Name	Description	Values
processing_centre	Processing Facility	PDS

Data Processing Information	
Attribute Name	Description
creation_time	Processing Time (Product Generation Time)
sensing_start	Sensing start time
sensing_stop	Sensing stop time
software_version	Processor Name and software version number

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Orbit Information	
Attribute Name	Description
phase	Phase Code (set to X if not used)
cycle_number	Cycle Number (set to +000 if not used)
rel_orbit_number	Relative Orbit Number at sensing start time (set to +00000 if not used)
abs_orbit_number	Absolute Orbit Number at sensing start time (set to +00000 if not used)
state_vector_time	UTC state vector time
delta_ut1	Universal Time Correction: DUT1 = UT1 – UTC
x_position	X position in Earth Fixed Reference If not used set to +0000000.000
y_position	Y position in Earth Fixed Reference If not used set to +0000000.000
z_position	Z position in Earth Fixed Reference If not used set to +0000000.000
x_velocity	X velocity in Earth Fixed Reference If not used set to +0000.000000
y_velocity	Y velocity in Earth Fixed Reference If not used set to +0000.000000
z_velocity	Z velocity in Earth Fixed Reference If not used set to +0000.000000
vector_source	Source of Orbit State Vector Record: fos predicted doris_navigator doris_precise fos_restituted doris_preliminary

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Leap Second Information	
Attribute Name	Description
leap_utc	UTC Time of the occurrence of the leap second. If a leap second occurred in the product window the field is set by a devoted function in the CFI EXPLORER_ORBIT library (see [EXPL_ORB-SUM] for details), otherwise it is not set. It corresponds to the time after the Leap Second occurrence (i.e. midnight of the day after the leap second)
leap_sign	If a leap second occurred in the product window the field is set to the expected value by a devoted function in the CFI EXPLORER_ORBIT library (see [EXPL_ORB-SUM] for details), otherwise it is not set
leap_err	This field is always not set considering that CRYOSAT products have true UTC times

Product Confidence Data Information	
Attribute Name	Description
product_err	Product Error Flag: 1 errors have been reported in the Product 0 no errors

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Product Time Information	
Attribute Name	Description
first_record_time	TAI of the first record in the Main MDS of this product
last_record_time	TAI of the last record in the Main MDS of this product

Product Orbit Information	
Attribute Name	Description
abs_orbit_start	Absolute Orbit Number at sensing start time.
rel_time_asc_node_start	Relative time since crossing ascending node time relative to start time of data sensing.
abs_orbit_stop	Absolute Orbit Number at sensing stop time.
rel_time_asc_node_stop	Relative time since crossing ascending node time relative to stop time of data sensing.
equator_cross_time	Time of equator crossing at the ascending node relative to the sensing start time.
equator_cross_long	Longitude of equator crossing at the ascending node relative to the sensing start time (positive East, 0 = Greenwich) referred to WGS84.
ascending_flag	Orbit Orientation at the sensing start time: A=Ascending D=Descending

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Product Location Information	
Attribute Name	Description
first_record_lat	WGS84 latitude of the first record in the Main MDS (positive north)
first_record_lon	WGS84 longitude of the first record in the Main MDS (positive East, 0 = Greenwich)
last_record_lat	WGS84 latitude of the last record in the Main MDS (positive north)
last_record_lon	WGS84 longitude of the last record in the Main MDS (positive East, 0 = Greenwich)

SIRAL Level 0 Quality information	
Attribute Name	Description
l0_proc_flag	Processing errors significance flag : 1 errors (percentage of errors greater than threshold) 0 no errors
l0_processing_quality	Percentage of quality checks successfully passed during ISP processing : max allowed +10000
l0_proc_thresh	Minimum acceptable percentage of quality threshold that must be passed during ISP processing: max allowed +10000
l0_gaps_flag	Flag to indicate gaps in input data: 1 gaps 0 no gaps
l0_gaps_num	Number of gaps detected during ISP processing

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SIRAL Instrument Configuration	
Attribute Name	Description
instr_id	Instrument_Identifier : A = SIRAL Nominal B = SIRAL Redundant
sir_op_mode	SIRAL Operative Mode: LRM SAR SARIN
sir_configuration	SIRAL Rx Configuration : RX_1 RX_2 BOTH UNKNOWN

Level 1 Surface Statistics	
Attribute Name	Description
open_ocean_percent	Percentage of output L1B records detected on open ocean or semi-enclosed seas
close_sea_percent	Percentage of output L1B records detected on close seas or lakes
continent_ice_percent	Percentage of output L1B records detected on continental ice
land_percent	Percentage of output L1B records detected on land

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SIRAL Level 1 Processing information	
Attribute Name	Description
l1b_prod_status	Complete/Incomplete Product Completion Flag (0 or 1). 1 if the product has a duration shorter than the input Level 0
l1b_proc_flag	Processing errors significance flag 1 errors (percentage of errors greater than threshold) 0 no errors
l1b_processing_quality	Percentage of quality checks successfully passed during Level 1B processing (max allowed +10000)
l1b_proc_thresh	Minimum acceptable percentage of quality threshold that must be passed during Level 1B processing (max allowed +10000)

Reference DSD	
Attribute Name	Description
xref_cal1	L1B CAL1 file
xref_cal1_sarin	L1B Complex CAL1 SARIn file
xref_cal2	L1B CAL2 file
xref_constants	Geophysical Constants File
xref_dip_map	Bent Modified Dip Map File used for Bent Model Ionospheric Correction
xref_earth_tide	Earth Tide File (Cartwright & Edden 1973)
xref_gim	Global Ionospheric Map generated by using either analysis or forecast data
xref_iono_cor	Ionospheric Coefficients file used for Bent Model Ionospheric Correction
xref_mean_pressure	Mean Pressure File for Meteo Correction generated by using either analysis or forecast data
xref_meteo	Meteo Grid Definition File
xref_mog2d	2D Gravity Wave model for Dynamic Atmospheric Correction (DAC) generated by using either analysis or forecast data
xref_ocean_tide	Ocean Tide File

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Reference DSD	
Attribute Name	Description
xref_orbit	Orbit File
xref_orbit_scenario	Orbit Scenario File
xref_pconf	Processor Configuration Parameters File
xref_pole_location	Pole Tide File
xref_s1_tide_amplitude	S1 tide grid of monthly mean of global amplitude
xref_s1_tide_phase	S1 tide grid of monthly mean of global phase
xref_s1s2_pressure_00h	Climatology Pressure Grids for each month at 00 h.
xref_s1s2_pressure_06h	Climatology Pressure Grids for each month at 06 h.
xref_s1s2_pressure_12h	Climatology Pressure Grids for each month at 12 h.
xref_s1s2_pressure_18h	Climatology Pressure Grids for each month at 18 h.
xref_s2_tide_amplitude	S2 tide grid of monthly mean of global amplitude
xref_s2_tide_phase	S2 tide grid of monthly mean of global phase
xref_sai	Solar Activity Index File used for Bent Model Ionospheric Correction
xref_siral_characterisation	SIRAL IPFDB File
xref_siral_l0	SIRAL L0 File
xref_star_tracker_attref	Star Tracker Level 1B File
xref_surf_pressure	Surface Pressure File for Meteo Correction generated by using either analysis or forecast data
xref_surf_type	Surface Type Map File
xref_tidal_load	Tidal Loading File
xref_u_wind	U Wind component File for Meteo Correction generated by using either analysis or forecast data
xref_uso	DORIS USO File
xref_v_wind	V Wind component File for Meteo Correction generated by using either analysis or forecast data
xref_wet_trop	Wet Troposphere File for Meteo Correction generated by using either analysis or forecast data

6.4 TABLE OF REFERENCE DSD VS L1B/FBR PROCESSORS

			Processors		
			LRM	SAR	SIN
Reference DSD HDR	Reference Attribute Netcdf	File Type			
PROC_CONFIG_PARAMS_FILE	xref_pconf	PCONF_IPF1	M	M	M
CALIBRATION_TYPE_1_FILE	xref_cal1	SIR1LRC11B	M		
		SIR2LRC11B			
		SIR1SAC11B		M	
		SIR2SAC11B			
		SIR_SIC11B			M
SIR_COMPLEX_CAL1_SARIN	xref_cal1_sarin	SIR_SICC1B			M
CALIBRATION_TYPE_2_FILE	xref_cal2	SIR1SAC21B	M	M	
		SIR2SAC21B			
		SIR1SIC21B			M
		SIR2SIC21B			
CONSTANTS_FILE	xref_constants	Geophysical Constants	M	M	M
MODIFIED_DIP_MAP_FILE	xref_dip_map	AUX_DIPMAP	M	M	M
EARTH_TIDE_FILE	xref_earth_tide	AUX_CARTWR	M	M	M
GPS_IONO_MAP	xref_gim	AUX_IONGIM	M	M	M
IONO_COEFFICIENTS_FILE	xref_iono_cor	AUX_MICOEF	M	M	M
MEAN_PRESSURE_FILE	xref_mean_pressure	AUX_SEAMPS	M	M	M
METEO_GRID_DEF_FILE	xref_meteo	AUX_ALTGRD	M	M	M
AUX_MOG2D	xref_mog2d	AUX_MOG_2D	M	M	M
OCEAN_TIDE_FILE	xref_ocean_tide	AUX_OCTIDE	M	M	M
ORBIT_FILE	xref_orbit	MPL_ORBPRES	M	M	M
		AUX_ORBDOR			

			Processors		
			LRM	SAR	SIN
		AUX_ORBDOP			
SCENARIO_FILE	xref_orbit_scenario	MPL_ORBREF	M	M	M
POLE_TIDE_FILE	xref_pole_location	AUX_POLLOC	M	M	M
S1_TIDE_AMPLITUDE_MAP	xref_s1_tide_amplitude	AUX_S1AMPL	M	M	M
S1_TIDE_PHASE_MAP	xref_s1_tide_phase	AUX_S1PHAS	M	M	M
S1S2_PRESSURE_00H_MAP	xref_s1s2_pressure_00h	AUX_PRSS00	M	M	M
S1S2_PRESSURE_06H_MAP	xref_s1s2_pressure_06h	AUX_PRSS06	M	M	M
S1S2_PRESSURE_12H_MAP	xref_s1s2_pressure_12h	AUX_PRSS12	M	M	M
S1S2_PRESSURE_18H_MAP	xref_s1s2_pressure_18h	AUX_PRSS18	M	M	M
S2_TIDE_AMPLITUDE_MAP	xref_s2_tide_amplitude	AUX_S1AMPL	M	M	M
S2_TIDE_PHASE_MAP	xref_s2_tide_phase	AUX_S2PHAS	M	M	M
SAI_FILE	xref_sai	AUX_SUNACT	M	M	M
IPF_RA_DATABASE_FILE	xref_siral_characterisation	AUX_IPFDBA AUX_IPFDBB	M	M	M
SIRAL_LEVEL_0_FILE	xref_siral_l0	SIR1SIN_0_ SIR2SIN_0_ SIR1TKSIO_ SIR2TKSIO_			M
		SIR1LRM_0_ SIR2LRM_0_	M		
		SIR1SAR_0_ SIR2SAR_0_		M	
STAR_TRACKER_ATTREF_FILE	xref_star_tracker_attref	STR_ATTREF	M	M	M

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			Processors		
			LRM	SAR	SIN
SURFACE_PRESSURE_FILE	xref_surf_pressure	AUX_SURFPS	M	M	M
SURFACE_TYPE_FILE	xref_surf_type	AUX_LS_MAP	M	M	M
TIDAL_LOADING_FILE	xref_tidal_load	AUX_TDLOAD	M	M	M
U_WIND_FILE	xref_u_wind	AUX_U_WIND	M	M	M
DORIS_USO_DRIFT_FILE	xref_uso	AUX_DORUSO	M	M	M
V_WIND_FILE	xref_v_wind	AUX_V_WIND	M	M	M
WET_TROPOSPHERE_FILE	xref_wet_trop	AUX_WETTRP	M	M	M

7 CRYOSAT LEVEL-1B CONFORM PRODUCTS

The following table provides the Product Identification for each CONFORM product generated by the IPF1.

CONFORM Products	
Product Identification	Description
SIR1SAR_FR	Level 1 FBR SAR Mode (Rx1 Channel)
SIR2SAR_FR	Level 1 FBR SAR Mode (Rx2 Channel)
SIR_SIN_FR	Level 1 FBR SARIn Mode
SIR_LRM_1B	Level 1 Product Low Rate Mode
SIR_SAR_1B	Level 1 SAR Mode
SIR_SIN_1B	Level 1 SARIn Mode

Table 3-1: Level 1B CONFORM products list

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7.1 CONFORM PRODUCT FILE NAMES

The file name of each Level-1B product abides to the following conventions (the variable parts are in italics):

MM_CCCC_TTTTTTTTTT_yyyymmddThhmmss_YYYYMMDDTHHMMSS_bvvv.nc

where

MM is the mission identifier **CS** for CryoSat

CCCC is the file class (i.e.: OFFL for routine operation, NRT_ for Near Real Time, RPRO for Reprocessing, TEST for Testing or Tlxx for stand alone IPF1 testing associated to Test Data Sets tagged as Tlxx, LTA_ for products generated in the Long Term Archive).

TTTTTTTTTT is the file type and corresponds to the Product ID of the Table 3-1.

yyymmddThhmmss is the validity start time and correspond to the time of the first valid record stored in the Interim FBR.

YYYYMMDDTHHMMSS is the validity stop time and correspond to time of the last valid record stored in the Interim FBR.

b is the baseline identifier as read-in from the PCONF.

vvv is the product version number.

For example in the case of an operational Level-1B product of the SIRAL instrument in Low Rate Mode (LRM) in baseline A and product version 1 the name would be:

CS_OFFL_SIR_LRM1B_20030624T075728_20030624T080231_C001.nc

Appendix A: Variables to Products

	FBR		L1B		
	SAR	SARIn	LRM	SAR	SARIn
agc_ch1_20_ku(time_20_ku)			x	x	x
agc_1_21_ku(time_21_ku)		x			
agc_1_85_ku(time_85_ku)	x				
agc_ch2_20_ku(time_20_ku)			x	x	x
agc_2_21_ku(time_21_ku)		x			
agc_2_85_ku(time_85_ku)	x				
alt_avg_01_ku(time_avg_01_ku)			x	x	x
alt_20_ku(time_20_ku)			x	x	x
alt_21_ku(time_21_ku)		x			
alt_85_ku(time_x85ku)	x				
off_nadir_pitch_angle_str_20_ku(time_20_ku)			x	x	x
off_nadir_roll_angle_str_20_ku(time_20_ku)			x	x	x
off_nadir_yaw_angle_str_20_ku(time_20_ku)			x	x	x
beam_dir_vec_20_ku(time_20_ku,space_3d)			x	x	x
beam_dir_vec_21_ku(time_21_ku,space_3d)		x			
beam_dir_vec_85_ku(time_95_ku,space_3d)	x				
coherence_waveform_20_ku(time_20_ku, ns_20_ku)					x
cor2_applied_20_ku(time_20_ku)			x	x	x
cor2_applied_21_ku(time_21_ku)		x			
cor2_applied_85_ku(time_85_ku)	x				
cplx_waveform_ch1_i_21_ku(time_21_ku,np_ku)		x			
cplx_waveform_ch1_i_85_ku(time_85_ku,np_ku)	x				
cplx_waveform_ch1_q_21_ku(time_21_ku,np_ku)		x			
cplx_waveform_ch1_q_85_ku(time_85_ku,np_ku)	x				
cplx_waveform_ch2_i_21_ku(time_21_ku,np_ku)		x			
cplx_waveform_ch2_q_21_ku(time_21_ku,np_ku)		x			
dop_angle_start_20_ku(time_20_ku)				x	x
dop_angle_stop_20_ku(time_20_ku)				x	x
dop_cor_20_ku(time_20_ku)			x	x	x
dop_cor_21_ku(time_21_ku)		x			
dop_cor_85_ku(time_85_ku)	x				
echo_numval_avg_01_ku(time_avg_01_ku)			x	x	x
echo_numval_20_ku(time_20_ku)			x	x	x
echo_numval_21_ku(time_21_ku)		x			
echo_numval_85_ku(time_85_ku)	x				
echo_scale_factor_avg_01_ku(time_avg_01_ku)			x	x	x

	FBR		L1B		
	SAR	SARIn	LRM	SAR	SARIn
echo_scale_factor_20_ku(time_20_ku)			x	x	x
echo_scale_pwr_20_ku(time_20_ku)			x	x	x
echo_scale_pwr_avg_01_ku(time_avg_01_ku)			x	x	x
flag_cor_err_01(time_01_ku)		x	x	x	x
flag_cor_status_01(time_01_ku)		x	x	x	x
flag_echo_20_ku(time_20_ku)			x	x	x
flag_echo_21_ku(time_21_ku)		x			
flag_echo_85_ku(time_85_ku)	x				
flag_echo_avg_01_ku(time_avg_01_ku)			x	x	x
flag_instr_conf_rx_bwdt_20_ku(time_20_ku)			x	x	x
flag_instr_conf_rx_bwdt_21_ku(time_21_ku)		x			
flag_instr_conf_rx_bwdt_85_ku(time_85_ku)	x				
flag_instr_conf_rx_flags_20_ku(time_20_ku)			x	x	x
flag_instr_conf_rx_flags_21_ku(time_21_ku)		x			
flag_instr_conf_rx_flags_85_ku(time_85_ku)	x				
flag_instr_conf_rx_in_use_20_ku(time_20_ku)			x	x	x
flag_instr_conf_rx_in_use_21_ku(time_21_ku)		x			
flag_instr_conf_rx_in_use_85_ku(time_85_ku)	x				
flag_instr_conf_rx_str_in_use_20_ku(time_20_ku)			x	x	x
flag_instr_conf_rx_str_in_use_21_ku(time_21_ku)		x			
flag_instr_conf_rx_str_in_use_85_ku(time_85_ku)	x				
flag_instr_conf_rx_trk_mode_20_ku(time_20_ku)			x	x	x
flag_instr_conf_rx_trk_mode_21_ku(time_21_ku)		x			
flag_instr_conf_rx_trk_mode_85_ku(time_85_ku)	x				
flag_instr_mode_att_ctrl_20_ku(time_20_ku)			x	x	x
flag_instr_mode_att_ctrl_21_ku(time_21_ku)		x			
flag_instr_mode_att_ctrl_85_ku(time_85_ku)	x				
flag_instr_mode_flags_20_ku(time_20_ku)			x	x	x
flag_instr_mode_flags_21_ku(time_21_ku)		x			
flag_instr_mode_flags_85_ku(time_85_ku)	x				
flag_instr_mode_op_20_ku(time_20_ku)			x	x	x
flag_instr_mode_op_21_ku(time_21_ku)		x			
flag_instr_mode_op_85_ku(time_85_ku)	x				
flag_mcd_20_ku(time_20_ku)			x	x	x
flag_mcd_21_ku(time_21_ku)		x			
flag_mcd_85_ku(time_85_ku)	x				
surf_type_01(time_cor_01)	x	x	x	x	x
flag_trk_cycle_20_ku(time_20_ku)			x		

	FBR		L1B		
	SAR	SARIn	LRM	SAR	SARIn
h0_applied_20_ku(time_20_ku)			x	x	x
h0_applied_21_ku(time_21_ku)		x			
h0_applied_85_ku(time_85_ku)	x				
h0_fai_word_20_ku(time_20_ku)			x	x	x
h0_fai_word_21_ku(time_21_ku)		x			
h0_fai_word_85_ku(time_85_ku)	x				
h0_lai_word_20_ku(time_20_ku)			x	x	x
h0_lai_word_21_ku(time_21_ku)		x			
h0_lai_word_85_ku(time_85_ku)	x				
hf_fluct_total_cor_01(time_cor_01)	x	x	x	x	x
ind_first_meas_20hz_01(time_cor_01)			x	x	x
ind_meas_1hz_20_ku(time_20_ku)			x	x	x
instr_cor_gain_rx_20_ku(time_20_ku)			x	x	x
instr_cor_gain_rx_21_ku(time_21_ku)		x			
instr_cor_gain_rx_85_ku(time_85_ku)	x				
instr_cor_gain_tx_rx_20_ku(time_20_ku)			x	x	x
instr_cor_gain_tx_rx_21_ku(time_21_ku)		x			
instr_cor_gain_tx_rx_85_ku(time_85_ku)	x				
instr_cor_range_rx_20_ku(time_20_ku)			x	x	x
instr_cor_range_rx_21_ku(time_21_ku)		x			
instr_cor_range_rx_85_ku(time_85_ku)	x				
instr_cor_range_tx_rx_20_ku(time_20_ku)			x	x	x
instr_cor_range_tx_rx_21_ku(time_21_ku)		x			
instr_cor_range_tx_rx_85_ku(time_85_ku)	x				
instr_ext_ph_cor_20_ku(time_20_ku)					x
instr_ext_ph_cor_21_ku(time_21_ku)		x			
instr_int_ph_cor_20_ku(time_20_ku)					x
instr_int_ph_cor_21_ku(time_21_ku)		x			
seq_count_20_ku(time_20_ku)	x	x	x	x	x
seq_count_21_ku(time_21_ku)		x			
seq_count_85_ku(time_85_ku)	x				
inter_base_vec_20_ku(time_20_ku,space_3d)			x	x	x
inter_base_vec_21_ku(time_21_ku,space_3d)		x			
inter_base_vec_85_ku(time_85_ku,space_3d)	x				
inv_bar_cor_01(time_cor_01)	x	x	x	x	x
iono_cor_01(time_cor_01)	x	x	x	x	x
iono_cor_gim_01(time_cor_01)	x	x	x	x	x
lat_20_ku(time_20_ku)			x	x	x

	FBR		L1B		
	SAR	SARIn	LRM	SAR	SARIn
lat_21_ku(time_21_ku)		x			
lat_85_ku(time_85_ku)	x				
lat_avg_01_ku(time_avg_01_ku)			x	x	x
load_tide_01(time_cor_01)	x	x	x	x	x
lon_20_ku(time_20_ku)			x	x	x
lon_21_ku(time_21_ku)		x			
lon_85_ku(time_85_ku)	x				
lon_avg_01_ku(time_avg_01_ku)			x	x	x
look_angle_start_20_ku(time_20_ku)				x	x
look_angle_stop_20_ku(time_20_ku)				x	x
noise_power_20_ku(time_20_ku)			x	x	x
noise_power_21_ku(time_21_ku)		x			
noise_power_85_ku(time_85_ku)	x				
mod_dry_tropo_cor_01(time_cor_01)	x	x	x	x	x
mod_wet_tropo_cor_01(time_cor_01)	x	x	x	x	x
ocean_tide_01(time_cor_01)	x	x	x	x	x
ocean_tide_eq_01(time_cor_01)	x	x	x	x	x
orb_alt_rate_20_ku(time_20_ku)			x	x	x
orb_alt_rate_21_ku(time_21_ku)		x			
orb_alt_rate_85_ku(time_85_ku)	x				
ph_slope_cor_20_ku(time_20_ku)					x
ph_slope_cor_21_ku(time_21_ku)		x			
ph_diff_waveform_20_ku(time_20_ku, ns_20_ku)					x
pole_tide_01(time_cor_01)	x	x	x	x	x
pwr_waveform_20_ku(time_20_ku, ns_20_ku)			x	x	x
pwr_waveform_avg_01_ku(time_avg_01_ku, ns_avg_01_ku)			x	x	x
rec_count_20_ku(time_20_ku)			x	x	x
rec_count_21_ku(time_21_ku)		x			
rec_count_85_ku(time_85_ku)	x				
sat_vel_vec_20_ku(time_20_ku, space_3d)			x	x	x
sat_vel_vec_21_ku(time_21_ku, space_3d)		x			
sat_vel_vec_85_ku(time_85_ku, space_3d)	x				
solid_earth_tide_01(time_cor_01)	x	x	x	x	x
stack_centre_20_ku(time_20_ku)				x	x
stack_centre_angle_20_ku(time_20_ku)				x	x
stack_centre_look_angle_20_ku(time_20_ku)				x	x
stack_gaussian_fitting_residuals_20_ku(time_20_ku)				x	x

	FBR		L1B		
	SAR	SARIn	LRM	SAR	SARIn
stack_kurtosis_20_ku(time_20_ku)				x	x
stack_number_after_weighting_20_ku(time_20_ku)				x	x
stack_number_before_weighting_20_ku(time_20_ku)				x	x
stack_peakiness_20_ku(time_20_ku)				x	x
stack_scaled_amplitude_20_ku(time_20_ku)				x	x
stack_skewness_20_ku(time_20_ku)				x	x
stack_std_20_ku(time_20_ku)				x	x
stack_std_angle_20_ku(time_20_ku)				x	x
time_20_ku(time_20_ku)			x	x	x
time_21_ku(time_21_ku)		x			
time_85_ku(time_85_ku)	x				
time_avg_01_ku(time_avg_01_ku)			x	x	x
time_cor_01(time_cor_01)	x	x	x	x	x
tot_gain_ch1_20_ku(time_20_ku)			x	x	x
tot_gain_ch1_21_ku(time_21_ku)		x			
tot_gain_ch1_85_ku(time_85_ku)	x				
tot_gain_ch2_20_ku(time_20_ku)			x	x	x
tot_gain_ch2_21_ku(time_21_ku)		x			
tot_gain_ch2_85_ku(time_85_ku)	x				
transmit_pwr_20_ku(time_20_ku)			x	x	x
transmit_pwr_21_ku(time_21_ku)		x			
transmit_pwr_85_ku(time_85_ku)	x				
uso_cor_20_ku(time_20_ku)			x	x	x
uso_cor_avg_01_ku(time_avg_01_ku)			x	x	x
uso_cor_21_ku(time_21_ku)		x			
uso_cor_85_ku(time_85_ku)	x				
window_del_20_ku(time_20_ku)			x	x	x
window_del_21_ku(time_21_ku)		x			
window_del_85_ku(time_85_ku)	x				
window_del_avg_01_ku(time_avg_01_ku)			x	x	x

Appendix B: Default Setting of the Attribute: _FillValue

By design, each variable of the CONFORM products has a _FillValue attribute, which contains the default value of that variable, i.e. the value the variable holds when its content hasn't been changed by the CryoSat processor.

The only exceptions to this rule are the variables that use the whole validity range of their types and these are:

Variables with no <u>_FillValue</u>			
name	type	units	comment
cplx_waveform_ch1_i_x_ku(time_x_ku,np_ku)	byte	count	power waveforms i samples (ch1)
cplx_waveform_ch1_q_x_ku(time_x_ku,np_ku)	byte	count	power waveforms q samples (ch1)
cplx_waveform_ch2_i_x_ku(time_x_ku,np_ku)	byte	count	power waveforms i samples (ch2)
cplx_waveform_ch2_q_x_ku(time_x_ku,np_ku)	byte	count	power waveforms q samples (ch2)
seq_count_20_ku(time_20_ku)	short	count	Source Sequence Counter read from the L0 echo telemetry packet
pwr_waveform_avg_01_ku(time_avg_01_ku, ns_avg_01_ku)	ushort	count	1Hz averaged fully-calibrated power waveform. Obtained by averaging all individual L0 echoes covering approx 1 second after range compressopon. Units are counts scaled to fit in the range 0-65535.
pwr_waveform_20_ku(time_20_ku, ns_20_ku)	ushort	count	The L1b 20Hz power waveform is a fully-calibrated, high resolution multilooked waveform. Units are counts scaled to fit in the range 0-65535.
rec_count_20_ku(time_20_ku)	int	count	Record counter - progressive counter incremented by 1 for each data block.

For the above variables, the `_FillValue` is missing but it is possible to figure out whether the variables are meaningful or not by checking the status of some flags.

In particular, as to the counters (i.e. `rec_count_20_ku` and `seq_count_20_ku`) there is no way to know whether they are meaningful so the only case when their contents shouldn't be used (as any other variables) is when the whole block containing the counters are flagged as invalid (i.e. the following bitfields are set in `flag_mcd_20_ku`: `block_degraded` `blank_block` `datation_degraded`)

Likewise specific bitfields in the same flag are devoted to flag the validity or the errors in the waveforms.

For all the remaining variables (with a few exceptions, see later) the default `_FillValue` for each type is as follows:

<code>_FillValue</code> Specific Settings	
variable type	<code>_FillValue</code>
byte	-128b
double	NaN
int	-2147483648
int64	-9223372036854775808LL
short	-32768
ushort	32767US

The above convention is not used in the following cases:



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_FillValue Default Settings

Variable Name	Variable Type	_FillValue	Note
flag_cor_err_01(time_cor_01)	int	-1	
flag_cor_status_01(time_cor_01)	int	-1	
flag_echo_20_ku(time_20_ku)	short	-1s	
flag_instr_conf_rx_bwdt_20_ku(time_20_ku)	int	-1	
flag_mcd_20_ku(time_20_ku)	int	-1	
stack_kurtosis_20_ku(time_20_ku)	short	-999	This is the default value used in the EE product
stack_skewness_20_ku(time_20_ku)	short	-999	This is the default value used in the EE product
uso_cor_20_ku(time_20_ku)	int	2147483647	It has been observed a negative drift in time of the uso correction, then choosing the max positive value as _FillValue seems to be the safest choice.

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Appendix C: Timestamps Data Type

All the timestamps used in the CONFORM products represent the number of seconds since 01/01/2000 in double precision.

In this appendix it is shown that the current choice allows the timestamps to be represented with a precision of 1 microsecond till January 2034.

As the timestamps are typically added to or subtracted from each other, in order to preserve the precision of these operations down to the microsecond, we need to keep the exact representation of the number to 10^{-7} , whose binary representation is around 2^{-23} , i.e. 23 bits are needed to represent the decimal part of the timestamps with a precision of 0.1 microseconds.

The IEEE 754 standard representation for a double precision type reserves 54 bits for the representation of the mantissa (53 bits plus 1 implicitly set), which means that the number of bits left to be used to represent the integer part of the number of seconds is: $53 - 23 = 30$ bits, which means that we have at our disposal $2^{30} - 1 = 1,073,741,823$ seconds, i.e. 34 years.

Accordingly, the current representation allows us to represent and manage timestamps in the CONFORM without issues in arithmetic operations till January 2034, a date compatible with the mission lifetime.

Appendix D: EE to netCDF migration

The purpose of this section is to give the CryoSat users some insight into the criteria adopted to implement the migration from EE to CONFORM hoping that this can ease the analysis of the products in the new format.

The logic driving the migration is that this operation has to be implemented in two steps:

1. A version of the IPF1 software has to be released that generates baseline C CONFORM products. This IPF1 version as well as the baseline C CONFORM products are hidden versions, i.e. the software is not installed in the operational platform and the products are not distributed but to a selected groups of users to receive their feedback and suggestions for improvements.
2. The first official version of the IPF1 CONFORM software is baseline D that has to generate CONFORM products containing some evolution from baseline C.

Accordingly the contents of this section are applicable to the step one only, i.e. they explain how the baseline C CONFORM products have been designed. As of baseline D, the format will evolve without any relation to the EE format.

The Earth Explorer CryoSat Product consists of two files (Figure 6-1):

- The XML Header File
- The Product File.

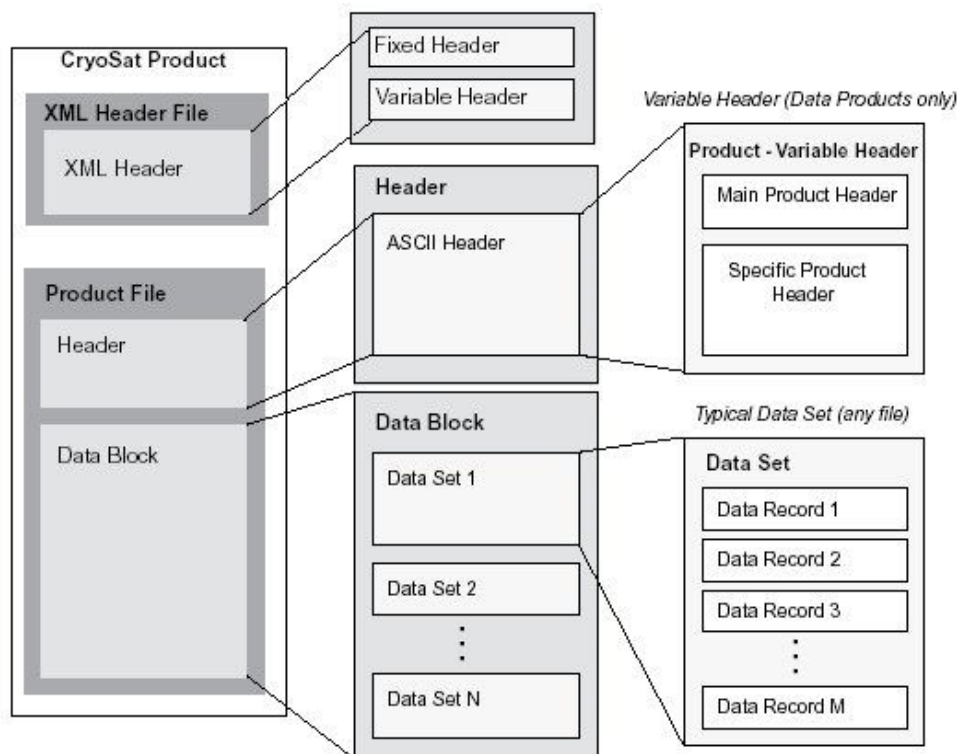


Figure 6-1: EE Product Structure

7.2 THE XML HEADER FILE

The XML Header file contains information identifying the product and easy to read as based on a standard syntax accessed by common tools available for visualising its content. The XML syntax has been chosen for the scope of the PDS.

The XML Header file is composed by:

- a Fixed Header
- a Variable Header

The Fixed Header (hereafter called Standard CryoSat Header) is the common header for all files managed into the PDS. That means it is applied to all files flowing amongst the sub-systems composing the PDS.

The Variable Header (hereafter called Product Header) is the header with format and content depending on the file type and kind of product.

7.2.1 Fixed Header (CryoSat Header)

The Standard CryoSat Header is completely ASCII and based on XML syntax and conventions proposed in [FMT-GUIDE].

The format and content of the Standard CryoSat Header is under ESA responsibility and it is specified in [FMT-GUIDE].

7.2.2 Variable Header (Product Header)

The Variable Header (hereafter called Product Header) for the Level-1 product is composed of:

- a XML Main Product Header (XML MPH)
- a XML Specific Product Header (XML SPH) which includes Reference Data Set Descriptors for external input files and one or more XML Specific Measurement Data Header (XML MDH) for the Data Sets of the Product

The XML MPH and XML SPH are derived from the correspondent headers (MPH and SPH) of the Product File, removing the unused fields and fields already reported in the Standard CryoSat Header.

Each header is completely ASCII and based on XML syntax and conventions proposed in the [FMT-GUIDE].

The following paragraphs describe the format and content of the XML MPH and XML SPH without overload of the XML format description.

7.2.2.1 XML Main Product Header (XML MPH)

Field #	Description	Units	Bytes	Format
	MPH	Tag		
	<i>Product Identification Information</i>			
#01	Product	Tag		
	Product File Name without extension		62	See Section 8
#02	Proc_Stage_Code	Tag		
	Processing stage code identifier: RPRO = Reprocessing OFFL = Routine Operation NRT_ = Near Real Time TEST = Test LTA_ = Long Term Archive		4	4*uc
#03	Ref_Doc	Tag		
	Reference DFCB Document describing the product		23	CS-RS-ACS-ESL-5364 01.07
	<i>Data Processing Information</i>			
#04	Proc_Time	Tag		
	Processing Time (Product Generation Time)		30	UTC=yyyy-mm-ddThh:mm:ss.uuuuuu
#05	Software_Version	Tag		



Field #	Description	Units	Bytes	Format
	Processor Name and software version number		14	ProcessorName/VV.rr
	<i>Orbit Information</i>			
#06	Phase	Tag		
	Phase Code (set to X if not used)		1	uc
#07	Cycle	Tag		
	Cycle Number (set to +000 if not used)		4	%+04d
#08	Rel_Orbit	Tag		
	Relative Orbit Number at sensing start time (set to +00000 if not used)		6	%+06d
#09	Abs_Orbit	Tag		
	Absolute Orbit Number at sensing start time (set to +00000 if not used)		6	%+06d
#10	State_Vector_Time	Tag		
	UTC state vector time		30	UTC=yyyy-mm-ddThh:mm:ss.uuuuuu
#11	Delta_UT1	Tag		
	Universal Time Correction: DUT1 = UT1 – UTC	s	8	%+08.6f
#12	X_Position	Tag		
	X position in Earth Fixed Reference If not used set to +0000000.000	m	12	%+012.3f
#13	Y_Position	Tag		
	Y position in Earth Fixed Reference If not used set to +0000000.000	m	12	%+012.3f
#14	Z_Position	Tag		
	Z position in Earth Fixed Reference If not used set to +0000000.000	m	12	%+012.3f
#15	X_Velocity	Tag		
	X velocity in Earth Fixed Reference If not used set to +0000.000000	m/s	12	%+012.6f
#16	Y_Velocity	Tag		
	Y velocity in Earth Fixed Reference If not used set to +0000.000000	m/s	12	%+012.6f
#17	Z_Velocity	Tag		
	Z velocity in Earth Fixed Reference If not used set to +0000.000000	m/s	12	%+012.6f

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Field #	Description	Units	Bytes	Format
#18	State_Vector_Source	Tag		
	Source of Orbit State Vector Record FP = FOS predicted DN = DORIS Level 0 navigator DP = DORIS precise orbit FR= FOS restituted DI = DORIS preliminary		2	2*uc
	<i>Product Confidence Data Information</i>			
#19	Product_Err	Tag		
	Product Error Flag 1 errors have been reported in the Product 0 no errors		1	uc
	<i>Product Size Information</i>			
#20	Tot_Size	Tag		
	Total Size of the Data Product	bytes	21	%021d

Table 2.2.2.1-1: XML Main Product Header Description

7.2.2.2 XML Specific Product Header (XML SPH)

Field #	Description	Units	Bytes	FORMAT
	SPH	tag		
<i>Product description and identification</i>				
#1	SPH_Descriptor	tag		
	Name describing the Specific Product Header		28	<i>ProductID SPECIFIC HEADER</i> <i>See Table 8-1</i>
<i>Product Time information</i>				
	Time_Information	tag		
#2	Start_Record_Time	tag		
	TAI of the first record in the Main MDS of this product		30	TAI=yyyy-mm-ddThh:mm:ss.uuuuuu
#3	Stop_Record_Time	tag		
	TAI of the last record in the Main MDS of this product		30	TAI=yyyy-mm-ddThh:mm:ss.uuuuuu
<i>Product Orbit information</i>				
	Orbit_Information	Tag		
#4	ABS_Orbit_Start	Tag		
	Absolute Orbit Number at sensing start time.		6	%06d
#5	Rel_Time_ASC_Node_Start	Tag		
	Relative time since crossing ascending node time relative to start time of data sensing.	s	11	%011.6f
#6	ABS_Orbit_Stop	Tag		
	Absolute Orbit Number at sensing stop time.		6	%06d
#7	Rel_Time_ASC_Node_Stop	Tag		

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Field #	Description	Units	Bytes	FORMAT
	Relative time since crossing ascending node time relative to stop time of data sensing.	s	11	%011.6f
#8	Equator_Cross_Time	Tag		
	Time of equator crossing at the ascending node relative to the sensing start time.		30	UTC=yyyy-mm-ddThh:mm:ss.uuuuuu
#9	Equator_Cross_Long	Tag		
	Longitude of equator crossing at the ascending node relative to the sensing start time (positive East, 0 = Greenwich) referred to WGS84.	10-6 deg	11	%+011d
#10	Ascending_Flag	Tag		
	Orbit Orientation at the sensing start time A=Ascending D=Descending		1	uc
<i>Product Location Information</i>				
	Product_Location	tag		
#11	Start_Lat	tag		
	WGS84 latitude of the first record in the Main MDS (positive north)	10-6 deg	11	%+011d
#12	Start_Long	tag		
	WGS84 longitude of the first record in the Main MDS (positive East, 0 = Greenwich)	10-6 deg	11	%+011d
#13	Stop_Lat	tag		
	WGS84 latitude of the last record in the Main MDS (positive north)	10-6 deg	11	%+011d
#14	Stop_Long	tag		

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Field #	Description	Units	Bytes	FORMAT
	WGS84 longitude of the last record in the Main MDS (positive East, 0 = Greenwich)	10-6 deg	11	%+011d
<i>SIRAL Level 0 Quality information</i>				
	Level_0_Confidence_Data	tag		
#15	L0_Proc_Flag	tag		
	Processing errors significance flag 1 errors (percentage of errors greater than threshold) 0 no errors		1	uc
#16	L0_Processing_Quality	tag		
	Percentage of quality checks successfully passed during ISP processing (max allowed +10000)	10-2 %	6	%+06d
#17	L0_Proc_Thresh	tag		
	Minimum acceptable percentage of quality threshold that must be passed during ISP processing (max allowed +10000)	10-2 %	6	%+06d
#18	L0_Gaps_Flag	tag		
	Flag to indicate gaps in input data • 1 gaps • 0 no gaps		1	uc
#19	L0_Gaps_Num	tag		
	Number of gaps detected during ISP processing		7	%07d
<i>SIRAL Instrument Configuration</i>				
	SIR_Instrument_Configuration	tag		
#20	Instrument_Identifier	tag	1	1*uc A (SIRAL Nominal) B (SIRAL Redundant)
#21	SIR_Op_Mode	tag		

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Field #	Description	Units	Bytes	FORMAT
	SIRAL Operative Mode		10	10*uc LRM_____ SAR_____ SARIN_____ CAL1_LRM_____ CAL1_SAR_____ CAL1_SARIN_____ CAL2_SAR_____ CAL2_SARIN_____ ACQ_____ TRK_SARIN_____ TRK_SAR_____ CAL4_____
#22	SIR_Configuration	tag		
	SIRAL Rx Configuration		7	7*uc RX_1_____ RX_2_____ BOTH_____ UNKNOWN
<i>Level 1 Surface Statistics</i>				
	Surface_Statistics	tag		
#23	Open_Ocean_Percent	tag		
	Percentage of output L1B records detected on open ocean or semi-enclosed seas	10-2 %	6	%+06d
#24	Close_Sea_Percent	tag		
	Percentage of output L1B records detected on close seas or lakes	10-2 %	6	%+06d
#25	Continent_Ice_Percent	tag		
	Percentage of output L1B records detected on continental ice	10-2 %	6	%+06d
#26	Land_Percent	tag		
	Percentage of output L1B records detected on land	10-2 %	6	%+06d
<i>SIRAL Level 1 Processing information</i>				
	Level_1_Confidence_Data	tag		

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Field #	Description	Units	Bytes	FORMAT
#27	L1B_Prod_Status	tag		
	Complete/Incomplete Product Completion Flag (0 or 1). 1 if the product has a duration shorter than the input Level 0		1	uc
#28	L1B_Proc_Flag	tag		
	Processing errors significance flag 1 errors (percentage of errors greater than threshold) 0 no errors		1	uc
#29	L1B_Processing_Quality	tag		
	Percentage of quality checks successfully passed during Level 1B processing (max allowed +10000)	10-2 %	6	%+06d
#30	L1B_Proc_Thresh	tag		
	Minimum acceptable percentage of quality threshold that must be passed during Level 1B processing (max allowed +10000)	10-2 %	6	%+06d
<i>Data Set Descriptors</i>				
	DSDs	tag		
	List_of_DSDs	tag		
	Data_Set_Descriptor	tag		
#31	Data_Set_Name	tag		
	Name of the Data Set		28	uc
#32	Data_Set_Type	tag		
	M for Measurement – R for Reference		1	uc
#33	File_Name	tag		
	Name of the reference file. Field is left empty for Measurement DSD		62	uc
#34	Data_Set_Offset	tag		
	Offset in bytes from the beginning of the DBL file. For reference DSDs the field is set to 0.	bytes	21	%+021d
#35	Data_Set_Size	tag		

Field #	Description	Units	Bytes	FORMAT
	Size in bytes of the Measurement Data Set Record. For reference DSDs the field is set to 0.	bytes	21	%+021d
#36	Num_of_Records	tag		
	Number of Data Set Records. For reference DSDs the field is set to 0.		11	%+011d
#37	Record_Size	tag		
	Record size in bytes. For reference DSDs the field is set to 0.	bytes	11	%+011d
#38	Byte_Order	tag		
	It describes the endianness of the data set 3210 → Big-endian 0123 → Little-endian For Reference DSDs the field is left empty		4	%4c 3210 for CryoSat

Table 2.2.2.2-1: XML Specific Product Header description

Main relevant content of XML Header File is reported in the Global Attribute section of the netcdf product, in any case the XML Header File Product will be generated for Legacy.

7.3 THE PRODUCT FILE

The EE Product File is defined taking the ENVISAT Level 0 products as a template and consists of:

- Main Product Header (MPH)
- Specific Product Header (SPH)
- Data Sets (DS)

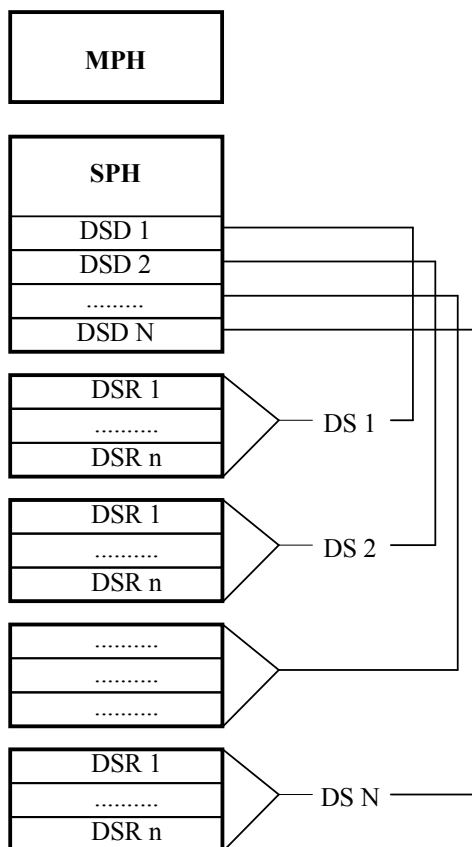


Figure 6-2: EE Product File Structure

The MPH and SPH blocks are ASCII whereas the Data Sets are completely binary and each of them contains one or more Data Set Records.

All the EE CryoSat Products that have migrated to the netCDF format contain one DS.

The general rules driving the migration are:

- The contents of the MPH and SPH have to be converted into netCDF global attributes
- each DS fields has been converted into a netCDF variable
- Grouping within the product is only logical (i.e. the group feature of the netCDF 4.0 is not used but the rationale is kept in the variable naming)
- Three time dimensions are used:
 - One time stamp for each 1 Hz measurement.
 - One time stamp for each 20 Hz measurement.

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- One time stamp to tag the time when the correction is applied.
- 20 Hz measurements are linked to the corresponding 1 Hz measurement by means of one index.
- _FillValue attribute is always filled with limited exceptions.
- Coding of binary flags:
 - For flags coded in a single bit the same convention as S6 GPP is used
 - For flags coded on more than one bit, a variable will be created

8 CRYOSAT LEVEL-1B EEF PRODUCTS

The following table provides the Product Identification for each product generated by the IPF1.

Product Identification	Description
SIR1LRC11B	Level-1 CAL1 Low Rate Mode (Rx1 Channel)
SIR2LRC11B	Level-1 CAL1 Low Rate Mode (Rx2 Channel)
SIR1SAC11B	Level-1 CAL1 SAR Mode (Rx1 Channel)
SIR2SAC11B	Level-1 CAL1 SAR Mode (Rx2 Channel)
SIR_SIC11B	Level-1 CAL1 SARin Mode
SIR_SICC1B	Level-1 CAL1 SARIN Exotic Data
SIR1SAC21B	Level-1 CAL2 SAR Mode (Rx1 Channel)
SIR2SAC21B	Level-1 CAL2 SAR Mode (Rx2 Channel)
SIR1SIC21B	Level-1 CAL2 SARin Mode (Rx1 Channel)
SIR2SIC21B	Level-1 CAL2 SARin Mode (Rx1 Channel)
SIR1LRM_0M	LRM and TRK Monitoring Data from Rx 1 Channel
SIR2LRM_0M	LRM and TRK Monitoring Data from Rx 2 Channel
SIR1SAR_0M	SAR Monitoring Data from Rx 1 Channel
SIR2SAR_0M	SAR Monitoring Data from Rx 1 Channel
SIR_SIN_0M	SARIN Monitoring Data
SIR_SIC40M	CAL4 Monitoring Data

Table 8-1 L1b Product List

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8.1 FILE NAMES

The file name of each Level-1 product follows what specified in [MASTER-ICD], i.e.:

MM_CCCC_TTTTTTTTTT_yyyymmddThhmmss_YYYYMMDDTHHMMSS_bvvv.HDR
MM_CCCC_TTTTTTTTTT_yyyymmddThhmmss_YYYYMMDDTHHMMSS_bvvv.DBL

where

MM is the mission identifier ***CS*** for CryoSat

CCCC is the file class (i.e.: OPER for routine operation, NRT_ for Near Real Time, RPRO for Reprocessing, TEST for Testing or Tlxx for stand alone IPF1 testing associated to Test Data Sets tagged as Tlxx, LTA_ for products generated in the Long Term Archive).

TTTTTTTTTT is the file type and corresponds to the Product ID of the Table 3-1

yyymmddThhmmss is the validity start time and correspond to the time of the first valid record stored in the Interim FBR.

YYYYMMDDTHHMMSS is the validity stop time and correspond to time of the last valid record stored in the Interim FBR.

b is the baseline identifier as read-in from the PCONF

vvv is the version number

For example in case of an operational Level-1 product of the SIRAL instrument in Low Rate Mode in baseline number A and version 1 the name could be:

CS_OPER_SIR_LRM1B_20030624T075728_20030624T080231_A001.HDR
CS_OPER_SIR_LRM1B_20030624T075728_20030624T080231_A001.DBL

The file with extension ***.HDR*** is the xml Header and the file with the extension ***.DBL*** is the Level 1b Product file.

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