CRYOSAT Ground Segment

Instrument Processing Facility L2

Cryosat Ice netCDF L2 Product Format Specification

[PFS-I-L2]

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Document Signature Table

APPROVAL TABLE		
Date		
Name	**Function**	**Signature**
F. CARRIERO A. DI BELLA R. GRIMALDI	Project Manager ESA Technical Officier Cryosat PDGS Manager	

CONTRACTOR TABLE				
	Name	**Function**	**Signature**	**Date**
Author	D. Brockley [MSSL]	Software Engineer		
Verification	T. Geminale	System Engineer		
Quality Assurance	A. Giustiniani	Quality Manager		
Approval	F. Carriero	IPF Project Manager		

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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 draft 2		26/07/2016	Response to comments	All
1.0	R	29/07/2016	First Official Release	All
1.1	R	04/10/2016	Implementation of ESA's comments	Appendices B (list of default values of _FillValue attribute for each variable type) and D (timestamp granularity) added Because of the previous change, section 1.2 has been modified and appendix B has become now D. Variable names harmonisation with ocean products and S3, S6 variables. The following sections have changed: section 3, 4 and appendix A. Unused variables types removed from section 2.3.1 FDM format added. The following sections have changed: section 2.1, 3 and appendix A
1.2	R	10/10/2016	Alignment with implementation	Explanation how to link 20Hz records to 1-Hz ones added in section 3 hf_fluct_cor_01 -> hf_fluct_total_cor_01. The following sections have been modified: 3.1, 3.2, 3.3.13, 3.3.14 and 4.1 mean_sea_surface_ice_01 -> mean_sea_surf_sea_ice_01. The following sections have been modified: 3.1, 3.2, 3.3.22, 3.3.26, 4.1, 4.2.38, 4.2.46, 4.2.58, 4.2.62 and 4.2.124 noise_pwr -> noise_power. The following sections have been modified: 4.1 and 4.2.61
1.3	R	27/01/2017	Comment fields of the variables : lat_poca_20_ku and	Section 3.3.27 and section 3.3.30

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			lon_poca_20_ku have been updated Minor typos have been corrected in the CDL dumps	 Section 3 and section 4
1.4	R	24/03/2017	The netCDF dump of the following L2 variables has been updated to align the document to the code: flag_instr_conf_rx_str_in_use_01 hf_fluct_total_cor_01 lon_01 mod_wet_tropo_cor_01 peakiness_20_ku retracker_2_quality_20_ku ssha_interp_rms_20_ku time_20_ku The netCDF dump of the following L2I variables has been updated to align the document to the code: flag_instr_conf_rx_bwdt_20_ku flag_instr_conf_rx_trk_mode_20_ku flag_quality_20_ku lat_poca_20_ku retracker_output_13_20_ku ssha_interp_rms_20_ku Typo errors corrected Veriables "comment" reviewed	 Section 3.3.7 Section 3.3.22 Section 3.3.29 Section 3.3.33 Section 3.3.43 Section 3.3.55 Section 3.3.75 Section 3.3.82 Section 4.2.17 Section 4.2.21 Section 4.2.27 Section 4.2.51 Section 4.2.91 Section 4.2.128 Section 4.2.18, 4.2.56, 4.2.57, 4.2.65, 4.2.134, 4.2.135 Section 3.3.7, 3.3.22->3.3.30, 3.3.32, 3.3.33, 3.3.35, 3.3.36, 3.3.42 -> 3.3.44, 3.3.53, 3.3.72, 3.3.83, 4.2.20, 4.2.38 -> 4.2.42, 4.2.45 ->4.2.55, 4.2.59-> 4.2.63, 4.2.70, 4.2.73, 4.2.74, 4.2.122, 4.2.131, 4.2.132, 4.2.144 and 4.2.145

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1.5	R	06/06/2017	sea_state_bias_01 -> sea_state_bias_01_ku flag_instr_conf_rx_str_in_use_01: _FillValue corrected wind_speed_alt_01:units corrected flag_cor_err_20_ku: CDL corrected flag_cor_status_20_ku: CDL corrected	Sections 3.1 and 3.3.58 Section 3.3.7 Section 3.3.84 Section 4.2.12 Section 4.2.13
1.6	R	21/06/2018	Global Attributes nomenclature aligned to COP Processor specification L2 and L2I cdl dump aligned to baseline D product content	Section 5 Section 3 and Section 4
2.0	R	23/12/2020	Issue for BaselineE VO1.0	Section 3.3.17: freeboard_20_ku comment updated Section3.3.19 height_1_20_ku updated Section 3.3.22 height_sea_ice_floe_20_ku comment updated Section 3.3.51 range_2_20_ku comment updated Section 3.3.52 range_3_20_ku comment updated Section 3.3.78 snow_depth_01 comment updated Section 3.3.79 variable snow_depth_cor_20_ku introduced Section 4.4.11 flag_cor_err_20_ku flag_mask and flag_meaning updated

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				Section 4.4.12 flag_cor_status_20_ku flag_mask and flag_meanings updated Section 4.2.30 flag_sea_ice_type_20_ku introduced Section 4.2.33: freeboard_20_ku comment updated Section 4.2.35 height_1_20_ku comment updated Section 4.2.16 height_sea_ice_floe_20_ku comment updated Section 4.2.75 range_2_20_ku comment updated Section 4.2.76 range_3_20_ku comment updated Section 4.2.124 snow_depth_20_ku comment updated Section 4.2.125 snow_depth_cor_20_ku added Section 5 xref_sea_ice_north and xref_sea_ice_south added
2.1draft	R	16/07/2021	Finale Baseline E Release	freeboard_20_ku variable renamed in radar_freeboard_20_ku in both L2 and L2I cdl Comments updated for the following variables: height_1_20_ku height_sea_ice_floe_20_ku snow_depth_cor_20_ku Section 4.3 and 4.4 added: CRYO-IDE_355
3.0	R	31/10/2025	Release for Baseline F	Section "Flag Meaning Tables L2" moved from section 4 to

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				section 3, in agreement with relevant content. **Section 3.2** ocean_tide_eq_01 model source corrected cats2008_tide_01, flag_bedmachine_mask_20_ku , sea_ice_freeboard_20_ku, sea_ice_thickness_20_ku, ice_density_01, water_density_01 variables added plrm variables added: time_cor_plrm_01, lat_plrm_20_ku, lon_plrm_20_ku, time_plrm_20_ku, cats2008_tide_plrm_01, echo_numval_plrm_20_ku flag_cor_applied_plrm_20_ku, flag_prod_status_plrm_20_ku, lat_poca_plrm_20_ku, lon_poca_plrm_20_ku, peakiness_plrm_20_ku, surf_type_plrm_20_ku, int height_ocog_plrm_20_ku, range_ocog_plrm_20_ku, sig0_ocog_plrm_20_ku, distance_to_coast_20_ku and distance_to_coast_01 variables added flag_prod_status_20_ku updated to account for sarin_height_unwrap and sarin_off_nadir_lead mean_sea_surf_sea_ice_01 updated for new model DTU21 used sea_state_bias_01_ku variable suppressed

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				snow_depth_01 updated for source used swh_ocean_01_ku and wind_speed_alt_01_ku suppressed distance_to_coast_20_ku and distance_to_coast_01 variables added lat_20_ku and lon_20_ku added to L2 product snow_density_01 comment updated **Section 4.2** load_tide_01 and ocean_tide_01 model udated to FES2022b ocean_tide_eq_01 model source corrected cats2008_tide_01, flag_bedmachine_mask_20_ku , range_larm_20_ku, sea_ice_freeboard_20_ku, sea_ice_thickness_20_ku, distance_to_lead_20_ku variables added flag_height_20_ku updated to account for sarin_off_nadir_lead flag_sarin_ambiguity_warning _20_ku updated to account for unwrapped meaning mean_sea_surf_sea_ice_20_k u updated for new model DTU21 used retracker_output_4_20_ku updated to specify it is unused for SARin mode retracker_output_6_20_ku updated to specify it is unused for SARin mode

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				retracker_output_7_20_ku updated to specify it is unused for SARin mode retracker_output_8_20_ku updated to specify it is unused for SARin mode retracker_output_9_20_ku updated to specify how it is used for SAR and SARin mode retracker_output_14_20_ku updated to specify it is unused for SARin mode retracker_output_15_20_ku updated to specify it is unused for SARin mode sea_state_bias_20_ku suppressed snow_depth_20_ku updated for source used avg_peakiness_20_ku avg_stack_peakiness_20_ku distance_to_coast_20_ku variables added swh_ocean_20_ku and wind_speed_alt_20_ku suppressed Section 4.3, 4.4 and AppendixA updated according to changes introduced in section 3 and 4 **Section 5** Global attributes xref_distance_to_coast xref_bedmachine, xref_density added xref_ocean_tide and xref_load_tide suppressed in favour of xref_ocean_load_tide xref_ssb suppressed **Appendix A**

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				List of variables reviewed in agreement with Section 3 and Section 4 **All** Reference to FDM removed from document CRYO-IDE-425 load_tide_01 and ocean_tide_01 model pdated to FES2022b CRYO-IDE-437 Larm variables added: larm_wf_metric_1_20_ku larm_wf_metric_2_20_ku
3.1Draft	R	27/04/2026	Update after QWG#11 review	L2: ssb reference suppressed for flag_cor_applied_20_ku flag_cor_err_01 L2I: ssb reference suppressed for flag_cor_err_20_ku flag_cor_status_20_ku flag_height_20_ku flag_cor_applied_plrm_20_ku sea_ice_freeboard_20_ku:comment updated Section 3.3 Flag meaning tables updated
3.1	R	28/04/2026		geoid_01 and geoid_20_ku updated to EGM2008 comment and institution attributes updated as well

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1 INTRODUCTION

This document specifies the netCDF format of the Level-2 products generated by the CryoSat ice processing chains.

1.1 PURPOSE AND SCOPE

The purpose of the document is to specify the netCDF product structure and content of the Level-2 products generated by the CryoSat ice processing.

Since the beginning of the mission (2010), all CryoSat products had been generated in EE (Earth Explorer) a 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 whole Cryosat L2 production:

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

However the migration is prototyped on the baseline C even though this production is intended to be distributed only to selected users with the purpose of receiving feedback to be implemented in baseline D.

This document specifies the CryoSat baseline C netCDF ice products.

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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 - Level-2 Format Description	This section contains the specification of the L2 ice CONFORM products in terms of variable list and variable CDL dumps.
Section 4 - Level-2I Format Description	This section contains the specification of the L2i ice CONFORM products in terms of variable list and variable CDL dumps.
Section 5 – Level 2 and Level 2I	This section specifies the global attributes used for L2 and L2I products
Section 6- Cryosat Level-2 Conform Products	Here is the list of the L2 CONFORM ice products
Appendix A – Variables to Products Mapping	In this section there is the variable name list alphabetically ordered and for each variable it is shows in which product types it can be used
Appendix B: Default Setting of the Attribute: _FillValue	In this section the list of _FillValues for each variable type is listed
Appendic C: Timestamps Data Type	In this section it is demonstrated that 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]

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1.4 ACRONYMS AND ABBREVIATIONS

ACS	Advanced Computer Systems S.p.A.
AGC	Automatic Gain Control
AIR	Azimuth Impulse Response
AISP	Annotated Instrument Source Packet
APID	Application Process Identifier
BER	Bit Error Rate
BLOB	Binary Large Object
CADU	Channel Access Data Unit
CAL	Calibration
CCSDS	Consultative Committee for Space Data Systems
COG	Centre Of Gravity
CVCDU	Coded Virtual Channel Data Unit
DEM	Digital Elevation Model
DSR	Data Set Record
EO	Earth Observation
ESA	European Space Agency
FOS	Flight Operations Segment
FDO	Fast delivery Ocean
G/S	Ground Segment
HK/TM	Housekeeping/Telemetry data
ID	Identifier Digits or Document
I/O	Input/Output
IPF	Instrument Processing Facility
ISP	Instrument Source Packet
L1B	Level 1B
LRM	Low Rate Mode
MDS	Measurement Data Set
MJD	Modified Julian Day
MON	Monitoring
MPH	Main Product Header
MQE	Mean Quadratic Error
PDS	Payload Data System
PSLR	Peak to Side Lobe Ratio
PSS-05	ESA Software Engineering Standard
RC	Radar Cycle
RIR	Range Impulse Response
SAR	Synthetic Aperture Radar mode
SHA	Surfae Height Anomaly
SIN	Synthetic Interferometric mode
SIRAL	Synthetic Interferometric Radar Altimeter
SOW	Statement Of Work
SPH	Specific Product Header
SSHA	Sea-surface Height Anomaly
TAI	International Atomic Time Reference
TBC	To Be Confirmed
TBD	To Be Defined
TT&C	Tracking, Telemetry and Command
U10	Windspeed at 10m altitude, as calculated by the altimeter
UTC	Universal Time Co-ordinates
VCDU	Virtual Channel Data Unit
WGS84	World Geodetic System 1984

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2 GENERAL OVERVIEW

2.1 OVERVIEW OF THE IPF2 ICE PRODUCTION

The Level-2 products are derived from the Cryosat L1B products generated by the IPF1 and relevant to the science modes, that are LRM - SAR – SIN (nominal and degraded).

A common layout (i.e. independent from the SIRAL operative mode) is defined for all the Level-2 products.

A L2 product is generated soon after a L1B product is available thus resembling still a data driven approach. This implies that following this first generation step there will be L2 products still separated by modes (specifically LRM – SAR – SIN) defined over the same time window of the input L1B.

The L2 data is the main output from the L2 processors and consists of a compact product designed to minimise the data volume distributed to users. However, another L2 data set is available and called 'In-depth L2' and is identified with an 'I' in the filetype: SIR_xxxI2x. This dataset contains many more parameters and flags and is therefore much larger. This detailed product is also required as the input to the second pass of the L2 SAR processing chain where the sea-surface height anomaly is interpolated to the location of all measurements identified as sea ice, to allow the computation of freeboard.

The In-depth products are sometimes referred to as the Intermediate products. This is an old terminology coming from the early phases of the Cryosat project and shouldn't be used anymore.

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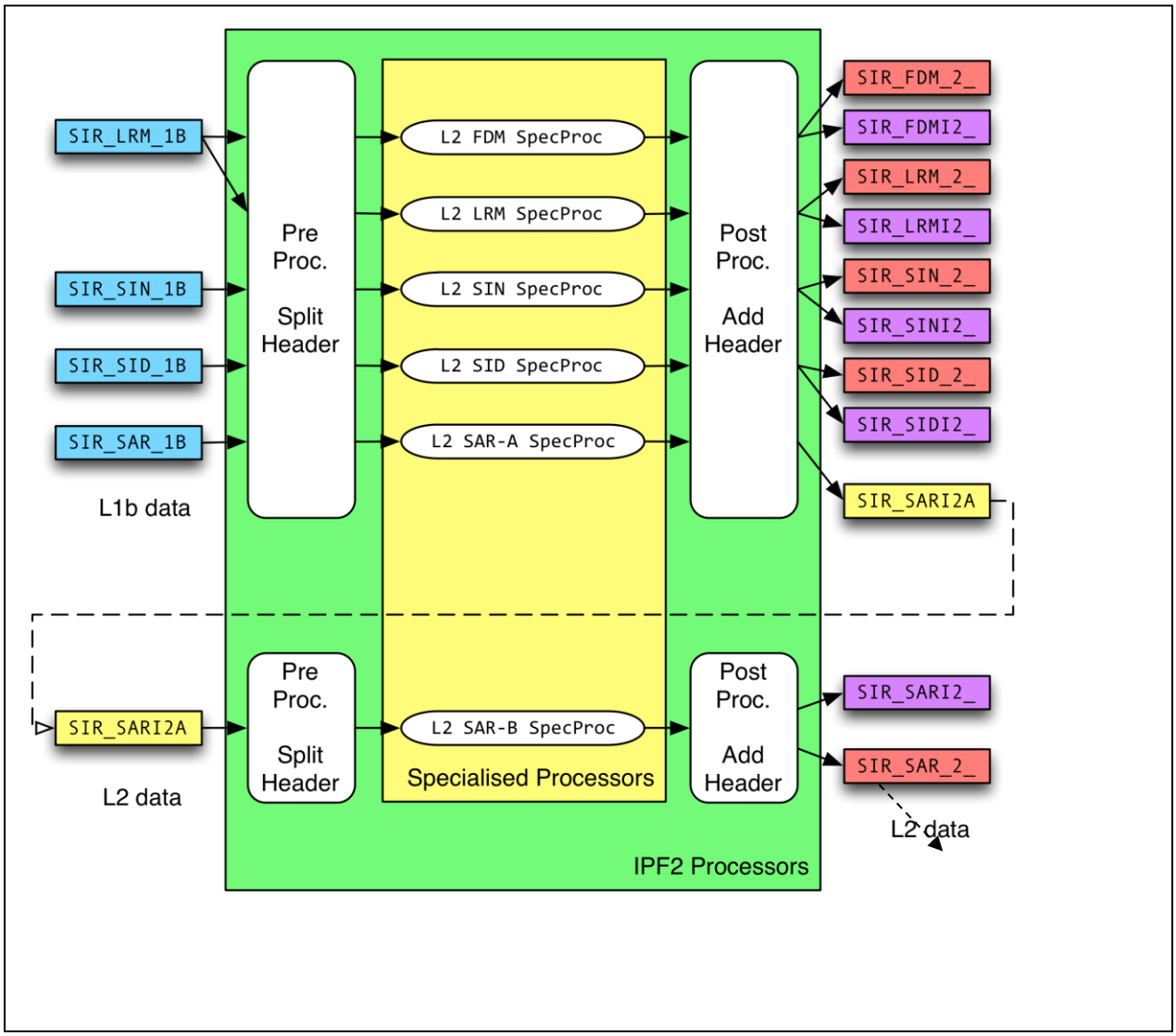


Figure 2-1 Level-2 (Step 1) Product Generation

In the second step of the processing, a global L2 product is generated from the L2 mode dependent products collected over an entire orbit, specifically from an ascending node (ANX) to the next one (ANX to ANX). This second step most likely does not imply any specific processing, but simply a concatenation of files in chronological order. L2 products from the first step, in fact, regardless of their SIRAL mode dependence, have binary records with the same layout.

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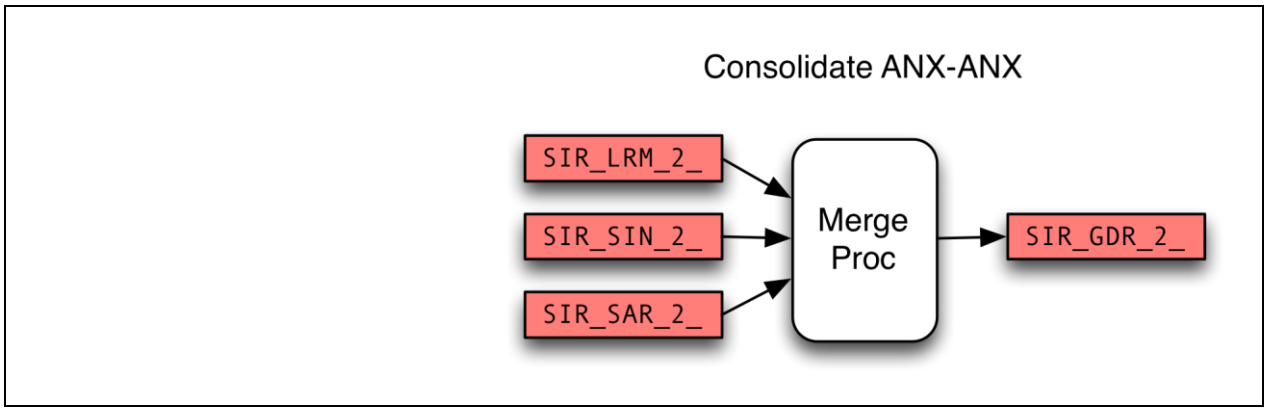


Figure 2-2 Level-2 (Step 2) ANX to ANX Consolidation

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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 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 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 were 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 Level2 CONFORM products:

Dimensions					
Name	Description	Size	Units	Type	Limited/ Unlimited
time_20	Timestamps of 20 Hz waveforms in the L1b product file (L1b only)	Number of 20 Hz waveforms in the product file	seconds since 2000-01-01 00:00:00.0	double	Limited
time_cor_01	Time of the first record in every block of 20 records input	Number of 1 Hz blocks in the input L1b file	seconds since 2000-01-01 00:00:00.0	double	Limited
space_3d	3 dimensions of space (x,y,z)	3	---	short	limited

The following **variables** are used in the Cryosat ice Level2 CONFORM products:

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

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The following **attributes** are used in the Cryosat ice Level2 CONFORM products:

Attributes	
Name	Description
calendar	Reference time calendar
comment	Miscellaneous information about the data or the methods used to produce it
coordinates	Identified auxiliary coordinates variables
_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*.
flag_mask	Provide a list of number of independent Boolean conditions using bit field notation. Use in conjunction with *flag_meanings*.
institution	Institution which provides the data
long_name	A descriptive name that indicates a variable's content. This name is not standardized.
quality_flag	Name of the variable(s) (quality flag) representing the quality of the current variable
scale_factor	If present, the date are to be multiplied by this factor after the data are read by an application. See also *add_offset* attribute
source	Data source (model features, or observation)
standard_name	A standard name that references a description of a variables content in the standard name table.
units	Unit of a variable's content. The value of this attribute must be a string that can be recognized by the UNIDATA's Udunits package.

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3 LEVEL-2 FORMAT DESCRIPTION

In this section the variable names used in the CONFORM product are listed in a table where the corresponding EE variables are also indicated.

The general rule used to implement the migration is to one-to-one map EE variables to netCDF ones although this is not always possible: appendix D described this strategy in details.

It is worth pointing out here an aspect of the CONFORM products, or better a difference of theirs to the EE format: the Cryosat netCDF products – quite obviously- won't contain blank records that are needed in the EE format to keep the binary structure consistent.

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

3.1 LIST OF L2 LRM/SAR/SARIN/GDR VARIABLES

L2 Product			
Variable Name (dim1,...,dim N) ***long_name***	**units**	**Standard_name**	**EE Field**
time_cor_01(time_cor_01) *time (sec. since 2000-01-01)*	s	time	Data Record Time (MDSR Time Stamp)
time_20_ku(time_20_ku) *time (sec. since 2000-01-01)*	s	time	
time_plrm_20_ku(time_plrm_20_ku) *time in TAI: seconds since 1 Jan 2000*	s	time	
alt_plrm_20_ku(time_plrm_20_ku) *altitude of the Satellite CoM above reference ellipsoid*	m	height_above_reference_ellipsoid	
cats2008_tide_01(time_cor_01)	m	CATS2008 tide correction	
cats2008_tide_plrm_01(time_cor_01)	m		

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L2 Product			
Variable Name (dim1,…,dim N) ***long_name***	**units**	**Standard_name**	**EE Field**
distance_to_coast_20_ku(time_20_ku)	m		
distance_to_coast_01(time_cor_01)	m		
ind_first_meas_20hz_01(time_cor_01)	count		
ind_meas_1hz_20_ku	count		
flag_bedmachine_mask_20_ku			
flag_instr_mode_op_20_ku (time_20_ku)			Measurement Mode
flag_instr_conf_rx_str_in_use_01(time_cor_01) *star tracker id*			Star Tracker ID
flag_prod_status_20_ku(time_20_ku)		quality flag	
flag_prod_status_plrm_20_ku(time_plrm_20_ku)		quality flag	
flag_sea_ice_type_20_ku(time_20_ku)			
larm_wf_metric_1_ku(time_20_ku)			
larm_wf_metric_2_ku(time_20_ku)			
lat_01(time_cor_01) *latitude*	degrees_north	latitude	Latitude of Orbit in WGS84
lon_01(time_cor_01) *longitude*	degrees_east	longitude	Latitude of Orbit in WGS84
lat_plrm_20_ku(time_plrm_20_ku) *latitude of measurement*	degrees_north	latitude	
lon_plrm_20_ku(time_plrm_20_ku) *longitude of measurement*	degrees_east	longitude	
alt_01(time_cor_01) *center of mass altitude above reference ellipsoid*	m	height_above_reference_ellipsoid	Altitude of COG above reference ellipsoid

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L2 Product			
Variable Name (dim1,…,dim N) ***long_name***	**units**	**Standard_name**	**EE Field**
echo_numval_20_ku(time_20_ku)	count		
echo_numval_plrm_20_ku(time_plrm_20_ku)	count	count of echoes or beams averaged	
flag_cor_err_01(time_cor_01)			
off_nadir_roll_angle_str_01(time_cor_01) *antenna bench roll angle corresponding to the mdsr time stamp*	deg		Antenna Bench Roll Angle
off_nadir_pitch_angle_str_01(time_cor_01) *antenna bench pitch angle corresponding to the mdsr time stamp*	deg		Antenna Bench Pitch Angle
off_nadir_yaw_angle_str_01(time_cor_01) *antenna bench yaw angle corresponding to the mdsr time stamp*	deg		Antenna Bench Yaw Angle
num_valid_01(time_cor_01) *number of valid measurements*	count		Number of valid Measurements in this record
mod_dry_tropo_cor_01(time_cor_01) *dry tropospheric correction*	m	altimeter_range_correction_due_to_dry_troposphere	Dry Tropospheric Correction
mod_wet_tropo_cor_01(time_cor_01) *wet tropospheric correction*	m	altimeter_range_correction_due_to_wet_troposphere	Wet Tropospheric Correction
inv_bar_cor_01(time_cor_01) *inverse barometric correction*	m	sea_surface_height_correction_due_to_air_pressure_at_low_frequency	Inverse Barometric Correction

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L2 Product			
Variable Name (dim1,…,dim N) ***long_name***	**units**	**Standard_name**	**EE Field**
hf_fluct_total_cor_01(time_cor_01) *dynamic atmospheric correction*	m	sea_surface_height_correction_due_to_air_pressure_and_wind_at_high_frequency	Dynamic Atmospheric Correction
iono_cor_01(time_cor_01) *model ionospheric correction*	m	altimeter_range_correction_due_to_ionosphere	Model Ionospheric Correction
iono_cor_gim_01(time_cor_01) *gim ionospheric correction*	m	altimeter_range_correction_due_to_ionosphere	GIM Ionospheric Correction
ocean_tide_01(time_cor_01) *elastic ocean tide*	m		Elastic Ocean Tide
ocean_tide_eq_01(time_cor_01) *long period ocean tide*	m	sea_surface_height_amplitude_due_to_equilibrium_ocean_tide	Long Period Ocean Tide
load_tide_01(time_cor_01) *ocean loading tide*	m		Ocean Loading Tide
solid_earth_tide_01(time_cor_01) *solid earth tide*	m	sea_surface_height_amplitude_due_to_earth_tide	Solid Earth Tide
pole_tide_01(time_cor_01) *geocentric polar tide*	m	sea_surface_height_amplitude_due_to_pole_tide	Geocentric Polar Tide
surf_type_20_ku (time_20_ku) *surface type from mask*			Surface type flag

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L2 Product			
Variable Name (dim1,…,dim N) ***long_name***	**units**	**Standard_name**	**EE Field**
surf_type_plrm_20_ku (time_plrm_20_ku) *surface type from mask*			Surface type flag
mean_sea_surf_sea_ice_01(time_cor_01) *mean sea surface height*	m	sea_surface_height_above_reference_ellipsoid	MSS / Geoid from model
geoid_01(time_cor_01) *geoid height*	m	geoid_height_above_reference_ellipsoid	MSS / Geoid from model
odle_01 (time_cor_01) *ocean depth/land elevation*	m		Ocean Depth / Land Elevation from model
sea_ice_concentration_01 (time_cor_01) *sea ice area fraction*	percent	sea_ice_area_fraction	Ice Concentration
snow_depth_01 (time_cor_01)	m	surface_snow_thickness	Snow Depth
snow_density_01(time_cor_01) *snow density*	kgm^{-3}	snow_density	Snow Density
snow_depth_cor_20_ku(time_20_ku)	m	snow depth correction	
lat_poca_20_ku (time_20_ku) *20 Hz latitude of the estimated echo location (POCA)*	degrees_north	latitude	Latitude of measurement
lat_poca_plrm_20_ku (time_plrm_20_ku)	degrees_north	latitude	Latitude of measurement

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L2 Product			
Variable Name (dim1,…,dim N) ***long_name***	**units**	**Standard_name**	**EE Field**
20 Hz latitude of the estimated echo location (POCA)			
lon_poca_20_ku (time_20_ku) *20 Hz longitude of the estimated echo location (POCA)*	degrees_east	longitude	Longitude of measurement
lon_poca_plrm_20_ku (time_plrm_20_ku) *20 Hz longitude of the estimated echo location (POCA)*	degrees_east	longitude	Longitude of measurement
height_1_20_ku (time_20_ku) *20 Hz surface height (retracker 1)*	m	height_above_reference_ellipsoid	Height of surface w.r.t. reference ellipsoid (retracker 1)
height_2_20_ku (time_20_ku) *20 Hz surface height (retracker 2)*	m	height_above_reference_ellipsoid	Height of surface w.r.t. reference ellipsoid (retracker 2)
height_3_20_ku (time_20_ku) *20 Hz surface height (retracker 3)*	m	height_above_reference_ellipsoid	Height of surface w.r.t. reference ellipsoid (retracker 3)
height_ocog_plrm_20_ku(time_plrm_20_ku) *20 Hz surface height (retracker 3)*	m	height_above_reference_ellipsoid	Height of surface w.r.t. reference ellipsoid (retracker 3)
height_sea_ice_floe_20_ku(time_20_ku) *surface height (sea-ice floe retracker)*	m	height_above_reference_ellipsoid	
height_sea_ice_lead_20_ku(time_20_ku) *surface height (sea-ice floe retracker)*	m	height_above_reference_ellipsoid	

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L2 Product			
Variable Name (dim1,…,dim N) ***long_name***	**units**	**Standard_name**	**EE Field**
sig0_1_20_ku (time_20_ku) *20 Hz backscatter coefficient (retracker 1)*	dB	surface_backwards_scattering_coefficient_of_radar_wave	Backscatter (sigma-zero) (retracker 1)
sig0_2_20_ku (time_20_ku) *20 Hz backscatter coefficient (retracker 2)*	dB	surface_backwards_scattering_coefficient_of_radar_wave	Backscatter (sigma-zero) (retracker 2)
sig0_3_20_ku (time_20_ku) *20 Hz backscatter coefficient (retracker 3)*	dB	surface_backwards_scattering_coefficient_of_radar_wave	Backscatter (sigma-zero) (retracker 3)
sig0_ocog_plrm_20_ku (time_plrm_20_ku) *20 Hz backscatter coefficient (retracker 3)*	dB	surface_backwards_scattering_coefficient_of_radar_wave	Backscatter (sigma-zero) (retracker 3)
radar_freeboard_20_ku (time_20_ku) *sea-ice freeboard*	m	sea_ice_freeboard	Freeboard
range_1_20_ku(time_20_ku) *range to surface (retracker 1)*	m	altimeter_range	
range_2_20_ku(time_20_ku) *range to surface (retracker 2)*	m	altimeter_range	
range_3_20_ku(time_20_ku) *range to surface (retracker 3)*	m	altimeter_range	
ssha_interp_20_ku (time_20_ku) *interpolated sea-surface height anomaly*	m		Interpolated sea surface height anomaly

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L2 Product			
Variable Name (dim1,…,dim N) ***long_name***	**units**	**Standard_name**	**EE Field**
ssha_interp_numval_20_ku (time_20_ku) *number of ssha interpolation points*	count		Number of interpolated records for SSHA
ssha_interp_rms_20_ku (time_20_ku) *ssha interpolation error*	m		SSHA interpolation quality
peakiness_20_ku (time_20_ku) *20 Hz waveform peakiness*			Peakiness
peakiness_plrm_20_ku (time_plrm_20_ku) *20 Hz waveform peakiness*			Peakiness
flag_cor_applied_20_ku (time_20_ku) *corrections application flag*			Correction application flags
flag_cor_applied_plrm_20_ku (time_plrm_20_ku) *corrections application flag*			Correction application flags
range_3_20_ku(time_20_ku)	m	Altimeter Range	
range_ocog_plrm_20_ku(time_plrm_20_ku)	m	Altimeter Range	
retracker_1_quality_20_ku (time_20_ku) *quality metric (retracker 1)*			Retracker 1 quality value
retracker_2_quality_20_ku (time_20_ku) *quality metric (retracker 2)*			Retracker 2 quality value

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L2 Product			
Variable Name (dim1,…,dim N) ***long_name***	**units**	**Standard_name**	**EE Field**
retracker_3_quality_20_ku (time_20_ku) *quality metric (retracker 3)*			Retracker 3 quality value
sea_ice_freeboard_20_ku(time_20_ku)	m	sea ice freeboard	
sea_ice_thickness_20_ku(time_20_ku)	m	sea ice thickness	
ice_density_20_ku(time_20_ku)	kg/m^3	Ice density	
water_density_20_ku(time_20_ku)	kg/m^3	Sea_water_density	
uso_cor_plrm_20_ku(time_plrm_20_ku) *uso correction applied to window delay (2-way)*	s		

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3.2 L2 CDL DUMP

3.2.1 alt_01(time_cor_01)

```
 int alt_01(time_cor_01);
        alt_01:units = "m";
        alt_01:_FillValue = -2147483648;
        alt_01:long_name = "Altitude of CoM above reference ellipsoid";
        alt_01:standard_name = "height_above_reference_ellipsoid";
        alt_01:scale_factor = 0.001;
        alt_01:coordinates = "lon_01 lat_01";
        alt_01:comment = "Altitude of satellite CoM above reference ellipsoid
(WGS84).";
```

3.2.2 cats2008_tide_01(time_cor_01)

```
 int cats2008_tide_01(time_cor_01) ;
        cats2008_tide_01:_FillValue = -2147483648;
        cats2008_tide_01:comment = "CATS2008 tide correction. This correction is
not applied during L2 processing, and is supplied here so that data users can
remove the applied tide corrections and replace them with CATS2008 if desired.
The field [cats2008_tide_01] is a replacement for [ocean_tide_01] +
[ocean_tide_eq_01]. The convention for range corrections is that they should be
added to range (or subtracted from a height) to apply them. To apply CATS2008 to
range, the user has to compute range_new = range - ocean_tide_01 -
ocean_tide_eq_01 + cats2008_tide_01. CATS2008 does not include a separate load
tide component, so users could remove load_tide_01 as well and add a percentage
of cats2008_tide_01 as a loading tide correction. The CATS2008 tide correction is
only provided for the circum-Antarctic ocean." ;
        cats2008_tide_01:coordinates = "lon_01 lat_01" ;
        cats2008_tide_01:institution = "OSU" ;
        cats2008_tide_01:long_name = "CATS2008 tide correction" ;
        cats2008_tide_01:scale_factor = 0.001 ;
        cats2008_tide_01:source = "CATS2008 is available for download through the
U.S. Antarctic Program Data Center: Data DOI: 10.15784/601235" ;
        cats2008_tide_01:units = "m" ;
```

3.2.3 cats2008_tide_plrm_01(time_cor_plrm_01)

```
 int cats2008_tide_plrm_01(time_cor_plrm_01) ;
        cats2008_tide_plrm_01:_FillValue = -2147483648;
        cats2008_tide_plrm_01:comment = "CATS2008 tide correction. This
correction is not applied during L2 processing, and is supplied here so that data
users can remove the applied tide corrections and replace them with CATS2008 if
desired. The field [cats2008_tide_01] is a replacement for [ocean_tide_01] +
[ocean_tide_eq_01]. The convention for range corrections is that they should be
added to range (or subtracted from a height) to apply them. To apply CATS2008 to
range, the user has to compute range_new = range - ocean_tide_01 -
ocean_tide_eq_01 + cats2008_tide_01. CATS2008 does not include a separate load
tide component, so users could remove load_tide_01 as well and add a percentage
of cats2008_tide_01 as a loading tide correction. The CATS2008 tide correction is
only provided for the circum-Antarctic ocean." ;
        cats2008_tide_plrm_01:coordinates = "lon_plrm_01 lat_plrm_01" ;
```

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```
        cats2008_tide_plrm_01:institution = "OSU" ;
        cats2008_tide_plrm_01:long_name = "CATS2008 tide correction" ;
        cats2008_tide_plrm_01:scale_factor = 0.001 ;
        cats2008_tide_plrm_01:source = "CATS2008 is available for download
through the U.S. Antarctic Program Data Center: Data DOI: 10.15784/601235" ;
        cats2008_tide_plrm_01:units = "m" ;
```

3.2.4 distance_to_coast_20_ku(time_20_ku)

```
 short distance_to_coast_20_ku(time_20_ku) ;
        distance_to_coast_20_ku:_FillValue = -32767s ;
        distance_to_coast_20_ku:long_name = "Distance to the coast" ;
        distance_to_coast_20_ku:units = "m" ;
        distance_to_coast_20_ku:scale_factor = 1.e+2 ;
        distance_to_coast_20_ku:comment = "Distance to the closest coast
(negative over land, positive over water bodies)" ;
        distance_to_coast_20_ku:coordinates = "lon_20_ku lat_20_ku" ;
        distance_to_coast_20_ku:institution = "EUMETSAT" ;
        distance_to_coast_20_ku:source = "GSHHG v2.3.7" ;
```

3.2.5 distance_to_coast_01(time_cor_01)

```
 short distance_to_coast_01(time_cor_01) ;
        distance_to_coast_01:_FillValue = -32767s ;
        distance_to_coast_01:long_name = "Distance to the coast" ;
        distance_to_coast_01:units = "m" ;
        distance_to_coast_01:scale_factor = 1.e+2 ;
        distance_to_coast_01:comment = "Distance to the closest coast (negative
over land, positive over water bodies)" ;
        distance_to_coast_01:coordinates = "lon_01 lat_01" ;
        distance_to_coast_01:institution = "EUMETSAT" ;
        distance_to_coast_01:source = "GSHHG v2.3.7" ;
```

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3.2.6 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:comment = "For LRM is the number of echoes averaged to
compute the corresponding L1B 20Hz power waveform. For SAR/SARin 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_20_ku:long_name = "count of echoes or beams averaged" ;
       echo_numval_20_ku:units = "count" ;
```

3.2.7 echo_numval_plrm_20_ku(time_plrm_20_ku)

```
 short echo_numval_plrm_20_ku(time_plrm_20_ku) ;
 echo_numval_plrm_20_ku:_FillValue = -32768s ;
 echo_numval_plrm_20_ku:units = “count” ;
 echo_numval_plrm_20_ku:long_name = “number of echoes averaged” ;
 echo_numval_plrm_20_ku:add_offset = 0s ;
 echo_numval_plrm_20_ku:scale_factor = 1s ;
echo_numval_plrm_20_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_plrm_20_ku:coordinates = “lon_plrm_20_ku lat_plrm_20_ku”;
```

3.2.8 flag_bedmachine_mask_20_ku(time_20_ku)

```
 byte flag_bedmachine_mask_20_ku(time_20_ku) ;
     flag_bedmachine_mask_20_ku:coordinates = "lon_20_ku lat_20_ku" ;
       flag_bedmachine_mask_20_ku:comment = "Mask variable taken from
Bedmachine. For use in locating ice shelves." ;
       flag_bedmachine_mask_20_ku:long_name = "Bedmachine mask" ;
             flag_bedmachine_mask_20_ku:grid_mapping = "mapping" ;
             flag_bedmachine_mask_20_ku:valid_range = 0B, 4B ;
             flag_bedmachine_mask_20_ku:flag_values = 0B, 1B, 2B, 3B, 4B ;
             flag_bedmachine_mask_20_ku:flag_meanings = "ocean ice_free_land
grounded_ice floating_ice lake_vostok" ;
             flag_bedmachine_mask_20_ku:source = "Antarctic Digital Database
(rock outcrop) and Jeremie Mouginot (pers. comm., grounding lines)" ;
             flag_bedmachine_mask_20_ku:_FillValue = -128;
```

3.2.9 flag_cor_applied_20_ku(time_20_ku)

```
 int flag_cor_applied_20_ku(time_20_ku);
 flag_cor_applied_20_ku:_FillValue = -2147483648 ;
 flag_cor_applied_20_ku:long_name = "corrections application flag";
       flag_cor_applied_20_ku:coordinates = "lon_poca_20_ku lat_poca_20_ku";
       flag_cor_applied_20_ku:flag_masks = 1, 4, 8, 16, 32, 64, 128, 256, 512,
1024, 2048, 4096, 8192, 16384, 32768, 65536, 131072, 262144, 524288, 1048576,
```

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```
2097152, 4194304, 8388608, 16777216, 33554432, 67108864, 134217728, 268435456,
536870912;
        flag_cor_applied_20_ku:flag_meanings = "correction_failure
                        sarin_bad_velocity
                        sarin_out_of_range
                        sarin_bad_baseline
                        lrm_slope_model_invalid
                        sarin_ice_bias_applied
                        sarin_ocean_bias_applied
                        sar_ice_bias_applied
                        sar_ocean_bias_applied
                        lrm_ice_bias_applied
                        lrm_ocean_bias_applied
                        lrm_retracker_applied
                        sarin_retracker_applied
                        sar_retracker_applied
                        window_offset_applied
                        slope_doppler_applied
                        pole_tide_applied
                        solid_earth_applied
                        load_tide_applied
                        ocean_tide_equil_applied
                        ocean_tide_applied
                        iono_model_applied
                        iono_gim_applied
                        hf_fluctuations_applied
                        inv_bar_applied
                        model_wet_applied
                        model_dry_applied
                        doppler_applied
                        internal_cal_applied";"
        flag_cor_applied_20_ku:comment = "This flag indicates which corrections
were applied in the computation of the height values in this record. The intent
of this is to allow the user to remove applied corrections and substitute their
own.";
```

3.2.10 flag_cor_applied_plrm_20_ku(time_plrm_20_ku)

```
 int flag_cor_applied_plrm_20_ku(time_20_ku);
 flag_cor_applied_plrm_20_ku:_FillValue = -2147483648 ;
 flag_cor_applied_plrm_20_ku:long_name = "corrections application flag";
        flag_cor_applied_plrm_20_ku:coordinates      =      "lon_poca_plrm_20_ku
lat_poca_20_plrm_ku";
        flag_cor_applied_plrm_20_ku:flag_masks = 1, 4, 8, 16, 32, 64, 128, 256,
512, 1024, 2048, 4096, 8192, 16384, 32768, 65536, 131072, 262144, 524288, 1048576,
2097152, 4194304, 8388608, 16777216, 33554432, 67108864, 134217728, 268435456,
536870912;
        flag_cor_applied_plrm_20_ku:flag_meanings = "correction_failure
                        sarin_bad_velocity
                        sarin_out_of_range
                        sarin_bad_baseline
                        lrm_slope_model_invalid
                        sarin_ice_bias_applied
                        sarin_ocean_bias_applied
                        sar_ice_bias_applied
                        sar_ocean_bias_applied
                        lrm_ice_bias_applied
                        lrm_ocean_bias_applied
                        lrm_retracker_applied
```

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```
                    sarin_retracker_applied
                    sar_retracker_applied
                    window_offset_applied
                    slope_doppler_applied
                    pole_tide_applied
                    solid_earth_applied
                    load_tide_applied
                    ocean_tide_equil_applied
                    ocean_tide_applied
                    iono_model_applied
                    iono_gim_applied
                    hf_fluctuations_applied
                    inv_bar_applied
                    model_wet_applied
                    model_dry_applied
                    doppler_applied
                    internal_cal_applied";"
        flag_cor_applied_plrm_20_ku:comment = "This flag indicates which
corrections were applied in the computation of the height values in this record.
The intent of this is to allow the user to remove applied corrections and
substitute their own.";
```

3.2.1 flag_cor_err_01(time_cor_01)

int flag_cor_err_01(time_cor_01) ;

flag_cor_err_01:_FillValue = -2147483648 ;

flag_cor_err_01:comment = "Correction error flag. This flag shows whether the correction models returned an error." ;

flag_cor_err_01:coordinates = "lon_01 lat_01" ;

flag_cor_err_01:flag_masks = 1, 2, 4, 8, 16, 32, 64, 128, 256, 512, 1024, 2048, 8192, 16384, 32768, 65536, 131072, 262144, 524288, 1048576, 2097152, 4194304 ;

flag_cor_err_01:flag_meanings = "surface_type_error pole_tide_error solid_earth_error load_tide_error ocean_tide_equil_error ocean_tide_error iono_model_error iono_gim_error hf_fluctuations_error inv_bar_error model_wet_error model_dry_error slope_model_error dem_error odle_error geoid_error mss_error snow_density_error snow_depth_error ice_conc_error swh_error wind_error" ;

flag_cor_err_01:long_name = "corrections error flags" ;

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3.2.2 flag_instr_conf_rx_str_in_use_01(time_cor_01)

```
 byte flag_instr_conf_rx_str_in_use_01(time_cor_01);
        flag_instr_conf_rx_str_in_use_01:_FillValue = -128b;
        flag_instr_conf_rx_str_in_use_01:long_name = "star tracker id";
        flag_instr_conf_rx_str_in_use_01:flag_values = 0b, 1b, 2b, 3b, 4b;
        flag_instr_conf_rx_str_in_use_01:flag_meanings     =     "no_star_tracker
                                                          tracker_1      tracker_2
                                                          tracker_3 attref_file";
        flag_instr_conf_rx_str_in_use_01:coordinates = "lon_01 lat_01";
        flag_instr_conf_rx_str_in_use_01: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.";
```

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3.2.3 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 = "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:coordinates = "lon_20_ku lat_20_ku" ;
        flag_instr_mode_op_20_ku:comment = "Instrument measurement mode derived
from configuration bits in L0.";
```

3.2.4 flag_prod_status_20_ku(time_20_ku)

```
 int flag_prod_status_20_ku(time_20_ku) ;
        flag_prod_status_20_ku:_FillValue = -2147483648 ;
        flag_prod_status_20_ku:long_name = "quality flag" ;
        flag_prod_status_20_ku:coordinates = "lon_poca_20_ku lat_poca_20_ku" ;
        flag_prod_status_20_ku:flag_masks = 1, 2, 4, 8, 16, 32, 64, 128, 256,
512, 1024, 2048, 4096, 8192, 16384, 32768, 65536, 131072, 262144, 524288, 1048576,
2097152, 4194304, 8388608, 16777216, 33554432, 67108864, 134217728, 268435456 ,
536870912, 1073741824 ; ;
        flag_prod_status_20_ku:flag_meanings       =       "calibration_warning
sarin_bad_velocity sarin_out_of_range sarin_bad_baseline lrm_slope_model_invalid
delta_time_error           mispointing_error           surface_model_unavailable
sarin_side_redundant  sarin_rx_2_error  sarin_rx_1_error  sarin_height_ambiguous
surf_type_class_undefined      surf_type_class_sea_ice      surf_type_class_lead
surf_type_class_ocean    freeboard_error    peakiness_error    ssha_interp_error
sig0_3_error    sig0_2_error    sig0_1_error    height_3_error    height_2_error
height_1_error       orbit_discontinuity       orbit_error       block_degraded
height_sea_ice_error sarin_height_unwrap sarin_off_nadir_lead" ;
        flag_prod_status_20_ku:comment = "Flags indicating the quality of the
20Hz measurement parameters. The surface type discriminated by the SAR chain is
also packed within this flag. An error flag for height or backscatter when the
corresponding field is not set to _FillValue means that the result should
typically be rejected, but could be of use for certain specialised users who
prefer degraded data to no data." ;
```

3.2.5 flag_prod_status_plrm_20_ku(time_plrm_20_ku)

```
 int flag_prod_status_plrm_20_ku(time_plrm_20_ku) ;
        flag_prod_status_plrm_20_ku:_FillValue = -2147483648 ;
        flag_prod_status_plrm_20_ku:long_name = "quality flag" ;
        flag_prod_status_plrm_20_ku:coordinates      =      "lon_poca_plrm_20_ku
lat_poca_plrm_20_ku" ;
        flag_prod_status_plrm_20_ku:flag_masks = 1, 2, 4, 8, 16, 32, 64, 128,
256, 512, 1024, 2048, 4096, 8192, 16384, 32768, 65536, 131072, 262144, 524288,
1048576, 2097152, 4194304, 8388608, 16777216, 33554432, 67108864, 134217728,
268435456 , 536870912, 1073741824 ; ;
        flag_prod_status_plrm_20_ku:flag_meanings     =     "calibration_warning
sarin_bad_velocity sarin_out_of_range sarin_bad_baseline lrm_slope_model_invalid
delta_time_error           mispointing_error           surface_model_unavailable
sarin_side_redundant  sarin_rx_2_error  sarin_rx_1_error  sarin_height_ambiguous
surf_type_class_undefined      surf_type_class_sea_ice      surf_type_class_lead
surf_type_class_ocean    freeboard_error    peakiness_error    ssha_interp_error
sig0_3_error    sig0_2_error    sig0_1_error    height_3_error    height_2_error
```

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```
height_1_error       orbit_discontinuity       orbit_error       block_degraded
height_sea_ice_error sarin_height_unwrap sarin_off_nadir_lead" ;
        flag_prod_status_plrm_20_ku:comment = "Flags indicating the quality of
the 20Hz measurement parameters. The surface type discriminated by the SAR chain
is also packed within this flag. An error flag for height or backscatter when the
corresponding field is not set to _FillValue means that the result should
typically be rejected, but could be of use for certain specialised users who
prefer degraded data to no data." ;
```

3.2.6 flag_sea_ice_type_20_ku(time_20_ku)

```
 byte flag_sea_ice_type_20_ku(time_20_ku) ;
        flag_sea_ice_type_20_ku:_FillValue = -128b ;
        flag_sea_ice_type_20_ku:comment = "Flag indicating sea ice type. Unused
in LRM mode." ;
        flag_sea_ice_type_20_ku:coordinates = "lon_20_ku lat_20_ku" ;
        flag_sea_ice_type_20_ku:flag_masks = 1b, 2b, 3b, 4b ;
        flag_sea_ice_type_20_ku:flag_meanings   =   "open_water   first_year_ice
multi_year_ice ambiguous" ;
        flag_sea_ice_type_20_ku:institution = "EUMETSAT OSI SAF" ;
        flag_sea_ice_type_20_ku:long_name = "sea ice type flag" ;
        flag_sea_ice_type_20_ku:source = "OSI SAF Sea Ice Edge and Type Product"
;
```

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3.2.7 geoid_01(time_cor_01)

```
int geoid_01(time_cor_01);
       geoid_01:units = "m";
       geoid_01:_FillValue = -2147483648;
       geoid_01:long_name = "geoid height";
       geoid_01:standard_name = "geoid_height_above_reference_ellipsoid";
       geoid_01:scale_factor = 0.001;
       geoid_01:coordinates = "lon_01 lat_01";
       geoid_01:source = "EGM2008";
       geoid_01:institution = "NGIA and SGT";
       geoid_01:comment = "Computed from the geoid model with a correction to
refer the value to the mean tide system i.e. includes the permanent tide (zero
frequency), and referenced to WGS84. See Pavlis, N. K., S. A.Holmes, S. C.Kenyon,
and J. K.Factor (2012), The development and evaluation of the Earth Gravitational
Model 2008 (EGM2008), J. Geophys. Res., 117, B04406, doi:10.1029/2011JB008916."
;
```

3.2.8 height_1_20_ku(time_20_ku)

```
int height_1_20_ku (time_20_ku);
       height_1_20_ku:units = "m";
       height_1_20_ku:_FillValue = -2147483648;
       height_1_20_ku:long_name = "surface height (retracker 1)";
       height_1_20_ku:standard_name = "height_above_reference_ellipsoid";
       height_1_20_ku:scale_factor = 0.001;
       height_1_20_ku:coordinates = "lon_poca_20_ku lat_poca_20_ku ";
       height_1_20_ku:comment = "Measured height of the surface above the
reference ellipsoid (WGS84) at the coordinate location [lon_poca_20_ku]
[lat_poca_20_ku]. All instrumental [instr_cor_range_rx_20_ku] and appropriate
geophysical corrections included (see [flag_cor_applied_20_ku] for the set of
corrections applied), and system bias. Corrected for surface slope via a slope
model in LRM and SARin degraded mode. Corrected for surface slope via phase
information in SARin mode. Contains the Ocean CFI retracker result in LRM mode,
the UCL sea-ice retracker results in SAR mode (different method for specular and
diffuse echoes), and the UCL margins retracker in SARin mode. ";
```

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3.2.9 height_2_20_ku(time_20_ku)

```
 int height_2_20_ku(time_20_ku);
       height_2_20_ku:units = "m";
       height_2_20_ku:_FillValue = -2147483648;
       height_2_20_ku:long_name = "surface height (retracker 2)";
       height_2_20_ku:standard_name = "height_above_reference_ellipsoid";
       height_2_20_ku:scale_factor = 0.001;
       height_2_20_ku:coordinates = "lon_poca_20_ku lat_poca_20_ku";
       height_2_20_ku:comment = "Measured height of the surface above the
reference ellipsoid (WGS84) at the coordinate location [lon_poca_20_ku]
[lat_poca_20_ku]. All instrumental [instr_cor_range_rx_20_ku] and appropriate
geophysical corrections included (see [flag_cor_applied_20_ku] for the set of
corrections applied), and system bias. Corrected for surface slope via a slope
model in LRM. Not currently used in SAR and SARin modes. Contains the UCL land-
ice retracker in LRM mode.";
```

3.2.10 height_3_20_ku(time_20_ku)

```
 int height_3_20_ku(time_20_ku);
       height_3_20_ku:units = "m";
       height_3_20_ku:_FillValue = -2147483648;
       height_3_20_ku:long_name = "surface height (retracker 3)";
       height_3_20_ku:standard_name = "height_above_reference_ellipsoid";
       height_3_20_ku:scale_factor = 0.001;
       height_3_20_ku:coordinates = "lon_poca_20_ku lat_poca_20_ku";
       height_3_20_ku:comment = "Measured height of the surface above the
reference ellipsoid (WGS84) at the coordinate location [lon_poca_20_ku]
[lat_poca_20_ku]. All instrumental [instr_cor_range_rx_20_ku] and appropriate
geophysical corrections included (see [flag_cor_applied_20_ku] for the set of
corrections applied), and system bias. Corrected for surface slope via a slope
model in LRM. Not currently used in SAR and SARin modes. Contains the OCOG
retracker in LRM mode.";
```

3.2.11 height_ocog_plrm_20_ku(time_plrm_20_ku)

```
 int height_ocog_plrm_20_ku(time_plrm_20_ku);
       height_ocog_plrm_20_ku:units = "m";
       height_ocog_plrm_20_ku:_FillValue = -2147483648;
       height_ocog_plrm_20_ku:long_name = "surface height (retracker 3)";
       height_ocog_plrm_20_ku:standard_name                                =
"height_above_reference_ellipsoid";
       height_ocog_plrm_20_ku:scale_factor = 0.001;
       height_ocog_plrm_20_ku:coordinates        =        "lon_poca_plrm_20_ku
lat_poca_plrm_20_ku";
       height_ocog_plrm_20_ku:comment = "Measured height of the surface above
the reference ellipsoid (WGS84) at the coordinate location [lon_poca_plrm_20_ku]
[lat_poca_plrm_20_ku].   All   instrumental   [instr_cor_range_rx_20_ku]   and
appropriate geophysical corrections included (see [flag_cor_applied_20_ku] for
the set of corrections applied), and system bias. Corrected for surface slope via
a slope model in LRM. Not currently used in SAR and SARin modes. Contains the
OCOG retracker in LRM mode.";
```

3.2.12 height_sea_ice_floe_20_ku (time_20_ku)

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```
 int height_sea_ice_floe_20_ku(time_20_ku) ;
        height_sea_ice_floe_20_ku:units = "m" ;
        height_sea_ice_floe_20_ku:_FillValue = -2147483648 ;
        height_sea_ice_floe_20_ku:long_name = "surface height (sea-ice floe
retracker)" ;
        height_sea_ice_floe_20_ku:standard_name =
"height_above_reference_ellipsoid" ;
        height_sea_ice_floe_20_ku:scale_factor = 0.001 ;
        height_sea_ice_floe_20_ku:coordinates = "lon_poca_20_ku lat_poca_20_ku"
;
        height_sea_ice_floe_20_ku:comment = "Measured height of the surface above
the reference ellipsoid (WGS84) at the coordinate location [lon_poca_20_ku]
[lat_poca_20_ku]. All instrumental [instr_cor_range_rx_20_ku] and appropriate
geophysical corrections included (see [flag_cor_applied_20_ku] for the set of
corrections applied), and system bias. Only filled if the sea-ice floe retracker
ran. This retracker is run over all surfaces not discriminated as a sea-ice lead,
not just over sea-ice floes" ;
```

3.2.13 height_sea_ice_lead_20_ku (time_20_ku)

```
 int height_sea_ice_lead_20_ku(time_20_ku) ;
        height_sea_ice_lead_20_ku:units = "m" ;
        height_sea_ice_lead_20_ku:_FillValue = -2147483648 ;
        height_sea_ice_lead_20_ku:long_name = "surface height (sea-ice floe
retracker)" ;
        height_sea_ice_lead_20_ku:standard_name =
"height_above_reference_ellipsoid" ;
        height_sea_ice_lead_20_ku:scale_factor = 0.001 ;
        height_sea_ice_lead_20_ku:coordinates = "lon_poca_20_ku lat_poca_20_ku"
;
        height_sea_ice_lead_20_ku:comment = "Measured height of the surface above
the reference ellipsoid (WGS84) at the coordinate location [lon_poca_20_ku]
[lat_poca_20_ku]. All instrumental [instr_cor_range_rx_20_ku] and appropriate
geophysical corrections included (see [flag_cor_applied_20_ku] for the set of
corrections applied), and system bias. Only filled if the sea-ice lead retracker
ran." ;
```

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3.2.14 hf_fluct_total_cor_01(time_cor_01)

```
short hf_fluct_total_cor_01(time_cor_01);
       hf_fluct_total_cor_01:units = "m";
       hf_fluct_total_cor_01:_FillValue = -32768s;
       hf_fluct_total_cor_01:long_name = "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:scale_factor = 0.001;
       hf_fluct_total_cor_01:coordinates = "lon_01 lat_01";
       hf_fluct_total_cor_01:source = "MOG2D 2.1.0";
       hf_fluct_total_cor_01:institution = "LEGOS/CLS/CNES";
                    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 omputed 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\tThis correction has been accounted for during the computation of height
(see [flag_cor_applied_20_ku] to determine if it was applied) 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." ;
```

3.2.15 ice_density_01(time_cor_01)

```
short ice_density_01(time_cor_01) ;
                    ice_density_01:_FillValue = -32768s ;
                    ice_density_01:comment = "Sea ice density. Interpolated from
a monthly model file. Can contain different values for FYI and MYI. Unused in
LRM mode." ;
                    ice_density_01:coordinates = "lon_01 lat_01" ;
                    ice_density_01:institution = "UCL" ;
                    ice_density_01:long_name = "ice density" ;
                    ice_density_01:scale_factor = 1. ;
                    ice_density_01:source = "UCL AUX_DENSSI from A. Jutila, S.
Hendricks, R. Ricker, L. von Albedyll, T. Krumpen, and C. Haas, 'Retrieval and
parameterisation of sea-ice bulk density from airborne multi-sensor
measurements', The Cryosphere, vol. 16, no. 1, pp. 259–275, Jan. 2022, doi:
10.5194/tc-16-259-2022. and M. Bocquet, S. Fleury, F. Rémy, and F. Piras, 'Arctic
and Antarctic Sea Ice Thickness and Volume Changes From Observations Between
1994 and 2023', JGR Oceans, vol. 129, no. 11, Nov. 2024, doi:
10.1029/2023jc020848." ;
                    ice_density_01:units = "kg/m^3" ;
```

3.2.16 water_density_01(time_cor_01)

```
short water_density_01(time_cor_01) ;
                    water_density_01:_FillValue = -32768s ;
                    water_density_01:comment = "Sea water density. Interpolated
from a model file, currently filled with an average value. Unused in LRM mode.";
                    water_density_01:coordinates = "lon_01 lat_01" ;
                    water_density_01:institution = "UCL" ;
                    water_density_01:long_name = "water density" ;
                    water_density_01:scale_factor = 1. ;
```

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```
                    water_density_01:source = "UCL AUX_DENSSI from V.
 Alexandrov, S. Sandven, J. Wahlin, and O. M. Johannessen, 'The relation between
 sea ice thickness and freeboard in the Arctic', The Cryosphere, vol. 4, no. 3,
 pp. 373–380, 2010, doi: 10.5194/tc-4-373-2010." ;
                    water_density_01:standard_name = "sea_water_density" ;
                    water_density_01:units = "kg/m^3" ;
```

3.2.17 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." ;
       ind_first_meas_20hz_01:long_name = "index of the first 20Hz measurement:
1 Hz" ;
       ind_first_meas_20hz_01:coordinates = "lon_01 lat_01" ;
       ind_first_meas_20hz_01:units = "count" ;
```

3.2.18 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:long_name = "index of the 1Hz measurement: 20 Hz ku
band" ;
       ind_meas_1hz_20_ku:coordinates = "lon_20_ku lat_20_ku" ;
       ind_meas_1hz_20_ku:units = "count" ;
```

3.2.19 inv_bar_cor_01(time_cor_01)

```
 short inv_bar_cor_01(time_cor_01);
       inv_bar_cor_01:units = "m";
       inv_bar_cor_01:_FillValue = -32768s;
       inv_bar_cor_01:long_name = "inverse barometric correction";
       inv_bar_cor_01:standard_name                                    =
"sea_surface_height_correction_due_to_air_pressure_at_low_frequency";
       inv_bar_cor_01:scale_factor = 0.001;
       inv_bar_cor_01:coordinates = "lon_01 lat_01";
       inv_bar_cor_01:source = "European Center for Medium Range Weather
Forecasting ";
       inv_bar_cor_01:institution = "ECMWF";
       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 has been accounted for during the computation of height (see
[flag_cor_applied_20_ku] to determine if it was applied) 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.";
```

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3.2.20 iono_cor_01(time_cor_01)

```
 short iono_cor_01(time_cor_01);
        iono_cor_01:units = "m";
        iono_cor_01:_FillValue = -32768s;
        iono_cor_01:long_name = "model ionospheric correction";
        iono_cor_01:standard_name                                                    =
"altimeter_range_correction_due_to_ionosphere";
        iono_cor_01:scale_factor = 0.001;
        iono_cor_01:coordinates = "lon_01 lat_01";
        iono_cor_01:source = "Bent";
        iono_cor_01:institution = "Bent";
        iono_cor_01:comment = "Model ionospheric correction. This 1-way
correction has been accounted for during the computation of height (see
[flag_cor_applied_20_ku] to determine if it was applied) 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.";
```

3.2.21 iono_cor_gim_01(time_cor_01)

```
 short iono_cor_gim_01(time_cor_01);
        iono_cor_gim_01:units = "m";
        iono_cor_gim_01:_FillValue = -32768s;
        iono_cor_gim_01:long_name = "GIM ionospheric correction";
        iono_cor_gim_01:standard_name                                                =
"altimeter_range_correction_due_to_ionosphere";
        iono_cor_gim_01:scale_factor = 0.001;
        iono_cor_gim_01:coordinates = "lon_01 lat_01";
        iono_cor_gim_01:source = "GIM";
        iono_cor_gim_01:institution = "NASA/JPL";
        iono_cor_gim_01:comment = "GIM ionospheric correction. This correction
 has been accounted for during the computation of height (see
 [flag_cor_applied_20_ku] to determine if it was applied) 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."
 ;
```

3.2.22 larm_wf_metric_1_20_ku(time_20_ku)

```
        int larm_wf_metric_1_20_ku(time_20_ku) ;
                    larm_wf_metric_1_20_ku:_FillValue = -2147483648;
                    larm_wf_metric_1_20_ku:comment = "Value of sigma_si fitted
 by the LARM retracker that represents the millimeter-centimeter Ku-band
 wavelength-scale surface roughness of the primary backscattering interface.
 Contains the LARM retracker results in SAR or SARIn mode, if that retracker has
 been activated. For LARM details see DOI 10.1029/2019JC015820" ;
                    larm_wf_metric_1_20_ku:coordinates    =    "lon_poca_20_ku
 lat_poca_20_ku" ;
                    larm_wf_metric_1_20_ku:long_name = "LARM waveform metric 1
 (sigma_si)" ;
                    larm_wf_metric_1_20_ku:scale_factor = 1E-6 ;
                    larm_wf_metric_1_20_ku:units = "m" ;
```

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3.2.23 larm_wf_metric_2_20_ku(time_20_ku)

```
        int larm_wf_metric_2_20_ku(time_20_ku) ;
                    larm_wf_metric_2_20_ku:_FillValue = -2147483648;
                    larm_wf_metric_2_20_ku:comment = "Value of sigma_surf
  fitted by the LARM retracker that represents the 1-100s m footprint-scale
  topography of the primary backscattering interface. Contains the LARM retracker
  results in SAR or SARIn mode, if that retracker has been activated. For LARM
  details see DOI 10.1029/2019JC015820" ;
                    larm_wf_metric_2_20_ku:coordinates = "lon_poca_20_ku
  lat_poca_20_ku" ;
                    larm_wf_metric_2_20_ku:long_name = "LARM waveform metric 2
  (sigma_surf)" ;
                    larm_wf_metric_2_20_ku:scale_factor = 1E-6 ;
                    larm_wf_metric_2_20_ku:units = "m" ;
```

3.2.24 lat_01(time_cor_01)

```
  int lat_01(time_cor_01);
        lat_01:units = "degrees_north";
        lat_01:_FillValue = -2147483648;
        lat_01:long_name = "latitude";
        lat_01:standard_name = "latitude";
        lat_01:scale_factor = 1.e-07;
        lat_01:comment = "Latitude of nadir location [-90,+90]. Positive latitude
  is North latitude, negative latitude is South latitude. Note the scale factor.";
```

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

3.2.26 lat_poca_20_ku(time_20_ku)

```
 int lat_poca_20_ku(time_20_ku);
        lat_poca_20_ku:units = "degrees_north";
        lat_poca_20_ku:_FillValue = -2147483648;
        lat_poca_20_ku:long_name = "latitude of the estimated echo location
(POCA)";
        lat_poca_20_ku:standard_name = "latitude";
        lat_poca_20_ku:scale_factor = 1.e-07;
        lat_poca_20_ku:comment = "Latitude of estimated echo location (point of
closest approach) [-90,+90]. Positive latitude is North latitude, negative
latitude is South latitude. Note the scale factor. Set to the nadir location if
uncorrected, so it always available to use as a plotting coordinate.";
```

3.2.27 lat_poca_plrm_20_ku(time_plrm_20_ku)

```
 int lat_poca_plrm_20_ku(time_plrm_20_ku);
        lat_poca_plrm_20_ku:units = "degrees_north";
        lat_poca_plrm_20_ku:_FillValue = -2147483648;
        lat_poca_plrm_20_ku:long_name = "latitude of the estimated echo location
(POCA)";
        lat_poca_plrm_20_ku:standard_name = "latitude";
        lat_poca_plrm_20_ku:scale_factor = 1.e-07;
        lat_poca_plrm_20_ku:comment = "Latitude of estimated echo location (point
of closest approach) [-90,+90]. Positive latitude is North latitude, negative
latitude is South latitude. Note the scale factor. Set to the nadir location if
uncorrected, so it always available to use as a plotting coordinate. All this
lat/lon variables are for plrm geophysical variables ";
```

3.2.28 lat_plrm_20_ku(time_plrm_20_ku)

```
int lat_plrm_20_ku(time_plrm_20_ku) ;
 lat_plrm_20_ku:_FillValue = -2147483648 ;
 lat_plrm_20_ku:units = “degrees_north” ;
 lat_plrm_20_ku:long_name = “latitude of measurement” ;
 lat_plrm_20_ku:standard_name = “latitude” ;
 lat_plrm_20_ku:add_offset = 0. ;
 lat_plrm_20_ku:scale_factor = 1.e-07 ;
```

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lat_plrm_20_ku:comment = "Latitude of nadir location [-90,+90]. Positive latitude is North latitude, negative latitude is South latitude. Note the scale factor." ;
lat_plrm_20_ku:coordinates = "lon_plrm_20_ku lat_plrm_20_ku";

3.2.29 load_tide_01(time_cor_01)

```
short load_tide_01(time_cor_01);
       load_tide_01:units = "m";
       load_tide_01:_FillValue = -32768s;
       load_tide_01:long_name = "ocean loading tide height";
       load_tide_01:scale_factor = 0.001;
       load_tide_01:source = "FES2022b";
       load_tide_01:institution = "LEGOS/CNES";
       load_tide_01:coordinates = "lon_01 lat_01";
       load_tide_01:comment = "Ocean loading tide. This 1-way correction has
been accounted for during the computation of height (see [flag_cor_applied_20_ku]
to determine if it was applied) to remove the effect of local tidal distortion
to the Earth's crust, caused by increasing weight of ocean as local water tide
rises. This correction accounts for heigh of the diurnal and semi-diurnal and the
heigh of the long period wave constituents of the tidal spectrum. It is set to
nan if no data is available at the given position. Geocentric elastic tide is
given by [load_tide_01]+[ocean_tide_01] ";
```

3.2.30 lon_01(time_cor_01)

```
int lon_01(time_cor_01);
       lon_01:units = "degrees_east";
       lon_01:_FillValue = -2147483648;
       lon_01:long_name = "longitude";
       lon_01:standard_name = "longitude";
       lon_01:scale_factor = 1.e-07;
       lon_01:comment = "Longitude of the nadir location [-180,+180]. East
longitude relative to Greenwich meridian. Note the scale factor.";
```

3.2.31 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";
       lon_20_ku:scale_factor = 1.e-07;
       lon_20_ku:comment = "Longitude of nadir location [-180,+180]. East
longitude relative to Greenwich meridian. Note the scale factor.";
```

3.2.32 lon_poca_20_ku(time_20_ku)

```
int lon_poca_20_ku(time_20_ku);
       lon_poca_20_ku:units = "degrees_east";
       lon_poca_20_ku:_FillValue = -2147483648;
       lon_poca_20_ku:long_name = "longitude of the estimated echo location
(POCA)";
       lon_poca_20_ku:standard_name = "longitude";
```

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```
        lon_poca_20_ku:scale_factor = 1.e-07;
        lon_poca_20_ku:comment = "Longitude of estimated echo location (point of
closest approach) [-180,+180. East longitude relative to Greenwich meridian. Note
the scale factor. Set to the nadir location if uncorrected, so it always available
to use as a plotting coordinate.";
```

3.2.33 lon_poca_plrm_20_ku(time_plrm_20_ku)

```
 int lon_poca_plrm_20_ku(time_plrm_20_ku);
        lon_poca_plrm_20_ku:units = "degrees_east";
        lon_poca_plrm_20_ku:_FillValue = -2147483648;
        lon_poca_plrm_20_ku:long_name = "longitude of the estimated echo location
(POCA)";
        lon_poca_plrm_20_ku:standard_name = "longitude";
        lon_poca_plrm_20_ku:scale_factor = 1.e-07;
        lon_poca_plrm_20_ku:comment = "Longitude of estimated echo location
(point of closest approach) [-180,+180. East longitude relative to Greenwich
meridian. Note the scale factor. Set to the nadir location if uncorrected, so it
always available to use as a plotting coordinate.";
```

3.2.34 lon_plrm_20_ku(time_plrm_20_ku)

```
int lon_plrm_20_ku(time_plrm_20_ku) ;
 lon_plrm_20_ku:_FillValue = -2147483648 ;
 lon_plrm_20_ku:units = “degrees_east” ;
 lon_plrm_20_ku:long_name = “longitude of measurement” ;
 lon_plrm_20_ku:standard_name = “longitude” ;
 lon_plrm_20_ku:add_offset = 0. ;
 lon_plrm_20_ku:scale_factor = 1.e-07 ;
lon_plrm_20_ku:comment = “Longitude of nadir location [-180,+180]. Positive
longitude is East relative to Greenwich meridian. Note the scale factor.” ;
lon_plrm_20_ku:coordinates = “lon_plrm_20_ku lat_plrm_20_ku”;
```

3.2.35 mean_sea_surf_sea_ice_01(time_cor_01)

```
 int mean_sea_surf_sea_ice_01(time_cor_01);
        mean_sea_surf_sea_ice_01:units = "m";
        mean_sea_surf_sea_ice_01:_FillValue = -2147483648;
        mean_sea_surf_sea_ice_01:long_name = "mean sea surface height";
        mean_sea_surf_sea_ice_01:standard_name                                  =
"sea_surface_height_above_reference_ellipsoid";
        mean_sea_surf_sea_ice_01:source = "DTU21";
        mean_sea_surf_sea_ice_01:institution = "DTU";
        mean_sea_surf_sea_ice_01:scale_factor = 0.001;
        mean_sea_surf_sea_ice_01:coordinates = "lon_01 lat_01";

        mean_sea_surf_sea_ice_01:comment = "Mean sea surface model, referenced to
the WGS84 ellipsoid, from DTU21 model." ;
```

3.2.36 mod_dry_tropo_cor_01(time_cor_01)

```
 short mod_dry_tropo_cor_01(time_cor_01);
        mod_dry_tropo_cor_01:units = "m";
        mod_dry_tropo_cor_01:_FillValue = -32768s;
```

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```
        mod_dry_tropo_cor_01:long_name = "dry tropospheric correction";
        mod_dry_tropo_cor_01:standard_name                                    =
"altimeter_range_correction_due_to_dry_troposphere";
        mod_dry_tropo_cor_01:scale_factor = 0.001;
        mod_dry_tropo_cor_01:coordinates = "lon_01 lat_01";
        mod_dry_tropo_cor_01:source = "European Center for Medium Range Weather
Forecasting ";
        mod_dry_tropo_cor_01:institution = "ECMWF";
        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 has been accounted for during the computation of height (see
[flag_cor_applied_20_ku] to determine if it was applied) in order to correct for
the propagation delay to the radar pulse, caused by the dry-gas component of the
Earth\'s atmosphere." ;
```

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3.2.37 mod_wet_tropo_cor_01(time_cor_01)

```
 short mod_wet_tropo_cor_01(time_cor_01);
        mod_wet_tropo_cor_01:units = "m";
        mod_wet_tropo_cor_01:_FillValue = -32768s;
        mod_wet_tropo_cor_01:long_name = "wet tropospheric correction";
        mod_wet_tropo_cor_01:standard_name                                    =
"altimeter_range_correction_due_to_wet_troposphere";
        mod_wet_tropo_cor_01:scale_factor = 0.001;
        mod_wet_tropo_cor_01:coordinates = "lon_01 lat_01";
        mod_wet_tropo_cor_01:source = "European Center for Medium Range Weather
Forecasting ";
        mod_wet_tropo_cor_01:institution = "ECMWF";
        mod_wet_tropo_cor_01:comment = "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 has been accounted for during the computation of height (see
[flag_cor_applied_20_ku] to determine if it was applied) in order to correct for
the propagation delay to the radar pulse, caused by the H~2~O component of the
Earth's atmosphere.";
```

3.2.38 num_valid_01(time_cor_01)

```
 byte num_valid_01(time_cor_01);
        num_valid_01:_FillValue = 128b;
        num_valid_01:units = "count";
        num_valid_01:long_name = "number of valid measurements";
        num_valid_01:coordinates = "lon_01 lat_01";
        num_valid_01:comment = "Count of the number of records in the meas_ind
dimension that are valid.";
```

3.2.39 ocean_tide_01(time_cor_01)

```
 short ocean_tide_01(time_cor_01);
        ocean_tide_01:units = "m";
        ocean_tide_01:_FillValue = -32768s;
        ocean_tide_01:long_name = "pure ocean tide height";
        ocean_tide_01:scale_factor = 0.001;
        ocean_tide_01:coordinates = "lon_01 lat_01";
        ocean_tide_01:source = "FES2022b";
        ocean_tide_01:institution = "LEGOS/CNES";
        ocean_tide_01:comment = "Ocean tide. This 1-way correction has been
accounted for during the computation of height (see [flag_cor_applied_20_ku] to
determine if it was applied) 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]. This correction accounts for heigh
of the diurnal and semi-diurnal and the heigh of the long period wave constituents
of the tidal spectrum. It is set to nan if no data is available at the given
position. Geocentric elastic tide is given by [load_tide_01]+[ocean_tide_01] " ;
```

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3.2.40 ocean_tide_eq_01(time_cor_01)

```
short ocean_tide_eq_01(time_cor_01);
       ocean_tide_eq_01:units = "m";
       ocean_tide_eq_01:_FillValue = -32768s;
       ocean_tide_eq_01:long_name = "long-period ocean tide height";
       ocean_tide_eq_01:standard_name                                    =
"sea_surface_height_amplitude_due_to_equilibrium_ocean_tide";
       ocean_tide_eq_01:scale_factor = 0.001;
       ocean_tide_eq_01:coordinates = "lon_01 lat_01";
       ocean_tide_eq_01:source = "Cartwright and Edden [1973] Corrected tables
of tidal harmonics - J. Geophys. J. R. Astr. Soc., 33, 253-264." ;
       ocean_tide_eq_01:institution = "LEGOS/CNES";
       ocean_tide_eq_01:comment = "Equilibrium ocean tide. This correction has
been accounted for during the computation of height (see [flag_cor_applied_20_ku]
to determine if it was applied) to remove the effect of the oceanic response to
the single tidal forcing." ;
```

3.2.41 odle_01(time_cor_01)

```
int odle_01 (time_cor_01);
       odle_01:units = "m";
       odle_01:_FillValue = -2147483648;
       odle_01:long_name = "ocean depth/land elevation";
       odle_01:scale_factor = 0.001;
       odle_01:coordinates = "lon_01 lat_01";
       odle_01:source = "MACESS ";
       odle_01:institution = "ESA/ESRIN";
       odle_01:comment = "Ocean depth and land elevation model. The model is a
merge of ACE land elevation data and Smith and Sandwell ocean bathymetry. See
P. A. M. Berry, R. A. Pinnock, R. D. Hilton, and C. P. D. Johnson, ACE: a new
GDEM incorporating satellite altimeter derived heights,\tESA Pub. SP-461, 9pp,
2000 and W. H. F Smith, and D. T. Sandwell, Global seafloor topography from
satellite altimetry and ship depth soundings, Science, v. 277, p. 1957-1962, 26
Sept., 1997." ;
```

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3.2.42 off_nadir_pitch_angle_str_01(time_cor_01)

```
 int off_nadir_pitch_angle_str_01(time_cor_01);
       off_nadir_pitch_angle_str_01:_FillValue = -2147483648;
       off_nadir_pitch_angle_str_01:units = "degrees";
       off_nadir_pitch_angle_str_01:long_name = "antenna bench pitch angle";
       off_nadir_pitch_angle_str_01:scale_factor = 1.e-07;
       off_nadir_pitch_angle_str_01:coordinates = "lon_01 lat_01";
       off_nadir_pitch_angle_str_01:comment = "Pitch angle with respect to the
nadir pointing, measured by the STRs and post-processed by ground facility.";
```

3.2.43 off_nadir_roll_angle_str_01(time_cor_01)

```
 int off_nadir_roll_angle_str_01(time_cor_01);
       off_nadir_roll_angle_str_01:_FillValue = -2147483648;
       off_nadir_roll_angle_str_01:units = "degrees";
       off_nadir_roll_angle_str_01:long_name = "antenna bench roll angle";
       off_nadir_roll_angle_str_01:scale_factor = 1.e-07;
       off_nadir_roll_angle_str_01:coordinates = "lon_01 lat_01";
       off_nadir_roll_angle_str_01:comment = "Roll angle with respect to the
nadir pointing, measured by the STRs and post-processed by ground facility.";
```

3.2.44 off_nadir_yaw_angle_str_01(time_cor_01)

```
 int off_nadir_yaw_angle_str_01(time_cor_01);
       off_nadir_yaw_angle_str_01:_FillValue = -2147483648;
       off_nadir_yaw_angle_str_01:units = "degrees";
       off_nadir_yaw_angle_str_01:long_name = "antenna bench yaw angle";
       off_nadir_yaw_angle_str_01:scale_factor = 1.e-07;
       off_nadir_yaw_angle_str_01:coordinates = "lon_01 lat_01";
       off_nadir_yaw_angle_str_01:comment = "Yaw angle with respect to the nadir
pointing, measured by the STRs and post-processed by ground facility.";
```

3.2.45 peakiness_20_ku(time_20_ku)

```
 int peakiness_20_ku(time_20_ku);
       peakiness_20_ku:_FillValue = -2147483648;
       peakiness_20_ku:long_name = "waveform peakiness";
       peakiness_20_ku:scale_factor = 0.01;
       peakiness_20_ku:coordinates = "lon_20_ku lat_20_ku" ;
       peakiness_20_ku:comment = "Waveform peakiness. Note that this will
require different interpretation for SAR and SARin echoes which do not have the
typical pulse-limited echo shape. For LRM and SARin, the traditional ENVISAT
derivation is used. This is the ratio of the maximum power in the waveform to the
average of the waveform power to the right hand side of the expected waveform
leading edge location. For SAR mode, waveform bins with no power are excluded
from the average to account for the specular nature of some waveforms. ";
```

3.2.46 peakiness_plrm_20_ku(time_plrm_20_ku)

```
 int peakiness_plrm_20_ku(time_plrm_20_ku);
       peakiness_plrm_20_ku:_FillValue = -2147483648;
       peakiness_plrm_20_ku:long_name = "waveform peakiness";
       peakiness_plrm_20_ku:scale_factor = 0.01;
```

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peakiness_plrm_20_ku:coordinates = "lon_plrm_20_ku lat_plrm_20_ku" ;
peakiness_plrm_20_ku:comment = “Waveform peakiness. For LRM and SARin, the traditional ENVISAT derivation is used. This is the ratio of the maximum power in the waveform to the average of the waveform power to the right hand side of the expected waveform leading edge location.";

3.2.47 pole_tide_01(time_cor_01)

short pole_tide_01(time_cor_01);
pole_tide_01:units = "m";
pole_tide_01:_FillValue = -32768s;
pole_tide_01:long_name = "geocentric pole tide height";
pole_tide_01:standard_name = "sea_surface_height_amplitude_due_to_pole_tide";
pole_tide_01:scale_factor = 0.001;
pole_tide_01:coordinates = "lon_01 lat_01";
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"
pole_tide_01:comment = "Geocentric polar tide.This 1-way correction has been accounted for during the computation of height (see [flag_cor_applied_20_ku] to determine if it was applied) to remove a long-period distortion of the Earth\'s crust. Although called a Ã”tide\' this is in fact caused by variations in centrifugal force as the Earth\'s rotational axis moves its geographic location." ;

3.2.48 radar_freeboard_20_ku(time_20_ku)

short radar_freeboard_20_ku(time_20_ku) ;
radar_freeboard_20_ku:_FillValue = -32768s ;
radar_freeboard_20_ku:comment = " Radar freeboard, the height of the radar scattering horizon above the local sea surface. Computed as [radar_freeboard_20_ku] = [height_1_20_ku] - [ssha_interp_20_ku]. Note that freeboard can be a small negative value due to the effect of random noise (in both the height estimation and the interpolation of the sea surface) on small freeboard values. Unused in LRM mode. " ;
radar_freeboard_20_ku:coordinates = "lon_20_ku lat_20_ku" ;
radar_freeboard_20_ku:long_name = "radar freeboard" ;
radar_freeboard_20_ku:scale_factor = 0.001 ;
radar_freeboard_20_ku:units = "m" ;

3.2.49 range_1_20_ku(time_20_ku)

int range_1_20_ku(time_20_ku) ;
range_1_20_ku:units = "m" ;
range_1_20_ku:_FillValue = -2147483648 ;
range_1_20_ku:long_name = "range to surface (retracker 1)" ;
range_1_20_ku:standard_name = "altimeter_range" ;
range_1_20_ku:scale_factor = 0.001 ;
range_1_20_ku:coordinates = "lon_poca_20_ku lat_poca_20_ku" ;
range_1_20_ku:comment = "Measured range from the satellite CoM to the surface at the coordinate location [lon_poca_20_ku] [lat_poca_20_ku]. All instrumental corrections applied. Contains the Ocean CFI retracker result in LRM mode, the UCL sea-ice retracker results in SAR mode (different method for specular

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and diffuse echoes), and the UCL margins retracker in SARin mode. Does not include geophysical corrections." ;

3.2.50 range_2_20_ku(time_20_ku)

```
 int range_2_20_ku(time_20_ku) ;
        range_2_20_ku:units = "m" ;
        range_2_20_ku:_FillValue = -2147483648 ;
        range_2_20_ku:long_name = "range to surface (retracker 2)" ;
        range_2_20_ku:standard_name = "altimeter_range" ;
        range_2_20_ku:scale_factor = 0.001 ;
        range_2_20_ku:coordinates = "lon_poca_20_ku lat_poca_20_ku" ;
        range_2_20_ku:comment = "Measured range from the satellite CoM to the
surface at the coordinate location [lon_poca_20_ku] [lat_poca_20_ku]. All
instrumental corrections applied.  Not currently used in SAR and SARin modes.
Contains the UCL land-ice retracker in LRM mode. Does not include geophysical
corrections." ;
```

3.2.51 range_3_20_ku(time_20_ku)

```
 int range_3_20_ku(time_20_ku) ;
        range_3_20_ku:units = "m" ;
        range_3_20_ku:_FillValue = -2147483648 ;
        range_3_20_ku:long_name = "range to surface (retracker 3)" ;
        range_3_20_ku:standard_name = "altimeter_range" ;
        range_3_20_ku:scale_factor = 0.001 ;
        range_3_20_ku:coordinates = "lon_poca_20_ku lat_poca_20_ku" ;
        range_3_20_ku:comment = "Measured range from the satellite CoM to the
surface at the coordinate location [lon_poca_20_ku] [lat_poca_20_ku]. All
instrumental corrections applied. Not currently used in SAR and SARin modes.
Contains the OCOG retracker in LRM mode. Does not include geophysical
corrections." ;
```

3.2.1 range_larm_20_ku(time_20_ku)

```
int range_larm_20_ku(time_20_ku) ;
        range_larm_20_ku:_FillValue = -2147483648;
        range_larm_20_ku:comment = "Measured range from the satellite CoM to the
surface at the coordinate location [lon_poca_20_ku] [lat_poca_20_ku]. All
instrumental [instr_cor_range_rx_20_ku] [uso_cor_applied_20_ku] corrections
applied. Unused in LRM mode. Contains the LARM retracker results in SAR or SARIn
mode, if that retracker has been activated. Does not include geophysical
corrections. For LARM details see DOI 10.1029/2019JC015820" ;
        range_larm_20_ku:coordinates = "lon_poca_20_ku lat_poca_20_ku" ;
        range_larm_20_ku:long_name = "range to surface (LARM retracker)" ;
        range_larm_20_ku:scale_factor = 0.001 ;
        range_larm_20_ku:standard_name = "altimeter_range" ;
        range_larm_20_ku:units = "m" ;
```

3.2.2 range_ocog_plrm_20_ku(time_plrm_20_ku)

```
 int range_ocog_plrm_20_ku(time_plrm_20_ku) ;
        range_ocog_plrm_20_ku:units = "m" ;
        range_ocog_plrm_20_ku:_FillValue = -2147483648 ;
        range_ocog_plrm_20_ku:long_name = "range to surface (OCOG retracker)" ;
        range_ocog_plrm_20_ku:standard_name = "altimeter_range" ;
```

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```
        range_ocog_plrm_20_ku:scale_factor = 0.001 ;
        range_ocog_plrm_20_ku:coordinates        =        "lon_poca_plrm_20_ku
lat_poca_plrm_20_ku" ;
        range_ocog_plrm_20_ku:comment = "Measured range from the satellite CoM to
the surface at the coordinate location [lon_poca_20_ku] [lat_poca_20_ku]. All
instrumental corrections applied. Contains the OCOG retracker in LRM mode. Does
not include geophysical corrections." ;
```

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3.2.3 retracker_1_quality_20_ku(time_20_ku)

```
 int retracker_1_quality_20_ku (time_20_ku);
       retracker_1_quality_20_ku:_FillValue = -2147483648;
       retracker_1_quality_20_ku:long_name = "quality metric (retracker 1)";
       retracker_1_quality_20_ku:coordinates = "lon_poca_20_ku lat_poca_20_ku";
       retracker_1_quality_20_ku:comment = "The quality metric (chi^2 of fitted
model) computed by the Ocean CFI retracker in LRM mode, the UCL sea-ice retracker
in SAR mode (over leads only) and the UCL margins retracker in SARin mode.";
```

3.2.4 retracker_2_quality_20_ku(time_20_ku)

```
 int retracker_2_quality_20_ku (time_20_ku);
       retracker_2_quality_20_ku:_FillValue = -2147483648;
       retracker_2_quality_20_ku:long_name = "quality metric (retracker 2)";
       retracker_2_quality_20_ku:coordinates = "lon_poca_20_ku lat_poca_20_ku";
       retracker_2_quality_20_ku:comment = "The quality metric (chi^2 of fitted
model) computed by the UCL land-ice retracker in LRM mode. Unused in SAR and SARin
modes.";
```

3.2.5 retracker_3_quality_20_ku(time_20_ku)

```
 int retracker_3_quality_20_ku (time_20_ku);
       retracker_3_quality_20_ku:_FillValue = -2147483648;
       retracker_3_quality_20_ku:long_name = "quality metric (retracker OCOG)";
       retracker_3_quality_20_ku:coordinates = "lon_poca_20_ku lat_poca_20_ku
";
       retracker_3_quality_20_ku:comment = "Unused in LRM, SAR, and SARin
modes.";
```

3.2.6 sea_ice_concentration_01(time_cor_01)

```
 short sea_ice_concentration_01 (time_cor_01);
       sea_ice_concentration_01:units = "percent";
       sea_ice_concentration_01:_FillValue = -32768s;
       sea_ice_concentration_01:long_name = "sea ice area fraction";
       sea_ice_concentration_01:standard_name = "sea_ice_area_fraction";
       sea_ice_concentration_01:source = "UCL";
       sea_ice_concentration_01:institution = "UCL";
       sea_ice_concentration_01:scale_factor = 1.;
       sea_ice_concentration_01:coordinates = "lon_01 lat_01";
       sea_ice_concentration_01:comment = " Sea ice concentration derived from
NSIDC-0081 (before July 2025) or OSI-408-a data depending on time period. Unused
in LRM mode.";
```

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3.2.7 sea_ice_freeboard_20_ku(time_20_ku)

```
short sea_ice_freeboard_20_ku(time_20_ku) ;
        sea_ice_freeboard_20_ku:_FillValue = -32768s ;
        sea_ice_freeboard_20_ku:comment = "Sea ice freeboard, the height of the
snow-ice interface above the local sea surface. Only output if computation has
been activated. Computed as [sea_ice_freeboard_20_ku] = [radar_freeboard_20_ku]
+ [snow_depth_cor_20_ku]. Unused in LRM mode." ;
        sea_ice_freeboard_20_ku:coordinates = "lon_20_ku lat_20_ku" ;
        sea_ice_freeboard_20_ku:long_name = "sea ice freeboard" ;
        sea_ice_freeboard_20_ku:scale_factor = 0.001 ;
        sea_ice_freeboard_20_ku:units = "m" ;
```

3.2.8 sea_ice_thickness_20_ku(time_20_ku)

```
short sea_ice_thickness_20_ku(time_20_ku) ;
        sea_ice_thickness_20_ku:_FillValue = -32768s ;
        sea_ice_thickness_20_ku:comment =
"Sea ice thickness. Only output if computation has been activated. Computed as (
sea_ice_freeboard_20_ku    *    water_density_20_ku    +    snow_depth_20_ku    *
snow_density_20_ku ) / ( water_density_20_ku - ice_density_20_ku ). Unused in LRM
mode." ;
        sea_ice_thickness_20_ku:coordinates = "lon_20_ku lat_20_ku" ;
        sea_ice_thickness_20_ku:long_name = "sea ice thickness" ;
        sea_ice_thickness_20_ku:scale_factor = 0.001 ;
        sea_ice_thickness_20_ku:units = "m" ;
```

3.2.9 sig0_1_20_ku(time_20_ku)

```
 short sig0_1_20_ku(time_20_ku);
        sig0_1_20_ku:units = "dB";
        sig0_1_20_ku:_FillValue = -32768s;
        sig0_1_20_ku:long_name = "backscatter coefficient (retracker 1)";
        sig0_1_20_ku:standard_name                                              =
"surface_backwards_scattering_coefficient_of_radar_wave";
        sig0_1_20_ku:scale_factor = 0.01;
        sig0_1_20_ku:coordinates = "lon_poca_20_ku lat_poca_20_ku ";
        sig0_1_20_ku:comment = "The measured backscatter from the surface,
corrected for instrument effects [instr_cor_gain_rx_20_ku], and including a
system bias that calibrates the results against previous missions. The backscatter
is computed from the amplitude of the waveform in Watts, as measured by the Ocean
CFI retracker in LRM mode. The measured power is used to solve the radar equation
to recover the value for backscatter. For SAR and SARin mode, the power waveform
is first convolved with a function to produce an LRM-like waveform, that is then
retracked with OCOG to produce the amplitude estimate.";
```

3.2.10 sig0_2_20_ku(time_20_ku)

```
 short sig0_2_20_ku (time_20_ku);
        sig0_2_20_ku:units = "dB";
        sig0_2_20_ku:_FillValue = -32768s;
              sig0_2_20_ku:long_name = "backscatter coefficient (retracker 2)" ;
 sig0_2_20_ku:standard_name                                                     =
"surface_backwards_scattering_coefficient_of_radar_wave";
        sig0_2_20_ku:scale_factor = 0.01;
```

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```
        sig0_2_20_ku:coordinates = "lon_poca_20_ku lat_poca_20_ku ";
        sig0_2_20_ku:comment = "The measured backscatter from the surface,
corrected for instrument effects [instr_cor_gain_rx_20_ku], and including a
system bias that calibrates the results against previous missions. The backscatter
is computed from the amplitude of the waveform in Watts, as measured by the UCL
land-ice retracker. The measured power is used to solve the radar equation to
recover the value for backscatter. Not currently used in SAR and SARin modes.";
```

3.2.11 sig0_3_20_ku(time_20_ku)

```
 short sig0_3_20_ku (time_20_ku);
        sig0_3_20_ku:units = "dB";
        sig0_3_20_ku:_FillValue = -32768s;
        sig0_3_20_ku:long_name = "backscatter coefficient (retracker 3)" ;
 sig0_3_20_ku:standard_name                                                    =
"surface_backwards_scattering_coefficient_of_radar_wave";
        sig0_3_20_ku:scale_factor = 0.01;
        sig0_3_20_ku:coordinates = "lon_poca_20_ku lat_poca_20_ku ";
        sig0_3_20_ku:comment = "The measured backscatter from the surface,
corrected for instrument effects [instr_cor_gain_rx_20_ku], and including a
system bias that calibrates the results against previous missions. The backscatter
is computed from the amplitude of the waveform in Watts, as measured by the OCOG
retracker. The measured power is used to solve the radar equation to recover the
value for backscatter. Not currently used in SAR and SARin modes.";
```

3.2.1 sig0_larm_20_ku(time_20_ku)

```
int sig0_larm_20_ku(time_20_ku) ;
        sig0_larm_20_ku:_FillValue = -2147483648;
        sig0_larm_20_ku:comment = "The measured backscatter from the surface,
corrected for instrument effects [instr_cor_gain_rx_20_ku], and including a
system bias that calibrates the results against previous missions. The backscatter
is computed from the amplitude of the waveform in Watts, as measured by the OCOG
retracker. The measured power is used to solve the radar equation to recover the
value for backscatter. Contains the LARM retracker results in SAR or SARIn mode,
if that retracker has been activated. For LARM details see DOI
10.1029/2019JC015820" ;
        sig0_larm_20_ku:coordinates = "lon_poca_20_ku lat_poca_20_ku" ;
        sig0_larm_20_ku:long_name = "backscatter coefficient (LARM)" ;
        sig0_larm_20_ku:scale_factor = 0.01 ;
        sig0_larm_20_ku:standard_name                                          =
"surface_backwards_scattering_coefficient_of_radar_wave" ;
        sig0_larm_20_ku:units = "dB" ;
```

3.2.2 sig0_ocog_plrm_20_ku(time_plrm_20_ku)

```
 short sig0_ocog_plrm_20_ku (time_plrm_20_ku);
        sig0_ocog_plrm_20_ku:units = "dB";
        sig0_ocog_plrm_20_ku:_FillValue = -32768s;
        sig0_ocog_plrm_20_ku:long_name   =   "backscatter   coefficient   (OCOG
retracker)" ;
        sig0_ocog_plrm_20_ku:standard_name                                     =
 "surface_backwards_scattering_coefficient_of_radar_wave";
        sig0_ocog_plrm_20_ku:scale_factor = 0.01;
        sig0_ocog_plrm_20_ku:coordinates         =         "lon_poca_plrm_20_ku
lat_poca_plrm_20_ku ";
```

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```
        sig0_ocog_plrm_20_ku:comment = "The measured backscatter from the
surface, corrected for instrument effects [instr_cor_gain_rx_20_ku], and
including a system bias that calibrates the results against previous missions.
The backscatter is computed from the amplitude of the waveform in Watts, as
measured by the OCOG retracker. The measured power is used to solve the radar
equation to recover the value for backscatter. ";
```

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3.2.3 snow_density_01(time_cor_01)

```
 short snow_density_01(time_cor_01);
        snow_density_01:units = "kg/m^3";
        snow_density_01:_FillValue = -32768s;
        snow_density_01:long_name = "snow density";
        snow_density_01:standard_name = "snow_density";
        snow_density_01:source = "UCL AUX_DENSSI from R. D. C. Mallett, 'A
methodologically robust densification function for snow on multiyear Arctic sea
ice', J. Glaciol., vol. 71, p. e24, 2025, doi: 10.1017/jog.2025.5. and M. Bocquet,
S. Fleury, F. Rémy, and F. Piras, 'Arctic and Antarctic Sea Ice Thickness and
Volume Changes From Observations Between 1994 and 2023', JGR Oceans, vol. 129,
no. 11, Nov. 2024, doi: 10.1029/2023jc020848.";
        snow_density_01:institution = "UCL";
        snow_density_01:scale_factor = 1.0;
        snow_density_01:coordinates = "lon_01 lat_01";
        snow_density_01:comment =
"Snow density. Interpolated from a monthly model file. Unused in LRM mode." ;
```

3.2.4 snow_depth_01(time_cor_01

```
 short snow_depth_01(time_cor_01);
        snow_depth_01:units = "m";
        snow_depth_01:_FillValue = -32768s;
        snow_depth_01:long_name = "snow depth";
        snow_depth_01:standard_name = "surface_snow_thickness";
        snow_depth_01:source = "CryoTEMPO Baseline C " ;
        snow_depth_01:institution = "UCL";
        snow_depth_01:scale_factor = 0.001;
        snow_depth_01:coordinates = "lon_01 lat_01";
        snow_depth_01:comment = "Snow Depth computed from CryoTEMPO Baseline C
radar freeboard and ICESat-2 ATL10 version 6 lidar freeboard (using the 3 stronger
beams). DOI: 10.57780/cr2-2a0c25a" ;
```

3.2.5 snow_depth_cor_20_ku(time_20_ku)

```
short snow_depth_cor_20_ku(time_20_ku) ;
        snow_depth_cor_20_ku:_FillValue = -32768s ;
        snow_depth_cor_20_ku:comment = "Snow depth correction. This one-way
  correction corrects for the propagation delay caused by snow present on top of
  sea ice. To apply, add to range or subtract from height or freeboard. The
  correction in m is directly proportional to snow depth (-0.25 x snow_depth)." ;
        snow_depth_cor_20_ku:coordinates = "lon_20_ku lat_20_ku" ;
        snow_depth_cor_20_ku:long_name = "snow depth correction" ;
        snow_depth_cor_20_ku:scale_factor = 0.001 ;
        snow_depth_cor_20_ku:units = "m" ;
```

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3.2.6 solid_earth_tide_01(time_cor_01)

```
 short solid_earth_tide_01(time_cor_01);
        solid_earth_tide_01:units = "m";
        solid_earth_tide_01:_FillValue = -32768s;
        solid_earth_tide_01:long_name = "solid earth tide height";
        solid_earth_tide_01:standard_name                                    =
"sea_surface_height_amplitude_due_to_earth_tide";
        solid_earth_tide_01:scale_factor = 0.001;
        solid_earth_tide_01:coordinates = "lon_01 lat_01";
        solid_earth_tide_01:source = "Cartwright and Edden [1973] Corrected
tables of tidal harmonics - J. Geophys. J. R. Astr. Soc., 33, 253-264";
        solid_earth_tide_01:comment = "Solid earth tide. This 1-way correction
has been accounted for during the computation of height (see
[flag_cor_applied_20_ku] to determine if it was applied) to remove the effect of
local tidal distortion to the Earth's crust, in particular by the sun and moon.";
```

3.2.7 ssha_interp_20_ku(time_20_ku)

```
 short ssha_interp_20_ku (time_20);
        ssha_interp_20_ku:units = "m";
        ssha_interp_20_ku:_FillValue = -32768s;
        ssha_interp_20_ku:long_name = "interpolated sea-surface height anomaly";
        ssha_interp_20_ku:scale_factor = 0.001;
        ssha_interp_20_ku:coordinates = "lon_poca_20_ku lat_poca_20_ku ";
        ssha_interp_20_ku:comment = "Sea-surface height anomaly computed using
sea-surface height interpolated to the current location. Unused in LRM mode.";
```

3.2.8 ssha_interp_numval_20(time_20_ku)

```
 short ssha_interp_numval_20_ku(time_20_ku);
        ssha_interp_numval_20_ku:units = "count";
        ssha_interp_numval_20_ku:_FillValue = -32768s;
        ssha_interp_numval_20_ku:long_name = "number of ssha interpolation
points";
        ssha_interp_numval_20_ku:coordinates = "lon_poca_20_ku lat_poca_20_ku";
        ssha_interp_numval_20_ku:comment = "Number of SSHA points used in the
interpolation of [ssha_interp_20] at this location. Unused in LRM mode.";
```

3.2.9 ssha_interp_rms_20_ku(time_20_ku)

```
 short ssha_interp_rms_20_ku(time_20_ku);
        ssha_interp_rms_20_ku:units = "m";
        ssha_interp_rms_20_ku:_FillValue = -32768s;
        ssha_interp_rms_20_ku:long_name = "ssha interpolation error";
        ssha_interp_rms_20_ku:scale_factor = 0.001;
        ssha_interp_rms_20_ku:coordinates = "lon_poca_20_ku lat_poca_20_ku";
              ssha_interp_rms_20_ku:comment    =    "Estimated    error    in
[ssha_interp_20_ku]. Unused in LRM mode." ;
```

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3.2.10 surf_type_20_ku(time_20_ku)

```
byte surf_type_20_ku(time_20_ku) ;
        surf_type_20_ku:_FillValue = -128b ;
        surf_type_20_ku: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" ;
        surf_type_20_ku:coordinates = "lon_20_ku lat_20_ku" ;
        surf_type_20_ku:flag_meanings = "ocean lake_enclosed_sea ice land" ;
        surf_type_20_ku:flag_values = 0b, 1b, 2b, 3b ;
        surf_type_20_ku:institution = "CLS/CNES" ;
        surf_type_20_ku:long_name = "surface type from mask" ;
        surf_type_20_ku:source = "GMT, GlobCover, Modis Mosaic of Antarctica, and
Water body outlines from LEGOS" ;
```

3.2.11 surf_type_plrm_20_ku(time_plrm_20_ku)

```
byte surf_type_plrm_20_ku(time_plrm_20_ku) ;
                surf_type_plrm_20_ku:_FillValue = -128b ;
                surf_type_plrm_20_ku: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" ;
                surf_type_plrm_20_ku:coordinates        =        "lon_plrm_20_ku
lat_plrm_20_ku" ;
                surf_type_plrm_20_ku:flag_meanings  =  "ocean  lake_enclosed_sea
ice land" ;
                surf_type_plrm_20_ku:flag_values = 0b ;
                surf_type_plrm_20_ku:institution = "CLS/CNES" ;
                surf_type_plrm_20_ku:long_name = "surface type from mask" ;
                surf_type_plrm_20_ku:source = "GMT, GlobCover, Modis Mosaic of
Antarctica, and Water body outlines from LEGOS" ;
```

3.2.12 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 = "TAI time (sec. since 2000-01-01)";
       time_20_ku:standard_name = "time";
       time_20_ku:coordinates = "lon_20_ku lat_20_ku" ;
       time_20_ku:calendar = "gregorian";
       time_20_ku:comment  =  "TAI  time  counted  in  seconds  since  2000-01-01
00:00:00.";
```

3.2.13 time_plrm_20_ku(time_plrm_20_ku)

```
double time_plrm_20_ku(time_plrm_20_ku) ;
 time_plrm_20_ku:units = "seconds since 2000-01-01 00:00:00.0" ;
 time_plrm_20_ku:calendar = "gregorian" ;
 time_plrm_20_ku:long_name = "time in TAI: seconds since 1 Jan 2000" ;
 time_plrm_20_ku:standard_name = "time" ;
```

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```
time_plrm_20_ku:comment = "TAI time counted in seconds since 2000-01-01 00:00:00.
Time refers to the instant the L1B 20Hz average power waveform touches the
surface." ;
time_plrm_20_ku:coordinates = "lon_plrm_20_ku lat_plrm_20_ku";
```

3.2.14 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 = "TAI time (sec. since 2000-01-01)";
        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.  ";
```

3.2.15 time_cor_plrm_01(time_cor_plrm_01)

```
double time_cor_plrm_01(time_cor_plrm_01) ;
        time_cor_plrm_01:calendar = "gregorian" ;
        time_cor_plrm_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.\t" ;
        time_cor_plrm_01:long_name = "TAI time (sec. since 2000-01-01)" ;
        time_cor_plrm_01:standard_name = "time" ;
        time_cor_plrm_01:units = "seconds since 2000-01-01 00:00:00.0" ;
```

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3.3 FLAG MEANING TABLES L2

3.3.1 flag_cor_applied_20_ku, flag_cor_applied_plrm_20_ku

ID	Flag Name	Setting
1.	correction_failure	0 = no, 1 = yes
2.		
3.	sarin_bad_velocit	0 = no, 1 = yes
4.	sarin_out_of_range	0 = no, 1 = yes
5.	sarin_bad_baseline	0 = no, 1 = yes
6.	lrm_slope_model_invalid	0 = no, 1 = yes
7.	sarin_ice_bias_applied	0 = no, 1 = yes
8.	sarin_ocean_bias_applied	0 = no, 1 = yes
9.	sar_ice_bias_applied	0 = no, 1 = yes
10.	sar_ocean_bias_applied	0 = no, 1 = yes
11.	lrm_ice_bias_applied	0 = no, 1 = yes
12.	lrm_ocean_bias_applied	0 = no, 1 = yes
13.	lrm_retracker_applied	0 = no, 1 = yes
14.	sarin_retracker_applied	0 = no, 1 = yes
15.	sar_retracker_applied	0 = no, 1 = yes
16.	window_offset_applied	0 = no, 1 = yes
17.	slope_doppler_applied	0 = no, 1 = yes
18.	pole_tide_applied	0 = no, 1 = yes
19.	solid_earth_applied	0 = no, 1 = yes
20.	load_tide_applied	0 = no, 1 = yes
21.	ocean_tide_equil_applied	0 = no, 1 = yes
22.	ocean_tide_applied	0 = no, 1 = yes
23.	iono_model_applied	0 = no, 1 = yes
24.	iono_gim_applied	0 = no, 1 = yes

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25.	hf_fluctuations_applied	0 = no, 1 = yes
26.	inv_bar_applied	0 = no, 1 = yes
27.	model_wet_applied	0 = no, 1 = yes
28.	model_dry_applied	0 = no, 1 = yes
29.	doppler_applied	0 = no, 1 = yes
30.	internal_cal_applied	0 = no, 1 = yes

3.3.2 flag_cor_err_01

ID	Flag Name	Setting
1.	surface_type_error	0 = OK, 1 = error
2.	pole_tide_error	0 = OK, 1 = error
3.	solid_earth_error	0 = OK, 1 = error
4.	load_tide_error	0 = OK, 1 = error
5.	ocean_tide_equil_error	0 = OK, 1 = error
6.	ocean_tide_error	0 = OK, 1 = error
7.	iono_model_error	0 = OK, 1 = error
8.	iono_gim_error	0 = OK, 1 = error
9.	hf_fluctuations_error	0 = OK, 1 = error
10.	inv_bar_error	0 = OK, 1 = error
11.	model_wet_error	0 = OK, 1 = error
12.	model_dry_error	0 = OK, 1 = error
13.		
14.	slope_model_error	0 = OK, 1 = error
15.	dem_error	0 = OK, 1 = error
16.	odle_error	0 = OK, 1 = error
17.	geoid_error	0 = OK, 1 = error
18.	mss_error	0 = OK, 1 = error
19.	snow_density_error	0 = OK, 1 = error

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20.	snow_depth_error	0 = OK, 1 = error
21.	ice_conc_error	0 = OK, 1 = error
22.	swh_error wind_error	0 = OK, 1 = error

3.3.3 flag_instr_conf_rx_str_in_use_01

ID	Flag Name	Setting
1.	no_star_tracker	0
2.	tracker_1	1
3.	tracker_2	2
4.	tracker_3	3
5.	attref_file	4

3.3.4 flag_instr_mode_op_20_ku

ID	Flag Name	Setting
1.	lrm	1
2.	sar	2
3.	Sarin	3

3.3.5 flag_mcd_20_ku

ID	Flag Name	Setting
1.	block_degraded	0 = OK 1 = Degraded (set if the block should not be processed – indicated by **bold** typeface)
2.	blank_block	0 = OK 1 = Blank Block inserted for record padding
3.	datation_degraded	0 = OK 1 = Datation is bad or not set
4.	orbit_prop_error	0 = OK 1 = Error (returned by CFI or independent check)

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ID	Flag Name	Setting
5.	orbit_file_change	0 = OK 1 = Orbit file has changed wrt previous record
6.	orbit_gap	0 = OK 1 = discontinuity (e.g. gap)
7.	echo_saturated	0 = OK 1 = Saturated
8.	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	0 = OK 1 = degraded or missing
10.	sarin_rx2_error	0 = OK 1 = degraded or missing
11.	window_delay_error	0 = OK (value is in range) 1 = value out of range or computation error
12.	agc_error	0 = OK (value is in range) 1 = value out of range or computation error
13.	cal1_missing	0 = correction applied 1 = correction not applied
14.	cal1_default	0 = correction from CAL1 product used 1 = correction from IPF DB used
15.	doris_uso_missing	0 = USO Correction Factor is available 1 = USO Correction Factor is not available
16.	ccal1_default	0 = correction from Complex CAL1 Product used 1 = correction from IPF DB used
17.	trk_echo_error	0 = OK 1 = empty (or null) tracking echo
18.	echo_rx1_error	0 = OK 1 = empty (or null) raw echo
19.	echo_rx2_error	0 = OK 1 = empty (or null) raw echo
20.	npm_error	0 = OK 1 = value out of range or computation error
21	azimuth_cal_missing	0 = OK 1= missing
23.	phase_pert_cor_missing	0 = applied 1 = not applied
24.	cal2_missing	0 = correction applied 1 = correction not applied
25.	cal2_default	0 = correction from CAL2 product used 1 = correction from IPF DB used
26.	power_scale_error	0 = OK (echo has been power scaled)

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ID	Flag Name	Setting
		1 = Error in scaling (L1B waveform is null) Used only for LRM L1B
27.	attitude_cor_missing	0 = OK, Correction Applied 1 = Not Corrected
28.	phase_pert_cor_default	0 = computed by CCAL1 1 = default from IPF DB used (applicable only to SARin data)

3.3.6 flag_ocean_quality_01_ku

ID	Flag Name	Setting
1.	record_0_ok	0 = ok 1 = nok
2.	record_1_ok	0 = ok 1 = nok
3.	record_2_ok	0 = ok 1 = nok
4.	record_3_ok	0 = ok 1 = nok
5.	record_4_ok	0 = ok 1 = nok
6.	record_5_ok	0 = ok 1 = nok
7.	record_6_ok	0 = ok 1 = nok
8.	record_7_ok	0 = ok 1 = nok
9.	record_8_ok	0 = ok 1 = nok
10.	record_9_ok	0 = ok 1 = nok
11.	record_10_ok	0 = ok 1 = nok
12.	record_11_ok	0 = ok 1 = nok
13.	record_12_ok	0 = ok 1 = nok
14.	record_13_ok	0 = ok 1 = nok
15.	record_14_ok	0 = ok 1 = nok

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ID	Flag Name	Setting
16.	record_15_ok	0 = ok 1 = nok
17.	record_16_ok	0 = ok 1 = nok
18.	record_17_ok	0 = ok 1 = nok
19.	record_18_ok	0 = ok 1 = nok
20.	record_19_ok	0 = ok 1 = nok

3.3.7 flag_prod_status_20_ku, flag_prod_status_plrm_20_ku

ID	Flag Name	Setting
1.	calibration_warning	0 = ok, 1 = nok
2.	sarin_bad_velocity	0 = ok, 1 = nok
3.	sarin_out_of_range	0 = ok, 1 = nok
4.	sarin_bad_baseline	0 = ok, 1 = nok
5.	lrm_slope_model_invalid	0 = ok, 1 = nok
6.	delta_time_error	0 = ok, 1 = nok
7.	mispointing_error	0 = ok, 1 = nok
8.	surface_model_unavailable	0 = ok, 1 = nok
9.	sarin_side_redundant	0 = ok, 1 = nok
10.	sarin_rx_2_error	0 = ok, 1 = nok
11.	sarin_rx_1_error	0 = ok, 1 = nok
12.	sarin_height_ambiguous	0 = ok, 1 = nok
13.	surf_type_class_undefined	0 = ok, 1 = nok
14.	surf_type_class_sea_ice	0 = ok, 1 = nok
15.	surf_type_class_lead	0 = ok, 1 = nok
16.	surf_type_class_ocean	0 = ok, 1 = nok
17.	freeboard_error	0 = ok, 1 = nok
18.	peakiness_error	0 = ok, 1 = nok

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ID	Flag Name	Setting
19.	ssha_interp_error	0 = ok, 1 = nok
20.	sig0_3_error	0 = ok, 1 = nok
21.	sig0_2_error	0 = ok, 1 = nok
22.	sig0_1_error	0 = ok, 1 = nok
23.	height_3_error	0 = ok, 1 = nok
24.	height_2_error	0 = ok, 1 = nok
25.	height_1_error	0 = ok, 1 = nok
26.	orbit_discontinuity	0 = ok, 1 = nok
27.	orbit_error	0 = ok, 1 = nok
28.	block_degraded	0 = ok, 1 = nok
29.	height_sea_ice_error	0 = ok, 1 = nok
30.	sarin_height_unwrap	0 = ok, 1 = nok
31.	sarin_off_nadir_lead	0 = ok, 1 = nok

3.3.8 flag_range_ocean_01_ku

ID	Flag Name	Setting
1.	record_0_ok	0 = ok 1 = nok
2.	record_1_ok	0 = ok 1 = nok
3.	record_2_ok	0 = ok 1 = nok
4.	record_3_ok	0 = ok 1 = nok
5.	record_4_ok	0 = ok 1 = nok
6.	record_5_ok	0 = ok 1 = nok
7.	record_6_ok	0 = ok 1 = nok
8.	record_7_ok	0 = ok 1 = nok
9.	record_8_ok	0 = ok 1 = nok
10.	record_9_ok	0 = ok 1 = nok

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ID	Flag Name	Setting
11.	record_10_ok	0 = ok 1 = nok
12.	record_11_ok	0 = ok 1 = nok
13.	record_12_ok	0 = ok 1 = nok
14.	record_13_ok	0 = ok 1 = nok
15.	record_14_ok	0 = ok 1 = nok
16.	record_15_ok	0 = ok 1 = nok
17.	record_16_ok	0 = ok 1 = nok
18.	record_17_ok	0 = ok 1 = nok
19.	record_18_ok	0 = ok 1 = nok
20.	record_19_ok	0 = ok 1 = nok
21.	regression_fail	0 = ok 1 = nok

3.3.9 flag_sig0_ocean_01_ku

ID	Flag Name	Setting
1.	record_0_ok	0 = ok 1 = nok
2.	record_1_ok	0 = ok 1 = nok
3.	record_2_ok	0 = ok 1 = nok
4.	record_3_ok	0 = ok 1 = nok
5.	record_4_ok	0 = ok 1 = nok
6.	record_5_ok	0 = ok 1 = nok
7.	record_6_ok	0 = ok 1 = nok

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ID	Flag Name	Setting
8.	record_7_ok	0 = ok 1 = nok
9.	record_8_ok	0 = ok 1 = nok
10.	record_9_ok	0 = ok 1 = nok
11.	record_10_ok	0 = ok 1 = nok
12.	record_11_ok	0 = ok 1 = nok
13.	record_12_ok	0 = ok 1 = nok
14.	record_13_ok	0 = ok 1 = nok
15.	record_14_ok	0 = ok 1 = nok
16.	record_15_ok	0 = ok 1 = nok
17.	record_16_ok	0 = ok 1 = nok
18.	record_17_ok	0 = ok 1 = nok
19.	record_18_ok	0 = ok 1 = nok
20.	record_19_ok	0 = ok 1 = nok
21.	regression_fail	0 = ok 1 = nok

3.3.10 flag_sig0_ocog_01_ku

ID	Flag Name	Setting
1.	record_0_ok	0 = ok 1 = nok
2.	record_1_ok	0 = ok 1 = nok
3.	record_2_ok	0 = ok 1 = nok
4.	record_3_ok	0 = ok 1 = nok
5.	record_4_ok	0 = ok 1 = nok

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ID	Flag Name	Setting
6.	record_5_ok	0 = ok 1 = nok
7.	record_6_ok	0 = ok 1 = nok
8.	record_7_ok	0 = ok 1 = nok
9.	record_8_ok	0 = ok 1 = nok
10.	record_9_ok	0 = ok 1 = nok
11.	record_10_ok	0 = ok 1 = nok
12.	record_11_ok	0 = ok 1 = nok
13.	record_12_ok	0 = ok 1 = nok
14.	record_13_ok	0 = ok 1 = nok
15.	record_14_ok	0 = ok 1 = nok
16.	record_15_ok	0 = ok 1 = nok
17.	record_16_ok	0 = ok 1 = nok
18.	record_17_ok	0 = ok 1 = nok
19.	record_18_ok	0 = ok 1 = nok
20.	record_19_ok	0 = ok 1 = nok
21.	regression_fail	0 = ok 1 = nok

3.3.11 flag_surf_type_01

ID	Flag Name	Setting
1.	ocean	0
2.	lake_enclosed_sea	1
3.	ice	2
4.	land	3

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4 LEVEL-2I FORMAT DESCRIPTION

4.1 LIST L2I OF VARIABLES

L2i Variables			
Variable Name (dim1,...,dim N) ***long_name***	**units**	**Standard_name**	**EE Field**
time_cor_01(time_cor_01) *time (sec. since 2000-01-01)*	s	time	Data Record Time (MDSR Time Stamp)
time_20_ku (time_20_ku) *time (sec. since 2000-01-01)*	s	time	
time_plrm_20_ku(time_plrm_20_ku) *time in TAI: seconds since 1 Jan 2000*	s	time	
space_3d(space_3d) *space dimension*	count		
alt_plrm_20_ku(time_plrm_20_ku) *altitude of the Satellite CoM above reference ellipsoid*	m	height_above_reference_ellipsoid	
uso_cor_20_ku (time_20_ku) USO correction factor			USO correction
uso_cor_applied_20_ku(time_20_ku) uso correction (1-way range)	m		
flag_instr_mode_op_20_ku (time_20_ku) *mode id - identifies the siral instrument measurement mode*			Mode ID (instrument mode information)
flag_instr_mode_att_ctrl_20_ku (time_20_ku)			Mode ID (instrument mode information)

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L2i Variables			
Variable Name (dim1,...,dim N) ***long_name***	**units**	**Standard_name**	**EE Field**
mode id - identifies the siral instrument measurement mode			
flag_instr_mode_flags_20_ku (time_20_ku) *mode id*			Mode ID (instrument mode information)
flag_sea_ice_type_20_ku(time_20_ku)		sea ice type flag	
seq_count_20_ku (time_20_ku) *source sequence counter*			Source Sequence Counter (from telemetry)
flag_instr_conf_rx_in_use_20_ku (time_20_ku) *reception chain in use*			Instrument Config (including loop status)
flag_instr_conf_rx_bwdt_20_ku (time_20_ku) *instrument bandwidth*			Instrument Config (including loop status)
flag_instr_conf_rx_trk_mode_20_ku (time_20_ku) *instrument tracking mode*			Instrument Config (including loop status)
flag_instr_conf_rx_flags_20_ku (time_20_ku) *instrument configuration flags*			Instrument Config (including loop status)
instr_cor_gain_tx_rx_20_ku(time_20_ku)	dB	instrument gain correction (tx-rx chain)	
mean_sea_surf_sea_ice_20_ku(time_20_ku)	m	sea_surface_height_above_reference_ellipsoid	

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L2i Variables			
Variable Name (dim1,...,dim N) ***long_name***	**units**	**Standard_name**	**EE Field**
rec_count_20_ku (time_20_ku)	count		Surface Sample Counter (record counter)
larm_wf_metric_1_20_ku(time_20_ku)			
larm_wf_metric_1_20_ku(time_20_ku)			
lat_poca_20_ku (time_20_ku) *latitude of the estimated echo location*	degrees	latitude	Latitude of measurement in WGS84
lat_poca_plrm_20_ku (time_plrm_20_ku) *latitude of the estimated echo location*	degrees	latitude	Latitude of measurement in WGS84
lon_poca_20_ku (time_20_ku) *longitude of the estimated echo location*	degrees	longitude	Longitude of measurement in WGS84
lon_poca_plrm_20_ku (time_plrm_20_ku) *longitude of the estimated echo location*	degrees	longitude	Longitude of measurement in WGS84
lat_plrm_20_ku(time_plrm_20_ku) *latitude of measurement*	degrees_north	latitude	
lon_plrm_20_ku(time_plrm_20_ku) *longitude of measurement*	degrees_east	longitude	

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L2i Variables			
Variable Name (dim1,…,dim N) ***long_name***	**units**	**Standard_name**	**EE Field**
alt_20_ku (time_20_ku) *altitude of satellite*	m	height_above_reference_ellipsoid	Altitude of COG above reference ellipsoid (interpolated value)
orb_alt_rate_20_ku (time_20_ku) *orbital altitude rate*	m/s		Instantaneous altitude rate derived from orbit
sat_vel_vec_20_ku(time_20_ku) (time_20_ku,space_3d) *satellite velocity vector*	m/s		Satellite velocity vector[3] (in IERF)
beam_dir_vec_20_ku(time_20_ku) (time_20_ku,space_3d) *real beam vector*	m		Real beam direction vector[3] (in CRF)
echo_numval_20_ku(time_20_ku)	count	count of echoes or beams averaged	
inter_base_vec_20_ku (time_20_ku,space_3d) *interferometer baseline vector*	m		Interferometer baseline vector[3] (in CRF)
flag_instr_conf_rx_str_in_use_20_ku (time_20_ku) *star tracker id*			Star Tracker ID
off_nadir_roll_angle_str_20_ku (time_20_ku) *antenna bench roll angle*	degrees		Spacecraft Roll

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L2i Variables			
Variable Name (dim1,...,dim N) ***long_name***	**units**	**Standard_name**	**EE Field**
off_nadir_pitch_angle_str_20_ku (time_20_ku) *antenna bench pitch angle*	degrees		Spacecraft Pitch
off_nadir_yaw_angle_str_20_ku (time_20_ku) *antenna bench yaw angle*	degrees		Spacecraft Yaw
flag_mcd_20_ku (time_20_ku) *quality flag*			Measurement Confidence Data
height_1_20_ku (time_20_ku) *altimeter height (retracker 1)*	m	height_above_reference_ellipsoid	Height of surface w.r.t. ellipsoid (retracker 1)
height_2_20_ku (time_20_ku) *altimeter height (retracker 2)*	m	height_above_reference_ellipsoid	Height of surface w.r.t. ellipsoid (retracker 2)
height_3_20_ku (time_20_ku) *altimeter height (retracker 3)*	m	height_above_reference_ellipsoid	Height of surface w.r.t. ellipsoid (retracker 3)
height_ocog_plrm_20_ku (time_plrm_20_ku) *altimeter height (retracker 3)*	m	height_above_reference_ellipsoid	Height of surface w.r.t. ellipsoid (retracker 3)
height_sea_ice_floe_20_ku(time_20_ku) *surface height (sea-ice floe retracker)*	m	height_above_reference_ellipsoid	
height_sea_ice_lead_20_ku(time_20_ku) *surface height (sea-ice floe retracker)*	m	height_above_reference_ellipsoid	
sig0_1_20_ku (time_20_ku) *backscatter coefficient (retracker 1)*	dB	surface_backwards_scattering_coefficient_of_radar_wave	Sigma-0 (retracker 1)

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L2i Variables			
Variable Name (dim1,...,dim N) ***long_name***	**units**	**Standard_name**	**EE Field**
sig0_2_20_ku (time_20_ku) *backscatter coefficient (retracker 2)*	dB	surface_backwards_scattering_coefficient_of_radar_wave	Sigma-0 (retracker 2)
sig0_3_20_ku (time_20_ku) *backscatter coefficient (retracker 3)*	dB	surface_backwards_scattering_coefficient_of_radar_wave	Sigma-0 (retracker 3)
peakiness_20_ku (time_20_ku) *peakiness of waveforms*			Peakiness
peakiness_plrm_20_ku (time_plrm_20_ku) *peakiness of waveforms*			Peakiness
avg_peakiness_20_ku(time_20_ku)			
radar_freeboard_20_ku(time_20_ku)	m		
retracker_1_cor_20_ku (time_20_ku) *correction to range (retracker 1)*	m		Retracker range correction (retracker 1)
retracker_2_cor_20_ku (time_20_ku) *correction to range (retracker 2)*	m		Retracker range correction (retracker 2)
retracker_3_cor_20_ku (time_20_ku) *correction to range (retracker 3)*	m		Retracker range correction (retracker 3)
retracker_1_quality_20_ku (time_20_ku) *quality metric (retracker 1)*			Retracker 1 quality metric
retracker_2_quality_20_ku (time_20_ku) *quality metric (retracker 2)*			Retracker 2 quality metric

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L2i Variables			
Variable Name (dim1,...,dim N) ***long_name***	**units**	**Standard_name**	**EE Field**
retracker_3_quality_20_ku (time_20_ku) *quality metric (retracker 3)*			Retracker 3 quality metric
retracker_output_3_20_ku (time_20_ku) *retracker output 3*			Retracker output 3
retracker_output_4_20_ku (time_20_ku) *retracker output 4*			Retracker output 4
retracker_output_5_20_ku (time_20_ku) *retracker output 5*			Retracker output 5
retracker_output_6_20_ku (time_20_ku) *retracker output 6*			Retracker output 6
retracker_output_7_20_ku (time_20_ku) *retracker output 7*			Retracker output 7
retracker_output_8_20_ku (time_20_ku) *retracker output 8*			Retracker output 8
retracker_output_9_20_ku (time_20_ku) *retracker output 9*			Retracker output 3
retracker_output_10_20_ku (time_20_ku) *retracker output 10*			Retracker output 9
retracker_output_11_20_ku (time_20_ku) *retracker output 11*			Retracker output 10
retracker_output_12_20_ku (time_20_ku) *retracker output 12*			Retracker output 11

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L2i Variables			
Variable Name (dim1,...,dim N) ***long_name***	**units**	**Standard_name**	**EE Field**
retracker_output_13_20_ku (time_20_ku) *retracker output 13*			Retracker output 12
retracker_output_14_20_ku (time_20_ku) *retracker output 14*			Retracker output 13
retracker_output_15_20_ku (time_20_ku) *retracker output 15*			Retracker output 14
retracker_output_16_20_ku (time_20_ku) *retracker output 16*			Retracker output 15
retracker_output_17_20_ku (time_20_ku) *retracker output 17*			Retracker output 16
retracker_output_18_20_ku (time_20_ku) *retracker output 18*			Retracker output 17
retracker_output_19_20_ku (time_20_ku) *retracker output 19*			Retracker output 18
retracker_output_20_20_ku (time_20_ku) *retracker output 20*			Retracker output 19
retracker_output_21_20_ku (time_20_ku) *retracker output 21*			Retracker output 20

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L2i Variables			
Variable Name (dim1,…,dim N) ***long_name***	**units**	**Standard_name**	**EE Field**
retracker_output_22_20_ku (time_20_ku) *retracker output 22*			Retracker output 22
retracker_output_23_20_ku (time_20_ku) *retracker output 23*			Retracker output 23
across_track_angle_20_ku (time_20_ku) *across track angle*	radian		X-Track Angle (interferometric angle computed at Retrack point)
across_track_angle_cor_20_ku (time_20_ku) *across track angle correction*	radian		X-Track Angle Correction
coherence_20_ku (time_20_ku) *coherence*			Coherence (at Retrack point)
ssha_20_ku (time_20_ku) *sea-surface height anomaly*	m		Surface Height Anomaly
ssha_interp_20_ku (time_20_ku) interpolated sea-surface height anomaly	m		Interpolated Sea Surface Height Anomaly
ssha_interp_rms_20_ku (time_20_ku) *SSHA interpolation error*	m		Interpolation error for Ocean Height

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L2i Variables			
Variable Name (dim1,...,dim N) ***long_name***	**units**	**Standard_name**	**EE Field**
ssha_interp_numval_fwd_20_ku (time_20_ku) *number of forward SSHA interpolation points*	count		Number of interpolation points used forward
ssha_interp_numval_back_20_ku (time_20_ku) *number of backward SSHA interpolation points*	count		Number of interpolation points used backward
ssha_interp_time_fwd_20_ku (time_20_ku) *forward timespan of SSHA interpolation points*	s		Radius of interpolation -forward (in time)
ssha_interp_time_back_20_ku (time_20_ku) *backward timespan of SSHA interpolation points*	s		Radius of interpolation -backward (in time)
flag_ssha_interp_20_ku (time_20_ku) *SSHA interpolation error flag*			Interpolation error flag
flag_quality_20_ku (time_20_ku) *quality flag*			Measurement Quality Flags
flag_retracker_20_ku (time_20_ku) *retracker flag*			Retracker Flags
flag_height_20_ku (time_20_ku) *height status flag*			Height Status Flags
flag_freeboard_20_ku (time_20_ku) *freeboard flag*			SAR Freeboard Status Flags

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L2i Variables			
Variable Name (dim1,...,dim N) ***long_name***	**units**	**Standard_name**	**EE Field**
sea_ice_concentration_20_ku (time_20_ku) *sea ice area fraction*	percent	sea_ice_area_fraction	Ice concentration parameter
snow_depth_20_ku (time_20_ku) *snow depth*	m	surface_snow_thickness	Snow Depth
snow_depth_cor_20_ku(time_20_ku)	m		
snow_density_20_ku (time_20_ku) *snow density*	kg/m^3	snow_density	Snow Density
flag_surf_type_class_20_ku (time_20_ku) *discriminated surface type*			Discriminator result (enumerated type)
sarin_output_1_20_ku (time_20_ku) sarin discriminator output 1			SIN Discriminator Parameter 1=total power
sarin_output_2_20_ku (time_20_ku) sarin discriminator output 2			SIN Discriminator Parameter 2=max power
sarin_output_3_20_ku (time_20_ku) sarin discriminator output 3			SIN Discriminator Parameter 3=mean - sl 4 4 power
sarin_output_4_20_ku (time_20_ku)			SIN Discriminator 4=bin of max power

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L2i Variables			
Variable Name (dim1,...,dim N) ***long_name***	**units**	**Standard_name**	**EE Field**
sarin discriminator output 4			
sarin_output_5_20_ku (time_20_ku) sarin discriminator output 5			SIN Discriminator 5=bin of half max power
sarin_output_6_20_ku (time_20_ku) sarin discriminator output 6			SIN Discriminator 6=max Coherence
sarin_output_7_20_ku (time_20_ku) sarin discriminator output 7			SIN Discriminator 7=bin of max Coherence
sarin_output_8_20_ku (time_20_ku) sarin discriminator output 8			SIN Discriminator 8=first power bin
sarin_output_9_20_ku (time_20_ku) sarin discriminator output 9			SIN Discriminator 9=last power bin
sarin_output_10_20_ku (time_20_ku) sarin discriminator output 10			SIN Discriminator 10 - reserved
flag_disc_stat_20_ku (time_20_ku) *discrimination status flag*			Discriminator status flag
offset_attitude_20_ku (time_20_ku) *echo azimuth*	radian		Slope model correction attitude

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L2i Variables			
Variable Name (dim1,...,dim N) ***long_name***	**units**	**Standard_name**	**EE Field**
offset_azimuth_20_ku (time_20_ku) *echo attitude*	radian		Slope model correction azimuth
slope_dop_cor_20_ku (time_20_ku) *Slope Doppler correction to altimeter range*	m		Slope Doppler Correction
lat_20_ku (time_20_ku) *latitude*	degrees	latitude	Uncorrected Latitude
lon_20_ku (time_20_ku) *longitude*	degrees	longitude	Uncorrected Longitude
flag_sarin_ambiguity_warning_20_ku (time_20_ku) *ambiguity warning flag*			Ambiguity indicator
geoid_20_ku (time_20_ku) *geoid height*	m	geoid_height_above_reference_ellipsoid	Geoid from model
odle_20_ku(time_20_ku) ocean depth/land elevation	m		Ocean Depth / Land Elevation from model
dem_height_20_ku(time_20_ku) *height of DEM*	m		DEM elevation (interpolated)
dem_identifier_20_ku (time_20_ku) *ID of DEM*			DEM identifier (used in SIN mode)

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L2i Variables			
Variable Name (dim1,...,dim N) ***long_name***	**units**	**Standard_name**	**EE Field**
mod_dry_tropo_cor_01(time_cor_01) *dry tropospheric correction*	m	altimeter_range_correction_due_to_dry_troposphere	Dry Tropospheric Correction
mod_wet_tropo_cor_01(time_cor_01) *wet tropospheric correction*	m	altimeter_range_correction_due_to_wet_troposphere	Wet Tropospheric Correction
inv_bar_cor_01(time_cor_01) *inverse barometric correction*	m	sea_surface_height_correction_due_to_air_pressure_at_low_frequency	Inverse Barometric Correction
hf_fluct_total_cor_01(time_cor_01) *dynamic atmosphere correction*	m	sea_surface_height_correction_due_to_air_pressure_and_wind_at_high_frequency	Dynamic Atmospheric Correction (DAC from Mog2D)
ind_first_meas_20hz_01(time_cor_01) *index of the first 20Hz measurement: 1 Hz*	count		
ind_meas_1hz_20_ku(time_20_ku) *index of the 1Hz measurement: 20 Hz ku band*	count		
iono_cor_gim_01(time_cor_01) *GIM ionospheric correction*	m	altimeter_range_correction_due_to_ionosphere	GIM Ionospheric Correction
iono_cor_01(time_cor_01) *model ionospheric correction*	m	altimeter_range_correction_due_to_ionosphere	Model Ionospheric Correction
ocean_tide_01(time_cor_01)	m		Elastic Ocean Tide

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L2i Variables			
Variable Name (dim1,...,dim N) ***long_name***	**units**	**Standard_name**	**EE Field**
elastic ocean tide			
ocean_tide_eq_01(time_cor_01) *long-period ocean tide*	m	sea_surface_height_amplitude_due_to_equilibrium_ocean_tide	Long Period Ocean Tide
load_tide_01(time_cor_01) *ocean loading tide*	m		Ocean Loading Tide
solid_earth_tide_01(time_cor_01) *solid earth tide*	m	sea_surface_height_amplitude_due_to_earth_tide	Solid Earth Tide
pole_tide_01(time_cor_01) *geocentric pole tide*	m	sea_surface_height_amplitude_due_to_pole_tide	Geocentric Polar Tide
range_1_20_ku(time_20_ku) *range to surface (retracker 1)*	m	altimeter_range	
range_2_20_ku(time_20_ku) *range to surface (retracker 2)*	m	altimeter_range	
range_3_20_ku(time_20_ku) *range to surface (retracker 3)*	m	altimeter_range	
range_ocog_plrm_20_ku(time_plrm_20_ku) *range to surface (retracker 3)*	m	altimeter_range	
surf_type_20_ku (time_20_ku) *surface type from mask*			Surface type flag
surf_type_plrm_20_ku (time_plrm_20_ku) *surface type from mask*			Surface type flag

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L2i Variables			
Variable Name (dim1,…,dim N) ***long_name***	**units**	**Standard_name**	**EE Field**
flag_cor_status_20_ku (time_20_ku) *corrections status flags*			Correction status flags
flag_cor_err_20_ku (time_20_ku) *corrections error flags*			Correction error flags
dop_cor_20_ku (time_20_ku) *Doppler correction to altimeter range*	m		Doppler range correction (inc slope)
instr_cor_range_tx_rx_20_ku (time_20_ku) *range calibration correction TxRx chain*	m		Instrument Range Correction, t-r antenna
instr_cor_gain_tx_rx_20_ku(time_20_ku)	dB		
instr_cor_range_rx_20_ku (time_20_ku) *range calibration correction Rx chain*	m		Instrument Range Correction, r only mm antenna
instr_cor_gain_rx_20_ku (time_20) _ku *gain calibration correction Rx chain*	dB		Instrument Sigma-0 correction, r only antenna
instr_int_ph_cor_20_ku (time_20_ku) *internal phase calibration correction TxRx chain*	radian		Internal Phase Correction
instr_ext_ph_cor_20_ku (time_20_ku) *external phase correction TxRx chain*	radian		External Phase Correction

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L2i Variables			
Variable Name (dim1,…,dim N) ***long_name***	**units**	**Standard_name**	**EE Field**
ph_slope_cor_20_ku (time_20_ku) *phase slope TxRx chain*	radian		Phase Slope Correction
noise_power_20_ku (time_20_ku) *noise floor*	dB		Noise power measurement
dop_angle_start_20_ku(time_20_ku) *doppler angle start* *(FillValue in LRM case)*	rad		
dop_angle_stop_20_ku(time_20_ku) *doppler angle stop* *(FillValue in LRM case)*	rad		
look_angle_start_20_ku(time_20_ku) *look angle start* *(FillValue in LRM case)*	rad		
look_angle_stop_20_ku(time_20_ku) *look angle stop* *(FillValue in LRM case)*	rad		
stack_std_20_ku (time_20_ku) *Gaussian power fitting: std wrt beam number* *(FillValue in LRM case)*	count		Beam behaviour parameter
stack_centre_20_ku (time_20_ku) *gaussian power fitting: center wrt beam number* *(FillValue in LRM case)*	count		

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L2i Variables			
Variable Name (dim1,…,dim N) ***long_name***	**units**	**Standard_name**	**EE Field**
stack_scaled_amplitude_20_ku(time_20_ku) *gaussian power fitting: amplitude* *(FillValue in LRM case)*	dB		
Stack_skewness_20_ku(time_20_ku) *gaussian power fitting: skewness wrt beam number* *(FillValue in LRM case)*	count		
stack_kurtosis_20_ku(time_20_ku) *gaussian power fitting: kurtosis wrt beam number* *(FillValue in LRM case)*	count		
stack_std_angle_20_ku(time_20_ku) *gaussian power fitting: std wrt boresight angle* *(FillValue in LRM case)*	rad		
stack_centre_angle_20_ku(time_20_ku) *gaussian power fitting: center wrt boresight angle number* *(FillValue in LRM case)*	rad		
stack_centre_look_angle_20_ku(time_20_ku) *gaussian power fitting: center wrt look angle*	rad		
stack_gaussian_fitting_residuals_20_ku(time_20_ku) *gaussian power fitting: residuals fitting*	dbW		

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L2i Variables			
Variable Name (dim1,…,dim N) ***long_name***	**units**	**Standard_name**	**EE Field**
stack_number_after_weighting_20_ku(time_20_ku) *number of contributing beams in the stack after weighting* *(FillValue in LRM case)*	count		Beam behaviour parameter
stack_number_before_weighting_20_ku(time_20_ku) *number of contributing beams in the stack after weighting* *(FillValue in LRM case)*	count		Beam behaviour parameter
stack_peakiness_20_ku(time_20_ku) *gaussian power fitting: peakiness wrt beam number*	count		
avg_stack_peakiness_20_ku(time_20_ku)	count		
distance_to_coast_20_ku(time_20_ku)	m		
distance_to_coast_01(time_cor_01)	m		
cats2008_tide_01(time_cor_01)	m		
cats2008_tide_plrm_01(time_cor_01)	m		
flag_bedmachine_mask_20_ku(time_20_ku)			
range_larm_20_ku(time_20_ku)	m		
sea_ice_freeboard_20_ku(time_20_ku)	m		
sea_ice_thickness_20_ku(time_20_ku)	m		
uso_cor_plrm_20_ku(time_plrm_20_ku)	s		

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L2i Variables			
Variable Name (dim1,…,dim N) ***long_name***	**units**	**Standard_name**	**EE Field**
uso correction applied to window delay (2-way)			
distance_to_lead_20_ku(time_20_ku)	m		

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4.2 L2I CDL DUMP

4.2.1 across_track_angle_20_ku(time_20_ku)

```
 int across_track_angle_20_ku (time_20_ku);
       across_track_angle_20_ku:units = "rad";
       across_track_angle_20_ku:_FillValue = -2147483648;
       across_track_angle_20_ku:long_name = "across track angle";
       across_track_angle_20_ku:scale_factor = 1e-6;
       across_track_angle_20_ku:coordinates = "lon_20_ku lat_20_ku ";
       across_track_angle_20_ku:comment = "The across track angle between the
nadir vector and the vector from the satellite to the point of closest approach
computed from the phase measurement in SARin mode. Unused in LRM and SAR modes.
";
```

4.2.2 across_track_angle_cor_20_ku(time_20_ku)

```
 int across_track_angle_cor_20_ku(time_20_ku);
       across_track_angle_cor_20_ku:units = "rad";
       across_track_angle_cor_20_ku:_FillValue = -2147483648;
       across_track_angle_cor_20_ku:long_name = "across track angle correction";
       across_track_angle_cor_20_ku:scale_factor = 1e-6;
       across_track_angle_cor_20_ku:coordinates = "lon_20_ku lat_20_ku ";
       across_track_angle_cor_20_ku:comment = "The applied to the across track
angle between the nadir vector and the vector from the satellite to the point of
closest approach computed from the phase measurement in SARin mode. Unused in LRM
and SAR modes.";
```

4.2.3 alt_20_ku(time_20_ku)

```
 int alt_20_ku (time_20_ku);
       alt_20_ku:units = "m";
       alt_20_ku:_FillValue = -2147483648;
       alt_20_ku:long_name = "altitude of CoM satellite above reference
ellipsoid ";
       alt_20_ku:standard_name = "height_above_reference_ellipsoid";
       alt_20_ku:scale_factor = 0.001;
       alt_20_ku:coordinates = "lon_20_ku lat_20_ku ";
       alt_20_ku:comment = "Altitude of satellite CoM above reference ellipsoid
(WGS84).";
```

4.2.4 alt_plrm_20_ku(time_plrm_20_ku)

```
int alt_plrm_20_ku(time_plrm_20_ku) ;
 alt_plrm_20_ku:_FillValue = -2147483648 ;
 alt_plrm_20_ku:units = „m“ ;
alt_plrm_20_ku:long_name = “Altitude of the Satellite CoM above reference
ellipsoid” ;
alt_plrm_20_ku:comment = “Altitude of the Satellite CoM above reference ellipsoid
[WGS84] corresponding to the MDSR Time Stamp for L1B 1Hz average power waveform.”
;
alt_plrm_20_ku:coordinates = “lon_plrm_20_ku lat_plrm_20_ku”;
alt_plrm_20_ku:add_offset = 0.0 ;
 alt_plrm_20_ku:scale_factor = 0.001 ;
```

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4.2.5 avg_peakiness_20_ku(time_20_ku)

```
 int avg_peakiness_20_ku(time_20_ku) ;
        avg_peakiness_20_ku:_FillValue = -2147483648;
        avg_peakiness_20_ku:comment = "Waveform peakiness, averaged along track.
Note that this will require different interpretation for SAR and SARIn echoes
which do not have the typical pulse-limited echo shape. For LRM and SARIn, the
traditional ENVISAT derivation is used. This is the ratio of the maximum power
in the waveform to the average of the waveform power to the right hand side of
the expected waveform leading edge location. For SAR mode, waveform bins with no
power are excluded from the average to account for the specular nature of some
waveforms." ;
        avg_peakiness_20_ku:coordinates = "lon_20_ku lat_20_ku" ;
        avg_peakiness_20_ku:long_name = "averaged waveform peakiness" ;
        avg_peakiness_20_ku:scale_factor = 0.01 ;
```

4.2.6 avg_stack_peakiness_20_ku(time_20_ku)

```
 short avg_stack_peakiness_20_ku(time_20_ku) ;
        avg_stack_peakiness_20_ku:_FillValue = -32768s ;
        avg_stack_peakiness_20_ku:add_offset = 0. ;
        avg_stack_peakiness_20_ku:comment = "Peakiness of the range integrated
power of the single look echoes within a stack, averaged along track." ;
        avg_stack_peakiness_20_ku:coordinates = "lon_20_ku lat_20_ku" ;
        avg_stack_peakiness_20_ku:long_name = "gaussian power fitting: averaged
peakiness wrt beam number" ;
        avg_stack_peakiness_20_ku:scale_factor = 0.01 ;
        avg_stack_peakiness_20_ku:units = "count" ;
```

4.2.7 cats2008_tide_01(time_cor_01)

```
 int cats2008_tide_01(time_cor_01) ;
        cats2008_tide_01:_FillValue = -2147483648;
        cats2008_tide_01:comment = " CATS2008 tide correction. This correction is
not applied during L2 processing, and is supplied here so that data users can
remove the applied tide corrections and replace them with CATS2008 if desired.
The field [cats2008_tide_01] is a replacement for [ocean_tide_01] +
[ocean_tide_eq_01]. The convention for range corrections is that they should be
added to range (or subtracted from a height) to apply them. To apply CATS2008 to
range, the user has to compute range_new = range - ocean_tide_01 -
ocean_tide_eq_01 + cats2008_tide_01. CATS2008 does not include a separate load
tide component, so users could remove load_tide_01 as well and add a percentage
of cats2008_tide_01 as a loading tide correction. The CATS2008 tide correction is
only provided for the circum-Antarctic ocean." ;
        cats2008_tide_01:coordinates = "lon_01 lat_01" ;
        cats2008_tide_01:institution = "OSU" ;
        cats2008_tide_01:long_name = "CATS2008 tide correction" ;
        cats2008_tide_01:scale_factor = 0.001 ;
        cats2008_tide_01:source = "CATS2008 is available for download through the
U.S. Antarctic Program Data Center: Data DOI: 10.15784/601235" ;
        cats2008_tide_01:units = "m" ;
```

4.2.8 cats2008_tide_plrm_01(time_cor_plrm_01)

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```
 int cats2008_tide_plrm_01(time_cor_plrm_01) ;
        cats2008_tide_plrm_01:_FillValue = -2147483648;
        cats2008_tide_plrm_01:comment = " CATS2008 tide correction. This
correction is not applied during L2 processing, and is supplied here so that data
users can remove the applied tide corrections and replace them with CATS2008 if
desired. The field [cats2008_tide_01] is a replacement for [ocean_tide_01] +
[ocean_tide_eq_01]. The convention for range corrections is that they should be
added to range (or subtracted from a height) to apply them. To apply CATS2008 to
range, the user has to compute range_new = range - ocean_tide_01 -
ocean_tide_eq_01 + cats2008_tide_01. CATS2008 does not include a separate load
tide component, so users could remove load_tide_01 as well and add a percentage
of cats2008_tide_01 as a loading tide correction. The CATS2008 tide correction is
only provided for the circum-Antarctic ocean." ;
        cats2008_tide_plrm_01:coordinates = "lon_plrm_01 lat_plrm_01" ;
        cats2008_tide_plrm_01:institution = "OSU" ;
        cats2008_tide_plrm_01:long_name = "CATS2008 tide correction" ;
        cats2008_tide_plrm_01:scale_factor = 0.001 ;
        cats2008_tide_plrm_01:source = "CATS2008 is available for download
through the U.S. Antarctic Program Data Center: Data DOI: 10.15784/601235" ;
        cats2008_tide_plrm_01:units = "m" ;
```

4.2.9 beam_dir_vec_20_ku(time_20_ku,space_3d)

```
 int beam_dir_vec_20_ku (time_20_ku,space_3d_ku);
        beam_dir_vec_20_ku:units = "m";
        beam_dir_vec_20_ku:_FillValue = -2147483648;
        beam_dir_vec_20_ku:long_name = "real beam direction vector in crf";
        beam_dir_vec_20_ku:scale_factor = 1.0e-6;
        beam_dir_vec_20_ku:coordinates = "lon_20_ku lat_20_ku ";
        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.";
```

4.2.10 coherence_20_ku(time_20_ku)

```
 int coherence_20_ku(time_20_ku);
        coherence_20_ku:_FillValue = -2147483648;
        coherence_20_ku:long_name = "coherence";
        coherence_20_ku:scale_factor = 0.001;
        coherence_20_ku:coordinates = "lon_20_ku lat_20_ku ";
        coherence_20_ku:comment = "The coherence of the SARin echoes at the
retracking point. This is sampled from the coherence waveforms in the L1b product.
The coherence waveform is a fully-calibrated, high resolution, multilooked
coherence computed from the complex echoes on the two receiving channels.Unused
in LRM and SAR modes.";
```

4.2.11 dem_height_20_ku(time_20_ku)

```
 int dem_height_20_ku(time_20_ku);
        dem_height_20_ku:units = "m";
        dem_height_20_ku:_FillValue = -2147483648;
        dem_height_20_ku:long_name = "height of DEM";
        dem_height_20_ku:scale_factor = 0.001;
        dem_height_20_ku:coordinates = "lon_poca_20_ku lat_poca_20_ku";
        dem_height_20_ku:source = "Bamber and GIMP";
        dem_height_20_ku:institution = "UCL";
```

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dem_height_20_ku:comment = "Height value extracted from DEM used for SARin ambiguity check. Unused in LRM and SAR modes. See Bamber, Jonathan L., Jose Luis Gomez-Dans, and Jennifer A. Griggs. 2009. Antarctic 1 km Digital Elevation Model (DEM) from Combined ERS-1 Radar and ICESat Laser Satellite Altimetry. Boulder, Colorado USA: National Snow and Ice Data Center and Howat I.M., A. Negrete and B.E. Smith, 2014, The Greenland Ice Mapping Project (GIMP) land classification and surface elevation datasets, The Cryosphere, 8, 1509-1518, doi:10.5194/tc-8-1509-2014.";

4.2.12 dem_identifier_20_ku(time_20_ku)

```
byte dem_identifier_20_ku (time_20_ku);
       dem_identifier_20_ku:_FillValue = -128b;
       dem_identifier_20_ku:long_name = "ID of DEM";
       dem_identifier_20_ku:coordinates = "lon_poca_20_ku lat_poca_20_ku";
       dem_identifier_20_ku:comment = "ID of the DEM interpolated to supply the value present in [dem_height_20_ku]. Unused in LRM and SAR modes.";
```

4.2.13 distance_to_coast_20_ku(time_20_ku)

```
short distance_to_coast_20_ku(time_20_ku) ;
       distance_to_coast_20_ku:_FillValue = -32767s ;
       distance_to_coast_20_ku:long_name = "Distance to the coast" ;
       distance_to_coast_20_ku:units = "m";
       distance_to_coast_20_ku:scale_factor = 1.e+2 ;
       distance_to_coast_20_ku:comment = "Distance to the closest coast (negative over land, positive over water bodies)" ;
       distance_to_coast_20_ku:coordinates = "lon_20_ku lat_20_ku" ;
       distance_to_coast_20_ku:institution = "EUMETSAT" ;
       distance_to_coast_20_ku:source = "GSHHG v2.3.7" ;
```

4.2.14 distance_to_coast_01(time_cor_01)

```
short distance_to_coast_01(time_cor_01) ;
       distance_to_coast_01:_FillValue = -32767s ;
       distance_to_coast_01:long_name = "Distance to the coast" ;
       distance_to_coast_01:units = "m" ;
       distance_to_coast_01:scale_factor = 1.e+2 ;
       distance_to_coast_01:comment = "Distance to the closest coast (negative over land, positive over water bodies)" ;
```

4.2.15 distance_to_lead_20_ku(time_20_ku)

```
int distance_to_lead_20_ku(time_20_ku) ;
       distance_to_lead_20_ku:_FillValue = -2147483648 ;
       distance_to_lead_20_ku:long_name = "Distance to nearest lead" ;
       distance_to_lead_20_ku:units = "m" ;
       distance_to_lead_20_ku:scale_factor = 1.0 ;
       distance_to_lead_20_ku:comment = "Distance to the sea ice lead. SAR/SIN only." ;
       distance_to_lead_20_ku:coordinates = "lon_20_ku lat_20_ku" ;
```

4.2.16 dop_angle_start_20_ku(time_20_ku)

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```
 int dop_angle_start_20_ku(time_20_ku);
       dop_angle_start_20_ku:units = "rad";
       dop_angle_start_20_ku:_FillValue = -2147483648;
       dop_angle_start_20_ku:long_name = "doppler angle start";
       dop_angle_start_20_ku:scale_factor = 1.e-07;
       dop_angle_start_20_ku:add_offset = 0.;
             dop_angle_start_20_ku:comment = "Value of Doppler Angle for the
first single look echo in the stack. It is the angle between: perpendicular to
the velocity vector and the direction satellite - surface location. The Doppler
angle depends on velocity vector and on geometry." ;
```

4.2.17 dop_angle_stop_20_ku(time_20_ku)

```
 int dop_angle_stop_20_ku(time_20_ku);
       dop_angle_stop_20_ku:units = "rad";
       dop_angle_stop_20_ku:_FillValue = -2147483648;
       dop_angle_stop_20_ku:long_name = "doppler angle stop";
       dop_angle_stop_20_ku:scale_factor = 1.e-07;
       dop_angle_stop_20_ku:add_offset = 0.;
       dop_angle_stop_20_ku:comment = "Value of Doppler Angle for the last single
look echo in the stack. It is the angle between: perpendicular to the velocity
vector and the direction satellite - surface location. The Doppler angle depends
on velocity vector and on geometry." ;
```

4.2.18 dop_cor_20_ku(time_20_ku)

```
 int dop_cor_20_ku(time_20_ku);
       dop_cor_20_ku:units = "m";
       dop_cor_20_ku:_FillValue = -2147483648;
       dop_cor_20_ku:long_name = "doppler range correction ";
       dop_cor_20_ku:add_offset = 0.;
       dop_cor_20_ku:scale_factor = 0.001;
       dop_cor_20_ku:coordinates = "lon_20_ku lat_20_ku ";
       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 the window delay during the L1
processing, therefore height estimates at L2 include this correction.";
```

4.2.19 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:comment = "For LRM is the number of echoes averaged to
compute the corresponding L1B 20Hz power waveform. For SAR/SARin 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_20_ku:long_name = "count of echoes or beams averaged" ;
       echo_numval_20_ku:units = "count" ;
```

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4.2.20 flag_bedmachine_mask_20_ku(time_20_ku)

```
 byte flag_bedmachine_mask_20_ku(time_20_ku) ;
     flag_bedmachine_mask_20_ku:coordinates = "lon_20_ku lat_20_ku" ;
        flag_bedmachine_mask_20_ku:comment = "Mask variable taken from
Bedmachine. For use in locating ice shelves." ;
        flag_bedmachine_mask_20_ku:long_name = "Bedmachine mask" ;
               flag_bedmachine_mask_20_ku:grid_mapping = "mapping" ;
               flag_bedmachine_mask_20_ku:valid_range = 0B, 4B ;
               flag_bedmachine_mask_20_ku:flag_values = 0B, 1B, 2B, 3B, 4B ;
               flag_bedmachine_mask_20_ku:flag_meanings = "ocean ice_free_land
grounded_ice floating_ice lake_vostok" ;
               flag_bedmachine_mask_20_ku:source = "Antarctic Digital Database
(rock outcrop) and Jeremie Mouginot (pers. comm., grounding lines)" ;
               flag_bedmachine_mask_20_ku:_FillValue = -128;
```

4.2.21 flag_cor_err_20_ku(time_20_ku)

```
 int flag_cor_err_20_ku(time_20_ku);
        flag_cor_err_20_ku:_FillValue = -2147483648;
        flag_cor_err_20_ku:long_name = "corrections error flags";
        flag_cor_err_20_ku:coordinates = "lon_20_ku lat_20_ku";
        flag_cor_err_20_ku:flag_masks = 1, 2,4,8,16,32,64,128,256,512,1024,
2048, 8192, 16384, 32768, 65536, 131072, 262144, 524288, 1048576, 2097152;
               flag_cor_err_20_ku:flag_meanings = "surface_type_error
pole_tide_error solid_earth_error load_tide_error ocean_tide_equil_error
ocean_tide_error iono_model_error iono_gim_error hf_fluctuations_error
inv_bar_error model_wet_error model_dry_error slope_model_error dem_error
odle_error geoid_error mss_error snow_density_error snow_depth_error
ice_conc_error ice_type_error" ;
        flag_cor_err_20_ku:comment = "Correction error flag. This flag shows, for
corrections algorithms that have been called only (see [flag_cor_status_20_ku]),
whether the correction models returned an error.";
```

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4.2.22 flag_cor_status_20_ku(time_20_ku)

```
 int flag_cor_status_20_ku(time_20_ku);
       flag_cor_status_20_ku:_FillValue = -2147483648;
       flag_cor_status_20_ku:long_name = "corrections status flags";
       flag_cor_status_20_ku:coordinates = "lon_20_ku lat_20_ku";
       flag_cor_status_20_ku:flag_masks   =   1,2,4,8,16,32,64,128,256,512,1024,
2048, 8192, 16384, 32768, 65536, 131072, 262144, 524288, 1048576, 2097152;
       flag_cor_status_20_ku:flag_meanings        =        "surface_type_called
pole_tide_called  solid_earth_called  load_tide_called  ocean_tide_equil_called
ocean_tide_called   iono_model_called   iono_gim_called   hf_fluctuations_called
inv_bar_called model_wet_called model_dry_called slope_model_called dem_called
odle_called   geoid_called   mss_called   snow_density_called   snow_depth_called
ice_conc_called ice_type_called" ;       flag_cor_status_20_ku:comment        =
"Correction status flag. This flag shows which correction algorithms have been
called. This is used to determine which auxiliary datasets should be listed as
reference datasets.";
```

4.2.23 flag_disc_stat_20_ku (time_20_ku)

```
 int flag_disc_stat_20_ku(time_20_ku);
       flag_disc_stat_20_ku:_FillValue = -2147483648;
       flag_disc_stat_20_ku:long_name = "discrimination status flag";
       flag_disc_stat_20_ku:coordinates = "lon_20_ku lat_20_ku";
       flag_disc_stat_20_ku:flag_masks = 1, 2, 4, 8, 16, 32, 64, 128, 256, 512,
                          1024, 2048, 4096, 8192, 16384, 32768, 65536;
       flag_disc_stat_20_ku:flag_meanings     =     "multiple_match     no_match
                                          sar_wf_too_wide       sar_snr_low
                                          sar_unreliable_ice_conc
                                          sar_unavailable_ice_conc
                                          sar_bad_bb          sar_low_power
                                          sar_low_pk            sar_high_pk
                                          sin_high_pk         sin_low_power
                                          sin_low_pk         sin_high_noise
                                          sin_bad_le            sin_low_var
                                          discrimination_fail";
       flag_disc_stat_20_ku:comment = "Discriminator status flags. These flags
are raised to provide low-level detail on why individual waveforms were rejected
for processing. Unused in LRM mode.";
_;
```

4.2.24 flag_freeboard_20_ku(time_20_ku)

```
 int flag_freeboard_20_ku (time_20_ku);
       flag_freeboard_20_ku:_FillValue = -2147483648;
       flag_freeboard_20_ku:long_name = "freeboard flag";
       flag_freeboard_20_ku:coordinates = "lon_20_ku lat_20_ku ";
       flag_freeboard_20_ku:flag_masks = 1, 2, 4, 8 ;
       flag_freeboard_20_ku:flag_meanings   =   "in_south   in_north   unreliable
unavailable";
       flag_freeboard_20_ku:comment  =  "SAR  freeboard  status  flags  indicate
availability and reliability of the freeboard measurement. The measurement is
unavailable if any step in the processing fails. The measurement is unreliable
if extapolation has to be used to determine the sea-surface height anomaly. Unused
in LRM mode.";
```

4.2.25 flag_height_20_ku(time_20_ku)

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```
 int flag_height_20_ku (time_20_ku);
       flag_height_20_ku:_FillValue = -2147483648;
       flag_height_20_ku:long_name = "height status flag";
       flag_height_20_ku:coordinates = "lon_20_ku lat_20_ku";
       flag_height_20_ku:flag_masks = 1, 4, 8, 16, 32, 64, 128, 256, 512, 1024,
2048, 4096, 8192, 16384, 32768, 65536, 131072, 262144, 524288, 1048576, 2097152,
4194304, 8388608, 16777216, 33554432, 67108864, 134217728, 268435456, 536870912,
1073741824;;
       flag_height_20_ku:flag_meanings = "correction_failure
                           sarin_bad_velocity
                           sarin_out_of_range
                           sarin_bad_baseline
                           lrm_slope_model_invalid
                           lrm_slope_model_applied
                           sarin_ice_bias_applied
                           sarin_ocean_bias_applied
                           sar_ice_bias_applied
                           sar_ocean_bias_applied
                           lrm_ice_bias_applied
                           lrm_ocean_bias_applied
                           lrm_retracker_applied
                           sarin_retracker_applied
                           sar_retracker_applied
                           window_offset_applied
                           slope_doppler_applied
                           pole_tide_applied
                           solid_earth_applied
                           load_tide_applied
                           ocean_tide_equil_applied
                           ocean_tide_applied
                           iono_model_applied
                           iono_gim_applied
                           hf_fluctuations_applied
                           inv_bar_applied
                           model_wet_applied
                           model_dry_applied
                           doppler_applied
                           internal_cal_applied
                           sarin_off_nadir_lead";"
flag_height_20_ku:comment = "Height status flags show which corrections have been
applied to the height fields [height_1_20_ku] [height_2_20_ku] [height_3_20_ku].
Flags which are mode dependent incorporate the name of the mode to which they
apply.";
```

4.2.26 height_sea_ice_floe_20_ku (time_20_ku)

```
 int height_sea_ice_floe_20_ku(time_20_ku) ;
       height_sea_ice_floe_20_ku:units = "m" ;
       height_sea_ice_floe_20_ku:_FillValue = -2147483648 ;
       height_sea_ice_floe_20_ku:long_name = "surface height (sea-ice floe
retracker)" ;
       height_sea_ice_floe_20_ku:standard_name                                =
"height_above_reference_ellipsoid" ;
       height_sea_ice_floe_20_ku:scale_factor = 0.001 ;
       height_sea_ice_floe_20_ku:coordinates = "lon_poca_20_ku lat_poca_20_ku"
;
       height_sea_ice_floe_20_ku:comment = "Measured height of the surface above
the reference ellipsoid (WGS84) at the coordinate location [lon_poca_20_ku]
```

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[lat_poca_20_ku]. All instrumental [instr_cor_range_rx_20_ku] and appropriate geophysical corrections included (see [flag_cor_applied_20_ku] for the set of corrections applied), and system bias. Only filled if the sea-ice floe retracker ran. This retracker is run over all surfaces not discriminated as a sea-ice lead, not just over sea-ice floes. In SAR mode over sea ice floes, includes a correction for pulse delay due to snow [snow_depth_cor_20_ku]. " ;

4.2.27 height_sea_ice_lead_20_ku (time_20_ku)

```
 int height_sea_ice_lead_20_ku(time_20_ku) ;
        height_sea_ice_lead_20_ku:_FillValue = -2147483648 ;
        height_sea_ice_lead_20_ku:comment = "Measured height of the surface above
the reference ellipsoid (WGS84) at the coordinate location [lon_poca_20_ku]
[lat_poca_20_ku]. All instrumental [instr_cor_range_rx_20_ku] and appropriate
geophysical corrections included (see [flag_cor_applied_20_ku] for the set of
corrections applied), and system bias. Only filled if the sea-ice lead retracker
ran." ;
        height_sea_ice_lead_20_ku:coordinates = "lon_poca_20_ku lat_poca_20_ku"
;
        height_sea_ice_lead_20_ku:long_name = "surface height (sea-ice floe
retracker)" ;
        height_sea_ice_lead_20_ku:scale_factor = 0.001 ;
        height_sea_ice_lead_20_ku:standard_name                                 =
"height_above_reference_ellipsoid" ;
        height_sea_ice_lead_20_ku:units = "m" ;
```

4.2.28 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 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
instrument acquisition band of the SIRAL instrument.";
```

4.2.29 flag_instr_conf_rx_flags_20(time_20_ku)

```
 byte flag_instr_conf_rx_flags_20_ku (time_20_ku);
        flag_instr_conf_rx_flags_20_ku:long_name   =   "instrument   configuration
       flag";
        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.";
 byte flag_instr_conf_rx_flags_20_ku(time_20_ku);
        flag_instr_conf_rx_flags_20_ku:long_name   =   "instrument   configuration
flags.";
```

4.2.30 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;
```

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```
        flag_instr_conf_rx_in_use_20_ku:long_name = "instrument receive channel
";
        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
instrument receive channel in use in the SIRAL instrument.";
```

4.2.31 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 = "star tracker id";
        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_star_tracker
tracker_1 tracker_2 tracker_3 attref_file";
        flag_instr_conf_rx_str_in_use_20_ku:coordinates = "lon_20_ku lat_20_ku";
        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.";
```

4.2.32 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
flag";
        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.";
```

4.2.33 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 = "platform attitude control
mode ";
        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:coordinates = "lon_20_ku lat_20_ku";
        flag_instr_mode_att_ctrl_20_ku:comment = "Platform attitude control mode
from instrument configuration bits in L0.";
```

4.2.34 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 = "SARin sub-mode flags ";
        flag_instr_mode_flags_20_ku:coordinates = "lon_20_ku lat_20_ku";
        flag_instr_mode_flags_20_ku:flag_masks = 2b, 1b;
        flag_instr_mode_flags_20_ku:flag_meanings = "SARIN_degraded_case
CAL4_packet_detection ";
```

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```
            flag_instr_mode_flags_20_ku:comment = "Flags related to sub-modes of
      SARin mode from instrument configuration bits in L0.";
```

4.2.35 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 = "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:coordinates = "lon_20_ku lat_20_ku";
              flag_instr_mode_op_20_ku:comment = "Instrument measurement mode derived
from configuration bits in L0.";
```

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4.2.36 flag_mcd_20_ku(time_20_ku)

```
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:coordinates = "lon_20_ku lat_20_ku";
       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
                                          cal1_missing     cal1_default
                                          doris_uso_missing
                                          ccal1_default  trk_echo_error
                                          echo_rx1_error echo_rx2_error
                                          npm_error azimuth_cal_missing
                                          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.";
```

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4.2.37 flag_quality_20_ku(time_20_ku)

```
 int flag_quality_20_ku (time_20_ku);
       flag_quality_20_ku:_FillValue = -2147483648;
       flag_quality_20_ku:long_name = "quality flag";
       flag_quality_20_ku:coordinates = "lon_20_ku lat_20_ku ";
       flag_quality_20_ku:flag_masks = 1, 2, 4, 8, 16, 32, 64, 128, 256, 512,
1024, 2048, 4096;
       flag_quality_20_ku:flag_meanings = "swh_error
                              alt_wind_error
                              maths_error
                              coherence_error
                              xtrack_angle_error
                              echo_shape_error
                              peakiness_error
                              sig0_3_error
                              sig0_2_error
                              sig0_1_error
                              height_3_error
                              height_2_error
                              height_1_error";
       flag_quality_20_ku:comment = "Indicates whether any of the measured
values are in error.";
```

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4.2.38 flag_retracker_20_ku(time_20_ku)

```
 int flag_retracker_20_ku(time_20_ku) ;
        flag_retracker_20_ku:_FillValue = -2147483648 ;
        flag_retracker_20_ku:long_name = "retracker flag" ;
        flag_retracker_20_ku:coordinates = "lon_20_ku lat_20_ku" ;
        flag_retracker_20_ku:flag_masks = 1, 2, 4, 8, 16, 32, 64, 128, 256, 512,
1024, 2048, 4096, 8192, 16384, 32768, 65536, 131072 ;
        flag_retracker_20_ku:flag_meanings = "retracker_3_fail retracker_2_fail
retracker_1_fail   poor_phase_fit   poor_power_fit   fdm_ocog_fail   fit_failed
sarin_low_coherence     sarin_interp_fail     abnormal_bb_param     out_of_range
bad_leading_edge low_variance high_noise high_peakiness low_peakiness low_power
sea_ice_retracker_fail" ;
        flag_retracker_20_ku:comment = "Retracker flags indicate errors from the
retracker algorithms, and waveform quality checking results, in each mode. Mode
specific flags incorporate the name of the mode." ;
```

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4.2.39 flag_sarin_ambiguity_warning_20_ku(time_20_ku)

```
byte flag_sarin_ambiguity_warning_20_ku (time_20_ku);
       flag_sarin_ambiguity_warning_20_ku:_FillValue = -128b;
       flag_sarin_ambiguity_warning_20_ku:long_name = "ambiguity warning flag";
       flag_sarin_ambiguity_warning_20_ku:flag_values = 0b, 1b, 2b, 3b;
       flag_sarin_ambiguity_warning_20_ku:flag_meanings = "no_warning warning
not_checked unwrapped";
       flag_sarin_ambiguity_warning_20_ku:coordinates = "lon_20_ku lat_20_ku ";
       flag_sarin_ambiguity_warning_20_ku:comment = "Flag indicating if the
height measurement may be affected by positional ambiguity due to phase wrapping.
Used in SARin, Unused in LRM and SAR modes.";
```

4.2.40 flag_sea_ice_type_20_ku(time_20_ku)

```
byte flag_sea_ice_type_20_ku(time_20_ku) ;
       flag_sea_ice_type_20_ku:_FillValue = -128b ;
       flag_sea_ice_type_20_ku:comment = "Flag indicating sea ice type. Unused
in LRM mode." ;
       flag_sea_ice_type_20_ku:coordinates = "lon_20_ku lat_20_ku" ;
       flag_sea_ice_type_20_ku:flag_masks = 1b, 2b, 3b, 4b ;
       flag_sea_ice_type_20_ku:flag_meanings = "open_water first_year_ice
multi_year_ice ambiguous" ;
       flag_sea_ice_type_20_ku:institution = "EUMETSAT OSI SAF" ;
       flag_sea_ice_type_20_ku:long_name = "sea ice type flag" ;
       flag_sea_ice_type_20_ku:source = "OSI SAF Sea Ice Edge and Type Product"
 ;
```

4.2.41 flag_ssha_interp_20_ku(time_20_ku)

```
byte flag_ssha_interp_20_ku(time_20_ku);
       flag_ssha_interp_20_ku:_FillValue = -128b;
       flag_ssha_interp_20_ku:long_name = "SSHA interpolation error flag";
       flag_ssha_interp_20_ku:coordinates = "lon_20_ku lat_20_ku";
       flag_ssha_interp_20_ku:flag_masks = 1b, 2b, 3b;
       flag_ssha_interp_20_ku:flag_meanings = "no_values extrapolation
unreliable";
       flag_ssha_interp_20_ku:comment = "Flag indicating if an error occurred
during interpolation, due to a lack of values to interpolate. SSHA and freeboard
results will be unreliable. Unused in LRM mode.";
```

4.2.42 flag_surf_type_class_20_ku(time_20_ku)

```
short flag_surf_type_class_20_ku(time_20_ku) ;
       flag_surf_type_class_20_ku:_FillValue = -32768s ;
       flag_surf_type_class_20_ku:long_name = "discriminated surface type" ;
       flag_surf_type_class_20_ku:flag_masks = 1s, 2s, 4s, 8s, 16s, 32s, 64s,
128s, 256s ;
       flag_surf_type_class_20_ku:flag_meanings = "lrm_undefined lrm_ocean
lrm_land_ice sarin_undefined sarin_valid sar_undefined sar_ocean sar_sea_ice
sar_lead" ;
       flag_surf_type_class_20_ku:coordinates = "lon_20_ku lat_20_ku" ;
       flag_surf_type_class_20_ku:comment = "Flag indicating the surface type
determined by analysis of the waveform and aux values. Unused in LRM mode. Over
ocean in SARin mode, the SAR discriminator for sea-ice is used." ;
```

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4.2.43 radar_freeboard_20_ku(time_20_ku)

```
int radar_freeboard_20_ku(time_20_ku) ;
 radar_freeboard_20_ku:_FillValue = -2147483648 ;
 radar_freeboard_20_ku:comment = "Radar freeboard, the height of the radar
scattering horizon above the local sea surface. Computed as
[radar_freeboard_20_ku] = [height_1_20_ku] - [ssha_interp_20_ku]. Note that
freeboard can be a small negative value due to the effect of random noise (in
both the height estimation and the interpolation of the sea surface) on small
freeboard values. Unused in LRM mode." ;
 radar_freeboard_20_ku:coordinates = "lon_20_ku lat_20_ku" ;
 radar_freeboard_20_ku:long_name = "radar freeboard" ;
 radar_freeboard_20_ku:scale_factor = 0.001 ;
 radar_freeboard_20_ku:units = "m" ;
```

4.2.44 geoid_20_ku(time_20_ku)

```
 int geoid_20_ku (time_20_ku);
       geoid_20_ku:units = "m";
       geoid_20_ku:_FillValue = -2147483648;
       geoid_20_ku:long_name = "geoid height";
       geoid_20_ku:standard_name = "geoid_height_above_reference_ellipsoid";
       geoid_20_ku:scale_factor = 0.001;
       geoid_20_ku:coordinates = "lon_20_ku lat_20_ku";
       geoid_20_ku:source = "EGM2008";
       geoid_20_ku:institution = " NGIA and SGT";
       geoid_20_ku:comment = "Computed from the geoid model with a correction to
refer the value to the mean tide system i.e. includes the permanent tide (zero
frequency), and referenced to WGS84. See Pavlis, N. K., S. A.Holmes, S. C.Kenyon,
and J. K.Factor (2012), The development and evaluation of the Earth Gravitational
Model 2008 (EGM2008), J. Geophys. Res., 117, B04406, doi:10.1029/2011JB008916.";
```

4.2.45 height_1_20_ku(time_20_ku)

```
 int height_1_20_ku(time_20_ku);
       height_1_20_ku:units = "m";
       height_1_20_ku:_FillValue = -2147483648;
       height_1_20_ku:long_name = "surface height (retracker 1)";
       height_1_20_ku:standard_name = "height_above_reference_ellipsoid";
       height_1_20_ku:scale_factor = 0.001;
       height_1_20_ku:coordinates = "lon_poca_20_ku lat_poca_20_ku ";
       height_1_20_ku:comment = "Measured height of the surface above the
reference ellipsoid (WGS84) at the coordinate location [lon_poca_20_ku]
[lat_poca_20_ku]. All instrumental [instr_cor_range_rx_20_ku] and appropriate
geophysical corrections included (see [flag_height_20_ku] for the set of
corrections applied), and system bias. Corrected for surface slope via a slope
model in LRM and SARin degraded mode. Corrected for surface slope via phase
information in SARin mode. Contains the Ocean CFI retracker result in LRM mode,
the UCL sea-ice retracker results in SAR mode (different method for specular and
diffuse echoes), and the UCL margins retracker in SARin mode. In SAR mode over
sea ice floes, includes a correction for pulse delay due to snow
[snow_depth_cor_20_ku]. ";
```

4.2.46 height_2_20_ku(time_20_ku)

```
 int height_2_20_ku (time_20_ku);
```

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height_2_20_ku:units = "m";
height_2_20_ku:_FillValue = -2147483648;
height_2_20_ku:long_name = "surface height (retracker 2)";
height_2_20_ku:standard_name = "height_above_reference_ellipsoid";
height_2_20_ku:scale_factor = 0.001;
height_2_20_ku:coordinates = "lon_poca_20_ku lat_poca_20_ku ";
height_2_20_ku:comment = "Measured height of the surface above the reference ellipsoid (WGS84) at the coordinate location [lon_poca_20_ku] [lat_poca_20_ku]. All instrumental [instr_cor_range_rx_20_ku] and appropriate geophysical corrections included (see [flag_height_20_ku] for the set of corrections applied), and system bias. Corrected for surface slope via a slope model in LRM. Not currently used in SAR and SARin modes. Contains the UCL land-ice retracker in LRM mode.";

4.2.47 height_3_20_ku(time_20_ku)

int height_3_20_ku (time_20_ku);
height_3_20_ku:units = "m";
height_3_20_ku:_FillValue = -2147483648;
height_3_20_ku:long_name = "surface height (retracker 3)";
height_3_20_ku:standard_name = "height_above_reference_ellipsoid";
height_3_20_ku:scale_factor = 0.001;
height_3_20_ku:coordinates = "lon_poca_20_ku lat_poca_20_ku ";
height_3_20_ku:comment = "Measured height of the surface above the reference ellipsoid (WGS84) at the coordinate location [lon_poca_20_ku] [lat_poca_20_ku]. All instrumental [instr_cor_range_rx_20_ku] and appropriate geophysical corrections included (see [flag_height_20_ku] for the set of corrections applied), and system bias. Corrected for surface slope via a slope model in LRM. Not currently used in SAR and SARin modes. Contains the OCOG retracker in LRM mode.";

4.2.48 height_ocog_plrm_20_ku(time_plrm_20_ku)

int height_ocog_plrm_20_ku (time_plrm_20_ku);
height_ocog_plrm_20_ku:units = "m";
height_ocog_plrm_20_ku:_FillValue = -2147483648;
height_ocog_plrm_20_ku ku:long_name = "surface height (retracker 3)";
height_ocog_plrm_20_ku:standard_name = "height_above_reference_ellipsoid";
height_ocog_plrm_20_ku:scale_factor = 0.001;
height_ocog_plrm_20_ku:coordinates = "lon_poca_plrm_20_ku lat_poca_plrm_20_ku ";
height_ocog_plrm_20_ku:comment = "Measured height of the surface above the reference ellipsoid (WGS84) at the coordinate location [lon_poca_20_ku] [lat_poca_20_ku]. All instrumental [instr_cor_range_rx_20_ku] and appropriate geophysical corrections included (see [flag_height_20_ku] for the set of corrections applied), and system bias. Corrected for surface slope via a slope model in LRM. Not currently used in SAR and SARin modes. Contains the OCOG retracker in LRM mode.";

4.2.49 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: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

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```
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 has been accounted
for during the computation of height (see [flag_height_20_ku] to determine if it
was applied) 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." ;
        hf_fluct_total_cor_01:coordinates = "lon_01 lat_01" ;
        hf_fluct_total_cor_01:institution = "LEGOS/CLS/CNES" ;
        hf_fluct_total_cor_01:long_name = "dynamic atmosphere correction" ;
        hf_fluct_total_cor_01:scale_factor = 0.001 ;
        hf_fluct_total_cor_01:source = "MOG2D 2.1.0" ;
        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:units = "m" ;
```

4.2.50 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." ;
        ind_first_meas_20hz_01:long_name = "index of the first 20Hz measurement:
1 Hz" ;
        ind_first_meas_20hz_01:units = "count" ;
```

4.2.51 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:long_name = "index of the 1Hz measurement: 20 Hz ku
band" ;
        ind_meas_1hz_20_ku:units = "count" ;
```

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4.2.52 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:coordinates = "lon_20_ku lat_20_ku";
        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.
";
```

4.2.53 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:units = "dB";
        instr_cor_gain_tx_rx_20_ku:_FillValue = -2147483648;
        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;
        instr_cor_gain_tx_rx_20_ku:coordinates = "lon_20_ku lat_20_ku ";
        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.";
```

4.2.54 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:units = "m";
        instr_cor_range_rx_20_ku:_FillValue = -2147483648;
        instr_cor_range_rx_20_ku:long_name = "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:coordinates = "lon_20_ku lat_20_ku ";
              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
CoOM - Antenna distance." ;
```

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4.2.55 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:units = "m";
       instr_cor_range_tx_rx_20_ku:_FillValue = -2147483648;
       instr_cor_range_tx_rx_20_ku:long_name = "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:coordinates = "lon_20_ku lat_20_ku";
       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.";
```

4.2.56 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:units = "rad";
       instr_ext_ph_cor_20_ku:_FillValue = -2147483648;
       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:coordinates = "lon_20_ku lat_20_ku";
       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.";
```

4.2.57 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:units = "rad";
       instr_int_ph_cor_20_ku:_FillValue = -2147483648;
       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:coordinates = "lon_20_ku lat_20_ku ";
       instr_int_ph_cor_20_ku:comment = "Internal phase correction computed from
the CAL-4 packets during the azimuth impulse response amplitude (SARIN only). It
is set from the latest available CAL-4 packet.";
```

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4.2.58 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:units = "m";
       inter_base_vec_20_ku:_FillValue = -2147483648;
       inter_base_vec_20_ku:long_name = "interferometer baseline direction
vector in crf ";
       inter_base_vec_20_ku:scale_factor = 1.0e-6;
       inter_base_vec_20_ku:coordinates = "lon_20_ku lat_20_ku ";
       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.";
```

4.2.59 inv_bar_cor_01(time_cor_01)

```
 int inv_bar_cor_01(time_cor_01);
       inv_bar_cor_01:units = "m";
       inv_bar_cor_01:_FillValue = -2147483648;
       inv_bar_cor_01:long_name = "inverse barometric correction";
       inv_bar_cor_01:standard_name                                    =
"sea_surface_height_correction_due_to_air_pressure_at_low_frequency";
       inv_bar_cor_01:scale_factor = 0.001;
       inv_bar_cor_01:coordinates = "lon_01 lat_01";
       inv_bar_cor_01:source = "European Center for Medium Range Weather
Forecasting";
       inv_bar_cor_01:institution = "ECMWF";
       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 has been accounted for during the computation of height (see
[flag_height_20_ku] to determine if it was applied) 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.";
```

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4.2.60 iono_cor_01(time_cor_01)

```
 int iono_cor_01(time_cor_01);
        iono_cor_01:units = "m";
        iono_cor_01:_FillValue = -2147483648;
        iono_cor_01:long_name = "model ionospheric correction";
        iono_cor_01:standard_name                                                    =
"altimeter_range_correction_due_to_ionosphere";
        iono_cor_01:scale_factor = 0.001;
        iono_cor_01:coordinates = "lon_01 lat_01";
        iono_cor_01:source = "Bent";
        iono_cor_01:institution = "Bent";
        iono_cor_01:comment = "Model ionospheric correction. This 1-way
correction has been accounted for during the computation of height (see
[flag_height_20_ku] to determine if it was applied) 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.";
```

4.2.61 iono_cor_gim_01(time_cor_01)

```
 int iono_cor_gim_01(time_cor_01);
        iono_cor_gim_01:units = "m";
        iono_cor_gim_01:_FillValue = -2147483648;
        iono_cor_gim_01:long_name = "GIM ionospheric correction";
        iono_cor_gim_01:standard_name                                                =
"altimeter_range_correction_due_to_ionosphere";
        iono_cor_gim_01:scale_factor = 0.001;
        iono_cor_gim_01:coordinates = "lon_01 lat_01";
        iono_cor_gim_01:source = "GIM";
        iono_cor_gim_01:institution = "NASA/JPL";
        iono_cor_gim_01:comment = "GIM ionospheric correction. This 1-way
correction has been accounted for during the computation of height (see
[flag_height_20_ku] to determine if it was applied) 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.";
```

4.2.1 larm_wf_metric_1_20_ku(time_20_ku)

```
      int larm_wf_metric_1_20_ku(time_20_ku) ;
              larm_wf_metric_1_20_ku:_FillValue = -2147483648;
              larm_wf_metric_1_20_ku:comment = "Value of sigma_si fitted by the
LARM retracker that represents the millimeter-centimeter Ku-band wavelength-scale
surface roughness of the primary backscattering interface. Contains the LARM
retracker results in SAR or SARIn mode, if that retracker has been activated. For
LARM details see DOI 10.1029/2019JC015820" ;
              larm_wf_metric_1_20_ku:coordinates       =       "lon_poca_20_ku
lat_poca_20_ku" ;
              larm_wf_metric_1_20_ku:long_name  =  "LARM  waveform  metric  1
(sigma_si)" ;
              larm_wf_metric_1_20_ku:scale_factor = 1E-6 ;
              larm_wf_metric_1_20_ku:units = "m" ;
```

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4.2.2 larm_wf_metric_2_20_ku(time_20_ku)

```
      int larm_wf_metric_2_20_ku(time_20_ku) ;
            larm_wf_metric_2_20_ku:_FillValue = -2147483648;
            larm_wf_metric_2_20_ku:comment = "Value of sigma_surf fitted by
the LARM retracker that represents the 1-100s m footprint-scale topography of the
primary backscattering interface. Contains the LARM retracker results in SAR or
SARIn mode, if that retracker has been activated. For LARM details see DOI
10.1029/2019JC015820" ;
            larm_wf_metric_2_20_ku:coordinates       =       "lon_poca_20_ku
lat_poca_20_ku" ;
            larm_wf_metric_2_20_ku:long_name  =  "LARM  waveform  metric  2
(sigma_surf)" ;
            larm_wf_metric_2_20_ku:scale_factor = 1E-6 ;
            larm_wf_metric_2_20_ku:units = "m" ;
```

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

4.2.4 lat_poca_20_ku(time_20_ku)

```
 int lat_poca_20_ku (time_20_ku);
       lat_poca_20_ku:units = "degrees_north";
       lat_poca_20_ku:_FillValue = -2147483648;
       lat_poca_20_ku:long_name = "latitude of the estimated echo location
(POCA)";
       lat_poca_20_ku:standard_name = "latitude";
       lat_poca_20_ku:scale_factor = 1.e-07;
       lat_poca_20_ku:comment = "Latitude of estimated echo location (point of
closest approach) [-90,+90]. Positive latitude is North latitude, negative
latitude is South latitude. Note the scale factor. Set to lat_20_ku if the echo
offset is not estimated, so it always available to use as a plotting coordinate.
In SAR mode, this value will be the uncorrected nadir location. In LRM/SARin, it
may change from nadir due to slope correction or interferometry.";
```

4.2.5 lat_poca_plrm_20_ku(time_plrm_20_ku)

```
 int lat_poca_plrm_20_ku (time_plrm_20_ku);
       lat_poca_plrm_20_ku:units = "degrees_north";
       lat_poca_plrm_20_ku:_FillValue = -2147483648;
       lat_poca_plrm_20_ku:long_name = "latitude of the estimated echo location
(POCA)";
       lat_poca_plrm_20_ku:standard_name = "latitude";
       lat_poca_plrm_20_ku:scale_factor = 1.e-07;
       lat_poca_plrm_20_ku:comment = "Latitude of estimated echo location (point
of closest approach) [-90,+90]. Positive latitude is North latitude, negative
latitude is South latitude. Note the scale factor. Set to lat_20_ku if the echo
```

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offset is not estimated, so it always available to use as a plotting coordinate. In SAR mode, this value will be the uncorrected nadir location. In LRM/SARin, it may change from nadir due to slope correction or interferometry.";

4.2.6 lat_plrm_20_ku(time_plrm_20_ku)

```
int lat_plrm_20_ku(time_plrm_20_ku) ;
 lat_plrm_20_ku:_FillValue = -2147483648 ;
 lat_plrm_20_ku:units = “degrees_north” ;
 lat_plrm_20_ku:long_name = “latitude of measurement” ;
 lat_plrm_20_ku:standard_name = “latitude” ;
 lat_plrm_20_ku:add_offset = 0. ;
 lat_plrm_20_ku:scale_factor = 1.e-07 ;
lat_plrm_20_ku:comment = “Latitude of nadir location [-90,+90]. Positive latitude
is North latitude, negative latitude is South latitude. Note the scale factor.”
;
lat_plrm_20_ku:coordinates = “lon_plrm_20_ku lat_plrm_20_ku”;
```

4.2.7 load_tide_01(time_cor_01)

```
 int load_tide_01(time_cor_01);
       load_tide_01:units = "m";
       load_tide_01:_FillValue = -2147483648;
       load_tide_01:long_name = "ocean loading tide height";
       load_tide_01:scale_factor = 0.001;
       load_tide_01:coordinates = "lon_01 lat_01";
       load_tide_01:source = " FES2022b";
       load_tide_01:institution = "LEGOS/CNES";
       load_tide_01:comment = “Ocean loading tide. This 1-way correction has
been accounted for during the computation of height (see [flag_height_20_ku] to
determine if it was applied) to remove the effect of local tidal distortion to
the Earth’s crust, caused by increasing weight of ocean as local water tide rises.
This correction accounts for heigh of the diurnal and semi-diurnal and the heigh
of the long period wave constituents of the tidal spectrum. It is set to nan if
no data is available at the given position. Geocentric elastic tide is given by
[load_tide_01]+[ocean_tide_01] ";
```

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4.2.8 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";
        lon_20_ku:scale_factor = 1.e-07;
        lon_20_ku:comment = "Longitude of nadir location [-180,+180]. East
longitude relative to Greenwich meridian. Note the scale factor.";
```

4.2.9 lon_poca_20_ku(time_20_ku)

```
 int lon_poca_20_ku(time_20_ku);
        lon_poca_20_ku:units = "degrees_east";
        lon_poca_20_ku:_FillValue = -2147483648;
        lon_poca_20_ku:long_name = "longitude of the estimated echo location
(POCA)";
        lon_poca_20_ku:standard_name = "longitude";
        lon_poca_20_ku:scale_factor = 1.e-07;
        lon_poca_20_ku:comment = "Longitude of estimated echo location (point of
closest approach) [-180,+180]. East longitude relative to Greenwich meridian.
Note the scale factor. Set to lon_20_ku if the echo offset is not estimated, so
it is always available for using as a plotting coordinate. In SAR mode, this value
will be the uncorrected nadir location. In LRM/SARin, it may change from nadir
due to slope correction or interferometry.";
```

4.2.10 lon_poca_plrm_20_ku(time_plrm_20_ku)

```
 int lon_poca_plrm_20_ku(time_plrm_20_ku);
        lon_poca_plrm_20_ku:units = "degrees_east";
        lon_poca_plrm_20_ku:_FillValue = -2147483648;
        lon_poca_plrm_20_ku:long_name = "longitude of the estimated echo location
(POCA)";
        lon_poca_plrm_20_ku:standard_name = "longitude";
        lon_poca_plrm_20_ku:scale_factor = 1.e-07;
        lon_poca_plrm_20_ku:comment = "Longitude of estimated echo location
(point of closest approach) [-180,+180]. East longitude relative to Greenwich
meridian. Note the scale factor. Set to lon_20_ku if the echo offset is not
estimated, so it is always available for using as a plotting coordinate. In SAR
mode, this value will be the uncorrected nadir location. In LRM/SARin, it may
change from nadir due to slope correction or interferometry.";
```

4.2.11 lon_plrm_20_ku(time_plrm_20_ku)

```
int lon_plrm_20_ku(time_plrm_20_ku) ;
  lon_plrm_20_ku:_FillValue = -2147483648 ;
  lon_plrm_20_ku:units = “degrees_east” ;
  lon_plrm_20_ku:long_name = “longitude of measurement” ;
  lon_plrm_20_ku:standard_name = “longitude” ;
  lon_plrm_20_ku:add_offset = 0. ;
  lon_plrm_20_ku:scale_factor = 1.e-07 ;
lon_plrm_20_ku:comment = “Longitude of nadir location [-180,+180]. Positive
longitude is East relative to Greenwich meridian. Note the scale factor.” ;
```

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```
lon_plrm_20_ku:coordinates = "lon_plrm_20_ku lat_plrm_20_ku";
```

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4.2.12 look_angle_start_20_ku(time_20_ku)

```
 int look_angle_start_20_ku(time_20_ku);
       look_angle_start_20_ku:units = "rad";
       look_angle_start_20_ku:_FillValue = -2147483648;
       look_angle_start_20_ku:long_name = "look angle start";
       look_angle_start_20_ku:scale_factor = 1.e-07;
       look_angle_start_20_ku:add_offset = 0.;
       look_angle_start_20_ku:comment = "look angle start";
                    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 satellite - surface
location. The look angle depends purely on geometry." ;
```

4.2.13 look_angle_stop_20_ku(time_20_ku)

```
 int look_angle_stop_20_ku(time_20_ku);
       look_angle_stop_20_ku:units = "rad";
       look_angle_stop_20_ku:_FillValue = -2147483648;
       look_angle_stop_20_ku:long_name = "data_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 = "data_look angle stop";
       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) perpendicular from the
satellite CoM to the surface, (b) direction satellite - surface location. The
look angle depends purely on geometry.";
```

4.2.14 mean_sea_surf_sea_ice_20_ku(time_20_ku)

```
 int mean_sea_surf_sea_ice_20_ku(time_20_ku);
       mean_sea_surf_sea_ice_20_ku:units = "m";
       mean_sea_surf_sea_ice_20_ku:_FillValue = -2147483648;
       mean_sea_surf_sea_ice_20_ku:long_name = "mean sea surface height above
reference ellipsoid";
       mean_sea_surf_sea_ice_20_ku:standard_name                              =
"sea_surface_height_above_reference_ellipsoid";
       mean_sea_surf_sea_ice_20_ku:source = "DTU21";
       mean_sea_surf_sea_ice_20_ku:institution = "DTU";
       mean_sea_surf_sea_ice_20_ku:scale_factor = 0.001;
       mean_sea_surf_sea_ice_20_ku:coordinates = "lon_20_ku lat_20_ku ";
       mean_sea_surf_sea_ice_20_ku:comment = "Mean sea surface model, referenced
to the WGS84 ellipsoid, from DTU21 model." ;
```

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4.2.15 mod_dry_tropo_cor_01(time_cor_01)

```
 int mod_dry_tropo_cor_01(time_cor_01);
        mod_dry_tropo_cor_01:units = "m";
        mod_dry_tropo_cor_01:_FillValue = -2147483648;
        mod_dry_tropo_cor_01:long_name = "dry tropospheric correction";
        mod_dry_tropo_cor_01:standard_name                                    =
"altimeter_range_correction_due_to_dry_troposphere";
        mod_dry_tropo_cor_01:scale_factor = 0.001;
        mod_dry_tropo_cor_01:coordinates = "lon_01 lat_01";
        mod_dry_tropo_cor_01:source = "European Center for Medium Range Weather
Forecasting";
        mod_dry_tropo_cor_01:institution = "ECMWF";
        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 has been accounted for during the computation of height (see
[flag_height_20_ku] to determine if it was applied) in order to correct for the
propagation delay to the radar pulse, caused by the dry-gas component of the
Earth\'s atmosphere." ;
```

4.2.16 mod_wet_tropo_cor_01(time_cor_01)

```
 int mod_wet_tropo_cor_01(time_cor_01);
        mod_wet_tropo_cor_01:units = "m";
        mod_wet_tropo_cor_01:_FillValue = -2147483648;
        mod_wet_tropo_cor_01:long_name = "wet tropospheric correction";
        mod_wet_tropo_cor_01:standard_name                                    =
"altimeter_range_correction_due_to_wet_troposphere";
        mod_wet_tropo_cor_01:scale_factor = 0.001;
        mod_wet_tropo_cor_01:coordinates = "lon_01 lat_01";
        mod_wet_tropo_cor_01:source = "European Center for Medium Range Weather
Forecasting";
        mod_wet_tropo_cor_01:institution = "ECMWF";
        mod_wet_tropo_cor_01:comment = "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 has been accounted for during the computation of height (see
[flag_height_20_ku] to determine if it was applied) in order to correct for the
propagation delay to the radar pulse, caused by the H~2~O component of the Earth's
atmosphere.";
```

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4.2.17 noise_power_20_ku(time_20_ku)

```
 int noise_power_20_ku(time_20_ku);
       noise_power_20_ku:units = "dB";
       noise_power_20_ku:_FillValue = -2147483648;
       noise_power_20_ku:long_name = "noise power measurement";
       noise_power_20_ku:scale_factor = 0.01;
       noise_power_20_ku:coordinates = "lon_20_ku lat_20_ku";
       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. ";
```

4.2.18 ocean_tide_01(time_cor_01)

```
 int ocean_tide_01(time_cor_01);
       ocean_tide_01:units = "m";
       ocean_tide_01:_FillValue = -2147483648;
       ocean_tide_01:long_name = "pure ocean tide height";
       ocean_tide_01:scale_factor = 0.001;
       ocean_tide_01:coordinates = "lon_01 lat_01";
       ocean_tide_01:source = " FES2022b";
       ocean_tide_01:institution = "LEGOS/CNES";
       ocean_tide_01:comment = "Ocean tide. This 1-way correction has been
accounted for during the computation of height (see [flag_height_20_ku] to
determine if it was applied) 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]. This correction accounts for heigh
of the diurnal and semi-diurnal and the heigh of the long period wave constituents
of the tidal spectrum. It is set to nan if no data is available at the given
position. Geocentric elastic tide is given by [load_tide_01]+[ocean_tide_01] ";
```

4.2.19 ocean_tide_eq_01(time_cor_01)

```
 int ocean_tide_eq_01(time_cor_01);
       ocean_tide_eq_01:units = "m";
       ocean_tide_eq_01:_FillValue = -2147483648;
       ocean_tide_eq_01:long_name = "long-period ocean tide height";
       ocean_tide_eq_01:standard_name                                    =
"sea_surface_height_amplitude_due_to_equilibrium_ocean_tide";
       ocean_tide_eq_01:scale_factor = 0.001;
       ocean_tide_eq_01:coordinates = "lon_01 lat_01";
       ocean_tide_eq_01:source = "Cartwright and Edden [1973] Corrected tables
of tidal harmonics - J. Geophys. J. R. Astr. Soc., 33, 253-264." ;
       ocean_tide_eq_01:institution = "LEGOS/CNES";
       ocean_tide_eq_01:comment = "Equilibrium ocean tide. This 1-way correction
has been accounted for during the computation of height (see [flag_height_20_ku]
to determine if it was applied) to remove the effect of the oceanic response to
the single tidal forcing.";
```

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4.2.20 odle_20_ku(time_20_ku)

```
 int odle_20_ku (time_20_ku);
       odle_20_ku:units = "m";
       odle_20_ku:_FillValue = -2147483648;
       odle_20_ku:long_name = "ocean depth/land elevation";
       odle_20_ku:scale_factor = 0.001;
       odle_20_ku:coordinates = "lon_20_ku lat_20_ku";
       odle_20_ku:source = "MACESS";
       odle_20_ku:institution = "ESA ESRIN";
       odle_20_ku:comment = "Ocean depth and land elevation model. The model is
a merge of ACE land elevation data and Smith and Sandwell ocean bathymetry. See
P. A. M. Berry, R. A. Pinnock, R. D. Hilton, and C. P. D. Johnson, ACE: a new
GDEM incorporating satellite altimeter derived heights,  ESA Pub. SP-461, 9pp,
2000 and W. H. F Smith, and D. T. Sandwell, Global seafloor topography from
satellite altimetry and ship depth soundings, Science, v. 277, p. 1957-1962, 26
Sept., 1997.";
```

4.2.21 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:add_offset = 0.;
       off_nadir_pitch_angle_str_20_ku:scale_factor = 1.e-07;
       off_nadir_pitch_angle_str_20_ku:coordinates = "lon_20_ku lat_20_ku";
       off_nadir_pitch_angle_str_20_ku:comment = "Pitch angle with respect to
the nadir pointing, measured by the STRs and post-processed by ground facility.";
```

4.2.22 off_nadir_roll_angle_str_20(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:add_offset = 0.;
       off_nadir_roll_angle_str_20_ku:scale_factor = 1.e-07;
       off_nadir_roll_angle_str_20_ku:coordinates = "lon_20_ku lat_20_ku";
       off_nadir_roll_angle_str_20_ku:comment = "Roll angle with respect to the
nadir pointing, measured by the STRs and post-processed by ground facility.";
```

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4.2.23 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:add_offset = 0.;
        off_nadir_yaw_angle_ str_20_ku:scale_factor = 1.e-07;
        off_nadir_yaw_angle_ str_20_ku:coordinates = "lon_20_ku lat_20_ku";
        off_nadir_yaw_angle_ str_20_ku:comment = "Yaw angle with respect to the
nadir pointing, measured by the STRs and post-processed by ground facility";
 int off_nadir_roll_angle_str_01(time_cor_01);
```

4.2.24 offset_attitude_20_ku(time_20_ku)

```
 int offset_attitude_20_ku(time_20_ku);
        offset_attitude_20_ku:units = "rad";
        offset_attitude_20_ku:_FillValue = -2147483648;
        offset_attitude_20_ku:long_name = "20 Hz Ku band echo attitude";
        offset_attitude_20_ku:scale_factor = 1.e-06;
        offset_attitude_20_ku:coordinates = "lon_20_ku lat_20_ku ";
        offset_attitude_20_ku:comment = "The attitude angle between the nadir
vector and the echo point vector. Unused in SAR and SARin modes.";
```

4.2.25 offset_azimuth_20_ku(time_20_ku)

```
 int offset_azimuth_20_ku (time_20_ku);
        offset_azimuth_20_ku:units = "rad";
        offset_azimuth_20_ku:_FillValue = -2147483648;
        offset_azimuth_20_ku:long_name = "echo azimuth";
        offset_azimuth_20_ku:scale_factor = 1.e-06;
        offset_azimuth_20_ku:coordinates = "lon_20_ku lat_20_ku ";
        offset_azimuth_20_ku:comment = "The azimuth angle between the north
vector and the echo point vector. Unused in SAR and SARin modes.";
```

4.2.26 orb_alt_rate_20_ku(time_20_ku)

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

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4.2.27 peakiness_20_ku(time_20_ku)

```
 int peakiness_20_ku(time_20_ku);
       peakiness_20_ku:_FillValue = -2147483648;
       peakiness_20_ku:long_name = "waveform peakiness ";
       peakiness_20_ku:scale_factor = 0.01;
       peakiness_20_ku:coordinates = "lon_20_ku lat_20_ku";
       peakiness_20_ku:comment = "Waveform peakiness. Note that this will require
different interpretation for SAR and SARin echoes which do not have the typical
pulse-limited echo shape. For LRM and SARin, the traditional ENVISAT derivation
is used. This is the ratio of the maximum power in the waveform to the average
of the waveform power to the right hand side of the expected waveform leading
edge location. For SAR mode, waveform bins with no power are excluded from the
average to account for the specular nature of some waveforms.";
```

4.2.28 peakiness_plrm_20_ku(time_plrm_20_ku)

```
 int peakiness_plrm_20_ku(time_plrm_20_ku);
       peakiness_plrm_20_ku:_FillValue = -2147483648;
       peakiness_plrm_20_ku:long_name = "waveform peakiness ";
       peakiness_plrm_20_ku:scale_factor = 0.01;
       peakiness_plrm_20_ku:coordinates = "lon_plrm_20_ku lat_plrm_20_ku";
       peakiness_plrm_20_ku:comment = "Waveform peakiness. Note that this will
require different interpretation for SAR and SARin echoes which do not have the
typical pulse-limited echo shape. For LRM and SARin, the traditional ENVISAT
derivation is used. This is the ratio of the maximum power in the waveform to the
average of the waveform power to the right hand side of the expected waveform
leading edge location. For SAR mode, waveform bins with no power are excluded
from the average to account for the specular nature of some waveforms.";
```

4.2.29 ph_slope_cor_20_ku(time_20_ku)

```
 int ph_slope_cor_20_ku(time_20_ku);
       ph_slope_cor_20_ku:units = "rad";
       ph_slope_cor_20_ku:_FillValue = -2147483648;
       ph_slope_cor_20_ku:long_name = "phase slope correction";
       ph_slope_cor_20_ku:scale_factor = 1.0e-6;
       ph_slope_cor_20_ku:coordinates = "lon_20_ku lat_20_ku";
       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.";
```

4.2.30 pole_tide_01(time_cor_01)

```
 int pole_tide_01(time_cor_01);
       pole_tide_01:units = "m";
       pole_tide_01:_FillValue = -2147483648;
       pole_tide_01:long_name = "geocentric pole tide height";
       pole_tide_01:standard_name                                              =
"sea_surface_height_amplitude_due_to_pole_tide";
       pole_tide_01:scale_factor = 0.001;
       pole_tide_01:coordinates = "lon_01 lat_01";
```

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```
        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";
        pole_tide_01:comment = "Geocentric polar tide. This 1-way correction has
been accounted for during the computation of height (see [flag_height_20_ku] to
determine if it was applied) 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.";
```

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4.2.31 range_1_20_ku(time_20_ku)

```
 int range_1_20_ku(time_20_ku) ;
        range_1_20_ku:units = "m" ;
        range_1_20_ku:_FillValue = -2147483648 ;
        range_1_20_ku:long_name = "range to surface (retracker 1)" ;
        range_1_20_ku:standard_name = "altimeter_range" ;
        range_1_20_ku:scale_factor = 0.001 ;
        range_1_20_ku:coordinates = "lon_poca_20_ku lat_poca_20_ku" ;
        range_1_20_ku:comment = "Measured range from the satellite CoM to the
surface at the coordinate location [lon_poca_20_ku] [lat_poca_20_ku]. All
instrumental [instr_cor_range_rx_20_ku] [uso_cor_applied_20_ku] corrections
applied. Contains the Ocean CFI retracker result in LRM mode, the UCL sea-ice
retracker results in SAR mode (different method for specular and diffuse echoes),
and the UCL margins retracker in SARin mode. Does not include geophysical
corrections." ;
```

4.2.32 range_2_20_ku(time_20_ku)

```
 int range_2_20_ku(time_20_ku) ;
        range_2_20_ku:_FillValue = -2147483648 ;
        range_2_20_ku:comment = "Measured range from the satellite CoM to the
surface at the coordinate location [lon_poca_20_ku] [lat_poca_20_ku]. All
instrumental [instr_cor_range_rx_20_ku] [uso_cor_applied_20_ku] corrections
applied. Not currently used in SAR and SARin modes. Contains the UCL land-ice
retracker in LRM mode. Does not include geophysical corrections. " ;
        range_2_20_ku:coordinates = "lon_poca_20_ku lat_poca_20_ku" ;
        range_2_20_ku:long_name = "range to surface (retracker 2)" ;
        range_2_20_ku:scale_factor = 0.001 ;
        range_2_20_ku:standard_name = "altimeter_range" ;
        range_2_20_ku:units = "m" ;
```

4.2.33 range_3_20_ku(time_20_ku)

```
 int range_3_20_ku(time_20_ku) ;
        range_3_20_ku:units = "m" ;
        range_3_20_ku:_FillValue = -2147483648 ;
        range_3_20_ku:long_name = "range to surface (retracker 3)" ;
        range_3_20_ku:standard_name = "altimeter_range" ;
        range_3_20_ku:scale_factor = 0.001 ;
        range_3_20_ku:coordinates = "lon_poca_20_ku lat_poca_20_ku" ;
        range_3_20_ku:comment = "Measured range from the satellite CoM to the
surface at the coordinate location [lon_poca_20_ku] [lat_poca_20_ku]. All
instrumental [instr_cor_range_rx_20_ku] [uso_cor_applied_20_ku] corrections
applied. Not currently used in SAR and SARin modes. Contains the OCOG retracker
in LRM mode. Does not include geophysical corrections. " ;
```

4.2.34 range_ocog_plrm_20_ku(time_plrm_20_ku)

```
 int range_ocog_plrm_20_ku(time_plrm_20_ku) ;
        range_ocog_plrm_20_ku:units = "m" ;
        range_ocog_plrm_20_ku:_FillValue = -2147483648 ;
        range_ocog_plrm_20_ku:long_name = "range to surface (retracker 3)" ;
        range_ocog_plrm_20_ku:standard_name = "altimeter_range" ;
```

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```
        range_ocog_plrm_20_ku:scale_factor = 0.001 ;
        range_ocog_plrm_20_ku:coordinates        =        "lon_poca_plrm_20_ku
lat_poca_plrm_20_ku" ;
        range_ocog_plrm_20_ku:comment = "Measured range from the satellite CoM to
the surface at the coordinate location [lon_poca_20_ku] [lat_poca_20_ku]. All
instrumental  [instr_cor_range_rx_20_ku]  [uso_cor_applied_20_ku]  corrections
applied. Not currently used in SAR and SARin modes. Contains the OCOG retracker
in LRM mode. Does not include geophysical corrections. " ;
```

4.2.35 range_larm_20_ku(time_20_ku)

```
int range_larm_20_ku(time_20_ku) ;
        range_larm_20_ku:_FillValue = -2147483648;
        range_larm_20_ku:comment = "Measured range from the satellite CoM to the
surface  at  the  coordinate  location  [lon_poca_20_ku]  [lat_poca_20_ku].  All
instrumental  [instr_cor_range_rx_20_ku]  [uso_cor_applied_20_ku]  corrections
applied. Unused in LRM mode. Contains the LARM retracker results in SAR or SARIn
mode,  if  that  retracker  has  been  activated.  Does  not  include  geophysical
corrections. For LARM details see DOI 10.1029/2019JC015820" ;
        range_larm_20_ku:coordinates = "lon_poca_20_ku lat_poca_20_ku" ;
        range_larm_20_ku:long_name = "range to surface (LARM retracker)" ;
        range_larm_20_ku:scale_factor = 0.001 ;
        range_larm_20_ku:standard_name = "altimeter_range" ;
        range_larm_20_ku:units = "m" ;
```

4.2.36 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 = "sample counter";
        rec_count_20_ku:comment  =  "Record  counter  -  progressive  counter
 incremented by 1 for each record . Surface Sample counter for SAR/SARin L1B
 products. See [seq_count_20_ku] for LRM.";
```

4.2.37 retracker_1_cor_20_ku(time_20_ku)

```
 int retracker_1_cor_20_ku(time_20_ku);
        retracker_1_cor_20_ku:units = "m";
        retracker_1_cor_20_ku:_FillValue = -2147483648;
        retracker_1_cor_20_ku:long_name = "correction to range (retracker 1)";
        retracker_1_cor_20_ku:scale_factor = 0.001;
        retracker_1_cor_20_ku:coordinates = "lon_poca_20_ku lat_poca_20_ku";
        retracker_1_cor_20_ku:comment = "The correction to range computed by the
retracker and used in the computation of height.";
```

4.2.38 retracker_1_quality_20_ku(time_20_ku)

```
 int retracker_1_quality_20_ku(time_20_ku);
        retracker_1_quality_20_ku:_FillValue = -2147483648;
        retracker_1_quality_20_ku:long_name = "quality metric (retracker 1)";
        retracker_1_quality_20_ku:coordinates = "lon_poca_20_ku lat_poca_20_ku";
        retracker_1_quality_20_ku:comment = "The quality metric (chi^2 of fitted
model) computed by the Ocean CFI retracker in LRM mode, the UCL sea-ice retracker
in SAR mode (over leads only) and the UCL margins retracker in SARin mode.";
```

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4.2.39 retracker_2_cor_20_ku(time_20_ku)

```
 int retracker_2_cor_20_ku(time_20_ku);
       retracker_2_cor_20_ku:units = "m";
       retracker_2_cor_20_ku:_FillValue = -2147483648;
       retracker_2_cor_20_ku:long_name = "correction to range (retracker 2)";
       retracker_2_cor_20_ku:scale_factor = 0.001;
       retracker_2_cor_20_ku:coordinates = "lon_poca_20_ku lat_poca_20_ku";
       retracker_2_cor_20_ku:comment = "The correction to range computed by the
retracker and used in the computation of height. Not currently used in SAR and
SARin modes.";
```

4.2.40 retracker_2_quality_20_ku(time_20_ku)

```
 int retracker_2_quality_20_ku(time_20_ku);
       retracker_2_quality_20_ku:_FillValue = -2147483648;
       retracker_2_quality_20_ku:long_name = "quality metric (retracker 2)";
       retracker_2_quality_20_ku:coordinates = "lon_poca_20_ku lat_poca_20_ku";
       retracker_2_quality_20_ku:comment = "The quality metric (chi^2 of fitted
model) computed by the UCL land-ice retracker in LRM mode. Unused in SAR and SARin
modes.";
```

4.2.41 retracker_3_cor_20_ku(time_20_ku)

```
 int retracker_3_cor_20_ku(time_20_ku);
       retracker_3_cor_20_ku:units = "m";
       retracker_3_cor_20_ku:_FillValue = -2147483648;
       retracker_3_cor_20_ku:long_name = "correction to range (retracker 3)";
       retracker_3_cor_20_ku:scale_factor = 0.001;
       retracker_3_cor_20_ku:coordinates = "lon_poca_20_ku lat_poca_20_ku";
       retracker_3_cor_20_ku:comment = "The correction to range computed by the
retracker and used in the computation of height. Not currently used in SAR and
SARin modes.";
```

4.2.42 retracker_3_quality_20_ku(time_20_ku)

```
 int retracker_3_quality_20_ku(time_20_ku);
       retracker_3_quality_20_ku:_FillValue = -2147483648;
       retracker_3_quality_20_ku:long_name = "quality metric (retracker OCOG)";
       retracker_3_quality_20_ku:coordinates = "lon_poca_20_ku lat_poca_20_ku";
       retracker_3_quality_20_ku:comment = "Unused in LRM, SAR, and SARin
modes.";
```

4.2.43 retracker_output_3_20_ku(time_20_ku)

```
 int retracker_output_3_20_ku(time_20_ku);
       retracker_output_3_20_ku:_FillValue = -2147483648;
       retracker_output_3_20_ku:long_name = "retracker output 3";
       retracker_output_3_20_ku:coordinates = "lon_poca_20_ku lat_poca_20_ku";
       retracker_output_3_20_ku:comment = "Amplitude fitted by retracker 1
[scaled Watts].";
```

4.2.44 retracker_output_4_20_ku (time_20_ku)

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```
 int retracker_output_4_20_ku(time_20_ku);
retracker_output_4_20_ku:_FillValue = -2147483648;
        retracker_output_4_20_ku:long_name = "retracker output 4";
        retracker_output_4_20_ku:coordinates = "lon_poca_20_ku lat_poca_20_ku";
        retracker_output_4_20_ku:comment = "The meaning and units of this field
vary by mode. LRM: retracker 1 leading edge width [milli-bins]. SAR: unused.
SARin: unused.";
```

4.2.45 retracker_output_5_20_ku(time_20_ku)

```
 int retracker_output_5_20_ku(time_20_ku);
        retracker_output_5_20_ku:_FillValue = -2147483648;
        retracker_output_5_20_ku:long_name = "retracker output 5";
        retracker_output_5_20_ku:coordinates = "lon_poca_20_ku lat_poca_20_ku";
        retracker_output_5_20_ku:comment = "Currently unused in any mode. ";
```

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4.2.46 retracker_output_6_20_ku(time_20_ku)

```
 int retracker_output_6_20_ku(time_20_ku);
       retracker_output_6_20_ku:_FillValue = -2147483648;
       retracker_output_6_20_ku:long_name = "retracker output 6";
       retracker_output_6_20_ku:coordinates = "lon_poca_20_ku lat_poca_20_ku";
       retracker_output_6_20_ku:comment = "The meaning and units of this field
vary by mode. LRM: retracker 1 noise estimate [counts]. SAR: unused. SARin:
unused.";
```

4.2.47 retracker_output_7_20_ku(time_20_ku)

```
 int retracker_output_7_20_ku(time_20_ku);
       retracker_output_7_20_ku:_FillValue = -2147483648;
       retracker_output_7_20_ku:long_name = "retracker output 7";
       retracker_output_7_20_ku:coordinates = "lon_poca_20_ku lat_poca_20_ku";
       retracker_output_7_20_ku:comment = "The meaning and units of this field
vary by mode. LRM: unused. SAR: retracker 1 fit parameter sigma for leads [scaled
1e6]. SARin: unused.";
```

4.2.48 retracker_output_8_20_ku(time_20_ku)

```
 int retracker_output_8_20_ku(time_20_ku);
       retracker_output_8_20_ku:_FillValue = -2147483648;
       retracker_output_8_20_ku:long_name = "retracker output 8";
       retracker_output_8_20_ku:coordinates = "lon_poca_20_ku lat_poca_20_ku";
       retracker_output_8_20_ku:comment = "The meaning and units of this field
vary by mode. LRM: unused. SAR: retracker 1 exponential fit parameter for leads
[scaled 1e6]. SARin: unused.";
```

4.2.49 retracker_output_9_20_ku(time_20_ku)

```
 int retracker_output_9_20_ku(time_20_ku);
       retracker_output_9_20_ku:_FillValue = -2147483648;
       retracker_output_9_20_ku:long_name = "retracker output 9";
       retracker_output_9_20_ku:coordinates = "lon_poca_20_ku lat_poca_20_ku";
       retracker_output_9_20_ku:comment = "The meaning and units of this field
vary by mode. LRM: unused. SAR: Sea ice floe LEW [millibins]. SARIn: Sea ice floe
LEW [millibins].";
```

4.2.50 retracker_output_10_20_ku(time_20_ku)

```
 int retracker_output_10_20_ku(time_20_ku);
       retracker_output_10_20_ku:_FillValue = -2147483648;
       retracker_output_10_20_ku:long_name = "retracker output 10";
       retracker_output_10_20_ku:coordinates = "lon_poca_20_ku lat_poca_20_ku";
       retracker_output_10_20_ku:comment = "OCOG position [milli-bins].";
```

4.2.51 retracker_output_11_20_ku(time_20_ku)

```
 int retracker_output_11_20_ku(time_20_ku);
       retracker_output_11_20_ku:_FillValue = -2147483648;
       retracker_output_11_20_ku:long_name = "retracker output 11";
       retracker_output_11_20_ku:coordinates = "lon_poca_20_ku lat_poca_20_ku";
       retracker_output_11_20_ku:comment = "OCOG amplitude [scaled Watts].";
```

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4.2.52 retracker_output_12_20_ku(time_20_ku)

```
 int retracker_output_12_20_ku(time_20_ku);
       retracker_output_12_20_ku:_FillValue = -2147483648;
       retracker_output_12_20_ku:long_name = "retracker output 12";
       retracker_output_12_20_ku:coordinates = "lon_poca_20_ku lat_poca_20_ku";
       retracker_output_12_20_ku:comment = "OCOG width [milli-bins].";
```

4.2.53 retracker_output_13_20_ku(time_20_ku)

```
 int retracker_output_13_20_ku(time_20_ku);
       retracker_output_13_20_ku:_FillValue = -2147483648;
       retracker_output_13_20_ku:long_name = "retracker output 13";
       retracker_output_13_20_ku:coordinates = "lon_poca_20_ku lat_poca_20_ku";
       retracker_output_13_20_ku:comment = "Window delay converted to range
[mm].";
```

4.2.54 retracker_output_14_20_ku(time_20_ku)

```
 int retracker_output_14_20_ku(time_20_ku);
       retracker_output_14_20_ku:_FillValue = -2147483648;
       retracker_output_14_20_ku:long_name = "retracker output 14";
       retracker_output_14_20_ku:coordinates = "lon_poca_20_ku lat_poca_20_ku";
       retracker_output_14_20_ku:comment = "The meaning and units of this field
vary by mode. LRM: unused. SAR: unused. SARin: unused.";
```

4.2.55 retracker_output_15_20_ku(time_20_ku)

```
 int retracker_output_15_20_ku(time_20_ku);
       retracker_output_15_20_ku:_FillValue = -2147483648;
       retracker_output_15_20_ku:long_name = "retracker output 15";
       retracker_output_15_20_ku:coordinates = "lon_poca_20_ku lat_poca_20_ku";
       retracker_output_15_20_ku:comment = "The meaning and units of this field
vary by mode. LRM: unused. SAR: unused. SARin: unused.";
```

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4.2.56 retracker_output_16_20_ku(time_20_ku)

```
int retracker_output_16_20_ku(time_20_ku);
       retracker_output_16_20_ku:_FillValue = -2147483648;
       retracker_output_16_20_ku:long_name = "retracker output 16";
       retracker_output_16_20_ku:coordinates = "lon_poca_20_ku lat_poca_20_ku";
       retracker_output_16_20_ku:comment = "Reserved for retracker 2.";
```

4.2.57 retracker_output_17_20_ku(time_20_ku)

```
int retracker_output_17_20_ku(time_20_ku);
       retracker_output_17_20_ku:_FillValue = -2147483648;
       retracker_output_17_20_ku:long_name = "retracker output 17";
       retracker_output_17_20_ku:coordinates = "lon_poca_20_ku lat_poca_20_ku";
       retracker_output_17_20_ku:comment = "Reserved for retracker 2.";
```

4.2.58 retracker_output_18_20_ku(time_20_ku)

```
int retracker_output_18_20_ku(time_20_ku);
       retracker_output_18_20_ku:_FillValue = -2147483648;
       retracker_output_18_20_ku:long_name = "retracker output 18";
       retracker_output_18_20_ku:coordinates = "lon_poca_20_ku lat_poca_20_ku";
       retracker_output_18_20_ku:comment = "Reserved for retracker 2.";
```

4.2.59 retracker_output_19_20_ku(time_20_ku)

```
int retracker_output_19_20_ku(time_20_ku);
       retracker_output_19_20_ku:_FillValue = -2147483648;
       retracker_output_19_20_ku:long_name = "retracker output 19";
       retracker_output_19_20_ku:coordinates = "lon_poca_20_ku lat_poca_20_ku";
       retracker_output_19_20_ku:comment = "Reserved for retracker 2.";
```

4.2.60 retracker_output_20_20_ku(time_20_ku)

```
int retracker_output_20_20_ku(time_20_ku);
       retracker_output_20_20_ku:_FillValue = -2147483648;
       retracker_output_20_20_ku:long_name = "retracker output 20";
       retracker_output_20_20_ku:coordinates = "lon_poca_20_ku lat_poca_20_ku";
       retracker_output_20_20_ku:comment = "The meaning and units of this field
vary by mode. LRM: OCOG amplitude [counts]. SAR: reserved for retracker 3. SARin:
reserved for retracker 3.";
```

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4.2.61 retracker_output_21_20_ku(time_20_ku)

```
 int retracker_output_21_20_ku(time_20_ku);
       retracker_output_21_20_ku:_FillValue = -2147483648;
       retracker_output_21_20_ku:long_name = "retracker output 21";
       retracker_output_21_20_ku:coordinates = "lon_poca_20_ku lat_poca_20_ku";
       retracker_output_21_20_ku:comment = "The meaning and units of this field
vary by mode. LRM: 25% OCOG range correction [mm]. SAR: reserved for retracker
3. SARin: reserved for retracker 3.";
```

4.2.62 retracker_output_22_20_ku(time_20_ku)

```
 int retracker_output_22_20_ku(time_20_ku);
       retracker_output_22_20_ku:_FillValue = -2147483648;
       retracker_output_22_20_ku:long_name = "retracker output 22";
       retracker_output_22_20_ku:coordinates = "lon_poca_20_ku lat_poca_20_ku";
       retracker_output_22_20_ku:comment = "Reserved for retracker 3.";
```

4.2.63 retracker_output_23_20_ku(time_20_ku)

```
 int retracker_output_23_20_ku(time_20_ku);
       retracker_output_23_20_ku:_FillValue = -2147483648;
       retracker_output_23_20_ku:long_name = "retracker output 23";
       retracker_output_23_20_ku:coordinates = "lon_poca_20_ku lat_poca_20_ku";
       retracker_output_23_20_ku:comment = "Reserved for retracker 3.";
```

4.2.64 sarin_output_1_20_ku(time_20_ku)

```
 int sarin_output_1_20_ku(time_20_ku);
       sarin_output_1_20_ku:_FillValue = -2147483648;
       sarin_output_1_20_ku:long_name = "sarin discriminator output 1";
       sarin_output_1_20_ku:coordinates  =  "lon_poca_20_ku  lat_poca_20_ku  ";
       sarin_output_1_20_ku:comment = "Total power in waveform. Unused in LRM
and SAR modes.";
```

4.2.65 sarin_output_2_20_ku(time_20_ku)

```
 int sarin_output_2_20_ku (time_20_ku);
       sarin_output_2_20_ku:_FillValue = -2147483648;
       sarin_output_2_20_ku:long_name = "sarin discriminator output 2";
       sarin_output_2_20_ku:coordinates = "lon_poca_20_ku lat_poca_20_ku ";
       sarin_output_2_20_ku:comment = "Maximum power in waveform. Unused in LRM
and SAR modes.";
```

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4.2.66 sarin_output_3_20_ku(time_20_ku)

```
 int sarin_output_3_20_ku (time_20_ku);
       sarin_output_3_20_ku:_FillValue = -2147483648;
       sarin_output_3_20_ku:long_name = "sarin discriminator output 3";
       sarin_output_3_20_ku:coordinates = "lon_poca_20_ku lat_poca_20_ku ";
       sarin_output_3_20_ku:comment = "Mean power of waveform. Unused in LRM and
SAR modes.";
```

4.2.67 sarin_output_4_20_ku(time_20_ku)

```
 int sarin_output_4_20_ku (time_20_ku);
       sarin_output_4_20_ku:_FillValue = -2147483648;
       sarin_output_4_20_ku:long_name = "sarin discriminator output 4";
       sarin_output_4_20_ku:coordinates = "lon_poca_20_ku lat_poca_20_ku ";
       sarin_output_4_20_ku:comment = "Bin of maximum power. Unused in LRM and
SAR modes.";
```

4.2.68 sarin_output_5_20_ku(time_20_ku)

```
 int sarin_output_5_20_ku (time_20_ku);
       sarin_output_5_20_ku:_FillValue = -2147483648;
       sarin_output_5_20_ku:long_name = "sarin discriminator output 5";
       sarin_output_5_20_ku:coordinates = "lon_poca_20_ku lat_poca_20_ku ";
       sarin_output_5_20_ku:comment = "Bin of half maximum power. Unused in LRM
and SAR modes.";
```

4.2.69 sarin_output_6_20_ku(time_20_ku)

```
 int sarin_output_6_20_ku (time_20_ku);
       sarin_output_6_20_ku:_FillValue = -2147483648;
       sarin_output_6_20_ku:long_name = "sarin discriminator output 6";
       sarin_output_6_20_ku:coordinates = "lon_poca_20_ku lat_poca_20_ku ";
       sarin_output_6_20_ku:comment = "Maximum coherence. Unused in LRM and SAR
modes.";
```

4.2.70 sarin_output_7_20_ku(time_20_ku)

```
 int sarin_output_7_20_ku (time_20_ku);
       sarin_output_7_20_ku:_FillValue = -2147483648;
       sarin_output_7_20_ku:long_name = "sarin discriminator output 7";
       sarin_output_7_20_ku:coordinates = "lon_poca_20_ku lat_poca_20_ku ";
       sarin_output_7_20_ku:comment = "Bin of maximum coherence. Unused in LRM
and SAR modes.";
```

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4.2.71 sarin_output_8_20_ku(time_20_ku)

```
 int sarin_output_8_20_ku (time_20_ku);
       sarin_output_8_20_ku:_FillValue = -2147483648;
       sarin_output_8_20_ku:long_name = "sarin discriminator output 8";
       sarin_output_8_20_ku:coordinates = "lon_poca_20_ku lat_poca_20_ku ";
       sarin_output_8_20_ku:comment = "First power bin. Unused in LRM and SAR
modes.";
```

4.2.72 sarin_output_9_20_ku(time_20_ku)

```
 int sarin_output_9_20_ku (time_20_ku);
       sarin_output_9_20_ku:_FillValue = -2147483648;
       sarin_output_9_20_ku:long_name = "sarin discriminator output 9";
       sarin_output_9_20_ku:coordinates = "lon_poca_20_ku lat_poca_20_ku ";
       sarin_output_9_20_ku:comment = "Last power bin. Unused in LRM and SAR
modes.";
```

4.2.73 sarin_output_10_20_ku(time_20_ku)

```
 int sarin_output_10_20_ku (time_20_ku);
       sarin_output_10_20_ku:_FillValue = -2147483648;
       sarin_output_10_20_ku:long_name = "sarin discriminator output 10";
       sarin_output_10_20_ku:coordinates = "lon_poca_20_ku lat_poca_20_ku ";
       sarin_output_10_20_ku:scale_factor = 0.01 ;
 sarin_output_10_20_ku:comment = "Sea-ice peakiness value. Unused in LRM and SAR
modes." ;
```

4.2.74 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:units = "m/s";
       sat_vel_vec_20_ku:_FillValue = -2147483648;
       sat_vel_vec_20_ku:long_name = "satellite velocity vector in itrf ";
       sat_vel_vec_20_ku:scale_factor = 0.001;
       sat_vel_vec_20_ku:coordinates = "lon_20_ku lat_20_ku ";
       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.";
```

4.2.75 sea_ice_concentration_20_ku(time_20_ku)

```
 int sea_ice_concentration_20_ku (time_20_ku);
       sea_ice_concentration_20_ku:units = "percent";
       sea_ice_concentration_20_ku:_FillValue = -2147483648;
       sea_ice_concentration_20_ku:long_name = "sea ice area fraction";
       sea_ice_concentration_20_ku:standard_name = "sea_ice_area_fraction";
       sea_ice_concentration_20_ku:source = "UCL";
       sea_ice_concentration_20_ku:institution = "UCL";
       sea_ice_concentration_20_ku:scale_factor = 0.1;
       sea_ice_concentration_20_ku:coordinates = "lon_20_ku lat_20_ku";
       sea_ice_concentration_20_ku:comment = " Sea ice concentration derived
from NSIDC-0081 (before July 2025) or OSI-408-a data depending on time period.
Unused in LRM mode.";
```

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4.2.76 sea_ice_freeboard_20_ku(time_20_ku)

```
short sea_ice_freeboard_20_ku(time_20_ku) ;
        sea_ice_freeboard_20_ku:_FillValue = -32768s ;
        sea_ice_freeboard_20_ku:comment = "Sea ice freeboard, the height of the
snow-ice interface above the local sea surface. Only output if computation has
been activated. Computed as [sea_ice_freeboard_20_ku] = [radar_freeboard_20_ku]
+ [snow_depth_cor_20_ku]. Unused in LRM mode." ;
        sea_ice_freeboard_20_ku:coordinates = "lon_20_ku lat_20_ku" ;
        sea_ice_freeboard_20_ku:long_name = "sea ice freeboard" ;
        sea_ice_freeboard_20_ku:scale_factor = 0.001 ;
        sea_ice_freeboard_20_ku:units = "m" ;
```

4.2.77 sea_ice_thickness_20_ku(time_20_ku)

```
short sea_ice_thickness_20_ku(time_20_ku) ;
        sea_ice_thickness_20_ku:_FillValue = -32768s ;
        sea_ice_thickness_20_ku:comment =
"Sea ice thickness. Only output if computation has been activated. Computed as (
sea_ice_freeboard_20_ku    *    water_density_20_ku    +    snow_depth_20_ku    *
snow_density_20_ku ) / ( water_density_20_ku - ice_density_20_ku ). Unused in LRM
mode." ;

        sea_ice_thickness_20_ku:coordinates = "lon_20_ku lat_20_ku" ;
        sea_ice_thickness_20_ku:long_name = "sea ice thickness" ;
        sea_ice_thickness_20_ku:scale_factor = 0.001 ;
        sea_ice_thickness_20_ku:units = "m" ;
```

4.2.78 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:comment = "Source Sequence Counter read from the L0 echo
telemetry packet (LRM only). See [rec_count_20_ku] for SAR/SARin.";
```

4.2.79 sig0_1_20_ku(time_20_ku)

```
 int sig0_1_20_ku(time_20_ku);
        sig0_1_20_ku:units = "dB";
        sig0_1_20_ku:_FillValue = -2147483648;
        sig0_1_20_ku:long_name = "backscatter coefficient (retracker 1)";
        sig0_1_20_ku:standard_name                                          =
"surface_backwards_scattering_coefficient_of_radar_wave";
        sig0_1_20_ku:scale_factor = 0.01;
        sig0_1_20_ku:coordinates = "lon_poca_20_ku lat_poca_20_ku ";
        sig0_1_20_ku:comment = "The measured backscatter from the surface,
corrected for instrument effects [instr_cor_gain_rx_20_ku], and including a
system bias that calibrates the results against previous missions. The backscatter
is computed from the amplitude of the waveform in Watts, as measured by the Ocean
CFI retracker in LRM mode. The measured power is used to solve the radar equation
to recover the value for backscatter. For SAR and SARin mode, the power waveform
is first convolved with a function to produce an LRM-like waveform, that is then
retracked with OCOG to produce the amplitude estimate.";
```

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4.2.80 sig0_2_20_ku(time_20_ku)

```
 int sig0_2_20_ku (time_20_ku);
        sig0_2_20_ku:units = "dB";
        sig0_2_20_ku:_FillValue = -2147483648;
        sig0_2_20_ku:long_name = "backscatter coefficient (retracker 2)";
        sig0_2_20_ku:standard_name                                          =
"surface_backwards_scattering_coefficient_of_radar_wave";
        sig0_2_20_ku:scale_factor = 0.01;
        sig0_2_20_ku:coordinates = "lon_poca_20_ku lat_poca_20_ku";
        sig0_2_20_ku:comment = "The measured backscatter from the surface,
corrected for instrument effects [instr_cor_gain_rx_20_ku], and including a
system bias that calibrates the results against previous missions. The backscatter
is computed from the amplitude of the waveform in Watts, as measured by the UCL
land-ice retracker. The measured power is used to solve the radar equation to
recover the value for backscatter. Not currently used in SAR and SARin modes.";
```

4.2.81 sig0_3_20_ku(time_20_ku)

```
 int sig0_3_20_ku (time_20_ku);
        sig0_3_20_ku:units = "dB";
        sig0_3_20_ku:_FillValue = -2147483648;
        sig0_3_20_ku:long_name = "backscatter coefficient (retracker 3)";
        sig0_3_20_ku:standard_name                                          =
"surface_backwards_scattering_coefficient_of_radar_wave";
        sig0_3_20_ku:scale_factor = 0.01;
        sig0_3_20_ku:coordinates = "lon_poca_20_ku lat_poca_20_ku ";
        sig0_3_20_ku:comment = "The measured backscatter from the surface,
corrected for instrument effects [instr_cor_gain_rx_20_ku], and including a
system bias that calibrates the results against previous missions. The backscatter
is computed from the amplitude of the waveform in Watts, as measured by the OCOG
retracker. The measured power is used to solve the radar equation to recover the
value for backscatter. Not currently used in SAR and SARin modes.";
```

4.2.1 sig0_larm_20_ku(time_20_ku)

```
int sig0_larm_20_ku(time_20_ku) ;
        sig0_larm_20_ku:_FillValue = -2147483648;
        sig0_larm_20_ku:comment = "The measured backscatter from the surface,
corrected for instrument effects [instr_cor_gain_rx_20_ku], and including a
system bias that calibrates the results against previous missions. The backscatter
is computed from the amplitude of the waveform in Watts, as measured by the OCOG
retracker. The measured power is used to solve the radar equation to recover the
value for backscatter. Contains the LARM retracker results in SAR or SARIn mode,
if that retracker has been activated. For LARM details see DOI
10.1029/2019JC015820" ;
        sig0_larm_20_ku:coordinates = "lon_poca_20_ku lat_poca_20_ku" ;
        sig0_larm_20_ku:long_name = "backscatter coefficient (LARM)" ;
        sig0_larm_20_ku:scale_factor = 0.01 ;
        sig0_larm_20_ku:standard_name                                       =
"surface_backwards_scattering_coefficient_of_radar_wave" ;
        sig0_larm_20_ku:units = "dB" ;
```

4.2.1 sig0_ocog_plrm_20_ku(time_plrm_20_ku)

```
 int sig0_ocog_plrm_20_ku (time_plrm_20_ku);
```

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```
        sig0_ocog_plrm_20_ku:units = "dB";
        sig0_ocog_plrm_20_ku:_FillValue = -2147483648;
        sig0_ocog_plrm_20_ku:long_name = "backscatter coefficient (retracker 3)"
;       sig0_3_20_ku:standard_name                                              =
"surface_backwards_scattering_coefficient_of_radar_wave";
        sig0_ocog_plrm_20_ku:scale_factor = 0.01;
        sig0_ocog_plrm_20_ku:coordinates = "lon_poca_20_ku lat_poca_20_ku ";
        sig0_ocog_plrm_20_ku:comment = "The measured backscatter from the
surface, corrected for instrument effects [instr_cor_gain_rx_20_ku], and
including a system bias that calibrates the results against previous missions.
The backscatter is computed from the amplitude of the waveform in Watts, as
measured by the OCOG retracker. The measured power is used to solve the radar
equation to recover the value for backscatter. Not currently used in SAR and SARin
modes.";
```

4.2.2 slope_dop_cor_20_ku(time_20_ku)

```
 short slope_dop_cor_20_ku (time_20_ku);
        slope_dop_cor_20_ku:units = "m";
        slope_dop_cor_20_ku:_FillValue = -32768s;
        slope_dop_cor_20_ku:long_name = "Slope Doppler correction to altimeter
range";
        slope_dop_cor_20_ku:scale_factor = 0.001;
        slope_dop_cor_20_ku:coordinates = "lon_20_ku lat_20_ku ";
        slope_dop_cor_20_ku:comment = "This value has replaced the use of
dop_cor_20 in the range used to compute the height values. This is done to correct
for the effect of sloping terrain. Unused in SAR and SARin modes.";
```

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4.2.3 snow_density_20_ku(time_20_ku)

```
int snow_density_20_ku (time_20_ku);
       snow_density_20_ku:units = "kg/m^3";
       snow_density_20_ku:_FillValue = -2147483648;
       snow_density_20_ku:long_name = "snow density";
       snow_density_20_ku:standard_name = "snow_density";
       snow_density_20_ku:source = "UCL AUX_DENSSI from R. D. C. Mallett, 'A
methodologically robust densification function for snow on multiyear Arctic sea
ice', J. Glaciol., vol. 71, p. e24, 2025, doi: 10.1017/jog.2025.5. and M. Bocquet,
S. Fleury, F. Rémy, and F. Piras, 'Arctic and Antarctic Sea Ice Thickness and
Volume Changes From Observations Between 1994 and 2023', JGR Oceans, vol. 129,
no. 11, Nov. 2024, doi: 10.1029/2023jc020848.";
       snow_density_20_ku:institution = "UCL";
       snow_density_20_ku:scale_factor = 1.0;
       snow_density_20_ku:coordinates = "lon_20_ku lat_20_ku ";
       snow_density_20_ku:comment =
"Snow density. Interpolated from a monthly model file. Unused in LRM mode." ;
```

4.2.1 ice_density_01(time_cor_01)

```
short ice_density_01(time_cor_01) ;
                    ice_density_01:_FillValue = -32768s ;
                    ice_density_01:comment = "Sea ice density. Interpolated from
a monthly model file. Can contain different values for FYI and MYI. Unused in
LRM mode." ;
                    ice_density_01:coordinates = "lon_01 lat_01" ;
                    ice_density_01:institution = "UCL" ;
                    ice_density_01:long_name = "ice density" ;
                    ice_density_01:scale_factor = 1. ;
                    ice_density_01:source = "UCL AUX_DENSSI from A. Jutila, S.
Hendricks, R. Ricker, L. von Albedyll, T. Krumpen, and C. Haas, 'Retrieval and
parameterisation of sea-ice bulk density from airborne multi-sensor
measurements', The Cryosphere, vol. 16, no. 1, pp. 259–275, Jan. 2022, doi:
10.5194/tc-16-259-2022. and M. Bocquet, S. Fleury, F. Rémy, and F. Piras, 'Arctic
and Antarctic Sea Ice Thickness and Volume Changes From Observations Between
1994 and 2023', JGR Oceans, vol. 129, no. 11, Nov. 2024, doi:
10.1029/2023jc020848." ;
                    ice_density_01:units = "kg/m^3" ;
```

4.2.2 water_density_01(time_cor_01)

```
short water_density_01(time_cor_01) ;
                    water_density_01:_FillValue = -32768s ;
                    water_density_01:comment = "Sea water density. Interpolated
from a model file, currently filled with an average value. Unused in LRM mode.";
                    water_density_01:coordinates = "lon_01 lat_01" ;
                    water_density_01:institution = "UCL" ;
                    water_density_01:long_name = "water density" ;
                    water_density_01:scale_factor = 1. ;
                    water_density_01:source = "UCL AUX_DENSSI from V.
Alexandrov, S. Sandven, J. Wahlin, and O. M. Johannessen, 'The relation between
sea ice thickness and freeboard in the Arctic', The Cryosphere, vol. 4, no. 3,
pp. 373–380, 2010, doi: 10.5194/tc-4-373-2010." ;
                    water_density_01:standard_name = "sea_water_density" ;
```

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```
water_density_01:units = "kg/m^3" ;
```

4.2.3 snow_depth_20_ku(time_20_ku)

```
int snow_depth_20_ku (time_20_ku);
       snow_depth_20_ku:units = "m";
       snow_depth_20_ku:_FillValue = -2147483648;
       snow_depth_20_ku:long_name = "snow depth";
       snow_depth_20_ku:standard_name = "surface_snow_thickness";
       snow_depth_20_ku:source = "CryoTEMPO Baseline C " ;
       snow_depth_20_ku:institution = "UCL";
       snow_depth_20_ku:scale_factor = 0.001;
       snow_depth_20_ku:coordinates = "lon_20_ku lat_20_ku";
       snow_depth_20_ku:comment = "Snow Depth computed from CryoTEMPO Baseline
C radar freeboard and ICESat-2 ATL10 version 6 lidar freeboard (using the 3
stronger beams). DOI: 10.57780/cr2-2a0c25a" ;
```

4.2.4 snow_depth_cor_20_ku(time_20_ku)

```
int snow_depth_cor_20_ku(time_20_ku) ;
       snow_depth_cor_20_ku:_FillValue = -2147483648 ;
       snow_depth_cor_20_ku:comment = "Snow depth correction. This one-way
correction corrects for the propagation delay caused by snow present on top of
sea ice. To apply, add to range or subtract from height or freeboard. The
correction in m is directly proportional to snow depth (-0.25 x
snow_depth_20_ku)." ;;
       snow_depth_cor_20_ku:coordinates = "lon_20_ku lat_20_ku" ;
       snow_depth_cor_20_ku:long_name = "snow depth correction" ;
       snow_depth_cor_20_ku:scale_factor = 0.001 ;
       snow_depth_cor_20_ku:units = "m" ;
```

4.2.5 solid_earth_tide_01

```
int solid_earth_tide_01(time_cor_01);
       solid_earth_tide_01:units = "m";
       solid_earth_tide_01:_FillValue = -2147483648;
       solid_earth_tide_01:long_name = "solid earth tide height";
       solid_earth_tide_01:standard_name                                    =
"sea_surface_height_amplitude_due_to_earth_tide";
       solid_earth_tide_01:scale_factor = 0.001;
       solid_earth_tide_01:coordinates = "lon_01 lat_01";
       solid_earth_tide_01:source = "Cartwright and Edden [1973] Corrected
tables of tidal harmonics - J. Geophys. J. R. Astr. Soc., 33, 253-264.";
       solid_earth_tide_01:comment = "Solid earth tide. This 1-way correction
has been accounted for during the computation of height (see [flag_height_20_ku]
to determine if it was applied) to remove the effect of local tidal distortion
to the Earth's crust, in particular by the sun and moon.";
```

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4.2.6 space_3d(space_3d)

```
 short space_3d(space_3d);
       space_3d:units = "count";
       space_3d:long_name = "space dimension";
       space_3d:comment = "Set to be compliant with the CF convention. Counts
0..2.";
```

4.2.7 ssha_20_ku(time_20_ku)

```
 int ssha_20_ku(time_20_ku);
       ssha_20_ku:units = "m";
       ssha_20_ku:_FillValue = -2147483648;
       ssha_20_ku:long_name = "sea-surface height anomaly";
       ssha_20_ku:scale_factor = 0.001;
       ssha_20_ku:coordinates = "lon_20_ku lat_20_ku ";
             ssha_20_ku:comment = "Sea-surface height anomaly. Computed as
[ssha_20_ku] = [height_1_20_ku] - [mean_sea_surf_sea_ice_20_ku].Unused in LRM
mode." ;
```

4.2.8 ssha_interp_20_ku(time_20_ku)

```
 int ssha_interp_20_ku(time_20_ku);
       ssha_interp_20_ku:units = "m";
       ssha_interp_20_ku:_FillValue = -2147483648;
       ssha_interp_20_ku:long_name = "interpolated sea-surface height anomaly";
       ssha_interp_20_ku:scale_factor = 0.001;
       ssha_interp_20_ku:coordinates = "lon_20_ku lat_20_ku ";
       ssha_interp_20_ku:comment = "Sea-surface height anomaly computed using
sea-surface height anomaly [ssha_20_ku] interpolated to the current location.
Unused in LRM mode.";
```

4.2.9 ssha_interp_numval_back_20_ku(time_20_ku)

```
 int ssha_interp_numval_back_20_ku (time_20_ku);
       ssha_interp_numval_back_20_ku:units = "count";
       ssha_interp_numval_back_20_ku:_FillValue = -2147483648;
       ssha_interp_numval_back_20_ku:long_name = "number of backward SSHA
interpolation points";
       ssha_interp_numval_back_20_ku:coordinates = "lon_20_ku lat_20_ku ";
       ssha_interp_numval_back_20_ku:comment = "Number of backward (behind
nadir) SSHA points used in the interpolation of SSHA at this location. Unused in
LRM mode.";
```

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4.2.10 ssha_interp_numval_fwd_20_ku(time_20_ku)

```
 int ssha_interp_numval_fwd_20_ku (time_20_ku);
        ssha_interp_numval_fwd_20_ku:units = "count";
        ssha_interp_numval_fwd_20_ku:_FillValue = -2147483648;
        ssha_interp_numval_fwd_20_ku:long_name = "number of forward SSHA
interpolation points";
        ssha_interp_numval_fwd_20_ku:coordinates = "lon_20_ku lat_20_ku ";
        ssha_interp_numval_fwd_20_ku:comment = "Number of forward (ahead of
nadir)SSHA points used in the interpolation of SSHA at this location. Unused in
LRM mode.";
```

4.2.11 ssha_interp_rms_20_ku(time_20_ku)

```
 int ssha_interp_rms_20_ku (time_20_ku);
        ssha_interp_rms_20_ku:units = "m";
        ssha_interp_rms_20_ku:_FillValue = -2147483648;
        ssha_interp_rms_20_ku:long_name = "ssha interpolation error";
        ssha_interp_rms_20_ku:scale_factor = 0.001;
        ssha_interp_rms_20_ku:coordinates = "lon_20_ku lat_20_ku ";
        ssha_interp_rms_20_ku:comment = "Estimated error in [ssha_interp_20_ku].
Unused in LRM mode.";
```

4.2.12 ssha_interp_time_back_20_ku(time_20_ku)

```
 int ssha_interp_time_back_20_ku (time_20_ku);
        ssha_interp_time_back_20_ku:units = "s";
        ssha_interp_time_back_20_ku:_FillValue = -2147483648;
        ssha_interp_time_back_20_ku:long_name = "backward timespan of SSHA
interpolation points";
        ssha_interp_time_back_20_ku:scale_factor = 0.001;
        ssha_interp_time_back_20_ku:coordinates = "lon_20_ku lat_20_ku ";
        ssha_interp_time_back_20_ku:comment = "Delta in time between this record
and the most backward (smallest time) SSHA point used in the interpolation of
SSHA at this location. Unused in LRM mode.";
```

4.2.13 ssha_interp_time_fwd_20_ku(time_20_ku)

```
 int ssha_interp_time_fwd_20_ku (time_20_ku);
        ssha_interp_time_fwd_20_ku:units = "s";
        ssha_interp_time_fwd_20_ku:_FillValue = -2147483648;
        ssha_interp_time_fwd_20_ku:long_name = "forward timespan of SSHA
interpolation points";
        ssha_interp_time_fwd_20_ku:scale_factor = 0.001;
        ssha_interp_time_fwd_20_ku:coordinates = "lon_20_ku lat_20_ku ";
        ssha_interp_time_fwd_20_ku:comment = "Delta in time between this record
and the most forward (largest time) SSHA point used in the interpolation of SSHA
at this location. Unused at LRM mode.";
```

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4.2.14 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:scale_factor = 0.01;
       stack_centre_20_ku:add_offset = 0.;
       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.";
```

4.2.15 stack_centre_angle_20_ku(time_20_ku)

```
 short stack_centre_angle_20_ku(time_20_ku);
       stack_centre_angle_20_ku:units = "rad";
       stack_centre_angle_20_ku:_FillValue = -32768s;
       stack_centre_angle_20_ku:long_name = "gaussian power fitting: center wrt
boresight angle number";
       stack_centre_angle_20_ku:scale_factor = 1.e-06;
       stack_centre_angle_20_ku:add_offset = 0.;
       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 direction, (b) direction satellite - surface location. The pointing
angle depends on geometry and attitude (roll and pitch)";
```

4.2.16 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 satellite - surface
location. Read \'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:long_name = "gaussian power fitting: center
wrt look angle" ;
       stack_centre_look_angle_20_ku:scale_factor = 1.e-06 ;
       stack_centre_look_angle_20_ku:units = "rad" ;
```

4.2.17 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.
```

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```
It is the root mean squared error between the Gaussian fitting and the range
integrated power of the single look echoes within a stack." ;
        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" ;
```

4.2.18 stack_kurtosis_20_ku(time_20_ku)

```
 short stack_kurtosis_20_ku(time_20_ku);
        stack_kurtosis_20_ku:units = "count";
        stack_kurtosis_20_ku:_FillValue = -999s;
        stack_kurtosis_20_ku:long_name = "gaussian power fitting: kurtosis wrt
beam number";
        stack_kurtosis_20_ku:scale_factor = 0.01;
        stack_kurtosis_20_ku:add_offset = 0.;
        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.";
```

4.2.19 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:units = "count";
        stack_number_after_weighting_20_ku:_FillValue = -32768s;
        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." ;
```

4.2.20 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:units = "count";
        stack_number_before_weighting_20_ku:_FillValue = -32768s;
        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 that the Surface Sample Stack weighting is applied." ;
```

4.2.21 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. ;
        stack_peakiness_20_ku:comment = "Peakiness of the range integrated power
of the single look echoes within a stack." ;
        stack_peakiness_20_ku:long_name = "gaussian power fitting: peakiness wrt
beam number" ;
        stack_peakiness_20_ku:scale_factor = 0.01 ;
        stack_peakiness_20_ku:units = "count" ;
```

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4.2.22 stack_scaled_amplitude_20_ku(time_20_ku)

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

4.2.23 stack_skewness_20_ku(time_20_ku)

```
 short stack_skewness_20_ku(time_20_ku);
        stack_skewness_20_ku:units = "count";
        stack_skewness_20_ku:_FillValue = -999s;
        stack_skewness_20_ku:long_name = "gaussian power fitting: skewness wrt
beam number";
        stack_skewness_20_ku:scale_factor = 0.01;
        stack_skewness_20_ku:add_offset = 0.;
        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.";
```

4.2.24 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 wrt beam
number";
        stack_std_20_ku:scale_factor = 0.01;
        stack_std_20_ku:add_offset = 0.;
        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.";
```

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4.2.25 stack_std_angle_20_ku(time_20_ku)

```
 short stack_std_angle_20_ku(time_20_ku);
        stack_std_angle_20_ku:units = "rad";
        stack_std_angle_20_ku:_FillValue = -32768s;
        stack_std_angle_20_ku:long_name = "gaussian power fitting: std wrt
boresight angle";
        stack_std_angle_20_ku:scale_factor = 1.e-06;
        stack_std_angle_20_ku:add_offset = 0.;
        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 satellite - surface location. The
pointing angle depends on geometry and attitude (roll and pitch)";
```

4.2.26 surf_type_20_ku(time_20_ku)

```
byte surf_type_20_ku(time_20_ku) ;
        surf_type_20_ku:_FillValue = -128b ;
        surf_type_20_ku: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" ;
        surf_type_20_ku:coordinates = "lon_20_ku lat_20_ku" ;
        surf_type_20_ku:flag_meanings = "ocean lake_enclosed_sea ice land" ;
        surf_type_20_ku:flag_values = 0b, 1b, 2b, 3b ;
        surf_type_20_ku:institution = "CLS/CNES" ;
        surf_type_20_ku:long_name = "surface type from mask" ;
        surf_type_20_ku:source = "GMT, GlobCover, Modis Mosaic of Antarctica, and
Water body outlines from LEGOS" ;
```

4.2.27 surf_type_plrm_20_ku(time_plrm_20_ku)

```
        byte surf_type_plrm_20_ku(time_plrm_20_ku) ;
                surf_type_plrm_20_ku:_FillValue = -128b ;
                surf_type_plrm_20_ku: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" ;
                surf_type_plrm_20_ku:coordinates = "lon_plrm_20_ku
lat_plrm_20_ku" ;
                surf_type_plrm_20_ku:flag_meanings = "ocean lake_enclosed_sea
ice land" ;
                surf_type_plrm_20_ku:flag_values = 0b ;
                surf_type_plrm_20_ku:institution = "CLS/CNES" ;
                surf_type_plrm_20_ku:long_name = "surface type from mask" ;
                surf_type_plrm_20_ku:source = "GMT, GlobCover, Modis Mosaic of
Antarctica, and Water body outlines from LEGOS" ;
```

4.2.28 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 = "TAI time (sec. since 2000-01-01)";
```

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```
        time_20_ku:standard_name = "time";
        time_20_ku:calendar = "gregorian";
        time_20_ku:comment = "TAI time counted in seconds since 2000-01-01
00:00:00.";
```

4.2.29 time_plrm_20_ku(time_plrm_20_ku)

```
double time_plrm_20_ku(time_plrm_20_ku) ;
 time_plrm_20_ku:units = "seconds since 2000-01-01 00:00:00.0" ;
 time_plrm_20_ku:calendar = "159regorian" ;
 time_plrm_20_ku:long_name = "time in TAI: seconds since 1 Jan 2000" ;
 time_plrm_20_ku:standard_name = "time" ;
time_plrm_20_ku:comment = "TAI time counted in seconds since 2000-01-01 00:00:00.
Time refers to the instant the L1B 20Hz average power waveform touches the
surface." ;
time_plrm_20_ku:coordinates = "lat_plrm_20_ku lon_plrm_20_ku";
```

4.2.30 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 = "TAI time (sec. since 2000-01-01)";
        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.  ";
```

4.2.31 time_cor_plrm_01(time_cor_plrm_01)

```
double time_cor_plrm_01(time_cor_plrm_01) ;
        time_cor_plrm_01:calendar = "gregorian" ;
        time_cor_plrm_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.\t" ;
        time_cor_plrm_01:long_name = "TAI time (sec. since 2000-01-01)" ;
        time_cor_plrm_01:standard_name = "time" ;
        time_cor_plrm_01:units = "seconds since 2000-01-01 00:00:00.0" ;
```

4.2.32 uso_cor_20_ku(time_20_ku)

```
 int uso_cor_20_ku (time_20_ku);
        uso_cor_20_ku:_FillValue = -2147483648;
        uso_cor_20_ku:units = "seconds";
        uso_cor_20_ku:long_name = "uso correction (2-way)";
        uso_cor_20_ku:add_offset = 0.;
        uso_cor_20_ku:scale_factor = 1.e-12 ;          uso_cor_20_ku:comment    =
"USO correction factor defined as the ratio between the nominal and the modelled
value. This correction accounts for the different 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. ";
```

4.2.33 uso_cor_applied_20_ku(time_20_ku)

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```
 int uso_cor_applied_20_ku(time_20_ku) ;
        uso_cor_applied_20_ku:_FillValue = -2147483648 ;
        uso_cor_applied_20_ku:comment = "USO correction to range as applied in
the L1 processing. This value is included in the range and height estimates. This
value is [uso_cor_20_ku] converted from 2-way time to 1-way range." ;
        uso_cor_applied_20_ku:long_name = "uso correction (1-way range)" ;
        uso_cor_applied_20_ku:scale_factor = 0.001 ;
        uso_cor_applied_20_ku:units = "m" ;
```

4.2.34 uso_cor_plrm_20_ku(time_plrm_20_ku)

```
int uso_cor_plrm_20_ku(time_plrm_20_ku) ;
uso_cor_plrm_20_ku:_FillValue = 2147483647 ;
uso_cor_plrm_20_ku:add_offset = 0. ;
uso_cor_plrm_20_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. Correction to be applied by the user.” ;
uso_cor_plrm_20_ku:coordinates = “lon_plrm_20_ku lat_plrm_20_ku”;
uso_cor_plrm_20_ku:long_name = “uso correction applied to window delay (2-way)”
;
uso_cor_plrm_20_ku:scale_factor = 1.e-12 ;
uso_cor_plrm_20_ku:units = “seconds” ;
```

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4.3 FLAG MEANING TABLES L2I

4.3.1 flag_cor_err_20_ku

ID	Flag Name	Setting
1.	surface_type_error	0 = OK, 1 = error
2.	pole_tide_error	0 = OK, 1 = error
3.	solid_earth_error	0 = OK, 1 = error
4.	load_tide_error	0 = OK, 1 = error
5.	ocean_tide_equil_error	0 = OK, 1 = error
6.	ocean_tide_error	0 = OK, 1 = error
7.	iono_model_error	0 = OK, 1 = error
8.	iono_gim_error	0 = OK, 1 = error
9.	hf_fluctuations_error	0 = OK, 1 = error
10.	inv_bar_error	0 = OK, 1 = error
11.	model_wet_error	0 = OK, 1 = error
12.	model_dry_error	0 = OK, 1 = error
13.		
14.	slope_model_error	0 = OK, 1 = error
15.	dem_error	0 = OK, 1 = error
16.	odle_error	0 = OK, 1 = error
17.	geoid_error	0 = OK, 1 = error
18.	mss_error	0 = OK, 1 = error
19.	snow_density_error	0 = OK, 1 = error
20.	snow_depth_error	0 = OK, 1 = error
21.	ice_conc_error	0 = OK, 1 = error
22.	swh_error wind_error	0 = OK, 1 = error

4.3.2 flag_cor_status_20_ku

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ID	Flag Name	Setting
1.	surface_type_called	0 = no, 1 = yes
2.	pole_tide_called	0 = no, 1 = yes
3.	solid_earth_called	0 = no, 1 = yes
4.	load_tide_called	0 = no, 1 = yes
5.	ocean_tide_equil_called	0 = no, 1 = yes
6.	ocean_tide_called	0 = no, 1 = yes
7.	iono_model_called	0 = no, 1 = yes
8.	iono_gim_called	0 = no, 1 = yes
9.	hf_fluctuations_called	0 = no, 1 = yes
10.	inv_bar_called	0 = no, 1 = yes
11.	model_wet_called	0 = no, 1 = yes
12.	model_dry_called	0 = no, 1 = yes
13.		
14.	slope_model_called	0 = no, 1 = yes
15.	dem_called	0 = no, 1 = yes
16.	odle_called	0 = no, 1 = yes
17.	geoid_called	0 = no, 1 = yes
18.	mss_called	0 = no, 1 = yes
19.	snow_density_called	0 = no, 1 = yes
20.	snow_depth_called	0 = no, 1 = yes
21.	ice_conc_called	0 = no, 1 = yes
22.	ice_type_called	0 = no, 1 = yes

4.3.3 flag_disc_stat_20_ku

sin_low_var

ID	Flag Name	Setting

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1.	multiple_match	0 = no, 1 = yes
2.	no_match	0 = no, 1 = yes
3.	sar_wf_too_wide	0 = no, 1 = yes
4.	sar_snr_low	0 = no, 1 = yes
5.	sar_unreliable_ice_conc	0 = no, 1 = yes
6.	sar_unavailable_ice_conc	0 = no, 1 = yes
7.	sar_bad_bb	0 = no, 1 = yes
8.	sar_low_power	0 = no, 1 = yes
9.	sar_low_pk	0 = no, 1 = yes
10.	sar_high_pk	0 = no, 1 = yes
11.	sin_high_pk	0 = no, 1 = yes
12.	sin_low_power	0 = no, 1 = yes
13.	sin_low_pk	0 = no, 1 = yes
14.	sin_high_noise	0 = no, 1 = yes
15.	sin_bad_le	0 = no, 1 = yes
16.	sin_low_var	0 = no, 1 = yes
17.	discrimination_fail	0 = no, 1 = yes

4.3.4 flag_freeboard_20_ku

ID	Flag Name	Setting
1.	in_south	0 = no, 1 = yes
2.	in_north	0 = no, 1 = yes
3.	unreliable	0 = no, 1 = yes
4.	unavailable	0 = no, 1 = yes

4.3.5 flag_height_20_ku

ID	Flag Name	Setting
1.	correction_failure	0 = no, 1 = yes

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2.	sarin_bad_velocit	0 = no, 1 = yes
3.	sarin_out_of_range	0 = no, 1 = yes
4.	sarin_bad_baseline	0 = no, 1 = yes
5.	lrm_slope_model_invalid	0 = no, 1 = yes
6.	sarin_ice_bias_applied	0 = no, 1 = yes
7.	sarin_ocean_bias_applied	0 = no, 1 = yes
8.	sar_ice_bias_applied	0 = no, 1 = yes
9.	sar_ocean_bias_applied	0 = no, 1 = yes
10.	lrm_ice_bias_applied	0 = no, 1 = yes
11.	lrm_ocean_bias_applied	0 = no, 1 = yes
12.	lrm_retracker_applied	0 = no, 1 = yes
13.	sarin_retracker_applied	0 = no, 1 = yes
14.	sar_retracker_applied	0 = no, 1 = yes
15.	window_offset_applied	0 = no, 1 = yes
16.	slope_doppler_applied	0 = no, 1 = yes
17.	pole_tide_applied	0 = no, 1 = yes
18.	solid_earth_applied	0 = no, 1 = yes
19.	load_tide_applied	0 = no, 1 = yes
20.	ocean_tide_equil_applied	0 = no, 1 = yes
21.	ocean_tide_applied	0 = no, 1 = yes
22.	iono_model_applied	0 = no, 1 = yes
23.	iono_gim_applied	0 = no, 1 = yes
24.	hf_fluctuations_applied	0 = no, 1 = yes
25.	inv_bar_applied	0 = no, 1 = yes
26.	model_wet_applied	0 = no, 1 = yes
27.	model_dry_applied	0 = no, 1 = yes
28.	doppler_applied	0 = no, 1 = yes

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29.	internal_cal_applied	0 = no, 1 = yes
30.	sarin_off_nadir_lead	0 = no, 1 = yes

4.3.6 flag_instr_conf_rx_bwdt_20_ku

ID	Flag Name	Setting
1.	Unknown	0
2.	320_MHz	1
3.	40_MHz	2

4.3.7 flag_instr_conf_rx_flags_20

ID	Flag Name	Setting
1.	siral_redundant	0=no, 1=yes
2.	external_cal open_loop	0=no, 1=yes
3.	loss_of_echo	0=no, 1=yes
4.	real_time_error	0=no, 1=yes
5.	echo_saturation	0=no, 1=yes
6.	rx_band_attenuated	0=no, 1=yes
7.	cycle_report_error	0=no, 1=yes

4.3.8 flag_instr_conf_rx_in_use_20_ku

ID	Flag Name	Setting
1.	unknown	0
2.	Rx1	1
3.	Rx2	2
4.	Both	3

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4.3.9 flag_instr_conf_rx_str_in_use_20_ku

ID	Flag Name	Setting
1.	no_star_tracker	0
2.	tracker_1	1
3.	tracker_2	2
4.	tracker_3	3
5.	attref_file	4

4.3.10 flag_instr_conf_rx_trk_mode_20_ku

ID	Flag Name	Setting
1.	Unknown	0
2.	LRM	1
3.	SAR	2
4.	SARIN	3

4.3.11 flag_instr_mode_att_ctrl_20_ku

ID	Flag Name	Setting
1.	Unknown	0
2.	local_normal	1
3.	pointing yaw_steering	2

4.3.12 flag_instr_mode_flags_20_ku

ID	Flag Name	Setting
1.	SARIN_degraded_case	0=no, 1=yes
2.	CAL4_packet_detection	0=no, 1=yes

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4.3.13 flag_instr_mode_op_20_ku

ID	Flag Name	Setting
3.	lrm	1
4.	sar	2
5.	Sarin	3

4.3.14 flag_mcd_20_ku

ID	Flag Name	Setting
1.	block_degraded	0 = OK 1 = Degraded (set if the block should not be processed – indicated by **bold** typeface)
2.	blank_block	0 = OK 1 = Blank Block inserted for record padding
3.	datation_degraded	0 = OK 1 = Datation is bad or not set
4.	orbit_prop_error	0 = OK 1 = Error (returned by CFI or independent check)
5.	orbit_file_change	0 = OK 1 = Orbit file has changed wrt previous record
6.	orbit_gap	0 = OK 1 = discontinuity (e.g. gap)
7.	echo_saturated	0 = OK 1 = Saturated
8.	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	0 = OK 1 = degraded or missing
10.	sarin_rx2_error	0 = OK 1 = degraded or missing
11.	window_delay_error	0 = OK (value is in range) 1 = value out of range or computation error
12.	agc_error	0 = OK (value is in range) 1 = value out of range or computation error
13.	cal1_missing	0 = correction applied 1 = correction not applied

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ID	Flag Name	Setting
14.	cal1_default	0 = correction from CAL1 product used 1 = correction from IPF DB used
15.	doris_uso_missing	0 = USO Correction Factor is available 1 = USO Correction Factor is not available
16.	ccal1_default	0 = correction from Complex CAL1 Product used 1 = correction from IPF DB used
17.	trk_echo_error	0 = OK 1 = empty (or null) tracking echo
18.	echo_rx1_error	0 = OK 1 = empty (or null) raw echo
19.	echo_rx2_error	0 = OK 1 = empty (or null) raw echo
20.	npm_error	0 = OK 1 = value out of range or computation error
21	azimuth_cal_missing	0 = OK 1= missing
23.	phase_pert_cor_missing	0 = applied 1 = not applied
24.	cal2_missing	0 = correction applied 1 = correction not applied
25.	cal2_default	0 = correction from CAL2 product used 1 = correction from IPF DB used
26.	power_scale_error	0 = OK (echo has been power scaled) 1 = Error in scaling (L1B waveform is null) Used only for LRM L1B
27.	attitude_cor_missing	0 = OK, Correction Applied 1 = Not Corrected
28.	phase_pert_cor_default	0 = computed by CCAL1 1 = default from IPF DB used (applicable only to SARin data)

4.3.15 flag_quality_20_ku

ID	Flag Name	Setting
1.	swh_error	0=ok, 1=error
2.	alt_wind_error	0=ok, 1=error
3.	maths_error	0=ok, 1=error
4.	coherence_error	0=ok, 1=error

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5.	xtrack_angle_error	0=ok, 1=error
6.	echo_shape_error	0=ok, 1=error
7.	peakiness_error	0=ok, 1=error
8.	sig0_3_error	0=ok, 1=error
9.	sig0_2_error	0=ok, 1=error
10.	sig0_1_error	0=ok, 1=error
11.	height_3_error	0=ok, 1=error
12.	height_2_error	0=ok, 1=error
13.	height_1_error	0=ok, 1=error

4.3.16 flag_retracker_20_ku

ID	Flag Name	Setting
1.	retracker_3_fail	0=ok, 1=nok
2.	retracker_2_fail	0=ok, 1=nok
3.	retracker_1_fail	0=ok, 1=nok
4.	poor_phase_fit	0=ok, 1=nok
5.	poor_power_fit	0=ok, 1=nok
6.	fdm_ocog_fail	0=ok, 1=nok
7.	fit_failed	0=ok, 1=nok
8.	sarin_low_coherence	0=ok, 1=nok
9.	sarin_interp_fail	0=ok, 1=nok
10.	abnormal_bb_param	0=ok, 1=nok
11.	out_of_range	0=ok, 1=nok
12.	bad_leading_edge	0=ok, 1=nok
13.	low_variance	0=ok, 1=nok
14.	high_noise	0=ok, 1=nok
15.	high_peakiness	0=ok, 1=nok

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16.	low_peakiness	0=ok, 1=nok
17.	low_power	0=ok, 1=nok
18.	sea_ice_retracker_fail	0=ok, 1=nok

4.3.17 flag_sarin_ambiguity_warning_20_ku

ID	Flag Name	Setting
1.	no_warning	0
2.	warning	1
3.	not_checked	2
4.	unwrapped	3

4.3.18 flag_sea_ice_type_20_ku

ID	Flag Name	Setting
1.	open_water	1
2.	first_year_ice	2
3.	multi_year_ice	3
4.	ambiguous	4

4.3.19 flag_ssha_interp_20_ku

ID	Flag Name	Setting
1.	no_values	1
2.	extrapolation	2
3.	unreliable	3

4.3.20 flag_surf_type_class_20_ku

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ID	Flag Name	Setting
1.	lrm_undefined	0=no, 1=yes
2.	lrm_ocean	0=no, 1=yes
3.	lrm_land_ice	0=no, 1=yes
4.	sarin_undefined	0=no, 1=yes
5.	sarin_valid	0=no, 1=yes
6.	sar_undefined	0=no, 1=yes
7.	sar_ocean	0=no, 1=yes
8.	sar_sea_ice	0=no, 1=yes
9.	sar_lead	0=no, 1=yes

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5 LEVEL 2 AND LEVEL 2I GLOBAL ATTRIBUTES

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

The classification of each attribute is adopted for the sake of clarity and to trace each attribute back to the EE Header field where the attribute comes from.

In any real product 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
acquisition_station	Acquisition Station	any string
Mission	Mission Name	Cryosat
processing_centre	Procassing Facility	PDS

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Data Processing Information		
Attribute Name	**Description**	**Values**
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	

Orbit Information		
Attribute Name	**Description**	**Values**
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	

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Orbit Information		
Attribute Name	**Description**	**Values**
	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**	**Values**
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	

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

Product Time Information		
Attribute Name	**Description**	**Values**
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**	**Values**
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	

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Product Orbit Information		
Attribute Name	**Description**	**Values**
	(positive East, 0 = Greenwich) referred to WGS84.	
ascending_flag	Orbit Orientation at the sensing start time	A=Ascending D=Descending

Product Location Information		
Attribute Name	**Description**	**Values**
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)	

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SIRAL Instrument Configuration		
Attribute Name	**Description**	**Values**
instr_id	Instrument_Identifier	A = SIRAL Nominal B = SIRAL Redundnant
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**	**Values**
open_ocean_percent	Percentage ofrecords detected on open ocean or semi-enclosed seas	
close_sea_percent	Percentage ofrecords detected on close seas or lakes	
continent_ice_percent	Percentage ofrecords detected on continental ice	
land_percent	Percentage ofrecords detected on land	

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Operative mode Statistics		
Attribute Name	**Description**	**Values**
lrm_mode_percent	Percentage of input L1B records detected in LRM mode	
sar_mode_percent	Percentage of input L1B records detected in SAR mode	
sarin_mode_percent	Percentage of input L1B records detected in SARin mode	

SIRAL Level 1 Processing information		
Attribute Name	**Description**	**Values**
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)	

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SIRAL Level 2 Processing information		
Attribute Name	**Description**	**Values**
L2_prod_status	Complete/Incomplete Product Completion Flag (0 or 1). 1 if the product has a duration shorter than the input Level 0	
l2_proc_flag	Processing errors significance flag 1 errors (percentage of errors greater than threshold) 0 no errors	
l2_processing_quality	Percentage of quality checks successfully passed during Level 2 processing (max allowed +10000)	
l2_proc_thresh	Minimum acceptable percentage of quality threshold that must be passed during Level 2 processing (max allowed +10000)	

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Reference DSD		
Attribute Name	**Description**	**Values**
xref_cal1	L1B CAL1 file name	
xref_cal2	L1B CAL2 file name	
xref_calexotic	L1b Exotic CAL1 SARin file name	
xref_constants	Constants File	
xref_dem	DEM File	
xref_dip_map	Modified Dip Map File used for Bent Ionospheric Correction	
xref_earth_tide	CartWright File	
xref_fos	FOS Platform Data File	
xref_fos_hktm	FOS Sorted HouseKeeping Telemetries File	
xref_geoid	Geoid File	
xref_gim	GPS Ionospheric Map Data generated by using either analysis or forecast data	
xref_iono_cor	Ionospheric Coefficients file used for Bent Ionospheric Correction	
xref_mean_pressure	Mean Pressure File for Meteo Correction generated by using either analysis or forecast data	
xref_meteo	Meteo file name(s)	
xref_mog2d	2D Gravity Wave model for Dynamic Atmospheric Correction (DAC) generated by using either analysis or forecast data	
xref_mss	Mean Sea Surface File	
xref_ocean_load_tide	File for Ocean and Load Tide	
xref_odle	Ocean Depth/Land Elevation File	
xref_orbit	Orbit file name(s)	

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Reference DSD		
Attribute Name	**Description**	**Values**
xref_orbit_scenario	Orbit scenario file name	
xref_pconf	Processor Configuration Parameters File	
xref_pole_location	Pole location file name	
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 Ionospheric Correction	
xref_sea_ice	Sea Ice Concentration File	
xref_sea_ice_type_north	Sea Ice North File	
xref_sea_ice_type_south	Sea Ice South File	
xref_siral_characterisation	SIRAL IPFDB file name	
xref_siral_l0	SIRAL L0 file name(s)	
xref_siral_l1b	SIRAL L1b file name(s)	
xref_siral_l2	SIRAL L2 file name(s)	
xref_slope_model	Surface Slope File	

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Reference DSD		
Attribute Name	**Description**	**Values**
xref_snow_depht	Snow depth Climatology File	
xref_star_tracker_0	Star Tracker Level 1b 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_u_wind	U Wind component File for Meteo Correction generated by using either analysis or forecast data	
xref_uso	USO file name	
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	
xref_wind_model	Abdalla2007 Windspeed table	
xref_distance_to_coast	Distance to Costal map, derived from the full resolution shorelines	
xref_bedmachine	The BEDMAC is the BedMachine v3 mask file and is a static file used in all modes	
xref_density	The DENSSI is map of density values for sea ice and water used for SAR and SARIN modes	

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6 CRYOSAT LEVEL-2 PRODUCTS

The following table provides the Product Identification for each product generated by the IPF2.

File Type	Description
SIR_LRM_2_	L2 Product from Low Resolution Mode Processing
SIR_SIN_2_	L2 Product from SAR Interferometric Processing
SIR_SID_2_	L2 Product from SIN Degraded Processing
SIR_SAR_2_	L2 Product from SAR Processing
SIR_GDR_2_	L2 Consolidated Product
SIR_LRMI2_	In-depth L2 Product from LRM Processing
SIR_SINI2_	In-depth L2 Product from SIN Processing
SIR_SIDI2_	In-depth L2 Product from SIN Degraded Process.
SIR_SARI2_	In-depth L2 Product from SAR Processing

Table 5-1: Level-2 products list

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6.1 FILE NAMES

The file names abide to the following conventions (in italics the variable parts):

*MM_CCCC_XXXXXXXXXX_yyyymmdd_hhmmss_YYYYMMDD_HHMMSS__**bvvv***.nc

MM = CS (Mission Identifier)

CCCC = file class which can be: OFFL (Off Line Processing/Systematic)
NRT_ (Near Real Time)
RPRO (ReProcessing)
TEST (Testing)
LTA_ (Long Term Archive)

yyyymmdd_hhmmss = validity start time corresponds to the input Level 1 UTC start time
YYYYMMDD_HHMMSS = validity stop time corresponds to the input Level 1 UTC stop time

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

vvv is the version number of the file

XXXXXXXXXX is the file type. For the Level-2 products, this is defined in table 5.1

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Appendix A: Variables to Products

Variables to Products Mapping			
Variable Name	L2	L2I	SAR/SARin Only
across_track_angle_20_ku(time_20_ku);		X	
across_track_angle_cor_20_ku(time_20_ku);		X	
avg_peakiness_20_ku(time_20_ku);		X	
avg_stack_peakiness_20_ku(time_20_ku);		X	
alt_01(time_cor_01);	X		
alt_20_ku(time_20_ku);		X	
alt_plrm_20_ku(time_plrm_20_ku)		x	
beam_dir_vec_20_ku(time_20_ku, space_3d_ku);		X	
cats2008_tide_01(time_cor_01)	x	X	
cats2008_tide_plrm_01(time_cor_01)	x	X	x
coherence_20_ku(time_20_ku);		X	
distance_to_coast_20_ku(time_20_ku);	X	X	
distance_to_coast_01(time_cor_01);	X	x	
distance_to_lead_20_ku(time_20_ku)		x	
dem_height_20_ku(time_20_ku);		X	
dem_identifier_20_ku(time_20_ku);		X	
dop_angle_start_20_ku(time_20_ku);		X	
dop_angle_stop_20_ku(time_20_ku);		X	
dop_cor_01_ku(time_cor_01);			
dop_cor_20_ku(time_20_ku);		X	
echo_numval_20_ku(time_20_ku);	x		
echo_numval_plrm_20_ku(time_plrm_20_ku);	x		x
flag_bedmachine_mask_20_ku(time_20_ku)	x	x	
flag_cor_applied_20_ku(time_20_ku);	X		
flag_cor_applied_plrm_20_ku(time_plrm_20_ku);	X		x
flag_cor_err_01(time_cor_01);	x		
flag_cor_err_20_ku(time_20_ku);		X	
flag_cor_status_20_ku(time_20_ku);		X	
flag_disc_stat_20_ku(time_20_ku);		X	
flag_freeboard_20_ku(time_20_ku);		X	
flag_height_20_ku(time_20_ku);		X	
flag_instr_conf_rx_bwdt_20_ku(time_20_ku);		X	
flag_instr_conf_rx_flags_20_ku(time_20_ku);		X	
flag_instr_conf_rx_in_use_20_ku(time_20_ku);		X	

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Variables to Products Mapping			
Variable Name	L2	L2I	SAR/SARin Only
flag_instr_conf_rx_str_in_use_01(time_cor_01);	X	X	
flag_instr_conf_rx_trk_mode_20_ku(time_20_ku);		X	
flag_instr_mode_att_ctrl_20_ku(time_20_ku);		X	
flag_instr_mode_flags_20_ku(time_20_ku);		X	
flag_instr_mode_op_20_ku(time_20_ku);	X	X	
flag_mcd_20_ku(time_20_ku);		X	
flag_prod_status_20_ku(time_20_ku);	X		
flag_prod_status_plrm_20_ku(time_plrm_20_ku);	X		X
flag_sea_ice_type_20_ku(time_20_ku);	X	X	
flag_quality_20_ku(time_20_ku);		X	
flag_retracker_20_ku(time_20_ku);		X	
flag_sarin_ambiguity_warning_20_ku(time_20_ku);		X	
flag_ssha_interp_20_ku(time_20_ku);		X	
flag_surf_type_class_20_ku(time_20_ku);		X	
radar_freeboard_20_ku(time_20_ku);	X		
geoid_01(time_cor_01);	X	X	
height_1_20_ku(time_20_ku);	X	X	
height_2_20_ku(time_20_ku);	X	X	
height_3_20_ku(time_20_ku);	X	X	
height_ocog_plrm_20_ku(time_plrm_20_ku);	X	X	x
height_sea_ice_floe_20_ku(time_20_ku)	X	X	
height_sea_ice_lead_20_ku(time_20_ku)	X	X	
hf_fluct_total_cor_01(time_cor_01);	X	X	
ice_density_20_ku(time_20_ku)	x		
water_density_20_ku(time_20_ku)	x		
instr_int_ph_cor_20_ku(time_20_ku);		X	
ind_first_meas_20Hz_01(time_cor_01)	X	X	
ind_first_meas_1Hz_20_ku(time_20_ku)	X	X	
instr_cor_gain_rx_20_ku(time_20_ku);		X	
instr_cor_gain_tx_rx_20_ku(time_20_ku);		X	
instr_cor_range_rx_20_ku(time_20_ku);		X	
instr_cor_range_tx_rx_20_ku(time_20_ku);		X	
instr_ext_ph_cor_20_ku(time_20_ku);		X	
inter_base_vec_20_ku(time_20_ku, space_3d_ku);		X	

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Variables to Products Mapping			
Variable Name	L2	L2I	SAR/SARin Only
inv_bar_cor_01(time_cor_01);	X	X	
iono_cor_01(time_cor_01);	X	X	
iono_cor_gim_01(time_cor_01);	X	X	
larm_wf_metric_1_20_ku(time_20_ku)	x	x	
larm_wf_metric_2_20_ku(time_20_ku)	x	x	
lat_01(time_cor_01);	X		
lat_20_ku(time_20_ku);	X	X	
lat_poca_20_ku(time_20_ku);	X	X	
lat_poca_plrm_20_ku(time_20_ku);	X	X	x
lat_plrm_20_ku(time_plrm_20_ku)	x	x	x
load_tide_01(time_cor_01);	X	X	
lon_01(time_cor_01);	X		
lon_20_ku(time_20_ku);	X	X	
lon_poca_20_ku(time_20_ku);	X	X	
lon_poca_plrm_20_ku(time_plrm_20_ku);	X	X	x
lon_plrm_20_ku(time_plrm_20_ku)	x	x	x
look_angle_start_20_ku(time_20_ku);		X	
look_angle_stop_20_ku(time_20_ku);		X	
mean_sea_surf_sea_ice_01(time_cor_01);	X		
mean_sea_surf_sea_ice_20_ku(time_20_ku);		X	
mod_dry_tropo_cor_01(time_cor_01);	X	X	
mod_wet_tropo_cor_01(time_cor_01);	X	X	
noise_power_20_ku(time_20_ku);		X	
num_valid_01(time_cor_01);	X		
ocean_tide_01(time_cor_01);	X	X	
ocean_tide_eq_01(time_cor_01);	X	X	
odle_01(time_cor_01);	X		
odle_20_ku(time_20_ku);		X	
off_nadir_pitch_angle_str_01(time_cor_01);	X		
off_nadir_pitch_angle_str_20(time_20_ku)		X	
off_nadir_roll_angle_str_01(time_cor_01);	X		
off_nadir_roll_angle_str_20_ku(time_20_ku)		X	
off_nadir_yaw_angle_str_01(time_cor_01);	X		
off_nadir_yaw_angle_str_20_ku(time_20_ku)		X	
offset_attitude_20_ku(time_20_ku);		X	
offset_azimuth_20_ku(time_20_ku);		X	

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Variables to Products Mapping			
Variable Name	L2	L2I	SAR/SARin Only
orb_alt_rate_20_ku(time_20_ku);		X	
peakiness_20_ku(time_20_ku);	X	X	
peakiness_plrm_20_ku(time_plrm_20_ku);	X	X	x
ph_slope_cor_20_ku(time_20_ku);		X	
pole_tide_01(time_cor_01);	X	X	
range_1_20_ku(time_20_ku)	X	X	
range_2_20_ku(time_20_ku)	X	X	
range_3_20_ku(time_20_ku)	X	X	
range_ocog_plrm_20_ku(time_plrm_20_ku)	X	X	x
range_larm_20_ku(time_20_ku)		x	
rec_count_20_ku(time_20_ku);		X	
rec_count_20_ku(time_20_ku);			
retracker_1_cor_20_ku(time_20_ku);		X	
retracker_1_quality_20_ku(time_20_ku);	X	X	
retracker_2_cor_20_ku(time_20_ku);		X	
retracker_2_quality_20_ku(time_20_ku);	X	X	
retracker_3_cor_20_ku(time_20_ku);		X	
retracker_3_quality_20_ku(time_20_ku);	X	X	
retracker_output_10_20_ku(time_20_ku);		X	
retracker_output_11_20_ku(time_20_ku);		X	
retracker_output_12_20_ku(time_20_ku);		X	
retracker_output_13_20_ku(time_20_ku);		X	
retracker_output_14_20_ku(time_20_ku);		X	
retracker_output_15_20_ku(time_20_ku);		X	
retracker_output_16_20_ku(time_20_ku);		X	
retracker_output_17_20_ku(time_20_ku);		X	
retracker_output_18_20_ku(time_20_ku);		X	
retracker_output_19_20_ku(time_20_ku);		X	
retracker_output_20_20_ku(time_20_ku);		X	
retracker_output_21_20_ku(time_20_ku);		X	

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Variables to Products Mapping			
Variable Name	L2	L2I	SAR/SARin Only
retracker_output_22_20_ku(time_20_ku);		X	
retracker_output_23_20_ku(time_20_ku);		X	
retracker_output_3_20_ku(time_20_ku);		X	
retracker_output_4_20_ku(time_20_ku);		X	
retracker_output_5_20_ku(time_20_ku);		X	
retracker_output_6_20_ku(time_20_ku);		X	
retracker_output_7_20_ku(time_20_ku);		X	
retracker_output_8_20_ku(time_20_ku);		X	
retracker_output_9_20_ku(time_20_ku);		X	
sarin_output_1_20_ku(time_20_ku);		X	
sarin_output_10_20_ku(time_20_ku);		X	
sarin_output_2_20_ku(time_20_ku);		X	
sarin_output_3_20_ku(time_20_ku);		X	
sarin_output_4_20_ku(time_20_ku);		X	
sarin_output_5_20_ku(time_20_ku);		X	
sarin_output_6_20_ku(time_20_ku);		X	
sarin_output_7_20_ku(time_20_ku);		X	
sarin_output_8_20_ku(time_20_ku);		X	
sarin_output_9_20_ku(time_20_ku);		X	
sat_vel_vec_20_ku(time_20_ku, space_3d_ku);		X	
sea_ice_concentration_01(time_cor_01);	X		
sea_ice_concentration_20_ku(time_20_ku);		X	
sea_ice_freeboard_20_ku(time_20_ku)	x	x	
sea_ice_thickness_20_ku(time_20_ku)	x	x	
seq_count_20_ku(time_20_ku);		X	
sig0_1_20_ku(time_20_ku);	X	X	
sig0_2_20_ku(time_20_ku);	X	X	
sig0_3_20_ku(time_20_ku);	X	X	
sig0_ocog_plrm_20_ku(time_plrm_20_ku);	X	X	X
slope_dop_cor_20_ku(time_20_ku);		X	

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Variables to Products Mapping			
Variable Name	L2	L2I	SAR/SARin Only
snow_density_01(time_cor_01);	X		
snow_density_20_ku(time_20_ku);		X	
snow_depth_01(time_cor_01);	X		
snow_depth_20_ku(time_20_ku);		X	
snow_depth_cor_20_ku(time_20_ku);	X	X	
solid_earth_tide_01(time_cor_01);	X	X	
space_3d_ku(space_3d_ku);		X	
ssha_20_ku(time_20_ku);		X	
ssha_interp_20_ku(time_20_ku);	X	X	
ssha_interp_numval_20_ku(time_20_ku);	X		
ssha_interp_numval_back_20_ku(time_20_ku);		X	
ssha_interp_numval_fwd_20_ku(time_20_ku);		X	
ssha_interp_rms_20_ku(time_20_ku);	X	X	
ssha_interp_time_back_20_ku(time_20_ku);		X	
ssha_interp_time_fwd_20_ku(time_20_ku);		X	
stack_centre_20_ku(time_20_ku);		X	
stack_centre_angle_20_ku(time_20_ku);		X	
stack_centre_look_angle_20_ku(time_20_ku)		X	
stack_gaussian_fitting_residuals_20_ku(time_20_ku)		X	
stack_kurtosis_20_ku(time_20_ku);		X	
stack_number_after_weighting_20_ku(time_20_ku);		X	
stack_number_before_weighting_20_ku(time_20_ku);		X	
stack_peakiness_20_ku(time_20_ku);		X	
stack_scaled_amplitude_20_ku(time_20_ku);		X	
stack_skewness_20_ku(time_20_ku);		X	
stack_std_20_ku(time_20_ku);		X	
stack_std_angle_20_ku(time_20_ku);		X	
surf_type_20_ku(time_20_ku);	X	X	
surf_type_plrm_20_ku(time_plrm_20_ku);	X	X	X
time_20_ku(time_20_ku);	X	X	

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Variables to Products Mapping			
Variable Name	L2	L2I	SAR/SARin Only
time_plrm_20_ku(time_plrm_20_ku)	x	x	x
time_cor_01(time_cor_01);	X	X	
Time_cor_plrm_01(time_cor_plrm_01)	x	x	x
uso_cor_20_ku(time_20_ku);		X	
uso_cor_applied_20_ku(time_20_ku);		X	
uso_cor_plrm_20_ku(time_plrm_20_ku)		x	x

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Appendix B: Default Setting of the Attribute: _FillValue

By design, each variable of the CONFORM products has got 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 processing.

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

Variables with no _FillValue			
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)
instr_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.

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In particular, as to the counters (i.e. rec_count_20_ku and instr_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 conters are flagged as invalid (i.e. the following bitfields are set in flag_mcd_20_ku: `block_degraded blank_block datation_`)

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

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

_FillValue Specific Settings	
variable type	**_FillValue**
byte	-128b
int	-2147483648
int64	–9223372036854775808LL
short	-32768
ushort	32767US

The above convention is not used in the following cases:

_FillValue Default Settings			
Variable Name	**Variable Type**	**_FillValue**	**Note**
flag_cor_error_01(time_cor_01)	int	-1	
flag_cor_status_01(time_cor_01)	int	-1	
flag_echo_01(time_avg_01)	short	-1s	
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	

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_FillValue Default Settings			
Variable Name	**Variable Type**	**_FillValue**	**Note**
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 1/1/2000 in double precision.
In this appendix it is shown that the current choice allows the represent timestamps 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 till the 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 till 0,1 microseconds
The IEEE 754 standard representation for 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 disposal 2^{30} -1 = 1,073,741,823 sec, i.e. 34 years.

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

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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:

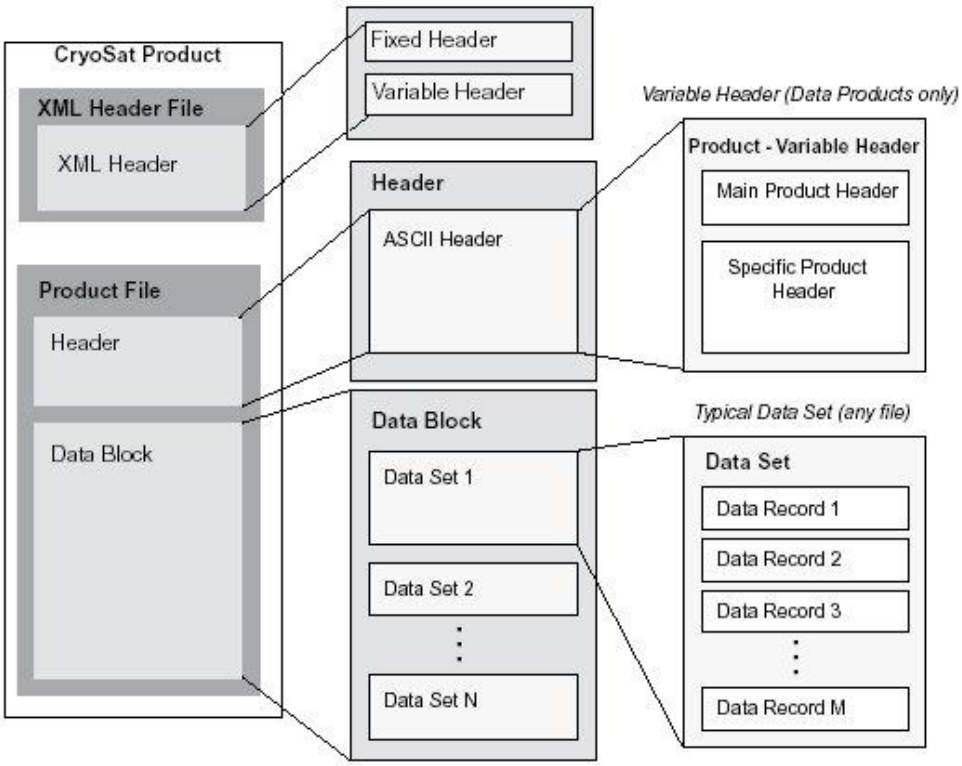
1. A version of the IPF2 software has to be released that generates baseline C CONFROM products. This IPF2 version as well as the baseline C CONFORM products are hidden versions, i.e. the software is not installed in the operational platform and the products are not distributed but to a selected groups of users to receive their feedback and suggestions for improvements.
2. The first official version of the IPF2 CONFORM software has to be the 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.



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Figure 6-1: EE Product Structure

The CONFORM products consists of one file that contains the same information as the EE Product File whilst the XML Header File doesn't exist anymore in CONFORM and will no longer referred to in this section.

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

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

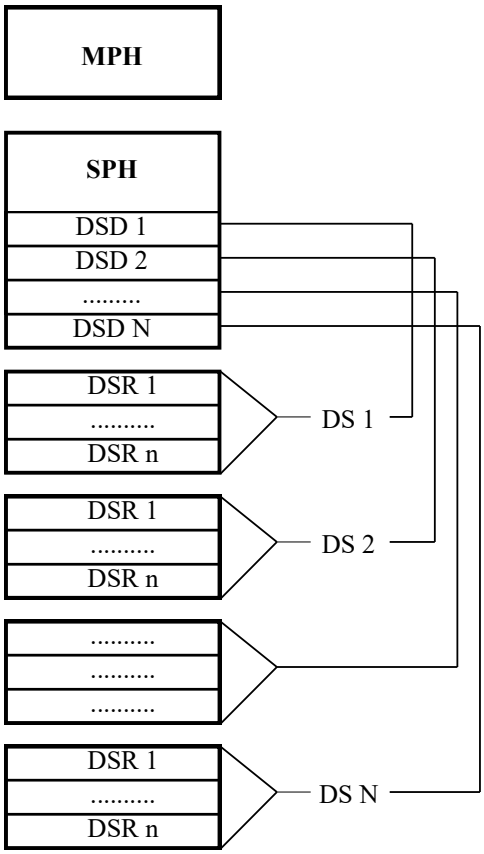


Figure 6-2: EE Product File Structure

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.

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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 1Hz measurement.
    - One time stamp for each 20Hz measurement.
    - 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

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Appendix E: ncdump referente template

In annex to the current document, the reference template representative of the product netcdf metadata are included.

The folder includes the following templates:

- L2: Level 2 Compact cdl dump for the LRM/SAR/SARin mode
- L2I: Level 2 In Depth cdl dump for the LRM/SAR/SARin mode
- L2 PLRM: Level 2 PLRM Compact cdl dump for the SAR/SARin mode
- L2I PLRM: Level 2 PLRM In Depth cdl dump for the SAR/SARin mode

END OF DOCUMENT

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