Development of Radar Altimetry Data Processing in the Oceanic Coastal Zone

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Revision History

Issue	Date	Change
1	3 June 2009	Initial Release
1.01	21 October 2009	Addition of headers, footers, cover page and distribution information. Correction of typos. Addition of section on COASTALT retrackers (§2.1). Minor modification to descriptions of global attributes. Addition of Coastal_mask_version global attribute. Change of variables names latitude & longitude to lat & lon and corresponding change to all coordinates attributes. Removal of byte orbit_proc_flags variable. Addition of hz18_alt_cog_ellip variable Changes to attributes of many variables- in particular addition of attributes to new retracker outputs. Correction of all byte data types to int or short
1.01 rev 1	19 Nov 2009	Addition of Revision History
1.01 rev 2	11 Dec 2009	Change unit definition for total electron content
1.1	31 March 2010	Corrected units and scale factor for hz18_alt_cog_ellip Corrected values of FillValue for all long integers Clarified information on size of product Updated reference documents Change of distribution list. Minor grammatical changes throughout.
2.0	31 August 2010	Changes to reflect v2.0 of COASTALT processor products: **Details of changes:** §4.1 added comment on compatibility of v2 files with v4 software §5.2 Changed information on availability of 18 Hz corrections §5.5 clarified text on use of default values §6 Added sentence explaining the variable size of the products §6.1 global attributes: added attributes RA2_CONFIGURATION_DATA, RA2_CHARACTERISATION_DATA and USO_CORRECTION_DATA §6.3 Variables Added new variables: uso_clock_correction hz18_inv_barom_corr hz18_mod_wet_tropo_corr hz18_ra2_ion_corr_ku hz18_ra2_ion_corr_s hz18_ion_corr_doris_ku hz18_ion_corr_doris_s hz18_ion_corr_mod_ku hz18_ion_corr_mod_s hz18_dib_hf hz18_m_sea_surf_ht

Issue	Date	Change
		hz18_geoid_ht hz18_ocean_depland_elev hz18_tot_geocen_ocn_tide_ht_sol2 hz18_long_period_ocn_tide_ht hz18_tidal_load_ht_sol1 hz18_tidal_load_ht_sol2 hz18_solid_earth_tide_ht hz18_geocen_pole_tide_ht distance_from_coast mwr_wet_trop_interp_flag Changed type from double to integer, changed FillValue attribute value to match changed type and added appropriate scale factor for: hz18_lat hz18_lon hz18_alt_cog_ellip Changed type from double or float to short and changed FillValue attribute value to match changed type for: hz18_dry_trop_mod hz18_mwr_wet_trop iono_corr_brown_ku (also renamed from iono_corr_brown) iono_corr_spec_ku (also renamed from iono_corr_spec) iono_corr_mixed_ku (also renamed from iono_corr_mixed) hz18_sea_bias_ku hz18_sea_bias_s hz18_tot_geocen_ocn_tide_ht_sol1 (also renamed from hz18_tide_sol1) Corrected FillValue attribute value for: alt_cog_ellip hz18_ku_trk_cog hz18_s_trk_cog ku_band_ocean_range s_band_ocean_range hz18_ku_band_ocean hz18_s_band_ocean Changed 'map' flags from 1 dimensional short to 2 dimensional byte arrays, changed FillValue attribute value to match new data type and changed coordinate variables to match new dimensions for map_18hz_ku_trk map_18hz_ku_ocean_flags map_18hz_s_ocean_flags slp_mod_flags map_18hz_k_cal_ku_flags ku_ocean_retrk_qua_flags s_ocean_retrk_qua_flags Changed data type from short or int to byte and changed FillValue attribute value to match new data type for ku_chirp_id_flags instr_id_data_level_flags coastal_mask_flag (also renamed from coastal_mask_flags) Corrected flag values and meanings for instr_mode_id_flags using documentation from ESA (SGDR manual incorrect) Added source attributes for all variables directly sourced from, or interpolated from, SGDR variables to provide SGDR source field

Issue	Date	Change
		§8 added full reference for COASTALT SoW
2.0 rev 1	31 Januay 2011	Minor modifications to correct for limitations of NetCDF 3.6.3 and correct typographic errors **Details of changes** Corrected typo in distribution list §6.3 Variables: Removed variable orbit_proc_flag (not included in products) Changed all byte variable types to short (for NetCDF 3.6.3 compatibility) and changed FillValue attribute to match changed data type. Variables affected are: map_18hz_ku_trk map_18hz_ku_ocean_flags map_18hz_s_ocean_flags slp_mod_flags map_18hz_k_cal_ku_flags ku_ocean_retrk_qua_flags s_ocean_retrk_qua_flags ku_chirp_id_flags instr_id_data_level_flags coastal_mask_flag
2.0 rev 2	14 June 2011	§6.1 global attributes : Additional Global Attributes: product_spec product_revision §6.3 Variables: The string "hs" has been removed from all long names and replaced with "swh"
2.0 rev 3	20 June 2011	§5.2 Corrections: Added note on use of High frequency ocean response correction Added note on use of USO correction Added note on smoothing of RA-2 derived ionospheric corrections Clarified that availability of corrections dependant on input SGDR version §6.3 Variables: Corrected data type for altim_landocean_flag and map_18hz_ku_trk from byte to short (typographical error) §8 added reference for COASTALT Handbook

Table of Contents

1 Introduction

The aim of this document is to define the default ENVISAT product generated by the COASTALT processor [RD 8]. The product will be produced for the coastal domain, as specified by the technical document [RD 8].

The product will be based on the data from the ENVISAT level 2 Sensor data record (SGDR), as defined in the ENVISAT product handbook [RD 2], product user manual [RD 3] and product specification documents [RD 4, RD 5, RD 6], together with the new output of the COASTALT processor. Not all records from the ENVISAT SGDR data are included in the COASTALT product – instead, only those data considered necessary for processing of the output data, or useful for direct comparison with the new fields, are included.

An overview of the COASTALT project aims is provided in the next section, followed by an introduction to the ENVISAT instrument.

2 COASTALT Overview

The primary aim of the COASTALT project is to make the status of pulse- limited coastal altimetry operational, by defining and testing a new ENVISAT coastal radar altimeter product that ESA can routinely generate and distribute.

In order to achieve these aims, the project has developed a coastal processor that can:

- ingest the ESA ENVISAT level-2 SGDR products.
- reprocess the waveform data, using a number of alternative retrackers to generate high resolution (18 Hz) data which may be more useful in coastal areas.
- generate new geophysical corrections from these new data.
- generate higher data rate geophysical correction data, by interpolation, as necessary for correcting the higher rate range data.
- output all the relevant original and new fields into a single file per pass, in a self describing format.

The basic coastal product includes fields that can be determined for any coastal region, using the data from the altimeter itself, or instruments mounted on the same platform, and global models. This product does not include fields that would require specific auxiliary information, such as a region-specific tidal model, or *in situ* observational data. However, such additional fields may be added to the product, using the standalone product enhancer.

The output product has been designed to allow use of the new, retracked, range, significant wave height and backscatter values, together with the geophysical corrections that rely on them (such as ionospheric correction and sea-state bias corrections). They also contain the comparable original data, to enable users to readily compare the SGDR and COASTALT values. One enhancement of the source data, is to provide all geophysical corrections fields at the higher (18 Hz) data rate. This involves interpolation of the existing 1Hz values.

2.1 COASTALT Retrackers

The COASTALT product contains output from three physically based waveform retrackers that are run in parallel within the COASTALT processor.

1) A Brown theoretical Ocean Retracker (BOR)
2) A Specular Beta-parameter Retracker (SBR)
3) A Mixed Brown and Specular Retracker (MBS).

Full technical specifications of these retrackers can be found in the COASTALT Waveform Retracker Software Technical Specification Document [RD 8].
For the BOR and MBS, the fitting returns a range (determined from t_0), sigma-0, SWH and thermal noise value for each of the Ku and S bands, and these are reported in the Products. The SBR and MBS return the values of the 5 beta-parameters (the first beta parameter is not include for MBS as this is accounted for by the thermal noise parameter). In all cases, a goodness of fit value is also returned.

3 Instrument Overview

The Radar Altimeter-2 measures the distance from the satellite to the closest point on the Earth's surface directly beneath it with high precision. If the orbit of the satellite is determined by independent means (such as by DORIS) the RA-2 data can be used to accurately map the Earth's topography. In addition, signal analysis of the returning radar echo can be used to provide insight into ground characteristics. The RA-2 is a nadir looking pulse limited radar operating at a nominal frequency of 13.575 GHz (Ku-band). A second channel, operating at a nominal frequency of 3.2 GHz (S-band) is also used, primarily to estimate the effects of the ionosphere on the Ku-band channel.

Table 3-1 RA-2 Characteristics

GEOMETRIC:	Approx. 19 km footprint. Spatial sampling approx. 390 meters along track. 47 cm height resolution at 320 MHz max chirp bandwidth.
RADIOMETRIC:	Nadir looking pulse: Main Nominal frequency = 13.575 GHz (Ku-band) Error Nominal frequency = 3.2 GHz (S-band)

The RA-2 instrument operates in three modes. These consist of Measurement Mode, RF and Digital Built-In Test Equipment (BITE) Mode, and IF Calibration Mode. Science data are gathered within the Measurement Mode, while the other modes are used for testing and calibrating the instrument.

1. Measurement Mode

The Measurement Mode consists of two primary phases. The first is Acquisition Phase, when the instrument attempts to locate the initial ground height. To do this, the instrument first initiates a Noise Power Estimation cycle to establish a noise power estimate, and then proceeds with a Detection cycle in which the location of the leading edge of the return echo is established. The final step in the Acquisition Phase is the Automatic Gain Control (AGC) Setting cycle in which instrument attempts to estimate the received signal power in order to set the appropriate gain settings to keep the return signal amplitude within the proper dynamic range of the receiving equipment. The second step of Measurement Mode is the Tracking Phase, in which the instrument acquires the science data. The transition from Acquisition to Tracking phases is performed automatically or started directly by macrocommand. During tracking it is possible to change tracking parameters without interruption of measurements. Periodic calibration is also performed while in the Tracking Phase of Measurement Mode. Operational products are constructed from the data obtained when the instrument is in the Tracking Phase of Measurement Mode.

2. RF and Digital BITE Mode

The aim of these two modes is to test the RF Tx/Rx channel and the digital signal processing modules. BITE is executed from Measurement Mode by macrocommand. During BITE the tracking is interrupted. RF and Digital BITE are executed cyclically until a mode change request is received. Data generated while in this mode are included in Level 0 products only.

3. IF Calibration Mode

The purpose of this mode is to measure the IF filter shape. This is done by measuring the spectra of averaged noise samples. Data generated while in this mode is included in Level 0 products only.

3.1 ENVISAT Products Overview

The RA-2 products are summarized in Table 3-1 and the product tree of Figure 3-1.

Table 3-2 RA-2 Products

Instrument / mode	**Product ID**	**Description**
RA-2	RA2_CAL_0P	RA2 Calibration and BITE Mode Level 0
	RA2_ME__0P	RA2 Measurement Mode Level 0
	RA2_MW__1P	Geolocated and calibrated Altimeter Waveforms with TOA Microwave Brightness Temperatures
	RA2_FGD_2P	FDGDR: Fast delivery Geophysical Data record from RA-2 and Water Vapour/Liquid Content from MWR. Available 3 hours after data acquisition
	RA2_IGD_2P	IGDR: Intermediate Geophysical Data record from RA2 and Water Vapour/Liquid Content from MWR. Processed off-line and available 3-5 days after acquisition
	RA2_GDR_2P	GDR: Geophysical Data Record from RA-2 and Water Vapour/Liquid Content from MWR. Processed off-line and available 50 days after acquisition
	RA2_WWV_2P	FDMAR/IMAR: Wind/Wave product with height and MWR information for NRT dissemination to Meteocean users (2 products released at different levels of consolidation: FDMAR built from RA2_FGD_2P or IMAR built from RA2_IGD_2P)
	RA2_MWS_2P	SGDR: Sensor Geophysical Data Record from RA-2, Water Vapour/Liquid content from MWR and Individual Uncalibrated Waveforms from RA-2. Available after 50 days from data take.

The COASTALT processor uses data from the level 2 SGDR products to generate the output product.

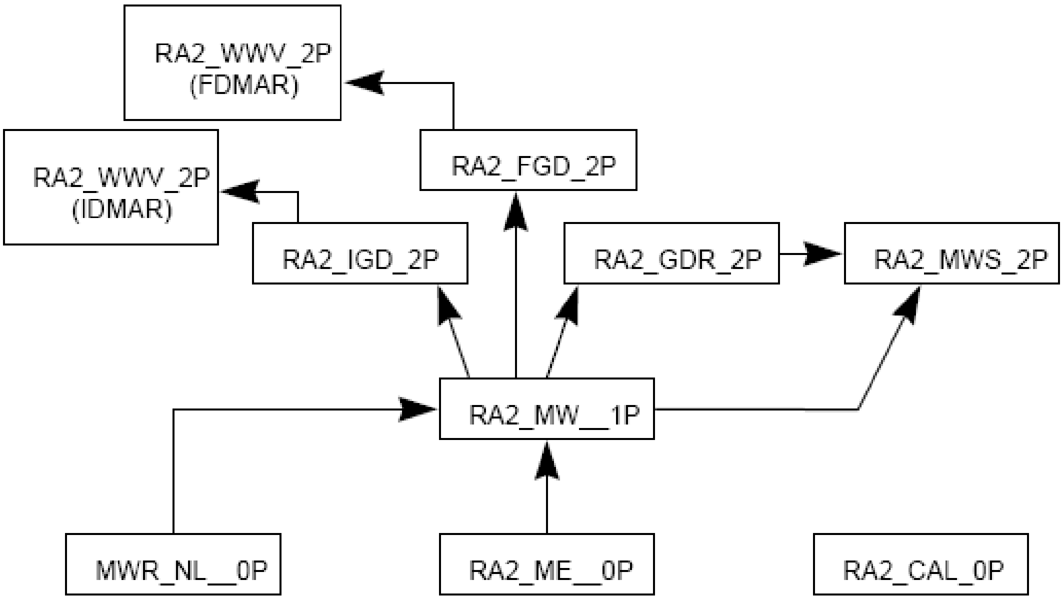

Figure 3-1 RA-2 Product Tree

4 COASTALT Product Overview

4.1 NetCDF Format and CF Conventions

The COASTALT data product uses the netCDF (network Common Data Form) data format. NetCDF is a set of software libraries and machine-independent data formats that support the creation, access, and sharing of array-oriented scientific data. The format was chosen as it is extremely flexible, self-describing, platform independent and has been adopted as a de-facto standard for many operational oceanography systems. Although the latest version of netCDF (v 4) has advantages in terms of data compression, COASTALT data will be produced in netCDF v 3 format, to retain maximum compatibility with existing software and for simplicity of installation, as it does not require the additional HDF 5 and compression libraries. The v3 files are compatible with v4 libraries and software.

In addition, the data and metadata within the files will follow the Climate and Forecast netCDF conventions CF-1.4 wherever applicable, in order to take advantage of generic software and tools developed to read and manipulate data files that conform to these standards.

4.2 The netCDF Data Model

A netCDF file contains dimensions, variables, and attributes, which all have a name by which they are identified. Each of these components has corresponding characteristics, which define what it holds and how it can be used. These components can be used together to capture the meaning of data and relations among data fields in an array-oriented data set.

4.2.1 Dimensions

A dimension may be used to represent a real physical dimension, for example, time, latitude, longitude or height. Variables may share common dimensions, relating them to the same grid. A dimension might also be an index for other quantities (waveform index for example).

4.2.2 Variables

Variables are used to store the bulk of the data in a netCDF file. 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. A variable may also have associated attributes, which may be added, deleted or changed after the variable is created.

A variable data type is one of a small set of netCDF types. In this document the variable types will be represent as follows:

Table 4-1 NetCDF variable types

Variable type	Description
char	characters
byte	8-bit data signed
short	16-bit signed integer
int	32-bit signed integer
float	IEEE single precision floating point (32 bits)

double	IEEE double precision floating point (64 bits)

4.2.3 Coordinate Variables And Auxiliary Coordinate Variables

A variable with the same name as a dimension is called a coordinate variable. It typically defines a physical coordinate corresponding to that dimension. In accordance with the Climate and Forecast conventions, we must declare a coordinate variable for each dimension. Missing values are not allowed in coordinate variables and they must be strictly monotonic.

An auxiliary coordinate variable is a netCDF variable that contains coordinates data but is not a coordinate variable as defined above. Unlike coordinate variables, there is no relationship between the name of an auxiliary coordinate variable and the name(s) of its dimension(s).

4.2.4 Attributes

NetCDF attributes are used to store data about the data (ancillary data or metadata), similar in many ways to the information stored in data dictionaries and schema in conventional database systems. Most attributes provide information about a specific variable. These are identified by the name of that variable, together with the name of the attribute.

Some attributes provide information about the data set as a whole. They are called global attributes and contain similar information to that found in product headers for the ENVISAT level 2 format files.

The following table shows the variable attributes used in the COASTALT product. There are no mandatory attributes and only attributes appropriate to each variable will be assigned.

Table 4-2 Variable attributes

Attribute	Description
_FillValue	A value used to represent undefined or missing data
ancillary_variables	Identifies a variable that contains closely associated data, e.g., the measurement uncertainties of instrument data.
add_offset	If present, this number is to be added to the data after it is read by an application. If both scale_factor and add_offset attributes are present, the data are first scaled before the offset is added.
comment	Miscellaneous information about the data or the methods used to produce it
coordinates	Identified auxiliary coordinates variables.
flag_masks	Describe a number of independent Boolean conditions using bit field notation by setting unique bits in each flag_masks value. The flag_masks attribute is the same type as the variable to which it is attached, and contains a list of values matching unique bit fields. A flagged condition is identified by performing a bitwise AND of the variable value and each flag_masks value; a non-zero result indicates a true condition. Used in conjunction with flag_meanings.
flag_meanings	Use in conjunction with flag_values or flag_meanings to provide descriptive words or phrase for each flag value.
flag_values	Provide a list of the flag values. The flag_values attribute is the same type as the variable to which it is attached. Used 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
references	References that describe the data or methods used to produce it.
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 variable's content in the CF 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.
valid_max	Largest theoretical valid value of a variable (this is not the maximum of actual data).
valid_min	Smallest theoretical valid value of a variable (this is not the minimum of actual data).

4.3 The Common Data Language

The Common Data Language (CDL) will be used to describe the content of a data set.

The CDL is textual notation that described the netCDF object and it is human readable. The NetCDF utility ncdump converts NetCDF binary objects to CDL text. The NetCDF utility ncgen creates a NetCDF binary file from a CDL text file.

A CDL description of a NetCDF data set takes the form:

```
netcdf name {
        dimension: …
        variables: …
        data: …
}
```

where the *name* is used only as a default in constructing file names by the ncgen utility. The value of name reported by ncdump is the filename of the netCDF binary source file. The CDL description consists of three optional parts, introduced by the keywords "dimensions", "variables" and "data". NetCDF dimension declarations appear after the dimensions keyword, netCDF variables and attributes are defined after the variables keyword and variable data assignments appear after the data keyword. CDL statements are terminated by a semicolon. Spaces, tabs and newlines can be used freely for readability. Comments in CDL follow the characters '//' on any line.

Example :

```
netcdf example {
dimensions:                              // dimensions are declared first
   time = 1000;

variables:
   double time(time);                         // variable <type> <name>(<dimension>)
      time:long_name = "time" ;               // variable attributes
```

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

- time is a coordinate variable.

```
int lon(time);
    lon:long_name = "longitude" ;
    lon:standard_name = "longitude" ;
    lon:units = "degrees_east" ;
    lon:scale_factor = 1.0e-06;
```

- lon is an auxiliary coordinate variable

```
short altim_landocean_flag (time);
    altim_landocean_flag:long_name = "Altimeter surface type flag" ;
    altim_landocean_flag:_FillValue = 127b;
    altim_landocean_flag:flag_values = 0b, 1b, 2b, 3b;
    altim_landocean_flag:flag_meanings = "ocean enclosed_seas_lakes continental_ice land" ;
    altim_landocean_flag:coordinates = "lon lat" ;
```

- altim_landocean_flag is a flag fully described by the flag_meanings and flag_values attributes:
    - altim_landocean_flag = 0 -> ocean
    - altim_landocean_flag = 1 -> enclosed seas or lakes
    - altim_landocean_flag = 2 -> continental ice
    - altim_landocean_flag = 3 -> land

If altim_landocean_flag is not computed, it will take the value 127 (_FillValue attribute).

```
int alt_cog_ellip(time);
    alt_cog_ellip:long_name = "Altitude of CoG above reference ellipsoid" ;
    alt_cog_ellip:_FillValue = 2147483647 ;
    alt_cog_ellip:units = "m" ;
    alt_cog_ellip:add_offset = 1.30e+06;
    alt_cog_ellip:scale_factor = 0.001;
    alt_cog_ellip:coordinates = "lon lat" ;
```

- alt_cog_ellipis is packed. The data are stored in 32-bit (long) integers. The value of the altitude of the satellite can be recovered using:

alt_cog_ellips = (alt_cog_ellip(long) * scale_factor) + add_offset

5 Product Conventions

5.1 Selection of Range

The COASTALT product includes six different estimates of range for each of the two altimeter frequencies, these are:

hz18_[ku/s]_trk_cog	[Ku/S] tracker range referenced to the COG, no Doppler correction at 18 Hz
[ku/s]_band_ocean_range	[Ku/S]-band ocean range from the SGDR Ocean retracker at 1Hz
hz18_[ku/s]_band_ocean	[Ku/S]-band ocean ranges from the SGDR Ocean retracker at 18 Hz
brown_range_[ku/s]	[Ku/S]-band Range from the COASTALT Brown retracker at 18 Hz
spec_range_[ku/s]	[Ku/S]-band range from the COASTALT Specular retracker at 18 Hz
mixed_range_[ku/s]	[Ku/S]-band range from the COASTALT Mixed retracker at 18 Hz

The default range to use for open ocean is the Ku band ocean range from the COASTALT Brown retracker. The S-band values are not intended to be used in investigation of sea surface height, as they are of lower precision. The tracker range referenced to the COG is an onboard estimate, not intended for use in scientific investigations.
In coastal regions, users are encouraged to investigate data from the alternative COASTALT retrackers, which may prove more reliable close to the coast.

5.2 Correction Conventions

The geophysical corrections given in the COASTALT product already have the appropriate sign and are to be ***added*** to the range.

The corrections that should to be added to the measured range are usually as follows:

Geophysical Corrections = Ionospheric Correction + Dry Tropospheric Correction + Wet Tropospheric Correction + Inverse Barometer Correction + Sea State Bias Correction + Ocean Tide + Polar Tide + Earth Tide

The selection of *which* version of a particular correction is to be used is at the discretion of the user. When using a range from one of the retrackers, users should apply the ionospheric correction determined with those retrackers for consistency. It is recommended that the dual frequency ionospheric corrections are smoothed over 100 – 200 km to remove point-to-point noise in these values, as the correction should not vary rapidly over short wavelengths. An additional correction exists to account for the high frequency response of the ocean to atmospheric pressure changes. This correction should be used *in addition* to the inverse barometer correction.

All corrections provided at 1 Hz in the SGDR and included in the COASTALT products have been interpolated to 18 Hz values using simple linear interpolation for ease of use with 18 Hz range data.

NOTE: the availability of any correction or global attribute may depend on the version of the software used to generate the level 1B and level 2 source SGDR products. For more details, please see the COASTALT Product Handbook [RD 1].

The instrumental range correction has already been added to each of the range values – including those from the COASTALT retrackers. This correction is based on Doppler correction, time delay flight calibration and time delay ground calibration:

Instrumental Range Correction = Doppler correction + Time Delay Flight Correction + Time Delay Ground Correction

From cycles 46 to 85, an additional correction should be applied to account for errors in the USO (Ultra Stable Oscillator) clock timing. This may cause a boas of several metres in the range. This correction *has not* been applied to any of the provided ranges.

5.3 Time Convention

The convention for the COASTALT product is to use time (in seconds) referenced to Universal Time from a datum of 1st January 2000.

5.4 Flagging and Editing

The Level 1 B (L1B) processed data included in the SGDR product have:

- operating mode set to RA-2 nominal tracking
- waveform quality flags set to OK (= 0) meaning that the waveform samples are not set to 0

Over the ***open ocean***, users are advised to edit the data according to Table 5-1.

Table 5-1 Advised data editing criteria for open ocean.

Min. Value	Parameters	Max. Value	Unit (SI)
-2	SSH – mean sea surface height	2	m
10	Number of 18 Hz valid points for Ku-band	20	-
0	Range Standard deviation	0.25	m
-0.2	Off-Nadir angle square of the satellite from waveforms	0.16	deg^2
-2.5	Dry tropospheric correction	-1.9	m
-2	Inverse barometer correction	2	m
-0.5	Wet tropospheric correction	-0.001	m
-0.4	Ionospheric correction	-0.04	m
0	Significant wave height	11	m
-0.5	Sea State Bias	0	m
7	Backscatter coefficient	30	db
-5	Ocean tide correction	5	m

-0.5	Long period equilibrium	0.5	m
-1	Earth tide correction	1	m
-5	Polar tide correction	5	m
0	Wind speed	30	m/s
0	S-band anomaly flag	0	-

For the coastal data, it is expected that valid data will fall outside some of these editing criteria. As yet, there are no recommendations for suitable editing criteria for coastal regions and users are advised to relax the limits used.

5.5 Default Values

Any field of the output product that cannot be computed or determined during processing will be set to its default value. The COASTALT products follow the ESA recommendations for default values.

- For an MCD indicator (one bit of a bit field) the default value is "1", except for 'spare' bits which must be set to "0".
- For any other field, the default value is the maximal value of the corresponding field (e.g. 65535 for an unsigned 2-byte integer).

6 COASTALT product

A single COASTALT product file will consist of all records, each representing approximately 1 second of data, within a single pass (from pole to pole), restricted to those data lying within the coastal mask. The size of the resultant product will be dependent on the mask used and the specific geography under any particular pass.

6.1 Global Attributes

The Global Attributes are set at time of processing, or sourced from the ENVISAT Level 2 MPH & SPH

Attribute Name	**Format**	**Description**
Conventions	String	netCDF convention followed. This attribute should be set to **"CF-1.4"** to indicate that the file is compliant with the Climate and Forecast netCDF convention
title	String	COASTALT : ENVISAT Coastal Dataset
institution	String	Institution carrying out processing, e.g. NOCS
history	String	Creation: <date of creation>
source	String	Radar Altimeter RA-2
product	String	COASTALT Product Name: Following the ENVISAT product naming convention from level 2 source data file
Processing Information		
Product_ref	String	Reference documents for SGDR Product processing and handbook
Product_spec	String	Version of Product Specification doc applicable to product
Software_version	String	Version of L2 Software used to generate product
Product_revision	String	Version of COASTALT processor used to generate product
Proc_time	String	UTC time of SGDR product generation
Data time and orbit information		
Sensing_start	String	UTC start time of data sensing for this pass
Sensing_stop	String	UTC stop time of data sensing for this pass
Phase	String	Phase letter
Cycle	String	Cycle number
Relative_orbit	String	Relative orbit number
Absolute_orbit	String	Absolute orbit number
Pass_number	String	Pass number from pole to pole
State_vector_time	String	UTC time of ENVISAT state vector
Delta_ut1	String	DUT1=UT1-UTC (s)
X_position		X Position in Earth-fixed reference (m)
Y_position		Y Position in Earth-fixed reference (m)
Z_position		Z Position in Earth-fixed reference (m)
X_velocity		X velocity in Earth-fixed reference (m s^{-1})
Y_velocityn		Y velocity in Earth-fixed reference (m s^{-1})
Z_velocity		Z velocity in Earth-fixed reference (m s^{-1})
Vector_source	String	Source of orbit vectors
Envisat_source	String	Source ENVISAT Level 2 product SPH Descriptor (RA2_MWR_SGDR)
Envisat_source_ref	String	Reference documents for ENVISAT L2 product Source
RA2_first_record_time	String	UTC Time of first record in this product
RA2_last_record_time	String	UTC Time of first record in this product
RA2_first_lat	String	Geodetic Latitude of the first record in this product (degrees N)
RA2_first_lon	String	Geodetic Longitude of the first record in this product (degrees E)
RA2_last_lat	String	Geodetic Latitude of the last record in this product (degrees N)

RA2_last_lon	String	Geodetic Longitude of the last record in this product (degrees E)
SBT to UTC Conversion Information		
UTC_SBT_time	String	UTC corresponding to SBT (currently defined to be given at the time of the ascending node state vector
Sat_binary_time	String	Satellite binary time (SBT) 32 bit integer time of satellite clock
Clock_step	String	Clock step size (pico s)
Leap second information		
Leap_utc	String	UTC time of the occurrence of the leap second
Leap_sign	String	Leap second sign: +001 is positive, -001 if negative
Leap_err	String	Leap second error, 1 if leap second occurs within processing segment, 0 otherwise
Instrument Status Information		
RA2_flag_manoeuver	String	Orbit manoeuvre indicator
RA2_MANOEUVER_START_UTC	String	UTC of start of manoeuvre
RA2_MANOEUVER_STOP_UTC	String	UTC of end of manoeuvre
RA2_RV_RFSS_DEF	String	Hardware configuration for RF subsystem (A or B)
RA2_RV_HPA_DEF	String	Hardware configuration for HPA subsystem (A or B)
RA-2 Processing Information		
RA2_TIME_SHIFT_MIDFRAME	String	Offset to apply to time tag to derive datation of the first waveform in a source packet <10-6s>
RA2_TIME_INTERVAL	String	Time interval between two waveforms <10-6s>
RA2_IF_MASK_SEL	String	IF Mask selection flag
RA2_IF_MASK_PROC	String	IF shape compensation processing mode
RA2_USO_SEL	String	USO selection flag
RA2_USO_PROC	String	USO compensation processing mode
RA2_CONFIGURATION_DATA	String	RA-2 Level1B Configuration File
RA2_CHARACTERISATION_DATA	String	RA-2 Level1B Characterisation Data File
USO_CORRECTION_DATA	String	USO Correction Data File
AVERAGE_GLOBAL_PRESSURE	String	Average of the global pressure over the ocean computed from the meteo field, the closest time to the first measurement. This field must be set to all zeros. <10Pa>
SOLAR_ACTIVITY_INDEX	String	Interpolated value for the solar activity index used for the first measurement
Reference Model Information		
METEO_MODEL_VERSION	String	Version of the meteorological model
DORIS_IONOSPHERIC_MODEL_VERSION	String	Version of the ionospheric model
Coastal_mask_version	String	Name of coastal mask file applied

6.2 Dimensions

dimensions:
time
samples

6.3 Variables

//Coordinate and Auxiliary Coordinate Variables

double time(time) ;
time:long_name = "time in sec since 2000-01-01" ;
time:standard_name = "time" ;
time:units = "seconds since 2000-01-01 00:00:00" ;

time:comment = "Determined from mdsr_time" ;

short samples(samples) ;
samples:long_name = "Elementary 18Hz sample index" ;
samples:units = "1" ;
samples:comment = "Set to be compliant with the CF-1.4 convention" ;

double mdsr_time(time) ;
mdsr_time:long_name = "MDSR time stamp" ;
mdsr_time:standard_name = "time" ;
mdsr_time:units = "days since 2000-01-01 00:00:00" ;
mdsr_time:coordinates = "lon lat" ;
mdsr_time:source = "SGDR MDSR field 1" ;
mdsr_time:comment = "Refers to the centre of the averaged waveform. Expressed in Modified Julian Day (MJD), elapsed since 01/01/2000" ;

double hz18_time(time, samples) ;
hz18_time:long_name = "18Hz time" ;
hz18_time:standard_name = "time" ;
hz18_time:units = "seconds since 2000-01-01 00:00:00" ;
hz18_time:_FillValue = 9.96920996838687e+36 ;
hz18_time:coordinates = "hz18_lon hz18_lat" ;

hz18_time:comment = "Determined from 1Hz averaged time and 18Hz time differences from 1Hz time" ;

int lat(time) ;
lat:long_name = "Geodetic Latitude" ;
lat:standard_name = "latitude" ;
lat:units = "degrees_north" ;
lat:scale_factor = 1.e-06 ;
lat:_FillValue = 2147483647 ;
lat:source = "SGDR MDSR field 4" ;
lat:comment = "1Hz latitude value, defined as the latitude of the source packet centre (i.e. average of blocks 9 and 10). It is not corrected for surface slope and so represents the orbit track position" ;

int lon(time) ;
lon:long_name = "Longitude" ;
lon:standard_name = "longitude" ;
lon:units = "degrees_east" ;
lon:scale_factor = 1.e-06 ;
lon:_FillValue = 2147483647 ;
lon:source = "SGDR MDSR field 5" ;
lon:comment = "1Hz longitude value, defined as the longitude of the source packet centre (i.e. average of blocks 9 and 10). It is not corrected for surface slope and so represents the orbit track position" ;

int hz18_lat(time, samples) ;
hz18_lat:long_name = "18Hz latitude" ;
hz18_lat:standard_name = "latitude" ;

hz18_lat:units = "degrees_north" ;
hz18_lat:scale_factor = 1.e-06 ;
hz18_lat:_FillValue = 2147483647 ;
hz18_lat:source = "SGDR MDSR field 4 + MDSR field 63" ;
hz18_lat:comment = "Reconstructed by adding the 18Hz slope corrected latitude difference to the 1Hz latitude value" ;

int hz18_lon(time, samples) ;
hz18_lon:long_name = "18Hz longitude" ;
hz18_lon:standard_name = "longitude" ;
hz18_lon:units = "degrees_east" ;
hz18_lon:scale_factor = 1.e-06 ;
hz18_lon:_FillValue = 2147483647 ;
hz18_lon:source = "SGDR MDSR field 5 + MDSR field 64" ;
hz18_lon:comment = "Reconstructed by adding the 18Hz slope corrected longitude difference to the 1Hz longitude value" ;

short hz18_diff_1hz_lat(time, samples) ;
hz18_diff_1hz_lat:long_name = "18Hz slope-corrected latitude differences from 1Hz latitude" ;
hz18_diff_1hz_lat:units = "degrees_north" ;
hz18_diff_1hz_lat:scale_factor = 1.e-05 ;
hz18_diff_1hz_lat:_FillValue = 32767s ;
hz18_diff_1hz_lat:source = "SGDR MDSR field 63" ;
hz18_diff_1hz_lat:comment = "Difference between the 18Hz slope-corrected latitudes of the echoing point and the 1Hz latitude value. Input L1B latitude values are used to compute these differences in the event of non tracking records and where a slope correction is not available" ;

short hz18_diff_1hz_lon(time, samples) ;
hz18_diff_1hz_lon:long_name = "18Hz slope-corrected longitude differences from 1Hz longitude" ;
hz18_diff_1hz_lon:units = "degrees_east" ;
hz18_diff_1hz_lon:scale_factor = 1.e-05 ;
hz18_diff_1hz_lon:_FillValue = 32767s ;
hz18_diff_1hz_lon:source = "SGDR MDSR field 64" ;
hz18_diff_1hz_lon:comment = "Difference between the 18Hz slope-corrected longitudes of the echoing point and the 1Hz longitude value. Input L1B longitude values are used to compute these differences in the event of non tracking records and where a slope correction is not available" ;

short hz18_lat_diff(time, samples) ;
hz18_lat_diff:long_name = "18Hz latitude differences from 1Hz" ;
hz18_lat_diff:units = "degrees_north" ;
hz18_lat_diff:scale_factor = 1.e-05 ;
hz18_lat_diff:_FillValue = 32767s ;
hz18_lat_diff:source = "SGDR MDSR field 32" ;
hz18_lat_diff:comment = "No slope correction applied" ;

short hz18_lon_diff(time, samples) ;
hz18_lon_diff:long_name = "18Hz longitude differences from 1Hz" ;
hz18_lon_diff:units = "degrees_east" ;

hz18_lon_diff:scale_factor = 1.e-05 ;
hz18_lon_diff:_FillValue = 32767s ;
hz18_lon_diff:source = "SGDR MDSR field 32bis" ;
hz18_lon_diff:comment = "No slope correction applied" ;

int src_pack_cnt(time) ;
src_pack_cnt:long_name = "Source Packet Counter" ;
src_pack_cnt:units = "1" ;
src_pack_cnt:_FillValue = 2147483647 ;
src_pack_cnt:coordinates = "lon lat" ;
src_pack_cnt:source = "SGDR MDSR field 6" ;
src_pack_cnt:comment = "Unique identifier within orbit for the source waveform packet" ;

int crs ;
crs:grid_mapping_name = "latitude_longitude" ;
crs:semi_major_axis = 6378137. ;
crs:inverse_flattening = 298.2572236 ;
crs:long_name = "Reference Ellipsoid Definition" ;

//Confidence Flags

int inst_mode_id_flags(time) ;
inst_mode_id_flags:long_name = "Instrument Mode Identifier at source packet level" ;
inst_mode_id_flags:_FillValue = 127 ;
inst_mode_id_flags:flag_values = 16s, 32s, 33s, 34s, 48s, 65s, 67s;
inst_mode_id_flags:flag_meanings = "acquisition Tracking Preset_Tracking Preset_Loop_Output IF_Cal BITE_RF BITE_DGT " ;
inst_mode_id_flags:coordinates = "lon lat" ;
inst_mode_id_flags:source = "SGDR MDSR field 7" ;
inst_mode_id_flags:comment = "Bits from 23 to 0 set spare (= 0)" ;

int meas_conf_data_flags(time) ;
meas_conf_data_flags:long_name = "Measurement Confidence Data (MCD)" ;
meas_conf_data_flags:_FillValue = 2147483647 ;
meas_conf_data_flags:coordinates = "lon lat" ;
meas_conf_data_flags:comment = "See ENVISAT User Handbook Annex 1: Definition of Flags in the MCD Field for NRT and OFL products Table 12.1.3-2" ;

//Orbit Information

int alt_cog_ellip(time) ;
alt_cog_ellip:long_name = "Altitude of CoG above reference ellipsoid" ;
alt_cog_ellip:units = "m" ;
alt_cog_ellip:scale_factor = 0.001 ;
alt_cog_ellip:_FillValue = 2147483647 ;
alt_cog_ellip:coordinates = "lon lat" ;
alt_cog_ellip:ancillary_variables = "orbit_proc_flag" ;
alt_cog_ellip:grid_mapping = "crs" ;

alt_cog_ellip:source = "SGDR MSDR field 9" ;
alt_cog_ellip:comment = "Obtained by interpolating the Orbit State Vectors in the DORIS precise orbit files" ;

int hz18_alt_cog_ellip(time, samples) ;
hz18_alt_cog_ellip:long_name = "18Hz altitude of CoG above reference ellipsoid" ;
hz18_alt_cog_ellip:units = "m" ;
hz18_alt_cog_ellip:scale_factor = 0.001 ;
hz18_alt_cog_ellip:_FillValue = 2147483647 ;
hz18_alt_cog_ellip:coordinates = "hz18_lon hz18_lat" ;
hz18_alt_cog_ellip:grid_mapping = "crs" ;
hz18_alt_cog_ellip:source = "SGDR MSDR field 9 + SGDR MDSR field 10" ;
hz18_alt_cog_ellip:comment = "Obtained by summing alt_cog_ellip and 18Hz differences from alt_cog_ellip (extracted from the input L1B records) provided on SGDR" ;

short hz18_diff_1hz_alt(time, samples) ;
hz18_diff_1hz_alt:long_name = "18Hz altitude differences from 1Hz altitude" ;
hz18_diff_1hz_alt:units = "m" ;
hz18_diff_1hz_alt:scale_factor = 0.001 ;
hz18_diff_1hz_alt:_FillValue = 32767s ;
hz18_diff_1hz_alt:coordinates = "hz18_lon hz18_lat" ;
hz18_diff_1hz_alt:source = "SGDR MSDR field 10" ;
hz18_diff_1hz_alt:comment = "Computed from the elementary altitudes (extracted from the input L1B records) and the corresponding averaged altitude" ;

short instant_alt_rate(time) ;
instant_alt_rate:long_name = "Instantaneous altitude rate" ;
instant_alt_rate:units = "m/s" ;
instant_alt_rate:scale_factor = 0.001 ;
instant_alt_rate:_FillValue = 32767s ;
instant_alt_rate:coordinates = "lon lat" ;
instant_alt_rate:source = "SGDR MSDR field 11" ;
instant_alt_rate:comment = "Obtained by interpolating the Orbit State Vectors in the DORIS precise orbit files" ;

//Range Information

int hz18_ku_trk_cog(time, samples) ;
hz18_ku_trk_cog:long_name = "18Hz Ku tracker range referenced to the COG (no Doppler correction)" ;
hz18_ku_trk_cog:standard_name = "altimeter_range" ;
hz18_ku_trk_cog:units = "m" ;
hz18_ku_trk_cog:scale_factor = 0.001 ;
hz18_ku_trk_cog:_FillValue = 2147483647 ;
hz18_ku_trk_cog:coordinates = "hz18_lon hz18_lat" ;
hz18_ku_trk_cog:ancillary_variables = "map_18hz_ku_trk" ;
hz18_ku_trk_cog:source = "model-free tracker (Ku band), SGDR MDSR field 13" ;
hz18_ku_trk_cog:comment = "The Ku-band onboard rough estimates of the altimeter range produced by the model-free tracker, derived from the L1B Ku window delay values, corrected for the

distance between the satellite's CoG and the RA-2 antenna's phase centre, and adjusted for the Doppler effects. Default values are output if the corresponding elementary measurement is not Tracking, Preset Tracking or Preset Loop Output, if the input Ku and S waveform samples are all set to 0, or if the AGC_Ku or Ku Rx delay value is out of bounds" ;

int hz18_s_trk_cog(time, samples) ;
hz18_s_trk_cog:long_name = "18Hz S tracker range referenced to the COG (no Doppler correction)" ;
hz18_s_trk_cog:standard_name = "altimeter_range" ;
hz18_s_trk_cog:units = "m" ;
hz18_s_trk_cog:scale_factor = 0.001 ;
hz18_s_trk_cog:_FillValue = 2147483647 ;
hz18_s_trk_cog:coordinates = "hz18_lon hz18_lat" ;
hz18_s_trk_cog:source = "model-free tracker (S band), SGDR MDSR field 14" ;
hz18_s_trk_cog:comment = "The S-band onboard rough estimates of the altimeter range produced by the model-free tracker, derived from the L1B S window delay values, corrected for the distance between the satellite's CoG and the RA-2 antenna's phase centre, and adjusted for the Doppler effects. Default values are output if the corresponding elementary measurement is not Tracking, Preset Tracking or Preset Loop Output, if the input Ku and S waveform samples are all set to 0, or if the AGC_Ku or Ku Rx delay value is out of bounds" ;

short map_18hz_ku_trk(time, samples) ;
map_18hz_ku_trk:long_name = "Map of valid points for 18Hz Ku-band tracker range" ;
map_18hz_ku_trk:_FillValue = 127b ;
map_18hz_ku_trk:flag_values = 0b, 1b ;
map_18hz_ku_trk:flag_meanings = "valid invalid" ;
map_18hz_ku_trk:coordinates = "hz18_lon hz18_lat" ;
map_18hz_ku_trk:source = "SGDR MDSR field 15" ;

int ku_band_ocean_range(time) ;
ku_band_ocean_range:long_name = "Ku-band ocean range" ;
ku_band_ocean_range:standard_name = "altimeter_range" ;
ku_band_ocean_range:units = "m" ;
ku_band_ocean_range:scale_factor = 0.001 ;
ku_band_ocean_range:_FillValue = 2147483647 ;
ku_band_ocean_range:coordinates = "lon lat" ;
ku_band_ocean_range:ancillary_variables = "hz18_ku_band_ocean sd_18hz_ku_ocean num_18hz_ku_ocean" ;
ku_band_ocean_range:source = "Ocean re-tracker (Ku band). SGDR MDSR field 17" ;
ku_band_ocean_range:comment = "1Hz estimate from the 18Hz Ku-band ocean ranges" ;

int s_band_ocean_range(time) ;
s_band_ocean_range:long_name = "S-band ocean range" ;
s_band_ocean_range:standard_name = "altimeter_range" ;
s_band_ocean_range:units = "m" ;
s_band_ocean_range:scale_factor = 0.001 ;
s_band_ocean_range:_FillValue = 2147483647 ;
s_band_ocean_range:coordinates = "lon lat" ;
s_band_ocean_range:ancillary_variables = "hz18_s_band_ocean sd_18hz_s_ocean num_18hz_s_ocean" ;

s_band_ocean_range:source = "Ocean re-tracker (S band). SGDR MDSR field 18" ;
s_band_ocean_range:comment = "1Hz estimate from the 18Hz S-band ocean ranges" ;

int hz18_ku_band_ocean(time, samples) ;
hz18_ku_band_ocean:long_name = "18Hz Ku-band ocean ranges" ;
hz18_ku_band_ocean:standard_name = "altimeter_range" ;
hz18_ku_band_ocean:units = "m" ;
hz18_ku_band_ocean:scale_factor = 0.001 ;
hz18_ku_band_ocean:_FillValue = 2147483647 ;
hz18_ku_band_ocean:coordinates = "hz18_lon hz18_lat" ;
hz18_ku_band_ocean:ancillary_variables = "map_18hz_ku_ocean hz18_ku_instr_corr" ;
hz18_ku_band_ocean:source = "Ocean re-tracker (Ku band). SGDR MDSR field 19" ;
hz18_ku_band_ocean:comment = "From an ocean retracking algorithm applied to the 18Hz Ku-band waveform" ;

int hz18_s_band_ocean(time, samples) ;
hz18_s_band_ocean:long_name = "18Hz S-band ocean ranges" ;
hz18_s_band_ocean:standard_name = "altimeter_range" ;
hz18_s_band_ocean:units = "m" ;
hz18_s_band_ocean:scale_factor = 0.001 ;
hz18_s_band_ocean:_FillValue = 2147483647 ;
hz18_s_band_ocean:coordinates = "hz18_lon hz18_lat" ;
hz18_s_band_ocean:ancillary_variables = "map_18hz_s_ocean hz18_s_instr_corr" ;
hz18_s_band_ocean:source = "Ocean re-tracker (S band). SGDR MDSR field 20" ;
hz18_s_band_ocean:comment = "From an ocean retracking algorithm applied to the 18Hz S-band waveform" ;

short sd_18hz_ku_ocean(time) ;
sd_18hz_ku_ocean:long_name = "Standard deviation of 18Hz Ku-band ocean range" ;
sd_18hz_ku_ocean:units = "m" ;
sd_18hz_ku_ocean:scale_factor = 0.001 ;
sd_18hz_ku_ocean:_FillValue = -1s ;
sd_18hz_ku_ocean:coordinates = "lon lat" ;
sd_18hz_ku_ocean:ancillary_variables = "hz18_ku_band_ocean num_18hz_ku_ocean" ;
sd_18hz_ku_ocean:source = "SGDR MDSR field 21" ;
sd_18hz_ku_ocean:comment = "The default value is output whenever the Number of 18Hz valid points for Ku-band ocean range values is less than a minimum threshold (currently set to 6)" ;

short sd_18hz_s_ocean(time) ;
sd_18hz_s_ocean:long_name = "Standard deviation of 18Hz S-band ocean range" ;
sd_18hz_s_ocean:units = "m" ;
sd_18hz_s_ocean:scale_factor = 0.001 ;
sd_18hz_s_ocean:_FillValue = -1s ;
sd_18hz_s_ocean:coordinates = "lon lat" ;
sd_18hz_s_ocean:ancillary_variables = "hz18_s_band_ocean num_18hz_s_ocean" ;
sd_18hz_s_ocean:source = "SGDR MDSR field 22" ;
sd_18hz_s_ocean:comment = "The default value is output whenever the Number of 18Hz valid points for S-band ocean range values is less than a minimum threshold (currently set to 6)" ;

short num_18hz_ku_ocean(time) ;

num_18hz_ku_ocean:long_name = "Number of 18Hz valid points for Ku-band ocean range" ;
num_18hz_ku_ocean:_FillValue = 32767s ;
num_18hz_ku_ocean:coordinates = "lon lat" ;
num_18hz_ku_ocean:ancillary_variables = "map_18hz_ku_ocean" ;
num_18hz_ku_ocean:source = "SGDR MDSR field 23" ;
num_18hz_ku_ocean:comment = "Number of elementary measurements effectively used for calculating the averaged Ku-band ocean range value and standard deviation" ;

short num_18hz_s_ocean(time) ;
num_18hz_s_ocean:long_name = "Number of 18Hz valid points for S-band ocean range" ;
num_18hz_s_ocean:_FillValue = 32767s ;
num_18hz_s_ocean:coordinates = "lon lat" ;
num_18hz_s_ocean:ancillary_variables = "map_18hz_s_ocean" ;
num_18hz_s_ocean:source = "SGDR MDSR field 24" ;
num_18hz_s_ocean:comment = "Number of elementary measurements effectively used for calculating the averaged S-band ocean range value and standard deviation" ;

short map_18hz_ku_ocean_flags(time, samples) ;
map_18hz_ku_ocean_flags:long_name = "Map of 18Hz valid points for Ku-band ocean range" ;
map_18hz_ku_ocean_flags:_FillValue = 127b ;
map_18hz_ku_ocean_flags:flag_values = 0b, 1b ;
map_18hz_ku_ocean_flags:flag_meanings = "valid invalid" ;
map_18hz_ku_ocean_flags:coordinates = "hz18_lon hz18_lat" ;
map_18hz_ku_ocean_flags:source = "SGDR MDSR field 25" ;

short map_18hz_s_ocean_flags(time, samples) ;
map_18hz_s_ocean_flags:long_name = "Map of 18Hz valid points for S-band ocean range" ;
map_18hz_s_ocean_flags:_FillValue = 127b ;
map_18hz_s_ocean_flags:flag_values = 0b, 1b ;
map_18hz_s_ocean_flags:flag_meanings = "valid invalid" ;
map_18hz_s_ocean_flags:coordinates = "hz18_lon hz18_lat" ;
map_18hz_s_ocean_flags:source = "SGDR MDSR field 26" ;

//Range Correction Information

short hz18_ku_instr_corr(time, samples) ;
hz18_ku_instr_corr:long_name = "18Hz Ku-band range instrumental correction" ;
hz18_ku_instr_corr:units = "m" ;
hz18_ku_instr_corr:scale_factor = 0.001 ;
hz18_ku_instr_corr:_FillValue = 32767s ;
hz18_ku_instr_corr:coordinates = "hz18_lon hz18_lat" ;
hz18_ku_instr_corr:ancillary_variables = "hz18_ku_dopp_corr" ;
hz18_ku_instr_corr:source = "SGDR MDSR field 33" ;
hz18_ku_instr_corr:comment = "hz18_ku_instr_corr = hz18_ku_dopp_corr + TD_Flight_Cal +TD_Ground_Cal, where hz18_ku_dopp_corr is the Doppler correction, TD_flight_Cal is the time delay flight calibration and TD_Ground_Cal is the time delay ground calibration" ;

short hz18_s_instr_corr(time, samples) ;

hz18_s_instr_corr:long_name = "18Hz S-band range instrumental correction" ;
hz18_s_instr_corr:units = "m" ;
hz18_s_instr_corr:scale_factor = 0.001 ;
hz18_s_instr_corr:_FillValue = 32767s ;
hz18_s_instr_corr:coordinates = "hz18_lon hz18_lat" ;
hz18_s_instr_corr:ancillary_variables = "hz18_s_dopp_corr" ;
hz18_s_instr_corr:source = "SGDR MDSR field 34" ;
hz18_s_instr_corr:comment = "hz18_s_instr_corr = hz18_s_dopp_corr + TD_Flight_Cal +TD_Ground_Cal, where hz18_s_dopp_corr is the Doppler correction, TD_flight_Cal is the time delay flight calibration and TD_Ground_Cal is the time delay ground calibration" ;

short hz18_ku_dopp_corr(time, samples) ;
hz18_ku_dopp_corr:long_name = "18Hz Ku-band Doppler correction" ;
hz18_ku_dopp_corr:units = "m" ;
hz18_ku_dopp_corr:scale_factor = 0.001 ;
hz18_ku_dopp_corr:_FillValue = 32767s ;
hz18_ku_dopp_corr:coordinates = "hz18_lon hz18_lat" ;
hz18_ku_dopp_corr:source = "SGDR MDSR field 35" ;
hz18_ku_dopp_corr:comment = "Computed from the 18Hz orbital altitude rates with respect to the reference ellipsoid" ;

short hz18_s_dopp_corr(time, samples) ;
hz18_s_dopp_corr:long_name = "18Hz S-band Doppler correction" ;
hz18_s_dopp_corr:units = "m" ;
hz18_s_dopp_corr:scale_factor = 0.001 ;
hz18_s_dopp_corr:_FillValue = 32767s ;
hz18_s_dopp_corr:coordinates = "hz18_lon hz18_lat" ;
hz18_s_dopp_corr:source = "SGDR MDSR field 36" ;
hz18_s_dopp_corr:comment = "Computed from the 18Hz orbital altitude rates with respect to the reference ellipsoid" ;

short hz18_ku_dopp_slp_corr(time, samples) ;
hz18_ku_dopp_slp_corr:long_name = "18Hz Ku-band Delta Doppler Slope correction" ;
hz18_ku_dopp_slp_corr:units = "m" ;
hz18_ku_dopp_slp_corr:scale_factor = 0.001 ;
hz18_ku_dopp_slp_corr:_FillValue = 32767s ;
hz18_ku_dopp_slp_corr:coordinates = "hz18_lon hz18_lat" ;
hz18_ku_dopp_slp_corr:source = "SGDR MDSR field 37" ;
hz18_ku_dopp_slp_corr:comment = "Calculated for a sloping surface by subtracting the flat surface Doppler correction from the general slope corrected Doppler. The default value is output if the elementary measurement is not Tracking/Preset Loop Output, if there is a data gap between adjacent orbit values, if the next record is invalid, or if this is the last record of a file" ;

short hz18_s_dopp_slp_corr(time, samples) ;
hz18_s_dopp_slp_corr:long_name = "18Hz S-band Delta Doppler Slope correction" ;
hz18_s_dopp_slp_corr:units = "m" ;
hz18_s_dopp_slp_corr:scale_factor = 0.001 ;
hz18_s_dopp_slp_corr:_FillValue = 32767s ;
hz18_s_dopp_slp_corr:coordinates = "hz18_lon hz18_lat" ;
hz18_s_dopp_slp_corr:source = "SGDR MDSR field 38" ;

hz18_s_dopp_slp_corr:comment = "Calculated for a sloping surface by subtracting the flat surface Doppler correction from the general slope corrected Doppler. The default value is output if the elementary measurement is not Tracking/Preset Loop Output, if there is a data gap between adjacent orbit values, if the next record is invalid, or if this is the last record of a file" ;

short mod_dry_tropo_corr(time) ;
mod_dry_tropo_corr:long_name = "Model dry tropospheric correction" ;
mod_dry_tropo_corr:standard_name = "altimeter_range_correction_due_to_dry_troposphere" ;
mod_dry_tropo_corr:units = "m" ;
mod_dry_tropo_corr:scale_factor = 0.001 ;
mod_dry_tropo_corr:_FillValue = 32767s ;
mod_dry_tropo_corr:coordinates = "lon lat" ;
mod_dry_tropo_corr:source = "ECMWF model. SGDR MDSR field 39" ;
mod_dry_tropo_corr:comment = "From the computational grid (Gaussian grid - quasi regular in latitude, irregular in longitude) of the ECMWF model run. The dry tropospheric correction is computed by the French met office from the ECMWF temperature profiles. The SWT 2004 recommendation was to use the new FES2004 tide model, which already includes the S1 and S2 waves. The dry tropospheric correction is derived from the surface pressure filtered and corrected from the S1 and S2 waves and from a climatological value" ;

short inv_barom_corr(time) ;
inv_barom_corr:long_name = "Inverted barometer correction" ;
inv_barom_corr:standard_name = "sea_surface_height_correction_due_to_air_pressure_at_low_frequency" ;
inv_barom_corr:units = "m" ;
inv_barom_corr:scale_factor = 0.001 ;
inv_barom_corr:_FillValue = 32767s ;
inv_barom_corr:coordinates = "lon lat" ;
inv_barom_corr:source = "SGDR MDSR field 40" ;
inv_barom_corr:comment = "Computed as inv_barom_corr = - b [Psurf - Pbar]/1000, where b = 9.948 mm/hPa, Psurf is the surface atmospheric pressure at the location and time of the altimeter measurement, and Pbar is the mean atmospheric pressure over the global ocean. Psurf is corrected first from a climatological value and then corrected for S1 and S2 (diurnal and semi-diurnal) atmospheric tides (see ENVISAT Product Handbook for more details)" ;

short mod_wet_tropo_corr(time) ;
mod_wet_tropo_corr:long_name = "Model wet tropospheric correction" ;
mod_wet_tropo_corr:standard_name = "altimeter_range_correction_due_to_wet_troposphere" ;
mod_wet_tropo_corr:units = "m" ;
mod_wet_tropo_corr:scale_factor = 0.001 ;
mod_wet_tropo_corr:_FillValue = 32767s ;
mod_wet_tropo_corr:coordinates = "lon lat" ;
mod_wet_tropo_corr:source = "ECMWF model. SGDR MDSR field 41" ;
mod_wet_tropo_corr:comment = "From the computational grid (Gaussian grid - quasi regular in latitude, irregular in longitude) of the ECMWF model run. The wet tropospheric correction is computed by the French met office from the ECMWF humidity and temperature profiles" ;

short mwr_wet_tropo_corr(time) ;

mwr_wet_tropo_corr:long_name = "MWR derived wet tropospheric correction" ;
mwr_wet_tropo_corr:standard_name = "altimeter_range_correction_due_to_wet_troposphere" ;
mwr_wet_tropo_corr:units = "m" ;
mwr_wet_tropo_corr:scale_factor = 0.001 ;
mwr_wet_tropo_corr:_FillValue = 32767s ;
mwr_wet_tropo_corr:coordinates = "lon lat" ;
mwr_wet_tropo_corr:source = "Microwave Radiometer. SGDR MDSR field 42" ;
mwr_wet_tropo_corr:comment = "Obtained with a neural algorithm from the 23.8 GHz and 36.5 GHz brightness temperatures (in K) interpolated to RA-2 time tag, and the ocean backscatter coefficient for Ku-band (dB), not corrected for atmospheric attenuation" ;

short ra2_ion_corr_ku(time) ;
ra2_ion_corr_ku:long_name = "RA2 Ionospheric correction on Ku-band" ;
ra2_ion_corr_ku:standard_name = "altimeter_range_correction_due_to_ionosphere" ;
ra2_ion_corr_ku:units = "m" ;
ra2_ion_corr_ku:scale_factor = 0.001 ;
ra2_ion_corr_ku:_FillValue = 32767s ;
ra2_ion_corr_ku:coordinates = "lon lat" ;
ra2_ion_corr_ku:source = "Altimeter range. SGDR MDSR field 43" ;
ra2_ion_corr_ku:comment = "The Ku-band and S-band sea state bias corrections are first added to the Ku-band and S-band altimeter ranges to give R_Ku and R_S, ra2_ion_corr_ku = dfKu * (R_Ku - R_S)/1000, given dfKu = f_S^2 / [f_Ku^2 - f_S^2], where f_Ku, f_S are the transmitted frequencies (in Hz)" ;

short ra2_ion_corr_s(time) ;
ra2_ion_corr_s:long_name = "RA2 Ionospheric correction on S-band" ;
ra2_ion_corr_s:standard_name = "altimeter_range_correction_due_to_ionosphere" ;
ra2_ion_corr_s:units = "m" ;
ra2_ion_corr_s:scale_factor = 0.001 ;
ra2_ion_corr_s:_FillValue = 32767s ;
ra2_ion_corr_s:coordinates = "lon lat" ;
ra2_ion_corr_s:source = "Altimeter range. SGDR MDSR field 44" ;
ra2_ion_corr_s:comment = "The Ku-band and S-band sea state bias corrections are first added to the Ku-band and S-band altimeter ranges to give R_Ku and R_S, ra2_ion_corr_s = dfS * (R_Ku - R_S), given dfS = f_Ku^2 / [f_Ku^2 - f_S^2] where f_Ku, f_S are the transmitted frequencies (in Hz)" ;

short ion_corr_doris_ku(time) ;
ion_corr_doris_ku:long_name = "Ionospheric correction from DORIS on Ku-band" ;
ion_corr_doris_ku:standard_name = "altimeter_range_correction_due_to_ionosphere" ;
ion_corr_doris_ku:units = "m" ;
ion_corr_doris_ku:scale_factor = 0.001 ;
ion_corr_doris_ku:_FillValue = 32767s ;
ion_corr_doris_ku:coordinates = "lon lat" ;
ion_corr_doris_ku:source = "DORIS TEC maps. SGDR MDSR field 45" ;
ion_corr_doris_ku:comment = "Obtained from the DORIS daily maps of Total Electron Content" ;

short ion_corr_doris_s(time) ;

ion_corr_doris_s:long_name = "Ionospheric correction from DORIS on S-band" ;
ion_corr_doris_s:standard_name = "altimeter_range_correction_due_to_ionosphere" ;
ion_corr_doris_s:units = "m" ;
ion_corr_doris_s:scale_factor = 0.001 ;
ion_corr_doris_s:_FillValue = 32767s ;
ion_corr_doris_s:coordinates = "lon lat" ;
ion_corr_doris_s:source = "DORIS TEC maps. SGDR MDSR field 46" ;
ion_corr_doris_s:comment = "Obtained from the DORIS daily maps of Total Electron Content" ;

short ion_corr_mod_ku(time) ;
ion_corr_mod_ku:long_name = "Ionospheric correction from model on Ku-band" ;
ion_corr_mod_ku:standard_name = "altimeter_range_correction_due_to_ionosphere" ;
ion_corr_mod_ku:units = "m" ;
ion_corr_mod_ku:scale_factor = 0.001 ;
ion_corr_mod_ku:_FillValue = 32767s ;
ion_corr_mod_ku:coordinates = "lon lat" ;
ion_corr_mod_ku:source = "GIM model. SGDR MDSR field 47" ;
ion_corr_mod_ku:comment = "Obtained from the GIM model for products processed with CMA v7.1 or higher (see ENVISAT Product Handbook for more details)" ;

short ion_corr_mod_s(time) ;
ion_corr_mod_s:long_name = "Ionospheric correction from model on S-band" ;
ion_corr_mod_s:standard_name = "altimeter_range_correction_due_to_ionosphere" ;
ion_corr_mod_s:units = "m" ;
ion_corr_mod_s:scale_factor = 0.001 ;
ion_corr_mod_s:_FillValue = 32767s ;
ion_corr_mod_s:coordinates = "lon lat" ;
ion_corr_mod_s:source = "GIM model. SGDR MDSR field 48" ;
ion_corr_mod_s:comment = "Obtained from the GIM model for products processed with CMA v7.1 or higher (see ENVISAT Product Handbook for more details)" ;

short sea_bias_ku(time) ;
sea_bias_ku:long_name = "Sea state bias correction on Ku-band" ;
sea_bias_ku:units = "m" ;
sea_bias_ku:scale_factor = 0.001 ;
sea_bias_ku:_FillValue = 32767s ;
sea_bias_ku:coordinates = "lon lat" ;
sea_bias_ku:source = "SGDR MDSR field 49" ;
sea_bias_ku:comment = "Computed by bilinear interpolation from a table given as function of Ku-band's significant wave height and the RA-2 wind speed, derived from one year of EnviSat data (cycles 25 to 35), using crossover SSH differences and applying the non parametric estimation technique" ;

short sea_bias_s(time) ;
sea_bias_s:long_name = "Sea state bias correction on S-band" ;
sea_bias_s:units = "m" ;
sea_bias_s:scale_factor = 0.001 ;
sea_bias_s:_FillValue = 32767s ;
sea_bias_s:coordinates = "lon lat" ;

sea_bias_s:source = "SGDR MDSR field 50" ;
sea_bias_s:comment = "Computed by bilinear interpolation from a table given as function of Ku-band's significant wave height and the RA-2 wind speed, derived from one year of EnviSat data (cycles 25 to 35), using crossover SSH differences and applying the non parametric estimation technique" ;

short dib_hf(time) ;
dib_hf:long_name = "MOG2D HF contribution" ;
dib_hf:standard_name = "sea_surface_height_correction_due_to_air_pressure_and_wind_at_high_frequency" ;
dib_hf:units = "m" ;
dib_hf:scale_factor = 0.001 ;
dib_hf:_FillValue = 32767s ;
dib_hf:coordinates = "lon lat" ;
dib_hf:source = "SGDR MDSR field 51" ;
dib_hf:comment = "Difference between the MOG2D estimate and the inverse barometer, where MOG2D is the sum of the high frequency variability of the sea surface height and the low frequency component of the inverse parameter" ;

//Significant Wave Height Information

short ku_sig_wv_ht(time) ;
ku_sig_wv_ht:long_name = "Ku-band Significant wave height" ;
ku_sig_wv_ht:standard_name = "sea_surface_wave_significant_height" ;
ku_sig_wv_ht:units = "m" ;
ku_sig_wv_ht:scale_factor = 0.001 ;
ku_sig_wv_ht:_FillValue = 32767s ;
ku_sig_wv_ht:coordinates = "lon lat" ;
ku_sig_wv_ht:ancillary_variables = "square_ku_sig_wv_ht sd_18hz_ku_swh num_18hz_ku_ocean_swh" ;
ku_sig_wv_ht:source = "SGDR MDSR field 54" ;
ku_sig_wv_ht:comment = "The 1Hz estimate from the 18Hz output ocean retracking estimates" ;

short s_sig_wv_ht(time) ;
s_sig_wv_ht:long_name = "S-band Significant wave height" ;
s_sig_wv_ht:standard_name = "sea_surface_wave_significant_height" ;
s_sig_wv_ht:units = "m" ;
s_sig_wv_ht:scale_factor = 0.001 ;
s_sig_wv_ht:_FillValue = 32767s ;
s_sig_wv_ht:coordinates = "lon lat" ;
s_sig_wv_ht:ancillary_variables = "square_s_sig_wv_ht sd_18hz_s_swh num_18hz_s_ocean_swh" ;
s_sig_wv_ht:source = "SGDR MDSR field 55" ;
s_sig_wv_ht:comment = "The 1Hz estimate from the 18Hz output ocean retracking estimates" ;

int square_ku_sig_wv_ht(time) ;
square_ku_sig_wv_ht:long_name = "Square of Ku-band significant wave height" ;

square_ku_sig_wv_ht:units = "m^2" ;
square_ku_sig_wv_ht:scale_factor = 0.001 ;
square_ku_sig_wv_ht:_FillValue = 2147483647 ;
square_ku_sig_wv_ht:coordinates = "lon lat" ;
square_ku_sig_wv_ht:source = "SGDR MDSR field 52" ;
square_ku_sig_wv_ht:comment = "May be negative when the Sigmac parameter (estimated by the ocean retracking) is smaller than the response width of the target point, due to speckle" ;

int square_s_sig_wv_ht(time) ;
square_s_sig_wv_ht:long_name = "Square of S-band significant wave height" ;
square_s_sig_wv_ht:units = "m^2" ;
square_s_sig_wv_ht:scale_factor = 0.001 ;
square_s_sig_wv_ht:_FillValue = 2147483647 ;
square_s_sig_wv_ht:coordinates = "lon lat" ;
square_s_sig_wv_ht:source = "SGDR MDSR field 53" ;
square_s_sig_wv_ht:comment = "May be negative when the Sigmac parameter (estimated by the ocean retracking) is smaller than the response width of the target point, due to speckle" ;

short sd_18hz_ku_swh(time) ;
sd_18hz_ku_swh:long_name = "Standard deviation of 18Hz Ku-band significant wave height" ;
sd_18hz_ku_swh:units = "m" ;
sd_18hz_ku_swh:scale_factor = 0.001 ;
sd_18hz_ku_swh:_FillValue = 32767s ;
sd_18hz_ku_swh:coordinates = "lon lat" ;
sd_18hz_ku_swh:ancillary_variables = "num_18hz_ku_ocean_swh" ;
sd_18hz_ku_swh:source = "SGDR MDSR field 56" ;
sd_18hz_ku_swh:comment = "The default value is output whenever the number of valid elementary Ku ocean SWH values used for the averaging is less than a minimum threshold (currently set to 6)" ;

short sd_18hz_s_swh(time) ;
sd_18hz_s_swh:long_name = "Standard deviation of 18Hz S-band significant wave height" ;
sd_18hz_s_swh:units = "m" ;
sd_18hz_s_swh:scale_factor = 0.001 ;
sd_18hz_s_swh:_FillValue = 32767s ;
sd_18hz_s_swh:coordinates = "lon lat" ;
sd_18hz_s_swh:ancillary_variables = "num_18hz_s_ocean_swh" ;
sd_18hz_s_swh:source = "SGDR MDSR field 57" ;
sd_18hz_s_swh:comment = "The default value is output whenever the number of valid elementary S ocean SWH values used for the averaging is less than a minimum threshold (currently set to 6)" ;

short num_18hz_ku_ocean_swh(time) ;
num_18hz_ku_ocean_swh:long_name = "Number of 18Hz valid points for Ku-band ocean SWH" ;
num_18hz_ku_ocean_swh:_FillValue = 32767s ;
num_18hz_ku_ocean_swh:coordinates = "lon lat" ;
num_18hz_ku_ocean_swh:source = "SGDR MDSR field 58" ;

num_18hz_ku_ocean_swh:comment = "The number of elementary measurements effectively used to calculate the averaged ocean SWH value and standard deviation" ;

short num_18hz_s_ocean_swh(time) ;

num_18hz_s_ocean_swh:long_name = "Number of 18Hz valid points for S-band ocean SWH" ;
num_18hz_s_ocean_swh:_FillValue = 32767s ;
num_18hz_s_ocean_swh:coordinates = "lon lat" ;
num_18hz_s_ocean_swh:source = "SGDR MDSR field 59" ;
num_18hz_s_ocean_swh:comment = "The number of elementary measurements effectively used to calculate the averaged ocean SWH value and standard deviation" ;

short slp_mod_flags(time, samples) ;

slp_mod_flags:long_name = "Slope model present flags" ;
slp_mod_flags:_FillValue = 127b ;
slp_mod_flags:flag_values = 0b, 1b ;
slp_mod_flags:flag_meanings = "valid invalid" ;
slp_mod_flags:coordinates = "hz18_lon hz18_lat" ;
slp_mod_flags:source = "SGDR MDSR field 60" ;
slp_mod_flags:comment = "invalid i.e. input data block not in Tracking, Preset Loop Output, or if the position of the input record is not within the models, currently only existing for Greenland and Antarctica" ;

int elev_echo_pt(time) ;

elev_echo_pt:long_name = "1Hz Elevation of echoing point" ;
elev_echo_pt:units = "m" ;
elev_echo_pt:scale_factor = 0.01 ;
elev_echo_pt:_FillValue = 2147483647 ;
elev_echo_pt:coordinates = "lon lat" ;
elev_echo_pt:source = "SGDR MDSR field 61" ;
elev_echo_pt:comment = "Mean slope-corrected elevation of the echoing points in the geodetic coordinate frame. The 1Hz value is obtained by averaging only valid elevation measurements (i.e. tracking records for which the Ice-1 leading edge was inside bounds). Where a slope correction is invalid, the elevation value used relates to the elevation at the orbit nadir position corrected for tracker range offset" ;

short hz18_diff_mean_ech_pt(time, samples) ;

hz18_diff_mean_ech_pt:long_name = "18Hz Elevation differences of echoing point from mean" ;
hz18_diff_mean_ech_pt:units = "m" ;
hz18_diff_mean_ech_pt:scale_factor = 0.01 ;
hz18_diff_mean_ech_pt:_FillValue = 32767s ;
hz18_diff_mean_ech_pt:coordinates = "hz18_lon hz18_lat" ;
hz18_diff_mean_ech_pt:source = "SGDR MDSR field 62" ;
hz18_diff_mean_ech_pt:comment = "Computed by subtracting the mean elevation from the elementary elevation values. Default values (set to 0) are output for non tracking records or for records where the Ice-1 leading edge is out of bounds" ;

//Backscatter Information

short ku_ocean_bscat_coeff(time) ;

ku_ocean_bscat_coeff:long_name = "Ku-band corrected ocean backscatter coefficient" ;
ku_ocean_bscat_coeff:units = "dB" ;
ku_ocean_bscat_coeff:scale_factor = 0.01 ;
ku_ocean_bscat_coeff:_FillValue = 32767s ;
ku_ocean_bscat_coeff:coordinates = "lon lat" ;
ku_ocean_bscat_coeff:ancillary_variables = "sd_18hz_ku_ocean_bscat num_18hz_ku_ocean_bscat ku_atm_atten_corr ku_rai_corr" ;
ku_ocean_bscat_coeff:source = "SGDR MDSR field 72" ;
ku_ocean_bscat_coeff:comment = "The 1Hz estimate from the 18Hz output ocean retracking estimates" ;

short s_ocean_bscat_coeff(time) ;

s_ocean_bscat_coeff:long_name = "S-band corrected ocean backscatter coefficient" ;
s_ocean_bscat_coeff:units = "dB" ;
s_ocean_bscat_coeff:scale_factor = 0.01 ;
s_ocean_bscat_coeff:_FillValue = 32767s ;
s_ocean_bscat_coeff:coordinates = "lon lat" ;
s_ocean_bscat_coeff:ancillary_variables = "sd_18hz_s_ocean_bscat num_18hz_s_ocean_bscat s_atm_atten_corr" ;
s_ocean_bscat_coeff:source = "SGDR MDSR field 73" ;
s_ocean_bscat_coeff:comment = "The 1Hz estimate from the 18Hz output ocean retracking estimates" ;

short sd_18hz_ku_ocean_bscat(time) ;

sd_18hz_ku_ocean_bscat:long_name = "Standard deviation of 18Hz Ku-band ocean backscatter coefficient" ;
sd_18hz_ku_ocean_bscat:units = "dB" ;
sd_18hz_ku_ocean_bscat:scale_factor = 0.01 ;
sd_18hz_ku_ocean_bscat:_FillValue = 32767s ;
sd_18hz_ku_ocean_bscat:coordinates = "lon lat" ;
sd_18hz_ku_ocean_bscat:ancillary_variables = "num_18hz_ku_ocean_bscat" ;
sd_18hz_ku_ocean_bscat:source = "SGDR MDSR field 74" ;
sd_18hz_ku_ocean_bscat:comment = "The 1Hz estimate from the 18Hz output ocean retracking estimates" ;

short sd_18hz_s_ocean_bscat(time) ;

sd_18hz_s_ocean_bscat:long_name = "Standard deviation of 18Hz S-band ocean backscatter coefficient" ;
sd_18hz_s_ocean_bscat:units = "dB" ;
sd_18hz_s_ocean_bscat:scale_factor = 0.01 ;
sd_18hz_s_ocean_bscat:_FillValue = 32767s ;
sd_18hz_s_ocean_bscat:coordinates = "lon lat" ;
sd_18hz_s_ocean_bscat:ancillary_variables = "num_18hz_ku_ocean_bscat" ;
sd_18hz_s_ocean_bscat:source = "SGDR MDSR field 75" ;
sd_18hz_s_ocean_bscat:comment = "The 1Hz estimate from the 18Hz output ocean retracking estimates" ;

short num_18hz_ku_ocean_bscat(time) ;

num_18hz_ku_ocean_bscat:long_name = "Number of 18Hz valid points for Ku-band ocean backscatter coefficient" ;
num_18hz_ku_ocean_bscat:_FillValue = 32767s ;
num_18hz_ku_ocean_bscat:coordinates = "lon lat" ;
num_18hz_ku_ocean_bscat:source = "SGDR MDSR field 76" ;
num_18hz_ku_ocean_bscat:comment = "The number of elementary measurements effectively used for calculating the averaged ocean Ku Sigma0 value and standard deviation" ;

short num_18hz_s_ocean_bscat(time) ;
num_18hz_s_ocean_bscat:long_name = "Number of 18Hz valid points for S-band ocean backscatter coefficient" ;
num_18hz_s_ocean_bscat:_FillValue = 32767s ;
num_18hz_s_ocean_bscat:coordinates = "lon lat" ;
num_18hz_s_ocean_bscat:source = "SGDR MDSR field 77" ;
num_18hz_s_ocean_bscat:comment = "The number of elementary measurements effectively used for calculating the averaged ocean S Sigma0 value and standard deviation" ;

short hz18_k_cal_ku(time, samples) ;
hz18_k_cal_ku:long_name = "18Hz Ku-band K_cal_Ku" ;
hz18_k_cal_ku:units = "dB" ;
hz18_k_cal_ku:scale_factor = 0.01 ;
hz18_k_cal_ku:_FillValue = 32767s ;
hz18_k_cal_ku:coordinates = "hz18_lon hz18_lat" ;
hz18_k_cal_ku:ancillary_variables = "map_18hz_k_cal_ku_flags" ;
hz18_k_cal_ku:source = "SGDR MDSR field 68" ;
hz18_k_cal_ku:comment = "Ku-band scaling factor for Sigma0 evaluation" ;

short hz18_k_cal_s(time, samples) ;
hz18_k_cal_s:long_name = "18Hz S-band K_cal_S" ;
hz18_k_cal_s:units = "dB" ;
hz18_k_cal_s:scale_factor = 0.01 ;
hz18_k_cal_s:_FillValue = 32767s ;
hz18_k_cal_s:coordinates = "hz18_lon hz18_lat" ;
hz18_k_cal_s:source = "SGDR MDSR field 69" ;
hz18_k_cal_s:comment = "S-band scaling factor for Sigma0 evaluation" ;

short map_18hz_k_cal_ku_flags(time, samples) ;
map_18hz_k_cal_ku_flags:long_name = "Map of valid points for 18Hz K-cal ku" ;
map_18hz_k_cal_ku_flags:_FillValue = 127b ;
map_18hz_k_cal_ku_flags:flag_values = 0b, 1b ;
map_18hz_k_cal_ku_flags:flag_meanings = "valid invalid" ;
map_18hz_k_cal_ku_flags:coordinates = "hz18_lon hz18_lat" ;
map_18hz_k_cal_ku_flags:source = "SGDR MDSR field 70" ;

//Backscatter Correction Information

short ku_net_instr_corr_agc(time) ;
ku_net_instr_corr_agc:long_name = "Ku-band net instrument correction for AGC" ;
ku_net_instr_corr_agc:units = "dB" ;

ku_net_instr_corr_agc:scale_factor = 0.01 ;
ku_net_instr_corr_agc:_FillValue = 32767s ;
ku_net_instr_corr_agc:coordinates = "lon lat" ;
ku_net_instr_corr_agc:source = "SGDR MDSR field 86" ;
ku_net_instr_corr_agc:comment = "Computed as: ku_net_instr_corr_agc =Sig0_Flight_Cal+Loss_Ground_Cal+AGC_Corr, where Sig0_Flight_Cal is the Sigma0 flight calibration factor, Loss_Ground_Cal is the loss calibration factor and AGC_Corr is the AGC correction factor" ;

short s_net_instr_corr_agc(time) ;
s_net_instr_corr_agc:long_name = "S-band net instrument correction for AGC" ;
s_net_instr_corr_agc:units = "dB" ;
s_net_instr_corr_agc:scale_factor = 0.01 ;
s_net_instr_corr_agc:_FillValue = 32767s ;
s_net_instr_corr_agc:coordinates = "lon lat" ;
s_net_instr_corr_agc:source = "SGDR MDSR field 87" ;
s_net_instr_corr_agc:comment = "Computed as: ku_net_instr_corr_agc =Sig0_Flight_Cal+Loss_Ground_Cal+AGC_Corr, where Sig0_Flight_Cal is the Sigma0 flight calibration factor, Loss_Ground_Cal is the loss calibration factor and AGC_Corr is the AGC correction factor" ;

short ku_atm_atten_corr(time) ;
ku_atm_atten_corr:long_name = "Ku-band atmospheric attenuation correction" ;
ku_atm_atten_corr:units = "dB" ;
ku_atm_atten_corr:scale_factor = 0.01 ;
ku_atm_atten_corr:_FillValue = 32767s ;
ku_atm_atten_corr:coordinates = "lon lat" ;
ku_atm_atten_corr:source = "SGDR MDSR field 88" ;
ku_atm_atten_corr:comment = "The Ku-band backscatter coefficient two-way MWR atmospheric attenuation (in dB), computed with neural algorithms as a function of TB23_Int, TB36_Int and sigma0_Ku (see ENVISAT Product Handbook for more details) This value is added to the Sigma0 in Ku-band" ;

short s_atm_atten_corr(time) ;
s_atm_atten_corr:long_name = "S-band atmospheric attenuation correction" ;
s_atm_atten_corr:units = "dB" ;
s_atm_atten_corr:scale_factor = 0.01 ;
s_atm_atten_corr:_FillValue = 32767s ;
s_atm_atten_corr:coordinates = "lon lat" ;
s_atm_atten_corr:source = "SGDR MDSR field 89" ;
s_atm_atten_corr:comment = "The S-band backscatter coefficient two-way MWR atmospheric attenuation (in dB), computed with neural algorithms as a function of TB23_Int, TB36_Int and sigma0_Ku (see ENVISAT Product Handbook for more details) This value is added to the Sigma0 in Ku-band" ;

int ku_rai_corr(time) ;
ku_rai_corr:long_name = "Ku-band rain attenuation correction" ;
ku_rai_corr:units = "dB" ;
ku_rai_corr:scale_factor = 0.01 ;
ku_rai_corr:_FillValue = 2147483647 ;

ku_rai_corr:coordinates = "lon lat" ;
ku_rai_corr:source = "SGDR MDSR field 90" ;
ku_rai_corr:comment = "Calculated using the ocean backscatter coefficient for Ku-band, sigma0_Ku (dB) by: Rain_Att = Exp_Sigma0_Ku - sigma0_Ku where the expected Ku-band backscatter coefficient, Exp_Sigma0_Ku, is determined by linear interpolation from the input table, as a function of the S-band backscatter coefficient" ;

//Off-nadir Angle Information

short off_nad_ang_platf(time) ;
off_nad_ang_platf:long_name = "Off nadir angle of the satellite from platform data" ;
off_nad_ang_platf:units = "degrees^2" ;
off_nad_ang_platf:scale_factor = 0.0001 ;
off_nad_ang_platf:_FillValue = 32767s ;
off_nad_ang_platf:coordinates = "lon lat" ;
off_nad_ang_platf:source = "SGDR MDSR field 91" ;
off_nad_ang_platf:comment = "The squared off-nadir angle (in radians) from the platform is derived from the interpolated pitch and roll mispointing angles" ;

short off_nad_ang_wvform(time) ;
off_nad_ang_wvform:long_name = "Off nadir angle of the satellite from waveform data" ;
off_nad_ang_wvform:units = "degrees^2" ;
off_nad_ang_wvform:scale_factor = 0.0001 ;
off_nad_ang_wvform:_FillValue = 32767s ;
off_nad_ang_wvform:coordinates = "lon lat" ;
off_nad_ang_wvform:source = "SGDR MDSR field 92" ;
off_nad_ang_wvform:comment = "The squared off-nadir angle (in radians) from the waveform is derived from the slope of the trailing edge of the waveform. This slope is derived from the Ice-2 retracking algorithm. For more details see the ENVISAT Product Handbook" ;

//Geophysical Information

int m_sea_surf_ht(time) ;
m_sea_surf_ht:long_name = "Mean sea-surface height" ;
m_sea_surf_ht:standard_name = "sea_level" ;
m_sea_surf_ht:units = "m" ;
m_sea_surf_ht:scale_factor = 0.001 ;
m_sea_surf_ht:_FillValue = 2147483647 ;
m_sea_surf_ht:coordinates = "lon lat" ;
m_sea_surf_ht:grid_mapping = "crs" ;
m_sea_surf_ht:source = "CLS01 mean sea surface. SGDR MDSR field 98" ;
m_sea_surf_ht:comment = "CLS (Collecte Localisation Satellite), CLS01 mean sea surface, estimated on a 1/30 degree (2 minutes) grid using a local inverse method, which also provides an estimate and an associated error field" ;

int geoid_ht(time) ;
geoid_ht:long_name = "Geoid height" ;
geoid_ht:standard_name = "geoid_height_above_reference_ellipsoid" ;

geoid_ht:units = "m" ;
geoid_ht:scale_factor = 0.001 ;
geoid_ht:_FillValue = 2147483647 ;
geoid_ht:coordinates = "lon lat" ;
geoid_ht:grid_mapping = "crs" ;
geoid_ht:source = "EGM96 geoid model. SGDR MDSR field 99" ;
geoid_ht:comment = "EGM96 geoid model (Lemoine et al., 1998)" ;

int ocean_depland_elev(time) ;
ocean_depland_elev:long_name = "Ocean depth/land elevation" ;
ocean_depland_elev:units = "m" ;
ocean_depland_elev:scale_factor = 0.001 ;
ocean_depland_elev:_FillValue = 2147483647 ;
ocean_depland_elev:coordinates = "lon lat" ;
ocean_depland_elev:source = "SGDR MDSR field 100" ;
ocean_depland_elev:comment = "MACESS Global Digital Elevation Model, developed at ESRIN by merging the ACE land elevation data and the Smith and Sandwell ocean bathymetry data" ;

short tot_geocen_ocn_tide_ht_sol1(time) ;
tot_geocen_ocn_tide_ht_sol1:long_name = "Total geocentric ocean tide height (solution 1)" ;
tot_geocen_ocn_tide_ht_sol1:standard_name = "sea_surface_height_amplitude_due_to_geocentric_ocean_tide" ;
tot_geocen_ocn_tide_ht_sol1:units = "m" ;
tot_geocen_ocn_tide_ht_sol1:scale_factor = 0.001 ;
tot_geocen_ocn_tide_ht_sol1:_FillValue = 32767s ;
tot_geocen_ocn_tide_ht_sol1:coordinates = "lon lat" ;
tot_geocen_ocn_tide_ht_sol1:source = "GOT00.2b. SGDR MDSR field 101" ;
tot_geocen_ocn_tide_ht_sol1:comment = "GOT00.2b ocean tide model which consists of independent near-global estimates of eight components (Q1,O1,P1,K1,N2,M2,S2 and K2). The total geocentric ocean tide is the sum of the ocean tide height, the tidal loading height and the long period tide height" ;

short tot_geocen_ocn_tide_ht_sol2(time) ;
tot_geocen_ocn_tide_ht_sol2:long_name = "Total geocentric ocean tide height (solution 2)" ;
tot_geocen_ocn_tide_ht_sol2:standard_name = "sea_surface_height_amplitude_due_to_geocentric_ocean_tide" ;
tot_geocen_ocn_tide_ht_sol2:units = "m" ;
tot_geocen_ocn_tide_ht_sol2:scale_factor = 0.001 ;
tot_geocen_ocn_tide_ht_sol2:_FillValue = 32767s ;
tot_geocen_ocn_tide_ht_sol2:coordinates = "lon lat" ;
tot_geocen_ocn_tide_ht_sol2:source = "FES2004. SGDR MDSR field 102" ;
tot_geocen_ocn_tide_ht_sol2:comment = "FES2004 ocean tide model, generated at LEGOS. The altimeter data reprocessing consists of a new atmospheric forcing response correction (mog2D-G) applied to the data before the harmonic analysis. This model includes two extra waves, S1 and M4, to add to the nine waves of the FES2002 model" ;

short long_period_ocn_tide_ht(time) ;
long_period_ocn_tide_ht:long_name = "Long period Tide height" ;
long_period_ocn_tide_ht:standard_name = "sea_surface_height_amplitude_due_to_equilibrium_ocean_tide" ;

long_period_ocn_tide_ht:units = "m" ;
long_period_ocn_tide_ht:scale_factor = 0.001 ;
long_period_ocn_tide_ht:_FillValue = 32767s ;
long_period_ocn_tide_ht:coordinates = "lon lat" ;
long_period_ocn_tide_ht:source = "Cartwright and Taylor tidal potential. SGDR MDSR field 103" ;
long_period_ocn_tide_ht:comment = "This equilibrium tide is added to the total geocentric ocean tide" ;

short tidal_load_ht_sol1(time) ;
tidal_load_ht_sol1:long_name = "Tidal loading height (solution 1)" ;
tidal_load_ht_sol1:units = "m" ;
tidal_load_ht_sol1:scale_factor = 0.001 ;
tidal_load_ht_sol1:_FillValue = 32767s ;
tidal_load_ht_sol1:coordinates = "lon lat" ;
tidal_load_ht_sol1:source = "GOT00.2b. SGDR MDSR field 114" ;
tidal_load_ht_sol1:comment = "The height of the tidal loading induced by the ocean tide is calculated from the GOT00.2 model" ;

short tidal_load_ht_sol2(time) ;
tidal_load_ht_sol2:long_name = "Tidal loading height (solution 2)" ;
tidal_load_ht_sol2:units = "m" ;
tidal_load_ht_sol2:scale_factor = 0.001 ;
tidal_load_ht_sol2:_FillValue = 32767s ;
tidal_load_ht_sol2:coordinates = "lon lat" ;
tidal_load_ht_sol2:source = "FES2002. SGDR MDSR field 104" ;
tidal_load_ht_sol2:comment = "tidal loading height induced by the ocean tide calculated from the FES2002 model" ;

short solid_earth_tide_ht(time) ;
solid_earth_tide_ht:long_name = "Solid earth tide height" ;
solid_earth_tide_ht:standard_name = "sea_surface_height_amplitude_due_to_earth_tide" ;
solid_earth_tide_ht:units = "m" ;
solid_earth_tide_ht:scale_factor = 0.001 ;
solid_earth_tide_ht:_FillValue = 32767s ;
solid_earth_tide_ht:coordinates = "lon lat" ;
solid_earth_tide_ht:source = "Cartwright and Taylor tidal potential. SGDR MDSR field 105" ;
solid_earth_tide_ht:comment = "The gravitational potential V induced by an astronomical body can be broken down into harmonic constituents, each characterised by amplitude, phase and frequency" ;

short geocen_pole_tide_ht(time) ;
geocen_pole_tide_ht:long_name = "Geocentric pole tide height" ;
geocen_pole_tide_ht:standard_name = "sea_surface_height_amplitude_due_to_pole_tide" ;
geocen_pole_tide_ht:units = "m" ;
geocen_pole_tide_ht:scale_factor = 0.001 ;
geocen_pole_tide_ht:_FillValue = 32767s ;
geocen_pole_tide_ht:coordinates = "lon lat" ;
geocen_pole_tide_ht:source = "Wahr [1985]. SGDR MDSR field 106" ;

geocen_pole_tide_ht:comment = "Geocentric tide height due to polar motion. The restored polar coordinates are obtained from the IERS centre (International Earth Rotation and Reference Systems Service), updated approximately twice a week. In the algorithm for the calculation of the polar tide different Love numbers are used over ocean and over land" ;

short mod_surf_atm_pres(time) ;
mod_surf_atm_pres:long_name = "Model surface atmospheric pressure" ;
mod_surf_atm_pres:standard_name = "air_pressure_at_sea_level" ;
mod_surf_atm_pres:units = "Pa" ;
mod_surf_atm_pres:scale_factor = 10. ;
mod_surf_atm_pres:_FillValue = 32767s ;
mod_surf_atm_pres:coordinates = "lon lat" ;
mod_surf_atm_pres:source = "ECMWF model. SGDR MDSR field 107" ;
mod_surf_atm_pres:comment = "From the computational grid (Gaussian grid - quasi regular in latitude, irregular in longitude) of the ECMWF model run" ;

short mwr_wvapour_cont(time) ;
mwr_wvapour_cont:long_name = "MWR water vapour content" ;
mwr_wvapour_cont:standard_name = "atmosphere_water_vapor_content" ;
mwr_wvapour_cont:units = "kg/m^2" ;
mwr_wvapour_cont:scale_factor = 0.1 ;
mwr_wvapour_cont:_FillValue = 32767s ;
mwr_wvapour_cont:coordinates = "lon lat" ;
mwr_wvapour_cont:source = "microwave radiometer. SGDR MDSR field 108" ;
mwr_wvapour_cont:comment = "May also be called total column water vapour. Computed with a neural algorithm from the MWR 23.8 GHz and 36.5 GHz brightness temperatures (TB23 and TB36) interpolated to RA-2 time tag, and sigma0_Ku, not corrected for atmospheric attenuation" ;

short mwr_liq_vapour_cont(time) ;
mwr_liq_vapour_cont:long_name = "MWR liquid water content" ;
mwr_liq_vapour_cont:standard_name = "atmosphere_cloud_liquid_water_content" ;
mwr_liq_vapour_cont:units = "kg/m^2" ;
mwr_liq_vapour_cont:scale_factor = 0.01 ;
mwr_liq_vapour_cont:_FillValue = 32767s ;
mwr_liq_vapour_cont:coordinates = "lon lat" ;
mwr_liq_vapour_cont:source = "microwave radiometer. SGDR MDSR field 109" ;
mwr_liq_vapour_cont:comment = "Computed from the MWR 23.8 GHz and 36.5 GHz brightness temperatures (TB23 and TB36, in K) nterpolated to RA-2 time tag and the ocean backscatter coefficient for Ku-band sigma0_Ku, not corrected for atmospheric attenuation, using a neural network algorithm" ;

short ra2_elec_cont(time) ;
ra2_elec_cont:long_name = "RA2 Total electron content" ;
ra2_elec_cont:units = "m-2" ;
ra2_elec_cont:scale_factor = 0.1 ;
ra2_elec_cont:_FillValue = 32767s ;
ra2_elec_cont:coordinates = "lon lat" ;
ra2_elec_cont:source = "RA-2. SGDR MDSR field 110" ;
ra2_elec_cont:comment = "Given by ra2_elec_cont (electrons/m^2) = ra2_ion_corr_ku * f_Ku^2 / (-40250) Where f_Ku is the Ku-band radar wavelength" ;

short ra2_wind_sp(time) ;

ra2_wind_sp:long_name = "RA2 wind speed" ;
ra2_wind_sp:standard_name = "wind_speed" ;
ra2_wind_sp:units = "m/s" ;
ra2_wind_sp:scale_factor = 0.001 ;
ra2_wind_sp:_FillValue = 32767s ;
ra2_wind_sp:coordinates = "lon lat" ;
ra2_wind_sp:source = "RA-2. SGDR MDSR field 111" ;
ra2_wind_sp:comment = "Computed using a linear interpolation of the input wind table, according to the algorithm proposed by Abdalla. The algorithm is based on a fit between EnviSat Ku-band Sigma0 and the collocated ECMWF model wind speed, adjusted based on in-situ wind measurements" ;

short mod_wind_sp_u(time) ;

mod_wind_sp_u:long_name = "U component of the model wind vector" ;
mod_wind_sp_u:units = "m/s" ;
mod_wind_sp_u:scale_factor = 0.001 ;
mod_wind_sp_u:_FillValue = 32767s ;
mod_wind_sp_u:coordinates = "lon lat" ;
mod_wind_sp_u:source = "ECMWF Model. SGDR MDSR field 112" ;
mod_wind_sp_u:comment = "From the U component of the 10 metre wind vector of the computational grid (Gaussian grid - quasi regular in latitude, irregular in longitude), of the ECMWF model run" ;

short mod_wind_sp_v(time) ;

mod_wind_sp_v:long_name = "V component of the model wind vector" ;
mod_wind_sp_v:units = "m/s" ;
mod_wind_sp_v:scale_factor = 0.001 ;
mod_wind_sp_v:_FillValue = 32767s ;
mod_wind_sp_v:coordinates = "lon lat" ;
mod_wind_sp_v:source = "ECMWF Model. SGDR MDSR field 113" ;
mod_wind_sp_v:comment = "From the V component of the 10 metre wind vector of the computational grid (Gaussian grid - quasi regular in latitude, irregular in longitude), of the ECMWF model run" ;

//MWR Information

short interpole_238_temp_mwr(time) ;

interpole_238_temp_mwr:long_name = "Interpolated 23.8 GHz brightness temperature from MWR" ;
interpole_238_temp_mwr:standard_name = "surface_brightness_temperature" ;
interpole_238_temp_mwr:units = "K" ;
interpole_238_temp_mwr:scale_factor = 0.01 ;
interpole_238_temp_mwr:_FillValue = 32767s ;
interpole_238_temp_mwr:coordinates = "lon lat" ;
interpole_238_temp_mwr:source = "SGDR MDSR field 116" ;
interpole_238_temp_mwr:comment = "The brightness temperature is interpolated to the altimeter time tag" ;

short interpole_365_temp_mwr(time) ;
interpole_365_temp_mwr:long_name = "Interpolated 36.5 GHz brightness temperature from MWR" ;
interpole_365_temp_mwr:standard_name = "surface_brightness_temperature" ;
interpole_365_temp_mwr:units = "K" ;
interpole_365_temp_mwr:scale_factor = 0.01 ;
interpole_365_temp_mwr:_FillValue = 32767s ;
interpole_365_temp_mwr:coordinates = "lon lat" ;
interpole_365_temp_mwr:source = "SGDR MDSR field 117" ;
interpole_365_temp_mwr:comment = "The brightness temperature is interpolated to the altimeter time tag" ;

short interpole_sd_238_temp_mwr(time) ;
interpole_sd_238_temp_mwr:long_name = "Interpolated standard deviation of MWR 23.8 GHz brightness temperature" ;
interpole_sd_238_temp_mwr:units = "K" ;
interpole_sd_238_temp_mwr:scale_factor = 0.01 ;
interpole_sd_238_temp_mwr:_FillValue = 32767s ;
interpole_sd_238_temp_mwr:coordinates = "lon lat" ;
interpole_sd_238_temp_mwr:source = "SGDR MDSR field 118" ;
interpole_sd_238_temp_mwr:comment = "The standard deviation of the brightness temperature is interpolated to the altimeter time tag" ;

short interpole_sd_365_temp_mwr(time) ;
interpole_sd_365_temp_mwr:long_name = "Interpolated standard deviation of MWR 36.5 GHz brightness temperature" ;
interpole_sd_365_temp_mwr:units = "K" ;
interpole_sd_365_temp_mwr:scale_factor = 0.01 ;
interpole_sd_365_temp_mwr:_FillValue = 32767s ;
interpole_sd_365_temp_mwr:coordinates = "lon lat" ;
interpole_sd_365_temp_mwr:source = "SGDR MDSR field 119" ;
interpole_sd_365_temp_mwr:comment = "The standard deviation of the brightness temperature is interpolated to the altimeter time tag" ;

//Flags and other Quality Information

short ave_ku_chirp(time) ;
ave_ku_chirp:long_name = "Average Ku chirp band" ;
ave_ku_chirp:_FillValue = 32767s ;
ave_ku_chirp:flag_values = 0b, 1b, 2b ;
ave_ku_chirp:flag_meanings = ">=1_320MHz >=1_80MHz all_20MHz" ;
ave_ku_chirp:coordinates = "lon lat" ;
ave_ku_chirp:source = "SGDR MDSR field 121" ;
ave_ku_chirp:comment = "associated with the minimum of the 20 elementary chirp band indexes in the source packet. Possible values:0 -> if there is at least one record at 320 MHz, 1 -> if there is at least one record at 80 MHz (and the others are at 20 MHz), 2 -> if all input records are at 20 MHz" ;

short ku_chirp_id_flags(time, samples) ;

ku_chirp_id_flags:long_name = "Ku chirp band id" ;
ku_chirp_id_flags:_FillValue = 127b ;
ku_chirp_id_flags:flag_values = 0b, 1b, 2b ;
ku_chirp_id_flags:flag_meanings = "320MHz 80MHz 20MHz" ;
ku_chirp_id_flags:coordinates = "hz18_lon hz18_lat" ;
ku_chirp_id_flags:source = "SGDR MDSR field 122" ;
ku_chirp_id_flags:comment = "Default values (bits set to 1) are output in the event of non tracking records (records not in Tracking, Preset Tracking or Preset Loop Output), wherever the sum of all Ku and S waveforms samples are set to 0, or if Ku AGC or Ku onboard Rx delay are out of bounds" ;

int error_flag_chirp_id_flags(time) ;
error_flag_chirp_id_flags:long_name = "Error flag for chirp band id" ;
error_flag_chirp_id_flags:_FillValue = 15 ;
error_flag_chirp_id_flags:flag_values = 0b, 1b ;
error_flag_chirp_id_flags:flag_meanings = "valid invalid" ;
error_flag_chirp_id_flags:coordinates = "lon lat" ;
error_flag_chirp_id_flags:source = "SGDR MDSR field 123" ;

int instr_flags(time) ;
instr_flags:long_name = "Instrument flag" ;
instr_flags:_FillValue = 2147483647 ;
instr_flags:coordinates = "lon lat" ;
instr_flags:source = "SGDR MDSR field 124" ;
instr_flags:comment = "See ENVISAT User Manual (Annex 1) : Definition of RA-2 Instrument Flag Table 12.1.3-3" ;

short instr_id_data_level_flags(time, samples) ;
instr_id_data_level_flags:long_name = "Instrument mode ID at data block level" ;
instr_id_data_level_flags:_FillValue = 127b ;
instr_id_data_level_flags:flag_values = 0b, 1b, 2b, 3b, 4b, 5b, 6b, 7b, 8b ;
instr_id_data_level_flags:flag_meanings = "spare acquisition Tracking IF_Cal BITE_RF BITE_DGT Preset_Tracking Preset_Loop_Output Alignment_failed" ;
instr_id_data_level_flags:coordinates = "hz18_lon hz18_lat" ;
instr_id_data_level_flags:source = "SGDR MDSR field 128" ;
instr_id_data_level_flags:comment = "Default values are output in the event of non tracking records (records not in Tracking, Preset Tracking or Preset Loop Output), wherever the sum of all Ku and S waveform samples are set to 0, or if Ku AGC or Ku onboard Rx delay are out of bounds" ;

short num_meas_ku_calibr(time) ;
num_meas_ku_calibr:long_name = "Number of measurements for Ku flight calibration factor evaluation" ;
num_meas_ku_calibr:_FillValue = 15s ;
num_meas_ku_calibr:coordinates = "lon lat" ;
num_meas_ku_calibr:source = "SGDR MDSR field 129" ;
num_meas_ku_calibr:comment = "Number of Ku flight calibration factors (currently from 0 to 5) used at L1B to obtain the smoothed Sigma0 and time delay PTR flight calibration factors. Default values will appear in the event that none of the 20 elementary records are in Tracking, Preset Tracking or Preset Loop Output, where the sum of all Ku/S waveforms samples are different from 0, and where Ku AGC and Ku onboard Rx delay values are inside bounds" ;

short num_meas_s_calibr(time) ;
num_meas_s_calibr:long_name = "Number of measurements for S flight calibration factor evaluation" ;
num_meas_s_calibr:_FillValue = 32767s ;
num_meas_s_calibr:coordinates = "lon lat" ;
num_meas_s_calibr:source = "SGDR MDSR field 130" ;
num_meas_s_calibr:comment = "Number of S flight calibration factors (currently from 0 to 5) used at L1B to obtain the smoothed Sigma0 and time delay PTR flight calibration factors. Default values will appear in the event that none of the 20 elementary records are in Tracking, Preset Tracking or Preset Loop Output, where the sum of all Ku/S waveforms samples are different from 0, and where Ku AGC and Ku onboard Rx delay values are inside bounds" ;

short mwr_instr_flag(time) ;
mwr_instr_flag:long_name = "MWR instrument flag" ;
mwr_instr_flag:_FillValue = 32767s ;
mwr_instr_flag:coordinates = "lon lat" ;
mwr_instr_flag:source = "SGDR MDSR field 131" ;
mwr_instr_flag:comment = "See ENVISAT User Manual (Annex 1): MWR Instrument Flag Table 12.1.4-2" ;

short ku_ocean_retrk_qua_flags(time, samples) ;
ku_ocean_retrk_qua_flags:long_name = "Ku-band ocean retracking quality flags" ;
ku_ocean_retrk_qua_flags:_FillValue = 127b ;
ku_ocean_retrk_qua_flags:flag_values = 0b, 1b ;
ku_ocean_retrk_qua_flags:flag_meanings = "valid invalid" ;
ku_ocean_retrk_qua_flags:coordinates = "hz18_lon hz18_lat" ;
ku_ocean_retrk_qua_flags:source = "SGDR MDSR field 135" ;
ku_ocean_retrk_qua_flags:comment = "0=valid measurement, 1=invalid i.e. non tracking record, sum of all Ku and S waveform filters set to 0, Ku AGC or Ku onboard Rx delay out of bounds, leading edge out of bounds or average power smaller than a multiple of the noise power" ;

short s_ocean_retrk_qua_flags(time, samples) ;
s_ocean_retrk_qua_flags:long_name = "S-band ocean retracking quality flags" ;
s_ocean_retrk_qua_flags:_FillValue = 127b ;
s_ocean_retrk_qua_flags:flag_values = 0b, 1b ;
s_ocean_retrk_qua_flags:flag_meanings = "valid invalid" ;
s_ocean_retrk_qua_flags:coordinates = "hz18_lon hz18_lat" ;
s_ocean_retrk_qua_flags:source = "SGDR MDSR field 136" ;
s_ocean_retrk_qua_flags:comment = "0=valid measurement, 1=invalid i.e. non tracking record, sum of all Ku and S waveform filters set to 0, Ku AGC or Ku onboard Rx delay out of bounds, leading edge out of bounds or average power smaller than a multiple of the noise power" ;

short ku_peak(time) ;
ku_peak:long_name = "1Hz Ku-band peakiness" ;
ku_peak:scale_factor = 0.001 ;
ku_peak:_FillValue = -1s ;
ku_peak:coordinates = "lon lat" ;
ku_peak:source = "SGDR MDSR field 142" ;
ku_peak:comment = "The ratio of the maximum amplitude and the mean amplitude of the waveform, weighted by the ratio of the number of samples on the right of the tracking point and the

total number of samples of the waveform (128). This independent waveform quality assessment parameter is computed irrespective of surface type. The 1Hz peakiness value is obtained by arithmetic averaging of the 18Hz peakiness values of the tracking records" ;

short s_peak(time) ;

s_peak:long_name = "1Hz S-band peakiness" ;
s_peak:scale_factor = 0.001 ;
s_peak:_FillValue = -1s ;
s_peak:coordinates = "lon lat" ;
s_peak:source = "SGDR MDSR field 143" ;
s_peak:comment = "The ratio of the maximum amplitude and the mean amplitude of the waveform, weighted by the ratio of the number of samples on the right of the tracking point and the total number of samples of the waveform (128). This independent waveform quality assessment parameter is computed irrespective of surface type. The 1Hz peakiness value is obtained by arithmetic averaging of the 18Hz peakiness values of the tracking records" ;

short altim_landocean_flag(time) ;

altim_landocean_flag:long_name = "Altimeter Surface type flag" ;
altim_landocean_flag:_FillValue = 32767s ;
altim_landocean_flag:flag_values = 0b, 1b, 2b, 3b ;
altim_landocean_flag:flag_meanings = "ocean seas_lakes continental_ice land" ;
altim_landocean_flag:coordinates = "lon lat" ;
altim_landocean_flag:source = "SGDR MDSR field 144" ;
altim_landocean_flag:comment = "The flag is based on a land/sea mask file and has the following four meanings: 0 -> oceans or semi-enclosed seas,1 -> enclosed seas or lakes, 2 -> continental ice, 3 -> land" ;

short radio_landocean_flag(time) ;

radio_landocean_flag:long_name = "Radiometer land/ocean flag" ;
radio_landocean_flag:standard_name = "land_binary_mask" ;
radio_landocean_flag:_FillValue = 32767s ;
radio_landocean_flag:flag_values = 0b, 1b ;
radio_landocean_flag:flag_meanings = "ocean land" ;
radio_landocean_flag:coordinates = "lon lat" ;
radio_landocean_flag:source = "Microwave Radiometer. SGDR MDSR field 145" ;
radio_landocean_flag:comment = "When MWR data are not available, this flag is set to its default value which is 1 (land)" ;

short mwr_qua_interp_flag(time) ;

mwr_qua_interp_flag:long_name = "MWR Quality interpolation flag" ;
mwr_qua_interp_flag:_FillValue = 32767s ;
mwr_qua_interp_flag:flag_values = 0b, 1b, 2b, 3b ;
mwr_qua_interp_flag:flag_meanings = "interp_no_gap interp_gap extrap none" ;
mwr_qua_interp_flag:coordinates = "lon lat" ;
mwr_qua_interp_flag:source = "SGDR MDSR field 146" ;
mwr_qua_interp_flag:comment = "0 -> if interpolation was OK with no gap between the two MWR measurements around the RA-2 time, 1 -> if interpolation was OK but there was a gap between the two selected MWR measurements, 2 -> if extrapolation was used, 3 -> if neither interpolation nor extrapolation could be used. The default value is output when no MWR data are available" ;

short rain_flag(time) ;
rain_flag:long_name = "Rain flag" ;
rain_flag:standard_name = "rain_binary_mask" ;
rain_flag:_FillValue = 32767s ;
rain_flag:flag_values = 0b, 1b ;
rain_flag:flag_meanings = "no_rain rain" ;
rain_flag:coordinates = "lon lat" ;
rain_flag:source = "RA-2. SGDR MDSR field 147" ;
rain_flag:comment = "1 (rain): if the expected Ku/S-band rain-free relationship minus the uncorrected Ku ocean backscattering coefficient, and if the MWR liquid water content, interpolated to RA-2 time, are bigger than certain thresholds. 0 (no rain): otherwise. Default values (1) are output if ocean retracking is not OK either for Ku- or S-band (i.e. default range, SWH or Sigma0 values obtained), if MWR data are not available or if the MWR data cannot be interpolated/extrapolated to the RA-2 time of the record" ;

short interpole_flag(time) ;
interpole_flag:long_name = "Interpolation flag" ;
interpole_flag:_FillValue = 32767s ;
interpole_flag:coordinates = "lon lat" ;
interpole_flag:source = "SGDR MDSR field 146" ;
interpole_flag:comment = "See ENVISAT User Manual (Annex 1): Definition of the interpolation flag Table 12.1.3-4" ;

//New Brown Model Tracker Outputs

double brown_range_ku(time, samples) ;
brown_range_ku:long_name = "Brown retracker range Ku-band" ;
brown_range_ku:standard_name = "altimeter_range" ;
brown_range_ku:units = "m" ;
brown_range_ku:scale_factor = 0.001 ;
brown_range_ku:_FillValue = 9.96920996838687e+36 ;
brown_range_ku:coordinates = "hz18_lon hz18_lat" ;
brown_range_ku:source = "Brown retracker (Ku-band)" ;

double brown_swh_ku(time, samples) ;
brown_swh_ku:long_name = "Brown retracker significant wave height Ku-band" ;
brown_swh_ku:standard_name = "sea_surface_wave_significant_height" ;
brown_swh_ku:units = "m" ;
brown_swh_ku:_FillValue = 9.96920996838687e+36 ;
brown_swh_ku:coordinates = "hz18_lon hz18_lat" ;
brown_swh_ku:source = "Brown retracker (Ku-band)" ;

double brown_sigma0_ku(time, samples) ;
brown_sigma0_ku:long_name = "Brown retracker sigma0 Ku-band" ;
brown_sigma0_ku:units = "1" ;
brown_sigma0_ku:_FillValue = 9.96920996838687e+36 ;
brown_sigma0_ku:coordinates = "hz18_lon hz18_lat" ;
brown_sigma0_ku:source = "Brown retracker (Ku-band)" ;

brown_sigma0_ku:comment = "Maximum amplitude of Brown tracked fit to normalized waveform" ;

double brown_t0_ku(time, samples) ;
brown_t0_ku:long_name = "Brown retracker t0 Ku-band" ;
brown_t0_ku:units = "ns" ;
brown_t0_ku:_FillValue = 9.96920996838687e+36 ;
brown_t0_ku:coordinates = "hz18_lon hz18_lat" ;
brown_t0_ku:source = "Brown retracker (Ku-band)" ;
brown_t0_ku:comment = "Offset of fitted waveform with respect to COG tracking point" ;

double brown_noise_ku(time, samples) ;
brown_noise_ku:long_name = "Brown retracker thermal noise Ku-band" ;
brown_noise_ku:_FillValue = 9.96920996838687e+36 ;
brown_noise_ku:coordinates = "hz18_lon hz18_lat" ;
brown_noise_ku:source = "Brown retracker (Ku-band)" ;
brown_noise_ku:comment = "Thermal noise determined from normalized waveform" ;

double gof_brown_ku(time, samples) ;
gof_brown_ku:long_name = "Goodness of Fit Brown retracker Ku-band" ;
gof_brown_ku:_FillValue = 9.96920996838687e+36 ;
gof_brown_ku:coordinates = "hz18_lon hz18_lat" ;
gof_brown_ku:source = "Brown retracker (Ku-band)" ;
gof_brown_ku:comment = "RMS difference between best fit retracked waveform and normalized waveform" ;

double brown_range_s(time, samples) ;
brown_range_s:long_name = "Brown retracker range S-band" ;
brown_range_s:standard_name = "altimeter_range" ;
brown_range_s:units = "m" ;
brown_range_s:scale_factor = 0.001 ;
brown_range_s:_FillValue = 9.96920996838687e+36 ;
brown_range_s:coordinates = "hz18_lon hz18_lat" ;
brown_range_s:source = "Brown retracker (S-band)" ;

double brown_swh_s(time, samples) ;
brown_swh_s:long_name = "Brown retracker significant wave height S-band" ;
brown_swh_s:standard_name = "sea_surface_wave_significant_height" ;
brown_swh_s:units = "m" ;
brown_swh_s:_FillValue = 9.96920996838687e+36 ;
brown_swh_s:coordinates = "hz18_lon hz18_lat" ;
brown_swh_s:source = "Brown retracker (S-band)" ;

double brown_sigma0_s(time, samples) ;
brown_sigma0_s:long_name = "Brown retracker sigma0 S-band" ;
brown_sigma0_s:units = "1" ;
brown_sigma0_s:_FillValue = 9.96920996838687e+36 ;
brown_sigma0_s:coordinates = "hz18_lon hz18_lat" ;
brown_sigma0_s:source = "Brown retracker (S-band)" ;
brown_sigma0_s:comment = "Maximum amplitude of Brown tracked fit to normalized waveform" ;

double brown_t0_s(time, samples) ;
brown_t0_s:long_name = "Brown retracker t0 S-band" ;
brown_t0_s:units = "ns" ;
brown_t0_s:_FillValue = 9.96920996838687e+36 ;
brown_t0_s:coordinates = "hz18_lon hz18_lat" ;
brown_t0_s:source = "Brown retracker (S-band)" ;
brown_t0_s:comment = "Offset of fitted waveform with respect to COG tracking point" ;

double brown_noise_s(time, samples) ;
brown_noise_s:long_name = "Brown retracker thermal noise S-band" ;
brown_noise_s:_FillValue = 9.96920996838687e+36 ;
brown_noise_s:coordinates = "hz18_lon hz18_lat" ;
brown_noise_s:source = "Brown retracker (S-band)" ;
brown_noise_s:comment = "Thermal noise determined from normalized waveform" ;

double gof_brown_s(time, samples) ;
gof_brown_s:long_name = "Goodness of Fit Brown retracker S-band" ;
gof_brown_s:_FillValue = 9.96920996838687e+36 ;
gof_brown_s:coordinates = "hz18_lon hz18_lat" ;
gof_brown_s:source = "Brown retracker (S-band)" ;
gof_brown_s:comment = "RMS difference between best fit retracked waveform and normalized waveform" ;

//Specular Tracker Outputs

double spec_range_ku(time, samples) ;
spec_range_ku:long_name = "Specular retracker range Ku-band" ;
spec_range_ku:standard_name = "altimeter_range" ;
spec_range_ku:units = "m" ;
spec_range_ku:scale_factor = 0.001 ;
spec_range_ku:_FillValue = 9.96920996838687e+36 ;
spec_range_ku:coordinates = "hz18_lon hz18_lat" ;
spec_range_ku:source = "Specular retracker (Ku-band)" ;

double specular_beta4_ku(time, samples) ;
specular_beta4_ku:long_name = "Specular retracker beta4 Ku-band" ;
specular_beta4_ku:units = "ns" ;
specular_beta4_ku:_FillValue = 9.96920996838687e+36 ;
specular_beta4_ku:coordinates = "hz18_lon hz18_lat" ;
specular_beta4_ku:source = "Specular retracker (Ku-band)" ;
specular_beta4_ku:comment = "Waveform rise time" ;

double specular_beta2_ku(time, samples) ;
specular_beta2_ku:long_name = "Specular retracker beta2 Ku-band" ;
specular_beta2_ku:_FillValue = 9.96920996838687e+36 ;
specular_beta2_ku:coordinates = "hz18_lon hz18_lat" ;
specular_beta2_ku:source = "Specular retracker (Ku-band)" ;
specular_beta2_ku:comment = "Signal amplitude of normalized waveform" ;

double specular_beta3_ku(time, samples) ;

specular_beta3_ku:long_name = "Specular retracker beta3 Ku-band" ;
specular_beta3_ku:units = "ns" ;
specular_beta3_ku:_FillValue = 9.96920996838687e+36 ;
specular_beta3_ku:coordinates = "hz18_lon hz18_lat" ;
specular_beta3_ku:source = "Specular retracker (Ku-band)" ;
specular_beta3_ku:comment = "Location of the mid-point of the waveform leading edge" ;

double specular_beta5_ku(time, samples) ;
specular_beta5_ku:long_name = "Specular retracker beta5 Ku-band" ;
specular_beta5_ku:_FillValue = 9.96920996838687e+36 ;
specular_beta5_ku:coordinates = "hz18_lon hz18_lat" ;
specular_beta5_ku:source = "Specular retracker (Ku-band)" ;
specular_beta5_ku:comment = "Decay of the trailing edge of the normalized waveform" ;

double specular_beta1_ku(time, samples) ;
specular_beta1_ku:long_name = "Specular retracker beta1 Ku-band" ;
specular_beta1_ku:_FillValue = 9.96920996838687e+36 ;
specular_beta1_ku:coordinates = "hz18_lon hz18_lat" ;
specular_beta1_ku:source = "Specular retracker (Ku-band)" ;
specular_beta1_ku:comment = "Thermal noise parameter determined from normalized waveform" ;

double gof_spec_ku(time, samples) ;
gof_spec_ku:long_name = "Goodness of Fit Specular retracker Ku-band" ;
gof_spec_ku:_FillValue = 9.96920996838687e+36 ;
gof_spec_ku:coordinates = "hz18_lon hz18_lat" ;
gof_spec_ku:source = "Specular retracker (Ku-band)" ;
gof_spec_ku:comment = "RMS difference between best fit retracked waveform and normalized waveform" ;

double spec_range_s(time, samples) ;
spec_range_s:long_name = "Specular retracker range S-band" ;
spec_range_s:standard_name = "altimeter_range" ;
spec_range_s:units = "m" ;
spec_range_s:scale_factor = 0.001 ;
spec_range_s:_FillValue = 9.96920996838687e+36 ;
spec_range_s:coordinates = "hz18_lon hz18_lat" ;
spec_range_s:source = "Specular retracker (S-band)" ;

double specular_beta4_s(time, samples) ;
specular_beta4_s:long_name = "Specular retracker beta4 S-band" ;
specular_beta4_s:units = "ns" ;
specular_beta4_s:_FillValue = 9.96920996838687e+36 ;
specular_beta4_s:coordinates = "hz18_lon hz18_lat" ;
specular_beta4_s:source = "Specular retracker (S-band)" ;
specular_beta4_s:comment = "Waveform rise time" ;

double specular_beta2_s(time, samples) ;
specular_beta2_s:long_name = "Specular retracker beta2 S-band" ;
specular_beta2_s:_FillValue = 9.96920996838687e+36 ;
specular_beta2_s:coordinates = "hz18_lon hz18_lat" ;

specular_beta2_s:source = "Specular retracker (S-band)" ;
specular_beta2_s:comment = "Signal amplitude of normalized waveform" ;

double specular_beta3_s(time, samples) ;
specular_beta3_s:long_name = "Specular retracker beta3 S-band" ;
specular_beta3_s:units = "ns" ;
specular_beta3_s:_FillValue = 9.96920996838687e+36 ;
specular_beta3_s:coordinates = "hz18_lon hz18_lat" ;
specular_beta3_s:source = "Specular retracker (S-band)" ;
specular_beta3_s:comment = "Location of the mid-point of the waveform leading edge" ;

double specular_beta5_s(time, samples) ;
specular_beta5_s:long_name = "Specular retracker beta5 S-band" ;
specular_beta5_s:_FillValue = 9.96920996838687e+36 ;
specular_beta5_s:coordinates = "hz18_lon hz18_lat" ;
specular_beta5_s:source = "Specular retracker (S-band)" ;
specular_beta5_s:comment = "Decay of the trailing edge of the normalized waveform" ;

double specular_beta1_s(time, samples) ;
specular_beta1_s:long_name = "Specular retracker beta1 S-band" ;
specular_beta1_s:_FillValue = 9.96920996838687e+36 ;
specular_beta1_s:coordinates = "hz18_lon hz18_lat" ;
specular_beta1_s:source = "Specular retracker (S-band)" ;
specular_beta1_s:comment = "Thermal noise parameter determined from normalized waveform" ;

double gof_spec_s(time, samples) ;
gof_spec_s:long_name = "Goodness of Fit Specular retracker S-band" ;
gof_spec_s:_FillValue = 9.96920996838687e+36 ;
gof_spec_s:coordinates = "hz18_lon hz18_lat" ;
gof_spec_s:source = "Specular retracker (S-band)" ;
gof_spec_s:comment = "RMS difference between best fit retracked waveform and normalized waveform" ;

//Mixed Tracker Outputs

double mixed_range_ku(time, samples) ;
mixed_range_ku:long_name = "Mixed retracker range Ku-band" ;
mixed_range_ku:standard_name = "altimeter_range" ;
mixed_range_ku:units = "m" ;
mixed_range_ku:scale_factor = 0.001 ;
mixed_range_ku:_FillValue = 9.96920996838687e+36 ;
mixed_range_ku:coordinates = "hz18_lon hz18_lat" ;
mixed_range_ku:source = "Mixed retracker (Ku-band)" ;
mixed_range_ku:comment = "Determined from Brown waveform fit of mixed retracker" ;

double mixed_swh_ku(time, samples) ;
mixed_swh_ku:long_name = "Mixed retracker Brown swh Ku-band" ;
mixed_swh_ku:standard_name = "sea_surface_wave_significant_height" ;
mixed_swh_ku:units = "m" ;

mixed_swh_ku:_FillValue = 9.96920996838687e+36 ;
mixed_swh_ku:coordinates = "hz18_lon hz18_lat" ;
mixed_swh_ku:source = "Mixed retracker (Ku-band)" ;
mixed_swh_ku:comment = "Determined from Brown waveform fit of mixed retracker" ;

double mixed_sigma0_ku(time, samples) ;
mixed_sigma0_ku:long_name = "Mixed retracker Brown sigma0, Ku-band" ;
mixed_sigma0_ku:units = "1" ;
mixed_sigma0_ku:_FillValue = 9.96920996838687e+36 ;
mixed_sigma0_ku:coordinates = "hz18_lon hz18_lat" ;
mixed_sigma0_ku:source = "Mixed retracker (Ku-band)" ;
mixed_sigma0_ku:comment = "Signal amplitude of Brown tracked fit to normalized waveform" ;

double mixed_t0_ku(time, samples) ;
mixed_t0_ku:long_name = "Mixed retracker Brown t0, Ku-band" ;
mixed_t0_ku:units = "ns" ;
mixed_t0_ku:_FillValue = 9.96920996838687e+36 ;
mixed_t0_ku:coordinates = "hz18_lon hz18_lat" ;
mixed_t0_ku:source = "Mixed retracker (Ku-band)" ;
mixed_t0_ku:comment = "Offset of Brown retracked waveform within mixed retracker with respect to COG tracking point" ;

double mixed_beta4_ku(time, samples) ;
mixed_beta4_ku:long_name = "Mixed retracker Specular beta4 Ku-band" ;
mixed_beta4_ku:units = "ns" ;
mixed_beta4_ku:_FillValue = 9.96920996838687e+36 ;
mixed_beta4_ku:coordinates = "hz18_lon hz18_lat" ;
mixed_beta4_ku:source = "Mixed retracker (Ku-band)" ;
mixed_beta4_ku:comment = "Waveform rise time of specular portion of mixed retracker" ;

double mixed_beta2_ku(time, samples) ;
mixed_beta2_ku:long_name = "Mixed retracker Specular beta2 Ku-band" ;
mixed_beta2_ku:_FillValue = 9.96920996838687e+36 ;
mixed_beta2_ku:coordinates = "hz18_lon hz18_lat" ;
mixed_beta2_ku:source = "Mixed retracker (Ku-band)" ;
mixed_beta2_ku:comment = "Signal amplitude of normalized waveforms from specular portion of mixed retracker" ;

double mixed_beta3_ku(time, samples) ;
mixed_beta3_ku:long_name = "Mixed retracker Specular beta3 Ku-band" ;
mixed_beta3_ku:units = "ns" ;
mixed_beta3_ku:_FillValue = 9.96920996838687e+36 ;
mixed_beta3_ku:coordinates = "hz18_lon hz18_lat" ;
mixed_beta3_ku:source = "Mixed retracker (Ku-band)" ;
mixed_beta3_ku:comment = "Location of the mid-point of the waveform leading edge from specular portion of mixed retracker" ;

double mixed_beta5_ku(time, samples) ;
mixed_beta5_ku:long_name = "Mixed retracker Specular beta5 Ku-band" ;
mixed_beta5_ku:_FillValue = 9.96920996838687e+36 ;

mixed_beta5_ku:coordinates = "hz18_lon hz18_lat" ;
mixed_beta5_ku:source = "Mixed retracker (Ku-band)" ;
mixed_beta5_ku:comment = "Decay of the trailing edge of the normalized waveform from specular portion of mixed retracker" ;

double mixed_noise_ku(time, samples) ;
mixed_noise_ku:long_name = "Mixed retracker Brown and Specular thermal noise Ku band" ;
mixed_noise_ku:_FillValue = 9.96920996838687e+36 ;
mixed_noise_ku:coordinates = "hz18_lon hz18_lat" ;
mixed_noise_ku:source = "Mixed retracker (Ku-band)" ;
mixed_noise_ku:comment = "Thermal noise determined from normalized waveform" ;

double gof_mixed_ku(time, samples) ;
gof_mixed_ku:long_name = "Goodness of Fit Mixed retracker Ku-band" ;
gof_mixed_ku:_FillValue = 9.96920996838687e+36 ;
gof_mixed_ku:coordinates = "hz18_lon hz18_lat" ;
gof_mixed_ku:source = "Mixed retracker (Ku-band)" ;
gof_mixed_ku:comment = "RMS difference between best fit retracked waveform and normalized waveform" ;

double mixed_range_s(time, samples) ;
mixed_range_s:long_name = "Mixed retracker range S-band" ;
mixed_range_s:standard_name = "altimeter_range" ;
mixed_range_s:units = "m" ;
mixed_range_s:scale_factor = 0.001 ;
mixed_range_s:_FillValue = 9.96920996838687e+36 ;
mixed_range_s:coordinates = "hz18_lon hz18_lat" ;
mixed_range_s:source = "Mixed retracker (S-band)" ;
mixed_range_s:comment = "Determined from Brown waveform fit of mixed retracker" ;

double mixed_swh_s(time, samples) ;
mixed_swh_s:long_name = "Mixed retracker Brown swh S-band" ;
mixed_swh_s:standard_name = "sea_surface_wave_significant_height" ;
mixed_swh_s:units = "m" ;
mixed_swh_s:_FillValue = 9.96920996838687e+36 ;
mixed_swh_s:coordinates = "hz18_lon hz18_lat" ;
mixed_swh_s:source = "Mixed retracker (S-band)" ;
mixed_swh_s:comment = "Determined from Brown waveform fit of mixed retracker" ;

double mixed_sigma0_s(time, samples) ;
mixed_sigma0_s:long_name = "Mixed retracker Brown sigma0 S-band" ;
mixed_sigma0_s:units = "1" ;
mixed_sigma0_s:_FillValue = 9.96920996838687e+36 ;
mixed_sigma0_s:coordinates = "hz18_lon hz18_lat" ;
mixed_sigma0_s:source = "Mixed retracker (S-band)" ;
mixed_sigma0_s:comment = "Signal amplitude of Brown tracked fit to normalized waveform" ;

double mixed_t0_s(time, samples) ;
mixed_t0_s:long_name = "Mixed retracker Brown t0 S-band" ;

mixed_t0_s:units = "ns" ;
mixed_t0_s:_FillValue = 9.96920996838687e+36 ;
mixed_t0_s:coordinates = "hz18_lon hz18_lat" ;
mixed_t0_s:source = "Mixed retracker (S-band)" ;
mixed_t0_s:comment = "Offset of Brown retracked waveform within mixed retracker with respect to COG tracking point" ;

double mixed_beta4_s(time, samples) ;
mixed_beta4_s:long_name = "Mixed retracker Specular beta4 S-band" ;
mixed_beta4_s:units = "ns" ;
mixed_beta4_s:_FillValue = 9.96920996838687e+36 ;
mixed_beta4_s:coordinates = "hz18_lon hz18_lat" ;
mixed_beta4_s:source = "Mixed retracker (S-band)" ;
mixed_beta4_s:comment = "Waveform rise time of specular portion of mixed retracker" ;

double mixed_beta2_s(time, samples) ;
mixed_beta2_s:long_name = "Mixed retracker Specular beta2 S-band" ;
mixed_beta2_s:_FillValue = 9.96920996838687e+36 ;
mixed_beta2_s:coordinates = "hz18_lon hz18_lat" ;
mixed_beta2_s:source = "Mixed retracker (S-band)" ;
mixed_beta2_s:comment = "Signal amplitude of normalized waveforms from specular portion of mixed retracker" ;

double mixed_beta3_s(time, samples) ;
mixed_beta3_s:long_name = "Mixed retracker Specular beta3 S-band" ;
mixed_beta3_s:units = "ns" ;
mixed_beta3_s:_FillValue = 9.96920996838687e+36 ;
mixed_beta3_s:coordinates = "hz18_lon hz18_lat" ;
mixed_beta3_s:source = "Mixed retracker (S-band)" ;
mixed_beta3_s:comment = "Location of the mid-point of the waveform leading edge from specular portion of mixed retracker" ;

double mixed_beta5_s(time, samples) ;
mixed_beta5_s:long_name = "Mixed retracker Specular beta5 S-band" ;
mixed_beta5_s:_FillValue = 9.96920996838687e+36 ;
mixed_beta5_s:coordinates = "hz18_lon hz18_lat" ;
mixed_beta5_s:source = "Mixed retracker (S-band)" ;
mixed_beta5_s:comment = "Decay of the trailing edge of the normalized waveform from specular portion of mixed retracker" ;

double mixed_noise_s(time, samples) ;
mixed_noise_s:long_name = "Mixed retracker Brown and Specular thermal noise S-band" ;
mixed_noise_s:_FillValue = 9.96920996838687e+36 ;
mixed_noise_s:coordinates = "hz18_lon hz18_lat" ;
mixed_noise_s:source = "Mixed retracker (S-band)" ;
mixed_noise_s:comment = "Thermal noise determined from normalized waveform" ;

double gof_mixed_s(time, samples) ;
gof_mixed_s:long_name = "Goodness of Fit Mixed retracker S-band" ;
gof_mixed_s:_FillValue = 9.96920996838687e+36 ;
gof_mixed_s:coordinates = "hz18_lon hz18_lat" ;

gof_mixed_s:source = "Mixed retracker (S-band)" ;
gof_mixed_s:comment = "RMS difference between best fit retracked waveform and normalized waveform" ;

//New range corrections

int uso_clock_correction(time,samples) ;
uso_clock_correction:long_name = "USO Clock Correction" ;
uso_clock_correction:units = "m" ;
uso_clock_correction:scale_factor = 0.0001;
uso_clock_correction:_FillValue = 2147483647 ;
uso_clock_correction:coordinates = "hz18_lon hz18_lat" ;

short hz18_dry_trop_mod(time, samples) ;
hz18_dry_trop_mod:long_name = "18Hz interpolated model dry trop correction" ;
hz18_dry_trop_mod:standard_name = "altimeter_range_correction_due_to_dry_troposhere" ;
hz18_dry_trop_mod:units = "m" ;
hz18_dry_trop_mod:scale_factor = 0.001 ;
hz18_dry_trop_mod:_FillValue = 32767s ;
hz18_dry_trop_mod:coordinates = "hz18_lon hz18_lat" ;
hz18_dry_trop_mod:source = "ECMWF model. SGDR MDSR field 39 (interpolated)" ;
hz18_dry_trop_mod:comment = "mod_dry_tropo_corr values interpolated to 18Hz times" ;

short hz18_inv_barom_corr(time, samples) ;
hz18_inv_barom_corr:long_name = "18Hz interpolated Inverted barometer correction" ;
hz18_inv_barom_corr:standard_name = "sea_surface_height_correction_due_to_air_pressure_at_low_frequency" ;
hz18_inv_barom_corr:units = "m" ;
hz18_inv_barom_corr:scale_factor = 0.001 ;
hz18_inv_barom_corr:_FillValue = 32767s;
hz18_inv_barom_corr:coordinates = "hz18_lon hz18_lat" ;
hz18_inv_barom_corr:source = "SGDR MDSR field 40 (interpolated)" ;
hz18_inv_barom_corr:comment = "inv_barom_corr values interpolated to 18Hz times" ;

short hz18_mod_wet_tropo_corr(time, samples) ;
hz18_mod_wet_tropo_corr:long_name = "18Hz interpolated Model wet tropospheric correction" ;
hz18_mod_wet_tropo_corr:standard_name = "altimeter_range_correction_due_to_wet_troposphere" ;
hz18_mod_wet_tropo_corr:units = "m" ;
hz18_mod_wet_tropo_corr:scale_factor = 0.001 ;
hz18_mod_wet_tropo_corr:_FillValue = 32767s ;
hz18_mod_wet_tropo_corr:coordinates = "hz18_lon hz18_lat" ;
hz18_mod_wet_tropo_corr:source = "ECMWF model. SGDR MDSR field 41 (interpolated)" ;
hz18_mod_wet_tropo_corr:comment = "mod_wet_tropo_corr values interpolated to 18Hz times" ;

short hz18_mwr_wet_trop(time, samples) ;

hz18_mwr_wet_trop:long_name = "18Hz interpolated MWR wet trop values" ;
hz18_mwr_wet_trop:standard_name = "altimeter_range_correction_due_to_wet_troposhere" ;
hz18_mwr_wet_trop:units = "m" ;
hz18_mwr_wet_trop:scale_factor = 0.001 ;
hz18_mwr_wet_trop:_FillValue = 32767s ;
hz18_mwr_wet_trop:coordinates = "hz18_lon hz18_lat" ;
hz18_mwr_wet_trop:source = "Microwave Radiometer. SGDR MDSR field 42 (interpolated with SGDR MDSR field 41)" ;
hz18_mwr_wet_trop:comment = "Values are calculated at 1Hz using the Dynamic Linear Model to interpolate over short gaps and extrapolate towards land using the model correction values, then linearly interpolated to 18Hz" ;

short hz18_ra2_ion_corr_ku(time, samples) ;
hz18_ra2_ion_corr_ku:long_name = "18Hz interpolated RA2 Ionospheric correction on Ku-band" ;
hz18_ra2_ion_corr_ku:standard_name = "altimeter_range_correction_due_to_ionosphere" ;
hz18_ra2_ion_corr_ku:units = "m" ;
hz18_ra2_ion_corr_ku:scale_factor = 0.001 ;
hz18_ra2_ion_corr_ku:_FillValue = 32767s ;
hz18_ra2_ion_corr_ku:coordinates = "hz18_lon hz18_lat" ;
hz18_ra2_ion_corr_ku:source = "Altimeter range. SGDR MDSR field 43 (interpolated)" ;
hz18_ra2_ion_corr_ku:comment = "ra2_ion_corr_ku values interpolated to 18Hz times" ;

short hz18_ra2_ion_corr_s(time, samples) ;
hz18_ra2_ion_corr_s:long_name = "18Hz interpolated RA2 Ionospheric correction on S-band" ;
hz18_ra2_ion_corr_s:standard_name = "altimeter_range_correction_due_to_ionosphere" ;
hz18_ra2_ion_corr_s:units = "m" ;
hz18_ra2_ion_corr_s:scale_factor = 0.001 ;
hz18_ra2_ion_corr_s:_FillValue = 32767s ;
hz18_ra2_ion_corr_s:coordinates = "hz18_lon hz18_lat" ;
hz18_ra2_ion_corr_s:source = "Altimeter range. SGDR MDSR field 44 (interpolated)" ;
hz18_ra2_ion_corr_s:comment = "ra2_ion_corr_s values interpolated to 18Hz times" ;

short hz18_ion_corr_doris_ku(time, samples) ;
hz18_ion_corr_doris_ku:long_name = "18Hz interpolated Ionospheric correction from DORIS on Ku-band" ;
hz18_ion_corr_doris_ku:standard_name = "altimeter_range_correction_due_to_ionosphere" ;
hz18_ion_corr_doris_ku:units = "m" ;
hz18_ion_corr_doris_ku:scale_factor = 0.001 ;
hz18_ion_corr_doris_ku:_FillValue = 32767s ;
hz18_ion_corr_doris_ku:coordinates = "hz18_lon hz18_lat" ;
hz18_ion_corr_doris_ku:source = "DORIS TEC maps. SGDR MDSR field 45 (interpolated)" ;
hz18_ion_corr_doris_ku:comment = "ion_corr_doris_ku values interpolated to 18Hz times" ;

short hz18_ion_corr_doris_s(time, samples) ;
hz18_ion_corr_doris_s:long_name = "18Hz interpolated Ionospheric correction from DORIS on S-band" ;

hz18_ion_corr_doris_s:standard_name = "altimeter_range_correction_due_to_ionosphere" ;
hz18_ion_corr_doris_s:units = "m" ;
hz18_ion_corr_doris_s:scale_factor = 0.001 ;
hz18_ion_corr_doris_s:_FillValue = 32767s ;
hz18_ion_corr_doris_s:coordinates = "hz18_lon hz18_lat" ;
hz18_ion_corr_doris_s:source = "DORIS TEC maps. SGDR MDSR field 46 (interpolated)" ;
hz18_ion_corr_doris_s:comment = "ion_corr_doris_s values interpolated to 18Hz times" ;

short hz18_ion_corr_mod_ku(time, samples) ;
hz18_ion_corr_mod_ku:long_name = "18Hz interpolated Ionospheric correction from model on Ku-band" ;
hz18_ion_corr_mod_ku:standard_name = "altimeter_range_correction_due_to_ionosphere" ;
hz18_ion_corr_mod_ku:units = "m" ;
hz18_ion_corr_mod_ku:scale_factor = 0.001 ;
hz18_ion_corr_mod_ku:_FillValue = 32767s ;
hz18_ion_corr_mod_ku:coordinates = "hz18_lon hz18_lat" ;
hz18_ion_corr_mod_ku:source = "GIM model. SGDR MDSR field 47 (interpolated)" ;
hz18_ion_corr_mod_ku:comment = "ion_corr_mod_ku values interpolated to 18Hz times" ;

short hz18_ion_corr_mod_s(time, samples) ;
hz18_ion_corr_mod_s:long_name = "18Hz interpolated Ionospheric correction from model on S-band" ;
hz18_ion_corr_mod_s:standard_name = "altimeter_range_correction_due_to_ionosphere" ;
hz18_ion_corr_mod_s:units = "m" ;
hz18_ion_corr_mod_s:scale_factor = 0.001 ;
hz18_ion_corr_mod_s:_FillValue = 32767s ;
hz18_ion_corr_mod_s:coordinates = "hz18_lon hz18_lat" ;
hz18_ion_corr_mod_s:source = "GIM model. SGDR MDSR field 48 (interpolated)" ;
hz18_ion_corr_mod_s:comment = "ion_corr_mod_s values interpolated to 18Hz times" ;

short iono_corr_brown_ku(time, samples) ;
iono_corr_brown_ku:long_name = "New Iono Correction with Brown retracked ranges" ;
iono_corr_brown_ku:standard_name = "altimeter_range_correction_due_to_ionosphere" ;
iono_corr_brown_ku:units = "m" ;
iono_corr_brown_ku:scale_factor = 0.001 ;
iono_corr_brown_ku:_FillValue = 32767s ;
iono_corr_brown_ku:coordinates = "hz18_lon hz18_lat" ;
iono_corr_brown_ku:source = "Brown retracker" ;

short iono_corr_spec_ku(time, samples) ;
iono_corr_spec_ku:long_name = "New Iono Correction with Specular retracked ranges" ;
iono_corr_spec_ku:standard_name = "altimeter_range_correction_due_to_ionosphere" ;
iono_corr_spec_ku:units = "m" ;
iono_corr_spec_ku:scale_factor = 0.001 ;
iono_corr_spec_ku:_FillValue = 32767s ;
iono_corr_spec_ku:coordinates = "hz18_lon hz18_lat" ;
iono_corr_spec_ku:source = "Specular retracker" ;

short iono_corr_mixed_ku(time, samples) ;
iono_corr_mixed_ku:long_name = "New Iono Correction with Mixed retracked ranges" ;

iono_corr_mixed_ku:standard_name = "altimeter_range_correction_due_to_ionosphere" ;
iono_corr_mixed_ku:units = "m" ;
iono_corr_mixed_ku:scale_factor = 0.001 ;
iono_corr_mixed_ku:_FillValue = 32767s ;
iono_corr_mixed_ku:coordinates = "hz18_lon hz18_lat" ;
iono_corr_mixed_ku:source = "Mixed retracker" ;

short hz18_sea_bias_ku(time, samples) ;
hz18_sea_bias_ku:long_name = "18Hz interpolated sea state bias Ku-band correction" ;
hz18_sea_bias_ku:units = "m" ;
hz18_sea_bias_ku:scale_factor = 0.001 ;
hz18_sea_bias_ku:_FillValue = 32767s ;
hz18_sea_bias_ku:coordinates = "hz18_lon hz18_lat" ;
hz18_sea_bias_ku:source = "SGDR MDSR field 49 (interpolated)" ;
hz18_sea_bias_ku:comment = "sea_bias_ku values interpolated to 18Hz times" ;

short hz18_sea_bias_s(time, samples) ;
hz18_sea_bias_s:long_name = "18Hz interpolated sea state bias S-band correction" ;
hz18_sea_bias_s:units = "m" ;
hz18_sea_bias_s:scale_factor = 0.001 ;
hz18_sea_bias_s:_FillValue = 32767s ;
hz18_sea_bias_s:coordinates = "hz18_lon hz18_lat" ;
hz18_sea_bias_s:source = "SGDR MDSR field 50 (interpolated)" ;
hz18_sea_bias_s:comment = "sea_bias_s values interpolated to 18Hz times" ;

short hz18_dib_hf(time, samples) ;
hz18_dib_hf:long_name = "18Hz interpolated MOG2D HF contribution" ;
hz18_dib_hf:standard_name =
"sea_surface_height_correction_due_to_air_pressure_and_wind_at_high_frequency" ;
hz18_dib_hf:units = "m" ;
hz18_dib_hf:scale_factor = 0.001 ;
hz18_dib_hf:_FillValue = 32767s ;
hz18_dib_hf:coordinates = "hz18_lon hz18_lat" ;
hz18_dib_hf:source = "SGDR MDSR field 51 (interpolated)" ;
hz18_dib_hf:comment = "dib_hf values interpolated to 18Hz times" ;

//New geophysical corrections

int hz18_m_sea_surf_ht(time, samples) ;
hz18_m_sea_surf_ht:long_name = "18Hz interpolated Mean sea-surface height" ;
hz18_m_sea_surf_ht:standard_name = "sea_level" ;
hz18_m_sea_surf_ht:units = "m" ;
hz18_m_sea_surf_ht:scale_factor = 0.001 ;
hz18_m_sea_surf_ht:_FillValue = 2147483647 ;
hz18_m_sea_surf_ht:coordinates = "hz18_lon hz18_lat" ;
hz18_m_sea_surf_ht:grid_mapping = "crs" ;
hz18_m_sea_surf_ht:source = "CLS01 mean sea surface. SGDR MDSR field 98
(interpolated)" ;
hz18_m_sea_surf_ht:comment = "m_sea_surf_ht values interpolated to 18Hz times" ;

int hz18_geoid_ht(time, samples) ;
hz18_geoid_ht:long_name = "18Hz interpolated Geoid height" ;
hz18_geoid_ht:standard_name = "geoid_height_above_reference_ellipsoid" ;
hz18_geoid_ht:units = "m" ;
hz18_geoid_ht:scale_factor = 0.001 ;
hz18_geoid_ht:_FillValue = 2147483647 ;
hz18_geoid_ht:coordinates = "hz18_lon hz18_lat" ;
hz18_geoid_ht:grid_mapping = "crs" ;
hz18_geoid_ht:source = "EGM96 geoid model. SGDR MDSR field 99 (interpolated)" ;
hz18_geoid_ht:comment = "geoid_ht:comment values interpolated to 18Hz times" ;

int hz18_ocean_depland_elev(time, samples) ;
hz18_ocean_depland_elev:long_name = "18Hz interpolated Ocean depth/land elevation" ;
hz18_ocean_depland_elev:units = "m" ;
hz18_ocean_depland_elev:scale_factor = 0.001 ;
hz18_ocean_depland_elev:_FillValue = 2147483647 ;
hz18_ocean_depland_elev:coordinates = "hz18_lon hz18_lat" ;
hz18_ocean_depland_elev:source = "SGDR MDSR field 100" ;
hz18_ocean_depland_elev:comment = "hz18_ocean_depland_elev values interpolated to 18Hz times" ;

short hz18_tot_geocen_ocn_tide_ht_sol1(time,samples) ;
hz18_tot_geocen_ocn_tide_ht_sol1:long_name = "18Hz interpolated Total geocentric ocean tide height (solution 1)" ;
hz18_tot_geocen_ocn_tide_ht_sol1:standard_name = "sea_surface_height_amplitude_due_to_geocentric_ocean_tide" ;
hz18_tot_geocen_ocn_tide_ht_sol1:units = "m" ;
hz18_tot_geocen_ocn_tide_ht_sol1:scale_factor = 0.001 ;
hz18_tot_geocen_ocn_tide_ht_sol1:_FillValue = 32767s ;
hz18_tot_geocen_ocn_tide_ht_sol1:coordinates = "hz18_lon hz18_lat" ;
hz18_tot_geocen_ocn_tide_ht_sol1:source = "GOT00.2b. SGDR MDSR field 101 (interpolated)" ;
hz18_tot_geocen_ocn_tide_ht_sol1:comment = "tot_geocen_ocn_tide_ht_sol1 values interpolated to 18Hz times" ;

short hz18_tot_geocen_ocn_tide_ht_sol2(time, samples) ;
hz18_tot_geocen_ocn_tide_ht_sol2:long_name = "18Hz interpolated Total geocentric ocean tide height (solution 2)" ;
hz18_tot_geocen_ocn_tide_ht_sol2:standard_name = "sea_surface_height_amplitude_due_to_geocentric_ocean_tide" ;
hz18_tot_geocen_ocn_tide_ht_sol2:units = "m" ;
hz18_tot_geocen_ocn_tide_ht_sol2:scale_factor = 0.001 ;
hz18_tot_geocen_ocn_tide_ht_sol2:_FillValue = 32767s ;
hz18_tot_geocen_ocn_tide_ht_sol2:coordinates = "hz18_lon hz18_lat" ;
hz18_tot_geocen_ocn_tide_ht_sol2:source = "FES2004. SGDR MDSR field 102 (interpolated)" ;
hz18_tot_geocen_ocn_tide_ht_sol2:comment = "tot_geocen_ocn_tide_ht_sol2 values interpolated to 18Hz times" ;

short hz18_long_period_ocn_tide_ht(time, samples) ;

```
            hz18_long_period_ocn_tide_ht:long_name = "18Hz interpolated Long period Tide height" ;
            hz18_long_period_ocn_tide_ht:standard_name =
"sea_surface_height_amplitude_due_to_equilibrium_ocean_tide" ;
            hz18_long_period_ocn_tide_ht:units = "m" ;
            hz18_long_period_ocn_tide_ht:scale_factor = 0.001 ;
            hz18_long_period_ocn_tide_ht:_FillValue = 32767s ;
            hz18_long_period_ocn_tide_ht:coordinates = "hz18_lon hz18_lat" ;
            hz18_long_period_ocn_tide_ht:source = "Cartwright and Taylor tidal potential. SGDR
MDSR field 103 (interpolated)" ;
            hz18_long_period_ocn_tide_ht:comment = "long_period_ocn_tide_ht values interpolated to
18Hz times" ;

      short hz18_tidal_load_ht_sol1(time, samples) ;
            hz18_tidal_load_ht_sol1:long_name = "18Hz interpolated Tidal loading height (solution 1)" ;
            hz18_tidal_load_ht_sol1:units = "m" ;
            hz18_tidal_load_ht_sol1:scale_factor = 0.001 ;
            hz18_tidal_load_ht_sol1:_FillValue = 32767s ;
            hz18_tidal_load_ht_sol1:coordinates = "hz18_lon hz18_lat" ;
            hz18_tidal_load_ht_sol1:source = "GOT00.2b. SGDR MDSR field 114 (interpolated)" ;
            hz18_tidal_load_ht_sol1:comment = "tidal_load_ht_sol1 values interpolated to 18Hz times" ;

      short hz18_tidal_load_ht_sol2(time, samples) ;
            hz18_tidal_load_ht_sol2:long_name = "18Hz interpolated Tidal loading height (solution 2)" ;
            hz18_tidal_load_ht_sol2:units = "m" ;
            hz18_tidal_load_ht_sol2:scale_factor = 0.001 ;
            hz18_tidal_load_ht_sol2:_FillValue = 32767s ;
            hz18_tidal_load_ht_sol2:coordinates = "hz18_lon hz18_lat" ;
            hz18_tidal_load_ht_sol2:source = "FES2002. SGDR MDSR field 104 (interpolated)" ;
            hz18_tidal_load_ht_sol2:comment = "tidal_load_ht_sol2 values interpolated to 18Hz times" ;

      short hz18_solid_earth_tide_ht(time, samples) ;
            hz18_solid_earth_tide_ht:long_name = "18Hz interpolated Solid earth tide height" ;
            hz18_solid_earth_tide_ht:standard_name =
"sea_surface_height_amplitude_due_to_earth_tide" ;
            hz18_solid_earth_tide_ht:units = "m" ;
            hz18_solid_earth_tide_ht:scale_factor = 0.001 ;
            hz18_solid_earth_tide_ht:_FillValue = 32767s ;
            hz18_solid_earth_tide_ht:coordinates = "hz18_lon hz18_lat" ;
            hz18_solid_earth_tide_ht:source = "Cartwright and Taylor tidal potential. SGDR MDSR field
105 (interpolated)" ;
            hz18_solid_earth_tide_ht:comment = "solid_earth_tide_ht values interpolated to 18Hz times"
;

      short hz18_geocen_pole_tide_ht(time, samples) ;
            hz18_geocen_pole_tide_ht:long_name = "18Hz interpolated Geocentric pole tide height" ;
            hz18_geocen_pole_tide_ht:standard_name =
"sea_surface_height_amplitude_due_to_pole_tide" ;
            hz18_geocen_pole_tide_ht:units = "m" ;
            hz18_geocen_pole_tide_ht:scale_factor = 0.001 ;
            hz18_geocen_pole_tide_ht:_FillValue = 32767s ;
```

hz18_geocen_pole_tide_ht:coordinates = "hz18_lon hz18_lat" ;
hz18_geocen_pole_tide_ht:source = "Wahr [1985]. SGDR MDSR field 106 (interpolated)" ;
hz18_geocen_pole_tide_ht:comment = "geocen_pole_tide_ht values interpolated to 18Hz times" ;

//New flags and quality indicators

short coastal_mask_flag(time, samples) ;
coastal_mask_flag:long_name = "Coastal mask flag" ;
coastal_mask_flag:_FillValue = 127b ;
coastal_mask_flag:flag_values = 0b, 1b ;
coastal_mask_flag:flag_meanings = "coastal non_coastal" ;
coastal_mask_flag:coordinates = "hz18_lon hz18_lat" ;

float distance_from_coast(time, samples) ;
distance_from_coast:long_name = "Distance to coast" ;
distance_from_coast:units = "km" ;
distance_from_coast:_FillValue = -999.f ;
distance_from_coast:coordinates = "hz18_lon hz18_lat" ;
distance_from_coast:comment = "Distance to closest coast determined from land mask" ;

short mwr_wet_trop_interp_flag
mwr_wet_trop_interp_flag:long_name = "MWR wet trop correction interpolation flag" ;
mwr_wet_trop_interp_flag:_FillValue = 127b ;
mwr_wet_trop_interp_flag:flag_values = 0b, 1b, 2b, 3b ;
mwr_wet_trop_interp_flag:flag_meanings = "interpolated interp_mod extrap_mod invalid" ;
mwr_wet_trop_interp_flag:coordinates = "lon lat" ;
mwr_wet_trop_interp_flag:comment = "Interpolation method used for 1Hz MWR wet trop value. 0 -> interpolated between 2 valid 1hz MWR wet tropospheric correction values, 1 -> interpolated between 2 valid 1hz MWR wet tropospheric correction values, using model correction, 2 -> extrapolated from 1 valid 1hz MWR wet tropospheric correction values using model correction, 3 -> no interpolation (invalid value)" ;

7 Glossary

Acronym	Definition
AD	Applicable Documents
AGC	Automatic Gain Control
AMR	Advanced Microwave Radiometer
ANX	Ascending Node crossing
CAL	Calibration
CCN	Contract Change Notice
CDL	Common Data Language
CF-1.1	Climate and Forecast convention v1.1
CFI	Customer-Furnished Item
CI	Configuration Item
COG	Centre Of Gravity
DAD	Dynamic Auxiliary Data
DORIS	Doppler Orbitography and Radiopositioning Integrated by Satellite
ECMWF	European Centre for Medium-Range Weather Forecasts
ESL	Expert Support Laboratory
FAT	Factory Acceptance Test
FEP	Front-End Processor
FFT	Fast Fourier Transform
FOS	Flight Operations Segment
F-PAC	Processing and Archiving Centre in France
FTP	File Transfer Protocol
GDR	Geophysical Data Record
GPS	Global Positioning System
GUI	Graphical User Interface
I/F	Interface
IGDR	Interim Geophysical Data Record
IPF	Instrument Processing Facility
LPF	Low Pass Filter
LTM	Long Term Monitoring
MCD	Measurement Confidence Data
MDS	Measurement Data Set
MWR	Microwave Radiometer

N/A	Not Applicable
NRT	Near Real Time
OFL	Off-Line
OGDR	Operational Geophysical Data Record
PAC	Processing and Archiving Centre
PDAS	Payload Data Acquisition Station (same as PDAS-F)
PDAS - F	Payload Data Acquisition Station at Fucino
PDCC	Payload Data Control Centre
PDHS - E	Payload Data Handling Station at ESRIN
PDHS - K	Payload Data Handling Station at Kiruna
PDS	Payload Data Segment
PF_HS	Processing Facility Host Structure
PNO	Public Network Operator
POD	Precise Orbit Determination
POE	Precise Orbit Ephemeris
PTR	Point Target Response
RA-2	Radar Altimeter - 2
RD	Reference Documents
RMS	Root Mean Square
SAD	Static Auxiliary Data
SDR	Sensor Data Record
SGDR	Sensor Geophysical Data Record
SLA	Sea Level Anomaly
S/W	Software
SNR	Signal to Noise Ratio
SSHA	Sea-Surface Height Anomaly
SWH	Significant Wave Height
TBC	To Be Confirmed
TBD	To Be Defined
TEC	Total Electron Content
USO	Ultra Stable Oscillator
UTC	Universal Time Coordinate

8 Applicable and Reference Documents

RD 1 Envisat Coastal Altimetry Product Handbook, Issue 2.0, 20 June 2011

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RD 17 Francis O. and Mazzega P.: "*Global charts of ocean tide loading effects*", J. Geophys. Res., Vol. 95, 11,411-11,424, 1990
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