High-frequency Along-track Level-2+ (L2P) SLA

Product Handbook

for missions Jason-3

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List of Acronyms:

ATBD	Algorithm Theoretical Baseline Document
ATP	Along Track Product
Aviso+	Archiving, Validation and Interpretation of Satellite Oceanographic data
CLS	Collecte, Localisation, Satellites
CMA	Centre Multimissions Altimetriques
Cnes	Centre National d'Etudes Spatiales
ECMWF	European Centre for Medium-range Weather Forecasting
EUMETSAT	European Organisation for the Exploitation of Meteorological Satellites
GDR	Geophysical Data Record(s)
GOT	Global Ocean Tides
IB	Inverse Barometer
IGDR	Interim Geophysical Data Record(s)
LRM	Low Resolution Mode
LWE	Large Wavelength Error
L2P	Level-2+ product: global 1 Hz along-track data (sea level anomaly, its components and validity flag) over marine surfaces based on Level-2 products
MSS	Mean Sea Surface
MWR	Microwave Radiometer
Nasa	National Aeronautics and Space Administration
NRT	Near Real Time
NTC	Non Time Critical
OER	Orbit Error Reduction
OSDR	Operational Sensor Data Records
POE	Precise Orbit Ephemeris
RD	Reference Document
SAR	Synthetic Aperture Radar
Ssalto	Segment Sol multimissions d'ALTimétrie, d'Orbitographie et de localisation précise.
SLA	Sea Level Anomaly
SSB	Sea State Bias
SSH	Sea Surface Height
STC	Short Time Critical
TAI	IAT – International Atomic Time
T/P	Topex/Poseidon
UTC	Universal Time Coordinated

Contents

1. Introduction

The purpose of this document is to describe products generated by the 20Hz monomission along-track altimeter data processing segment for Jason-3 along-track L2P SLA products. Other missions will be added in the future.

Note that 20 Hz Sea level anomaly L2P products are already available for the Sentinel-3 missions, the handbook is available here:

https://www.aviso.altimetry.fr/fileadmin/documents/data/tools/hdbk_L2P_S3.pdf

The generation of the L2P 20 Hz products is part of the Cnes SALP (Service d'Altimétrie et Localisation Précise). The dissemination of those products is part of the Cnes AVISO-SALP.

After a description of the input data, a short overview of the processing steps is presented. Then complete information about user products is provided, giving nomenclature, format description, and software routines.

2. Overview

2.1. Altimetry principle

The altimeter measures the **'Altimeter Range'** which is the distance between the center of mass of satellite to the surface of the Earth (figure 1). This allows computing the **'Sea Surface Height'** which is the height of the sea surface above the reference ellipsoid. The **'Satellite Altitude'** refers to the distance of the center of mass of the satellite above a reference point. The reference point will usually be either on the reference ellipsoid or the center of the Earth.

'Sea Surface Height' = 'Satellite Altitude' - 'Altimeter Range' - 'Corrections'

The **'Corrections'** due to environmental conditions need to be applied in order to retrieve the correct **'Sea Surface Height'**. They are listed in Table 2 and depend on the timeliness of the product.

Moreover another variable is often used in altimetry:

'Sea Level Anomaly'= 'Sea Surface Height' - 'Mean Sea Surface'

The **'Mean Sea Surface'** is the mean of the sea surface height relative to ellipsoid over 20 years. It is computed on a regular grid and combines the data of all satellites.

The **Reference ellipsoid** used for all missions in NTC is the World Geodetic System (WGS) 84 reference ellipsoid.

- Equatorial radius of 6 378 137 m
- Flattening coefficient of 1/298.257 223 563

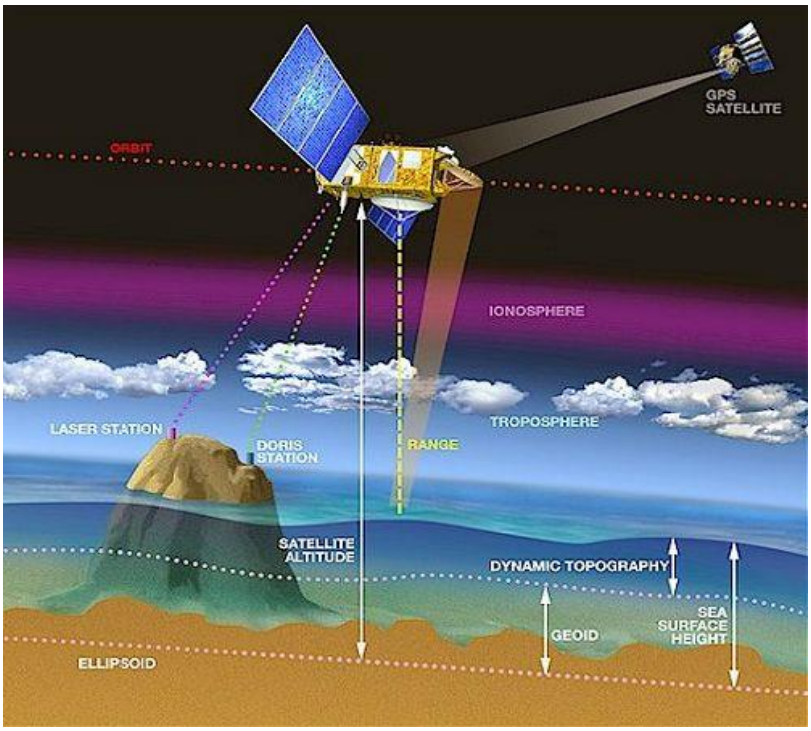


Figure 1. Altimetry principle

2.1.1. Orbits, Passes and Repeat cycle

'Orbit' is one revolution around the Earth by the satellite.

A satellite **'Pass' or 'Track'** is half a revolution of the Earth by the satellite from one extreme latitude to the opposite extreme latitude. Passes with odd numbers correspond to ascending orbits, from minimum to maximum latitude; passes with even numbers correspond to descending orbits, from maximum to minimum latitude.

'Repeat Cycle' is the time period that elapses until the satellite flies over the same location again. Every "pass file" of a given cycle (identified by its track number) flies over the same path as the pass file of every other cycle in the same repeat-cycle phase, and covers oceans basins continuously.

The table below lists the characteristics of the missions :

Altimeter mission	Cycle duration (days)	Latitude range (°N)	Number of tracks in the cycle	Inter-track distance at equator (km)	Sun-synchronous	Dual-frequency Altimeter	Radiometer on board
Jason-3	10	±66	254	~315	No	Yes	Yes

Table 1. Characteristics of the missions

2.2. Operating modes

The Jason-3 mission is on LRM mode.

3. Data Processing

3.1. Overview

The processing steps of the system are overviewed on **Erreur ! Source du renvoi introuvable.**. The L2P products are delivered in Near-Real-Time (NRT) and Short Time Critical (STC). The objective is:

- To provide operational applications with directly useable continuous and high quality altimeter data.
- To provide user friendly altimeter database where users can directly access to valid sea level height content without additional processing.

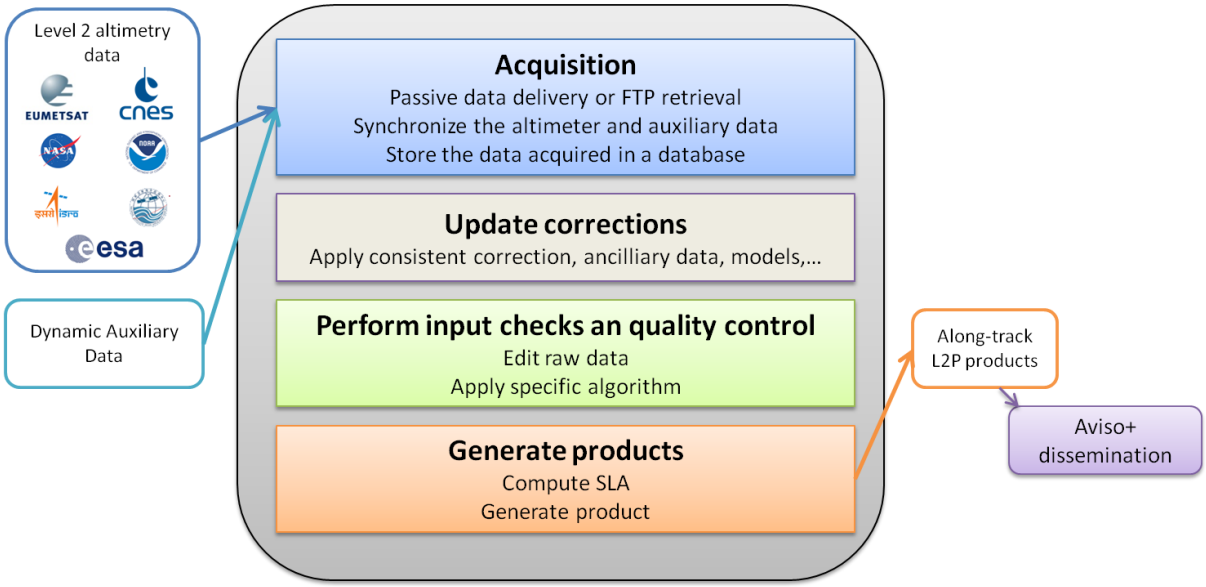


Figure 2. Processing steps of the system

The L2P products are along-track products that contain time, sea level anomaly, information of validity of the data and all corrections which were necessary to compute the sea level anomaly (range, orbital altitude. L2P products are the input data for the L3 production.

3.2. Input Data

3.2.1. Level-2 altimeter data

In order to produce Along-track L2P products, the system **uses Level-2** instrumental measurements (containing Ocean data). Indeed there are different data products associated with the three levels of processing of altimeter data:

- Level-0 (L0) is the raw telemetered data
- Level-1 (L1) is the Level-0 data corrected for instrumental effects
- Level-2 (L2) is the Level-1 data corrected for geophysical effects

There are different levels of data latency related to the Level-2 availability as detailed in Table 2 and Table 3:

Altimetry product	Source	Availability	Orbit
Jason-3 OGDR-F	CNES/NASA	3 hours	Fast delivery orbit

Table 2. Input data overview for near realtime data

Altimetry product	Source	Availability	Orbit
Jason-3 IGDR-F	CNES	48 hours	Intermediate orbit

Table 3. Input data overview for short time critical data

3.2.1.1. Dynamic and static auxiliary data

In order to compute the Sea Level Anomaly, various corrections are needed, some of them replace the ones from the L2 input product such as the Mean Sea Surface, the tidal model, ... The complete description of all the corrections used in the L2P products is given in Table 8.

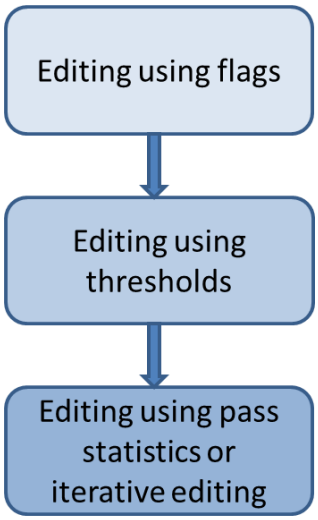
3.2.2. Applying altimetric corrections

Altimetric measurements need to be corrected for instrumental errors, environmental perturbations (wet tropospheric, dry tropospheric and ionospheric effects), the ocean sea state influence (sea state bias), the tide influence (ocean tide, earth tide and pole tide) and atmospheric pressure (combined atmospheric correction : high frequency fluctuations of the sea surface topography and inverted barometer height correction). The detail of these corrections applied is given in Table *8*. This table corresponds to the current available L2P standard 03_00 (global attribute “product_version” in the L2P files) for NRT and STC products.

3.2.3. Selecting valid data

The processing starts with quality control and validation of altimetric data and geophysical corrections in order to select valid ocean data.

Editing criteria are used to select valid measurements over ocean. The editing process is divided into 3 parts as described below:



1/ Editing using flags:

A first step is to select the points where the editing thresholds will be applied. The points where:

- the ice flag is 0 (Ocean),
- and the surface_type flag is 0 (Open Sea) or 2 (only for Caspian sea)

are taken into account.

2/ Editing with parameters thresholds:

The editing criteria are defined as minimum and maximum thresholds for altimeter, radiometer and geophysical parameters. They are expected to remain constant throughout the mission, so that monitoring the number of edited measurements allows an observation of data quality. Measurements are edited if at least one of the parameters does not lie within those thresholds.

Parameters	Minimum value	Maximum value
Sea Level Anomaly	-2m	2 m
Significant wave height	0m	15m

Table 4. Editing thresholds for each parameter for L2P 20 Hz processing.

3/ Iterative editing of sea level anomaly for 20 Hz NRT/STC data:

Robust statistics along each track are used to reject aberrant values on SLA based on a n*sigma criteria. A modulation with the ocean variability is used in order to limit the rejection of measurements in high variability areas (e.g. Gulf Stream). Then, the standard deviation of the SLA around its mean on a defined window (SLARunSTD) is calculated. As this quantity is linearly dependent on waves at first order, it is possible to estimate an expected SLARunSTD in relation with observed waves. By the comparison between observed and expected SLARunSTD it is possible to detect the incoherent values of SLA.

3.3. Product Generation

The **'Sea Level Anomalies'** as described in section 2.1 are computed with the corrections given in Table 8.

In order to allow the user to compute himself its own **'Sea Surface Height'** depending on his needs, the corrections used to compute the **'Sea Level Anomalies'** are present in the output product (see Table 7 for details about the names of variables). This allows computing the raw **'Sea Surface Height'**

Each product will contain one file per pass. The following table gives the frequency of delivery and the number of files delivered.

L2P altimetry output product	Frequency	Number of files delivered
Near Real Time (NRT) Jason-3	Several times a day	25 passes net per day. At the beginning of the service the high-frequency L2P products are delivered twice per day. This will be increased to 3 deliveries per day before end of 2021.
Short Time Critical (STC) Jason-3	Several times per day	25 passes net per day. At the beginning of the service the high-frequency L2P products are delivered twice per day. This will be increased to 3 deliveries per day before end of 2021. Note, as Jason-3 L2 IGDR products are generally produced only once per day, Jason-3 STC L2P products are also generally only in one of the deliveries.

Table 5. Number of L2P files delivered for each timeliness.

4. Product Presentation

4.1. Temporal availability

The Jason-3 20Hz L2P data is available starting from October 2021 for both STC and NRT.

Mission	Begin date	End date	Characteristics
NRT/STC Jason-3	13/10/2021 (cycle 209)	Ongoing	10-day cycles

Table 6. Temporal availability of 20 Hz L2P Jason-3 products

4.2. Nomenclature

The generic model of L2P filename is:

global_<frequency>_sla_l2p_<data_type>_<mission>_<cycle>_<pass>_<begin_date>_<end_date>_<production_date>.nc

The L2P products name components are:

- The frequency of the data (hf): <frequency>
- The type of data (NRT/STC): <data_type>
- The mission (j3): <mission>
- The cycle/pass considered: <cycle>_<pass>
- The begin and end dates of the data: <begin_date>_<end_date>
- The production date: <production_date>

This is an example of a 20 Hz L2P sea level anomaly filename:

global_hf_sla_l2p_stc_j3_C0207_P0010_20210921T095103_20210921T104715_20210922T100610.nc

5. Data Format

This chapter presents the data storage format and convention used for L2P products. All products are distributed in NetCDF-4 with norm CF.

NetCDF (Network Common Data Form) is an open source, generic and multi-platform format developed by Unidata. An exhaustive presentation of NetCDF and additional conventions is available on the following web site:

http://www.unidata.ucar.edu/packages/netcdf/index.html.

All basic NetCDF conventions are applied to files.

Additionally the files are based on the attribute data tags defined by the Cooperative Ocean/Atmopshere Reasearch Data Service (COARDS) and Climate Forecast (CF) metadata conventions. The CF convention generalises and extends the COARDS convention but relaxes the COARDS constraints on dimension and order and specifies methods for reducing the size of datasets. A wide range of software is available to write or read NetCDf/CF files. API made available by UNIDATA (http://www.unidata.ucar.edu/software/netcdf):

- C/C++/Fortran
- Java
- MATLAB, Objective-C, Perl, Python, R, Ruby, Tcl/Tk.

5.1. L2P Format

5.1.1. Dimensions

1 Dimension is defined:

- **time:** number of data in current file, sampled at 20Hz.

5.1.2. Data Handling Variables

You will find hereafter the definitions of the variables defined in the product:

Name of variable	Type	Content	Unit
time	double	Time of measurements	seconds since 2000-01-01 00:00:00 UTC
latitude	int	Latitude value of measurements	degrees_north
longitude	int	Longitude value of measurements	degrees_east
range	int	Range	meters
altitude	int	Altitude of the satellite	meters
wet_tropospheric_correction	short	Wet tropospheric correction	meters
wet_tropospheric_correction_model	short		
ionospheric_correction	int	Ionospheric correction	meters
sea_state_bias	short	Sea state bias	meters
solid_earth_tide	short	Solid Earth tide height	meters
pole_tide	short	Pole tide height	meters
Internal tide	int	Internal tide height	meters
dry_tropospheric_correction_model	short	Dry tropospheric correction	meters
dynamic_atmospheric_correction	short	Combined atmospheric correction	meters
ocean_tide_height	int	Ocean tide height	meters
mean_sea_surface	int	Mean sea surface height	meters
high_frequency_adjustment	short	high frequency adjustment for 20 Hz altimeter sea level data	meters
lf_inverse_barometer	short	low frequency part of inverse barometer	meters
inter_mission_bias	int	Bias to have consistent time series since TOPEX/Poseidon	meters
sea_level_anomaly	int	Sea Level Anomaly relative to MSS	meters
validation_flag	byte	Flag indicating if Sea Level	none

		Anomaly is valid (validation_flag=0) or not (validation_flag=1)	

Table 7. Overview of data handling variables in L2P NetCDF file.

5.1.2.1. Attributes

Additional attributes may be available in L2P files. They are providing information about the type of product or the processing and parameter used.

5.1.2.2. Example of L2P file

```
netcdf global_hf_sla_l2p_stc_j3_C0207_P0010_20210921T095103_20210921T104715_20210922T100610 {
dimensions:
    time = 66072 ;
variables:
    double time(time) ;
        time:standard_name = "time" ;
        time:units = "seconds since 2000-01-01" ;
        time:calendar = "gregorian" ;
    int latitude(time) ;
        latitude:comments = "Positive latitude is North latitude, negative latitude is South latitude." ;
        latitude:long_name = "latitude" ;
        latitude:standard_name = "latitude" ;
        latitude:units = "degrees_north" ;
        latitude:scale_factor = 1.e-06 ;
    int longitude(time) ;
        longitude:comments = "East longitude relative to Greenwich meridian." ;
        longitude:long_name = "longitude" ;
        longitude:standard_name = "longitude" ;
        longitude:units = "degrees_east" ;
        longitude:scale_factor = 1.e-06 ;
    int altitude(time) ;
        altitude:_FillValue = 2147483647 ;
        altitude:comment = "Altitude of satellite above the reference ellipsoid (WGS84)." ;
        altitude:coordinates = "longitude latitude" ;
        altitude:long_name = "20 Hz altitude of satellite" ;
        altitude:standard_name = "height_above_reference_ellipsoid" ;
        altitude:units = "m" ;
        altitude:add_offset = 1300000. ;
        altitude:scale_factor = 0.0001 ;
    short dry_tropospheric_correction_model(time) ;
        dry_tropospheric_correction_model:_FillValue = 32767s ;
        dry_tropospheric_correction_model:comment = "Computed at the altimeter time-tag from the interpolation of 2
meteorological fields that surround the altimeter time-tag. A dry tropospheric correction must be added (negative value) to
the instrument range to correct this range measurement for dry tropospheric range delays of the radar pulse." ;
        dry_tropospheric_correction_model:source = "European Center for Medium Range Weather Forecasting" ;
        dry_tropospheric_correction_model:coordinates = "longitude latitude" ;
        dry_tropospheric_correction_model:long_name = "operational ECMWF model dry tropospheric correction" ;
        dry_tropospheric_correction_model:standard_name = "altimeter_range_correction_due_to_dry_troposphere" ;
        dry_tropospheric_correction_model:units = "m" ;
        dry_tropospheric_correction_model:institution = "ECMWF" ;
        dry_tropospheric_correction_model:scale_factor = 0.0001 ;
    short dynamic_atmospheric_correction(time) ;
        dynamic_atmospheric_correction:_FillValue = 32767s ;
```

dynamic_atmospheric_correction:comment = "Based on MOG2D high resolution model forced with operational ECMWF pressure and wind speed fields for STC / with ECMWF operational forecasts of pressure and wind speed fields for NRT. This correction is computed by adding the high frequency fluctuations of the sea surface topography computed by MOG2D and the low-frequency of the inverted barometer effect computed from Mean Sea Level Pressure. The cut-period between high/low frequencies is 20 days." ;
dynamic_atmospheric_correction:coordinates = "longitude latitude" ;
dynamic_atmospheric_correction:long_name = "dynamic atmospheric correction" ;
dynamic_atmospheric_correction:units = "m" ;
dynamic_atmospheric_correction:institution = "LEGOS/CNES/CLS" ;
dynamic_atmospheric_correction:scale_factor = 0.0001 ;
short high_frequency_adjustment(time) ;
high_frequency_adjustment:_FillValue = 32767s ;
high_frequency_adjustment:comment = "This correction has to be substracted from the sea surface height." ;
high_frequency_adjustment:source = "Tran, N., Vandemark, D., Zaron, E.D., Thibaut, P., Dibarboure, G., Picot, N. Assessing the effects of sea-state related errors on the precicion of high-rate Jason-3 altimeter sea level data. ASR (2019)." ;
high_frequency_adjustment:coordinates = "longitude latitude" ;
high_frequency_adjustment:long_name = "high frequency adjustment for 20 Hz altimeter sea level data." ;
high_frequency_adjustment:units = "m" ;
high_frequency_adjustment:scale_factor = 1.e-05 ;
int inter_mission_bias(time) ;
inter_mission_bias:_FillValue = 2147483647 ;
inter_mission_bias:coordinates = "longitude latitude" ;
inter_mission_bias:long_name = "bias to have consistent time series since TOPEX/Poseidon" ;
inter_mission_bias:units = "m" ;
inter_mission_bias:scale_factor = 0.0001 ;
short internal_tide(time) ;
internal_tide:_FillValue = 32767s ;
internal_tide:comment = "Version of the model is HRET_v8.1. The following tidal frequencies are included: M2, K1, O1, S2." ;
internal_tide:coordinates = "longitude latitude" ;
internal_tide:long_name = "internal tide height" ;
internal_tide:units = "m" ;
internal_tide:scale_factor = 0.0001 ;
short ionospheric_correction(time) ;
ionospheric_correction:_FillValue = 32767s ;
ionospheric_correction:coordinates = "longitude latitude" ;
ionospheric_correction:long_name = "altimeter filtered ionospheric correction on main altimeter frequency band" ;
ionospheric_correction:standard_name = "altimeter_range_correction_due_to_ionosphere" ;
ionospheric_correction:units = "m" ;
ionospheric_correction:scale_factor = 0.0001 ;
short lf_inverse_barometer(time) ;
lf_inverse_barometer:_FillValue = 32767s ;
lf_inverse_barometer:comment = "Low frequency (20 days filtering) part of inverse barometer. This correction is already included in the dynamic_atmospheric_correction." ;
lf_inverse_barometer:coordinates = "longitude latitude" ;
lf_inverse_barometer:long_name = "low frequency part of inverse baromete" ;
lf_inverse_barometer:units = "m" ;
lf_inverse_barometer:institution = "LEGOS/CNES" ;
lf_inverse_barometer:scale_factor = 0.0001 ;
int mean_sea_surface(time) ;
mean_sea_surface:_FillValue = 2147483647 ;
mean_sea_surface:comment = "Combined SIO/CNES-CLS-15/DTU15 mean sea surface (referenced to 20 year period)." ;
mean_sea_surface:coordinates = "longitude latitude" ;
mean_sea_surface:long_name = "mean sea surface height above reference ellipsoid" ;
mean_sea_surface:units = "m" ;
mean_sea_surface:institution = "SIO/CNES/CLS/DTU" ;
mean_sea_surface:scale_factor = 0.0001 ;
int ocean_tide_height(time) ;

ocean_tide_height:_FillValue = 2147483647 ;
ocean_tide_height:comment = "Includes high frequency and long period ocean tide height and the corresponding loading tide height." ;
ocean_tide_height:source = "FES2014b" ;
ocean_tide_height:coordinates = "longitude latitude" ;
ocean_tide_height:long_name = "FES model geocentric ocean tide height" ;
ocean_tide_height:standard_name = "sea_surface_height_amplitude_due_to_geocentric_ocean_tide" ;
ocean_tide_height:units = "m" ;
ocean_tide_height:institution = "LEGOS/NOVELTIS/CNES/CLS" ;
ocean_tide_height:scale_factor = 0.0001 ;
short pole_tide(time) ;
pole_tide:_FillValue = 32767s ;
pole_tide:source = "Desai, Shailen & Wahr, John & Beckley, B. (2015). Revisiting the pole tide for and from satellite altimetry. Journal of Geodesy. 89. DOI:10.1007/s00190-015-0848-7; J. C. Ries and S. Desai; Conventional model update for rotational deformation. In Fall AGU Meeting, New Orleans, LA, 2017" ;
pole_tide:coordinates = "longitude latitude" ;
pole_tide:long_name = "geocentric pole tide height" ;
pole_tide:standard_name = "sea_surface_height_amplitude_due_to_pole_tide" ;
pole_tide:units = "m" ;
pole_tide:scale_factor = 0.0001 ;
int range(time) ;
range:_FillValue = 2147483647 ;
range:comment = "All instrumental corrections included, i.e. distance antenna-COG, USO drift correction, internal path correction, Doppler correction, modeled instrumental errors corrections." ;
range:coordinates = "longitude latitude" ;
range:long_name = "corrected 20 Hz altimeter range in main altimeter frequency band" ;
range:standard_name = "altimeter_range" ;
range:units = "m" ;
range:add_offset = 1300000. ;
range:scale_factor = 0.0001 ;
short sea_level_anomaly(time) ;
sea_level_anomaly:_FillValue = 32767s ;
sea_level_anomaly:quality_flag = "validation_flag" ;
sea_level_anomaly:comment = "altitude of satellite (altitude) - (Ku band corrected ocean altimeter range (range) - altimeter ionospheric correction on Ku band (ionospheric_correction) - model dry tropospheric correction (dry_tropospheric_correction_model) - wet tropospheric correction (wet_tropospheric_correction) - sea state bias correction in Ku band (sea_state_bias) - solid earth tide height (solid_earth_tide) - geocentric ocean tide height (ocean_tide_height) - geocentric pole tide height (pole_tide) - internal tide height (internal_tide)- dynamic atmospheric correction (dynamic_atmospheric_correction) - mean sea surface (mean_sea_surface) - inter mission bias (inter_mission_bias) - high frequency adjustment (high_frequency_adjustment)." ;
sea_level_anomaly:coordinates = "longitude latitude" ;
sea_level_anomaly:long_name = "sea level anomaly" ;
sea_level_anomaly:standard_name = "sea_surface_height_above_sea_level" ;
sea_level_anomaly:units = "m" ;
sea_level_anomaly:scale_factor = 0.0001 ;
short sea_state_bias(time) ;
sea_state_bias:_FillValue = 32767s ;
sea_state_bias:comment = "A sea state bias correction must be added (negative value) to the instrument range to correct this range measurement for sea state delays of the radar pulse." ;
sea_state_bias:source = "Tran2020 empirical solution fitted on one year of Jason-3 GDR_F data from MLE4 retracking" ;
sea_state_bias:coordinates = "longitude latitude" ;
sea_state_bias:long_name = "sea surface height bias due to sea surface roughness on main altimeter frequency band" ;
sea_state_bias:standard_name = "sea_surface_height_bias_due_to_sea_surface_roughness" ;
sea_state_bias:units = "m" ;
sea_state_bias:institution = "CNES" ;
sea_state_bias:scale_factor = 0.0001 ;
short solid_earth_tide(time) ;
solid_earth_tide:_FillValue = 32767s ;

solid_earth_tide:comment = "Calculated using Cartwright and Tayler tables and consisting of the second and third degree constituents. The permanent tide (zero frequency) is not included." ;
solid_earth_tide:source = "Cartwright and Edden [1973] Corrected tables of tidal harmonics - J. Geophys. J. R. Astr. Soc., 33, 253-264" ;
solid_earth_tide:coordinates = "longitude latitude" ;
solid_earth_tide:long_name = "solid earth tide height" ;
solid_earth_tide:standard_name = "sea_surface_height_amplitude_due_to_earth_tide" ;
solid_earth_tide:units = "m" ;
solid_earth_tide:institution = "National Institute of Oceanography (UK)" ;
solid_earth_tide:scale_factor = 0.0001 ;
byte validation_flag(time) ;
validation_flag:_FillValue = 127b ;
validation_flag:flag_meanings = "valid_data_over_ocean rejected_data" ;
validation_flag:flag_values = 0b, 1b ;
validation_flag:coordinates = "longitude latitude" ;
validation_flag:long_name = "validation flag" ;
short wet_tropospheric_correction(time) ;
wet_tropospheric_correction:_FillValue = 32767s ;
wet_tropospheric_correction:comment = "A wet tropospheric correction must be added (negative value) to the instrument range to correct this range measurement for wet tropospheric range delays of the radar pulse. The radiometer solution is used." ;
wet_tropospheric_correction:coordinates = "longitude latitude" ;
wet_tropospheric_correction:long_name = "radiometer or model wet tropospheric correction" ;
wet_tropospheric_correction:standard_name = "altimeter_range_correction_due_to_wet_troposphere" ;
wet_tropospheric_correction:units = "m" ;
wet_tropospheric_correction:scale_factor = 0.0001 ;
short wet_tropospheric_correction_model(time) ;
wet_tropospheric_correction_model:_FillValue = 32767s ;
wet_tropospheric_correction_model:comment = "Computed at the altimeter time-tag from the interpolation of 2 meteorological fields that surround the altimeter time-tag. A wet tropospheric correction must be added (negative value) to the instrument range to correct this range measurement for wet tropospheric range delays of the radar pulse." ;
wet_tropospheric_correction_model:coordinates = "longitude latitude" ;
wet_tropospheric_correction_model:long_name = "operational ECMWF model wet tropospheric correction" ;
wet_tropospheric_correction_model:standard_name = "altimeter_range_correction_due_to_wet_troposphere" ;
wet_tropospheric_correction_model:units = "m" ;
wet_tropospheric_correction_model:scale_factor = 0.0001 ;

// global attributes:
:Conventions = "CF-1.6" ;
:Metadata_Conventions = "Unidata Dataset Discovery v1.0" ;
:absolute_pass_number = 52588LL ;
:based_on = "Jason-3 L2 IGDR" ;
:cdm_data_type = "swath" ;
:contact = "aviso@altimetry.fr" ;
:creation_date = "2021-09-22T10:05:55" ;
:creator_email = "aviso@altimetry.fr" ;
:creator_name = "AVISO" ;
:creator_url = "http://aviso.altimetry.fr" ;
:cycle_number = 207LL ;
:first_meas_time = "2021-09-21T09:51:03.724196" ;
:institution = "CLS,CNES,EUMETSAT" ;
:last_meas_time = "2021-09-21T10:47:15.994516" ;
:pass_number = 10LL ;
:platform = "Jason-3" ;
:processing_level = "L2P" ;
:product_version = "03_00" ;
:project = "L2P/L3 marine altimetry service" ;
:references = "http://aviso.altimetry.fr" ;
:software_version = "conf_0.0.1-SNAPSHOT-core_0.3.0-SNAPSHOT-octant_0.18.0b0" ;
:source = "Jason-3 measurements" ;

:standard_name_vocabulary = "http://cf-pcmdi.llnl.gov/documents/cf-standard-names/standard-name-table/25/cf-standard-name-table.html" ;
:summary = "The 20 Hz Short Time Critical Level-2P sea surface height above mean sea surface products for Jason-3 mission." ;
:title = "20 Hz Short Time Critical Jason-3 Global Ocean Along track Sea Level Anomalies L2P products" ;
}

6. Products accessibility

6.1. access

The Jason-3 L2P products are available by AVISO+ as follows:

- On authenticated **AVISO+ FTP (online products)**:
  - You first need to register via the Aviso+ web portal and sign the License Agreement: http://www.aviso.altimetry.fr/en/en/data/data-access/registration-form.html and select the product "Sea Level Anomalies Along-track Level-2+ (L2P) for other mission"
  - note that a specific demand needs to be addressed for **L2P Sentinel-3 products** by clicking on **"Sea Level Anomalies Along-track Level-2+ (L2P) Sentinel-3"**

  A login /Password will be provided via email with all the necessary information to access the products.

  - Once you are registered, the access to the products is given in your personal MY AVISO+ account in the 'product page' available on: https://www.aviso.altimetry.fr/no_cache/en/my-aviso-plus.html

7. News and updates

7.1. Operational news

To be kept informed about events occurring on the satellites and on the potential services interruption, see the [Duacs] operational news on the Aviso+ website:

https://www.aviso.altimetry.fr/no_cache/en/news/operational-news-and-status.html

7.2. Updates and reprocessing

October 2021: The 20 Hz L2P sea level NRT and STC are available for Jason-3.

July 2021: The 20 Hz L2P sea level NRT and STC are available for Sentinel-3A and Sentinel-3B.

An Aviso+ web page is dedicated to updates of monomission products such as L2P products: https://www.aviso.altimetry.fr/en/data/product-information/updates-and-reprocessing/monomission-data-updates.html

7.3. Standards used for L2P processing

Hereafter the standards used for the high-frequency L2P products are listed in Table 8. The following color code is used in order to indicate whether (and how) the standard was updated in the high-frequency L2P product compared to the L2 product.

Color code	Indication of update in L2P product
	The variable exists in high-frequency resolution in the L2 product and is used as is in the L2P product => no update.
	The variable exists only in 1Hz resolution in the L2 product and is interpolated at high-frequency (20 Hz) for the L2P production => interpolation of 1Hz data to high-frequency
	The variable exists only in 1 Hz resolution in the L2 product. For the L2P product the same standard as in L2 product is used, but it is updated at high-frequency using auxiliary data (static or dynamic) => update at high-frequency using the same standard as used in L2 product.
	The variable is updated at high-frequency using another standard than in the L2 product or a correction not available in the L2 product.

Product	**Jason-3**	
	20 Hz L2P	
Correction	**NRT**	**STC**
Range	MLE4 from L2	MLE4 from L2
Orbit	Doris from L2	MOE from L2

Dry troposphere	Model computed from ECMWF Gaussian grids from L2	
Wet troposphere	Jason-3 MicroWave Radiometer from L2	
Ionosphere	filtered from L2	
Sea State Bias	Non parametric SSB [Tran et al., 2020]	
Ocean tide and loading tide	FES2014b [Carrère et al., 2016]	
Solid Earth tide	Elastic response to tidal potential [Cartwright and Tayler, 1971], [Cartwright and Edden, 1973]	
Pole tide	[Desai et al., 2015 + mean pole location 2017 (Ries et al., 2017)]	
Internal tide	Internal tide [Zaron, 2019] HRET v8.1	
Dynamic atmospheric correction	MOG2D High frequencies forced with **predicted** ECMWF pressure and wind field [Carrere and Lyard, 2003; operational version used, current version is 3.2.0] + inverse barometer Low frequencies	MOG2D High frequencies forced with **analysed+predicted** ECMWF pressure and wind field [Carrere and Lyard, 2003; operational version used, current version is 3.2.0] + inverse barometer Low frequencies
high frequency adjustment	High frequency adjustment [Tran et al., 2019]	
Low frequency invesre barometer	Low frequency (20 days filtering) part of inverse barometer.	Low frequency (20 days filtering) part of inverse barometer.
Mean Sea Surface	Combined (SCRIPPS,CNES/CLS15,DTU15)	

used	

Table 8. High-frequency L2P reference corrections overview.

8. Contacts

For more information, please contact:

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On Internet: https://www.aviso.altimetry.fr/

The user service is also interested in user feedbacks; questions, comments, proposals, requests are much welcome.

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