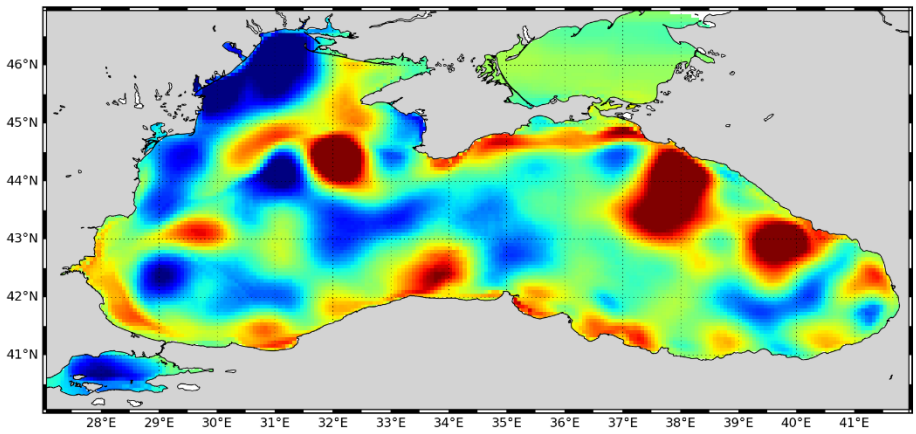

Data User Manual

Customer : ESA

Ref : ESA AO/1-9487/18/IEF/ESA-IPL-POE-EF-cb-LE-2018-588

Version : V1r1

Ref Internal : CLS-DSA-MU-20-0195

Date : 17/11/2021

Filename : EO4SIBS_D4.4_AltimetryL4_DUM_v1.1.docx

CLS
COLLECTE LOCALISATION SATELLITES

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Signatures

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Amendement Record Sheet

Date/Issue	Document change record Description	Section/Page
Jan 2021 / v1r0	creation	all
Nov 2021 / v1r1	Add project reference	First page

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Acronyms

C2	Cryosat-2
CLS	Collecte Localisation Satellites
DT	Delayed Time
DUM	Data User Manual
DUACS	Data Unification and Altimeter Combination System
HR	High Resolution (here 5Hz)
L4	Level 4 (Gridded merged product)
S3A	Sentinel-3A
SLA	Sea Level Anomaly

Table 1 : List of acronyms

1. Introduction

1.1. Scope of this document

This document holds the Data User Manual (DUM) prepared by EO4SIBS team, as part of the activities included in the [WP4] of the Proposal (Task 3 from SoW ref. ESA AO/1-9487/18/IEF/ ESA-IPL-POE-EF-cb-LE-2018-588). The objective of this document is to provide a detailed description of the dataset of the EO4SIBS Sea Surface Height gridded (L4) merged product.

1.2. Structure of this document

The DUM is structured as follow:

- Section 1: covers the introduction of this document
- Section 2: Describes the format of the EO4SIBS altimeter Sea Surface Height L4 product generated in the project

2. EO4SIBS Sea Surface Height datasets

2.1. Format file and global attributes

The altimeter L4 products are distributed in netCDF-4 format following the Climate and Forecast (CF) Metadata conventions (at least v1.6). Compression is applied for variables stored in netCDF files and time dimension is defined as a record dimension.

As a general procedure, the global attributes included in the produced netCDF files

are the following:

- **conventions**: CF-version
- **Metadata_Conventions** = "Unidata Dataset Discovery v1.0" ;
- **cdm_data_type**: type of the measurement considered
- **comment**: " Sea Surface Height measured by Altimetry and derived variables"
- **copyright**: copyright associated to the product
- **creator_name:** name of the processing chain that generated the product
- **creator_url:** url of the project
- **date_created / date_issued**: the date in which the file has been created
- **date_modified**: date of last modification
- **funding**: source of funding
- **geospatial_lat_min / geospatial_lat_max**: minimum and maximum value for latitude, range -90 to +90
- **geospatial_lat_resolution**: mean latitude resolution in degrees
- **geospatial_lat_units**: usually "degrees_north"
- **geospatial_lon_min / geospatial_lon_max**: minimum and maximum value for longitude, range -180 to +180
- **geospatial_lon_resolution**: mean longitude resolution in degrees
- **geospatial_lon_units**: usually "degrees_east"
- **history**: history of the file production/modification
- **institution**: By whom were the data produced.
- **keywords**: metadata/keyword
- **keywords_vocabulary** : guideline used for the keywords definition
- **platform**: satellites considered
- **processing_level**: Level of the altimeter processing
- **product_version**: the version of the product
- **project**: the project name "An Earth Observation Data Exploitation Platform for Science and Innovation in the Black Sea (EO4SIBS)"
- **reference**: reference of the product/project
- **software_version**: version of the software used for the production
- **source**: measurement considered
- **standard_name_vocabulary** : convention used for the variables standard name definition;
- **time_coverage_duration :** format ISO8601 duration string
- **time_coverage_end**: format ISO8601 date
- **time_coverage_resolution:** format ISO8601 duration string
- **time_coverage_start**: format ISO8601 date
- **title**: brief description of the dataset

2.2. Data distribution

Data will be distributed through the EO4SIBS website.

2.3. Spatial sampling and coverage

The L4 altimeter products are distributed on a regular grid with a 1/16° x 1/16° resolution.

The geographical coverage of the regional EO4SIBS altimeter products is defined as: longitude range [27E-42E] and latitude range [40N-47N]. Note that the Azov and Marmara Seas are not covered by the product.

2.4. Temporal resolution and coverage

Nine years (2011-2019) of altimeter data are available.

The measurements are available with a daily sampling.

2.5. NetCDF file format

We give here an example of dump of a L4 NetCDF file.

```
dimensions:
    time = 1 ;
    latitude = 112 ;
    longitude = 240 ;
    nv = 2 ;
variables:
    int crs ;
        crs:comment = "This is a container variable that describes the grid_mapping used by the data in this file.
This variable does not contain any data; only information about the geographic coordinate system." ;
        crs:grid_mapping_name = "latitude_longitude" ;
        crs:inverse_flattening = 298.257 ;
        crs:semi_major_axis = 6378136.3 ;
    float time(time) ;
        time:axis = "T" ;
        time:calendar = "gregorian" ;
        time:long_name = "Time" ;
        time:standard_name = "time" ;
        time:units = "days since 1950-01-01 00:00:00" ;
    float latitude(latitude) ;
        latitude:axis = "Y" ;
        latitude:bounds = "lat_bnds" ;
        latitude:long_name = "Latitude" ;
        latitude:standard_name = "latitude" ;
        latitude:units = "degrees_north" ;
        latitude:valid_max = 46.96875 ;
        latitude:valid_min = 40.03125 ;
    float lat_bnds(latitude, nv) ;
        lat_bnds:comment = "latitude values at the north and south bounds of each pixel." ;
        lat_bnds:units = "degrees_north" ;
    float longitude(longitude) ;
        longitude:axis = "X" ;
        longitude:bounds = "lon_bnds" ;
```

longitude:long_name = "Longitude" ;
longitude:standard_name = "longitude" ;
longitude:units = "degrees_east" ;
longitude:valid_max = 41.96875 ;
longitude:valid_min = 27.03125 ;
float lon_bnds(longitude, nv) ;
lon_bnds:comment = "longitude values at the west and east bounds of each pixel." ;
lon_bnds:units = "degrees_east" ;
int nv(nv) ;
nv:comment = "Vertex" ;
nv:units = "1" ;
int err(time, latitude, longitude) ;
err:_FillValue = -2147483647 ;
err:comment = "The formal mapping error represents a purely theoretical mapping error. It mainly traduces errors induced by the constellation sampling capability and consistency with the spatial/temporal scales considered, as described in Le Traon et al (1998) or Ducet et al (2000)" ;
err:coordinates = "longitude latitude" ;
err:grid_mapping = "crs" ;
err:long_name = "Formal mapping error" ;
err:scale_factor = 0.0001 ;
err:units = "m" ;
int adt(time, latitude, longitude) ;
adt:_FillValue = -2147483647 ;
adt:comment = "The absolute dynamic topography is the sea surface height above geoid; the adt is obtained as follows: adt=sla+mdt where mdt is the mean dynamic topography; see the product user manual for details" ;
adt:coordinates = "longitude latitude" ;
adt:grid_mapping = "crs" ;
adt:long_name = "Absolute dynamic topography" ;
adt:scale_factor = 0.0001 ;
adt:standard_name = "sea_surface_height_above_geoid" ;
adt:units = "m" ;
int ugos(time, latitude, longitude) ;
ugos:_FillValue = -2147483647 ;
ugos:coordinates = "longitude latitude" ;
ugos:grid_mapping = "crs" ;
ugos:long_name = "Absolute geostrophic velocity: zonal component" ;
ugos:scale_factor = 0.0001 ;
ugos:standard_name = "surface_geostrophic_eastward_sea_water_velocity" ;
ugos:units = "m/s" ;
int vgos(time, latitude, longitude) ;
vgos:_FillValue = -2147483647 ;
vgos:coordinates = "longitude latitude" ;
vgos:grid_mapping = "crs" ;
vgos:long_name = "Absolute geostrophic velocity: meridian component" ;
vgos:scale_factor = 0.0001 ;
vgos:standard_name = "surface_geostrophic_northward_sea_water_velocity" ;
vgos:units = "m/s" ;
int sla(time, latitude, longitude) ;
sla:_FillValue = -2147483647 ;
sla:comment = "The sea level anomaly is the sea surface height above mean sea surface; it is referenced to the [1993, 2012] period; see the product user manual for details" ;
sla:coordinates = "longitude latitude" ;
sla:grid_mapping = "crs" ;
sla:long_name = "Sea level anomaly" ;
sla:scale_factor = 0.0001 ;
sla:standard_name = "sea_surface_height_above_sea_level" ;

```
            sla:units = "m" ;
      int ugosa(time, latitude, longitude) ;
            ugosa:_FillValue = -2147483647 ;
            ugosa:comment = "The geostrophic velocity anomalies are referenced to the [1993, 2012] period" ;
            ugosa:coordinates = "longitude latitude" ;
            ugosa:grid_mapping = "crs" ;
            ugosa:long_name = "Geostrophic velocity anomalies: zonal component" ;
            ugosa:scale_factor = 0.0001 ;
            ugosa:standard_name =
"surface_geostrophic_eastward_sea_water_velocity_assuming_sea_level_for_geoid" ;
            ugosa:units = "m/s" ;
      int vgosa(time, latitude, longitude) ;
            vgosa:_FillValue = -2147483647 ;
            vgosa:comment = "The geostrophic velocity anomalies are referenced to the [1993, 2012] period" ;
            vgosa:coordinates = "longitude latitude" ;
            vgosa:grid_mapping = "crs" ;
            vgosa:long_name = "Geostrophic velocity anomalies: meridian component" ;
            vgosa:scale_factor = 0.0001 ;
            vgosa:standard_name =
"surface_geostrophic_northward_sea_water_velocity_assuming_sea_level_for_geoid" ;
            vgosa:units = "m/s" ;

// global attributes:
            :Conventions = "CF-1.6" ;
            :Metadata_Conventions = "Unidata Dataset Discovery v1.0" ;
            :cdm_data_type = "Grid" ;
            :comment = "Sea Surface Height measured by Altimetry and derived variables" ;
            :copyright = "If this data is used for publication, the following acknowledgment should be included: Black
Sea altimeter data  were produced by CLS (https://www.cls.fr/en/) and their production was funded by ESA under
project EO4SIBS (contract 4000127237/19/I-EF)" ;
            :creator_name = "CLS - EO4SIBS" ;
            :creator_url = "http://www.eo4sibs.uliege.be" ;
            :date_created = "2021-01-18T16:38:39Z" ;
            :date_issued = "2021-01-18T16:38:39Z" ;
            :date_modified = "2021-01-18T16:38:39Z" ;
            :funding = "European Space Agency under contract reference 4000127237/19/I-EF" ;
            :geospatial_lat_max = 46.96875 ;
            :geospatial_lat_min = 40.03125 ;
            :geospatial_lat_resolution = 0.0625 ;
            :geospatial_lat_units = "degrees_north" ;
            :geospatial_lon_max = 41.96875 ;
            :geospatial_lon_min = 27.03125 ;
            :geospatial_lon_resolution = 0.0625 ;
            :geospatial_lon_units = "degrees_east" ;
            :geospatial_vertical_max = 0. ;
            :geospatial_vertical_min = 0. ;
            :geospatial_vertical_positive = "down" ;
            :geospatial_vertical_resolution = "point" ;
            :geospatial_vertical_units = "m" ;
            :history = "2021-01-18 16:38:39Z: Creation" ;
            :institution = "CLS" ;
            :keywords = "Oceans > Ocean Topography > Sea Surface Height" ;
            :keywords_vocabulary = "NetCDF COARDS Climate and Forecast Standard Names" ;
            :platform = "Cryosat-2, ENVISAT Extension Phase, Jason-1 Interleaved, OSTM/Jason-2," ;
            :processing_level = "L4" ;
            :product_version = "1.0" ;
```

:project = "An Earth Observation Data Exploitation Platform for Science and Innovation in the Black Sea (EO4SIBS)" ;

:references = "http://www.eo4sibs.uliege.be " ;

:software_version = "EO4SIBS regional product v1.0" ;

:source = "Altimetry measurements" ;

:standard_name_vocabulary = "NetCDF Climate and Forecast (CF) Metadata Convention Standard Name Table v37" ;

:summary = "Delayed-Time Level-4 sea surface height and derived variables measured by multi-satellite altimetry observations over Black Sea." ;

:time_coverage_duration = "P1D" ;

:time_coverage_end = "2011-01-01T00:00:00Z" ;

:time_coverage_resolution = "P1D" ;

:time_coverage_start = "2011-01-01T00:00:00Z" ;

:title = "Experimental delayed time merged all satellites gridded Sea Surface Height L4 product and derived variables for the Black Sea "

2.6. Name convention

The file naming will follow the following convention:

<processing_delay>_<area>_<altimeter_mission>_<type_of_content>_<product_level>-<measurement_date>-<production_date>.nc

with

processing_delay	dt
area	blacksea
altimeter_mission	allsat (all altimeter available are used)
type_of_content	phy
product_level	l4
measurement_date	Day covered by the measurements (YYYYMMDD format)
production_date	Date of production of the file (YYYYMMDD format)

Therefore, an example for the L4 products is:

- dt _blacksea_allsat_phy_l4_20141027_20210118.nc