isardSAT

CP4O

Data Set User Manual

—DSUM—

isardSAT Reference: ISARD_ESA_CPO_USR_DSUM_182
Issue: V2

Prepared by: isardSAT CP4O team
Reviewed and Approved by: Mònica Roca
12 December 2013
Activity: CryoSat+ for Ocean

This page has been intentionally left blank

Change Record

Date	Issue	Section	Page	Comment
21 March 2013	draft	all	all	Initial Issue
04 April 2013	draft2	all	all	Format reviewed
24 May 2013	V1a	3	8-36	Data Set Descriptions
05 July 2013	V1b	2, 5	6, 38	New Section added: Data Sets Overview Section 5 updated
25 October 2013	V1c	Various	Various	Some updates
12 December 2013	V2	Various	Various	Changes as requested by ESA review.

Control Document

Process	Name	Date
Written by:	isardSAT CP4O team	12 December 2013
Checked by:	Pablo García	12 December 2013
Approved by:	Mònica Roca	12 December 2013

Distribution List

Company	Name
ESA	Jerome Benveniste Salvatore Dinardo Bruno Manuel Lucas
SATOC	David Cotton

Company	Name
isardSAT	Pablo García Bernat Martínez Mònica Roca Cristina Martin-Puig

Table of Contents

1 Introduction

1.1 Scope

The scope of this document is to define all data sets needed by each partner in order to develop the new algorithms and produce the new products defined. Data sets include CryoSat-2 data, auxiliary data, in-situ data and other EO satellites data.

This document is expected to be updated along the course of the project following the evolutions of the CP4O team data requirements.

1.2 Acronyms

TBD	To be defined
DS	Data Set
CS2	CryoSat-2
CP4O	CryoSat Plus For Ocean

1.3 References

AD. 1 Cryosat +: Ocean Theme. CP4O-Cryosat Plus 4 Oceans. Technical Proposal. November 2011. SATOC, DTU Space, isardSAT, NOC, Noveltis, STARLAB, TUDelft, University of Porto and CLS. Response to ESA ITT AO/1-6827/11/I-NB, November 2011

AD. 2 CryoSat-2 Product Handbook. 2013/04/17.
https://earth.esa.int/documents/10174/125272/CryoSat-PHB-17apr2013.pdf/23bdad87-5537-4980-b3b9-c243941e93fc?version=1.1

AD. 3 CRYOSAT Ground Segment Instrument Processing Facility L1b. Products Specification Format. Issue 4.9. 2011/11/14. CS-RS-ACS-GS-5106
https://earth.esa.int/documents/10174/125273/%5BPROD-FMT%5D_L1_Products_Format_Specification_v4.9.pdf/7bc7bdf6-3fef-4cc2-b7c9-b14437dcc6c2?version=1.0

AD. 4 CryoSat-2 L2 Products Format Specifications. Issue 4.6. 2011/11/14. CS-RS-ACS-GS-5123
https://earth.esa.int/documents/10174/125273/%5BL2_FMT%5D%20-+L2_Products_Format_Specification_v2.8.pdf/44c48581-c370-4c30-94a6-52051f637ff3?version=1.0

AD. 5 [Boy et al., 2011]: F. Boy et al., “Cryosat Processing Prototype, LRM and SAR processing on CNES side”, oral presentation given at OSTST’2011.

AD. 6 [Boy et al., 2012]: Boy, F., J.-D. Desjonqueres, N. Picot, T. Moreau, S. Labroue, J.-C. Poisson, and P. Thibaut, 2012, Cryosat Processing Prototype: LRM and SAR processing on CNES side. Ocean Surface Topography Science Team 2012, Venice, 27-28 Sept 2012, Available from: http://www.aviso.oceanobs.com/en/courses/sci-teams/ostst-2012.html.

AD. 7 CPP SAR L2 Product Format Description. Issue 1.0. 2013/05/06. CLS-DIR-NT-13-118

2 Data sets overview

In this section, a general overview of the different CP4O data sets is given. It is specifically described for each particular investigation the data type, responsible and the geographical and time coverage. Afterwards, in section 4, a much more detailed description is made.

Table 2–2-1: Summary of CP4O data sets and overall description

Field of Investigation	CS-2 data mode	Responsible	Time Coverage	Geographical Coverage
Open Ocean	LRM	TUDelft	CS-2 entire mission	Global
Open Ocean	SAR	Starlab	Jan 3rd, 2012 – Jan 16th, 2012	Lat = [46N, 61N] Lon = [0, 17W]
Open Ocean	SAR & RDSAR	CLS	May-June-July 2012	Lat = [3S, 25S] Lon = [85W, 160W]
Coastal Ocean	SAR	NOC	April 2011	South Coast of UK
Coastal Ocean	SARin	isardSAT	CS-2 entire mission	Global SARin mask areas of interest
Polar Ocean	SAR	DTU Space	CS-2 entire mission	Above 65 degrees of latitude
Sea Floor Mapping	SAR	DTU Space	One CS2 whole cycle of 369 days	Dedicated SAR mask for Sea Floor

In addition, here below they are also described very briefly the different geophysical corrections addressed in this project. Similarly, afterwards in section 4 a much more detailed description is made.

Table 2–2-2: Summary of CP4O geophysical corrections and overall description

Geophysical Correction	Responsible	Time Coverage	Geographical Coverage
Ionospheric	Noveltis	CS-2 entire mission	Lat = [30N, 70N] Lon = [-15E, 40E]
Tidal	Noveltis	CS-2 entire mission	Lat = [22.5N, 64N] Lon = [-20E, 13E]
Wet Troposphere	University of Porto	Start of Jason-2 mission (04-07-2008) until 31-12-2012.	Global
Others	TUDelft	CS-2 entire mission	Global

3 CryoSat-2 Input Baseline Data

3.1 CryoSat-2 products

There are two deliverable products of CryoSat-2 mission: L2 Geophysical Data Record (GDR) and L1b data product. Additionally, there is an intermediate product not delivered to public users called Full Bit Rate (FBR) product.

L2 GDR products contain the main ocean parameters computed at level-2 (Sea Surface Height, Significant Wave Height and Wind Speed) with all the geophysical corrections (atmospheric and tidal) applied as well as all the waveforms retracked according to their physical characteristics. L2 GDR products will be used to analyse these parameters and to modify some of the geophysical corrections if needed. In addition, L2 Interim products will be used to retrieve some additional parameters not included at conventional L2 GDR products.

L1b data product contains the main parameters computed at level-1 (range, sigma_0 scaling factor and waveforms) with all instrumental corrections applied. L1b data products will be used to apply an improved retracker adapted to SAR waveforms.

FBR data product contains the raw data parameters at instrument level with some calibration corrections computed but not applied. FBR products will be used to feed the RDSAR L1b processing chain in order to generate L1b LRM products from FBR SAR data.

In addition, thanks to the collaboration of CNES and CLS in the CP4O project, we have been able to perform some RDSAR sub-tasks starting from an additional data set: the CPP SAR L1b Products. The CryoSat Processing Prototype (CPP) is a CNES effort done in the scope of the Sentinel-3 mission preparation, to test and develop innovative methods for processing SAR mode data over ocean.

3.2 CryoSat-2 Auxiliary Data

Auxiliary data is needed as an input of the processing chain in order to take into account all models and standards used. The following table summarises all models and their correspondent auxiliary files used in CryoSat-2 mission. This table will help identifying the baseline models used for CryoSat-2 products.

Table 3-1: Models and Auxiliary data

Reference	Model	Auxiliary files	Comments
Orbit	DORIS Precise Orbit		
Reference Ellipsoid	WGS84		
Position Frame	International Terrestrial Reference Frame (ITRF)		
Dry Troposphere Range Correction	Meteo France		

Table 3-1: Models and Auxiliary data

Reference	Model	Auxiliary files	Comments
Wet Troposphere Range Correction Model	Meteo France		
Wet Tropospheric Correction from Radiometer	ECMWF		
Dynamic Atmospheric Correction	MOG2D (Meteo France)		
Ionospheric Correction	GIM model (nominal) Bent model (alternative)		
Sea State Bias			
Mean Sea Surface	UCL04 model: 1. Arctic Gravity Project + PIPS mean Dynamic Topography (above 81.5 degrees north) 2. ERS MSS (between 60 and 81.5 degrees north) 3. CLS01 (over the rest of the globe)	AUX_MSSURF	
Mean Dynamic Topography			
Geoid	EGM96	AUX_GEOID_	
Bathymetry model	MACESS Ocean Depth/land Elevation values		
Digital Terrain Model	USA NOAA	AUX_LS_MAP	
Inverse Barometer Correction	Meteo France		
Non-tidal High-frequency Dealiasing Correction			
Tide Solution 1	FES2004		
Tide Solution 2			
Ocean Loading Tide	FES2004		
Equilibrium long-period ocean tide model			
Non-equilibrium long-period ocean tide model			
Solid Earth Tide Model	Cartwright model		
Geocentric Polar Tide Model			
Wind Speed from Model	None		
Altimeter Wind Speed	Modified Witter and Chelton model	AUX_WNDCHE	

Table 3-1: Models and Auxiliary data

Reference	Model	Auxiliary files	Comments
Model			
Rain Flag			
Ice Flag			

4 Data Sets Description

This section contains the description of all the data sets corresponding to each sub-theme. There is one sub-section for each sub-theme.

In each sub-section, there are as many tables as needed to describe the data sets used for the sub-theme investigation.

For all the sub-themes (except geophysical corrections) there are three basic tables:

1- CryoSat-2 data

2- Other EO missions validation data

3- In situ validation data

The field structure of these tables may suffer some minor variations depending on the dedicated sub-theme investigation data needs.

The structure of the tables for the Geophysical corrections is different from the above mentioned. It will depend on each specific study. For example, the WTC will need a more extensive table collection, as it needs data from a wider spectra of instruments and missions.

4.1 Open Ocean LRM (TUDelft)

Table 4-1: Open Ocean LRM CS2 Data – RADS

Parameter	Value	Comments
OPEN OCEAN LRM – RADS CryoSat-2 Data		
Partner	TUDelft	
Geographical Coverage	Worldwide	
Temporal Coverage	20130101 to 20130320	
Product Type	ESA FDM and LRM L1B	
Processing version		
Cycles/Passes	Subcycles 36-38	
Main parameters	The needed to retrack and compute SWH, backscatter and range.	
Auxiliary data	ESA Baseline plus common RADS	
Product provider	TU Delft / NOAA	
Access details	Register at: http://rads.tudelft.nl/rads/data/authentication.cgi	

Table 4-1: Open Ocean LRM CS2 Data – RADS

Parameter	Value	Comments
FURTHER INFORMATION		
URL´s	http://rads.tudelft.nl/rads/rads.shtml	
Documents	http://rads.tudelft.nl/rads/literature.shtml	

Table 4-2: Open Ocean LRM EO Validation Data - Jason-1&2

Parameter	Value	Comments
EO Validation Data Jason-1&2		
Mission/Instrument	Jason-2, Jason 2	
Product Type	L2 GDR	
Processing version		
Cycles/Passes	Jason-1 (C406-414) and Jason-2 (C165-173)	
Main parameters	Name: Field Nr:	
Auxiliary data	ESA Baseline plus common RADS	
Product provider	NOAA/CNES	
FURTHER INFORMATION		
Format Specification	NETCDF	
URL´s	avisoftp.cnes.fr	
Documents	OSTM/Jason-2 Products Handbook, SALP-MU-M-OP-15815-CN	

4.2 Open Ocean SAR (Starlab)

Table 4-3: Open Ocean SAR CS2 Data - CPP

Parameter	Value	Comments
CryoSat-2 Data - CPP		
Partner	Starlab	

Table 4-3: Open Ocean SAR CS2 Data - CPP

Parameter	Value	Comments
Geographical Coverage	Lat = [46N, 61N] Lon = [0, 17W]	
Temporal Coverage	Jan 3rd, 2012 – Jan 16th, 2012	
Product Type	L1b CPP	
Processing version	11	
Cycles/Passes		
Products File Names	CS_OPER_SIR1TKSA0__20120104T221357_20120104T221644_0001.DBL.DOP10.RES.DOP1B.RESDOP20.RES CS_OPER_SIR1TKSA0__20120104T222016_20120104T223045_0001.DBL.DOP10.RES.DOP1B.RESDOP20.RES CS_OPER_SIR1TKSA0__20120105T225453_20120105T230120_0001.DBL.DOP10.RES.DOP1B.RESDOP20.RES CS_OPER_SIR1TKSA0__20120105T230120_20120105T230337_0001.DBL.DOP10.RES.DOP1B.RESDOP20.RES CS_OPER_SIR1TKSA0__20120106T220923_20120106T221711_0001.DBL.DOP10.RES.DOP1B.RESDOP20.RES CS_OPER_SIR1TKSA0__20120106T221753_20120106T222815_0001.DBL.DOP10.RES.DOP1B.RESDOP20.RES CS_OPER_SIR1TKSA0__20120107T114046_20120107T114140_0001.DBL.DOP10.RES.DOP1B.RESDOP20.RES CS_OPER_SIR1TKSA0__20120107T225227_20120107T225900_0001.DBL.DOP10.RES.DOP1B.RESDOP20.RES CS_OPER_SIR1TKSA0__20120107T225900_20120107T230104_0001.DBL.DOP10.RES.DOP1B.RESDOP20.RES CS_OPER_SIR1TKSA0__20120108T220602_20120108T220701_0001.DBL.DOP10.RES.DOP1B.RESDOP20.RES CS_OPER_SIR1TKSA0__20120108T220701_20120108T221442_0001.DBL.DOP10.RES.DOP1B.RESDOP20.RES CS_OPER_SIR1TKSA0__20120108T221531_20120108T222546_0001.DBL.DOP10.RES.DOP1B.RESDOP20.RES CS_OPER_SIR1TKSA0__20120109T113824_20120109T113913_0001.DBL.DOP10.RES.DOP1B.RESDOP20.RES CS_OPER_SIR1TKSA0__20120109T225002_20120109T225640_0001.DBL.DOP10.RES.DOP1B.RESDOP20.RES CS_OPER_SIR1TKSA0__20120109T225640_20120109T225836_0001.DBL.DOP10.RES.DOP1B.RESDOP20.RES CS_OPER_SIR1TKSA0__20120110T220332_20120110T220439_0001.DBL.DOP10.RES.DOP1B.RESDOP20.RES CS_OPER_SIR1TKSA0__20120110T220439_20120110T221214_0001.DBL.DOP10.RES.DOP1B.RESDOP20.RES CS_OPER_SIR1TKSA0__20120111T224736_20120111T225421_0001.DBL.DOP10.RES.DOP1B.RESDOP20.RES CS_OPER_SIR1TKSA0__20120111T225421_20120111T225606_0001.DBL.DOP10.RES.DOP1B.RESDOP20.RES CS_OPER_SIR1TKSA0__20120112T215957_20120112T220031_0001.DBL.DOP10.RES.DOP1B.RESDOP20.RES CS_OPER_SIR1TKSA0__20120112T220059_20120112T220217_0001.DBL.DOP10.RES.DOP1B.RESDOP20.RES CS_OPER_SIR1TKSA0__20120112T220217_20120112T220945_0001.DBL.DOP10.RES.DOP1B.RESDOP20.RES CS_OPER_SIR1TKSA0__20120113T224510_20120113T225202_0001.DBL.DOP10.RES.DOP1B.RESDOP20.RES CS_OPER_SIR1TKSA0__20120113T225202_20120113T225239_0001.DBL.DOP10.RES.DOP1B.RESDOP20.RES CS_OPER_SIR1TKSA0__20120113T225247_20120113T225337_0001.DBL.DOP10.RES.DOP1B.RESDOP20.RES CS_OPER_SIR1TKSA0__20120114T215704_20120114T215822_0001.DBL.DOP10.RES.DOP1B.RESDOP20.RES CS_OPER_SIR1TKSA0__20120114T215831_20120114T215956_0001.DBL.DOP10.RES.DOP1B.RESDOP20.RES CS_OPER_SIR1TKSA0__20120114T215956_20120114T220716_0001.DBL.DOP10.RES.DOP1B.RESDOP20.RES CS_OPER_SIR1TKSA0__20120115T224244_20120115T224930_0001.DBL.DOP10.RES.DOP1B.RESDOP20.RES CS_OPER_SIR1TKSA0__20120116T215438_20120116T215733_0001.DBL.DOP10.RES.DOP1B.RESDOP20.RES CS_OPER_SIR1TKSA0__20120116T215733_20120116T220447_0001.DBL.DOP10.RES.DOP1B.RESDOP20.RES	
Main parameters	Radar Echoes, Tracker command	
Auxiliary data	Baseline	
Product provider	CNES	
FURTHER INFORMATION		
Format Specification	See **AD. 7**.	
Documents	CPP_product_format.pdf	

Table 4-4: Open Ocean SAR In Situ Validation Data - UK Metoffice

Parameter	Value	Comments
In-situ Validation Data – UK Metoffice		

Location	WMO # Lat Lon Owner 64045 59.100N 11.401W UK Metoffice 64046 60.701N 4.5W UK Metoffice 62081 51N 13.30W UK Metoffice 62095 53.056N 15.924W Met Eireann 62105 55.400N 12.2W UK Metoffice 62163 47.500N 8.5W UK Metoffice	
Temporal Coverage	Jan 3rd, 2012 – Jan 16th, 2012	
Description	Sampling period: 1h	
Main parameters	Name: wind direction, wind speed, mean sea level pressure, measured wave period, measured wave height Field Nr:7,8,14,15,16	
Auxiliary data		
Product provider	UK Metoffice	
FURTHER INFORMATION		
Format Specification	MSExcel	
Documents	“KEY TO ELEMENTS” provided by UK Metoffice ©	

4.3 Open Ocean SAR (CLS)

Table 4-5: Open Ocean SAR CS2 Data - CPP

Parameter	Value	Comments
CryoSat-2 Data - CPP		
Partner	CLS	
Geographical Coverage	Lat = [3S, 25S] Lon = [85W, 160W]	
Temporal Coverage	May-June-July 2012	
Product Type	L1b CPP	
Processing version	V 11.0	
Cycles/Passes	Cycles: 30-32	
Main parameters	Radar Echoes, Tracker command	
Auxiliary data	Baseline	
Product provider	CNES	

Table 4-5: Open Ocean SAR CS2 Data - CPP

Parameter	Value	Comments
FURTHER INFORMATION		
Format Specification	See **AD. 7**.	
Documents	CPP_product_format.pdf	

Table 4-6: Open Ocean SAR CS2 Validation Data – RDSAR

Parameter	Value	Comments
CS2 Validation Data- RDSAR		
Mission/Instrument	CryoSat-2/RDSAR	
Product Type	L2 CPP	
Processing version	V 11.0	
Cycles/Passes	Cycles: 30-32	
Main parameters	Results from CPP retracking on PLRM parameters	
Auxiliary data	Baseline	
Product provider	CNES	
FURTHER INFORMATION		
Format Specification	See **AD. 7**.	
Documents	CPP_product_format.pdf	

Table 4-7: Open Ocean SAR EO Validation Data - Jason-2

Parameter	Value	Comments
EO Validation Data – Jason-2		
Location	Jason-2	
Temporal Coverage	L2 GDR-D	
Main parameters	Name: Field Nr:	
Auxiliary data		
Product provider	CNES	
FURTHER INFORMATION		
Format Specification	NETCDF	
URL´s	avisoftp.cnes.fr	
Documents	OSTM/Jaon-2 Products	

Table 4-7: Open Ocean SAR EO Validation Data - Jason-2

Parameter	Value	Comments
	Handbook, SALP-MU-M-OP-15815-CN	

4.4 Open Ocean RDSAR (CLS)

Table 4-8: Open Ocean RDSAR CS2 Data - ESA

Parameter	Value	Comments
CryoSat-2 Data - ESA		
Partner	CLS	
Geographical Coverage	Lat = [3S, 25S] Lon = [85W, 160W]	
Temporal Coverage	May-June-July 2012	
Product Type	L1	
Cycles/Passes	Cycles: 30-32	
Main parameters	Power waveforms, tracker range	
Auxiliary data	Baseline	
Product provider	ESA	
FURTHER INFORMATION		
Format Specification	See AD. 3	
URL´s	See AD. 3	

Table 4-9: Open Ocean RDSAR CS2 Validation Data - LRM

Parameter	Value	Comments
CS2 Validation Data - LRM		
Mission/Instrument	CryoSat-2/LRM	
Product Type	L2 CPP	
Cycles/Passes	Cycles: 30-32	
Main parameters	Main geophysical parameters from LRM retrackers.	
Auxiliary data	Baseline	
Product provider	CNES	
FURTHER INFORMATION		

Table 4-9: Open Ocean RDSAR CS2 Validation Data - LRM

Parameter	Value	Comments
Format Specification	See **AD. 7**.	
Documents	CPP_product_format.pdf	

Table 4-10: Open Ocean RDSAR EO Validation Data - Jason-2

Parameter	Value	Comments
4.4.1.1 EO Validation Data – Jason-2		
Mission/Instrument	Jason-2	
Product Type	L2 GDR-D	
Main parameters	Main geophysical parameters	
Product provider	CNES	
FURTHER INFORMATION		
Format Specification	NETCDF	
URL´s	avisoftp.cnes.fr	
Documents	OSTM/Jason-2 Products Handbook, SALP-MU-M-OP-15815-CN	

Table 4-11: Open Ocean RDSAR EO Validation Data - RADS

Parameter	Value	Comments
EO Validation Data – RADS		
Mission/Instrument	CryoSat-2	
Product Type	RADS PLRM	
Main parameters	Main geophysical parameters	
Product provider	Delft Institute for Earth-Oriented Space Research and NOAA Laboratory for Satellite Altimetry.	
FURTHER INFORMATION		
Format Specification	NETCDF	
URL´s	http://rads.tudelft.nl/rads/radsmanual.pdf	
Documents	RADS version 3.1 User Manual and Format Specification	

4.5 Coastal Ocean SAR (NOC)

Table 4-12: Coastal Ocean SAR CS2 Data - ESA

Parameter	Value	Comments
CryoSat-2 Data - ESA		
Partner	NOC	
Geographical Coverage	South Coast of UK	
Temporal Coverage	Selected tracks on April 2011	
Product Type	L1B	
Processing version	As available from IPF	
Cycles/Passes	N/A	
Products File Names	TBD	
Main parameters	Name: Multi-looked SAR waveforms and related retracking parameters Field Nr: see https://earth.esa.int/c/document_library/get_file?folderId=125272&name=DLFE-6409.pdf	
Auxiliary data	Baseline	
Product provider	ESA IPF	
FURTHER INFORMATION		
Format Specification	DBL binary products following ESA specifications. See AD. 3.	
URL´s	https://earth.esa.int/c/document_library/get_file?folderId=125272&name=DLFE-6409.pdf	
Documents	CryoSat-2 product Handbook 2013	

Table 4-13: Coastal Ocean SAR EO Validation Data – JASON-2

Parameter	Value	Comments
EO Validation Data – JASON-2		
Mission/Instrument	Jason-2	

Table 4-13: Coastal Ocean SAR EO Validation Data – JASON-2

Parameter	Value	Comments
Product Type	Satellite altimetry	
Processing version	d	
Temporal Coverage	Selected tracks on April 2011	
Main parameters	Name: SSH and SWH	
Product provider	AVISO	
Access details	ftp: avisoftp.cnes.fr usr: anonymous	
FURTHER INFORMATION		
Format Specification	NetCDF	
URL´s	avisoftp.cnes.fr/documentation/handbook	
Documents	Jason-2 user Handbook	

Table 4-14: Coastal Ocean SAR In Situ Validation Data - Channel Coast

Parameter	Value	Comments
In-situ Validation Data – Channel Coast		
Location	South Coast of UK	
Temporal Coverage	April 2011	
Description	In situ measurements from tide gauges and buoys	
Access Details	http://www.channelcoast.org/	
Main parameters	Name: SSH and SWH Field Nr: N/A	
Auxiliary data	None	
Product provider	NOC/CCO	
Access details	Real Time UKMO buoy data are available from UK Met Office web pages: http://www.metoffice.gov.uk/weather/marine/observations/#/maws_pic.html Archived UKMO buoy data are available to registered users through ICOADS : http://rda.ucar.edu/datasets/ds540.0/ Further Wave Buoy Data from the Channel Coast Observatory: http://www.channelcoast.org/data_management/online_data_catalogue/	

Table 4-14: Coastal Ocean SAR In Situ Validation Data - Channel Coast

Parameter	Value	Comments
	UK Tide Gauge data from BODC: https://www.bodc.ac.uk/data/online_delivery/ntslf/processed_customise_time_selection/	
FURTHER INFORMATION		
Format Specification	ASCII	
URL´s	N/A	
Documents	N/A	

4.6 Coastal Ocean SARIN (isardSAT)

Table 4-15: Coastal Ocean SARin CS2 Data - ESA

Parameter	Value	Comments
CryoSat-2 Data - ESA		
Partner	isardSAT	
Geographical Coverage	Cuban Archipelago : (Lat 19-24N / Lon 73-86W). Chilean coast.	Some other interesting areas could be investigated worldwide taking into account special geographical features.
Temporal Coverage	CS-2 entire mission	Cuban SARin mask has been set from 1st October 2012.
Product Type	L1B, L2I	L2I products has information about the retracked point (not present at L2 products)
Processing version	L1b: SARIN/4.0 L2I: IPF2SRN/2.4	
Cycles/Passes	Cycle: 5 (for Cuba) Relative Orbits: 4986, 4993, 5015, 5022, 5044, 5051, 5073, 5080, 5102, 5109, 5131, 5138	
Products File Names	CS_OFFL_SIR_SINI2__20121202T110747_20121202T110910_B001.DBL CS_OFFL_SIR_SINI2__20121202T232006_20121202T232129_B001.DBL CS_OFFL_SIR_SINI2__20121204T110520_20121204T110643_B001.DBL CS_OFFL_SIR_SINI2__20121204T231738_20121204T231901_B001.DBL CS_OFFL_SIR_SINI2__20121206T110253_20121206T110416_B001.DBL CS_OFFL_SIR_SINI2__20121206T231511_20121206T231634_B001.DBL CS_OFFL_SIR_SINI2__20121208T110026_20121208T110148_B001.DBL CS_OFFL_SIR_SINI2__20121208T231245_20121208T231407_B001.DBL CS_OFFL_SIR_SINI2__20121210T105759_20121210T105921_B001.DBL	

Parameter	Value	Comments
	CS_OFFL_SIR_SINI2__20121210T231016_20121210T231139_B001.DBL CS_OFFL_SIR_SINI2__20121212T105531_20121212T105654_B001.DBL CS_OFFL_SIR_SINI2__20121212T230750_20121212T230912_B001.DBL CS_OFFL_SIR_SIN_1B_20121202T110747_20121202T110910_B001.DBL CS_OFFL_SIR_SIN_1B_20121202T232006_20121202T232129_B001.DBL CS_OFFL_SIR_SIN_1B_20121204T110520_20121204T110643_B001.DBL CS_OFFL_SIR_SIN_1B_20121204T231738_20121204T231901_B001.DBL CS_OFFL_SIR_SIN_1B_20121206T110253_20121206T110416_B001.DBL CS_OFFL_SIR_SIN_1B_20121206T231511_20121206T231634_B001.DBL CS_OFFL_SIR_SIN_1B_20121208T110026_20121208T110148_B001.DBL CS_OFFL_SIR_SIN_1B_20121208T231245_20121208T231407_B001.DBL CS_OFFL_SIR_SIN_1B_20121210T105759_20121210T105921_B001.DBL CS_OFFL_SIR_SIN_1B_20121210T231016_20121210T231139_B001.DBL CS_OFFL_SIR_SIN_1B_20121212T105531_20121212T105654_B001.DBL CS_OFFL_SIR_SIN_1B_20121212T230750_20121212T230912_B001.DBL	
Main parameters	Name/Field: Retracked range correction / #19(L2I) x-Track Angle / #34(L2I)	
Auxiliary data	Baseline	
Product provider	ESA	
FURTHER INFORMATION		
Format Specification	DBL binary products following ESA specifications. See AD. 2, AD. 3, AD. 4.	
URL´s	https://earth.esa.int/c/document_library/get_file?folderId=125272&name=DLFE-6409.pdf	
Documents	CryoSat-2 product Handbook	

Note: No validation data is described in this sub-section because there is no validation exercise involved in this sub-theme investigation.

4.7 Polar Ocean SAR (DTU Space)

Table 4-16: Polar Ocean SAR CS2 Data - ESA

Parameter	Value	Comments
CryoSat-2 Data - ESA		
Partner	DTU Space	
Geographical Coverage	Above 65 deg latitude	
Temporal Coverage	CS-2 entire mission	
Product Type	L1b and L2	
Processing version	4.0 and 2.4	
Cycles/Passes	All available	

Table 4-16: Polar Ocean SAR CS2 Data - ESA

Parameter	Value	Comments
Main parameters	Surface Height	
Auxiliary data	Baseline	
Product provider	ESA	
FURTHER INFORMATION		
Format Specification	ESA CryoSat DBL format. See AD. 2, AD. 3, AD. 4.	
URL´s	https://earth.esa.int/c/document_library/get_file?folderId=125273&name=DLFE-1413.pdf	
Documents	Product Specification Format Issue: 4.9 CS-RS-ACS-GS-5106	

Table 4-17: Polar Ocean SAR EO Validation Data – EnviSat ASAR

Parameter	Value	Comments
EO Validation Data - EnviSat ASAR		
Mission/Instrument	EnviSat-ASAR	
Product Type	Image mode	
Processing version		
Cycles/Passes	August 2010 to end of EnviSat	
Main parameters	Name: Field Nr:	
Auxiliary data	Baseline	
Product provider	ESA and DTU Space	
FURTHER INFORMATION		
Format Specification	ESA EnviSat format and TIFF	
URL´s	https://earth.esa.int/web/guest/missions/esa-operational-eo-missions/envisat/instruments/asar/product-handbook and http://www.seaice.dk	
Documents	ASAR Product Handbook Issue 2.2	

Table 4-18: Polar Ocean SAR In Situ Validation Data - DTU & NSIDC

Parameter	Value	Comments
In-situ Validation Data - DTU & NSIDC		
Location	Arctic Ocean north of Alaska, Canada, Greenland and Svalbard	
Temporal Coverage	March 17 to April 17 2011 March 15 to April 29 2012	
Description	ESA CryoVEx 2011 and 2012 campaigns. NASA IceBridge 2011 and 2012 campaigns.	
Main parameters	Name: Field Nr:	
Auxiliary data		
Product provider	DTU Space and National Snow and Ice Data Center	
FURTHER INFORMATION		
URL´s	http://nsidc.org/icebridge/portal/	
Documents	ESA CryoVEx 2011 – Airborne field campaign with ASIRAS radar, EM induction sounder and laser scanner ESA CryoVx 2012 – Airborne field campaign. Data acquition report.	

4.8 Sea Floor Mapping SAR (DTU Space)

Table 4-19: Sea Floor Mapping SAR CS2 Data - xxx

Parameter	Value	Comments
CryoSat-2 Data - xxx		
Partner	DTU Space	
Geographical Coverage	Region1: Lat = [15N, 25N] Lon = [180E, 195E] Region 2: Lat = [0N, 17N] Lon = [136, 150E]	
Temporal Coverage	SAR under mask 3.4. September	1 Full repeat of 369 days is

Table 4-19: Sea Floor Mapping SAR CS2 Data - xxx

Parameter	Value	Comments
	2012-October 2013	essential.
Product Type	L1B and L2	
Processing version	4.0 and 2.4	
Cycles/Passes	All available	
Main parameters	Name: Field Nr:	
Auxiliary data	Baseline	
Product provider		
FURTHER INFORMATION		
Format Specification	DBL binary products following ESA specifications. See AD. 2, AD. 3, AD. 4.	
URL´s	https://earth.esa.int/c/document_library/get_file?folderId=125272&name=DLFE-6409.pdf	
Documents	CryoSat-2 product Handbook	

Table 4-20: Sea Floor Mapping SAR In Situ Validation Data - xxx

Parameter	Value	Comments
In-situ Validation Data - xxx		
Location	National geospatial Intelligence Agency unclassified data	Obtained already
Temporal Coverage	n/a	N/a
Description	Marine Gravity data	Not for distribution outside DTU
Auxiliary data		
Product provider	NGA	
FURTHER INFORMATION		
Format Specification	Format Description at https://geoint-online.nga.mil/	
URL´s	https://www.nga.mil/PRODUCTSSERVICES/Pages/default.aspx	

4.9 Ionospheric Corrections (Noveltis)

Table 4-21: Ionospheric Corrections Data - SPECTRE (Noveltis)

Parameter	Value	Comments
Ionospheric Corrections DATA – SPECTRE (Noveltis)		
Partner	Noveltis	
Geographical Coverage	North East Atlantic / Mediterranean Sea -15°E/40°E 30°N/70°N	
Temporal Coverage	CS-2 entire mission	
Description	Along-track ionospheric correction	
Cycles/Passes	CS2 passes in the geographical area covered by the regional correction	
Auxiliary data	CS2 passes : - Position (lon, lat) - Date - Altitude	
Product provider	CP4O	The last version of the CP4O CS2 products will be used.
FURTHER INFORMATION		
Format Specification	N/A	
URL´s	N/A	
Documents	http://www.noveltis.com/spectre/interface/pdf/ProceedingGalileo2007_SPECTRE.pdf	

Note: No validation data is described in this sub-section because there is no validation exercise involved in this sub-theme investigation.

4.10 Tidal Corrections (Noveltis)

Table 4-22: Tidal Corrections Data - COMAPI (Noveltis/CNES)

Parameter	Value	Comments
Tidal Corrections DATA – COMAPI (Noveltis/CNES)		
Partner	Noveltis	

Table 4-22: Tidal Corrections Data - COMAPI (Noveltis/CNES)

Parameter	Value	Comments
Geographical Coverage	North East Atlantic: -20°E/13°E 22.5°N/64°N	
Temporal Coverage	CS-2 entire mission	
Description	Along-track tidal correction	
Cycles/Passes	CS2 passes in the geographical area covered by the regional correction	
Auxiliary data	CS2 passes : - Position (lon, lat) - Date	
Product provider	CP4O	The last version of the CP4O CS2 products will be used.
FURTHER INFORMATION		
Format Specification	N/A	
URL´s	N/A	
Documents	http://www.coastalt.eu/files/portoworkshop10/pres/102_presentation_NOVELTIS_COMAPI.pdf + validation reports provided by CNES	

Note: No validation data is described in this sub-section because there is no validation exercise involved in this sub-theme investigation.

4.11 Wet Tropospheric Corrections (UPorto)

Table 4-23: Wet Tropospheric Corrections MWR Data 1 – AMR (Jason2)

Parameter	Value	Comments
Wet Tropospheric Corrections MWR DATA 1 – – AMR (Jason2)		
Partner	UPorto	
Geographical Coverage	global	
Temporal Coverage	Since the start of Jason-2 mission (04-07-2008) until 31-12-2012.	
Product Type	AMR wet tropospheric correction	
Processing version	GDR-D	
Cycles/Passes	J2 cycles 1 to 165	
Main parameters	Name: wet_tropo_rad	Flags associated to this

Table 4-23: Wet Tropospheric Corrections MWR Data 1 – AMR (Jason2)

Parameter	Value	Comments
	Field Nr: 801	parameter are also used
Product provider	RADS	
FURTHER INFORMATION		
Format Specification	netcdf	WTC is provided in metres
URL´s	http://rads.tudelft.nl	A dedicated installation of RADS, at FCUP, is used
Documents	Scharroo, R., RADS version 3.1 User Manual And Format Specification, 25 October 2012	

Table 4-24: Wet Tropospheric Corrections MWR Data 2 – SI-MWR from various sensors

Parameter	Value	Comments
Wet Tropospheric Corrections MWR DATA 2 – – SI-MWR from various sensors		
Partner	UPorto	
Geographical Coverage	global	
Temporal Coverage	From 01-01-2010 to 31-12-2012	
Product Type	Total column water vapour (TCWV) from scanning imaging MWR (SI-MWR) on board 12 Remote Sensing missions.	Level-2 swath or grid products were used
Processing version	Various, depending on product	
Satellites	Eleven sun-synchronous satellites: AQUA, NOAA-15, -16,-17, -18, -19, MetOp-A, DMSP-F15, -F16, -F17, Coriolis One non sun-synchronous satellite: TRMM	
Sensors	AMSR-E, AMSU-A, SSM/I, SSM/IS, WindSat and TMI	
Main parameters	Name: Total Column Water Vapour	Different names are used in the various products: Med_res_vapor, TPW, Columnar_water_vapor, VAPOR
Product provider	NOAA through its Comprehensive Large Array-Data Stewardship System (CLASS);	All products provided by RSS are grid products; all others are swath products.

Table 4-24: Wet Tropospheric Corrections MWR Data 2 – SI-MWR from various sensors

Parameter	Value	Comments
	National Snow and Ice Data Center; Global Hydrology Resource Center; Remote Sensing Systems (RSS)	
FURTHER INFORMATION		
Format Specification	HDF-EOF for all swath products; binary for grid products from RSS	
Access Details	NOAA/CLASS: http://www.class.ngdc.noaa.gov AMSR-E (swath products): ftp://n4ftl01u.ecs.nasa.gov/SAN/AMSA/AE_Ocean.002 TMI: ftp://ghrc.nsstc.nasa.gov/pub/data/tmi-op/ SSM/I, SSM/IS, WindSat and AMSR-E grid products from RSS: http://www.ssmi.com/	
Documents	Various documentation can be found in the webpages of the various data providers	

Table 4-25: Wet Tropospheric Corrections In Situ Data - Zenith Total Delays from GNSS Stations

Parameter	Value	Comments
Wet Tropospheric Corrections In-situ Data - Zenith Total Delays from GNSS Stations		
Locations	Stations from all over the world, in the coastal regions (distances from the coast up to ~50 km) and in islands.	
Temporal Coverage	Since 1995	Number of stations increases every year
Description	Depending on data provider, files may contain various additional parameters, but the only fields used are the date and the zenith total delay.	
Access Details	IGS: ftp://cddis.gsfc.nasa.gov/gps/products/troposphere/zpd/	

Table 4-25: Wet Tropospheric Corrections In Situ Data - Zenith Total Delays from GNSS Stations

Parameter	Value	Comments
	EUREF: ftp://igs.bkg.bund.de/EUREF/products/ SuomiNet: http://www.suominet.ucar.edu/data/suomifiles.html?dir=pwvConusDaily;file=SUOd	
Products File Names	IGS: ssssddd0.yyzpd.gz (ssss - station name, ddd - day of the year, yy – year) EPN: eurwwww7.tro.Z (wwww - GPS) Suominet: SUOd_yyyy.ddd-yyyy.ddd.tar (file generated according to a specified start and end date)	
Main parameters	Name: zenith total delay	
Product provider	IGS (International GNSS Service); EPN (EUREF Permanent Network); United States SuomiNet	
FURTHER INFORMATION		
Format Specification	IGS and EPN: SINEX_TROPO SuomiNet: NetCDF or ASCII.	
URL´s	IGS: http://igscb.jpl.nasa.gov/components/prods.html EPN: http://www.epncb.oma.be/_productsservices/sitezenithpathdelays/ Suominet: http://www.suominet.ucar.edu/data/index.html	

Table 4-26: Wet Tropospheric Corrections Model Data - ERA Interim

Parameter	Value	Comments
Wet Tropospheric Corrections Model Data - ERA Interim		
Geographical Coverage	global	
Temporal Coverage	since 1979-01-01 until present	
Model Description	Latest reanalysis model from	Full resolution model

Table 4-26: Wet Tropospheric Corrections Model Data - ERA Interim

Parameter	Value	Comments
	ECMWF provided at 0.75°× 0.75° spacing and 6 hour intervals	
Access Details	ftp: http://data-portal.ecmwf.int/data/d/interim_full_daily/	Open access
Main parameters	- Mean sea level pressure - Total column water vapour - 2 metre temperature	
Product provider	ECMWF	
FURTHER INFORMATION		
Format Specification	Netcdf or GRIB	
URL´s	http://data-portal.ecmwf.int/data/d/interim_full	
Documents	Dee et al. The ERA-Interim reanalysis: configuration and performance of the data assimilation system. Q.J.R. Meteorol. Soc. 2011, 137, 553-597.	

5 Data Access

The aim of this section is to give information about the access to the above extensively characterised data sets.

5.1 Data Sets

Information on all data sets described in section 4 will be accessible through dedicated pages on the CP4O website http://www.satoc.eu/projects/CP4O/data.html.

In the web page we will find links to information about the source data, auxiliary and validation data for each development product, as well as a brief description of the methods used in each investigation.

Here below it is showed the website table from which we can access to the different sub-themes descriptions and links.

Table 5-1. Table showed in the Data Set website

Theme	Product	Partner	Area	Source data		Validation data	
Open Ocean	LRM	TU Delft	Global	Cryosat	-	Satellite	-
	RDSAR	TU Delft	Global	Cryosat	-	Satellite	-
	RDSAR	CLS	Global	Cryosat	-	Satellite	-
	SAR	CLS	Global	Cryosat	-	Satellite	-
	SAR	Starlab	NE Atlantic	Cryosat	-	Satellite	In situ
Coastal Ocean	SAR	NOC	S Coast UK	Cryosat	Auxiliary	Satellite	In situ
	SARIN	isardSAT	Cuba / Chile	Cryosat	-	-	-
Polar Ocean	SAR	DTU		Cryosat	-	Satellite	Airborne
Sea Floor Mapping	SAR	DTU		Cryosat	-	Satellite	In situ
Corrections	Wet Tropo	U Porto	Global	-	Auxiliary	Satellite	-
	Iono	Noveltis	Med / European Shelf	Cryosat	Auxiliary	-	-
	Tides	Noveltis	NE Atlantic (Coastal)	Cryosat	Auxiliary	-	-