SCOOP

SAR Altimetry Coastal and Open Ocean Performance

Product Validation Plan
D2.4

Sentinel 3 For Science – SAR Altimetry Studies

SEOM Study 2. Coastal Zone and Open Ocean Study

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1 Introduction

1.1 Purpose and scope

The ESA Sentinel-3 mission is the second satellite to operate a Delay Doppler mode altimeter based on CryoSat-2 heritage, but the first one to cover the whole open ocean, providing high resolution and high precision of the ocean surface topography along the satellite track direction. Contrarily to CryoSat-2, the Sentinel-3 payload includes a dual frequency altimeter radar (in Ku and C band, allowing for ionospheric corrections), and a microwave radiometer (for water vapor correction) that will help to reduce range errors and to derive more accurate Sea Surface Height estimations.

The SCOOP project aims to characterize the expected performance of Sentinel-3 SAR-mode altimeter products as generated by the current Sentinel-3 data processing over open ocean, and then to develop, test and evaluate new processing schemes that are expected to provide enhanced performance when compared with the baseline processing (quantifying their skills and drawbacks).

A Cal/Val plan process is established with regard to the different data sets to be considered in the assessment. It includes two phases:

a) an assessment of the existing Sentinel-3 altimetry processing baselines (in SAR mode and PLRM) over the open ocean, and

b) an analysis of the innovative algorithms including also the comparison with the reference datasets defined in the preceding phase.

The present Product Validation Plan document gives an explicit and detailed overview on the assessment methods and quality metrics that will be used for estimating the performances of the different processing algorithms conducted in this study.

The performance analysis of the different methods done in the frame of the SCOOP project will be carried out initially on CryoSat-2 data, processed by a Sentinel-3 – like processing chain, in SAR-mode geographical areas defined within the CryoSat-2 mission. Sentinel-3 data will be included when available.

In addition, in the scope of WP7000, U Porto will also carry out a performance evaluation of the UPorto's Wet Troposphere Correction (WTC) by comparison with the ECMWF WTC. These tasks are complementary to the independent validation performed by CLS.

1.2 Document structure

This document is structured into an introductory chapter followed by three chapters describing:

- The methodologies that will be adopted to characterize the reference datasets (produced by applying the current Sentinel-3 altimetry SARM and PLRM processing baselines to CryoSat-2 data) and to assess both innovative algorithms and the UPorto's WTC solution.
- The full description of metrics and diagnoses that will be used to perform this assessment.
- The methodologies that will be used by UPorto to validate the WTC computed in WP7000.

1.3 Reference Documents

Ablain, M., SL_cci Product Validation Plan, Round Robin data package (RRDP) description, http://www.esa-sealevel-cci.org/PublicDocuments/technical/SLCCI-PVP-005-1-1.pdf, 2011.

Bonnefond, P., B. Haines and C. Watson. In Situ Calibration and Validation: A Link from Coastal to Open-ocean altimetry, chapter 11 in Coastal Altimetry, pp 259-296, edited by S. Vignudelli, A. Kostianoy, P. Cipollini, J. Benveniste, Springer, ISBN: 978-3-642-12795-3, 2011.

Buchhaupt C., Fenoglio-Marc L., Dinardo S. Retracking CryoSat-2 data with pulse limited processing, AdSR special session CryoSat-2, in preparation

Cancet, M., S. Bijac, J. Chimot, P. Bonnefond, E. Jeansou, O. Laurain, F. Lyard, E. Bronner and P. Féménias. Regional in situ validation of satellite altimeters: calibration and cross-calibration results at the Corsican sites, J. Adv. Space Res., DOI: 10.1016/j.asr.2012.06.017, 2012.

Cancet, M., B. Haines, P. Bonnefond, E. Jeansou, F. Lyard and P. Féménias. Regional CALVAL of Jason-2 and Envisat in Corsica and at Harvest. Presented at the OSTST meeting, Boulder, 8-11 October 2013.

Cancet, M., C. Watson, B. Haines, P. Bonnefond, E. Jeansou, F. Lyard and P. Féménias. Regional CALVAL of Jason-2 and Envisat at three calibration sites: Corsica, Harvest and Bass Strait. Presented at the OSTST meeting, Lake Constance, 28-31 October 2014.

Dinardo S., Fenoglio-Marc L., Buchhaupt C., Becker M., Scharroo R., M., Fernandez M. J., Benveniste J., Coastal SAR and PLRM altimetry in German Bight and Western Baltic Sea CryoSat-2 performance along the german coasts, AdSR special session CryoSat-2, submitted

Dinardo S, Fenoglio-Marc L., Buchhaupt C., Scharroo R., M., Benveniste J., Becker M. (2016), Coastal SAR and PLRM altimetry in German Bight and Western Baltic Sea, Proceedings of Leaving Planet 2016, Prague, SP-ESA, ESA Publications Division

Dumont et al., OSTM/Jason-2 Products Handbook, 4.2.6 Range Compression, http://www.aviso.altimetry.fr/en/data/product-information/aviso-user-handbooks.html, 2016.

Fenoglio-Marc, L., Dinardo, S., Scharroo, R., Roland, A., Dutour, M., Lucas, B., Becker, M., Benveniste, J., Weiss, R. (2015). The German Bight: a validation of CryoSat-2 altimeter data in SAR mode, *Advances in Space Research*, doi: http://dx.doi.org/10.1016/j.asr.2015.02.014

Fenoglio-Marc L., Buchhaupt C., Dinardo, S., Scharroo R., M., Benveniste J., Becker M. (2015a), The German Bight: preparing for Sentinel-3 with a cross-validation of SAR and PLRM Cryosat-2 altimeter data. Proceedings of Workshop S-3 for science, Venice, SP-ESA, ESA Publications Division

Jan, G., Ménard, Y., Faillot, M., et al., Offshore absolute calibration of space borne radar altimeters. Marine Geod. 27(3-4), 615-629, 2004, http://dx.doi.org/10.1080/01490410490883469

Ménard, Y., Faillot, M., et al., Offshore absolute calibration of space borne radar altimeters. Marine Geod. 27(3-4), 615-629, 2004

SCOOP Proposal: **S**AR Altimetry **C**oastal & **O**pen **O**cean **P**erformance Exploitation and Roadmap Study. Sentinel 3 For Science – SAR Altimetry Studies Study 2 – Coastal Zone and Open Ocean Study. Proposal, January 2015.

2 Methodology

2.1 Characterisation and assessment of the Sentinel-3 reference data sets

To assess any improvement in performance provided by innovative solutions applied to the Sentinel-3 processing and analyse their impact, the performance of reference data sets generated by the current Sentinel-3 Delay Doppler baseline (for both SARM and PLRM) must first be established (WP5100). To analyse and quantify the performances of these reference data sets the following methodology will be adopted:

- The PLRM reference dataset will be assessed by analysing the continuity with LRM at the SARM boxes border. Moreover cross comparisons with Jason-2 (or Jason-3) mission will be carried out considering both along-track (statistics over SARM areas) and crossovers data sets (Jason-2, Jason-3, SARAL/Altika...).
- Once the PLRM data set is assessed and characterized, we use these measurements that are perfectly collocated and time tagged with SARM data to assess these latter ones. Such a comparison between SARM and PLRM allows detecting very small errors because the oceanic signal is properly removed (as the measurements are collocated, the surface topography observed is the same for both modes), compared to a cross calibration exercise with another mission that needs long time series. In addition, we will have at our disposal a large amount of observations permitting to make a robust assessment with reliable statistics.

Data sets derived from the CNES CryoSat-2 Prototype Processing (CPP) and already assessed in the frame of the CryoSat Plus For Ocean (CP4O) may be used for the assessment of the reference SAR data sets.

Data sets derived from the CNES CryoSat-2 Prototype Processing (CPP) and already assessed in the frame of the CryoSat Plus For Ocean (CP4O) may be used for the assessment of the reference SAR data sets.

A preliminary independent assessment of both SAR and PLRM datasets is performed in the North Sea using SAR and PLRM products external to the project. The external database for SAR the ESA-ESRIN GPOD service (named SARvatore) and for PLRM the database of the University of Bonn and Technical University of Darmstadt (named TUDUB).

2.2 Innovative algorithms assessment over Open Ocean

As identified in Section 2.1 above, comparisons of the new data set against the reference data set will be performed to evaluate the impact of applying the alternative SAR altimetry algorithms on the Sentinel-3 ground processing performance. The CLS “retracking test bench” will be used in WP5400 to precisely validate and cross-calibrate the different algorithms (see presentation given during the Lisbon OSTST meeting in 2010 http://www.aviso.altimetry.fr/en/user-corner/science-teams/sci-teams/ostst-2010/ostst-2010-posters.html by P.Thibaut). Regarding the preliminary findings, other dedicated diagnoses could be added to focus on specific discrepancies as it was done in the frame of the CP4O project (http://www.satoc.eu/projects/CP4O/).

2.3 New Wet Troposphere Correction

UPorto's WTC proposed as an enhanced solution for the Sentinel-3 mission will be assessed for quality and relevance by comparison with a WTC reference computed from the ECMWF model. In the frame of the Sea Level Climate Change Initiative (SL-cci) project, a specific tool developed by CLS the Round Robin Data Package (RRDP) (Ablain, 2011) and designed to compare different geophysical corrections will be used for this task (WP5400). This tool has been used in the frame of the CP4O project to assess an earlier version of CryoSat-2 DComb solution, and more recently in the frame of the Sea Level CCI project to compare many geophysical correction standards.

2.4 Temporal resolution choice

Due to the specificities of the Sentinel-3 delay Doppler processing, the 20-Hz SARM and PLRM measurements are neither co-dated nor collocated. To enable direct comparisons between retrieved parameters, a 20-Hz to 1-Hz compression will be performed, making data co-dated on the 1-Hz time scale. The compression algorithm that will be used is based on Jason-2 ground segment heritage (Dumont et al., 2016).

In addition, working with 1-Hz data sets allows for:

- Limiting the time of processing.
- Reducing the impact of noise level, which could help to detect potential anomalies between the studied and the reference data sets.

Although several diagnoses will be performed with a 1-Hz temporal resolution, several of them such as the spectral analysis or the waveform fitting will be computed at 20 Hz.

2.5 Data Editing

Data editing is necessary to remove altimeter measurements having lower accuracy. In practice, this consists in selecting valid ocean data only (e.g., by removing data corrupted by land proximity, sea ice and rain) based on CLS Cal/Val expertise. Other editing criteria are also applied, that eliminate measurements that fall outside a range of admissible parameter values bounded by adjusted thresholds.

The results derived from the editing process will be examined statistically with respect to the ones obtained with other algorithm solutions. Such a comparison may add further relevant information to the performance analysis of a solution.

2.6 Iterations with algorithm experts

The evaluation process is composed of two main steps.

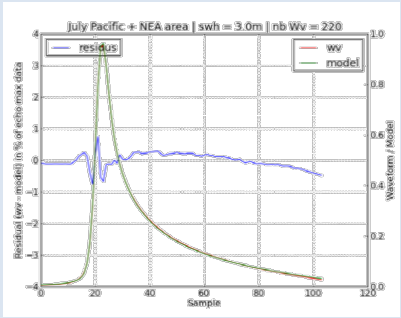
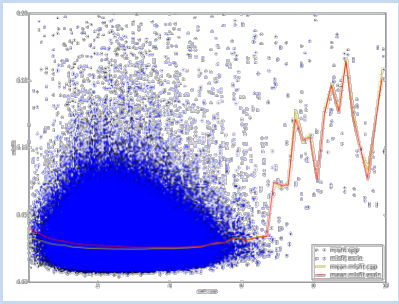
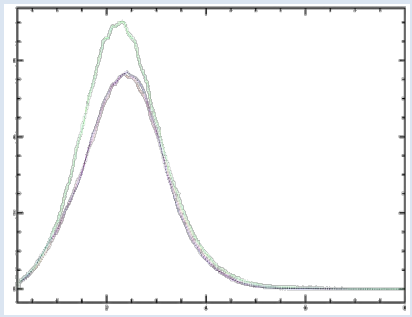
First, we plan to generate an inter-comparison and validation report for each innovative algorithm (including one for the WTC solution). The description and the analysis of all the differences will provide a very useful support to assess the performances of the algorithms.

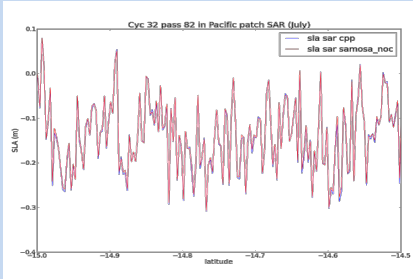
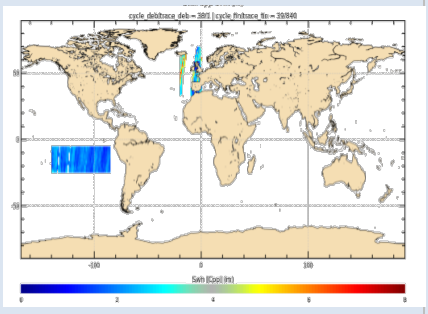
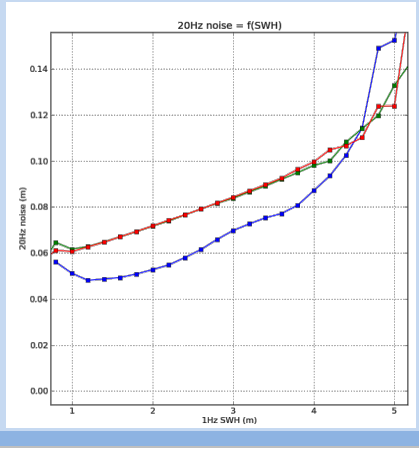
Then, the algorithm expert/responsible will be contacted to validate the content of the draft report. More precisely, his involvement will be twofold: first, to contribute to the report as an expert providing technical insights about the newly developed algorithm; second, to investigate the origin of either potential anomalous or unexpected behaviour that could be identified during the assessment and to correct the problem, if possible, in a timely, accurate manner.

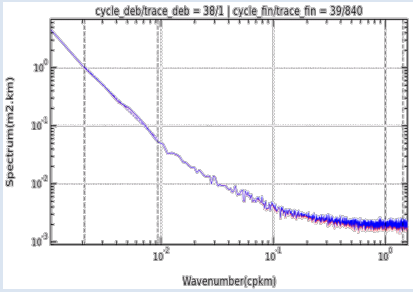
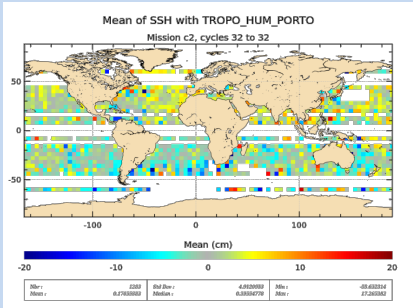
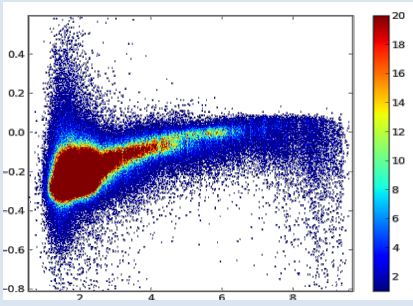
3 Diagnoses description

3.1 Open Ocean and coastal zone (CLS)

The list of diagnoses given hereafter (Table 1) is not exhaustive and new kind of diagnoses could be added, if needed. Indeed, following the experts' recommendation or after first results are obtained, the emphasis could be placed over specific diagnoses that are not currently listed in the following table.

Diagnosis	Parameters	Comment	Illustration	Applicable / Work Package
Residual between model and data (20Hz)	SARM Waveforms / model	This diagnosis allows to detect potential fitting anomalies and to identify on which part of the waveforms they are located		- Delay Doppler reference dataset (WP5100) - Innovative algorithm data sets (WP5400)
Misfit wrt SWH (20Hz or 1Hz)	Waveforms misfit	This diagnosis, performed on the misfit, allows to characterize the estimator performances		- Delay Doppler reference dataset (WP5100) - Innovative algorithm data sets (WP5400)
Histogram (1Hz)	SLA and their Differences SWH and their Differences Wind Speed and their differences Misfits	Histograms of estimated parameters and their differences to accurately characterise the global bias (drift not visible) and point out potential shape differences		- Delay Doppler reference dataset (WP5100) -Innovative algorithm data sets (WP5400) - GPD WTC (WP5400)

Diagnosis	Parameters	Comment	Illustration	Applicable / Work Package
Along-track temporal evolutions (1Hz)	SLA mean and std SWH mean and std Wind speed mean and std	Temporal evolution of along-track estimated parameters and of their differences averaged per days to characterize the potential drift.		- Delay Doppler reference dataset (WP5100) - Innovative algorithm data sets (WP5400) - GPD WTC (WP5400)
Maps (1Hz)	SLA and their differences SWH and their differences Wind Speed and their differences Misfits and their differences Maps of edited measurements	Maps of significant parameters (estimated parameters + misfit + WTC ...) and of their differences to geographically visualize potentially correlated discrepancies.		- Delay Doppler reference dataset (WP5100) - Innovative algorithm data sets (WP5400) - GPD WTC (WP5400)
Noise (defined as 20Hz standard deviation) wrt SWH (1Hz)	20Hz Range standard deviation 20Hz SWH standard deviation	The analysis of the 20Hz standard deviation derived from the compression process as a function of SWH allows to characterise the processing performances		- Delay Doppler reference dataset (WP5100) - Innovative algorithm data sets (WP5400)

Diagnosis	Parameters	Comment	Illustration	Applicable / Work Package
Wavenumber spectra (20Hz)	SLA SWH	The spectral analysis of SLA and SWH allows to point out discrepancies and/or performances of a given processing baseline separating the different spatial scales of the signal		- Delay Doppler reference dataset (WP5100) - Innovative algorithm data sets (WP5400)
Crossovers (1Hz)	SSH	Differences of SSH at crossovers allow to assess the reliability of altimeter measurements between ascending and descending passes.		- Delay Doppler reference dataset (WP5100) - GPD WTC (WP5400)
Dependency analysis / Dispersion diagrams (1Hz)	Range differences as function of several parameters SWH diffs as function of several parameters Wind speed diffs as function of several parameters Misfit diffs as function of several parameters	y=f(x) and z = f(x,y) diagrams allow to assess the dependencies between parameters. These diagnoses will be applied on estimated parameters and their differences.		- Delay Doppler reference dataset (WP5100) - Innovative algorithm data sets (WP5400)

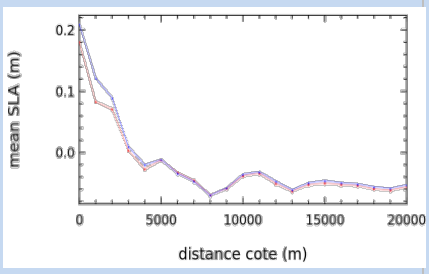
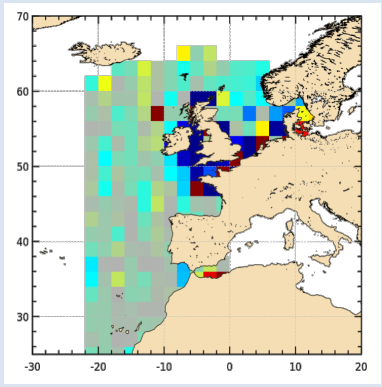
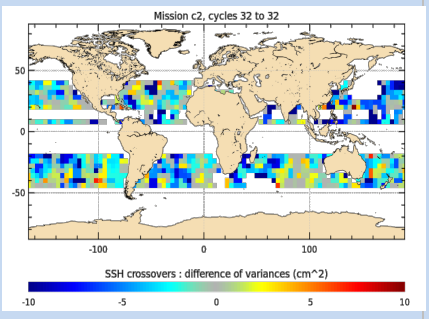
Diagnosis	Parameters	Comment	Illustration	Applicable / WorkPackage
Coastal comparisons (20Hz)	SLA	Plots of estimated parameter and their differences as function of the coastal distance and angle will be performed. This work will not be redundant to WP6000 since no external metrics will be used.		- Innovative algorithm data sets (WP5400) - GPD WTC (WP5400)
	Sigma0/ wind speed			
Along-track gain of variance (1Hz)	SLA	This diagnosis is used to compare the along – track variability of the SLA using two different geophysical corrections (in this case DComb / ECMWF WTC). Var(slaDcomb) – Var(slaECMWF)		- GPD WTC (WP5400)
Crossovers gain of variance (1Hz)	SSH	This diagnosis allows determining whether the studied geophysical correction (compared to the reference one) reduces or not errors at crossovers. Var(diffSSH1) – Var(diffSSH2) SSH1 and SSH2 being computed with different WTC.		- GPD WTC (WP5400)

Table 1: List of diagnoses used in WP5000

3.2 Open Ocean and Coastal Zone at University of Bonn

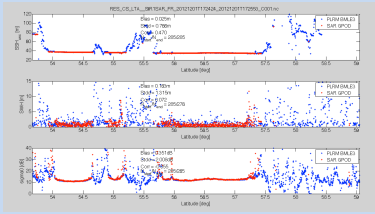
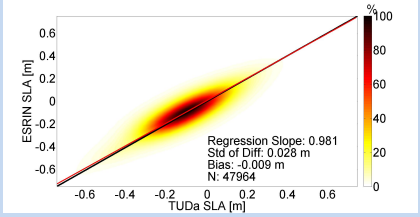
The analysis is performed in the North Sea. The quality of the PLRM and SAR SCOOP datasets are here first assessed independently and then cross-validated.

The independent assessment of both SAR and PLRM SCOOP CryoSat-2 uses the external products from GPOD (for SAR) and TUDUB (PLRM) respectively. The analysis is done along-track (Table 2). The two external products have been cross-validated in Dinardo et al. (submitted).

Uni Bonn will further assess regionally the CryoSat-2 and S-3 sea surface height (SSH), sea wave height (SWH) and wind speed (U10) data quality (Level 2 product) performing both a cross-validation analysis of SCOOP SAR and PLRM products and a cross-validation against model data. Cross-validation with Jason-2 and Saral/AltiKa altimeter data and against model data will also be performed at the in-situ stations.

The validation of SCOOP SAR against SCOOP PLRM products, in-situ data and models outputs is carried out for both open sea at distance to coast larger than 10 Km (Table 2) and coastal zone (Table 3). Evaluation of the wet tropospheric correction computed by UPorto in WP7000 is also done.

The goal is to carry out a characterisation of SAR mode performance and an estimation of the data precision and accuracy. The German Bight region typically has low significant wave heights. In-situ data are provided by 16 geo-referenced tide gauge stations for sea level, four wave rider buoys for wave height and four stations for wind measurements. All data have been provided by the German Federal Institute of Hydrology.

Diagnosis	Parameters	Comment	Illustration	Applicable / WorkPackage
Along-track analysis (20Hz)	SLA SWH Sigma0	SAR and PLRM independent evaluation Statistic (bias, correlation, stdd)		- Open Ocean (WP5400) - Coastal Zone (WP6400)
Scatterplots (1Hz)	SLA SWH Wind speed	SAR and PLRM independent and combined evaluation Statistics (bias, correlation, std)		- Open Ocean (WP5400) - Coastal Zone (WP6400)

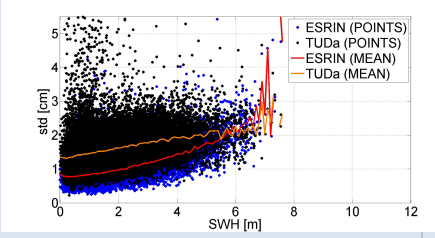
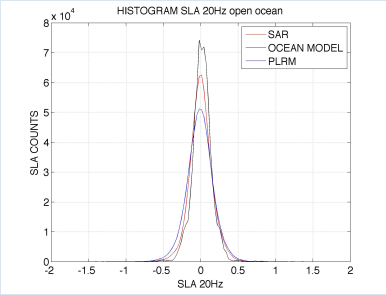
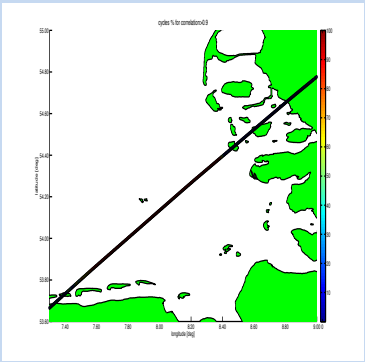
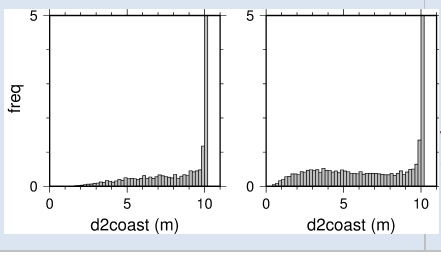
Dispersion diagrams (20 Hz)	SLA vs SWH SWH vs SWH Wind Speed vs SWH	Precision at 1 Hz is the median for each SWH of the standard deviation of the 20Hz measurements for each parameter (see Fenoglio-Marc et al. 2015)		- Open Ocean (WP5400) - Coastal Zone (WP6400)
Histograms (1 Hz, 20 Hz)	SLA vs SWH SWH vs SWH Wind Speed vs SWH	Power spectral density identifies data distribution		- Open Ocean (WP5400) - Coastal Zone (WP6400)

Table 2: List of diagnoses used in WP5400

Diagnosis	Parameters	Comment	Illustration	Applicable / WorkPackage
Scatterplots & along-track analysis Agreement with in-situ data (1Hz, 20Hz)	SLA SWH Wind speed	In-situ validation of altimetry by using data acquired by coastal or offshore stations. Various along-track distances considered Metrics: bias, standard deviation of differences, slope, correlation		- Open Ocean (WP5400) - Coastal Zone (WP6400)
retained points availability of data (20 Hz)	SLA SWH Wind Speed	SAR vs PLRM density		- Coastal Zone (WP6400)

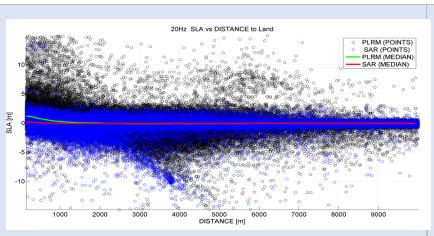
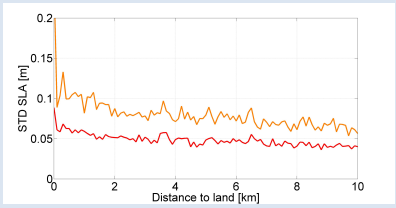
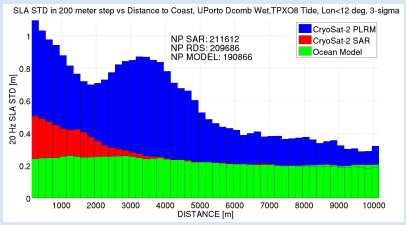
Averaged SLA as function of distance to coast (20 Hz)	SLA, SWH	SLA clouds of points and median as function of distance to coast (Dinardo et al., submitted)		- Coastal Zone (WP6400)
Quality as function of distance to coast	SLA	noise from difference of consecutive 20 Hz data		- Coastal Zone (WP6400)
Quality as function of distance to coast	SLA, SWH	Noise from comparison with model variability		- Coastal Zone (WP6400)

Table 3: List of diagnoses used in WP6400

3.3 Coastal Zone Performance Assessment at NOC

This section describes the test to be carried out by NOC for the internal verification of the performance of RDSAR and SAR altimetry in the coastal zone in dependence of distance from the coast, which aims at characterizing the precision in the measurements of height, significant wave height and σ0 in the coastal zone. The test chosen is the absolute difference of the 20-Hz values as described in section 4.6.2.2. of the SCOOP Technical Proposal. (SCOOP 2015). This allows an accurate localization of the noise estimates and therefore a much better representation of their change as function of distance from coast w.r.t. the traditional statistics from a 7-km (1-Hz) block of data.

These preliminary tests, using the baseline products, will also be repeated as a function of the angle of approach to the coast and of the coastal proximity parameter, with the main purpose of checking whether the angle of approach and the coastal proximity are useful variables for final performance assessment and screening.

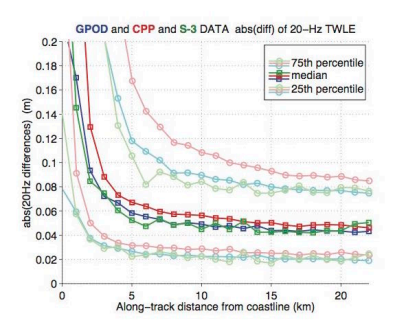
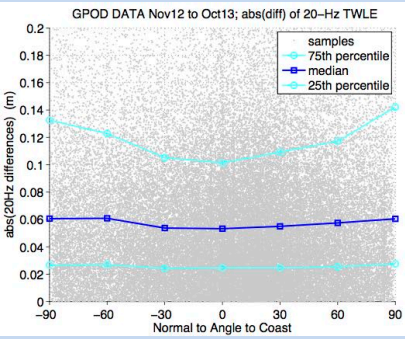
Diagnosis	Parameters	Comment	Illustration	Applicable / WorkPackage
Absolute differences at 20 Hz	SLA SWH sigma0	Median (and other distribution parameters, such as 25th-75th percentiles) of the absolute value of differences at 20 Hz as a function of distance from coast both in 'along-track' and 'across track' directions.		- Coastal Zone – baseline (WP6200) - Coastal Zone – any improved products from WP3000 and WP4000 Coastal Zone – products from improved stack weigthing (WP6500)
Absolute differences at 20 Hz	SLA SWH sigma0	Median (and other distribution parameters, such as 25th-75th percentiles) of the absolute value of differences at 20 Hz as a function of angle of approach and coastal proximity. The main purpose is to check whether angle of approach/coastal proximity are useful variables for performance assessment and screening, before actually using them for the assessment.		- Coastal Zone – baseline (WP6200)

Table 4. List of Diagnoses to be used by NOC in WP6200, WP6500

3.4 Performance Assessment (Sea State Impact on altimeter retrieved SSH) to be carried out at Noveltis

This section describes the validation work to be carried out at Noveltis in WP6300, which will in particular investigate the impact of sea state on the retrieval of sea surface height. Impact of alternative corrections such as the wet tropospheric correction developed in WP7000 by UPorto will also be evaluated. In agreement with the outputs of the negotiation and kick-off meetings, Noveltis will focus its study on the impact of the sea state on the SSH in SAR mode. Corsica is not an ideal location in this respect and the study will be done at the Harvest calibration site (an open-ocean configuration).

These activities are performed on local and regional bases, using the regional absolute calibration method developed by Noveltis. (Jan et al 2004, Cancet et al 2012).

Absolute calibration of the altimeter range consists in verifying the coherency between the sea surface heights measured by an in-situ tide gauge instrument and the sea surface heights measured by the satellite altimeter for the track directly flying over the tide gauge station, also called calibration site (Bonnefond et al 2011).

Noveltis has developed an original calibration method which also enables the computation of altimeter absolute bias for tracks located several hundreds of kilometres away from the calibration sites. (Cancet et al 2012, Cancet et al 2013, Cancet et al 2014). Multiplying the number of tracks increases the calibration opportunities and statistically improves the robustness of the bias estimates. Thanks to its totally generic character, Noveltis' regional calibration method can be used for any mission on nominal orbits passing over the dedicated calibration sites but also for missions flying near but not directly over the calibration sites. This includes interleaved and non-repetitive orbits. This regional technique consequently provides a great opportunity to quantify the uncertainties of the various parameters used to compute the altimeter sea surface heights for all the missions, and more particularly in coastal areas where the signals are generally impacted by the land vicinity.

In SCOOP, Noveltis will focus on Cryosat-2 SAR mode data collected both over a new SAR mode region off the Californian coast, that includes the well-established altimeter calibration site at the Harvest platform. This SAR mode region was specifically implemented at the request of the SCOOP team, and so only data collected since this area was included in the CryoSat Mode Mask can be used (i.e. since 15/12/2015).
To evaluate the impact of the sea state on the altimeter sea surface height, Noveltis will use the IOWAGA regional model outputs provided by IFREMER on the Harvest region.
The tests are summarised in Table 5:

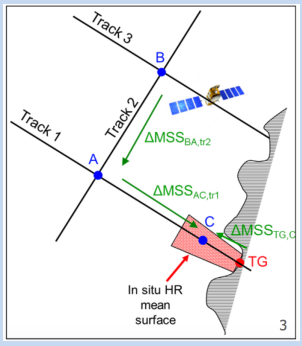
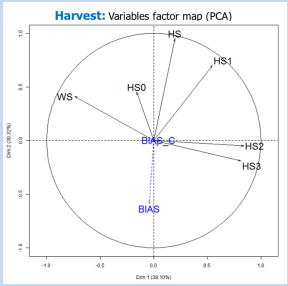
Diagnosis	Parameters	Comment	Illustration	Applicable / Work Package
Stability of the altimeter SSH	SSH	Altimeter absolute bias, drifts, geographically correlated errors, local coastal performances, corrections performances		- Coastal Zone – Regional absolute calibration of the altimeter range (WP6300)
Sea state impact on the altimeter SSH	SSH	Sensitivity of the altimeter SSH bias to the major sea state components (HS (SWH), HS0, HS1, HS2, HS3, wind speed...) Correlations, Principle Components Analyses		- Coastal Zone – Regional absolute calibration of the altimeter range (WP6300)

Table 5. List of Diagnoses to be used by NOVELTIS in WP6300

4 WTC validation performed in the scope of WP7000

In the scope of WP7000, the WTC and the associated error will be computed for:

- All selected CS-2 regions of interest
- S3 ground-tracks. While S3 data are not available, Envisat data may be used for test purposes

In this task the WTC will be validated by means of a set of statistical analyses of sea level anomaly variance (see Table 6):

- Along-track SLA variance
- SLA variance at crossovers
- SLA variance as a function of distance from coast
- SLA variance as a function of latitude

Analyses will be performed both globally (for all ROIs) and separately for each selected ROI.

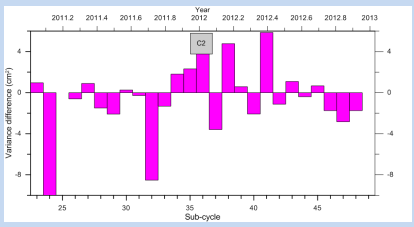
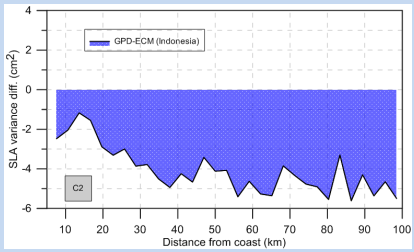
Diagnosis	Parameters	Comment	Illustration	Applicable / Work Package
Along-track SLA variance	WTC			WTC (WP7000)
SLA variance at cross overs	WTC			WTC (WP7000)
SLA variance as a function of distance from coast	WTC			WTC (WP7000)
SLA variance as a function of latitude	WTC			WTC (WP7000)

Table 6. List of Diagnoses to be used by U Porto in WP7000

5 List of Acronyms

CCI	Climate Change Initiative (ESA programme)
CLS	Collecte Localisation Satellite
CNES	Centre National d'Études Spatiales
CP4O	CryoSat Plus For Ocean
CPP	CNES CryoSat-2 Prototype Processing
CS-2	CryoSat-2
DComb	Data Combination – U Porto technique for generating Wet Troposphere Correction
ECMWF	European Centre for Medium-Range Weather Forecasts
ESA	European Space Agency
GNSS	Global Navigation Satellite System
GPD	GNSS derived Path Delay
HS, HS0, HS1, HS2, HS3	Significant wave height of different components of the wave spectrum
IFREMER	Institute Francais de Recherche pour l'Exploitation de la Mer
IOWAGA	Integrated Ocean Waves for Geophysical and Other Application; Wave data research project at IFREMER
MSS	Mean Sea Surface
NOC	National Oceanography Centre
PLRM	Pseudo Low Resolution Mode
PVP	Product Validation Plan
RDSAR	ReDuced SAR. Can refer to the processor or the data, for SAR altimeter data processed to be equivalent to LRM altimeter data
ROI	Region(s) of Interest
SAR(M)	Synthetic Aperture Radar (Mode)
SEOM	Scientific Exploitation of Operational Missions (element of ESA Earth Observation Envelope Programme 4)
SLA	Sea Level Anomaly
SSH	Sea Surface Height
SWH	Significant Wave Height
WTC	Wet Troposphere Correction