THE SLOOP PROJECT : PREPARING THE NEXT GENERATION OF ALTIMETRY PRODUCTS FOR OPEN OCEAN

A Step forward aLtimetry Open Ocean Products

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Project presentation

Since the launch of the first altimeters the accuracy of the altimetry data has continuously increased thanks to the improvement of both the technology of the instruments and the on-ground processing. These improvements allowed the apparition of various applications. About a thousand teams (in 2007) now use the altimetry products around the world for geodesy, oceanic circulation, model, wind/waves applications …

The SLOOP project, initiated by CNES in 2008, intends to prepare the next generation of altimetry products for open ocean. This project consists in two phases. The first phase is the analysis of the users needs and the subsequent redefinition of the product content in terms of content, resolution and data distribution. In a second phase, all the potential improvements of the altimetry processing chains will be analysed.

This project is a good opportunity to have a consistent approach for the general improvement of the current altimetry processing. It is also a good opportunity to reinforce the collaboration between the altimetry product development teams and the final users, which is essential to have optimal products, suitable for all kind of applications.

Consortium

A consortium composed of **CLS, Noveltis and expert support laboratories** will be in charge of this project on behalf of **CNES**.

The experts associated with this project are : **LEGOS laboratory, AER, TéSA laboratory (ENSEEIHT), IFREMER, LOCEAN, University of New Hampshire, IMEDEA, METEO-FRANCE, Mercator Ocean, SHOM, GRGS laboratory**

Product redefinition: Do we have to change the product content resolution and method of distribution?

User priorities
(result of survey)

- ✓Lower noise and a higher resolution
- ✓knowledge of the error associated with the measurement
- ✓Continuity of time series
- ✓Customized data product
  - ✓Geographical and temporal selection
  - ✓Choice of parameters and ability to use own recipe
  - ✓Output format Netcdf and ascii

For all additionnal comment please send to Marie-Isabelle Pujol <mpujol@cls.fr>

Need of a Level "2+" product associated with a flexible distribution method

The access to additional fields would be of interest :
✓Information allowing the SSH to be less noisy: additionnal range(SVD), a filtered iono field.

✓ information on the quality of the measurement
- ✓Easy to use Quality flag par application
- ✓Error associated with the measurement

✓Reanalysed Meteo model (ERA Interim, …)

Those fields could be added to the official GDR product or to a distributed Level2+ database which would :
- ✓be an intermediate between L2 and L3 products
- ✓contains added value information for specific applications

✓Thanks to the use of a Data Base through a Graphical User Interface :
=>More flexibility for the content: The user could choose the retracking algorithm, the tide model, …
=> Allows the user to customize his/her product

✓Add subscription functionalities for on line products
=>Customized product delivery on a regular basis and Update notification

a resolution higher than 7km: 1km?

✓New retracking approach allows a 20Hz noise reduction leading to a good compromise between resolution and noise

✓suitable with applications such as geodesy internal waves, sub mesoscale, coastal ocenography

✓Would allow the continuity between regional and open ocean products

✓Approximately same resolution as radiometers

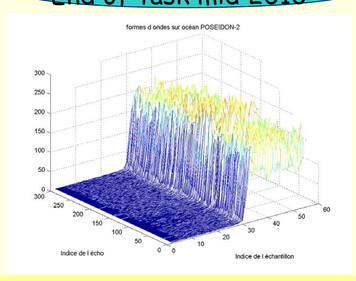
Analysis of all potential improvements of the altimetry components

Development of new retracking and noise reduction algorithms

End of task mid 2010

✓ The objective is a review and assessment of all known retracking techniques on open ocean (MLE3/4 on wave forms associated with the Singular Value Decomposition method, Least Square Estimator, Neural network, Bayesian estimator …) and the choice of the best candidate

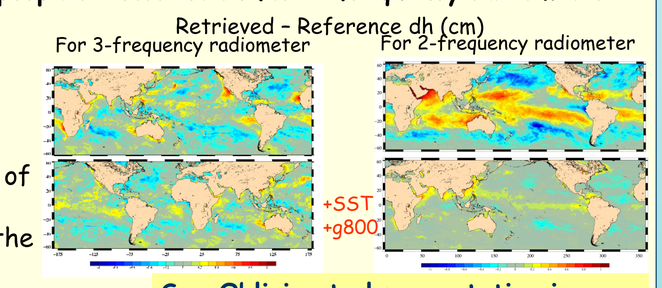
✓The development and tuning of a specific retracking for rain cells and Sigma0 Bloom is also planned



See Thibaut et al presentation in Instrument processing splinter

Development of neural radiometer wet troposphere correction for 3-frequency radiometer

✓Conventional way to characterize the different retrieval algorithms (global bias and standard deviation) ignored regional classification
✓Adding the SST and g800 (decrease rate of the atmospheric temperature between the surface and 800 mb) improve significantly the performances of the retrieval algorithms.



See Obligis et al presentation in Instrument processing splinter

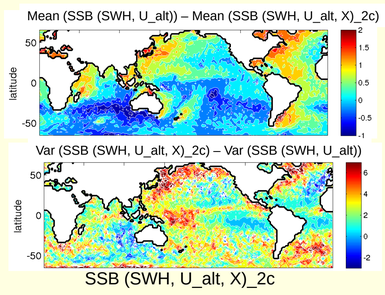
Development of Sea State Bias correction

End of task mid 2009

✓ A new SSB solution has been developed based on the use of outputs from the WaveWatch3 (WW3) sea state model and combining classification of sea states and suitable SSB per class

✓The use of additional gravity wave information from a model complete the very useful but insufficient altimeter derived SWH and U data to describe actual sea state

✓The impact is significant, up to 10cm on the SSH measurements. And the performances are improved (>1cm²)

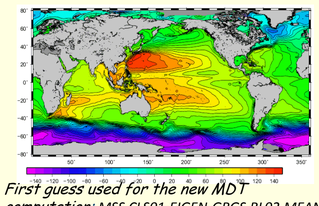


See Tran et al presentation in Instrument processing splinter

Computation of a new Mean Dynamic Topography

End of task End 2009

An updated version of the CMDT RIO05 is being computed based on the method described in (Rio and Hernandez, 2004):



First guess used for the new MDT computation: MSS CLS01-EIGEN-GRGS.RL02.MEAN-FIELD filtered using a 400km low-pass gaussian filter

✓ First, a large scale Mean Dynamic Topography is computed from the CLS01 altimetric Mean Sea Surface and the **latest geoid model computed at GRGS from 5 years of GRACE data.**

✓The second step of the estimation consists in combining altimetric sea level anomalies and in-situ measurements to compute synthetic estimates of the MDT and the corresponding mean currents using **15 years of in-situ data and including the latest ARGO reanalysis** from the Coriolis center.

✓Moreover the processing of the in-situ data is being improved: A **new Ekman model** was computed to extract the geostrophic velocity component from the drifting buoy measurements. The handling of hydrologic measurements has also been improved.

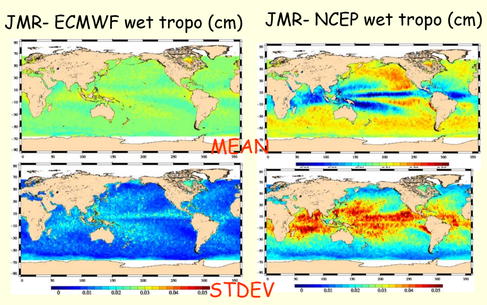
See Rio presentation in keynote talk III

Assessment of available new geophysical correction

End of task end 2009

✓**Model tropospheric** correction (dry and wet): Assessment of the NCEP reanalysed fields
- ✓Geographically correlated biases are observed on model - radiometers (JMR and MWR) differences
- ✓NCEP long term trend is different (+0.3-0.8 mm/year) from radiometer

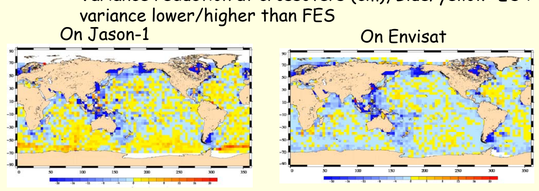
JMR- ECMWF wet tropo (cm) JMR- NCEP wet tropo (cm)



✓**Oceanic tides**: Estimation of EOT08 performances (Savcenko and Bosch 2008) relative to FES2004
- ✓Reduction of variance in the coastal areas for Jason1 et Envisat
- ✓ slight degradation in open ocean on Jason-1 notably, probably due to S2

Variance reduction at crossovers (cm), Blue/yellow: EOT variance lower/higher than FES

On Jason-1 On Envisat



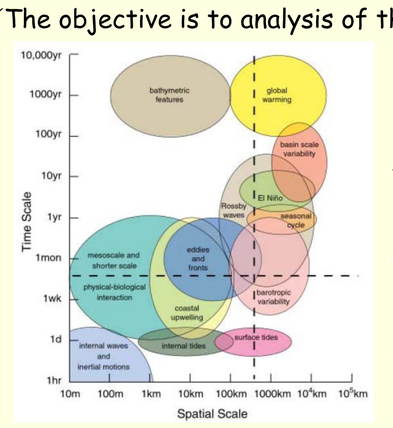
✓**Dynamic atmospheric correction**:
- ✓ Quality assessment of existing models and quantification of the potential interest of using a baroclinic model
- ✓Exploring new strategy for S1 and S2 filtering

See Carrere et al poster

Analysis of the error budget of altimetry

End of task mid 2009

✓The objective is to analysis of the error budget of the altimetric measurement. This implies:



✓To analyse the contribution of all the SSH component

✓To analyse the variation of these errors according to the spatial and temporal scale

✓To propose a common formalism to allows us to define a consistent error budget.

✓Finally to gather the information of all the experts on the SSH component to complete the error budget

See Dorandeu et al presentation in Sea Level Budget error session

Refining the dual frequency ionospheric correction

End of task mid 2010

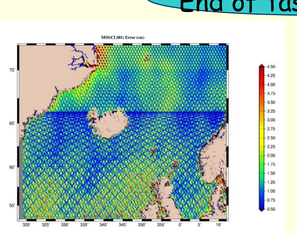
✓Analysis of the High Frequency content and improvement of the filtering method

Computation of a new Mean Sea Surface

End of task mid 2010

a new MSS:

✓With all the past and flying mission
✓With new standards, orbit and corrections
✓With improved methodology (coastal junction to geoid



Error map of the MSS CLS01

OSTST meeting Seattle, June 2009