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

This CNES 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**

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

Need of a Level "2+" product

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

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

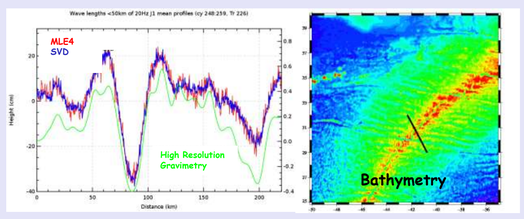
✓Would allow the continuity between regional and open ocean products

✓Approximately same resolution as radiometers

INSTRUMENTAL PROCESSING

New retracking allowing noise reduction

A Singular Value Decomposition (SVD) filtering technique is applied to remove noise from altimeter waveforms. A predefined threshold (energy of the singular values) is used to separate speckle from geophysical signal in the waveforms.Then a MLE4 Retracking is applied on filtered waveforms.



Noise reduction computed from spectra

	Range 20Hz	Range 1Hz	SWH 20Hz	SWH 1Hz
GDR	8.4cm	3cm	51cm	15 cm
SVD	**5cm**	**2.5cm**	**14cm**	**7.5cm**

The noise reduction on 20Hz range visible here on pass Jason-1 226 allows to better see fine geodesic structure

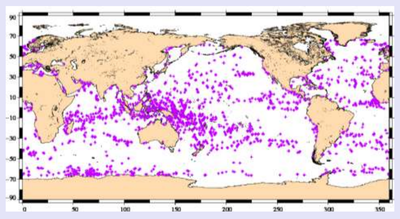
Gain in spatial resolution for (sub) mesoscale, Geodesy

Interest for AltiKa

New retracking allowing a better restitution of altimeter parameters in rain areas

✓The objective of this algorithm is first to automatically classify the waveform affected by rain and then improve the estimation of the altimeter parameters

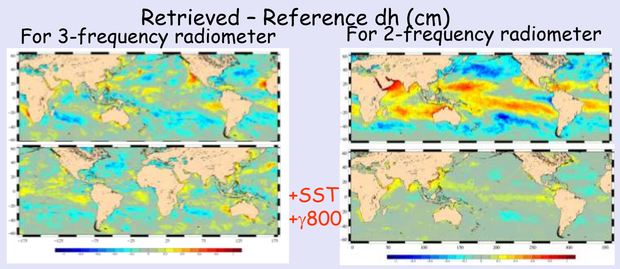
✓The classification gives very satisfactory results (99%) using 1 band (Ku)band and radiometer parameter



✓This new method allows us to reduce the global editing ratio **by 10%**

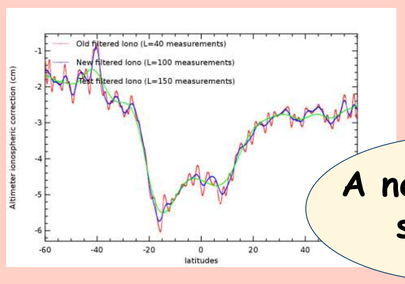
Development of neural radiometer wet troposphere correction for 3-frequency radiometer

✓Conventional way to characterize the different retrieval algorithms (global bias and standard deviation) ignored regional classification
✓Adding the SST and γ800 (decrease rate of the atmospheric temperature between the surface and 800 mb) improve significantly the performances of the retrieval algorithms.



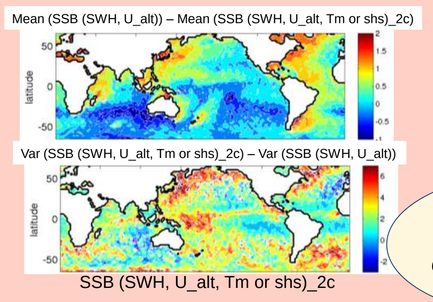
SSH CORRECTION

A new filtering strategy for the dual ionosphere correction based on an iterative editing of the raw ionosphere correction is proposed to replace the method used in Aviso CorSSH products:
✓It allows us to improve the ionosphere correction locally (rain and sea ice areas)
✓Along track residual oscillations are reduced thanks to larger filtering



A new filtering strategy

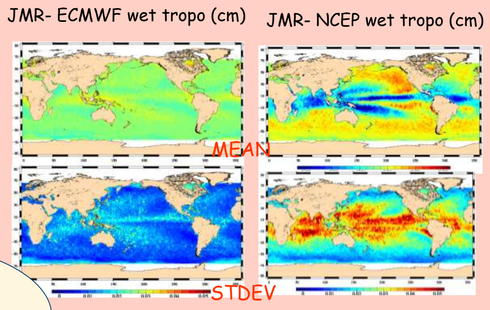
A new SSB solution has been developed based on the use of outputs from the WaveWatch3 (WW3) sea state model and combining classification of sea states and suitable SSB per class
✓The use of additional gravity wave information (Tm: mean wave period, shs: swell height) from a model completes the very useful 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)



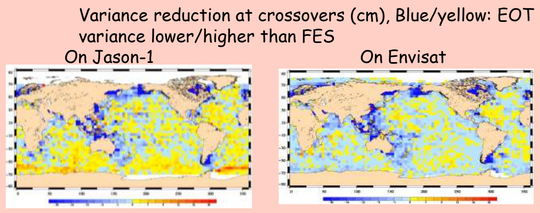
Impact at climate scales

✓**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



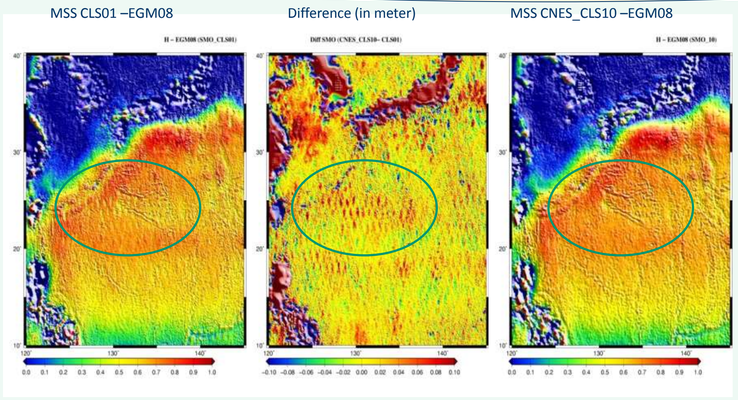
✓**Oceanic tides**: Estimation of EOT08 performances (Savcenko and Bosch 2008) relative to FES2004
- ✓Reduction of variance in the coastal areas for Jason1 et Envisat
- ✓ slight degradation in open ocean on Jason-1 notably, probably due to S2



✓**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

REFERENCE SURFACE

New MSS: A better processing of the oceanic variability

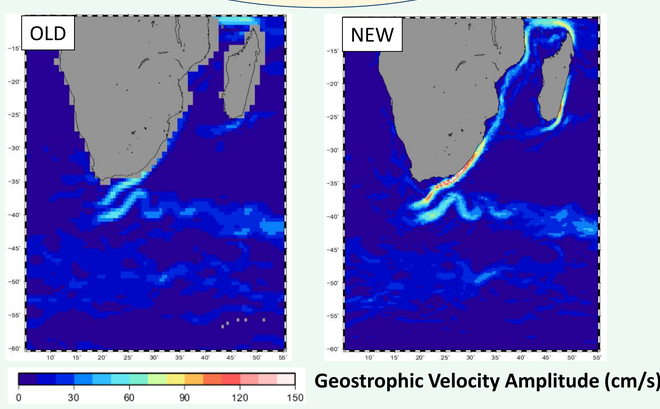


- **The CNES_CLS_10 MSS** has been computed using all the past and flying mission, latest standards, orbit and corrections and with improved methodology (coastal junction to geoid
- The "small diamonds", residual effect of the oceanic variability, visible on MSS CLS01 are removed on CNES_CLS10

CNES_CLS_09 MDT standards:
- Use of the latest geoid model computed at GRGS from 5 years of GRACE data
- 15 years of in-situ data and including the latest ARGO reanalysis
- A new Ekman model was computed to extract the geostrophic velocity component from the drifting buoy measurements

New MSS and MDT Available at http://www.aviso.oceanobs.com/en/data

High resolution ocean current



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