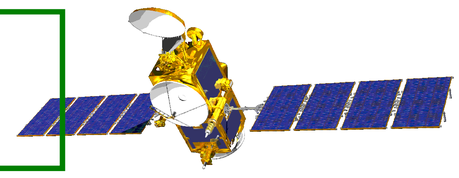
Prototype Innovant de Système de Traitement pour les Applications Côtières et Hydrologiques

The PISTACH project for coastal and hydrology altimetry: 2010 project status and activities



F. Mercier, G. Dibarboure, C. Dufau, L. Carrere, P. Thibaut, E. Obligis, S. Labroue, M. Ablain, P. Sicard, G. Garcia, T. Moreau, L. Commien, G. Valladeau (CLS)
N. Picot, T. Guinle, E. Bronner, A. Lombard (CNES) A. Cazenave, J. Bouffard, M.C. Gennero (LEGOS) F. Seyler (IRD) P. Kosuth, N. Bercher (Cemagref)

OVERVIEW

The **PISTACH** project, funded by CNES as part of Jason-2 project, aimed at improving satellite radar altimetry products over coastal areas and continental waters. It was organised around 3 phases:

- Phase 1 (Nov 2007-March 2008): user needs - design of coastal/hydrological products
- Phase 2 (Nov 2007-July 2008): Development of new dedicated algorithms(retracking of the waveforms, tropospheric corrections, ...)
- Phase 3 (July 2008-Sept 2009): prototype implementation, validation and operations

For year 2010, CNES decided to continue the operation of the PISTACH prototype on a best effort basis (still in V1.0), together with the diffusion of a user handbook and data use cases.
Production should be continued on the same basis in 2011.

The input of the prototype is constituted by Jason-2 Level 2 S-IGDR altimeter products, ECMWF meteo fields, as well as several state of the art static auxiliary datasets (DEM, geoid,….).
The first version of PISTACH products adopts the same format and structure as Jason-2 standard IGDR to facilitate their appropriation and assessment by expert users.

The prototype is now still operated and **products in V1.0 are accessible** since cycle 1 of Jason2.

PRODUCTS

SALP — Service Altimetrie & Localisation Precise

***Version 1.0:* from Jason2 Cycle 1 (July 2008)**

- **Experimental** products ➔ feedback from users welcome and product assessment to be pursued !
- High resolution along-track products: 20 Hz sampling rate, 1 file per track, no editing
- Format (NetCDF) and variables/files nomenclatures similar to standard Jason2 I-GDR
  ➔ **PISTACH** products easily handled by Jason-2 GDR users
- ~ 80 additional fields wrt to standard Jason2 I-GDR
- I-GDR fields interpolated/copied at 20Hz
- CALVAL report issued for each cycle (from cycle 1 to cycle 48)
- 2 products:
  - **« Coastal »**: whole ocean + 25 km fringe over lands → ~ 7 Go/cycle (uncompressed)
  - **« Hydro »**: all emerged lands + 25km fringe over oceans ~ 3 Go/cycle (uncompressed)

Data Access: ➔ **ftp://ftpsedr.cls.fr/pub/oceano/pistach/**

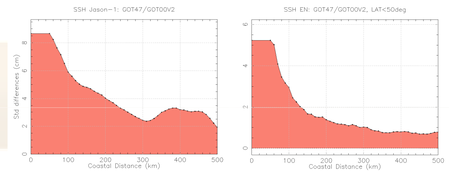
Future (possible) evolutions

- New fields (SSB, land/water masks, tide, DAC, ….) may be added in 2011 (in case of V2.0 ?).
- Application to Jason-1 data

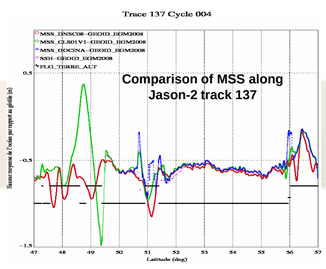
GEOPHYSICAL CORRECTIONS – LOCAL MODELS

The **PISTACH** products include **several** state of the art geophysical corrections as well as higher resolution global/local models, in addition to the content of standard Jason2 I-GDR:

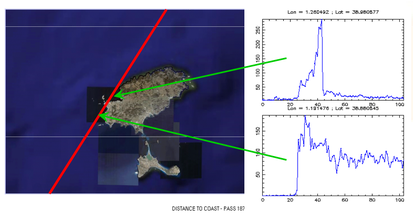
- Tides: GOT 4.7 (Ray)
  T-UGO regional models from LEGOS (TBC)
- MSS: GOCINA over the North Atlantic
  DNSC08 (global)
  Error fields on all MSS
- Bathymetry: MGG/ETOPO2V2 (US coasts),
  ETOPO2V2 (Black and Baltic seas)
  WebTide (NW Atlantic, Hudson Bay)
- Geoid: EGM2008
- DAC: HR Global solution
  T-UGO regional models from LEGOS (TBC)
- MDT: Rio 2007 (Mediterranean Sea)
- DEM: SRTM3_CGIAR to be replaced by ACE2 (3"arc)
- Land Cover Class: GLOBCOVER (10"arc)
- Land/Water Mask: IRD/HyBam
- Distance to Shoreline

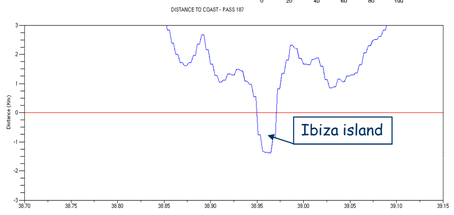


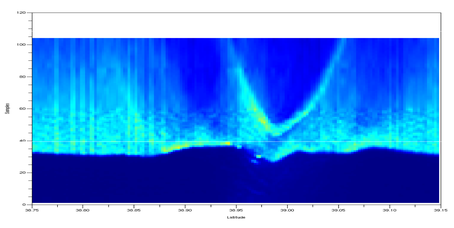
Gain of the GOT4.7 correction at Envisat crossovers as a function of the shore distance, for years 2004-2005 (std differences in cm): left on global ocean, right for latitudes <50°

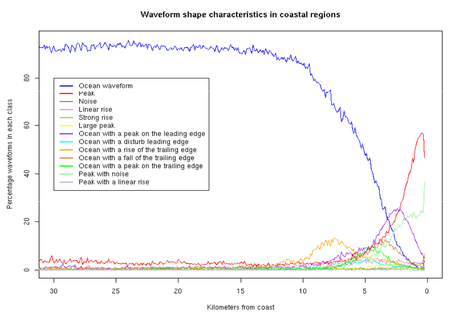


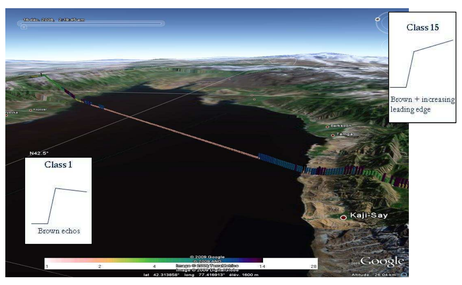
WAVEFORM RETRACKING







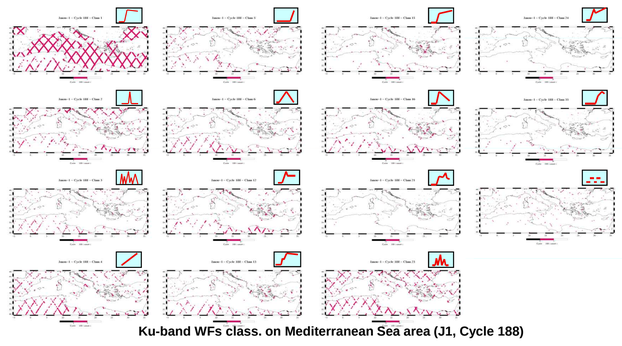




Altimeter echoes (waveforms) are highly perturbed by emerged lands wrt. open ocean returns and thus require a dedicated retracking strategy.

Within **PISTACH**, the retracking is organized around the following steps:

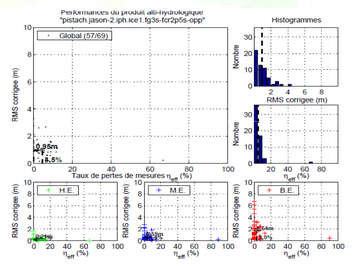
- Classification of the waveforms



Ku-band WFs class. on Mediterranean Sea area (J1, Cycle 188)

- Filtering of the waveforms (before MLE4 retracking)
- Application of 4 different retrackings:
  - Ice1: position of the center of gravity of the echo
  - Ice3: ~Ice1 but restricted to a portion of the echo indicated by the classification
  - Oce3: MLE4 retracking after filtering of the waveforms
  - Red3: MLE3 retracking restricted to a portion of the echo indicated by the classification

The 20Hz retracking ouputs (class, ranges, sigma0, SWH, …) are included in the **PISTACH** products.

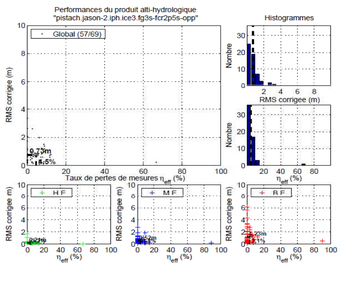


Retracker « ice1 »

$RMS_{\varepsilon Sat}$ = 0.95m

η_{eff} = 4.5%

Comparison of the performances of the Ice1 and Ice3 retrackers over the Amazon basin (See presentation by Bercher et al.)



Retracker « ice3 »

$RMS_{\varepsilon Sat}$ = 0.73m

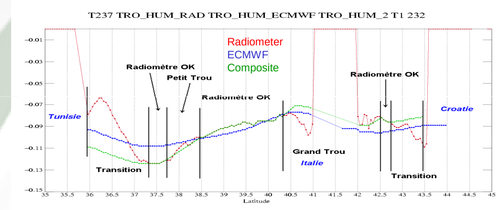
η_{eff} = 4.5%

WET TROPOSPHERIC CORRECTION

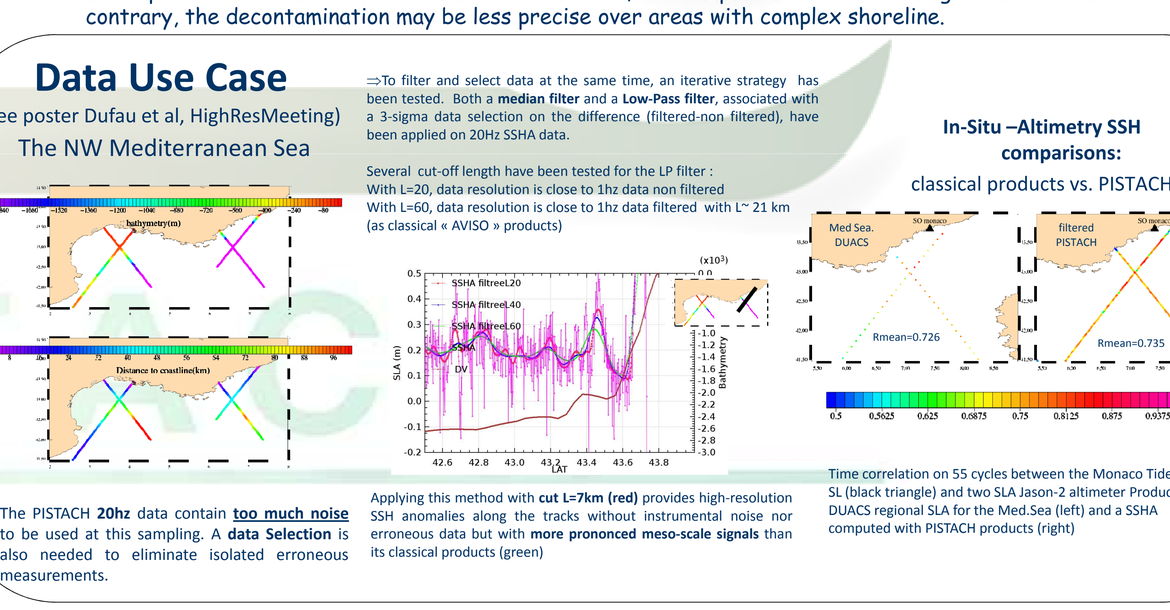
2 different wet tropo corrections are implemented in the **PISTACH** prototype for the coastal oceans:

composite correction:

- the model correction (ECMWF) replaces the radiometer near the coasts (<50 km)
- simplest case ("transition"): ECMWF corr. is shifted at the nearest valid radiometer corr.
- more complicated cases: idem + interpolation and detrending of the ECMWF corr.

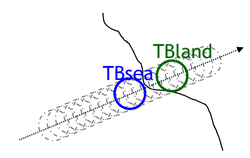


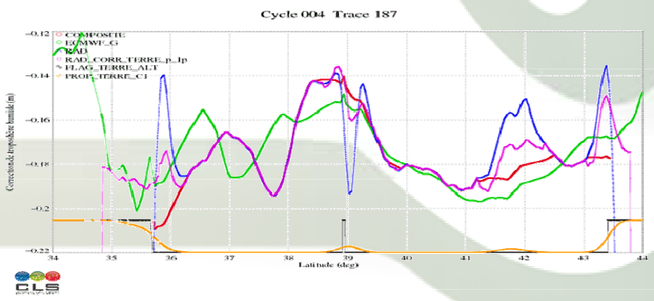
This correction is also implemented in other CLS altimetric databases. With 5 years of data for Jason-1, Topex-Poseidon and Envisat, it is shown that the use of the composite correction instead of radiometer correction over coastal waters significantly improves the coherency between altimetric and in-situ SLAs.
On the figures below, positive differences indicate an improvement of the coherence when using the composite wet tropo for correction and selection of the altimetric data near the coasts.
The impact is significant, ranging from 1.4 to 2.8 cm^2 on average for these 3 missions.
This diagnosis now performed with 2 years of Jason-2 gives similar results.

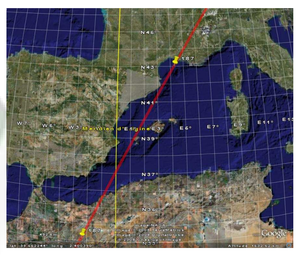


decontamination correction:

- TBcorr(f)=TB(f)-corr(p,f)
- corr (p , f) = [TBland(f) - TBsea (f)] × p (f)
- dh =f(TBcorr(f))
- p= land proportion in the pixel (taking into account the antenna pattern)







The decontamination correction is probably more adapted than the composite correction to areas where large and rapid fluctuations of the air masses are observed, the composite correction being too smooth. On the contrary, the decontamination may be less precise over areas with complex shoreline.

Data Use Case

(see poster Dufau et al, HighResMeeting)

The NW Mediterranean Sea

⇒To filter and select data at the same time, an iterative strategy has been tested. Both a **median filter** and a **Low-Pass filter**, associated with a 3-sigma data selection on the difference (filtered-non filtered), have been applied on 20Hz SSHA data.

Several cut-off length have been tested for the LP filter :
With L=20, data resolution is close to 1hz data non filtered
With L=60, data resolution is close to 1hz data filtered with L~ 21 km
(as classical « AVISO » products)

The PISTACH **20hz** data contain **too much noise** to be used at this sampling. A **data Selection** is also needed to eliminate isolated erroneous measurements.

Applying this method with **cut L=7km (red)** provides high-resolution SSH anomalies along the tracks without instrumental noise nor erroneous data but with **more prononced meso-scale signals** than its classical products (green)

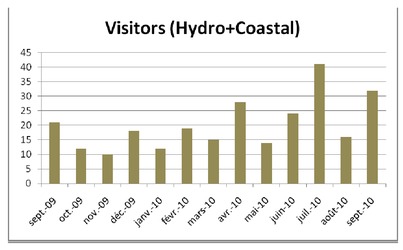
In-Situ –Altimetry SSH comparisons:

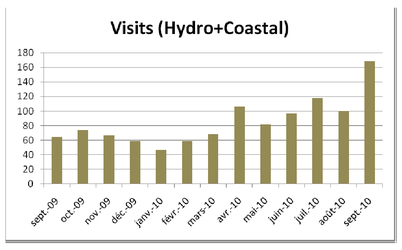
classical products vs. PISTACH

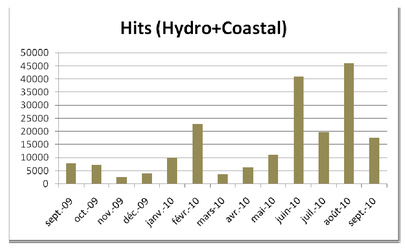
Time correlation on 55 cycles between the Monaco Tide Gauge SL (black triangle) and two SLA Jason-2 altimeter Products : The DUACS regional SLA for the Med.Sea (left) and a SSHA computed with PISTACH products (right)

DATA ACCESS STATISTICS

107 PISTACH users have registered on Aviso by the end of Septembe r2010







Collecte Localisation Satellites
Space Oceanography Division
8-10 rue Hermes
31520 Ramonville Saint Agne - France

2010 OST-ST Hydro

Lisbon, October 2010

Contact
E-mail: Franck.Mercier@cls.fr
Tel: +33.5.61.39.48.53
Web:
·http://www.aviso.oceanobs.com
·http://www.cls.fr