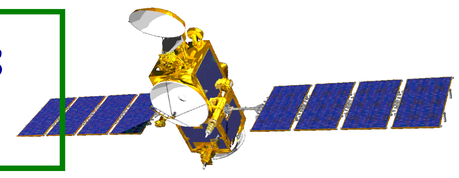
The PISTACH project for coastal altimetry: status, products and early results



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

SALP Service Altimetrie & Localisation Precise

OVERVIEW

The **PISTACH** project (funded by CNES as part of Jason-2 project to improve satellite radar altimetry products over coastal areas and continental waters) is organized around 3 phases:

- Phase 1 (Nov 2007 → March 2008): user needs and structure of coastal/hydrological products
- Phase 2 (Nov 2007 → July 2008): Development of new dedicated algorithms: retracking of the waveforms, wet and dry tropospheric corrections, local models or high resolution global models for topography, geoid, land cover classification, land water mask, data editing
- Phase 3 (July 2008 → Sept 2009): prototype implementation, validation and operation during Jason-2 CalVal phases

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. More simple and easy to-use products are already envisaged for a wider dissemination.

The implementation of the prototype is now completed and **products in V1.0 are accessible** since cycle 1 of Jason-2.

PRODUCTS

Version 1.0: **from Jason2 ~~Cycle 12~~ now from Cycle 1 !!**

- **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 to be issued for each cycle
- 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/**

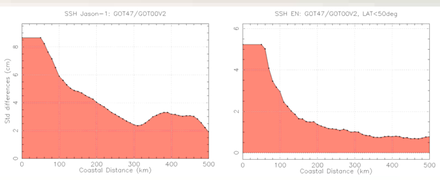
Future evolutions

- New fields (SSB, land/water masks, tide, DAC, ….) to be added soon.
- Conception of a lighter, easy-to-use product, possibly restricted to the strictly coastal zones and with primary editing → gain new users!

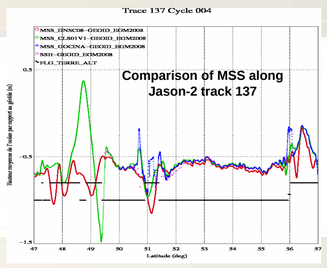
GEOPHYSICAL CORRECTIONS – LOCAL MODELS

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:

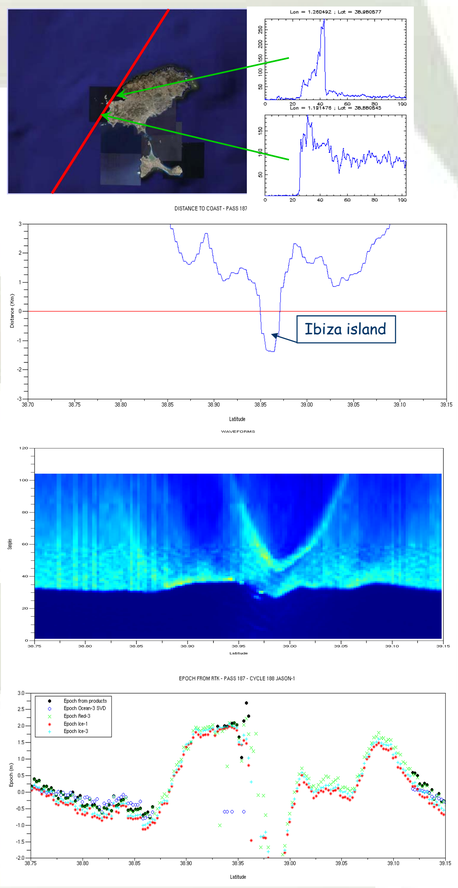
- Tides: GOT 4.7 (Ray)
  T-UGO regional models from LEGOS (TBC)
- MSS: GOCINA over the North Atlantic
  DNSC08 (global)
  Error fields on all MSS
- Bathymetry: MGG/ETOPO2V2 (US coasts),
  ETOPO2V2 (Black and Baltic seas)
  WebTide (NW Atlantic, Hudson Bay)
- Geoid: EGM2008
- DAC: HR Global solution
  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°



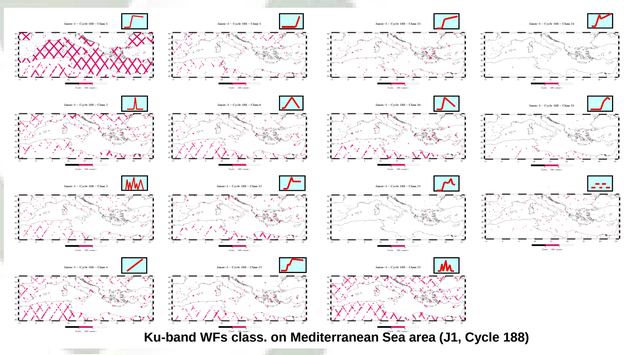
WAVEFORM RETRACKING



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)

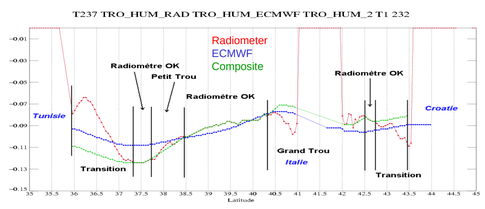
- Filtering of the waveforms (before MLE4 retracking)
- Application of 4 different retrackings:
  - Ice1: position of the center of gravity of the echo
  - Ice3: ~Ice1 but restricted to a portion of the echo indicated by the classification
  - Oce3: MLE4 retracking after filtering of the waveforms
 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

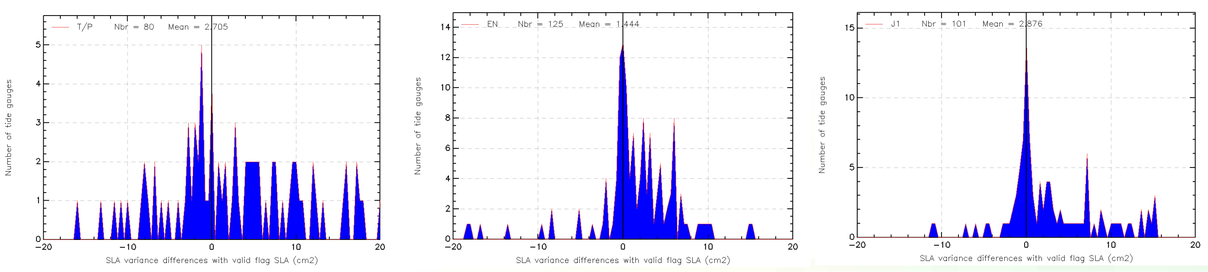
WET TROPOSPHERIC CORRECTION

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

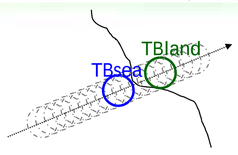
- **composite correction**:
  - the model correction (ECMWF) replaces the radiometer near the coasts (<50 km)
  - simplest case ("transition"): ECMWF corr. is shifted at the nearest valid radiometer corr.
  - more complicated cases: idem + interpolation and detrending of the ECMWF corr.

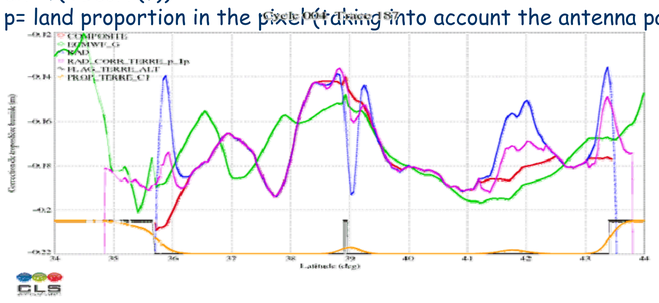


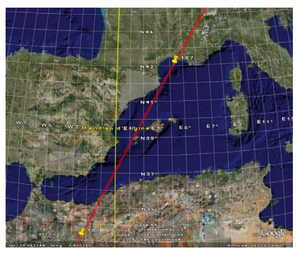
This correction is also implemented in other CLS altimetric databases. With 5 years of data for Jason-1, Topex-Poseidon and Envisat, it is shown that the use of the composite correction instead of radiometer correction over coastal waters significantly improves the coherency between altimetric and in-situ 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 cm² on average for these 3 missions.
This diagnosis cannot be performed yet for Jason-2 because of the shorter time series.



- **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)

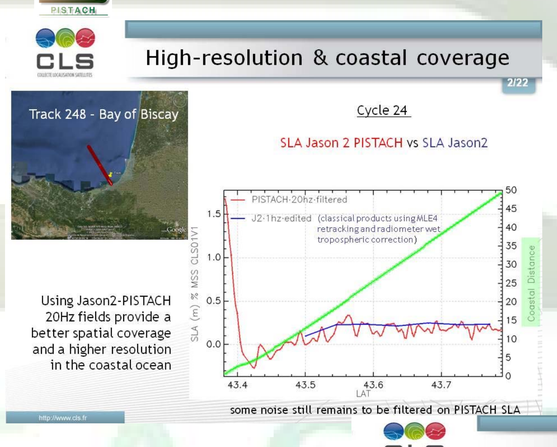


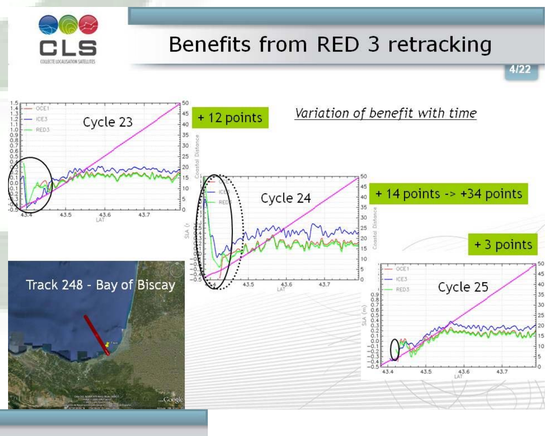


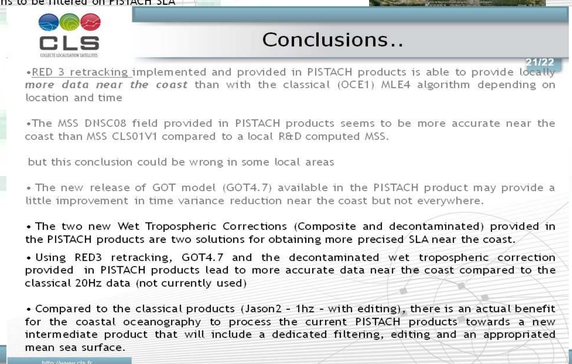


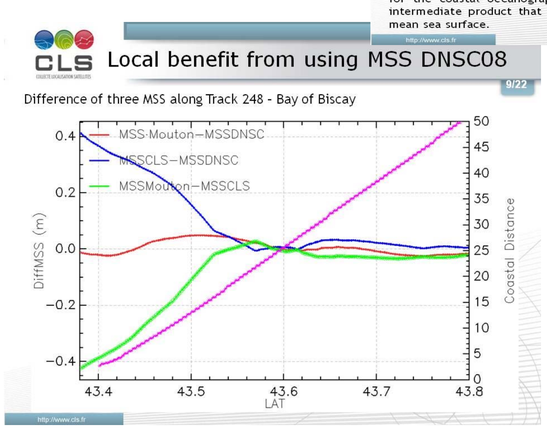
The decontamination correction is probably more adapted than the composite correction to areas where large and rapid fluctuations of the air masses are observed, the composite correction being too smooth. On the contrary, the decontamination may be less precise over areas with complex shoreline.

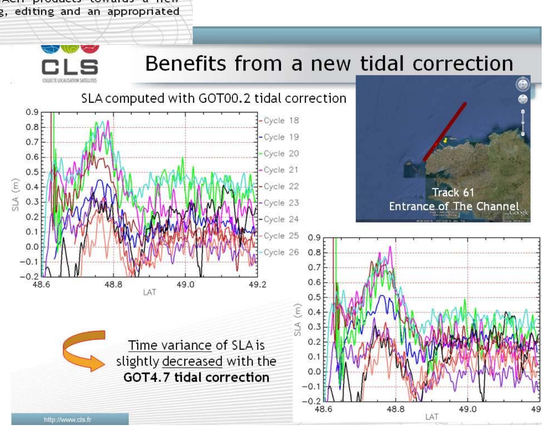
SOME LOCAL BENEFITS FROM PISTACH FIELDS











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