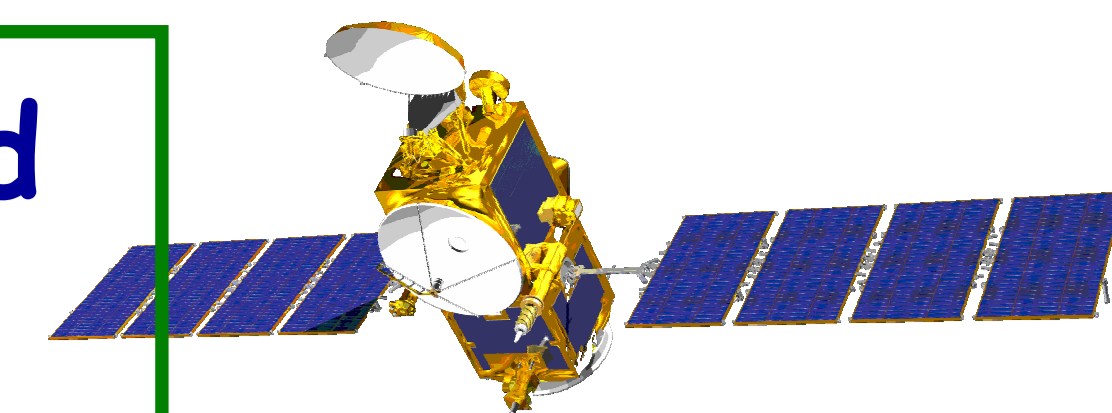


Improved JASON-2 Altimetry Products for Coastal Zones and Continental Waters (PISTACH Project)



F. Mercier, G. Dibarboure, C. Dufau, L. Carrere, P. Thibaut, E. Obligis, S. Labroue, M. Ablain, P. Sicard, G. Garcia, T. Moreau, L. Commien, N. Picot, J. Lambin, E. Bronner, A. Lombard, A. Cazenave, J. Bouffard, M.C. Gennero, F. Seyler, P. Kosuth, N. Bercher

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 operations during Jason-2 CalVal phases

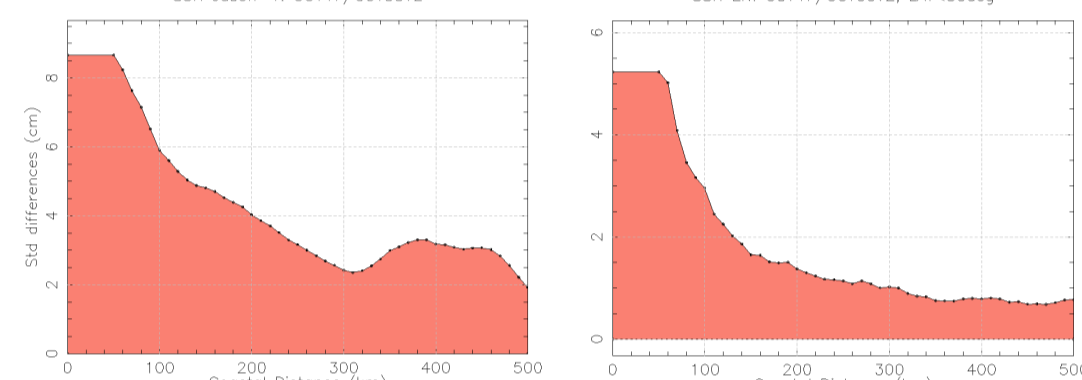
The input of the prototype is constituted by Jason-2 Level 2 S-IGDR altimeter products, ECMWF meteo fields, as well as several state of the art static auxiliary datasets (DEM, geoid, ...). The first version of PISTACH products adopts the same format and structure as Jason-2 standard IGDR to facilitate 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 12 of Jason-2.

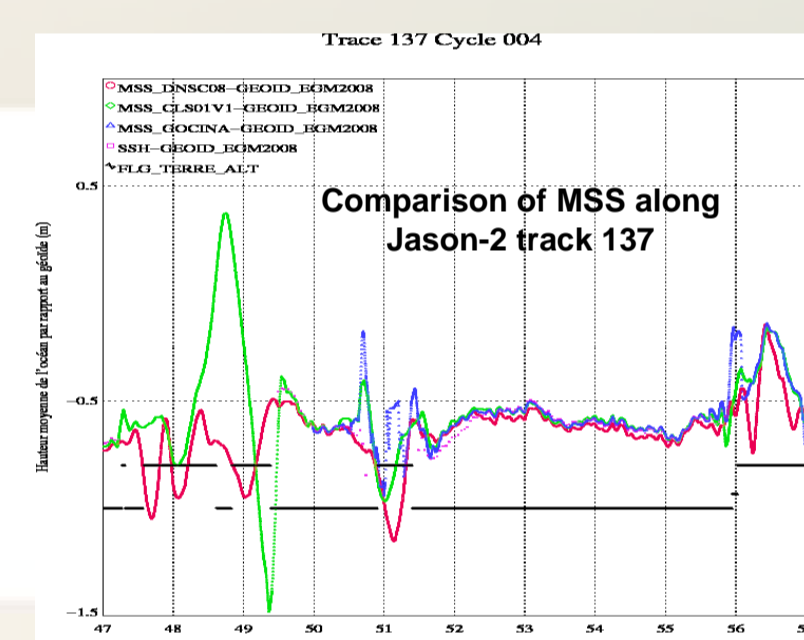
GEOPHYSICAL CORRECTIONS - LOCAL MODELS

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
DNSCO8 (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



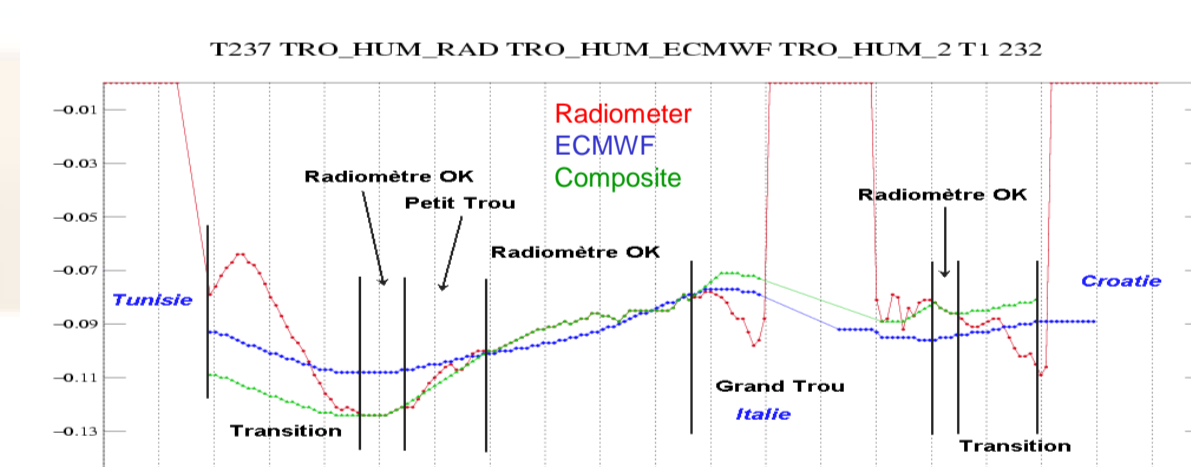
Gain of the GOT4.7 correction at Envisat crossovers as a function of the shore distance, for years 2004-2005 (std differences in cm): left on global ocean, right for latitudes <math>< 50^\circ</math>



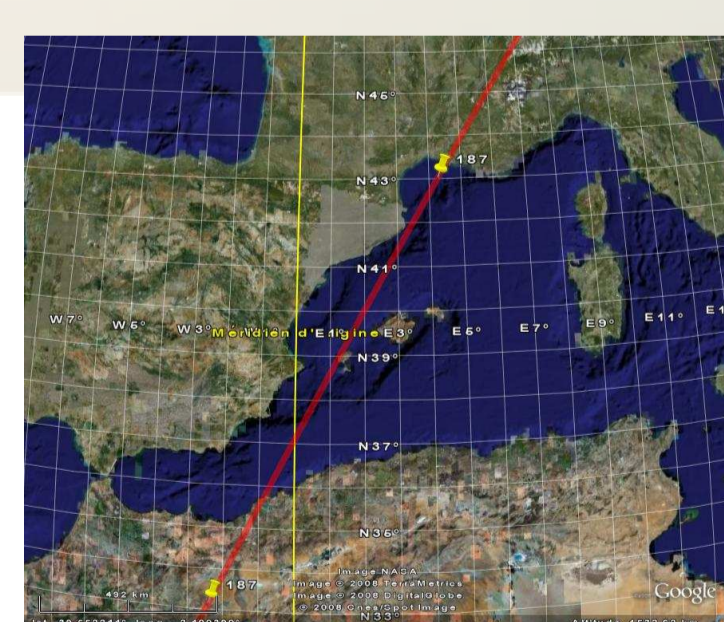
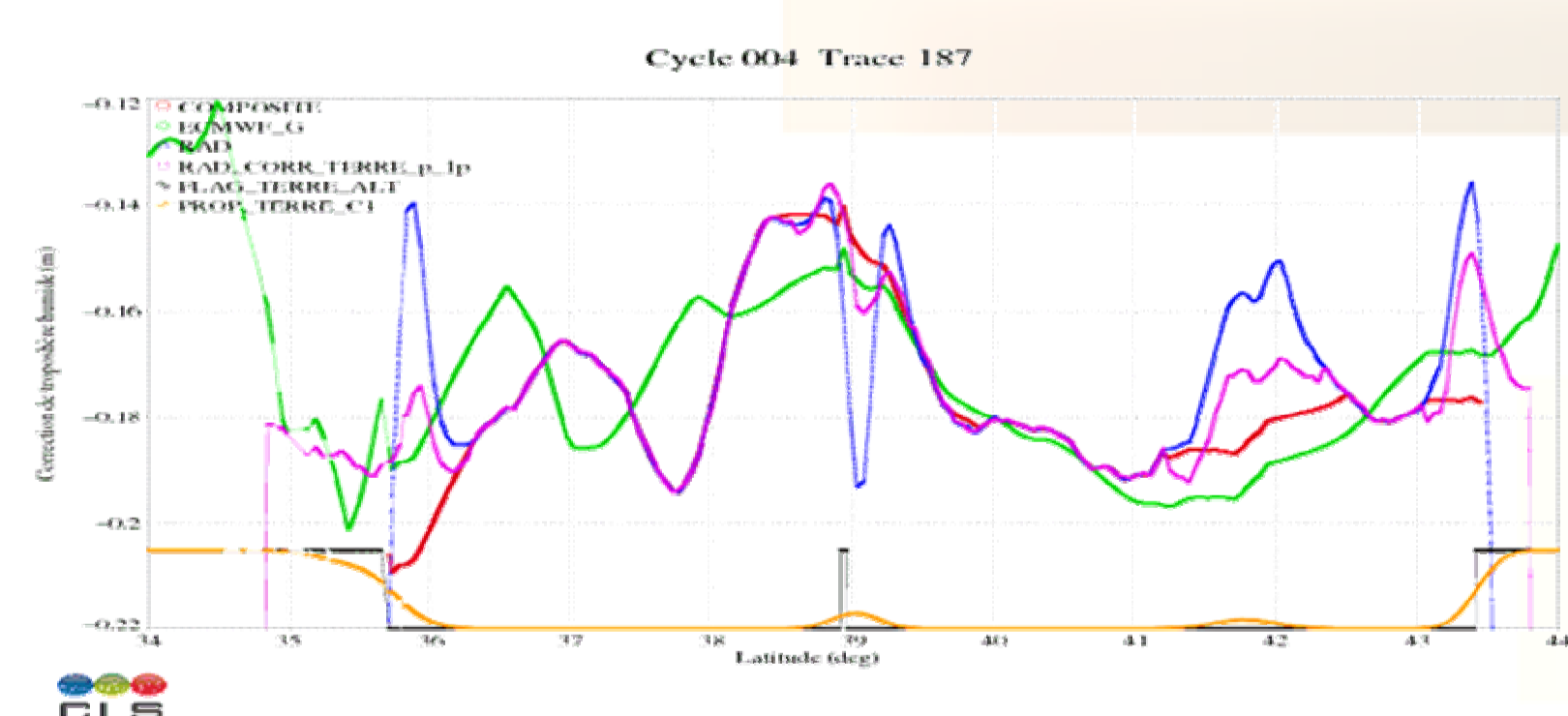
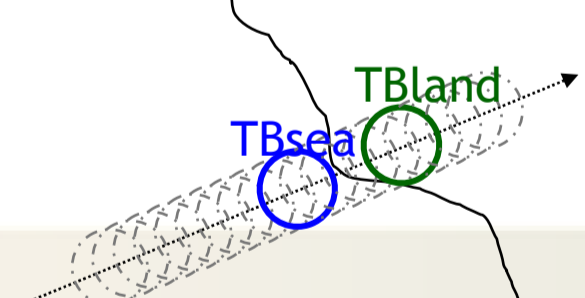
WET TROPOSPHERIC CORRECTION (Coastal Areas)

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 (<math>< 50\text{ km}</math>)
 - simplest case ("transition"): ECMWF corr. is shifted at the nearest valid radiometer corr.
 - more complicated cases: idem + interpolation and detrending of the ECMWF corr.



- decontamination correction:
 - $TB_{corr}(f) = TB(f) - corr(p, f)$
 - $corr(p, f) = [TB_{land}(f) - TB_{sea}(f)] \times p(f)$
 - $dh = f(TB_{corr}(f))$
 - p = land proportion in the pixel (taking into account the antenna pattern)



ENQUIRY ABOUT USER NEEDS

A detailed questionnaire was sent to:

- Coastal community: 110 users, 20 countries
- Hydro: 90 users, 15 countries

→ Answer rate ~ 30 % from both altimetry-experts and altimetry-novices.

Useful answers !

Questions asked:

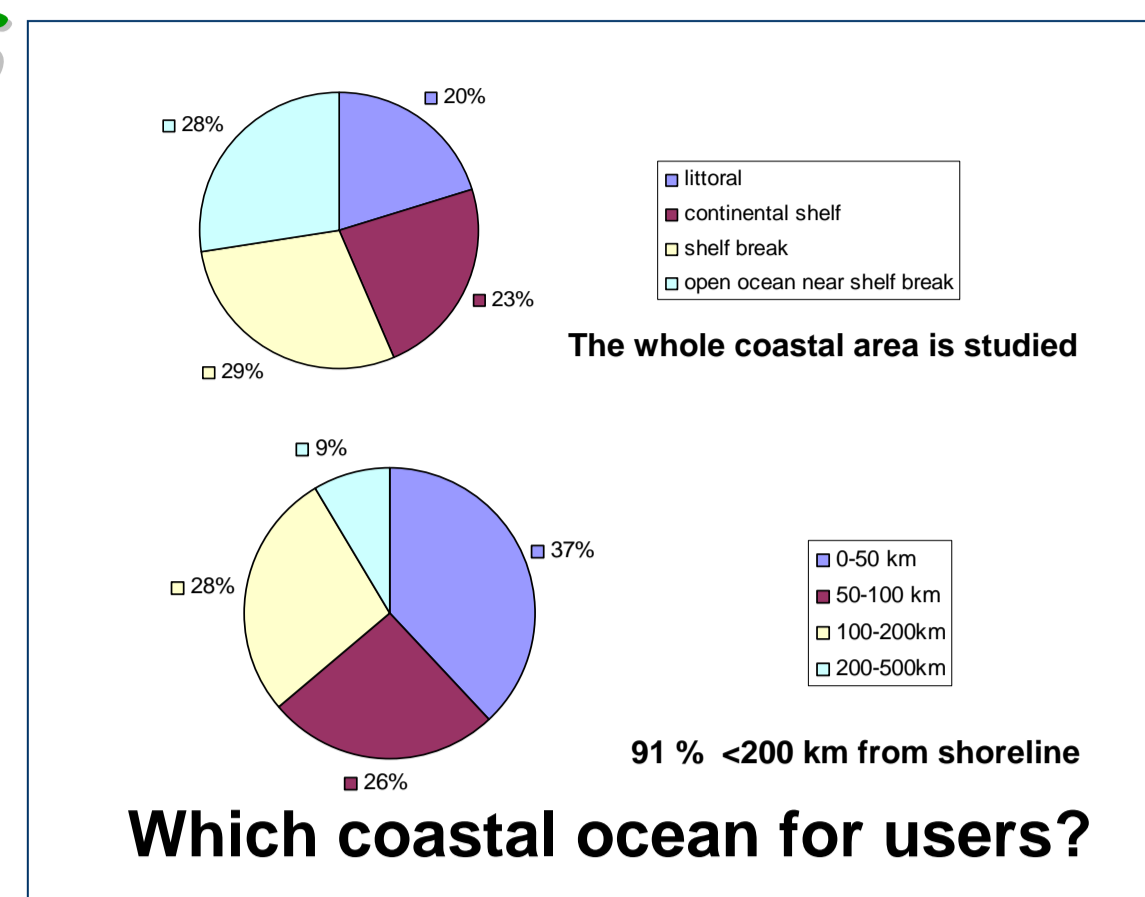
Users, uses, study areas, physical parameters and processes, quality indicator, spatial and temporal resolution, format, dissemination media, ...

Main requirements:

- Coastal Ocean**
 - NetCDF format
 - Some Real Time needs, but mainly Differed Time)
 - Sampling rate: 20 Hz or between 20 and 1 Hz
 - Error budget
 - Expert product (S/IGDR) and easy-to-use product !

Hydro

- NetCDF/raw binary
- Monthly delivery
- Sampling rate: 20 Hz
- need high resolution DEM, land cover classification, land/water mask

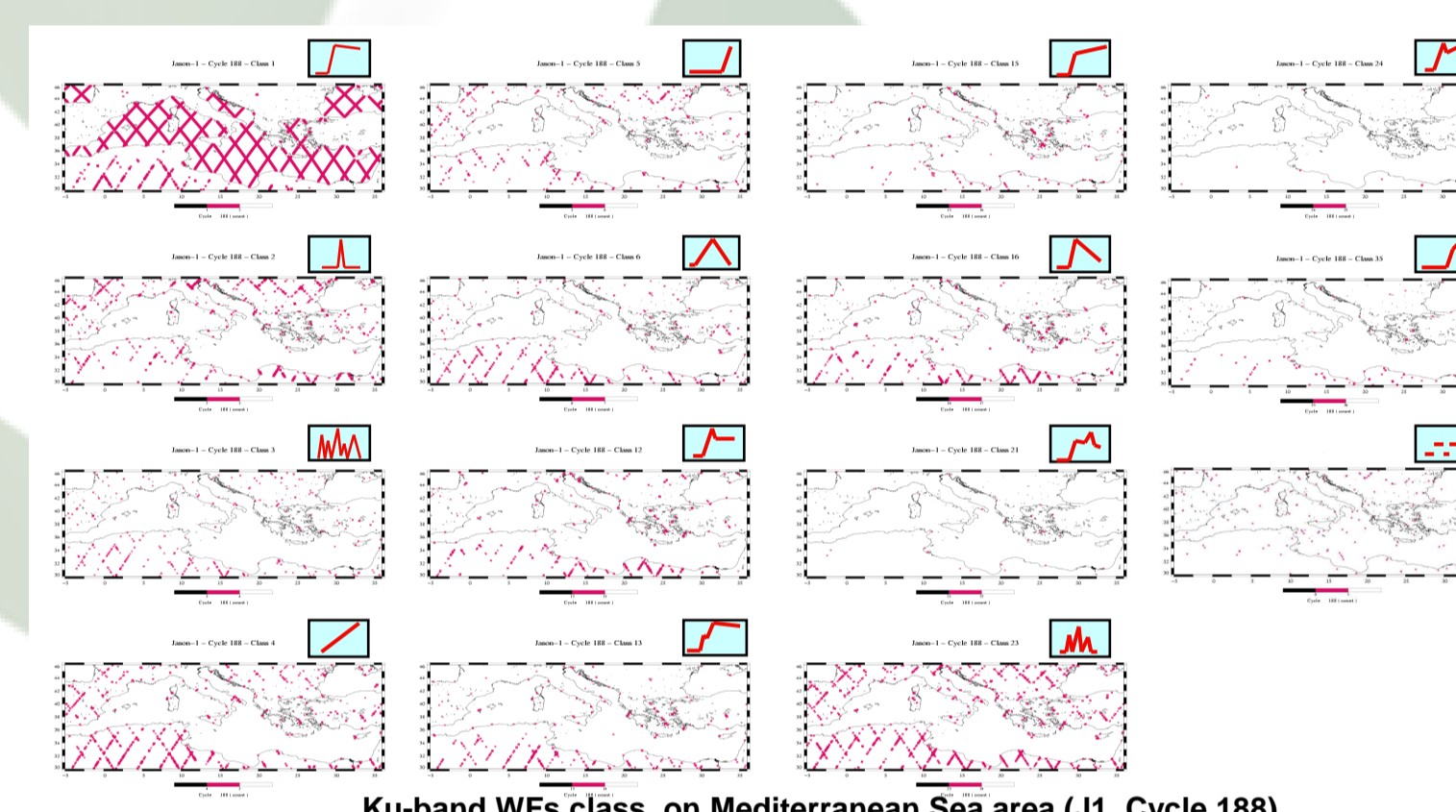


WAVEFORM RETRACKING

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

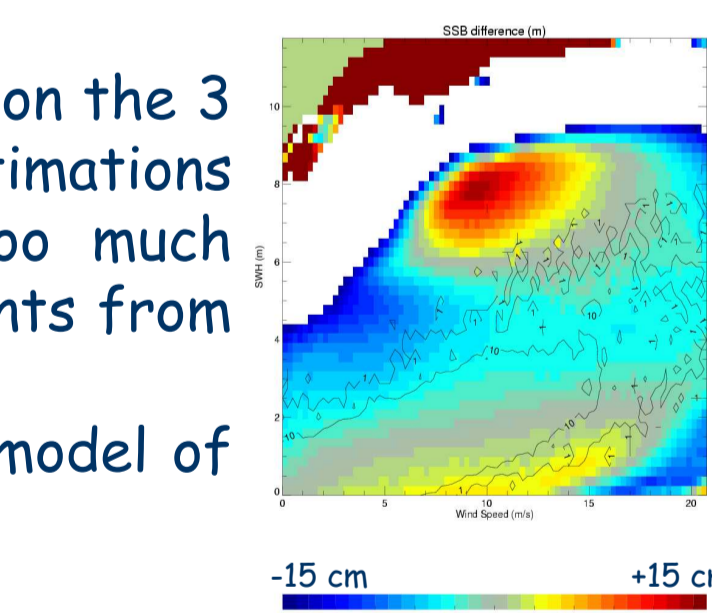
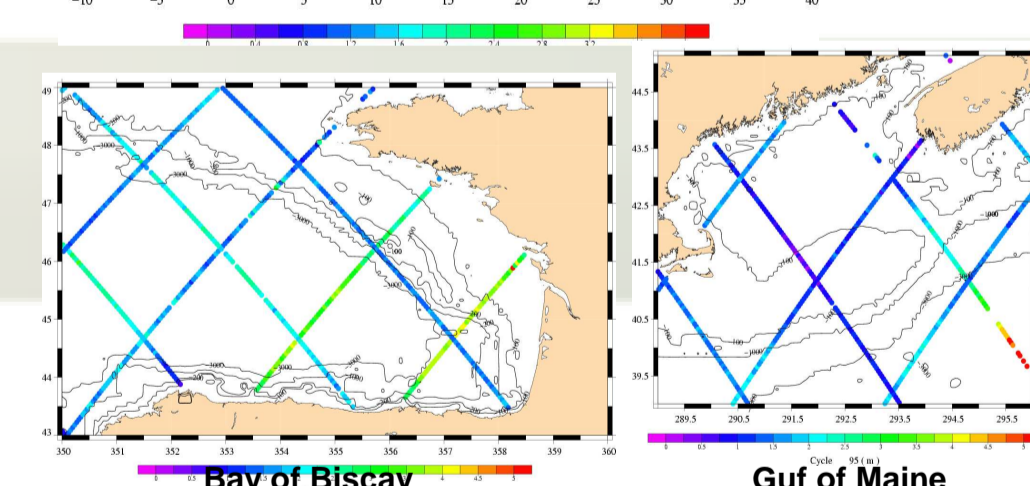
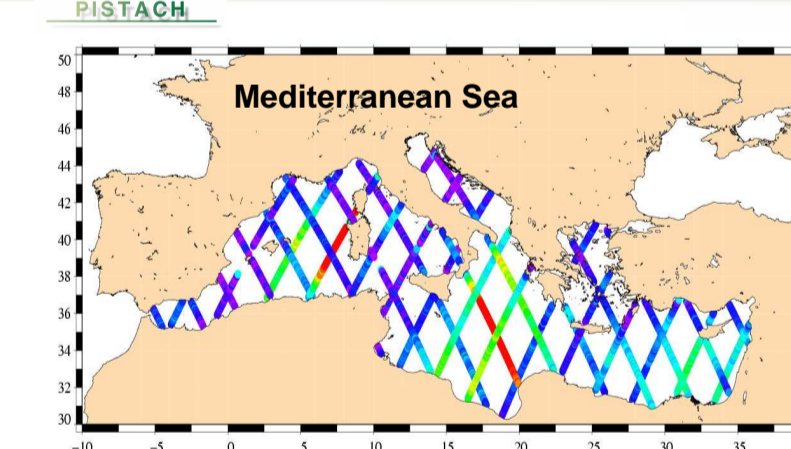
The 20Hz retracking outputs (class, ranges, sigma0, SWH, ...) are included in the PISTACH products.

SEA STATE BIAS

A study has been performed in order to assess the performances of empirical estimation of regional SSB models. Three zones have been selected: Mediterranean Sea, Bay of Biscay and Gulf of Maine because they represent different types of sea state regimes (dominated by young seas, short or long fetch etc...).

Different SSB models have been obtained on the 3 zones. It was showed that such estimations performed on very small regions are too much affected by the oceanic signal, that prevents from retrieving the real sea state bias.

The PISTACH products will use the SSB model of JASON-2 GDR products.



SSB estimated for Mediterranean sea minus Open Ocean SSB

PRODUCTS

Version 1.0: from Jason2 Cycle 12

- 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!

WET AND DRY TROPO CORRECTIONS (Hydrology)

Over land, the radiometer correction is erroneous and the ECMWF model geometry does not reconstitute small-scale topography, especially over water bodies in mountainous terrains.

The wet and dry tropo corrections are recomputed from ECMWF 3D meteo fields with the bottom (and thus thickness) of the atmosphere column given by each altimetric measurement.

