

CTOH STUDIES ON REGIONAL ALTIMETRY IN 2011/2012



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<http://ctoh.legos.obs-mip.fr/>

The screenshot shows the homepage of the CTOH website. The header includes the CTOH Legos logo, navigation links (Site Map, Accessibility, Contact), and a search bar. A main navigation menu lists: Home, Products, Altimetry, Applications, Quality Assessment, Outreach, About CTOH, News, and FAQ. On the left, there is a 'Log in' section with fields for 'Login Name' and 'Password', a 'Log in' button, and links for 'Forgot your password?' and 'New user?'. The main content area features a 'Home' section with the text: 'Welcome to the CTOH website, here you will find information about this team, its goals, its products, and the applications we work on.' Below this, it states: 'The CTOH is a French Observation Service dedicated to satellite altimetry studies (Centre of Topography of the Oceans and the Hydrosphere). The CTOH aims to help scientific users develop new altimetric products and applications. Within this framework, the CTOH maintains homogeneous altimetric data bases for the long-term monitoring of sea level and ocean currents, lake and river levels, the cryosphere, and the planet's climate. Scientific users can extract :'

- **alongtrack GDR data with up-to-date corrections**, over oceans and continental surfaces, for different altimetric missions (Topex/Poseidon, Jason-1, Jason-2, GFO, ENVISAT).
- **coastal alongtrack GDR data** with specific Xtrack processing
- **global surface currents** (Geostrophic and Ekman) from 1999-2008

The CTOH works in close collaboration with scientific research groups at LEGOS to develop new altimetric products, for **monitoring lake and river levels (HYDROWEB)**, and over the **cryosphere (OSCAR)**.

Three featured sections are visible at the bottom:

- Monitoring lake and river levels - HYDROWEB**: Includes a map of South America and a line graph titled 'Variations temporelles du niveau d'eau du fleuve PARANA (d'après Topex/Poseidon)'. The graph shows water level variations from 1990 to 2000, with peaks labeled 'El Niño' and 'La Niña'.
- Coastal altimetry - Xtrack**: Shows a map of the Atlantic Ocean with a grid of altimetry tracks.
- Polar Ice Cap topography**: Shows a polar projection map of the Arctic region with color-coded topographic data.

The browser window shows the address bar with the URL and various navigation icons. The taskbar at the bottom includes the Windows Start button, several open applications (Home - CTOH, OSTST2010, Microsoft PowerPoint), and system tray icons for Internet, volume, and time (13:34).

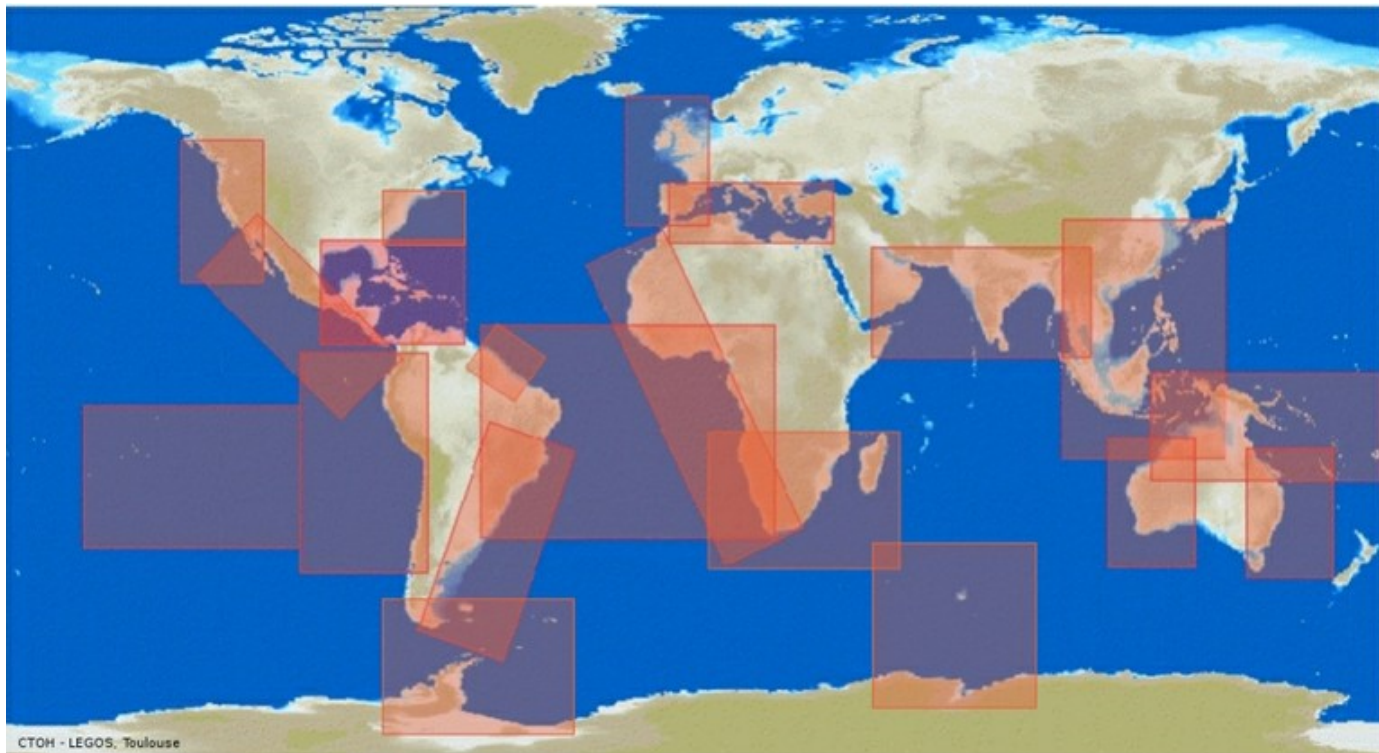


Outline

1. **CTOH regional products: what's new in 2012?**
2. **Impact of geophysical corrections on the observation of the coastal circulation : example of the wet tropospheric correction**
3. **Evaluation of high sampling rate (10/20Hz) altimeter data: a case study over the northwestern Mediterranean Sea (from Birol et al., 2012)**
4. **Conclusion / perspectives**

1. CTOH regional products: what's new in 2012?

- 1 Hz alongtrack SLA products, Netcdf format:
 - including : SLA, MSSH, geophysical corrections, distance to nearest coast (Leuliette)
- 20 different regions available



<http://ctoh.legos.obs-mip.fr/products/coastal-products/>

1. CTOH regional products: what's new in 2012?

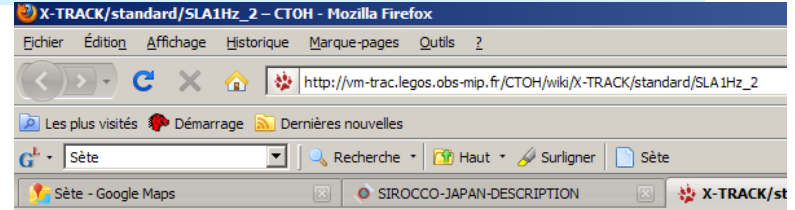
➤ Satellite missions (**homogeneous processing**):

- T/P, Jason-1, Jason-2, T/P interleaved, Jason-1 interleaved, T/P & Jason-1 & Jason-2 combined
- Envisat and GFO (on request)

➔ > 160 requests ; ~20 publications

Complete reprocessing in progress !!!

- ➔ Time series extended (→ Feb. 2012)
- ➔ Corrections (enhanced JMR from Brown, 2010; new filter on iono)
- ➔ Extrapolation of missing corrections shoreward improved



CTOH
Legos

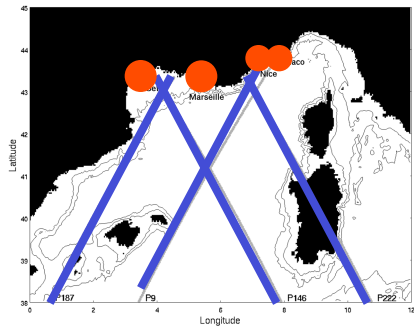
X-TRACK / standard / SLA1Hz_2

Suivi de production standard des produits SLA 1 Hz

J1N and TPN correspond to interleaved missions

	J1	J1N	J2	TP	TPN	TP+J1	TPN+J1N	TP+J1+J2	Envisat	GFO
AFRIQUE	●	●	●	●	●	●		●		
AMAZONE	●	●	●	●	●	●		●		
BIGBEN	●	●	●	●	●	●		●		
CALIFORNIA	●	●	●	●	●	●		●		
CHINASEA	●	●	●	●	●	●		●	●	●
DRAKE	●	●	●	●	●	●		●		
EAC	●	●	●	●	●	●		●		
GoM	●	●	●	●	●	●		●		
GOMMAB	●	●	●	●	●	●		●	●	
HUMBOLDT	●	●	●	●	●	●		●		
KERGUELEN	●	●	●	●	●	●		●		
MEDSEA	●	●	●	●	●	●		●	●	●
NEA	●	●	●	●	●	●		●	●	●
NINDIAN	●	●	●	●	●	●		●	●	●
OREGON	●	●	●	●	●	●		●		
PACIFICSUD	●	●	●	●	●	●		●		
PATAGONIA	●	●	●	●	●	●		●	●	●
SALOMON	●	●	●	●	●	●		●	●	
SOUTHAFRICA	●	●	●	●	●	●		●		
WAUSTRALIA	●	●	●	●	●	●		●		

1. CTOH regional products: what's new in 2012?

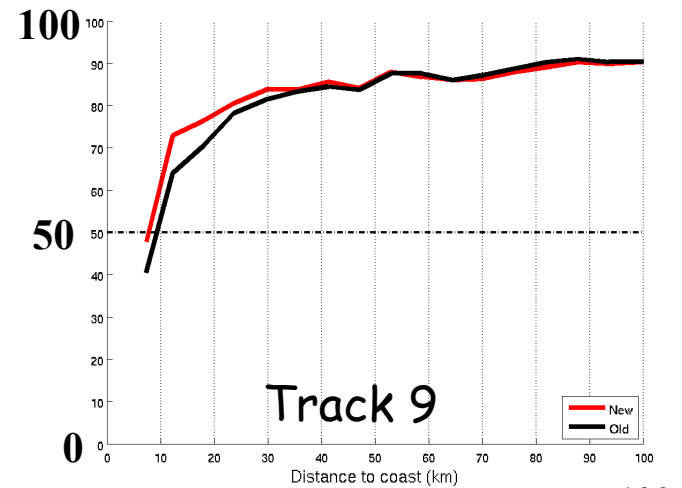
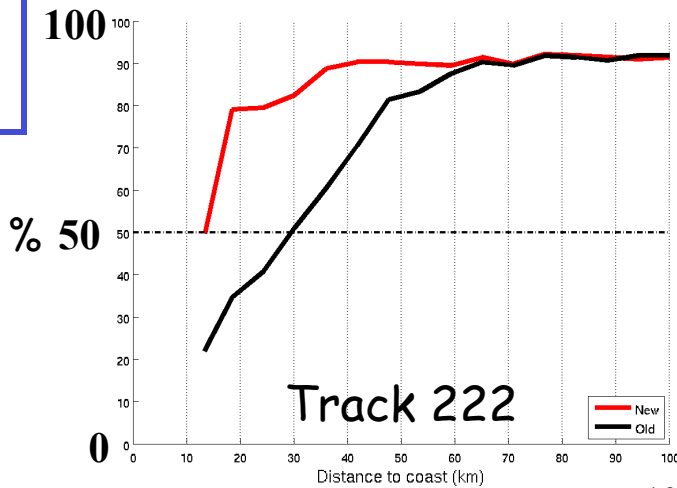
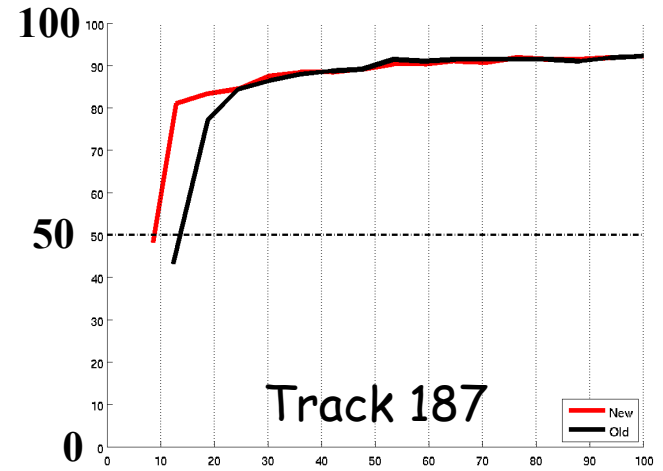
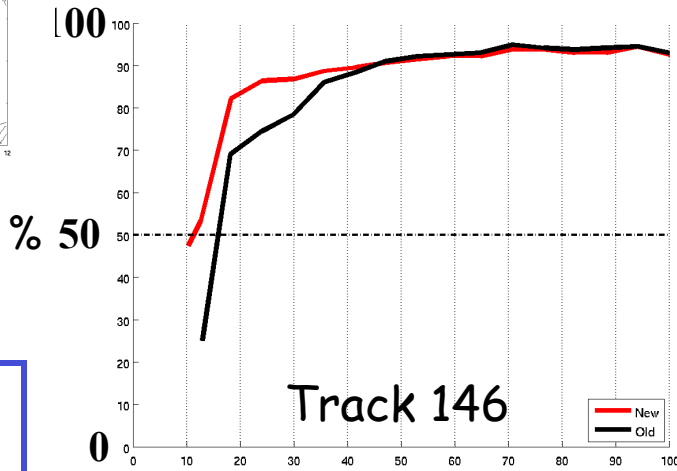


Impact of the changes in X-TRACK processing: example of Jason-1 - NW Mediterranean sea

% of valid SLA data available vs distance to coast

- 2012

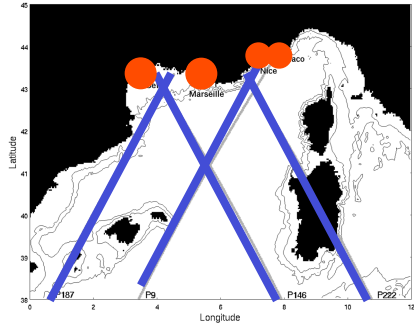
- 2011



Distance to coast (km)

Distance (km)

1. CTOH regional products: what's new in 2012?

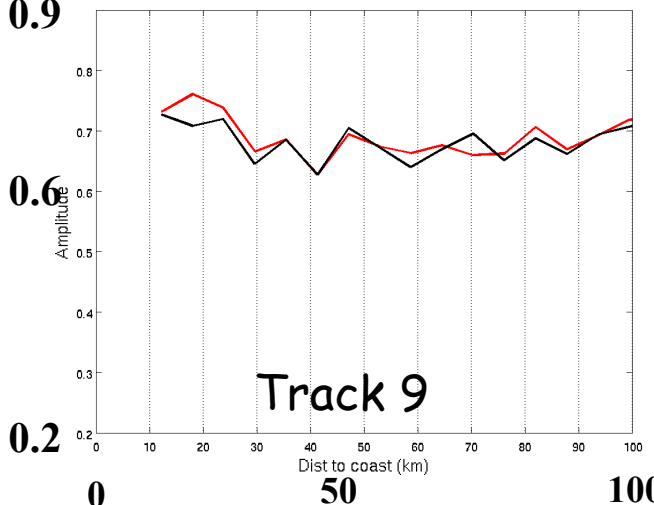
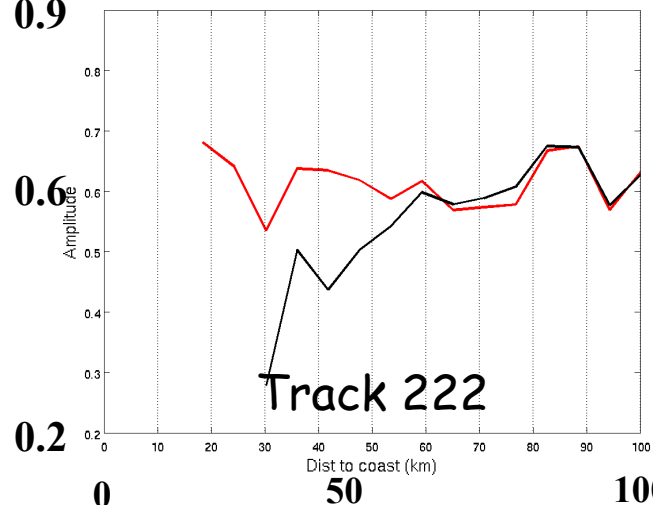
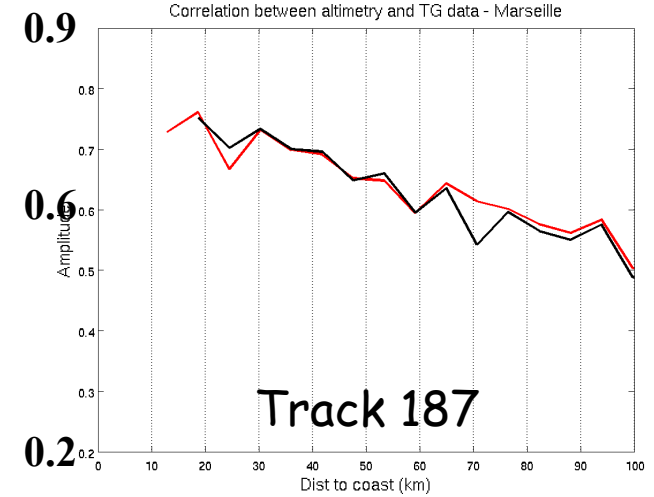
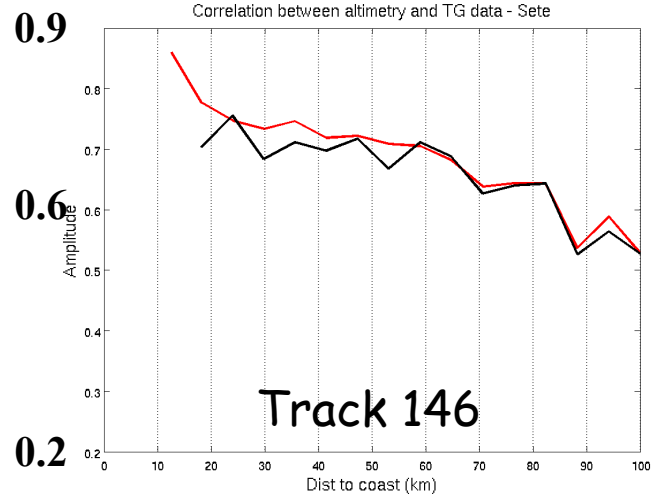


Impact of the changes in X-TRACK processing: example of Jason-1 - NW Mediterranean sea

Comparison to tide gauge measurements: correlation (no filter applied on SLA)

- 2012

- 2011



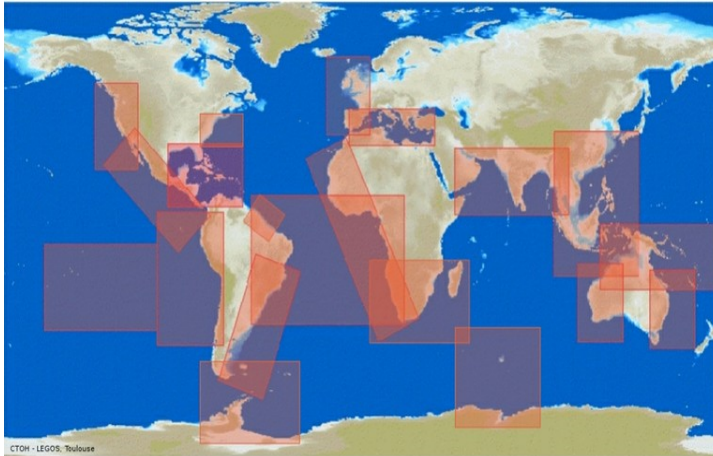
Distance to coast (km)

Distance (km)

1. CTOH regional products: what's new in 2012?

New regional product of alongtrack tidal harmonic constants derived from XTRACK SLA (since June 2012)

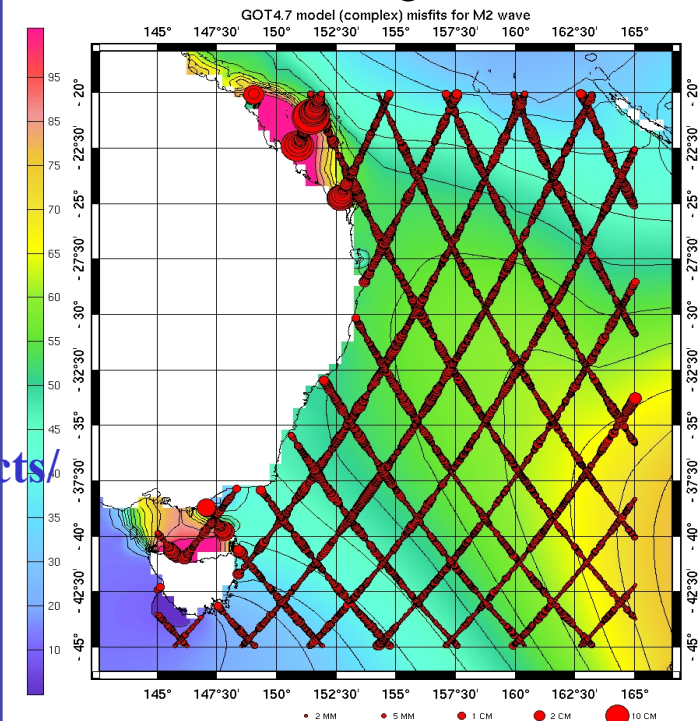
- from 18 years of 1-Hz X-TRACK SLA along T/P-Jason1&2 groundtracks
- amplitude, phase lags and accuracy estimates for a large spectrum of tidal constituents
- 20 different regions available



<http://ctoh.legos.obs-mip.fr/products/coastal-products/coastal-products-1/tidal-constants>

→ Access to diagnostics online (Misfits between altimeter derived and GOT4.7 model solutions for different constituents)

Example : East Australian Current region – M2

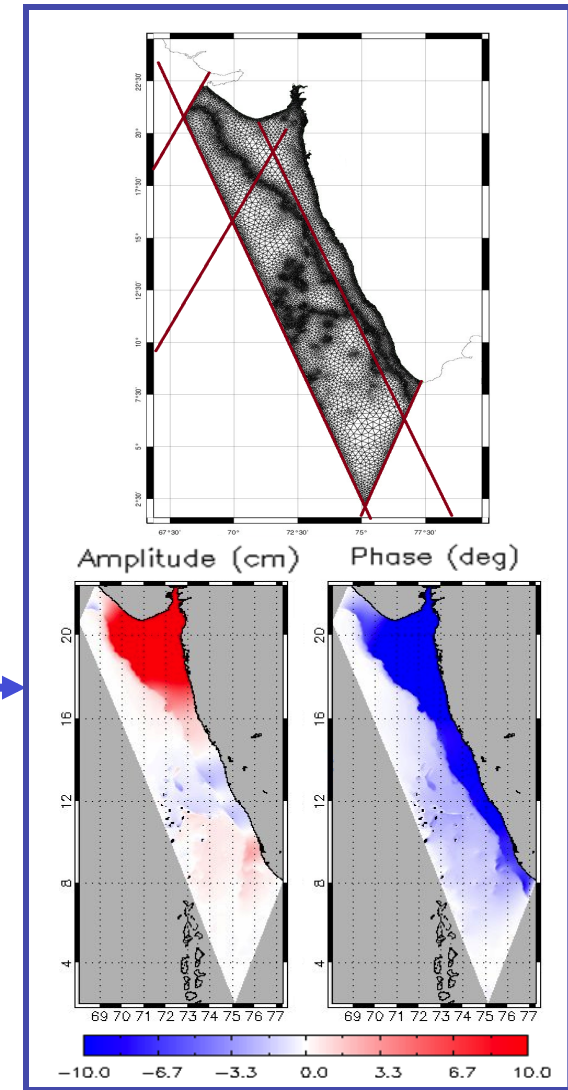


1. CTOH regional products: what's new in 2012?

New regional product of alongtrack tidal harmonic constants derived from XTRACK SLA (since June 2012)

Applications:

- Tidal model validation (exple : Fukushima Radioactive Dispersion Forecast, FES2012)
- Assimilation (exple: COMAPI regional tidal models)
- Tidal correction for altimetry data
- Boundary conditions for regional tidal models (exple : Gulf of Khambat experiment)
- ...

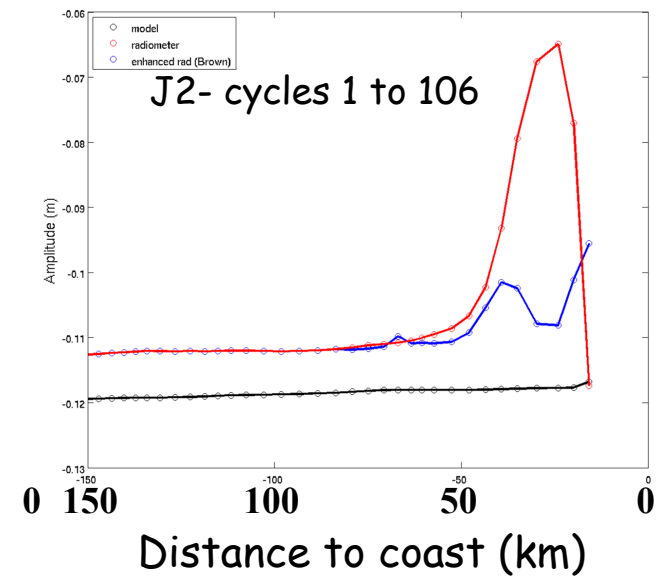
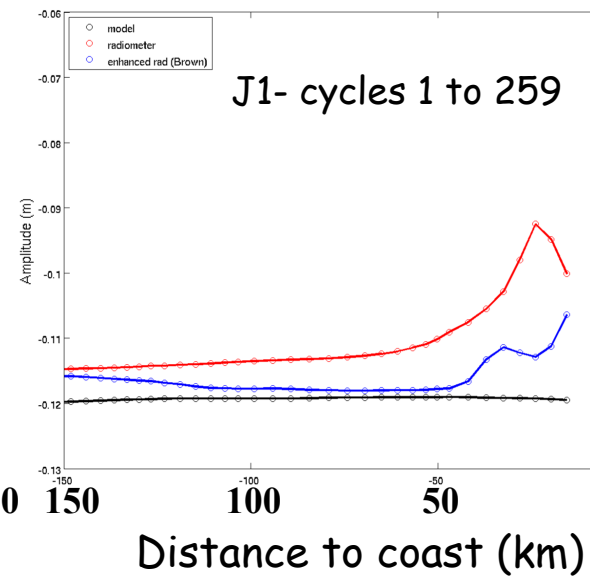
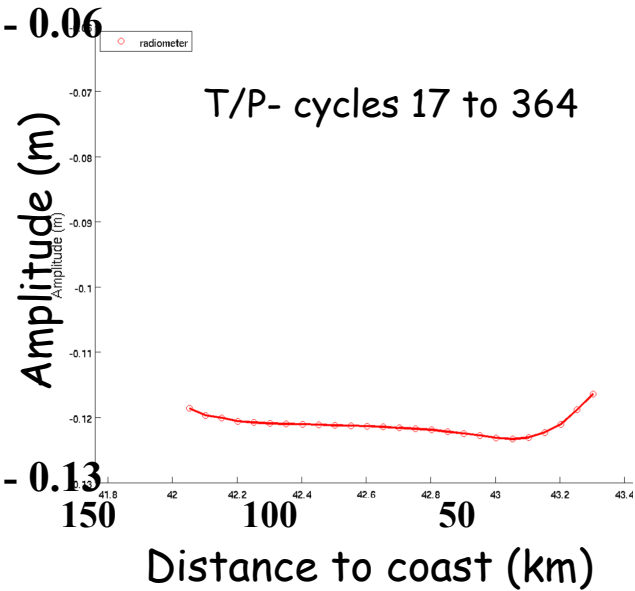
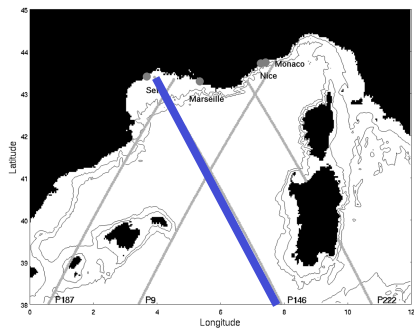


2. Impact of geophysical corrections on the observation of the coastal circulation

Example of the wet tropospheric correction

NW Mediterranean Sea - Track 146:
Average value of the wet tropospheric correction

- Radiometer (TMR/JMR/AMR)
- Enhanced correction (S. Brown, 2010)
- ECMWF model

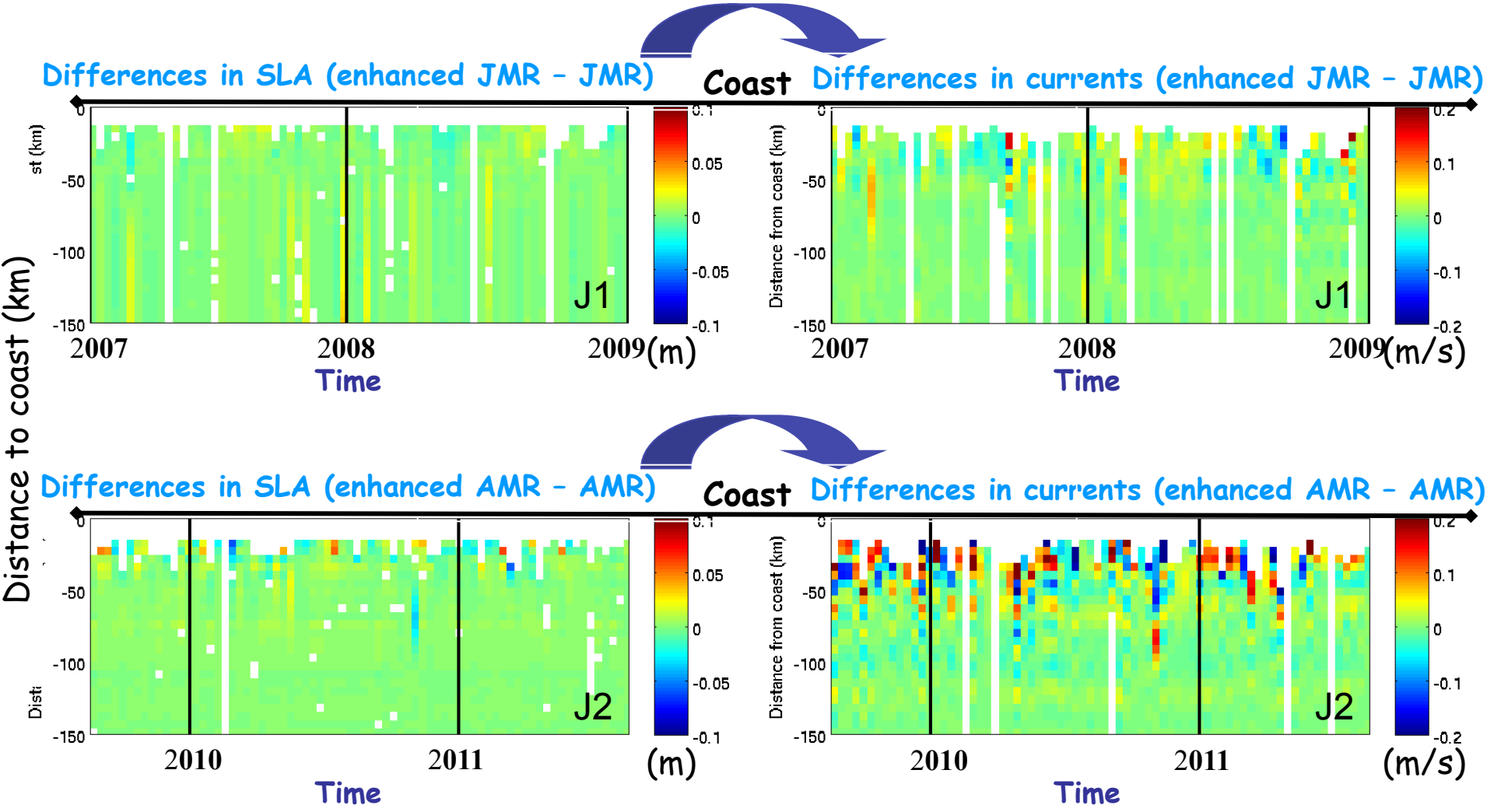




2. Impact of geophysical corrections on the observation of the coastal circulation

Example of the wet tropospheric correction

Impact on SLA and cross-track geostrophic current anomalies - track 146



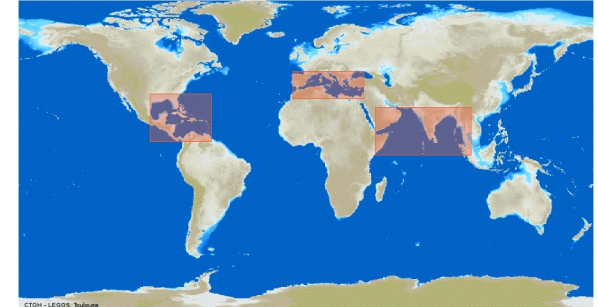
3. Evaluation of high sampling rate (10/20Hz) altimeter data



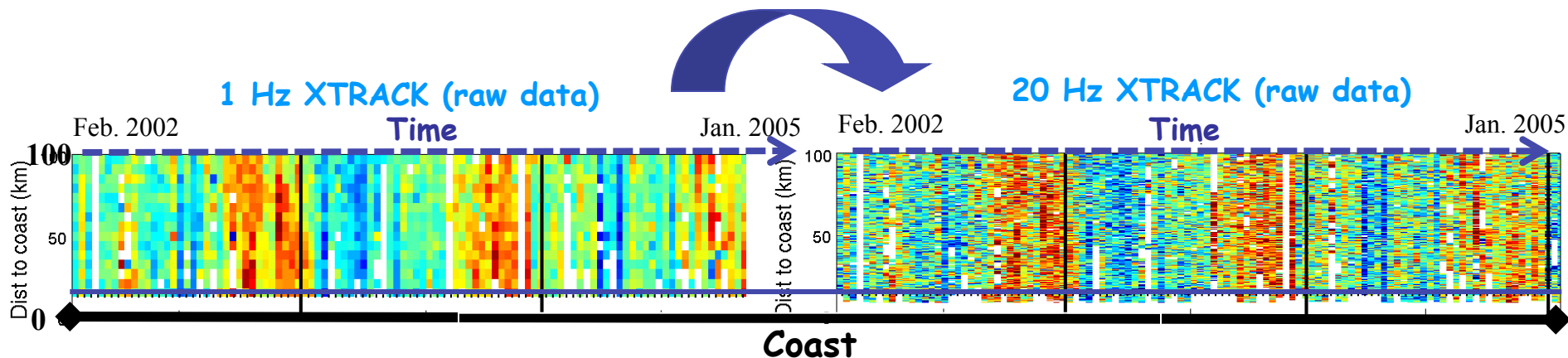
➤ 20Hz/10 Hz SLA experimental products available

- T/P, Jason-1 and Jason-2
- computed with X-TRACK software
- starting from 20Hz/10Hz altimeter measurements from standard GDRs
- corrections interpolated from 1Hz ones
- no spatial filtering applied
- same format and parameters than 1 Hz SLA products

3 regions available



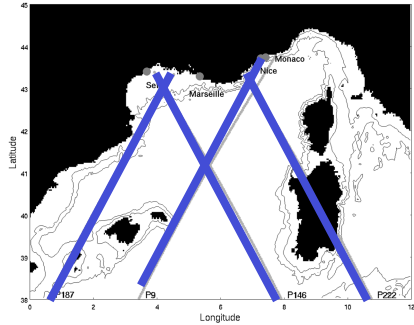
SLA vs distance from coast – Jason1 - track 146



Many different groups working on this HSR data (PISTACH, COASTALT, CTOH, ...)

3. Evaluation of high sampling rate (10/20Hz) altimeter data

A case study over the northwestern Mediterranean Sea



Average value of the percentage of valid 1Hz and **10/20Hz** SLA as a function of different ranges of distance to the coast and of the satellite mission. The mean gain/lost in number of valid data when using 10/20Hz data is in red.

Satellite mission	$d \leq 30$ km	$30 \text{ km} < d \leq 50$ km	$d > 50$ km
Topex/Poseidon	57.99% / 60.59% (+4.5%)	81.18% / 82.83% (+2%)	86.38% / 86.3% (+0.1%)
Jason-1	68.46% / 75.5% (+10.3%)	87.94% / 89.27% (+1.5%)	91.87% / 91.28% (-0.6%)
Jason-2	63.76% / 72.07% (+13%)	92% / 93.85% (+2%)	96.28% / 91.49% (-5%)

- T/P (1Hz, 10Hz):
Cycles 17 to 364

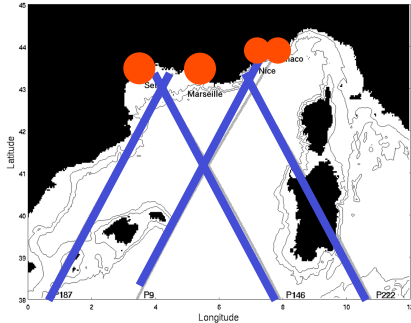
- Jason-1 (1Hz,
20Hz): Cycles 1 to 259

- Jason-2 (1Hz,
20Hz): Cycles 1 to 106

- Differences between valid 1-Hz and 10/20-Hz data vary significantly among the different altimeter missions and passes.
- By applying a specific processing to high rate measurements we can extend the number of valid SLA several kilometers shoreward.

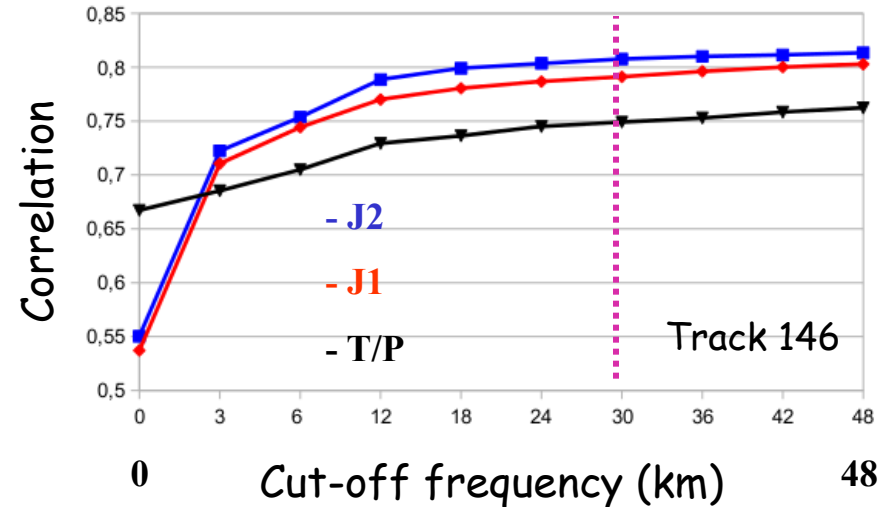
3. Evaluation of high sampling rate (10/20Hz) altimeter data

A case study over the northwestern Mediterranean Sea Comparison to 1Hz SLA data and to tide gauge measurements



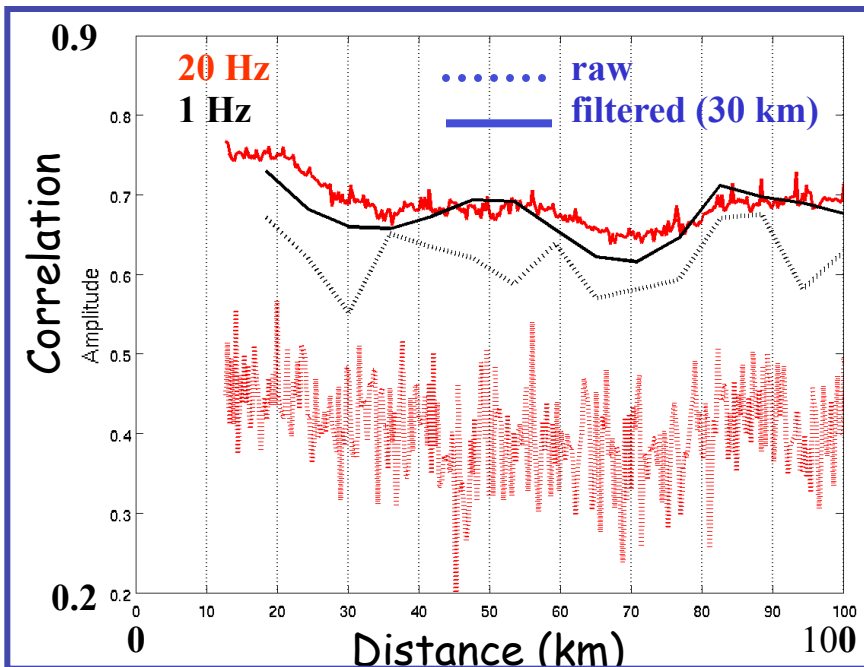
● Tide gauges

Average correlation between all 10/20-Hz low-pass filtered SLA located closer than 50-km from land and the nearest tide gauge observations computed using different cut-off frequencies.



Altimeter vs tide gauge SLA (example of Jason-1, track 146 – Sète TG)

See also poster Birol et al., 20YPR



4. Conclusions/perspectives

- ✓ X-TRACK processing tool now at a mature stage
 - provides homogeneous multi-mission 1 Hz alongtrack SLA products
 - complete reprocessing of the data sets in progress
- ✓ Higher sampling rate SLA: experimental data sets.
 - further analysis and validation needed in order to optimize the processing (impact of : retracking, geophysical corrections, editing, MSSH, filtering, ...)
 - other test cases in other coastal areas and independent in-situ observations needed
- ✓ Regional CAL/VAL activities: analysis of AltiKa and Cryosat-2 performances.
- ✓ Any request? ⇒ ctoh_products@legos.obs-mip.fr