The New Generation of High-Resolution X-TRACK/ALES Regional Altimeter Product And the Coastal Application Associated

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Thursday 06 february 2020 - ESA-ESRIN, Frascati, Italy

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

What is X-TRACK/ALES ?

The goal is to take advantage of the large progress that has been made in coastal altimetry during the past decade to obtain more accurate data closer to the coast
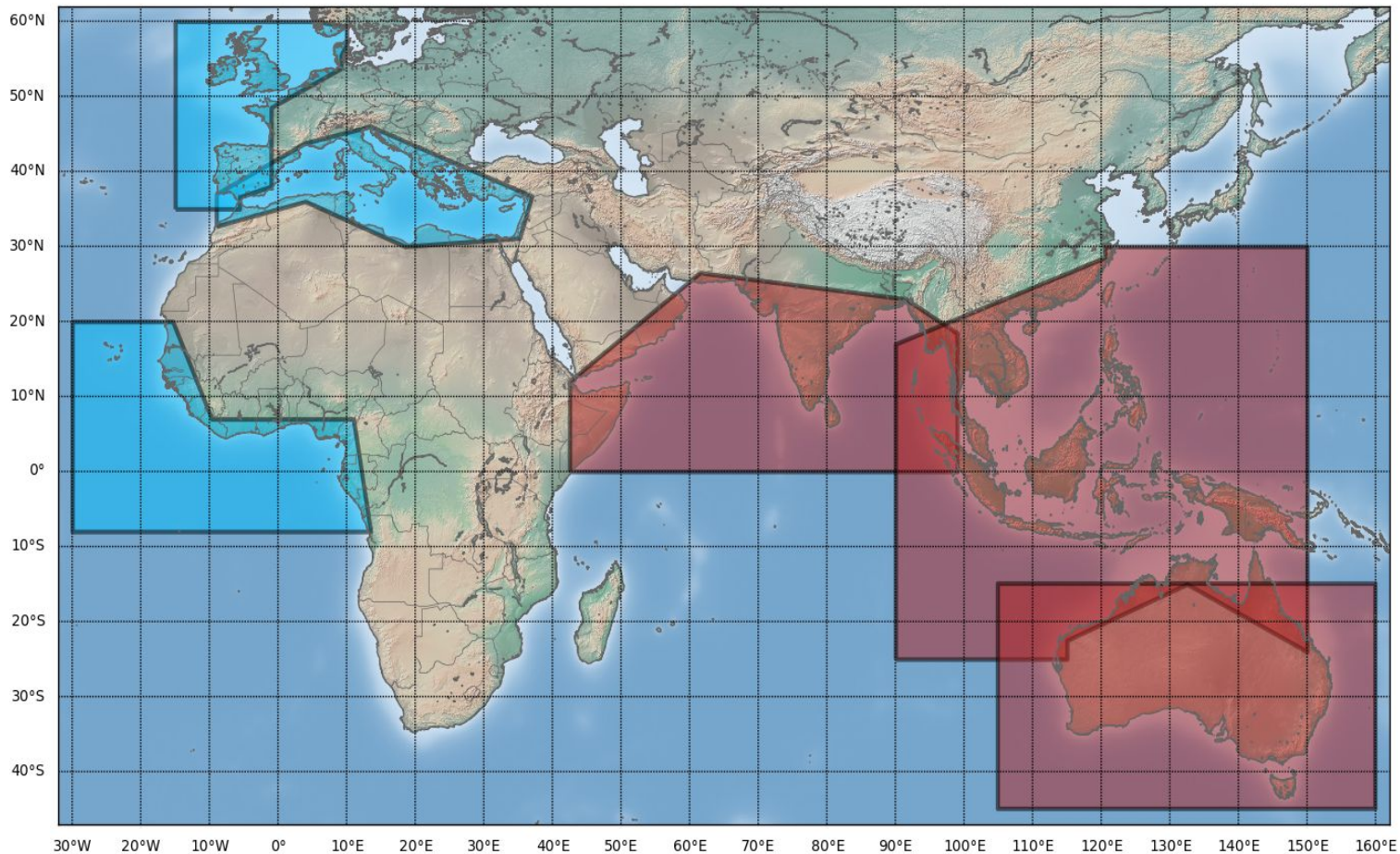
- Part of the ESA's climate change initiative sea-level projetcs (bridging phase in 2018-2019 and CCI extension in 2019-2022)

- Combines :
    - Better spatial resolution, **20 Hz** (~350m)
    - Benefit of **ALES** retracker
    - Benefit of **X-TRACK** post-processing strategy
    - Best set of geophysical corrections

What is X-TRACK/ALES ?

a L3 regional multi-mission product

[2018-2019]
Bridging phase zones
North East Atlantic
Mediterranean Sea
West African Coast

[2019-2022]
CCI+ zones
North East Atlantic
Mediterranean Sea
West African Coast
North Indian Ocean
China Sea
South Australia

Map of the X-TRACK/ALES zones, bridging phase in blue and CCI+ in red.

What is X-TRACK/ALES ?

Along-track SLA time series at 20-Hz for different missions:

Envisat, Jason 1, Jason 2, Jason 3, Saral/Altika, Sentinel 3

	Bridging phase	CCI+ internal	CCI+ users
J1+J2	October 2019		
J1+J2+J3		January 2020	
Envisat		June 2020	
Saral/ALTIKA		June 2020	
Sentinel3		2021	

Table: Schedule of data availability

What is X-TRACK/ALES ?

X-TRACK software reprocesses in delayed time corrections and parameters from the geophysical data records (GDR products) and combines them with the ALES data (range, sigma0 and sea state bias) to compute the SLA, after a robust editing of the measurements and corrections and the computation of a high rate MSSH along the altimeter tracks (by inversion of the corrected SSH data).

Red : 20Hz GDR J2 tracks
green : X-TRACK 1Hz nominal track
for the J2 track 9 in MEDSEA
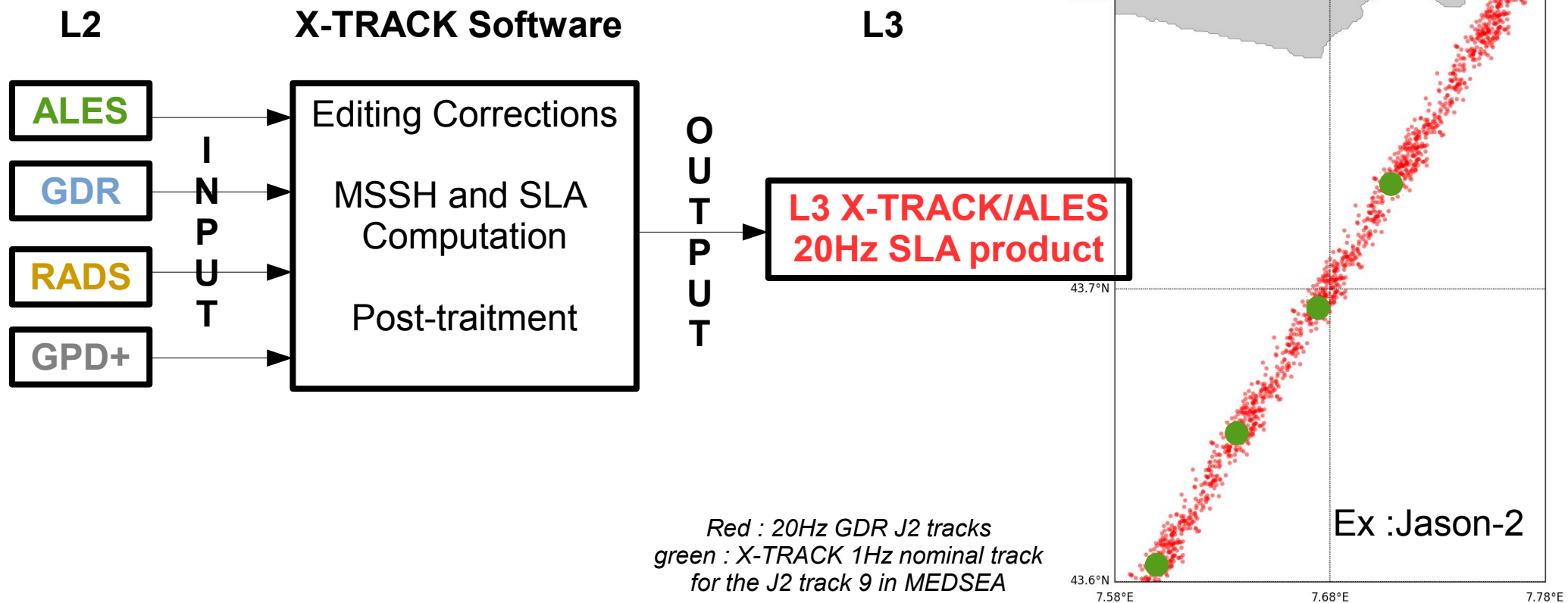
What is X-TRACK/ALES ?

Corrections/param.	Source
Range/sigma0	ALES (Passaro et al., 2014)
Ionosphere	Dual-frequency altimeter range measurements filtered by X-TRACK
Dry Troposphere	ECMWF model
Wet Troposphere	GPD+ (Fernandes and Lazaro, 2016)
Sea State Bias	SSB ALES
Solid Tides	Tide potential model (*Cartwright and Taylor*, 1971, *Cartwright and Eden*, 1973)
Pole Tides	Wahr, 1985
Loading Effect	FES 2014 (Carrere et al., 2012)
Atmospheric Correction	MOG2D dynamic atmospheric corr., includes the ocean dynamic response to wind and pressure forcing (Carrere and Lyard, 2013)
Ocean Tide	FES 2014 (Carrere et al., 2012)

What is the added value of this dataset ?

3 dataset created to answer this question

Dataset	Resolution	Retracker
X-TRACK LR	1 Hz	MLE4
X-TRACK HR	20 Hz	MLE4
X-TRACK/ALES	20 Hz	ALES

- X-TRACK LR and X-TRACK HR => impact of the increase in resolution

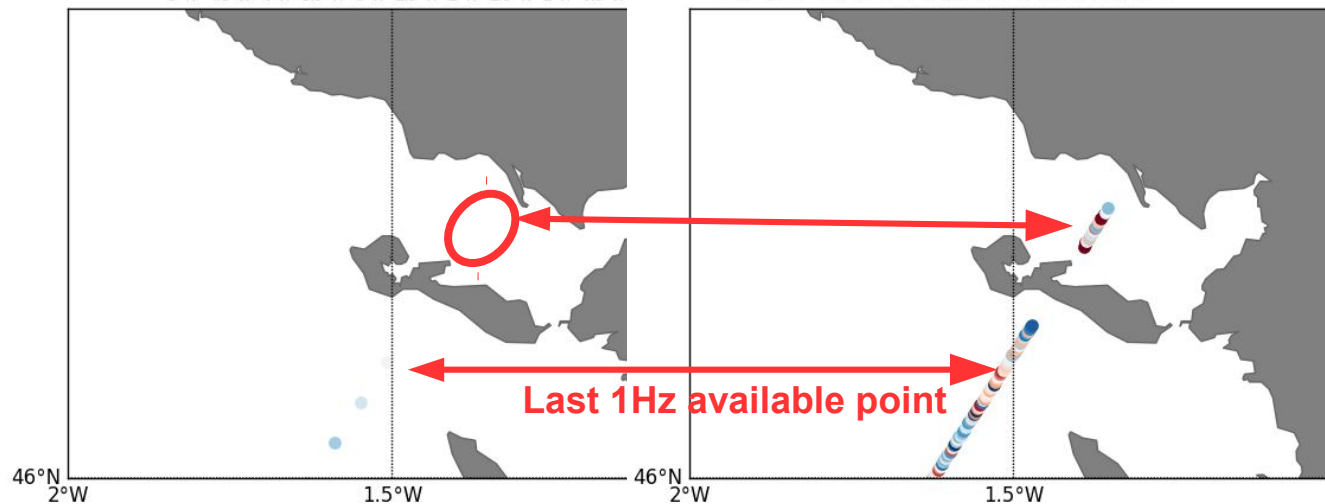- X-TRACK HR and X-TRACK/ALES => impact of specific retracker

What is the added value of this dataset ?
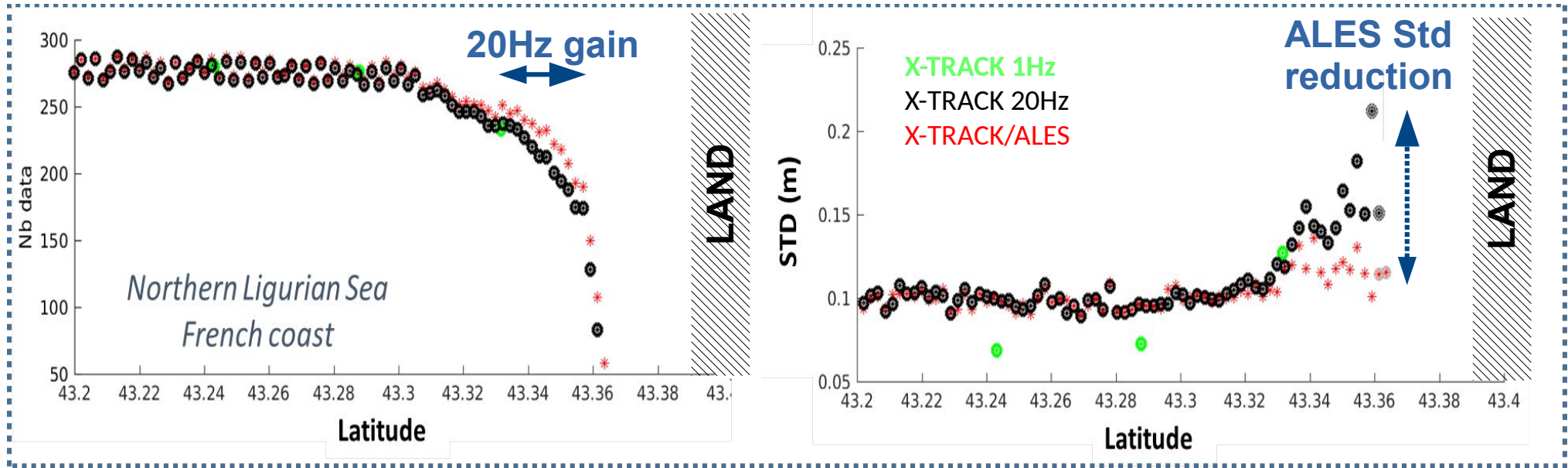
Track 213
In the Bay of biscay

1Hz

20Hz

Last 1Hz available point
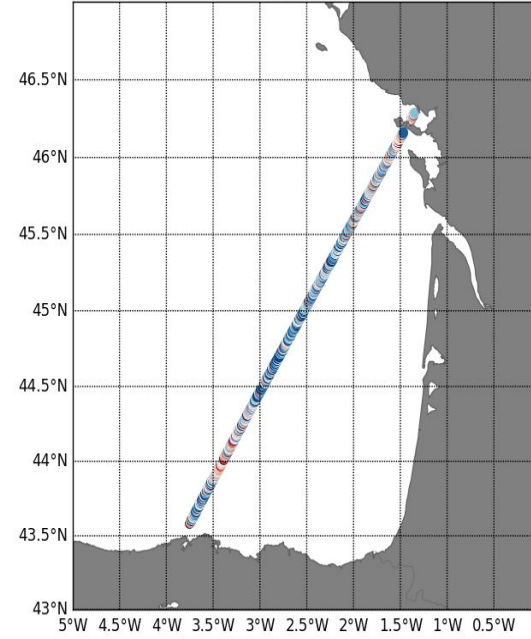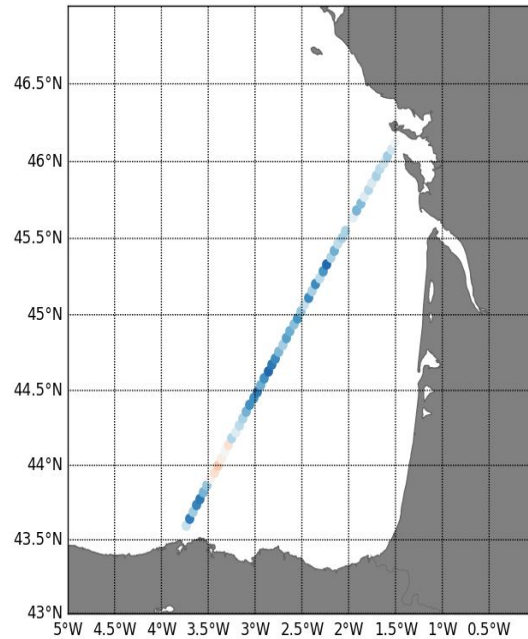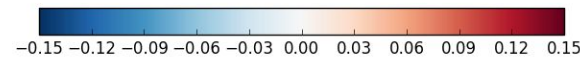
What is the added value of this dataset ?

Compared to X-TRACK 20Hz based on the MLE4 retracker, X-TRACK/ALES product shows a more coherent and realistic variability in coastal SLA.

Nbr of cycles available (left) and SLA std (right) for J2 track 222 in the Mediterranean Sea

What is the added value of this dataset ?

The new version of X-TRACK SLA multi-mission product at 20Hz, based on ALES retracker :

- Extends significantly the number of valid SLA computation several kilometers shoreward along the ground track.
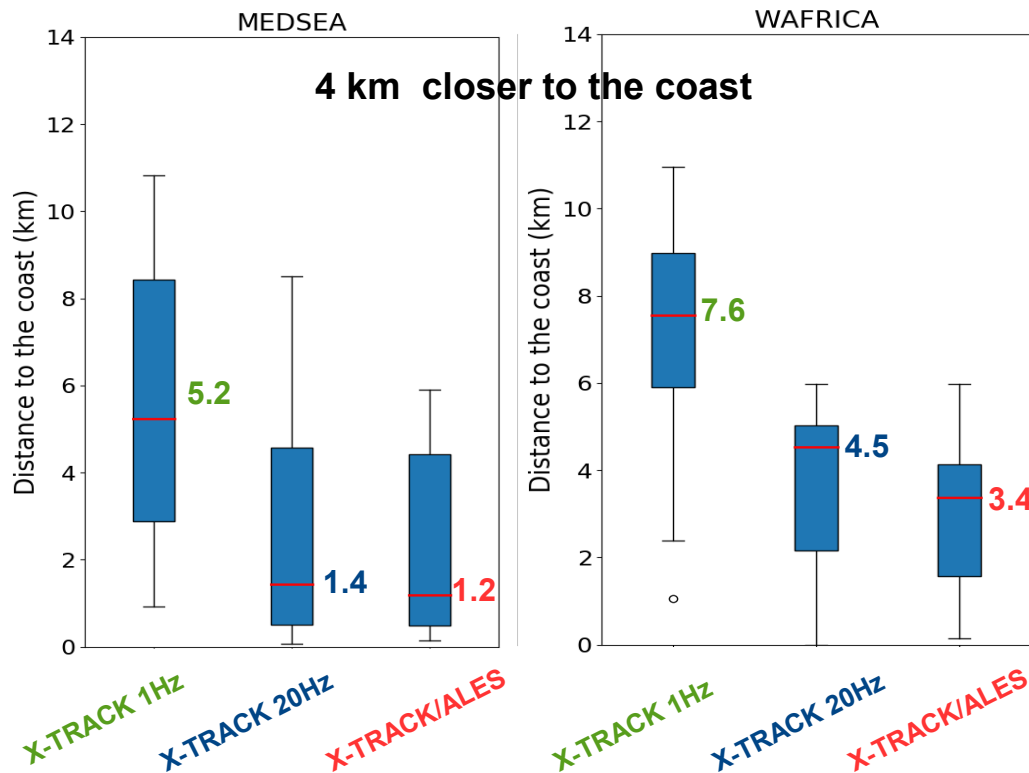
What is the added value of this dataset ?
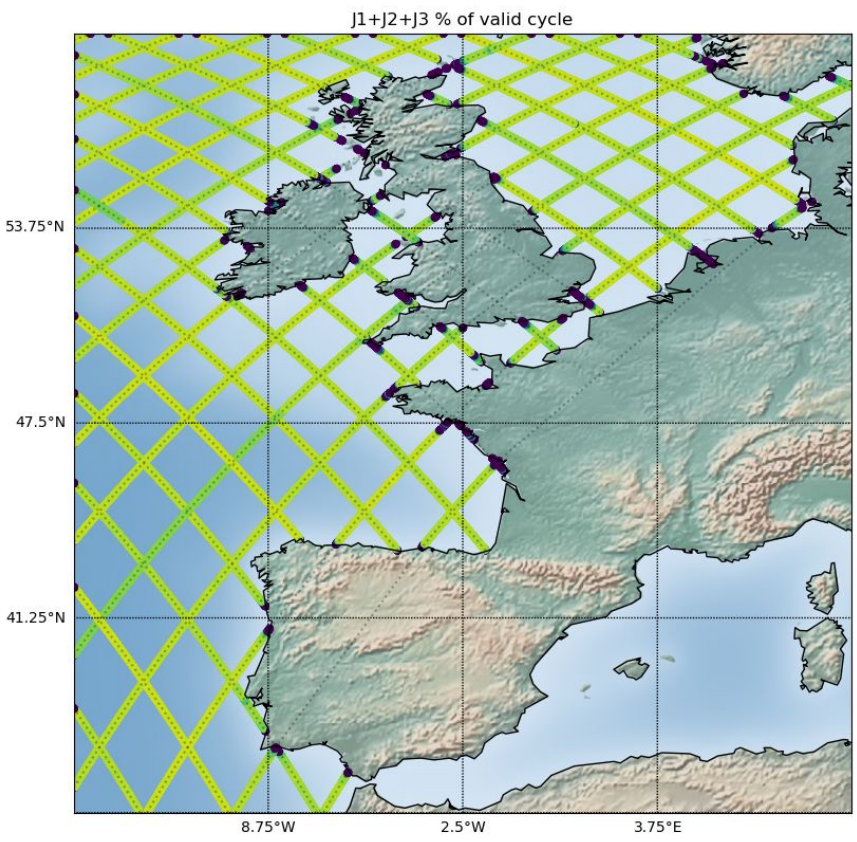
First point available with more than 80% of valid data
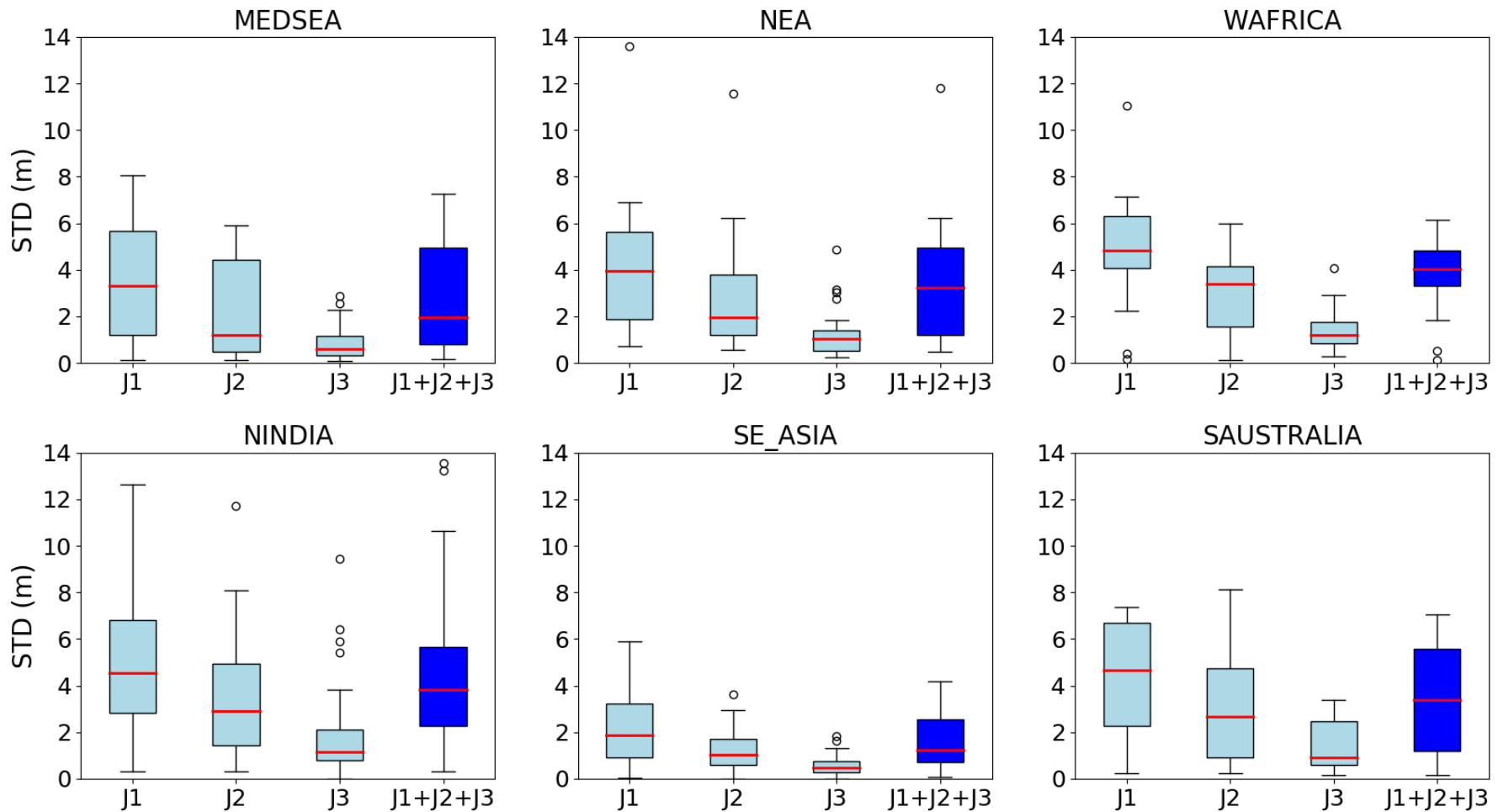
X-TRACK/ALES 20Hz J1+J2+J3	MEDSEA	NEA	WAFRICA	NINDIA	SE_ASIA	AUSTRALIA	MEAN
Distance 80 % (km)	1.94	3.23	4.04	3.81	1.23	3.38	2.94

VALIDATION
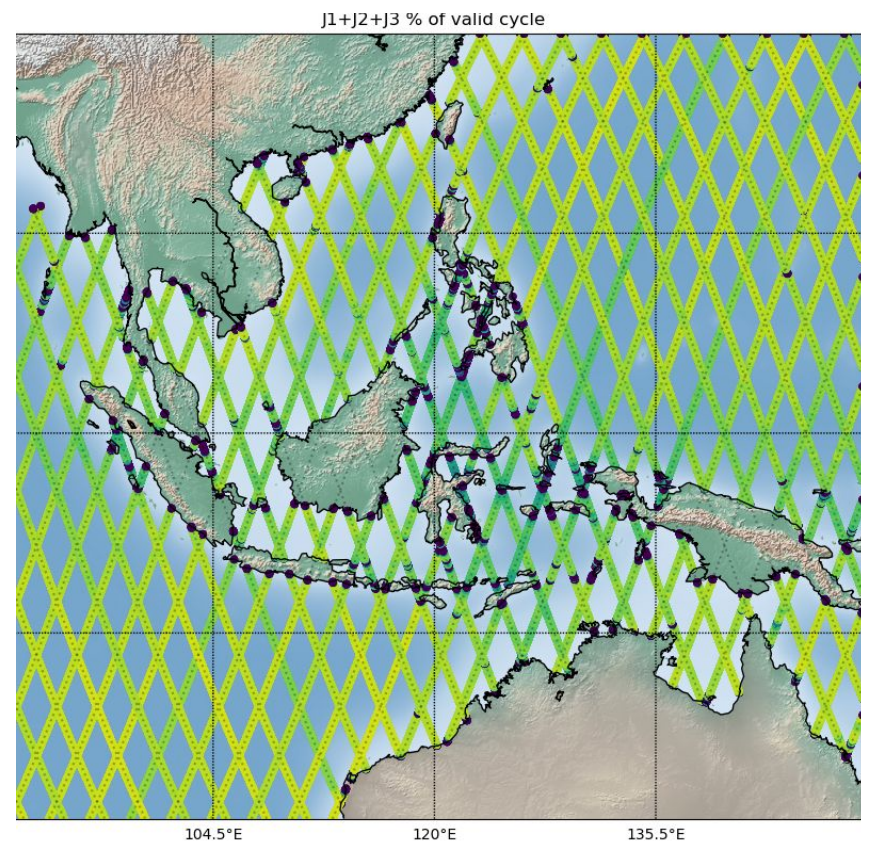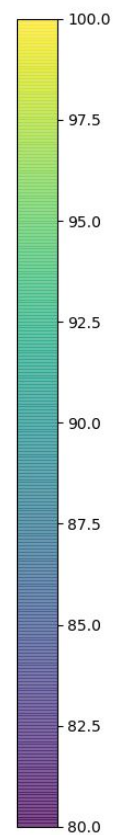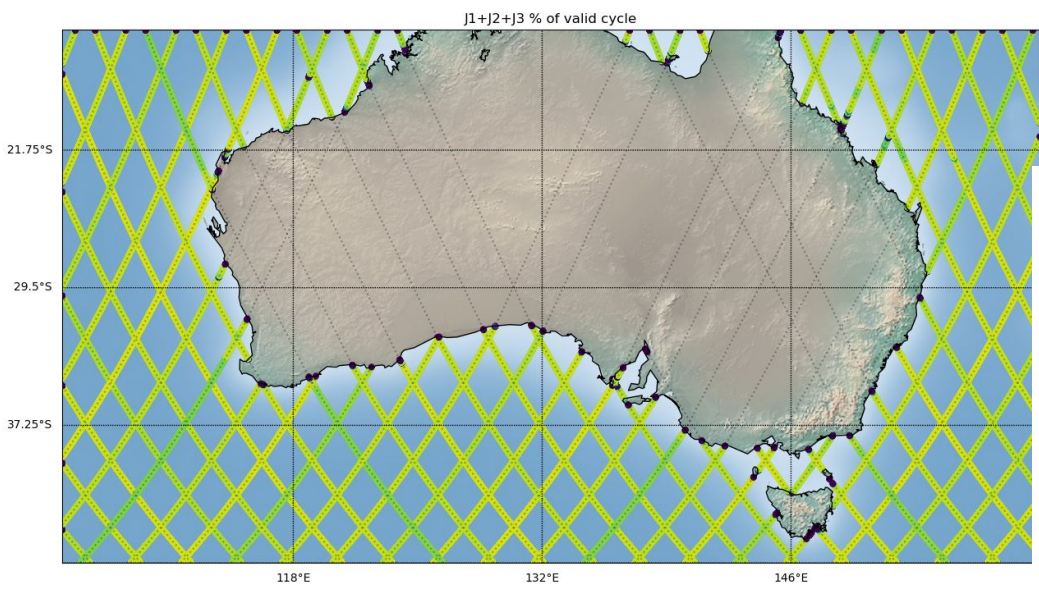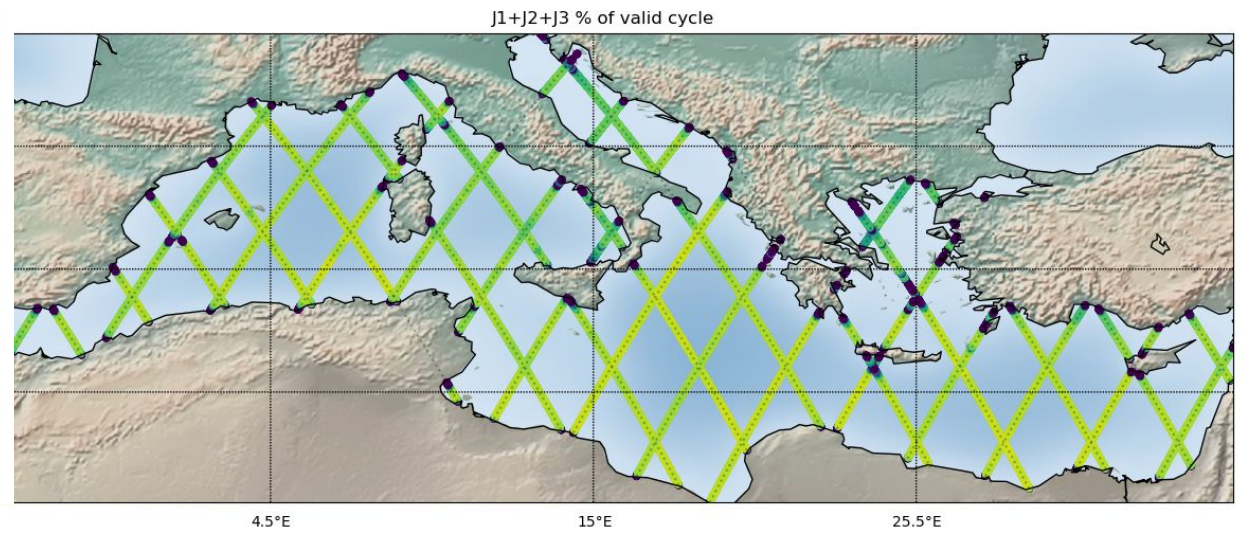
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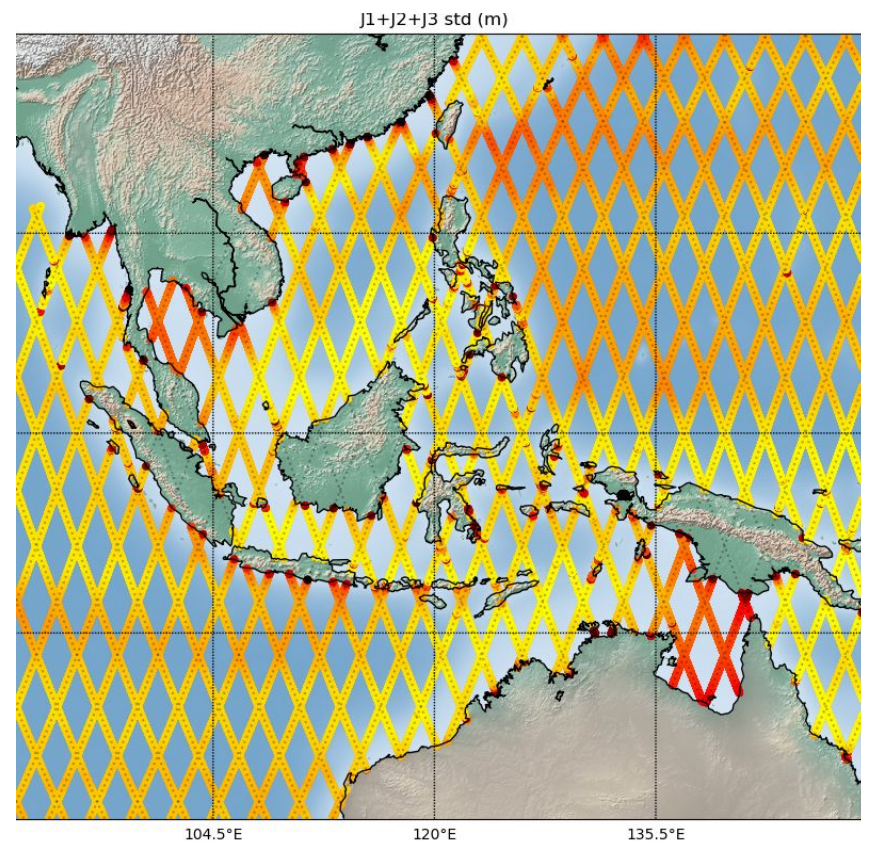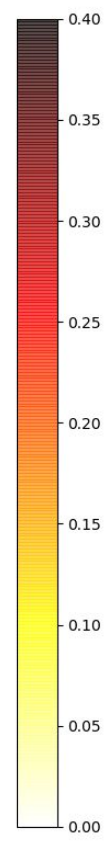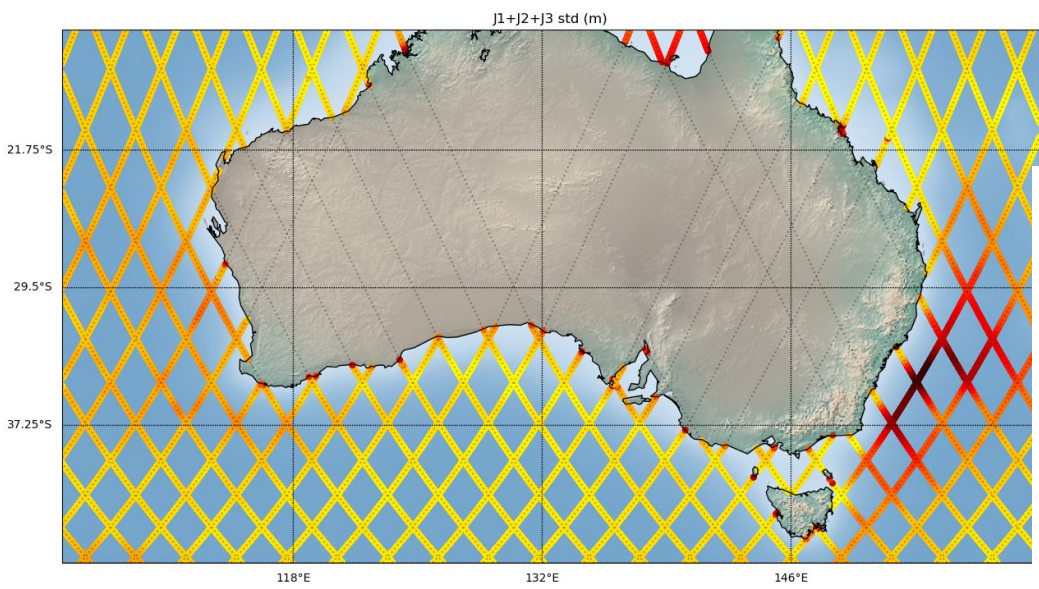
std

VALIDATION

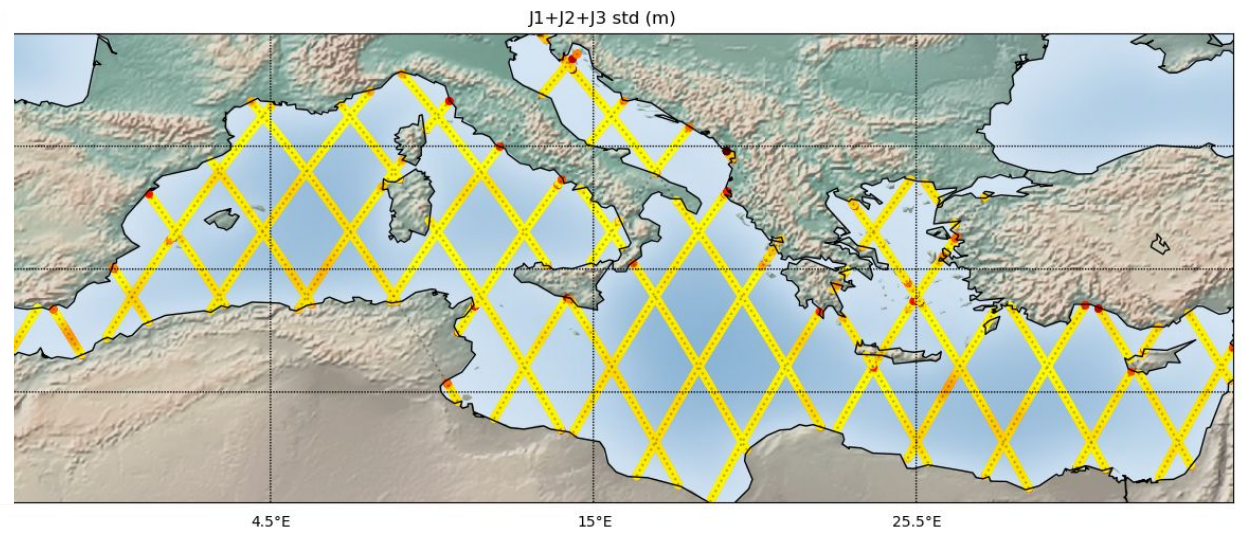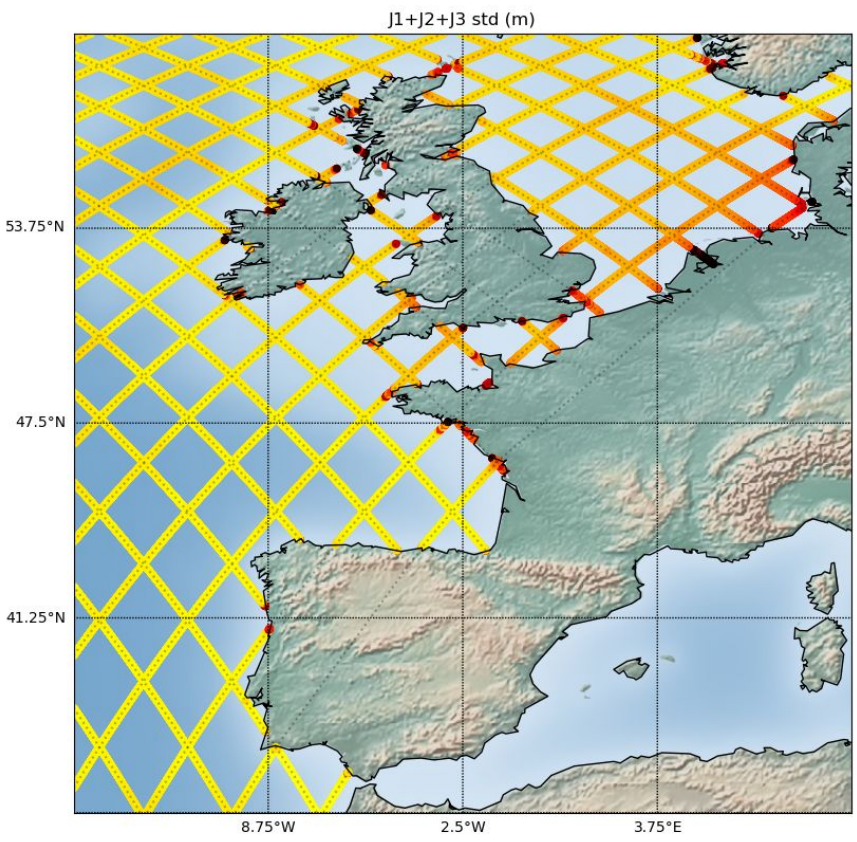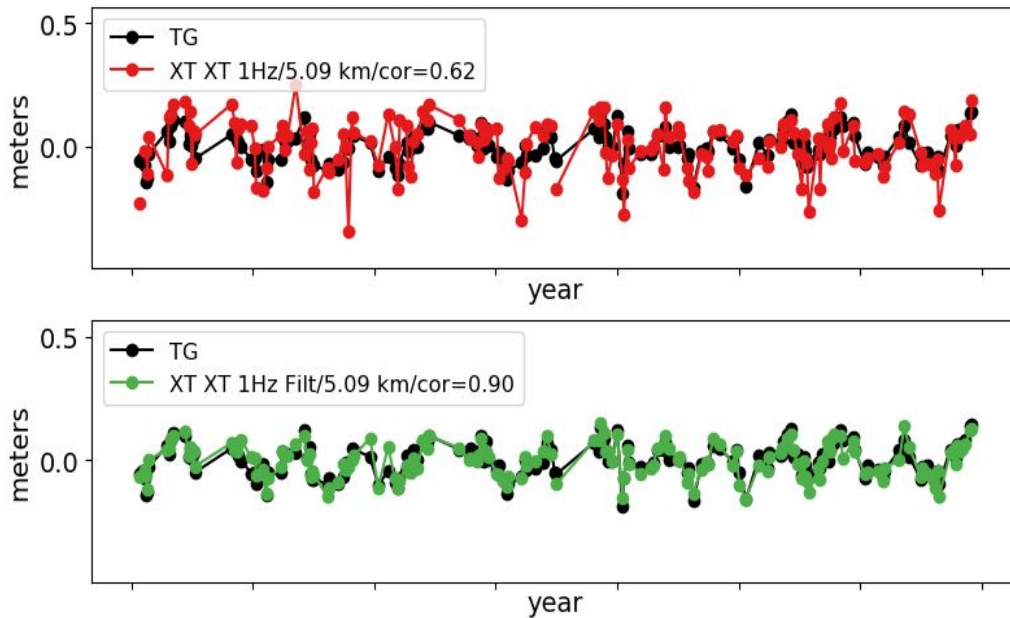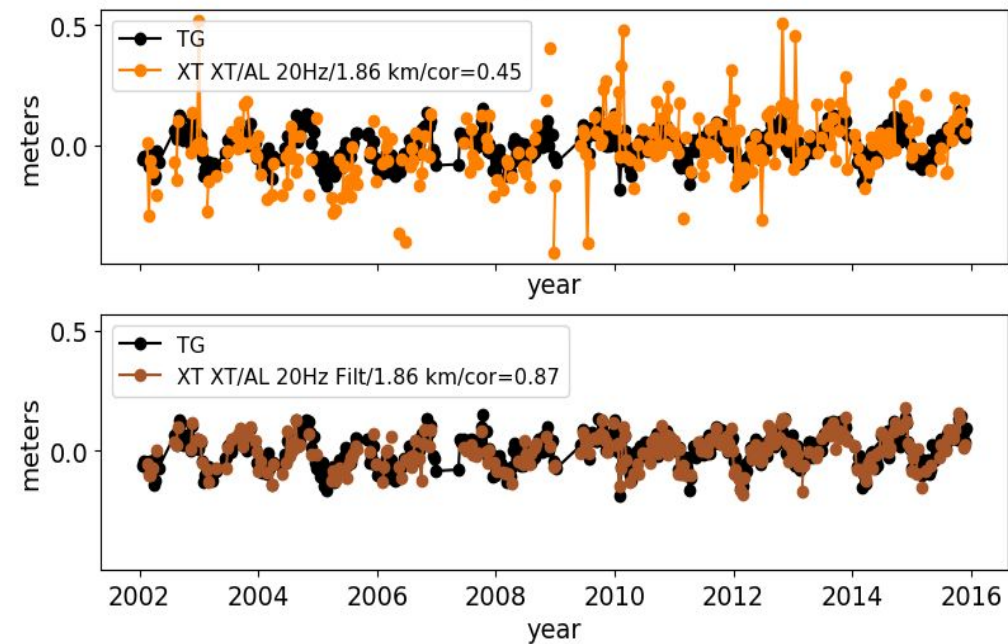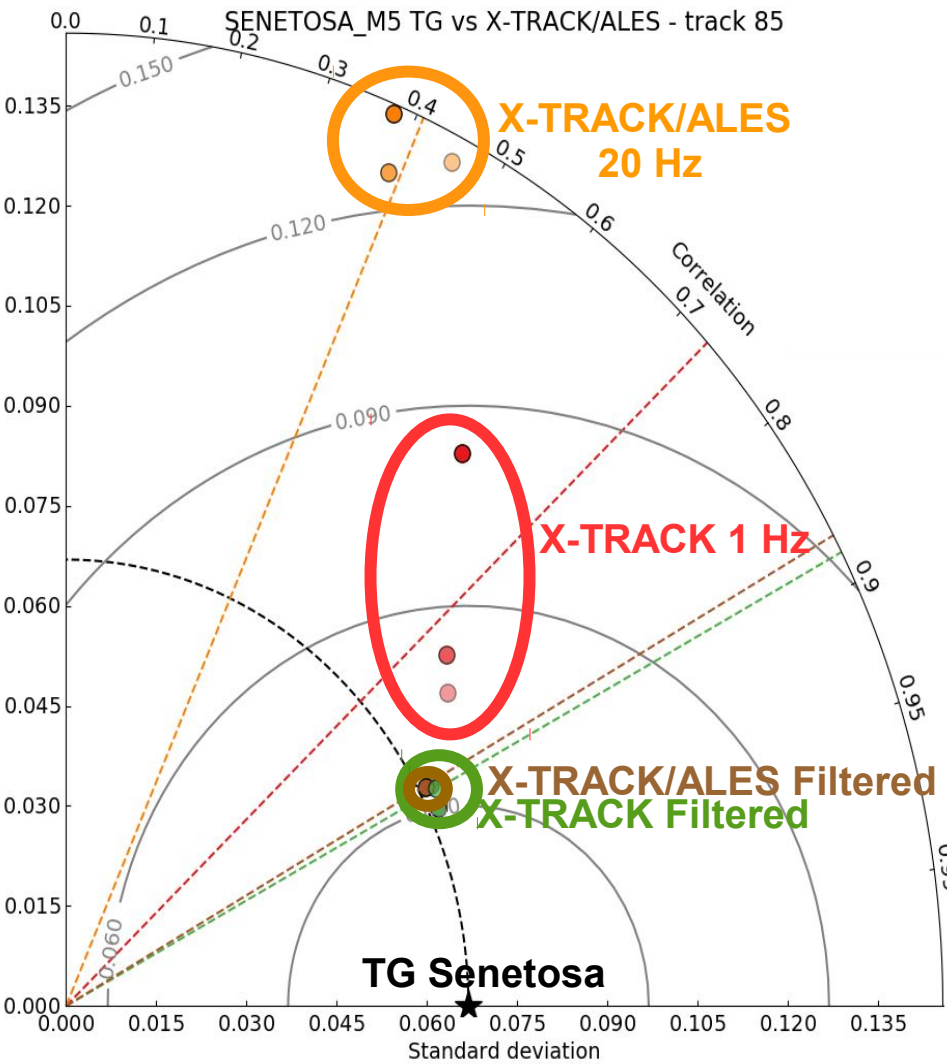X-TRACK 1 Hz

X-TRACK/ALES 20 Hz

20 hz data:
- Is more noisy
- But gives available data closer to the coast/TG
- Once correctly spatially filtered, similar behavior and results to 1-Hz
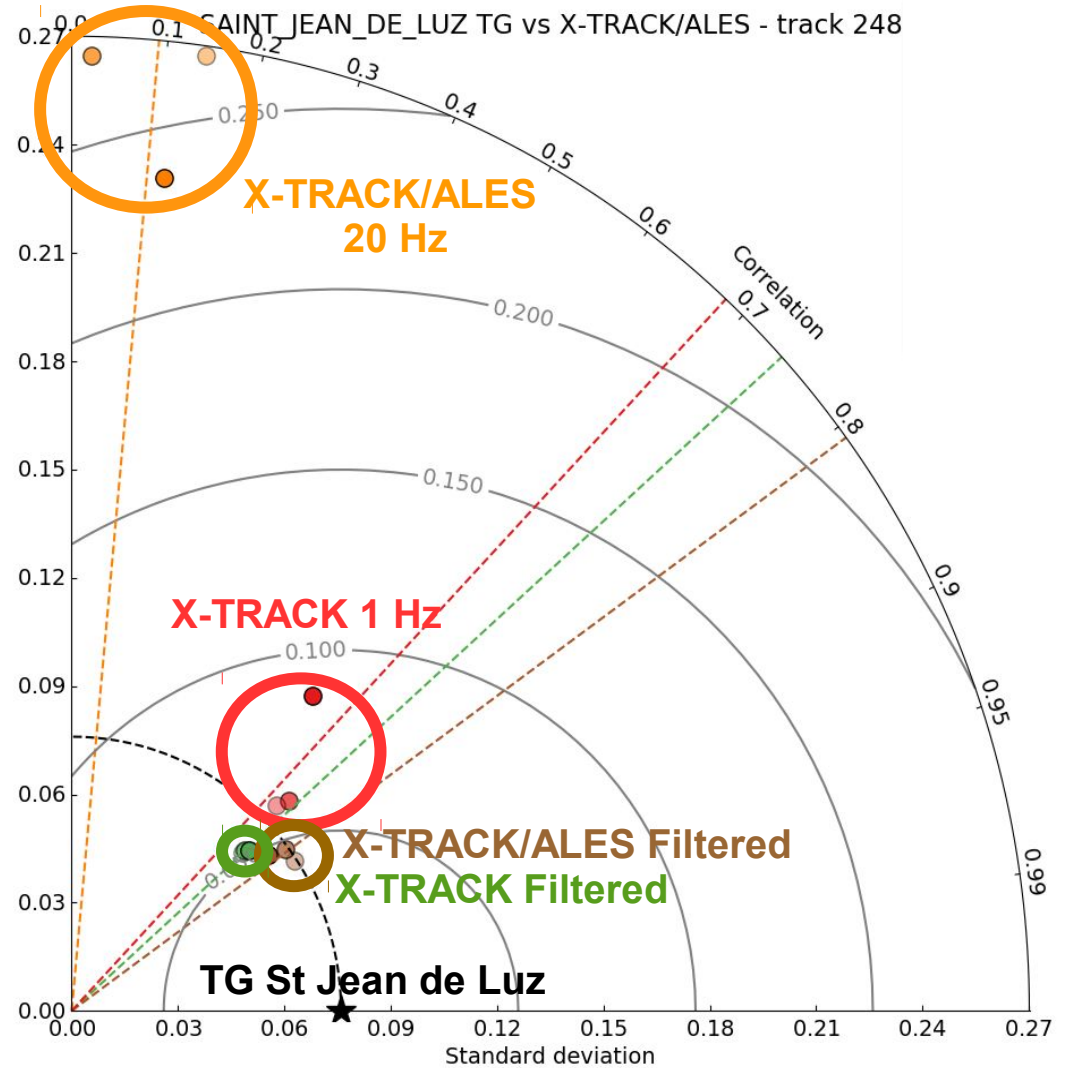
VALIDATION

Senetosa tide gauge (Med. Sea)

**St Jean de Luz tide gauge (NE Atl.)**

Example of application

Coastal current variability :

This dataset can be used to compute geostrophic currents in the NW Mediterranean Sea. The signature of the variability of the Northern Current (Mediterranean Sea) is well captured, and allows to better characterize the evolution of the coastal current very close to the coast compared to the conventional 1 Hz SLA product.
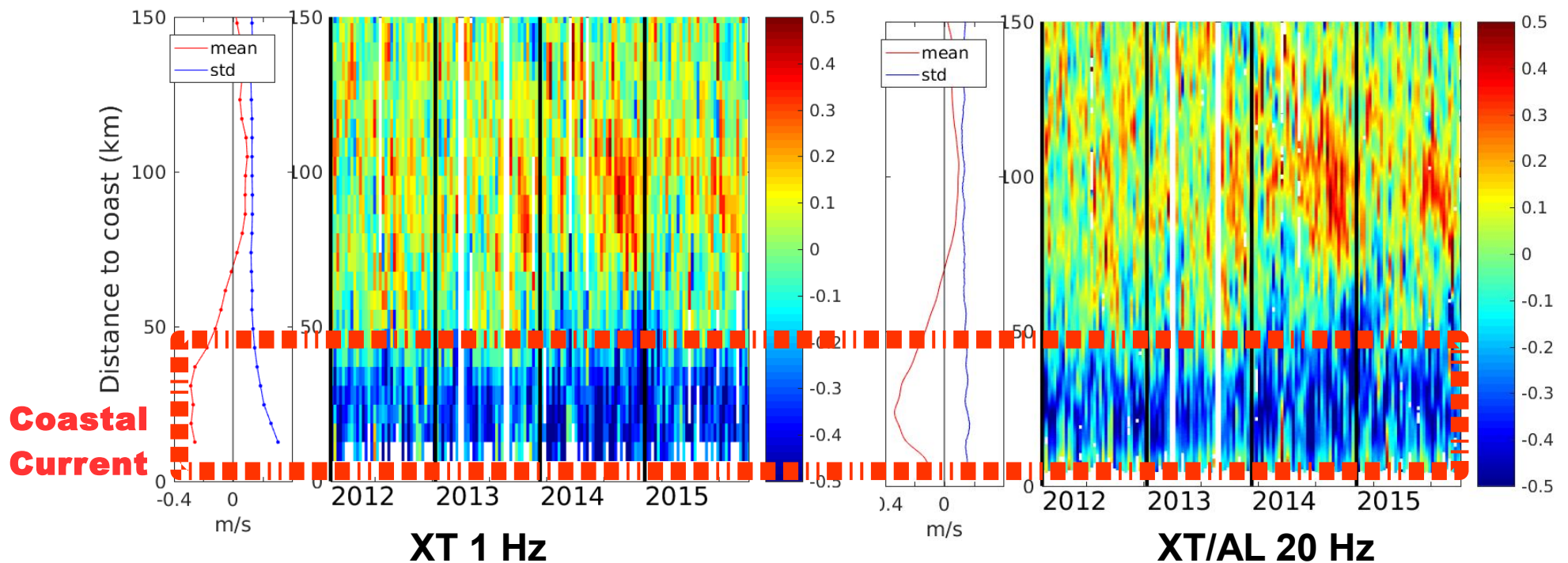
Example of application

Altimetry-based sea level trends along the coasts of Western Africa

Florence Marti [a], Anny Cazenave [a,*], Florence Birol [a], Marcello Passaro [b], Fabien Léger [a], Fernando Niño [a], Rafael Almar [a], Jérôme Benveniste [c], Jean François Legeais [d]
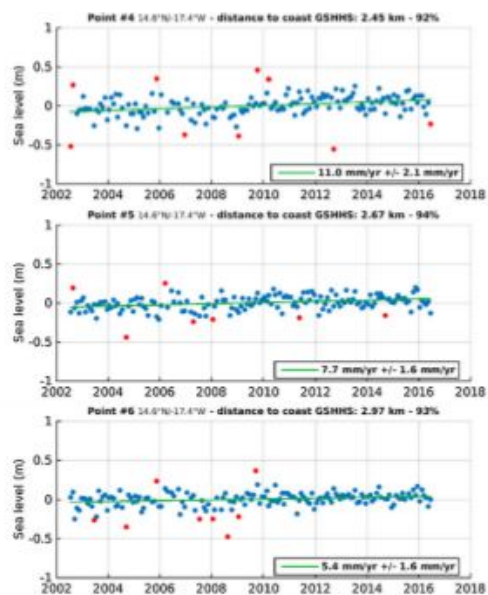
[a] LEGOS, 18 avenue Edouard Belin, 31401 Toulouse Cedex 9, France
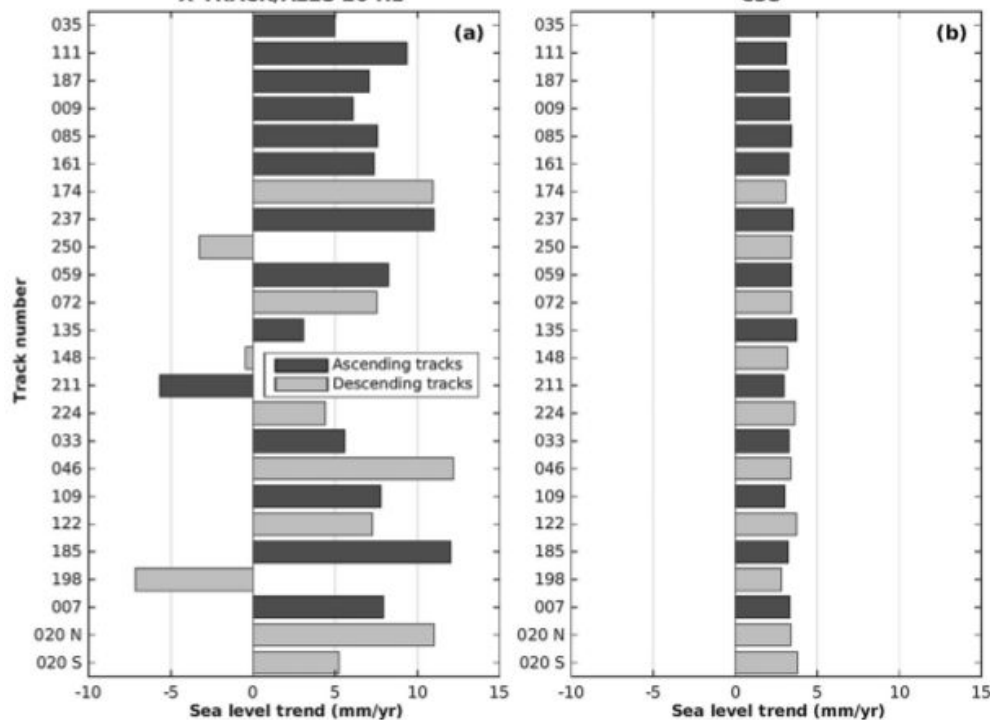[b] DGFI-TUM, Arcisstrasse 21, Munich 80333, Germany
[c] ESA-ESRIN, via Galileo Galilei, Frascati I-00044, Italy
[d] CLS, 8-10 rue Hermes, 31520 Ramonville St Agne, France

Long-term coastal sea level changes:
Estimate the long-term evolution of sea level as close to the shoreline as possible.

Example of application

Track 085
J1+J2 SLA trends
July2002-June2016

mm/yr

Google Earth
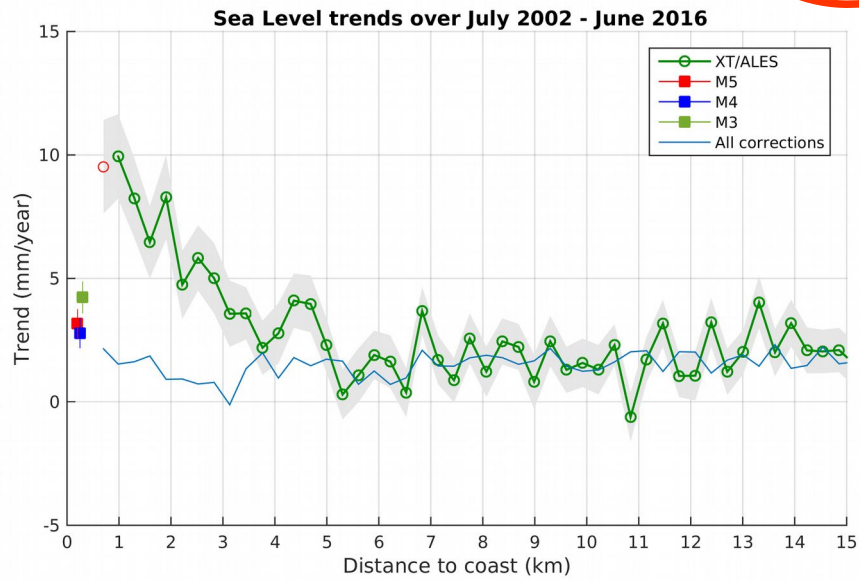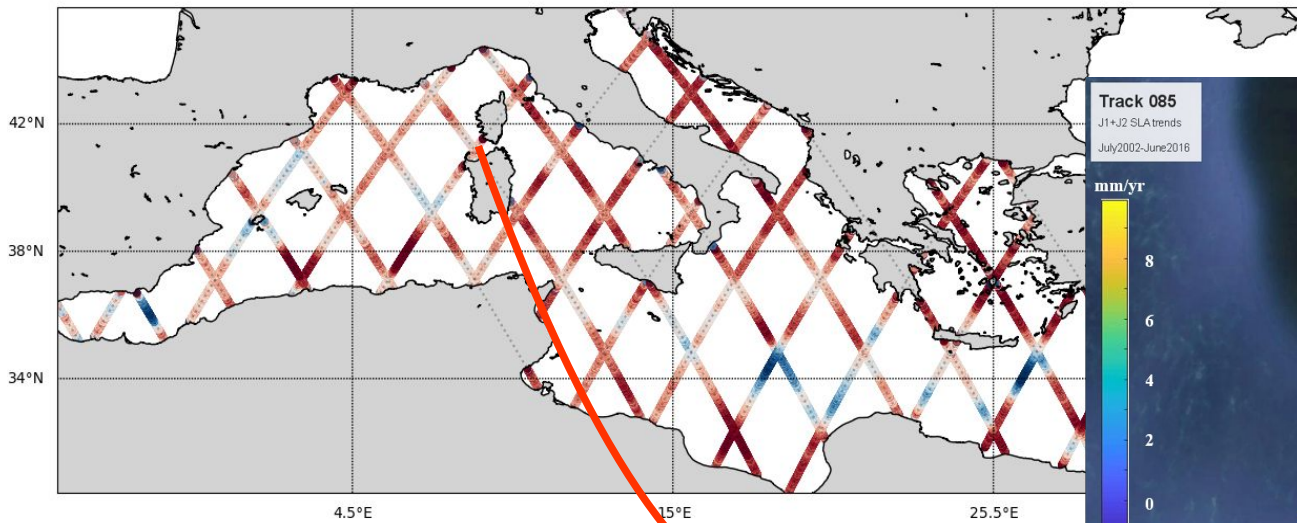
Long-term coastal sea level changes:
Understand the principal factors that are at the origin of the long-term evolution of sea level close to the shoreline.

Conclusion

- Once correctly, **retracked**, **edited**, **corrected** and **spatially filtered**, 20 Hz data gives similar statistics to X-TRACK 1 Hz data, providing even more information on coastal sea level data
  - **4km closer to the coast** (compare to 1 Hz)
  - The closest data is on average at **3 km from the coast**
    - **1 km in the best case!**

- Allows scientific application as coastal current variability and long-term coastal sea level changes

To get the data

http://www.esa-sealevel-cci.org/

Write an email at
info-sealevel@esa-sealevel-cci.org

Next
X-TRACK/ALES product will be available for Saral/ALTIKA and ENVISAT mission this year.