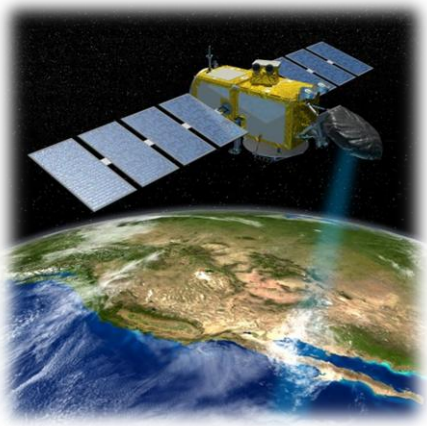
living planet symposium | MILAN 13–17 May 2019

Costal sea level changes (2002-2016)

from Jason-1 and Jason-2 altimetry along the coasts of West Africa, Mediterranean Sea and Western Europe



F. Marti[1], A. Cazenave[1], M. Passaro[2], F. Birol[1], F. Léger[1], F. Niño[1], J.Benveniste[3], J.F. Legeais[4], L. Feneglio-Marc[5]

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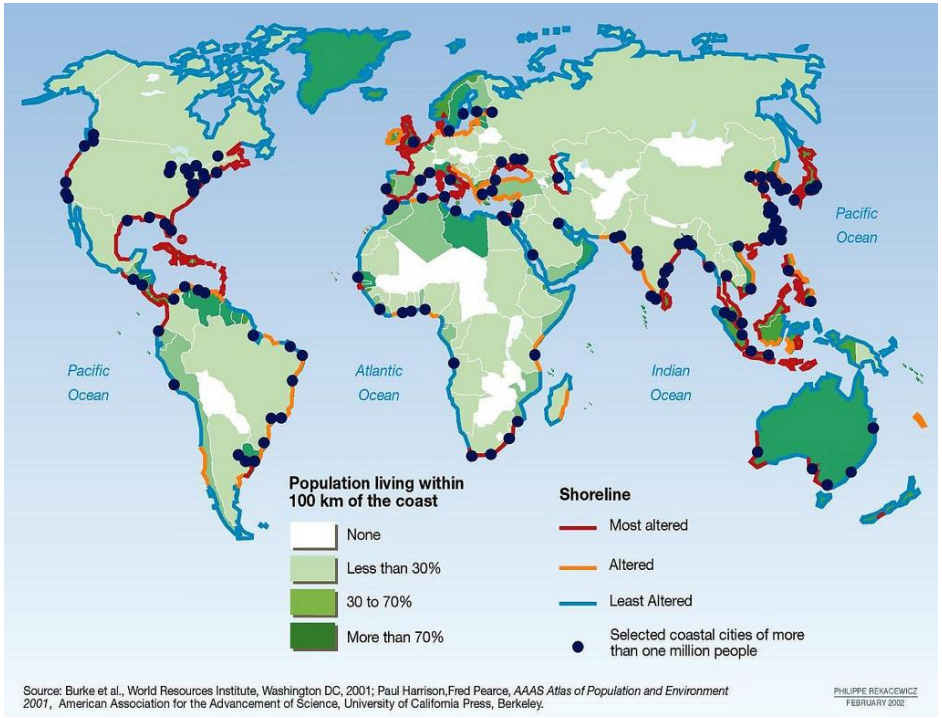
CLS LEGOS TECHNISCHE UNIVERSITÄT MÜNCHEN National Oceanography Centre NATURAL ENVIRONMENT RESEARCH COUNCIL

sea level cci esa European Space Agency

New challenges for applications of satellite altimetry →
Measure sea level changes at the coast



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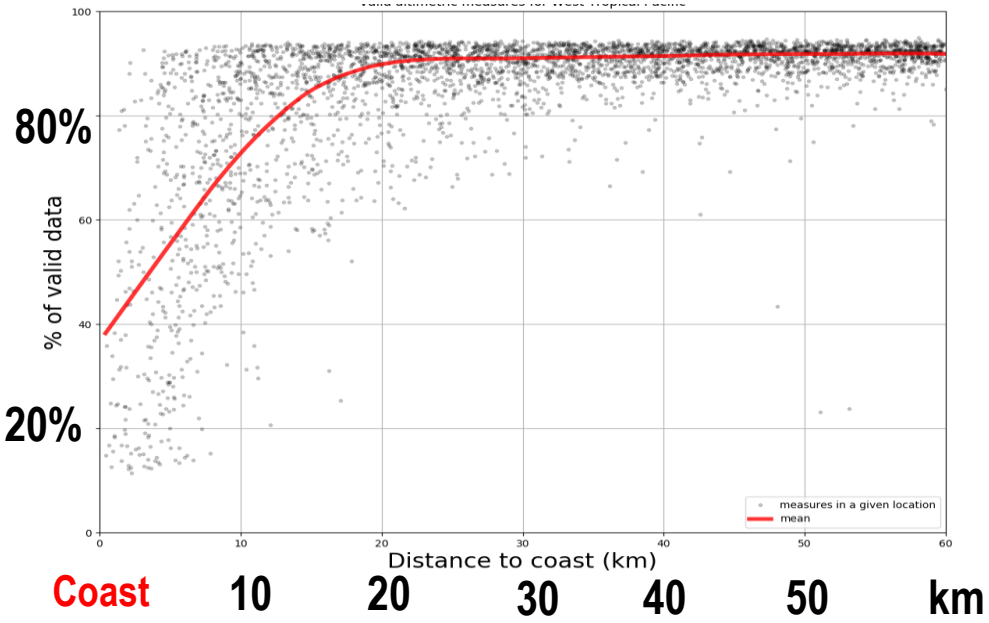
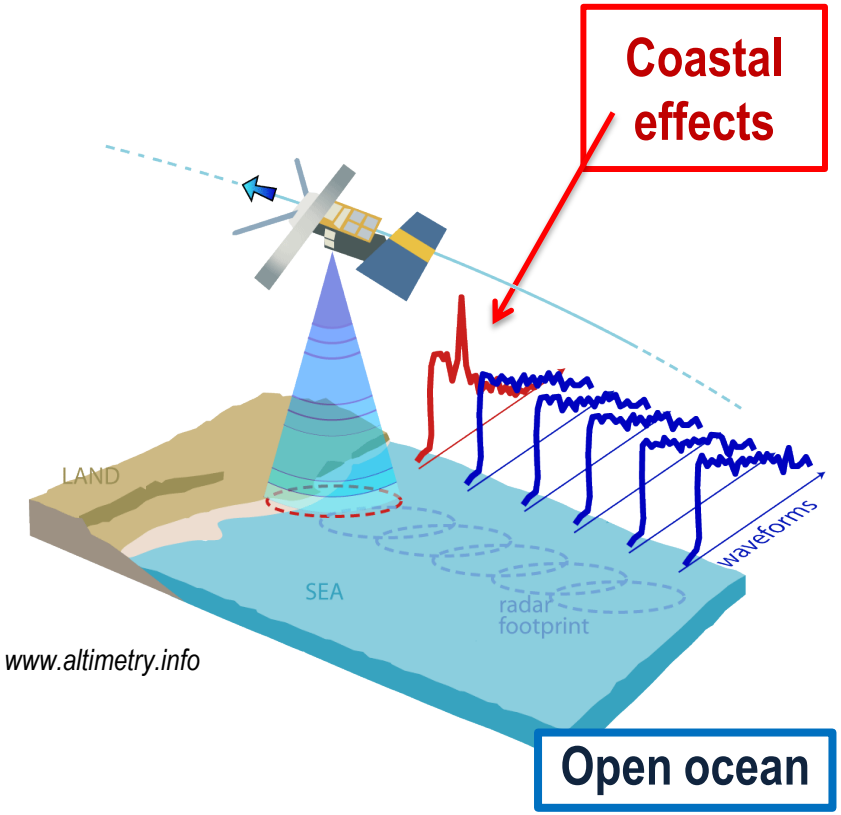
Tide gauge network with >40 years of data (from PSMSL)

Altimetry in coastal zones

Percentage of valid altimetry measurements as a function of distance to the coast





Need for specific post-processing :

"retracking" of the radar waveforms

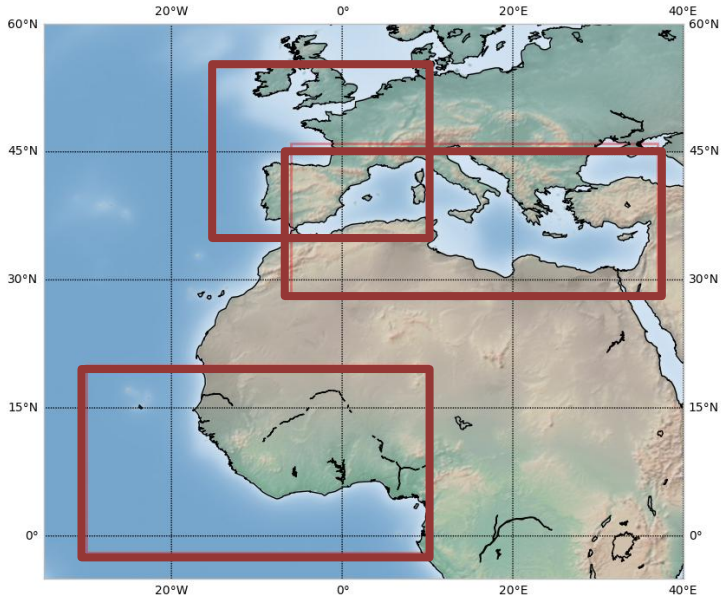
+

computation of adapted geophysical corrections

ESA Climate Change Initiative “Bridging phase” Sea level project (2018/2019)

esa European Space Agency

- Combination of ALES retracking with X-TRACK 20 Hz sea level data
- Jason-1 and Jason-2 missions (2002-2016)
- 3 pilot regions



CLS COLLECTE LOCALISATION SATELLITES

Technische Universität München

LEGOS

Consiglio Nazionale delle Ricerche

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SKYMAT

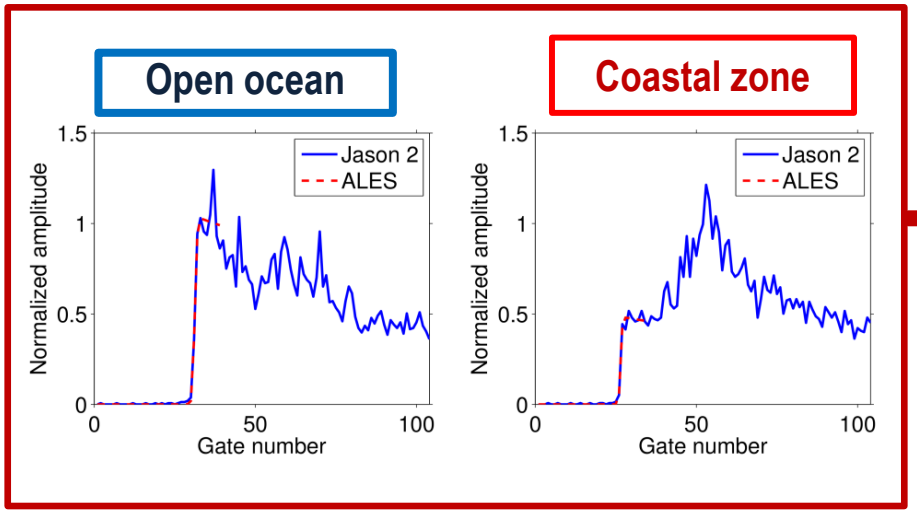
Built upon the CCI Sea Level project (ESA SL_cci ; 2011-2017)

Approach

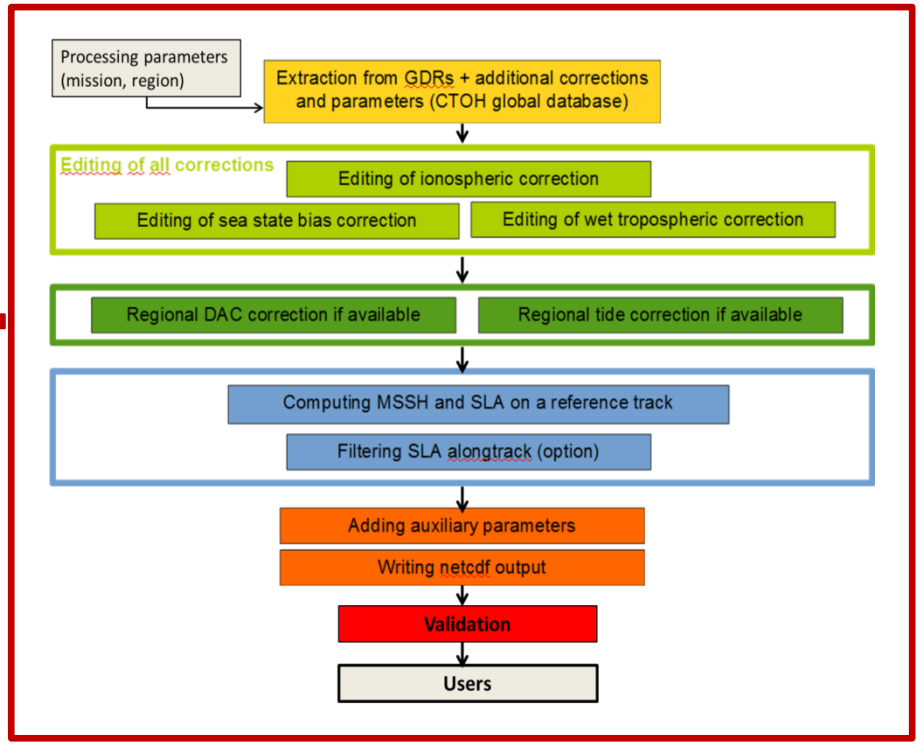
- Use of ALES (Adaptative Leading Edge Subwaveform) retracking developed by Passaro et al. 2014 (TUM) + associated Sea State Bias (SSB) (Passaro et al., 2018)

- Use of X-TRACK processing system developed at LEGOS (CTOH; Birol et al., 2017) :
  Severe data editing taking into account the individual characteristics of each correctives terms,
  Computation of sea level anomalies on fixed points on along nominal tracks, etc.)

ALES Retracking (TUM)



The X-TRACK system (CTOH)



From the radar waveform : range (MLE4)

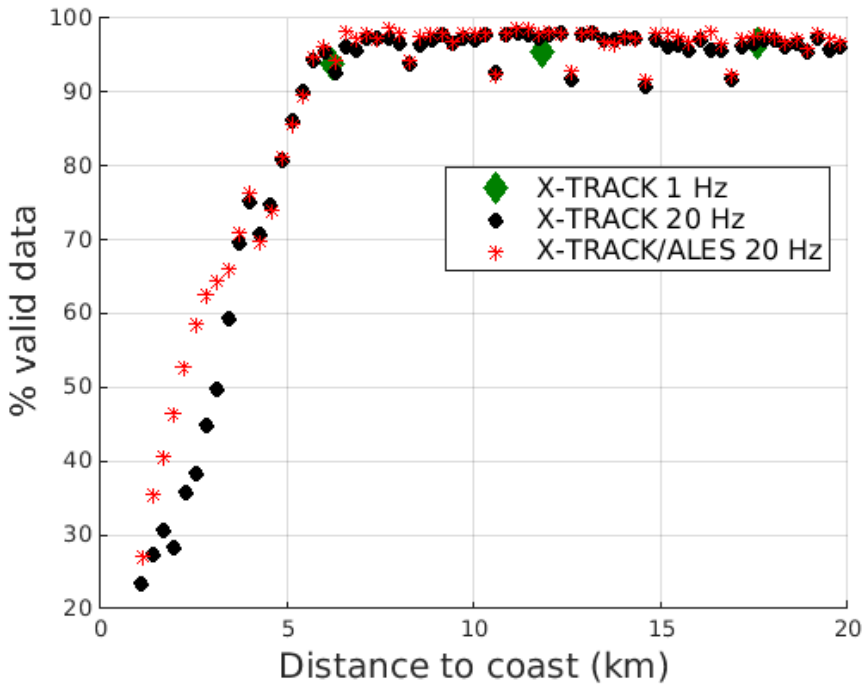
GDR parameters & geophysical corrections

X-TRACK: processing chain adapted for coastal zones

Léger et al, poster
Area D - Board 428

X-TRACK 1 Hz (~6-7 km)

X-TRACK 20 Hz (~350 m)



From the radar waveform : range **ALES**

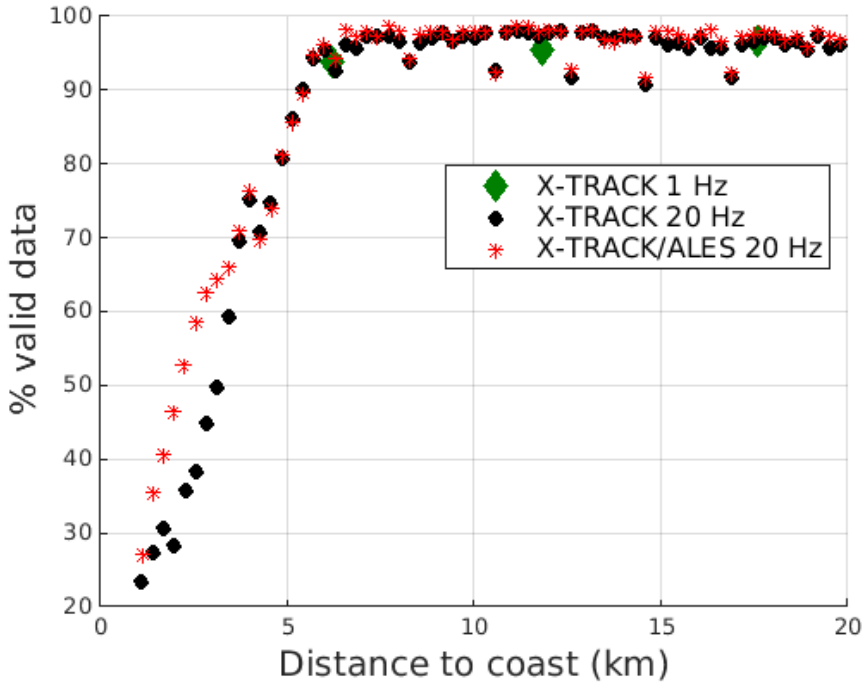
GDR parameters & geophysical corrections

X-TRACK: processing chain adapted for coastal zones

X-TRACK 1 Hz (~6-7 km)

X-TRACK 20 Hz (~350 m)

X-TRACK/ALES 20 Hz (~350 m)



From the radar waveform : range **ALES**

GDR parameters & geophysical corrections

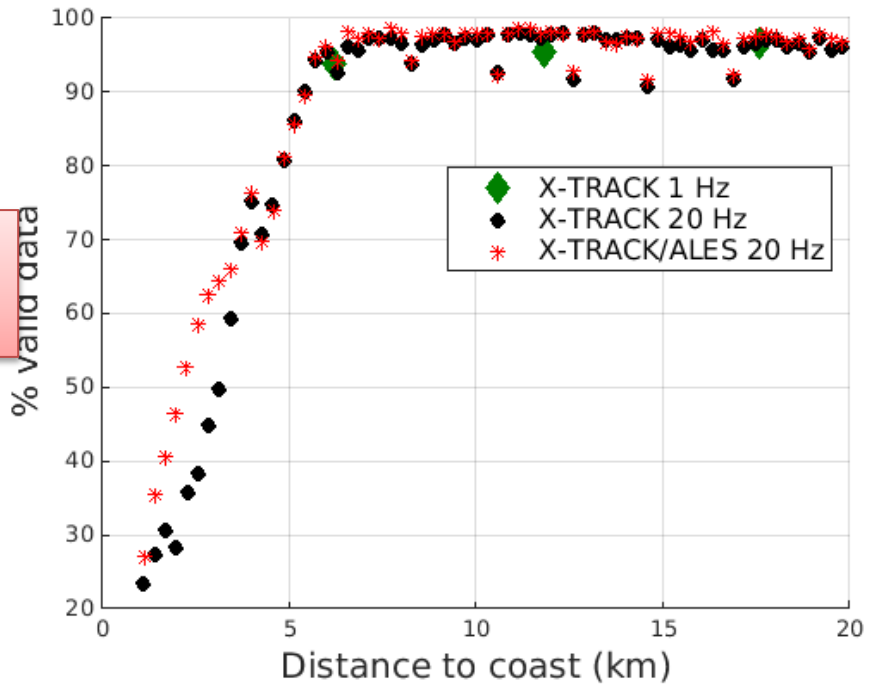
X-TRACK: processing chain adapted for coastal zones

X-TRACK 1 Hz (~6-7 km)

X-TRACK 20 H (~350 m)

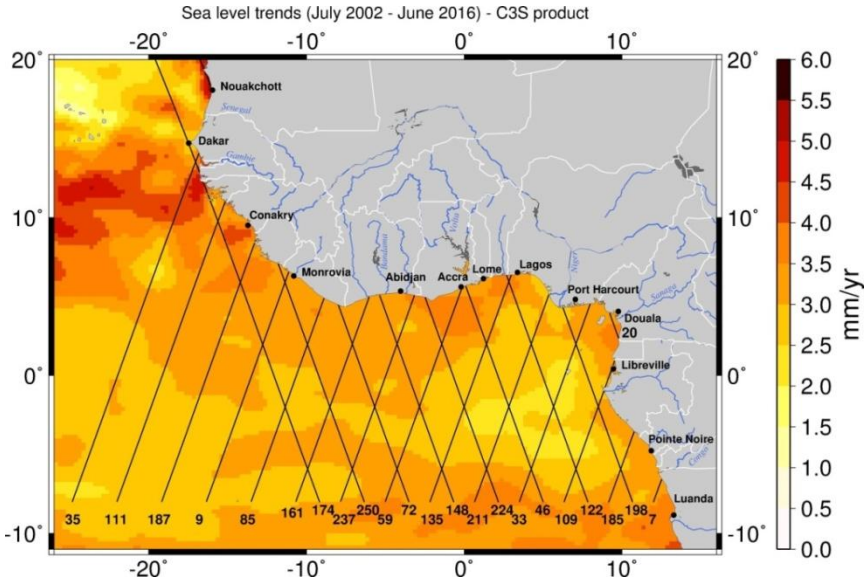
X-TRACK/ALES 20 Hz (~350 m)

Increase the number of valid Sea Level Height computation near shores



METHOD

- SLA data : X-TRACK/ALES 20 Hz
- Missions: Jason 1 & Jason 2
- Period: July 2002 to June 2016 → 14 years
- Monthly averaging
- Annual and semi-annual signals removed



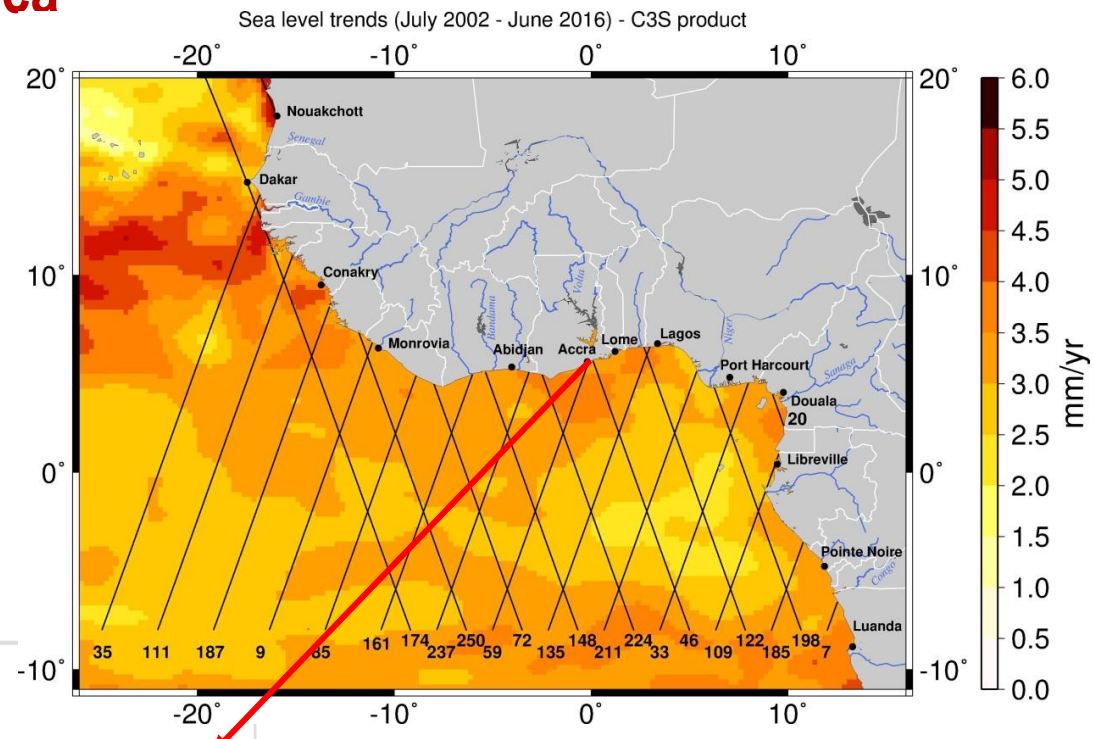
The Western African region
C3S gridded product and J-1 & J-2 tracks

- Sea level trends computed at individual 20 Hz point along the satellite tracks, with focus on the the last 15 km to the coast

- Each 20 Hz point is characterized by its distance to the nearest coast

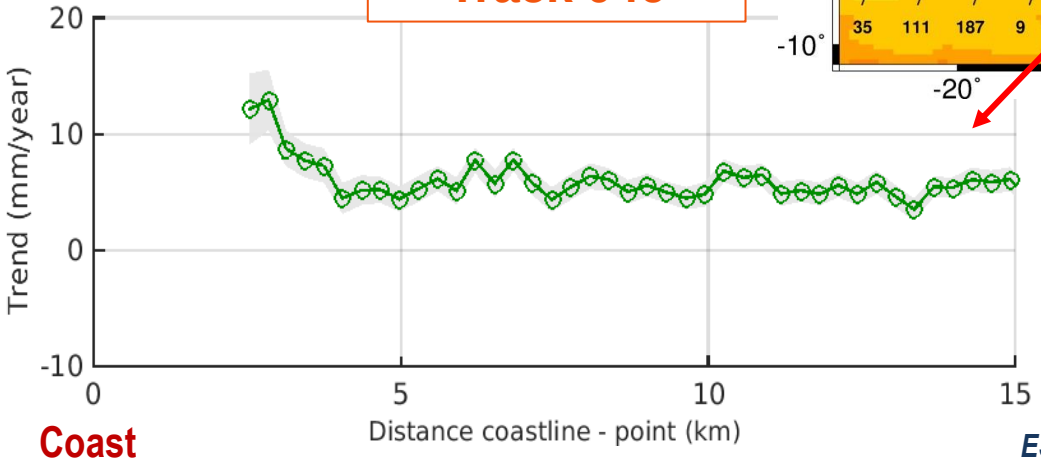
(GSHHS database; Smith & Wessel)

Coastal sea level trends from satellite altimetry (2002-2016) along the Jason-1&2 satellites tracks → Western Africa



Rate of sea level rise (mm/yr) near the coast

Track 046



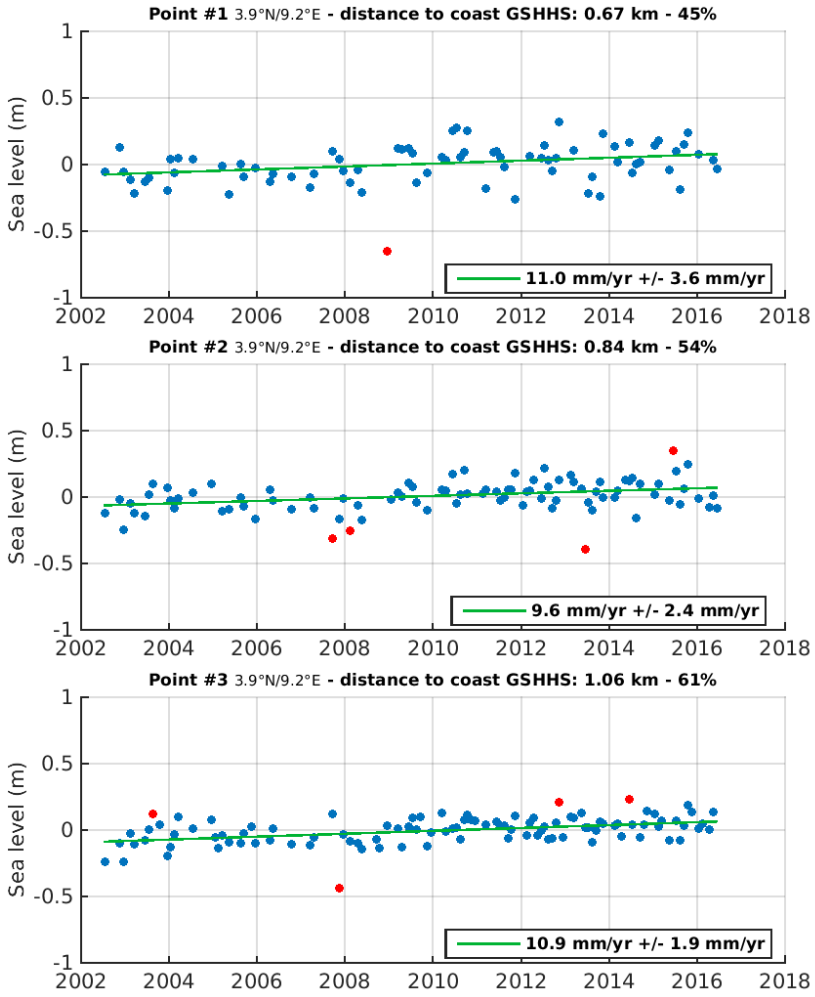
Coast

C3S gridded product and J-1 & J-2 tracks

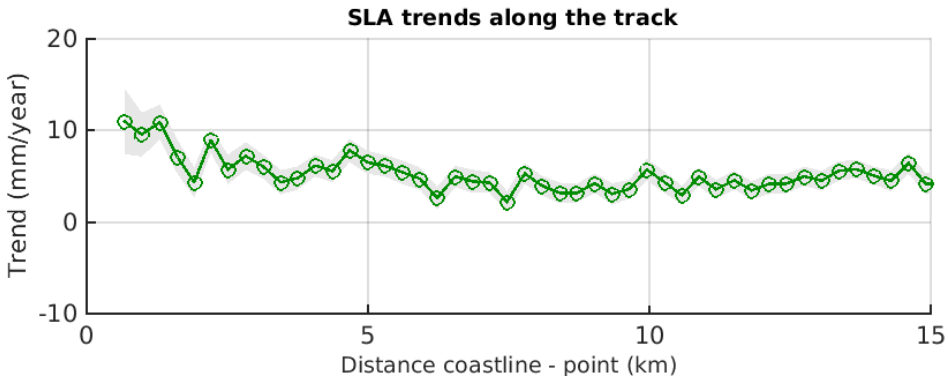
ESA CCI Sea Level project & Marti et al., ASR, 2019

Track 020

Sea level time-series of the closest points to coast



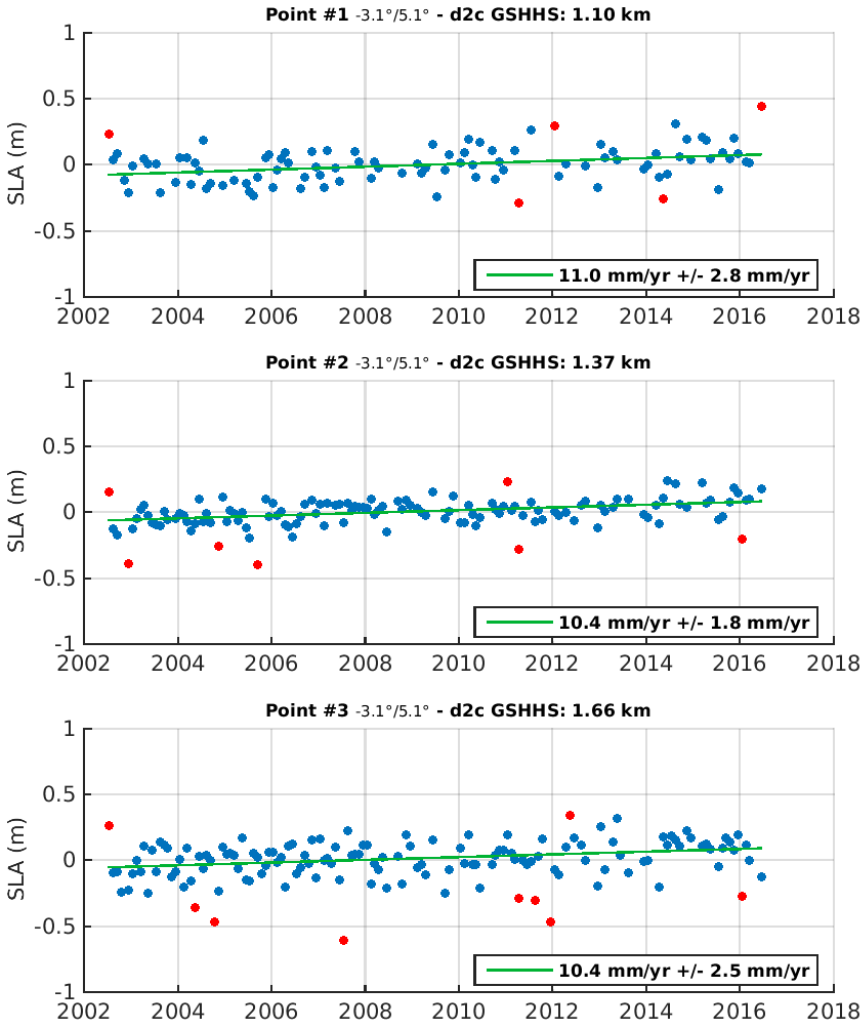
Sea level trends as a function of distance to coast



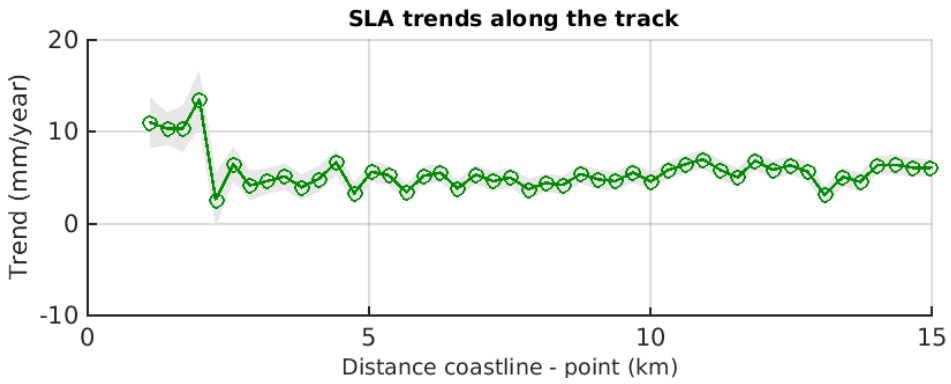
ESA CCI Sea Level project & Marti et al., ASR, 2019

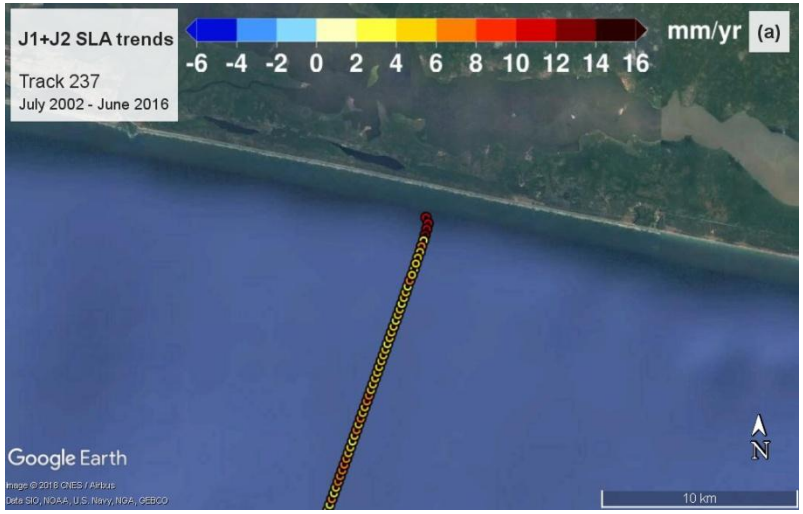
Track 237

Sea level time-series of the closest points to coast



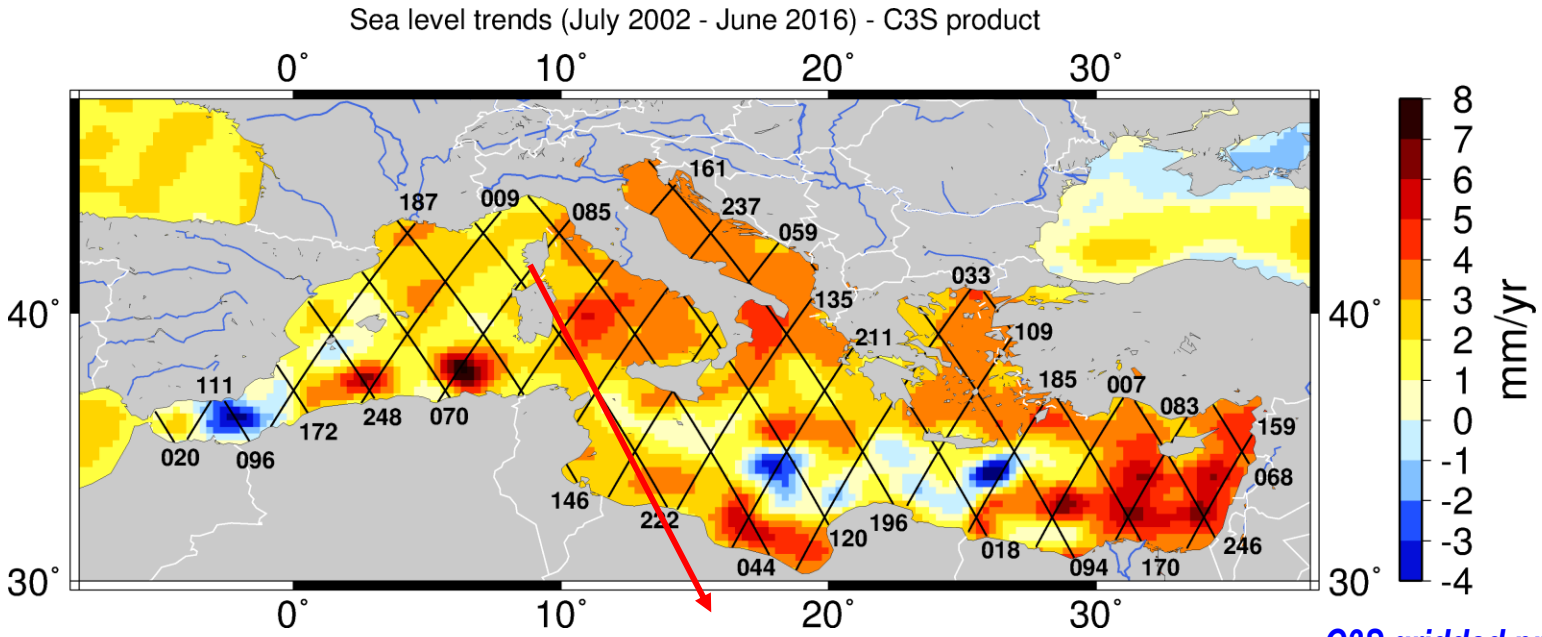
Sea level trends as a function of distance to coast





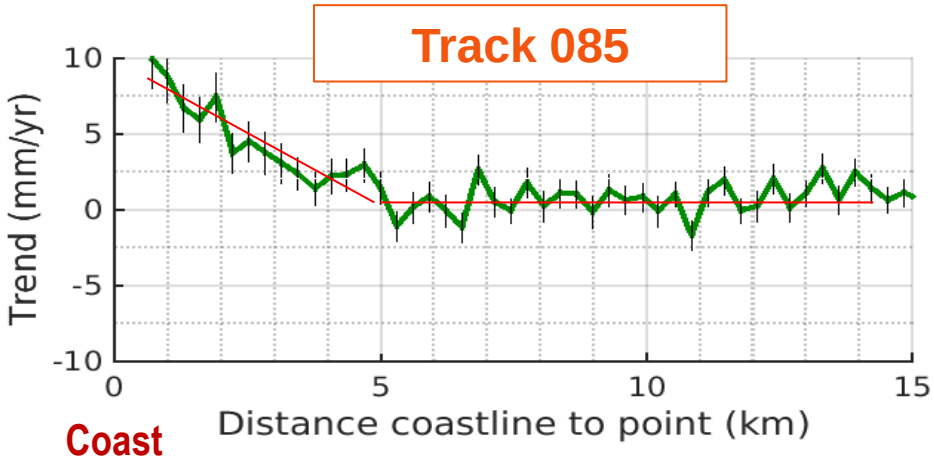
ESA CCI Sea Level project & Marti et al., ASR, 2019

Coastal sea level trends from satellite altimetry (2002-2016) along the Jason-1&2 satellites tracks → Mediterranean Sea



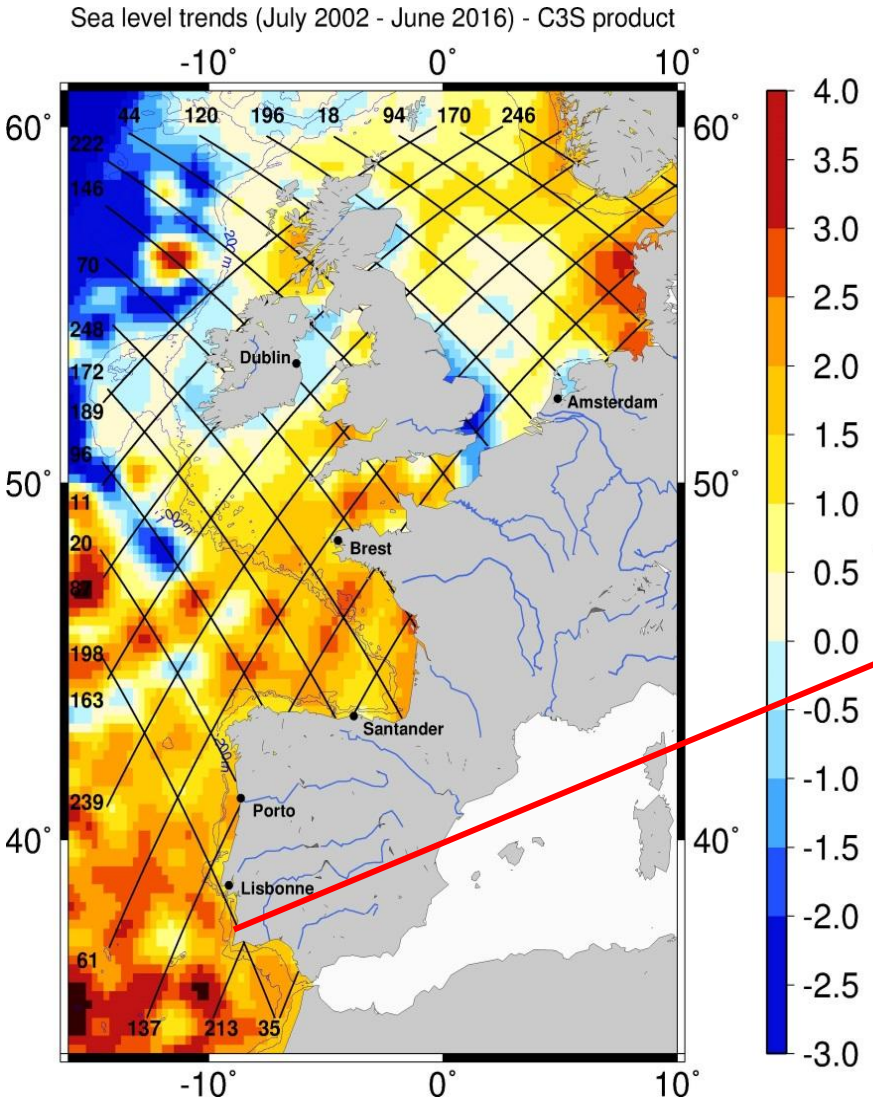
C3S gridded product and J-1 & J-2 tracks

Rate of sea level rise (mm/yr) near the coast



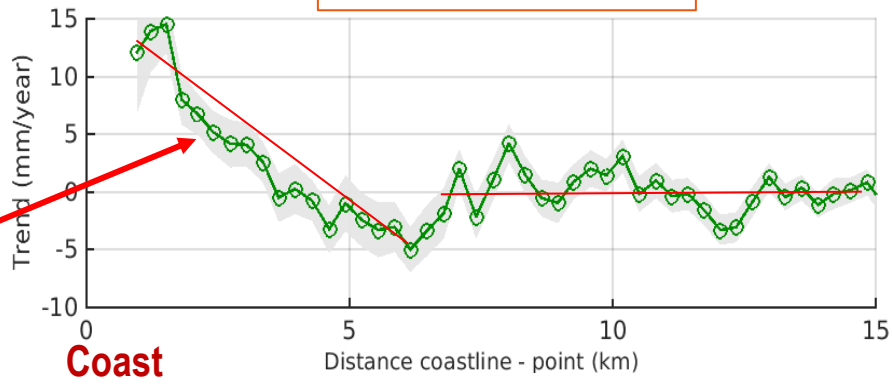
ESA CCI Sea Level project

Coastal sea level trends from satellite altimetry (2002-2016) along the Jason-1&2 satellites tracks → Western Europe



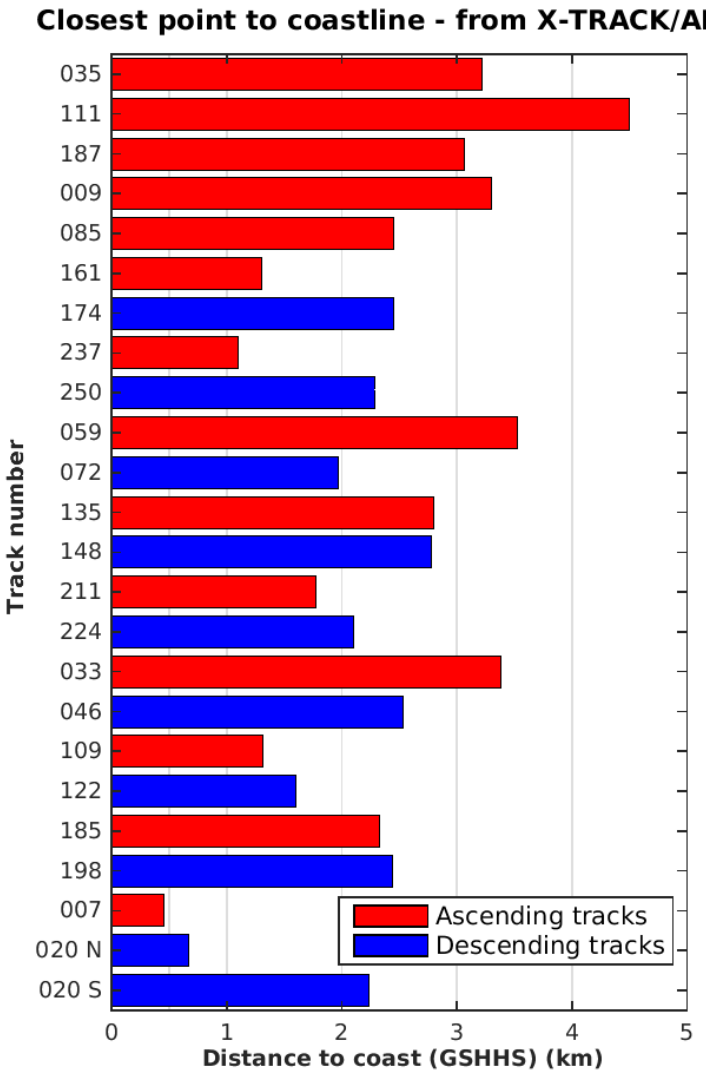
Rate of sea level rise (mm/yr) near the coast

Track 198



ESA CCI Sea Level project

Western Africa : Distance to coastline of the closest valid point



X-TRACK/ALES 20 Hz

Sea level data available at:

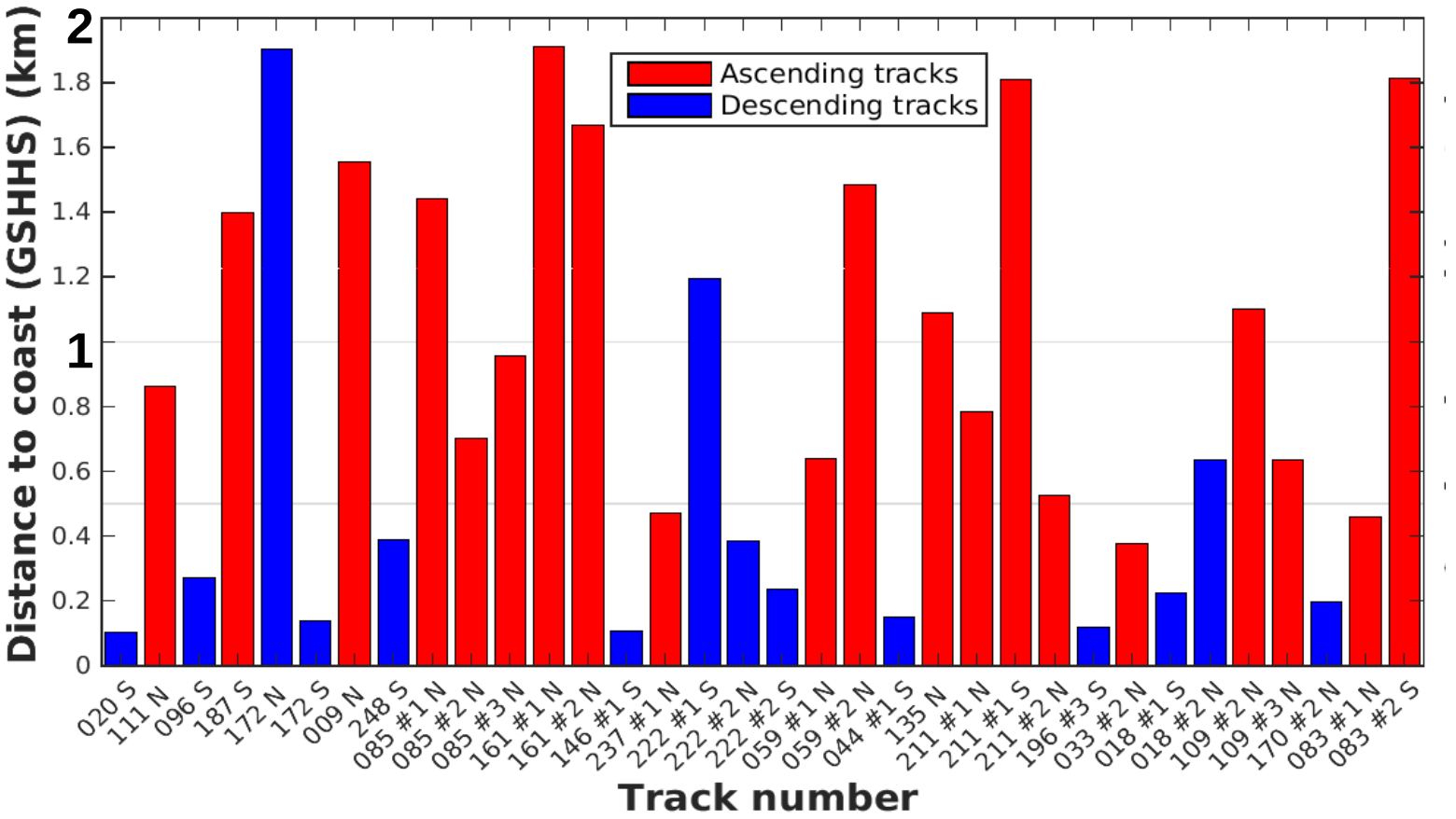
< 2.5 km from the coast
→ 16 tracks over 24

< 1 km from the coast
→3 tracks over 24

ESA CCI Sea Level project & Marti et al., ASR, 2019

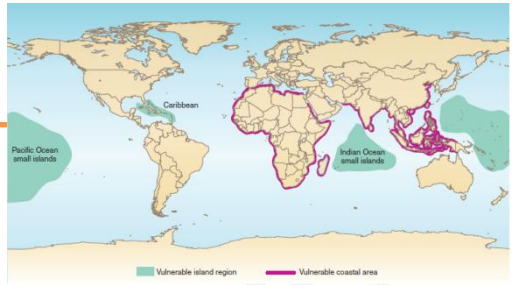
Mediterranean Sea:

Distance to coastline of the closest valid point



ESA CCI Sea Level project

Future work (ESA CCI+ Sea Level Project) →



Nicholls & Cazenave, 2010

(1) extend to the world coastlines
(2) use of SAR altimetry on Sentinel-3A/B,
(3) explain the change in sea level trends observed within the last ~5 km to the coast

~~Geophysical corrections ?~~

Winds ?

Shelf currents ?

Waves ?

River discharges ?

Niger River

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Thanks for your attention

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