Coastal Sea Level Trends from Retracked Satellite Altimetry over 2002-2016; Western Africa and Mediterranean Sea

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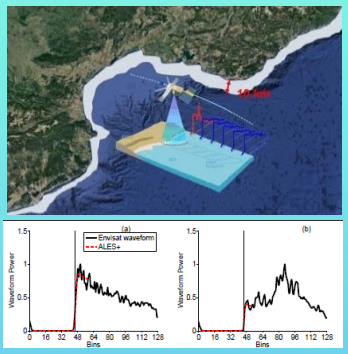
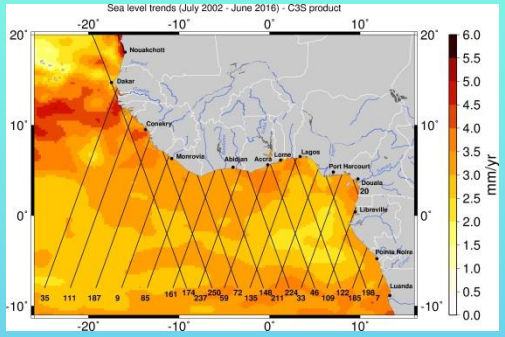
Summary: We present results of contemporary coastal sea level changes along the coasts of western Africa and Mediterranean Sea, obtained from a dedicated reprocessing of satellite altimetry data done in the context of the ESA 'Climate Change Initiative' sea level project. High sampling rate (20-Hz) sea level data from the Jason-1 and Jason-2 missions over a 14-year-long time span (July 2002 to June 2016) are considered. The data were retracked using the ALES 'Adaptative Leading Edge Subwaveform' retracker and combined with the X-TRACK processing system developed at LEGOS. We estimated sea level trends along the Jason-1 & 2 tracks covering the study regions and examined how the trends behave as the distance to coast decreases. This new data set provides valid sea level time series very close to land (in many instances, at distances < 1-2 km) from which robust trends can be estimated. Interestingly, coastal trends either increase or decrease in the last few km to coast and differ significantly from off shore trends. In some cases, the observed trends are suggestive of wave forcing along the surf zone. Interpretation of the results in terms of coastal processes is underway.

Method:

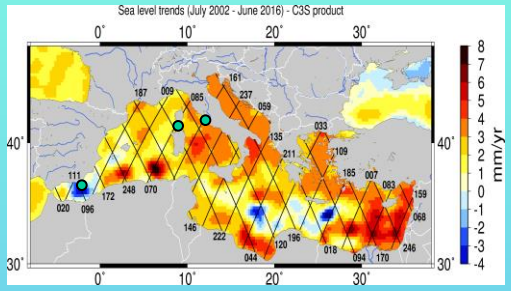
1. Reprocessing of Jason-1 & Jason-2 altimetry data by combining the 'ALES' (Adaptative Leading Edge Subwaveform) retracking of radar waveforms (Passaro et al., 2018) with improved XTRACK geophysical corrections (Birol et al., 2017); 2. Use of 20-Hz along-track reprocessed data; 3. Computation of sea level trends from open ocean to coast



ALES-based retracking of radar waveforms

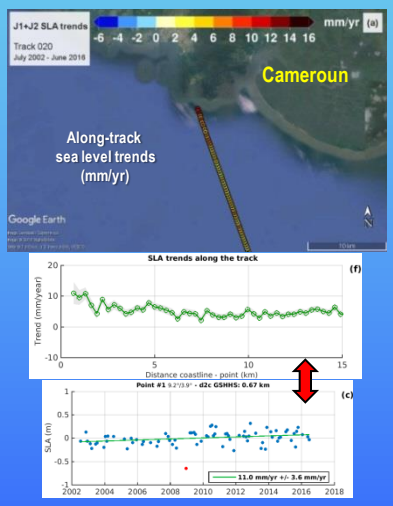


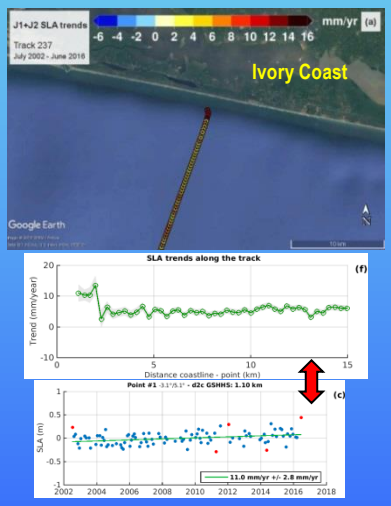
Western African sea level trends (2002-2016) from C3S with Jason tracks superimposed

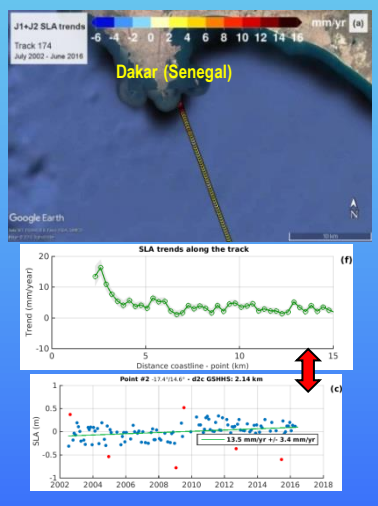


Mediterranean sea level trends (2002-2016) from C3S with Jason tracks superimposed

Results: Western Africa; a few examples

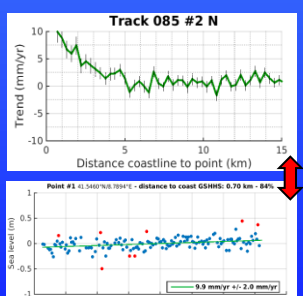


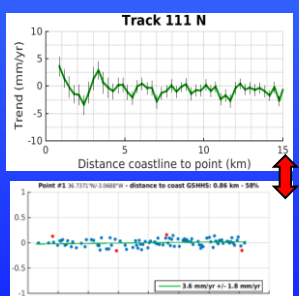


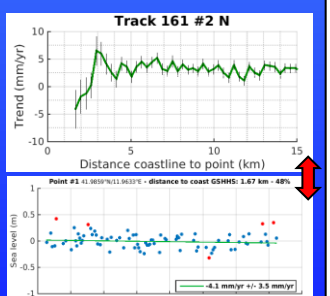


Upper plot: Sea level trend (mm/yr) as a function of distance to coast (last 15 km); Lower plot: sea level time series for the closest valid point to coast

Mediterranean Sea *(see coastal sites location –green dots- on map above)*







Conclusions:

(1) Combining ALES and XTRACK 20-Hz sea level products allows retrieving valid data very close to the coast. In the Western African region, robust sea level trends can be estimated within 1-2 km to the coast for 56% of the studied cases. Results are also good in the Mediterranean Sea where robust sea level trend values at distances within 1-2 km from land can be estimated for 40% of the studied coastal sites.

(2) In several instances, sea level trends significantly increase towards the coast. Some specific trend behaviors close to the coast are suggestive of wave trend driving (ongoing work).

References: Passaro et al., Validation of a global dataset based on subwaveform retracking: improving the precision of pulse-limited satellite altimetry; 11th Coastal Altimetry Workshop,Frascati (ESA-ESRIN), Italy, 2018-06-15, 2018; Birol et al., Coastal applications from nadir altimetry: example of the X-TRACK regional products. Advances in Space Research, 10.1016/j.asr.2016.11.005, 2017; Marti et al., Sea level change from satellite altimetry over 2002-2016 along the coasts of Western Africa, submitted, Advances Space Research, 2019