Accurate coastal altimeter products in the Strait of Gibraltar: ready for exploitation

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Abstract

We analyzed the availability and accuracy of coastal altimetry sea level products in the Strait of Gibraltar, the choke point connecting the Atlantic Ocean and the Mediterranean Sea. All possible repeats of two segments of ~30 km along two sections of the Envisat and AltiKa ground-tracks were used in the eastern and western portions of the Strait. For Envisat, along-track SLA at 18-Hz posting rate were computed (from Oct.-2002 to Oct.-2010) using the retracked ranges from two sources, the official SGDR and the outputs of a coastal waveform retracker, the Adaptive Leading Edge Subwaveform (ALES) retracker. For AltiKa, along-track SLA at 40 Hz (from May-2013 to Jan.-2015) was also computed both from SGDR and ALES retracked ranges. The SSB correction was recomputed for the ALES-retracked Envisat SLA. The quality of these altimeter products was validated using two tide gauges located on the southern coast of Spain (Tarifa). The use of products from both missions allows longer times series, leading to a better understanding of the hydrodynamic processes in the area. For more details: Gómez-Enri et al., 2016.

SLA_Sat = Orbit - Range - Range Corrections - Geophysical Corrections - MSS

Range (Envisat and AltiKa)

ALES (Passaro et al., 2014) & SGDR (Brown, 1977)

Range Corrections

Ionospheric (GIM maps), Dry/Wet Troposheric (ECMWF model). For SSB:

- Envisat_ALES): *SWH* and *sigma0* obtained from ALES were used to recompute the SSB.
- Envisat_SGDR: we interpolated to 18 Hz from the 1-Hz averages available in the SGDR files.

Geophysical Corrections

Ocean Tide, Load Tide, Solid Earth Tide, Pole Tide and atmospheric effects (DAC). Regarding tidal elevation we used DTU10 global ocean tide model (Andersen 2010).

MSS

The most updated version of the Danmarks Tekniske Universitet MSS: DTU13 (Andersen and Knudsen, 2009; Andersen, 2010).

SLA_TG = Water_Level – Geocentric Ocean Tide – DAC – MSS

Water Level

Record interpolated to the time of the altimeter measurement.

Geocentric Ocean Tide:

Extracted from DTU10 global ocean tide model using the location of the tide gauge and the time of the altimeter data as references.

DAC

Gridded maps from AVISO.

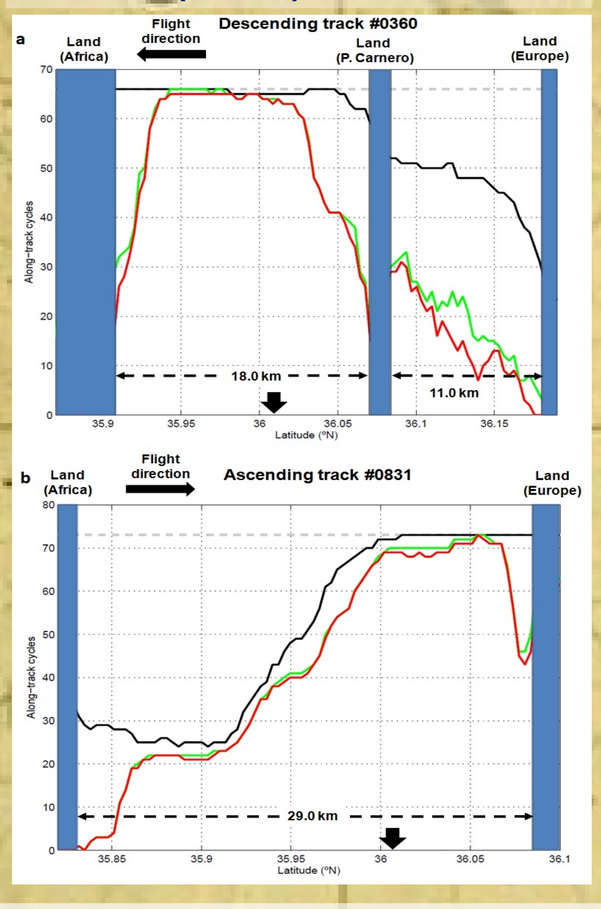
MSS

Mean sea level (1990-1999) over the TGZ

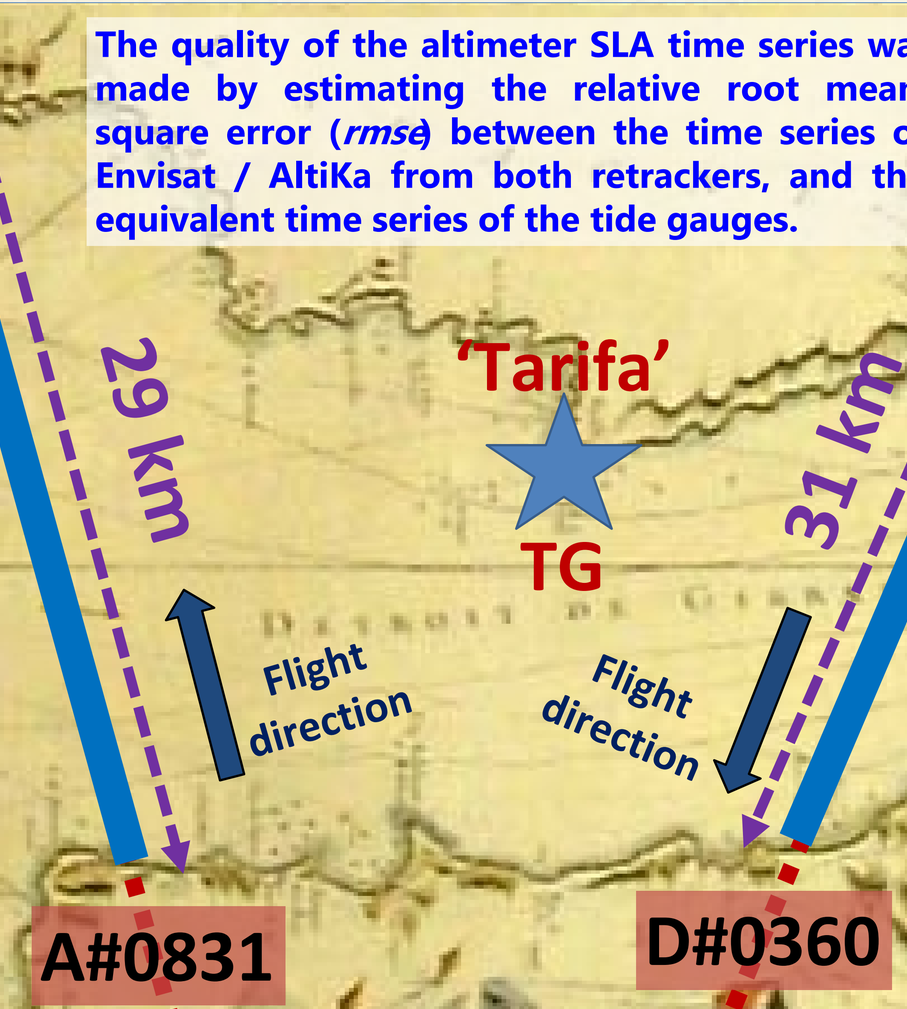
This work is in preparation of Sentinel -3 validation under VOCALS3 (Validation Of Coastal ALtimetry from Sentinel-3) approved by ESA under call "Sentinel-3 validation team"

The quality of the altimeter SLA time series was made by estimating the relative root mean square error (*rmse*) between the time series of Envisat / AltiKa from both retrackers, and the equivalent time series of the tide gauges.

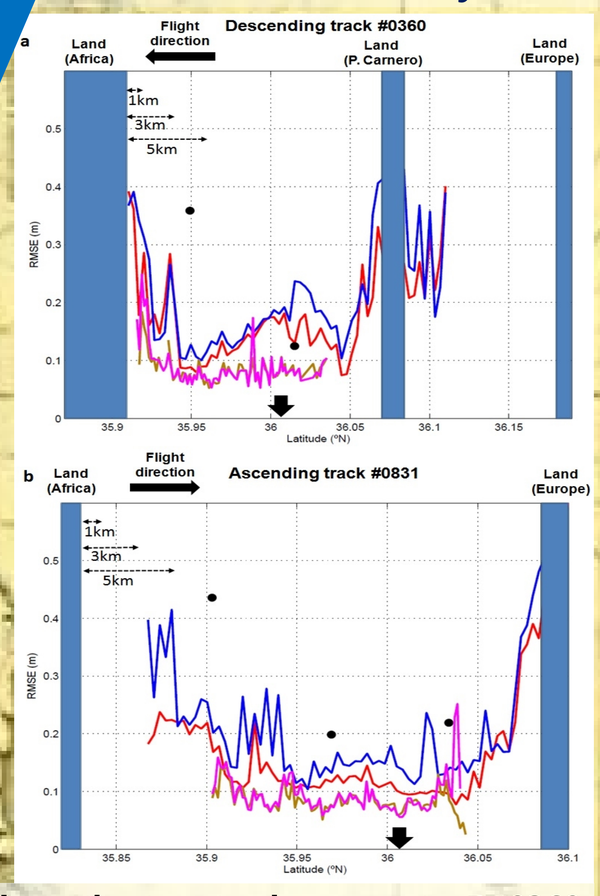
Availability of the coastal altimetry (Envisat) records



Number of cycles along the two tracks analyzed: D#0360 (a) and A#0831 (b). Grey dashed line gives the maximum number of cycles: 66 (D#0360) and 74 (A#0831). Black solid line indicates the number of cycles after applying the chirp_id mask to the dataset. Green solid line gives the number of along-track cycles used to estimate SLA after applying the editing of the corrections. Red solid line shows the number of cycles after all the outliers in SLA were removed. The big black arrows give the latitudinal position of the tide gauge.



Validation of altimeter-derived Sea Level Anomaly



***rmse* along the two track segments: D#0360 (a) and A#0831 (b). Blue lines show the results obtained with Envisat SGDR and red lines those from Envisat ALES. Black dots are the *rmse* for CTOH Envisat dataset (1 Hz). Also included the *rmse* from AltiKa/standard (pink line) and AltiKa/ALES (brown line).**

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CONCLUDING…

For Envisat, the availability of data close to the coast depends crucially on the strategy followed for data screening. Most of the rejected data were due to the radar instrument operating in a low-precision non-ocean mode (80 – 20 MHz). We observed an improvement of about 20% in the accuracy of the Envisat SLAs from ALES compared to the standard (SGDR) and the reprocessed CTOH data sets. A more accurate SSB correction (Envisat) improves the comparison against in-situ data. AltiKa shows higher accuracy, with no significant differences between SGDR and ALES.

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