Assessing SARAL/AltiKa data in the coastal zone with HF radar observations

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1. Introduction

Satellite altimetry is a key component of the observing platforms and its benefits in open ocean have been proved thoroughly during the last two decades. However, altimetry measurements in the coastal area have not been fully exploited yet for scientific applications at regional scales because of relatively poor sampling (land contamination) and inaccuracy of corrections.

The objective of this study (Pascual et al., 2015) is the evaluation of SARAL/Altika data in the coastal ocean (10-60 km to the shore) by using a multi-sensor approach. Namely, we will estimate geostrophic currents and compare them to High Frequency (HF, hereinafter) radar surface velocities in the Western Mediterranean.

2. The SARAL/AltiKa altimeter mission

The India-France SARAL/AltiKa mission is the first Ka-band altimetric mission dedicated to oceanography (Verron et al. 2015). With regard to the Ku band, the use of the Ka band ac-tually leads to an improved vertical and along-track resolutions and better discrimination in transition zones. This unique instrumental design results in more accurate measurements enabling a better characterization of coastal and mesoscale ocean processes.

- 2013/02/25: launch
- 2013/06/20: real time data dissemination to all users on the AVISO ftp server
- Orbit: 35 days repeat period over ENVISAT tracks.

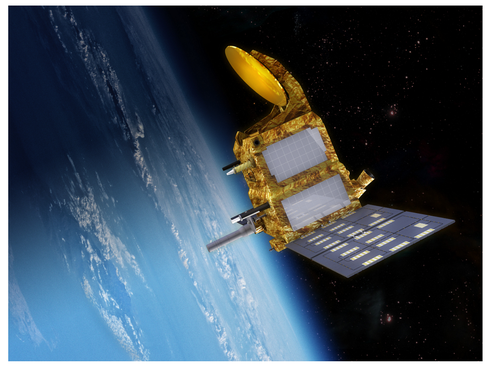

Figure 1: SARAL/AltiKa satellite

3. Study area

This study focuses on the Ibiza Channel where the north-south water exchanges play a key role in controlling the circulation variability in the Western Mediterranean at a wide range of scales. A SARAL-AltiKa satellite track (no. 16) located close to Ibiza Island. This track benefits from the SOCIB HF Radar facility, which provides surface currents in the Ibiza Channel. (Lana et al., 2015).

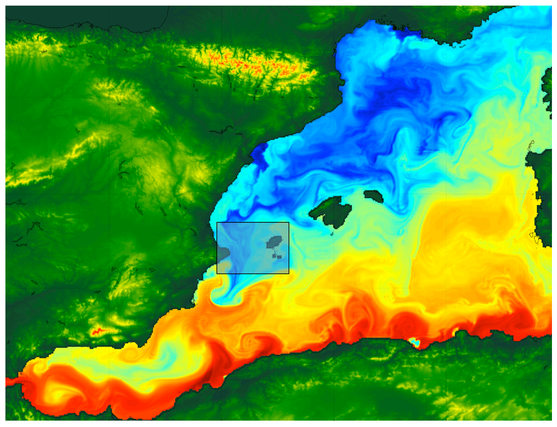

Figure 2: Area of study. The background color field corresponds to SST (IMEDEA- ROMS simulation).

4. Datasets

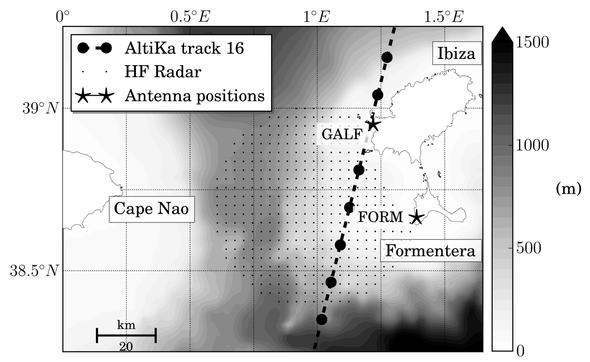

Figure 3: Spatial distribution of observations considered in this study: the SARAL/AltiKa track number 16 and HF radar. The dots in the tracks correspond to the position of available Ssalto/Duacs measurements (along track delayed filtered SLA data) for cycles 1-12. The total HF radar data grid coverage is represented by small dots and the background color field is the bathymetry. The location of the HF radar antennas is indicated with two stars.

SARAL/AltiKa

- Along track Sea Level Anomaly (AVISO, aviso.altimetry.fr) and Mean Dynamic Topography (SMDT-MED-2014, Rio et al. 2014) ➔ ADT = SLA + MDT
- Horizontal resolution: 14 km (vfec)
- Delayed time data. Across track geostrophic velocities
- Cycles: 1-12
- Period: April 2013 - May 2014

HF Radar

- Hourly surface currents with 3 km spatial resolution and a range up to 60 km (SOCIB, socib.es). 72-h averages
- See Lana et al. (2015) for more details.

5. Results

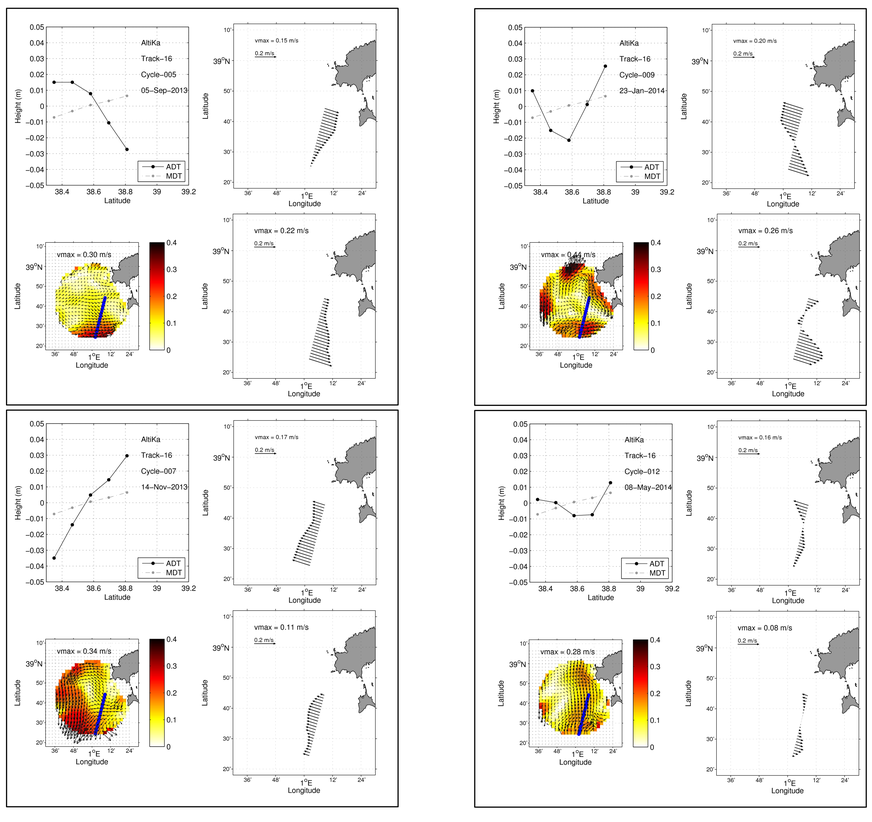

Figure 4. Qualitative comparisons between HF radar and SARAL/AltiKa dat. Top-left: ADT derived from SARAL/AltiKa filtered records in the area covered by the HF radar. The MDT interpolated along the track is plotted in grey; Top-right: absolute geostrophic velocities perpendicular to the track derived from SARAL/AltiKa data; Bottom-left: Surface HF radar currents averaged over a 72h period and centered at the date of the satellite passage. Background color corresponds to the magnitude of the currents (in m/s). The blue line denotes the position of the altimeter velocity vectors; Bottom-right: surface HF radar velocities perpendicular to the SARAL/track interpolated from the HF radar data.

6. Summary & Outlook

The standard AVISO delayed-time products evidence the emerging capabilities of SARAL/AltiKa in the coastal zone:

- Data are retrieved at a distance of only 7 km from the coast.
- Geostrophic fields resolve the general features of the seasonal mesoscale variability in reasonable agreement with HF radar fields (significant correlations of 0.54).

Detected differences up to 10-15 cm/s might be due to several factors such as instrumental radar errors, smooth effect during data processing, ageostrophic signals, inaccurate corrections and editing in the altimeter data and low signal to noise ratio (SSH gradients of the order of only 2-4 cm). Root mean square (rms) differences between the estimated SARAL/AltiKa and the HF radar velocities are of about 13 cm/s. These results are consistent with recent studies in other parts of the ocean applying similar approaches to Topex/Poseidon and Jason-1 missions and using coastal altimeter corrections.

Upcoming SARAL/AltiKa assessment studies should address the application of ad-hoc coastal-oriented altimeter corrections, including the review of the data recovery strategies near the coast and the exploitation of high-frequency measurements (40 Hz) for a better restitution of finescale structures (see an illustration in Troupin et al., 2015).

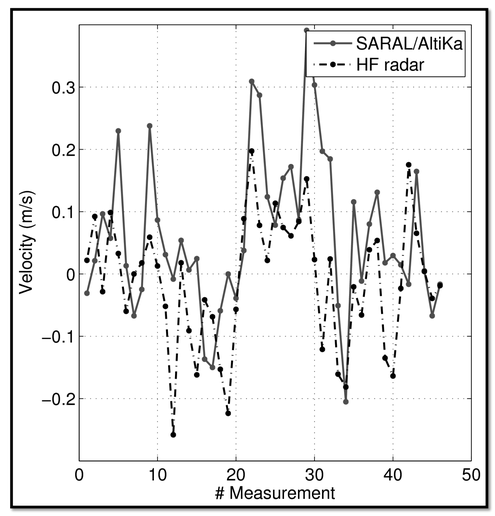

Figure 5. Cross-track velocity for SARAL/AltiKa (continuous line) and HF radar data interpolated at the satellite measurement point (dashed line). Positive (negative) values indicate north-westward (south-eastward) flow.

7. Acknowledgements

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