Assessing SARAL/AltiKa near-real time data in the coastal zone: comparisons with HF radar

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OBJECTIVE

To process and validate multi-platform datasets dedicated to coastal ocean, with a special focus on SARAL/AltiKa mission.

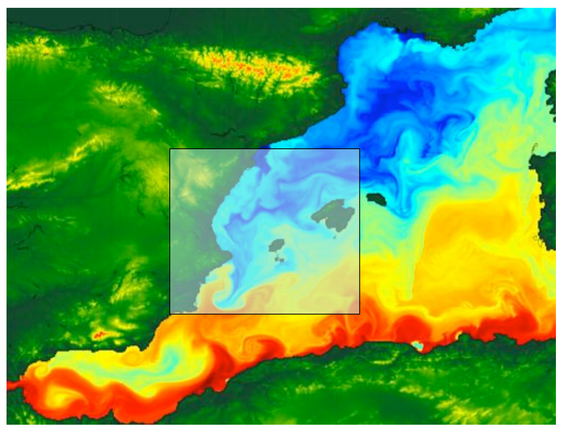


Figure 1: Area of study. The background color field correspond to SST (IMEDEA- ROMS simulation).

Ibiza Channel

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. Furthermore, two surface drifters were deployed in the area of interest.

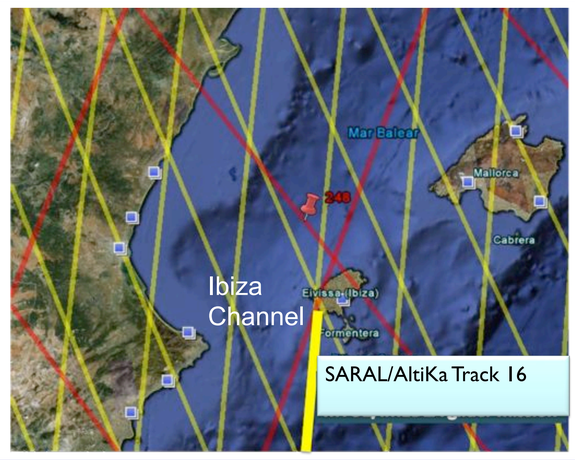
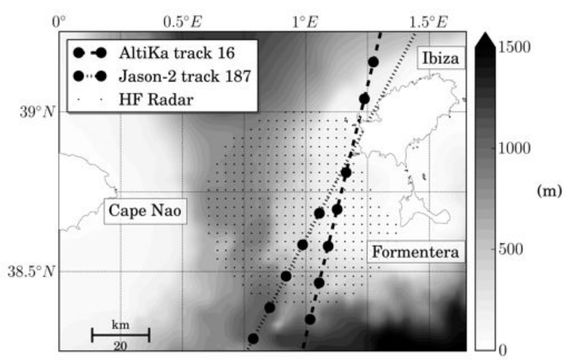


Figure 2: SARAL/AltiKa and Jason-2 tracks in the NW Mediterranean Sea. The SARAL/AltiKa track #16 is marked in yellow.

Multi-sensor data



SARAL/AltiKa

- Along track Sea Level Anomaly and Mean Dynamic Topography (SMDT-MED-2014, Rio et al. 2014) ➔ ADT = SLA + MDT
- Horizontal resolution: 14 km (vfec)
- NRT(MFS/MED) and DT
- Period: March 2013-September 2014

HF Radar

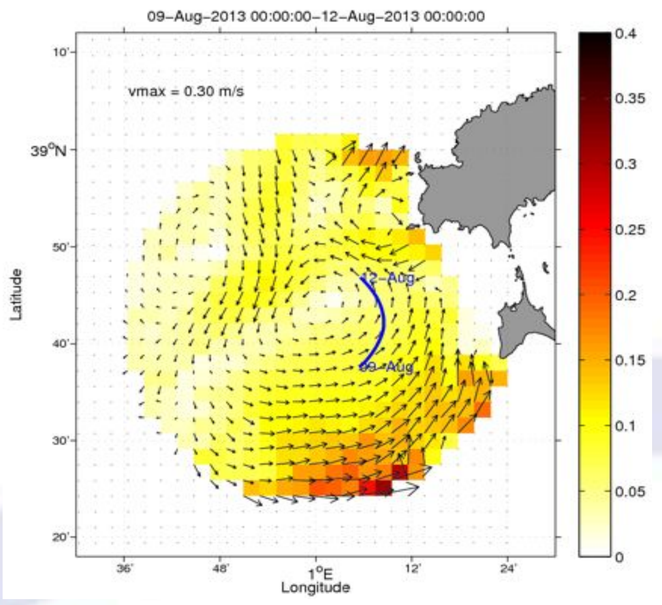
- Hourly surface currents with 3 km spatial resolution and a range up to 60 km. 72-h averages.

Drifters

- Trajectories and surface velocities. Interpolated and low-pass filtered with a 36-h cutoff to remove high-frequency components.

Figure 3: Spatial distribution of observations in the vicinity of Ibiza Island considered in this study: the SARAL/AltiKa track number 16; Jason-2 track number 187 and HF radar. The dots in the tracks correspond to the available points of along track near-real time data available for cycles 3-12. The HF radar grid coverage is represented by small dots and the background color field is the bathymetry.

HF radar validation with surface drifters



An in situ validation field experiment was carried out in August 2013, with the use of a surface drifter (Figure 4). The lagrangian drifter was launched in the HF Radar coverage area with a 15 meter depth drogue. Drifter derived mean velocities are compared with the closest radial data that fall within a 1-km diameter circle from the location of the drifter data. Visual comparisons reveal a reasonable agreement between drifter and HF radar, indicating both the presence of a cyclonic meander southwest of Ibiza Island with velocities around 0.15 m/s. High correlations are obtained between HF radar radial velocity and drifter-derived velocities: 0.8 for the antenna in Ibiza Island, and 0.7 for the antenna in Formentera Island and rms differences of 8.7 and 10.2 cm/s respectively.

Figure 4: Coverage of SOCIB HF radar in the Ibiza Channel. The vectors correspond to surface currents derived from HF radar averaged for the period 9-12 August-2013. The colors correspond to the magnitude of the currents (in m/s). The trajectory followed by of a drifter during the same days is ovelaid (high frequency signals such as inertial and tidal oscillations have been filtered out with a 36-h filter).

SARAL/AltiKa vs HF radar velocities

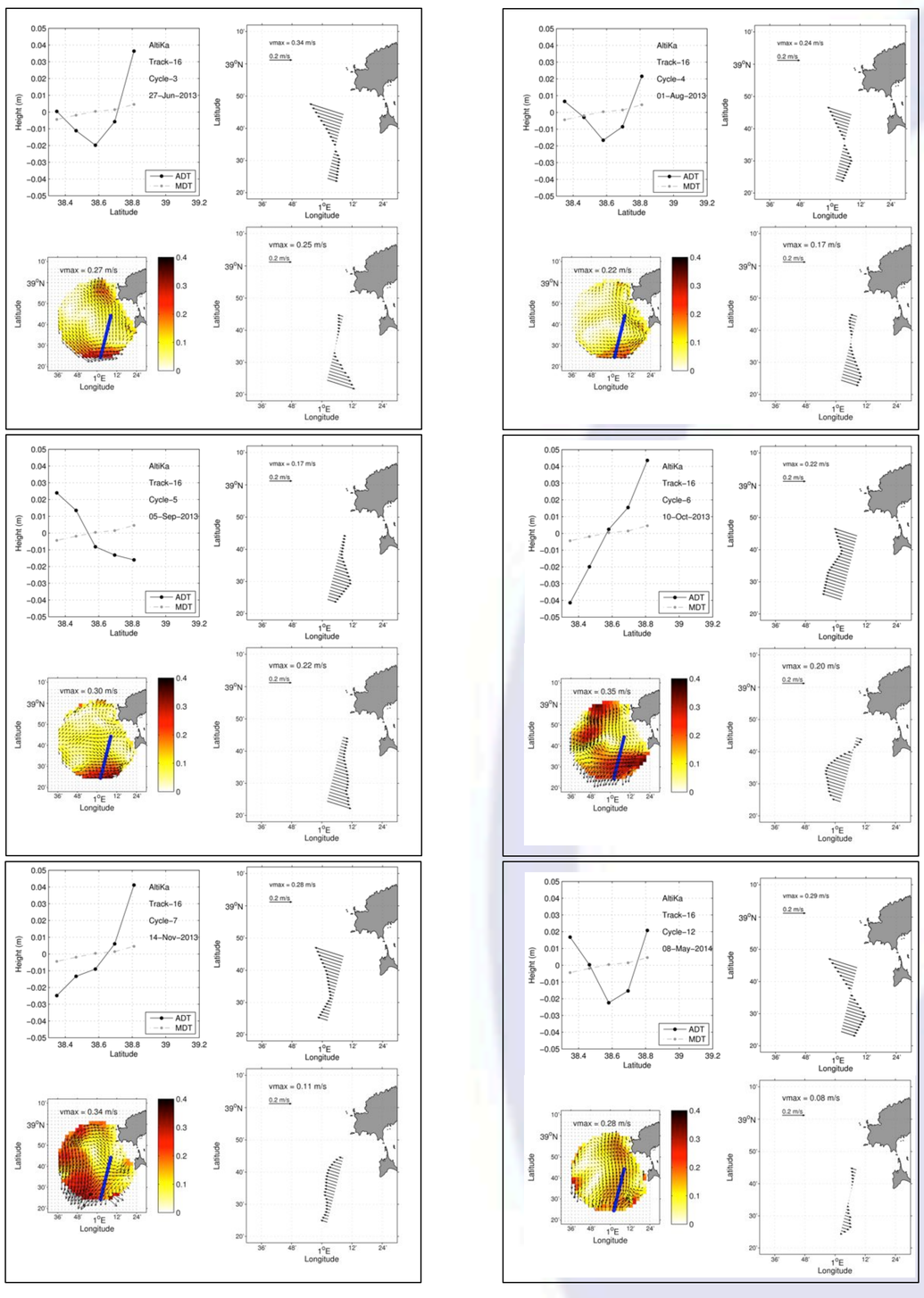
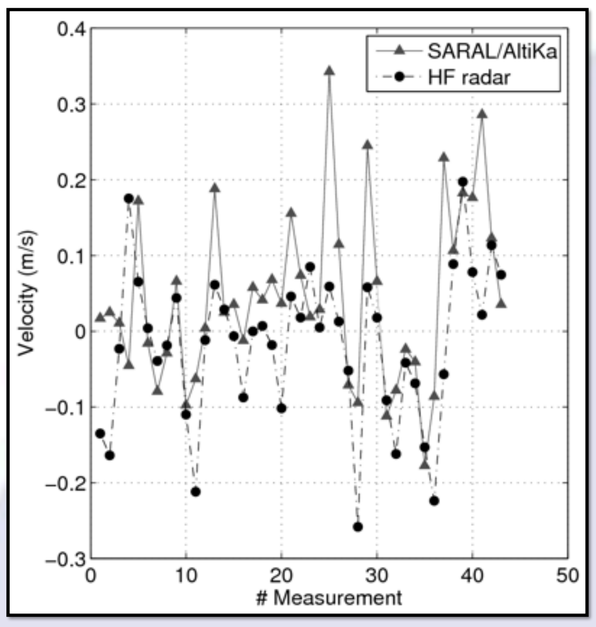


Figure 5. Qualitative comparisons between HF radar and SARAL/AltiKa NRT data. Top-left: ADT derived from SARAL/AltiKa records in the area covered by the HF radar. The MDT interpolated along the track is plotted in grey. Top-right: Map of absolute geostrophic velocities perpendicular to the track. Bottom-left: Surface HF radar currents. Background color corresponds to the magnitude of the currents (in m/s). The blue dots denote the position of the altimeter velocity. Bottom-right: absolute velocities perpendicular to the track interpolated from the HF radar data.

Summary & Outlook

The standard AVISO near-real 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, while Jason-2 measurements are located farther than 24 km off Southwest Ibiza, preventing from a robust analysis.



SARAL/AltiKa derived velocities reveal coherent mesoscale features among the different cycles and with general good agreement with HF radar fields (significant correlations of 0.60, rms diff. 11 cm/s). Detected differences up to 10-15 cm/s might be due to several factors such as instrumental radar errors, smooth effect during data processing, inaccurate altimeter corrections, suspicious coastal editing and low signal to noise ratio (SSH gradients of the order of only 2-4 cm). See Pascual et al. (2014) for more details.

Figure 6. 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.

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 fine scale structures (Troupin et al., 2014).

Acknowledgements

This study was carried out in the frame of MyOcean2 EU FP7 funded project and is a contribution to the SARAL/AltiKa science team under the proposal: 'On the use of SARAL/Altika products for coastal and MEsoscale studies in the BAlearic Sea: synergy with other sensors (SAMEBA)'. Funding from Local Government of the Balearic Islands (CAIB-51/2011 Grant) is also acknowledged.

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