Multi-sensor observations towards coastal and mesoscale characterization: SARAL/AltiKa, HF radar, glider and drifters

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OBJECTIVES

(1) To process, validate and intercalibrate multi-platform datasets dedicated to coastal ocean, with a special focus on SARAL/AltiKa mission;

(2) To use an integrated approach to improve the monitoring and understanding of dynamical processes in the Western Mediterranean Sea.

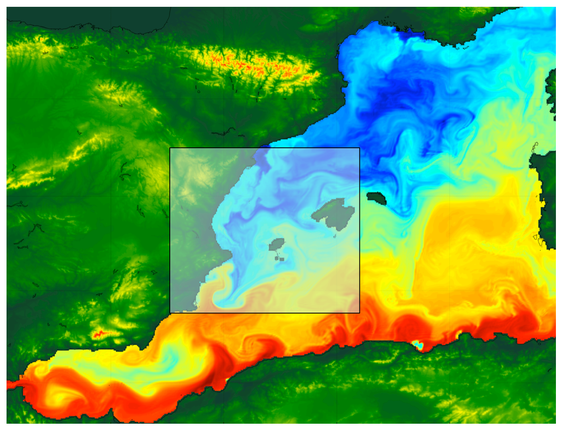


Figure 1: Area of study. The background color field correspond to SST (IMEDEA- ROMS simulation).

G-ALTIKA experiment

G-ALTIKA is a multi-sensor experiment performed by IMEDEA/SOCIB in August 2013 in the NW Mediterranean Sea. A deep Slocum glider followed almost simultaneously 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.

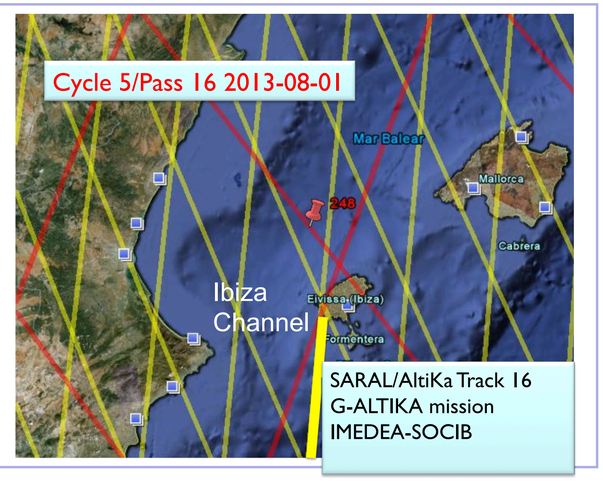
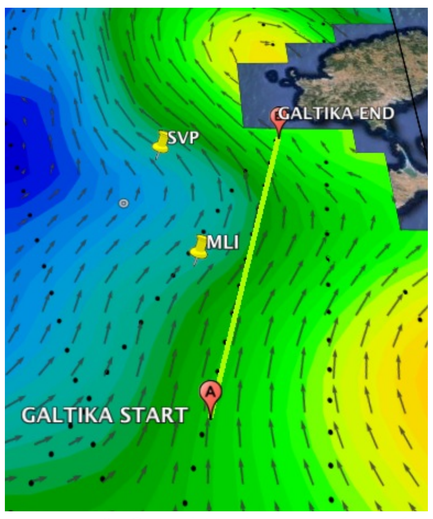


Figure 2: SARAL/AltiKa and Jason-2 tracks in the NW Mediterranean Sea. The SARAL/AltiKa track followed by the glider during G-ALTIKA is marked in yellow.

Multi-sensor data



SARAL/AltiKa

- Sea Level Anomaly and Mean Dynamic Topography (MDT-SOCIB-CLS) ➔ ADT = SLA + MDT
- Horizontal resolution: 7 km (resp. 1Hz)

Glider

- Pressure, Temperature and Salinity profiles.
- Dynamic height estimated from glider CTD. Tests with different reference levels (300-900) evidence a weak sensitivity.
- Vertical extension / Horizontal resolution: 10-900m / 1-3 km

HF Radar

- Hourly surface currents with 3 km spatial resolution and a range up to 60 km. A Lanczos filter with a 36-h cutoff frequency is applied to removed inertial oscillations.

Drifters

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

Figure 3: G-ALTIKA glider mission definition and drifter deployment location (SVP, MLI). The background color field is ADT from gridded NRT DIVA altimetry (1 August 2013) and the SOCIB-CLS MDT. and the vectors correspond to the associated surface geostrophic currents.

Drifter & Radar observations

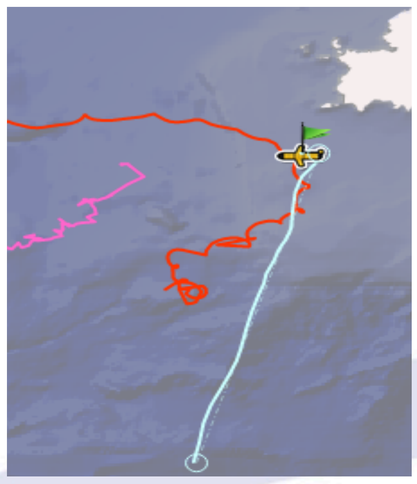


Figure 4: Raw drifter (MLI) trajectory during two weeks after deployment (2-16 August 2013). The initial trajectory of drifter (SVP) and the glider path are also shown.

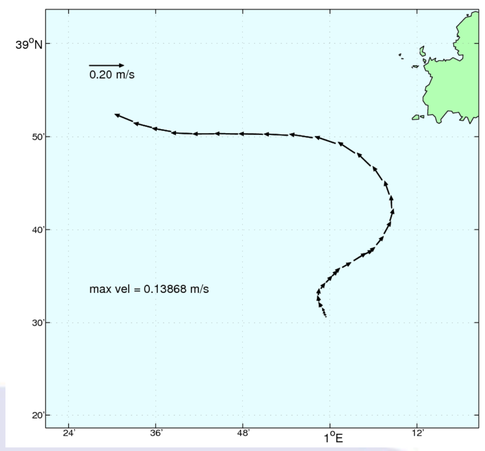
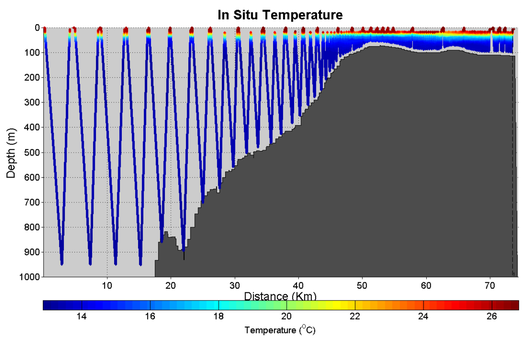


Figure 5: Filtered drifter (MLI) trajectory during two weeks after deployment (2-16 August). The associated surface drifter velocities are also shown.

Glider observations



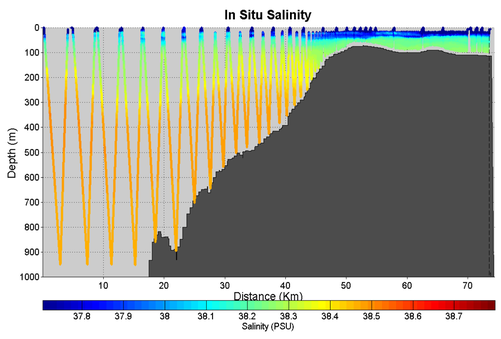


Figure 7 (top left and right): In situ temperature and salinity raw profiles from the glider CTD. The horizontal resolution ranges from 3 km in the deeper part of the transect to 1 km in the shallow area.

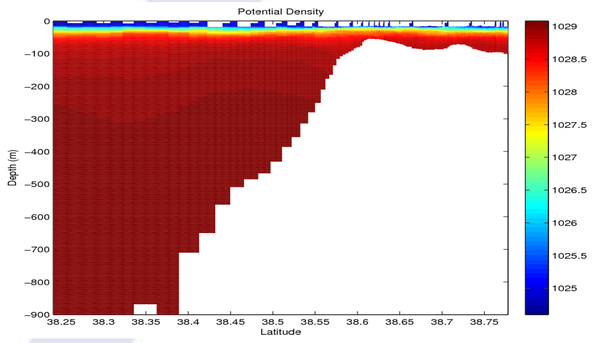
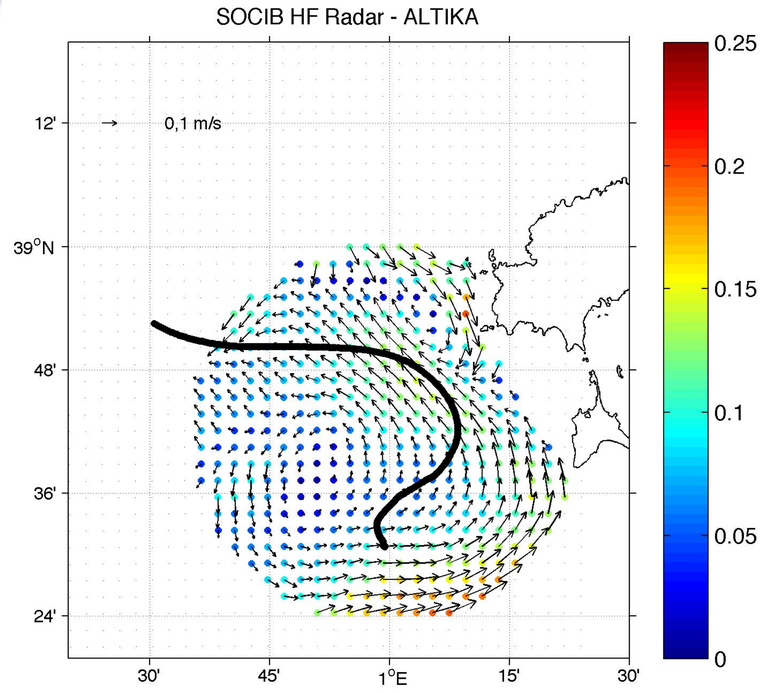


Figure 8 (bottom right): Processed potential density after interpolating vertically and horizontally the original profiles.



Initial 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.

Figure 6: Filtered HF radar velocities averaged during the days of the cruise (2-5 August 2013). The filtered drifter trajectory is also plotted.

Glider vs SARAL/AltiKa

- The gradient of dynamic height from glider observations (after the filtering of scales smaller than 10-15 km, not well resolved by altimetry) is only of the order of 2-3 cm, but denotes the occurrence of a coherent cyclonic meander with a diameter of around 25 km, located southwest of Ibiza, coinciding with drifter and HF radar data (cf. Fig. 4-6).
- Absolute Dynamic Topography (ADT) is obtained by combined 1 Hz, along-track near real-time SLA from SARAL/AltiKa and the new SOCIB-CLS Mean Dynamic Topography. SARAL/AltiKa filtered records also show the weak cyclonic meander, with consistent size, amplitude and position compared to glider observations.
- SARAL/AltiKa is able to capture the northward edge of the meander, a northwestward current that lies on a shallow bathymetry (less than 100 m) and flows very close to the coast (distance to Ibiza < 10 km). However, 1 Hz along track data fail to depict the fine-scale signals sampled by the glider, which are typical in the Mediterranean Sea (Rossby radius around 10km).

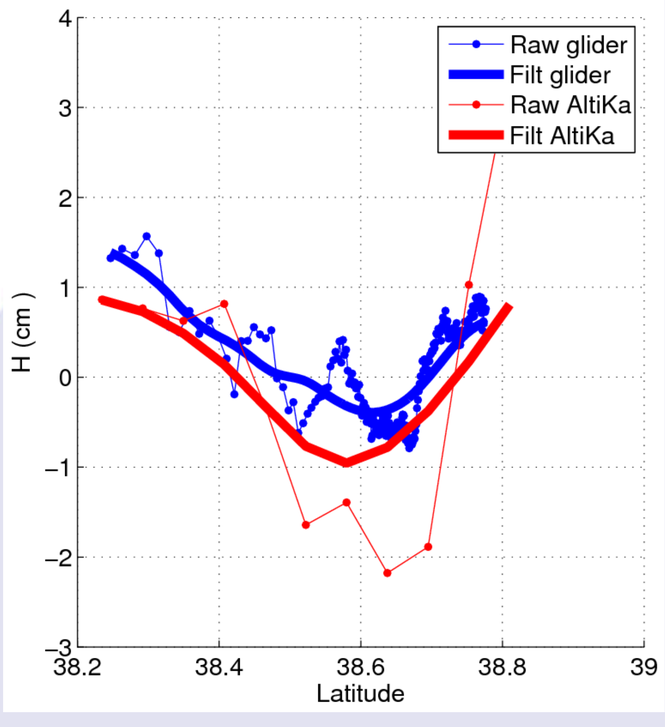


Figure 9: Glider dynamic height versus SARAL/AltiKA absolute dynamic topography obtained by adding 1 Hz, along-track near real-time SLA from SARAL/AltiKa and the SOCIB-CLS Mean Dynamic Topography.

Summary & Outlook

The preliminary results obtained within G-ALTIKA highlight that: (1) SARAL/AltiKa is providing reliable data very close to the coast with weak associated gradients, representing a challenge for the new era of satellite altimetry observations and (2) there is a clear need of high resolution ocean surface topography measurements, by using HR data (e.g. 40 Hz); the development of synergic approaches through the combined use of observing systems and model simulations and by the launch of the Surface Water and Ocean Topography (SWOT) mission.

Acknowledgements

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