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# Synergy between in-situ and altimetry data to observe and study the fine-scale dynamics in the Ligurian Sea (NW Mediterranean Sea).

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Historically, satellite altimetry has not been designed for observing the coastal ocean but, thanks to advances in the processing of the data and to technological innovations (Ka-band and SAR altimetry), more and more accurate altimetry sea level observations become available near land surfaces. As a consequence, we can easily assume that the use of this observational technique in coastal studies will be largely extended in the next years. The North-Western Mediterranean Sea (NWMed) has become a pilot area for coastal altimetry studies. It is a particularly interesting area in terms of coastal ocean dynamics, complex and associated with a large number of fine scale structures. Long time series of repeated in-situ datasets also exist in this area. Today, we know that only a small part of the NWMed ocean dynamics can be captured by satellite altimetry. Thus this is one of the ideal regions to investigate the progress made in coastal altimetry, and the perspectives it offers in terms of mesoscale and sub-mesoscale ocean observation.
In this study, the objectives are to define the contribution of satellite altimetry to observe and understand the NWMed ocean dynamics, in parallel with the other ocean observing systems. The impact of some aspects of the altimetry data processing on the observation of the coastal ocean dynamics will also be discussed. We focus here on the Ligurian Sea ocean circulation and use glider, ADCP and HF radars observations to analyse if the major regional ocean processes can or not be captured by altimetry-derived currents (through their signature in sea level at a wavelength which can be resolved by altimetry). We use three generation of altimetry missions : from Jason 2 (nadir Ku-band radar), to SARAL (nadir Ka-band altimetry) and Sentinel-3 (SAR altimetry) and analyze the progress allowed by the new technologies.
We focused on the Northern Current (or NC, less than 60 km wide) which flows cyclonally along the Italian, French and Spanish coasts. In terms of mean current, we observe a very good spatial continuity and coherence in the regional current map, showing the complementarity between all the observational techniques. In terms of current variability, we still observe a clear spatial coherence but significant differences appear in the standard deviation values computed. The origins of these differences are analyzed. Systematic intercomparisons between the altimetry data sets and in situ observations have been made to study the ability of altimetry to capture the NC in the study area (and which part can not be resolved). The differences in the NC amplitude, width and position derived from the different current datasets (altimetry vs HF radar, ADCP and glider) are analyzed in terms of the physical content, spatio-temporal resolution and location associated to each type of measurement.