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Quantification of the signature of the Northern Current in sea level variations or how can we optimally use altimetry observations in coastal circulation studies.

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Satellite altimetry enables to obtain the Sea Surface Height (SSH) variations along the satellite tracks. More and more accurate observations are available near the coasts thanks to advances in the data processing and to technological innovations. As a consequence, fine-scale coastal structures (eg down to 30-50 km, depending on their signature in SSH) can be regularly monitored. However, in terms of geostrophic current derived from the SSH altimetry gradients, intercomparisons with in situ observations show regularly that their amplitude is underestimated. This is due to the signal-over-noise ratio associated to altimetry measurements, which results in a loss of information. If we want to optimize the use of altimetry in coastal studies, it is important to quantify what current component can/can't be observed. This is the objective of this work.
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, associated to a large number of fine scale structures. It also benefits from a large number of in situ current observations (ADCP, gliders, HF radars).
In this study, the objectives are to quantify the SSH signature of dedicated coastal processes in the NWMed and to analyse the spatio-temporal scales associated. We focus on the Northern Current (or NC, less than 60 km wide) which flows cyclonally along the Italian, French and Spanish coasts. We use a high resolution numerical model (Symphonie) which is first validated against independant in situ datasets. Then it is used to quantify the SSH signature of the NC at two distinct locations along the French coast. We then compared the results obtained with the spatio-temporal variations observed in satellite altimetry data and quantify and study the differences. We also analyze the origin of the differences observed between different types of in situ current observations and altimetry data : their respective spatial/temporal resolution, track orientation, differences in location, geostrophic vs total current component,... Finally, this study also allows us to understand the intrinsic differences obtained from different types of ocean current observations.