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Assessment of a NEMO-based downscaling experiment for the North-Western Mediterranean region: impacts on the Northern Current and comparison with ADCP data and altimetry products.

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Realistic high resolution modelling of the North-Western Mediterranean Sea is performed using the NEMO code. The region presents a specific topography, with a narrow shelf at the eastern part, and a large continental shelf known as the gulf of Lions (GoL) in the west. In the area, the sea circulation is mainly governed by a major current, called the Northern Current (NC), flowing along the shelf. The NC dynamics is associated with typical processes taking place along its path, such as meanders giving birth to eddies and current intrusions onto the shelf, strongly conditioning the interactions between coastal and off-shore waters.

The aim of this work is to assess the impact of numerical resolution on the NC dynamics and in particular its spatio-temporal variability. It is made through a study of its characteristics and variability at key locations along its path in the studied area. The resolution impact on the NC features is evaluated by using a high resolution configuration (HRC) at 1/64°, as well as a low resolution configuration (LRC) at 1/16°, used for providing the open boundary conditions for this HRC. Both numerical configurations are assessed by using hull-mounted ADCP data and geostrophic velocities derived from AVISO altimetry at different locations of the NC path.

The study shows that the two configurations develop a different solution regarding the current dynamics, but both indicate an important variability of the NC position along its general path. The low resolution simulations systematically exhibit a NC shifted too far off the coast and shifted seaward along the GoL shelf edge. In comparison, the high resolution simulations better fit the remote and in-situ observations. It also comes that the high resolution model is able to simulate more realistic coastal features, such as mesoscale structures (eddies) and a confined coastal jet on the GoL shelf, in good agreement with the ADCP measurements.

Satisfactory agreement is reached with the various observations used at different space and time scales. Hence, the development of this NEMO high resolution configuration stands as a promising experiment for various process studies, or operational oriented applications.