



## **Origin and pathways of the Winter Intermediate Water in the Western Mediterranean Sea using observations and numerical simulation**

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The Winter Intermediate Water (WIW) plays a crucial role in the water exchanges through the Balearic channels and in the Western Mediterranean Sea general circulation. Its formation occurs in the North-Western of the basin under severe winter conditions. Observational datasets (in situ temperature and salinity profiles collected during CTD and glider transects) reveal the presence of WIW in the Gulf of Lion and in the Ibiza Channel during the winter-spring 2011. However, the inhomogeneous spatial and temporal coverage of the observational array makes the monitoring of WIW through the basin difficult. In this study, as a complement to the observations, a ROMS 1/40° regional oceanic simulation implemented over the Western Mediterranean Sea is used to determine the origin, evolution and pathways of the WIW in the basin.

The simulation outputs are first collocated at the observation positions. Their comparison against the observations shows the ability of the simulation to reproduce the observed WIW in the Gulf of Lion in March 2011 and in the Ibiza channel in winter-spring 2011. Then, the fully-sampled simulation outputs are used to study the spatial and temporal variability of the WIW in the Western Mediterranean Sea during the winter 2011. Investigating the T/S diagrams and transports in key sections over the basin and calculating lagrangian trajectories, the main pathways of WIW in winter-spring 2011 emerge. We show that, in good agreement with the literature, the simulated WIW are formed along the continental shelves of the Gulf of Lion and Catalan Sea, and then circulate southward in the Balearic Sea reaching 100-200m depth. One branch (mainly formed in the Ebro estuary) goes through the Ibiza Channel, while the second main branch (coming from both the Gulf of Lion and the Ebro estuary) splits to the East joining the Balearic Current.