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High resolution modelling of the oceanic circulation and winter vertical mixing in the northwestern Mediterranean

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The North Western Mediterranean Sea is one of the few regions in the world where open-ocean deep convection occurs. The local cyclonic circulation brings weakly stratified waters close to the surface. In winter, atmospheric conditions (strong cold winds and high heat losses) trigger the deep convection. When the strong forcing stops, restratification of the mixed patch occurs by lateral advection of surrounding lighter water. Mesoscale and submesoscale structures play an important role during these events both in the sinking and spreading of the new dense water formed and in the advection of light surrounding water.

The objective is first to check the capabilities of a high resolution model to reproduce the oceanic response to strong wind and, second, to identify processes involved in the water column restratification in terms of spacial and temporal scales. The SYMPHONIE model was implemented at 1 km resolution over the north-western Mediterranean. Simulations were initialized and forced at the open boundaries by the recent MERCATOR release PSY2V4R3. Two atmospheric forcings were use at the surface, ECMWF through bulk formulae and ARPERA. The recent years were simulated and comparisons were performed with the available data set particularly Argo and glider floats and the data of the CASCADE experiment in March 2011. A special attention was paid to the representation of the vertical stratification, of the mixed layer depth and of the properties of the water masses.

The characteristics of the deep convection event and of its restratification are examined in terms of water mass formation and budgets. The role played by small scale structures is quantified.