High resolution monitoring of deep water formations in the northwestern Mediterranean over the recent period (2007-2012).

Houpert L., P. Testor, X. Durrieu de Madron, A. Bosse, L. Mortier.

A multi-platform and integrated monitoring system in the framework of the Mediterranean Ocean Observing System for the Environment (MOOSE) enables to continuously monitor the deep water formation processes in the Gulf of Lion since 2007. High frequency temperature, salinity and current measurements from a moored surface buoy and a deep mooring in the convection region provide an assessment of the different time scales of the physical processes interfering in the phases of deep convection. They also allow for the first time estimates of the effects of the interannual variability of atmospheric forcing and the water column stratification on the intensity of the winter mixing, the evolution of the heat and salt contents of the water column, and the characteristics of the deep water masses.

All winters showed a primary deep convection period in February, reaching the bottom at 2350 m deep most of these winters. The typical time scale for the mixed layer deepening is comprised between 1 and 2 months. When the mixed layer reached the bottom, the violent vertical mixing of the whole homogeneous water column lasts between 9 and 12 days. Winters with bottom-reaching convection all present a short (2-4 days) secondary deep mixing period in March, associated to a wind-driven period of buoyancy loss, just after a quick onset of the restratification of the area due to less severe conditions. The “restratification time” of the intermediate layer (200-600m) (time needed by this layer to recover 50% of its heat content lost during deep convection) varies between 2.5 and 4.5 months, and the “spreading time” of the newly-formed deep water (time needed to the water column to dissipate 50% of the potential density increase in the 600-2300m layer following the strong vertical mixing phase) varies between 1.5 to 3 months.

Newly-formed deep waters are distinct water masses that interleaves with the older deep waters. This layering of deep water is a new feature that could not be observed as clearly in the past. This could be due to the poor coverage in previous data or because there has been an intensification of the variability of the deep water formation during the last decade, producing larger amounts of newly-formed deep waters that need more than a year to completely mix with the old ones.