Geophysical Research Abstracts,
Vol. 11, EGU2009-642, 2009
EGU General Assembly 2009

The role of atmospheric forcing and lateral advection in setting the properties of the Western Mediterranean Deep Water formed in winters 2004/05 and 2005/06

K. Schroeder (1), S.A. Josey (2), M. Herrmann (3), L. Grignon (2), G.P. Gasparini (1), and H.L. Bryden (2)
(1) CNR-ISMAR, Pozzuolo di Lerici (SP), Italy (katrin.schroeder@sp.ismar.cnr.it), (2) National Oceanography Centre, Southampton, United Kingdom, (3) Centre National de Recherche Météorologiques, CNRM/Météo-France

Several studies have revealed the abundant formation of a new warmer and saltier Western Mediterranean Deep Water (WMDW) during winters 2004/2005 and 2005/2006. This new WMDW is characterized by a peculiar stratification, suggesting the presence two new deep water masses (probably formed by either open-ocean and on-shelf convection), interacting with the ambient water. In the abyssal plain of the Western Mediterranean Sea (WMED), the new deep water showed temperatures of 12.85 - 12.88 ˚C and salinities of 38.455 - 38.473 below 2000 m depth. It formed a layer which became several hundreds of meters thick between 2005 and 2008.

This large production of anomalously warm, salty deep water is linked to extreme winter air-sea heat and freshwater forcing of the basin. Fields of heat, freshwater and buoyancy exchange are estimated from a daily high-resolution downscaling of the ERA-40 reanalysis dataset, ARPERA. In the deep water formation region, the heat loss and net evaporation of winter 2004-2005 were the strongest of the last 50 years. The relationship between the deep water formation episodes and large-scale atmospheric patterns is explored. The preconditioning in terms of stratification and lateral advection, which help trigger the deep water formation is also investigated, both for recent winters and on longer time scales.

If the exceptionally severe conditions of winter 2004/2005 were responsible for the huge deep water production, its anomalous properties can also be related to a progressive increase of heat and salt content in the intermediate layer. Indeed winter 2005/2006 showed the formation of anomalously warm and salty deep water despite relatively mild air-sea interactions. The intermediate salt and heat accumulation is likely to be due to the arrival of water of eastern origin affected by the Eastern Mediterranean Transient (EMT) event, which took place in the Eastern Mediterranean Sea between the late 1980s and mid 1990s.

The relative contributions of heat/freshwater loss and lateral advection of anomalously warm, salty intermediate water to the convection region are discussed in order to determine the respective roles of atmospheric forcing and preconditioning in causing the massive renewal of the WMDW and determining its thermohaline properties.