CREATION OF INDEXES FOR THE VARIABILITY OF WATER MASSES IN THE MEDITERRANEAN SEA INTERCOMPARING AN IN-SITU DATASET AND THE NEMO-MED12 MODEL.

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Abstract

Since 2007 intense observational efforts in the northewestern Mediterranean Sea have been carried out in the the framework of numerous projects leading to a quasi continuous monitoring of this area. By considering these data in regional boxes and at certain depths, we obtain time series typical of the evolution of the water masses. We compare these results with same estimates from model outputs (NEMO-Med12). We show that these timeseries can be considered as indexes of water masses distribution by assessing the relevance of the data sampling in following the water masses and evaluate the skill of the model using that approach.

Keywords: Circulation, Mediterranean Sea, Models

Water masses distribution in the Mediterranean Sea is affected by the circulations in and between the basins as well as by the external forcings. Thanks to the substantial dataset collected -especially in the Northwestern Mediterranean- with autonomous platforms (gliders, argo) as well as during cruises, an effective follow up of the water masses and of their properties is ensured. This follow up enables a near synoptic view of those properties and gives hydrographic time series for the basin, allowing to aprehend interannual variations and tendancies. Changes in salinity and temperature in Levantine Intermediate Waters (LIW) are important factors for the deep convection process and influence the properties of the newly formed deep waters [1]. In a climate change context, the heating of the deep waters (heat storage at depth) is influenced by the salt and temperature contents at intermediate levels [2,3]. It is consequently crucial to monitor the variability of these water masses in order to assess and predict those evolutions. Here, we use both the in-situ dataset and an interannual simulation performed with the NEMO-Med12 model to assess the evolution of the northwestern Mediterranean Sea on interannual time scales. Considering data in chosen regional boxes, we follow the evolution of different water masses in the basin and generate indexes to follow their evolution. We then put those indexes in relation with external (atmospheric) forcings and present an intercomparison with the NEMO-Med12 model to estimate both the skill of the model and the pertinence of the data-sampling in reproducing the evolution of water masses properties.

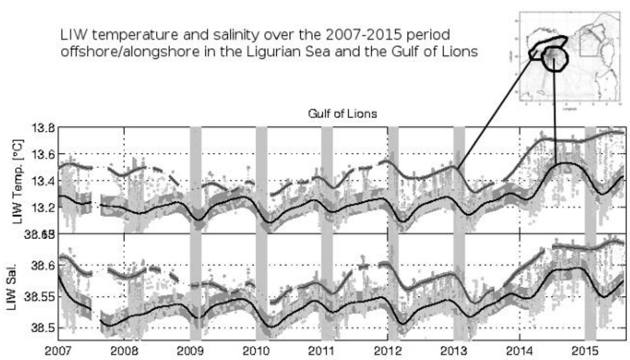

Fig. 1. LIW salinity and temperature in the Gulf of Lions along the coast and offshore during the 2007-2015 period. The vertical patches indicate deep convection episodes.

Figure 1 shows the evolution of LIW alongshore and offshore in the Gulf of Lions over the 2007-2015 period. We note the contrast between the coastal LIW which is warmer and saltier than the offshore one, as could be expected from the boundary current controlled along the continental slope. After each deep convection episode occuring in the Gulf of Lions, a decrease in temperature (0.1-0.3°C) and salinity (0.02-0.05psu) is noted for the LIW, denoting the transfer of salt and heat to the deep waters. Transfer confirmed in the time series of the deep waters which on the contrary see an increase in temperature and salinity after those episodes. These time series are obtained from region to region and the water masses are thus followed, enabling an assessment of their mixing and and spatial evolution as well as their temporal one. After a 2014 winter with little convection, we note that the LIW salinity and temperature have not decreased in winter as usual. The absence of convection results in a shift in LIW properties towards warmer and saltier waters, pressing the global trend from its formation point to the Gulf of Lions. The NEMO-Med12 model is used to assess this trend and see if the recent weak deep convection events, as well as the heating and salting of the intermediate layers are reproduced in the model. The intercomparison assesses the skill of the model in representing the variability of the deep conevection.

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