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Deep winter ventilation dynamics in the south Adriatic convection area from in situ glider observations and model output

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Dissolved oxygen dynamics in the south Adriatic pit have been investigated between 2015 and 2019 through in situ measurements and numerical models. This area is characterized by a frequent occurrence of deep water convection phenomena during winter time. Such convection phenomena represent the main source of dense waters for the Eastern Mediterranean basin modulating the oxygen advection in the deep water.

In situ glider measurements in the south Adriatic pit were performed by the OGS Glider Team since 2013. Typically, these missions covered the transect from Bari to Dubrovnik. The glider missions aim to investigate the water masses before, during and after the convection period. Pre-convection missions were carried out between the end of November and the beginning of December. Convection missions were performed between the end of January and the beginning of May.

Over 3000 profiles from the surface to 950m depth were collected and used to better understand the physical and biogeochemical highly variable processes in the southern Adriatic pit.

During the pre-convection period the water column is generally stratified; recorded data show an inverse correlation between dissolved oxygen and salinity. The pre-convection periods in 2015 and 2016 present the highest variability; the water column is mainly characterized by vertical profiles with a double oxygen minimum, which corresponds to the highest salinity concentrations. During the 2017 pre-convex mission the water column is characterized by a vertical salinity gradient, whereas dissolved oxygen profiles show a double dissolved oxygen maximum both on the surface and at 300-400 m depth. The 2018 pre-convex mission shows a thin surface layer of low salinity and high dissolved oxygen, which extends from the surface down to 50 m depth. A nucleus of high salinity and low oxygen is present close to the Italian coast at about 80-200m depth.

The 2016 convex mission revealed an inverse correlation of oxygen and salinity profiles and a double oxygen minimum with slightly different characteristics with respect to the previous pre convection period. During 2018 and 2019 the missions occurred during the convection phenomenon. The water column is well mixed from the surface down to 600 m depth, suggesting the occurrence of deep winter convection, also confirmed by the increase in oxygen and salinity concentrations along the water column.

In order to fully understand the process development in the south Adriatic Pit, which are the combinatorial result of coastal and open ocean processes, we integrated our observations with numerical model outputs provided by the Copernicus Marine Environment Monitoring Services. As the sea glider allows us to observe a high degree of variability from mesoscale to sub-mesoscale, the model output was used to evaluate mesoscale and sub basin scale phenomena.

Such an integration of different datasets provide information at different temporal and spatial scales of water mass dynamics, thus underlying the fundamental role of integrating multi-platform contributions to gain knowledge of the ocean processes.

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