Geophysical Research Abstracts
Vol. 18, EGU2016-4576, 2016
EGU General Assembly 2016

Basin-wide consequences for the hydrodynamics and biogeochemical conditions in the Mediterranean Sea of a closure in the Strait of Gibraltar. A modelling study

Diego Macias, Elisa Garcia Gorriz, and Adolf Stips
European Commission, Joint Research Center, Institute for Environment and Sustainability, Via E. Fermi, 21027 Ispra, Italy

The Strait of Gibraltar is the unique connection between the Mediterranean Sea and the open ocean. The water and heat budget in the Mediterranean is, hence, controlled by the water interchange through this narrow connection where relatively fresher Atlantic waters flow in at the surface while saltier Mediterranean waters flow out at depth.

This antiestuarine exchange has been proposed to have far-reaching consequences for the whole Mediterranean basin as, for example, tidal propagation, salinity anomalies and thermohaline circulation. However, up to date, no specific ad-hoc assessment of the basin-wide consequences of the water interchange through the strait has been done.

In this work we have used a hydrodynamic-biogeochemical coupled model of the entire Mediterranean basin to perform a set of twin model runs covering the period 1990 – 2000 only changing the conditions in the Strait of Gibraltar. In the first simulation the Strait is treated as an open boundary imposing climatologic temperature and salinity conditions. In the other simulations a closed boundary is set at the Strait, with different treatments in order to maintain the water balance within the basin.

We evaluate the difference between the performed runs in terms of sea surface temperature, surface salinity, surface kinetic energy, deep water convection and integrated primary production rate in the whole Mediterranean basin. We found that, as expected, conditions in the western basin are much more affected than in the eastern although some variables did also significantly change in the central Mediterranean Sea. Surface current patterns in the NorthWestern Mediterranean are particularly sensible to the closure of the Strait, affecting the overall circulation within the Gulf of Lion region.

With this work we have, for the first time, explored the basin-wide consequences of the water interchange through the Strait of Gibraltar for the entire Mediterranean Sea. Our results clearly indicate that this local interchange is important not only to determine the hydrological and biogeochemical conditions of the nearby Alboran Sea (the most affected region) but also for the entire western basin and even for some properties within the Ionian Sea. These results, thus, demonstrate the necessity to accurately represent the interchange processes in Gibraltar in order obtain a good representation of the basin-wide Mediterranean properties with numerical models.