



From complex ocean simulations to a simple regression model: finding a proxy between atmospheric pressure and water exchanges through the Strait of Gibraltar

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In the frame of the European R&D Project MedEX (“Inter-basin exchange in the changing Mediterranean Sea: Impact on ecosystems in the vicinity of the Straits connecting the Mediterranean Sea with the adjacent Basins”) a high-resolution ($\sim 2 \times 2$ km horizontal grid with 32 vertical sigma levels) numerical simulation using ROMS was conducted for the Gulf of Cadiz – Alboran Sea System Area. The simulation covers a 20 year period (1989-2008) and is forced by 9 km winds (WRF downscaling of ERA-Interim reanalysis).

In the present work, time series of the exchanges through the Strait of Gibraltar obtained by the simulation are analyzed with the aim of finding their relation with the sea-level atmospheric pressure fields (SLP) and/or their empirical orthogonal functions to investigate the possibility of prediction for the future or reconstruction for the past of the water fluxes through the Strait of Gibraltar.

Using correlation analysis we show that inter-annual variability of baroclinic components of the water exchanges (inflow of the Atlantic Water into Mediterranean Sea in the upper layer and outflow of the Mediterranean Water into Atlantic Ocean in the lower layer) have strong correlation (>0.8) with atmospheric pressure. This fact can be used to develop a simple regression model of the water exchanges based on information about atmospheric pressure. The latter can easily be obtained from reanalysis or global atmospheric models including IPCC climate scenarios.