

Interactive comment on “Modelling study of transformations of the exchange flows along the Strait of Gibraltar” by Antonio Sanchez-Roman et al.

Anonymous Referee #1

Received and published: 8 August 2018

1) This study differs from all the previous studies of the exchange flow in the strait of Gibraltar as it does not consider a given, material salinity surface as the separation of the usual two (or three) layers with which the exchange flow is modeled 2) Furthermore, the flow is analyzed not in a single section in the strait but in five successive sections which span the strait all along its length, from the Alboran sea inside the Mediterranean to the Gulf of Cadiz in the Atlantic 3) the numerical model used is the best numerical model developed by Dr. Sannino existing for the Mediterranean. It is forced not only by wind stress, atmospheric pressure and heat/fresh water fluxes at the surface, but also by realistic barotropic tides. The tidal forcing includes both the tide generating potential as a body force and the tidal velocities imposed as lateral

C1

boundary conditions at the open Atlantic boundary. Furthermore, it is the only model which can resolve the hydraulic control occurring at three sections in the Straits thanks to the very high resolution there reached (1/200 degree). 4) the very important result obtained is that most of the transformations of water properties along the strait are induced by vertical advection of heat and salt, and not by vertical mixing. The turbulent vertical mixing is what is assumed in coarse resolution models to produce these water masses transformations. In this study, thanks to the very high resolution, vertical mixing is shown to have very little influence. 5) the figures are excellent and make the patterns of vertical exchanges very clear (figs 7-8) One substantial comment and suggestions for improvement 1) I do not believe the explanation given at the top of page 16 for the recirculation of water from one layer to the other in the absence of tidal forcing. The explanation is that mechanical drag would explain the recirculation processes. This might be true in the hypothesis that a material surface separates the two layers, which is not true in this study. Furthermore, the exchanges inside the straits are so small to be almost insignificant. 2) sections 4.1 and 4.2 could be shortened and synthetized. 3) Equations 10 through 15 are cumbersome and distract the reader. I recommend putting them in an appendix and leave only a synthetic explanation in the main text

Interactive comment on Ocean Sci. Discuss., <https://doi.org/10.5194/os-2018-57>, 2018.

C2