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Mediterranean outflow at the western end of the strait of Gibraltar: a combined experimental and numerical modelling study

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The Strait of Gibraltar is a strategic key connection between the Atlantic Ocean and the Mediterranean Sea since it is the last gateway for the Mediterranean Water (MOW) towards the North Atlantic. In this work we combine very recent good-quality observed data with simulated data coming from a high resolution numerical model in order to estimate the volume transport of MOW for the last three years.

ADCP observed velocity data have been collected in the western section of the strait within the frame of the Spanish-funded INGRES project. In this section there is a seamount, called Majuan Bank (100 m depth), which divides the section into two channels: the southern one with a maximum depth of 360 m and the northern one of 250 m. The ADCP station has been placed into the southern channel as it constitutes the main exit for MOW. This station was installed in September 2004 and it is still collecting information. It was visited for the last time in September 2007, so in the present work a three years long time series has been used. The numerical model used in this work is CEPOM, a modified version of the Princeton Ocean Model (POM). It uses a coastal-following curvilinear orthogonal grid that includes the Gulf of Cadiz and the Alboran Sea, with very high resolution in the Strait (less than 500 m). It is forced by imposing the four major diurnal and semidiurnal tidal constituents (O_1, K_1, M_2, S_2) along the Atlantic and Mediterranean open boundaries.

The model has been validated through a direct comparison between the predicted and observed amplitude and phase of the diurnal and semidiurnal tidal constituents of the along-strait velocity field. Model outputs and experimental data have been used to investigate (1) the best method to estimate the volume transport in the strait according to the different experimental approaches used in literature, (2) to calculate both the southern and northern part of the MOW for the entire observed time-series with a time frequency of 30 minutes and (3) the high frequency Mediterranean volume transport in order to separate the tidal contribution from the seasonal signal.