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Modelling the Gibraltar Strait/West Alboran Sea ecohydrodynamics

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The ecohydrodynamics of the Gibraltar Strait and the West Alboran Sea is investigated using a 3-D, two way nested, coupled hydrodynamic/plankton ecosystem model exploiting the MEDATLAS climatological database. A high resolution model ($\sim$1 km) of the Gibraltar/West Alboran region embedded within a coarse resolution model of the West Mediterranean ($\sim$5 km) is implemented. Model results suggest that Gibraltar water exchange is submaximal throughout the year with a mean value of about 1.1 Sv. It exhibits an annual signal that peaks in late summer simultaneously with a deepening of the Atlantic/Mediterranean interface. The high-resolution model enabled the simulation of small-scale flow and nutrient/chlorophyll distribution structures under the influence of the steep topography of the Gibraltar Strait and enlightened the impact of hydrodynamic constraints on the local plankton ecosystem. Model results showed that the Western Alboran Sea region is one of the most productive areas within the oligotrophic Mediterranean Sea. An important feature produced by the model is a permanent upwelling zone in the northwestern part of the Alboran Sea along the Spanish coasts in agreement with observations. Model results show that current intensity of the Atlantic Jet increases progressively at the strait to obtain maximum values in the northeastern Mediterranean entrance. Maximum upwelling velocities are also obtained at the same location. This results in an upward displacement of the nitracline towards the northeastern entrance of the strait. The nutrient-rich water transport from the strait along with lower advection and generation of cyclonic vorticity in the northwestern coastal area of the Alboran Sea induce the accumulation of phytoplankton biomass there. Surface waters rich in nitrate and chlorophyll are then transported eastwards

following the wavelike path of the Atlantic Jet bordering the Alboran anticyclonic gyres. This project is funded by the European Union FP6 Marie Curie Actions, Intra-European Fellowships.