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The role of estuarine discharges on the biogeochemical characteristics of the nearby continental shelf ecosystem. The Guadalquivir-Gulf of Cadiz case study

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The hydrodynamics and biogeochemical conditions of the Gulf of Cadiz (SW Iberian peninsula) is strongly influenced by the input of fresh, warm and nutrient-rich water from the main estuary in the region, the Guadalquivir River. This sea-river interaction favors the generation of surface retention structures that encompasses highly productive waters throughout the year constituting and ideal place for fish spawning and nursery. The biological productivity of the Gulf and its high fisheries yields are, thus, heavily forced by the Guadalquivir River discharges which are conditioned by the freshwater inputs from the upstream sections of the river and by the tidal mixing dynamics in the lower reaches of the estuary. In this work we use a coupled hydrological-biogeochemical 3D model of the Gulf of Cadiz, Strait of Gibraltar and Alboran Sea (a regional application of the Regional Ocean Model System) connected to a virtual estuary representing the Guadalquivir River. With this coupled model we quantify the relative importance of each process (freshwater discharges and tidal mixing) for creating the special conditions of the nearby continental shelf. We found that freshwater input is only relevant during fall and winter when precipitation are important in the river catchment area. Tidal mixing, on the other hand, is more constant throughout the entire year and provides a nutrient input to the marine ecosystem of the same order of magnitude as the freshwater runoff. We also run the model with and without the river input and quantify, for the first time, the exact role of this external forcing on the biogeochemical conditions of the continental shelf ecosystem.