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Effects of wind forcing and river runoff on the dynamics in the Gulf of Trieste: a numerical study with a pre-operational model

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This numerical study is aimed to highlight the role of wind forcing and river freshwater discharge on the circulation in the Gulf of Trieste. The model used in the simulations is the MITgcm, a three-dimensional, finite volume, non-hydrostatic, general circulation model, which can solve the tracer equations using 3^{rd} order numerical schemes. We set up a high-resolution (250 m) model of the Gulf, using measured bathymetry data for the domain discretization, active and radiating conditions on the open boundary and thermohaline CTD recordings as initial conditions. The river flow is derived from in situ measurements and is modeled in such a way as to consider both the thermohaline and momentum contribution. The wind forcing is either spatially uniform or interpolated from atmospheric LAM results. A comparison between model results, coastal buoy measurements and satellite SST images is carried out to check the reliability of the model configuration: different test cases are made to reproduce some of the typical environmental conditions which can be found in the Gulf during a year. The simulations show the effect of the Isonzo river on the circulation and the thermohaline structure of the basin, expecially in the absence of severe atmospheric events. On the other hand, wind driven circulation can be dominant during strong episodes of Bora and Scirocco, which are the prevalent winds that blow over the basin. In particular, intense summertime Bora events can break the typical initial thermohaline stratification and mix the entire water column, expecially near the shores where relevant upwelling phenomena can occur. These issues are relevant to environmental problems such as pollutant dispersion or anoxia phenomena in the bottom layers of the Gulf.