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# Climate circulation in the Gulf of Trieste (northern) Adriatic and its application in a study of the ecological impact of potential gas terminals

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A 3D numerical model (Princeton Ocean model), nested in the northern Adriatic circulation model (Zavatarelli and Pinardi, 2003), revealed interesting circulation features in the Gulf of Trieste which were unknown until recently. When the bora wind blows along the Gulf's axis during winter, the water piles-up towards the Gulf's exterior. However, the surface current along the southern (Slovenian) coastline separates rightwards from the coastline and crosses the Gulf diagonally, reaching the freshwater outflow strip along the Italian coastline (Malačič and Petelin, 2006). Although this pattern of surface circulation during the bora has not yet been confirmed experimentally, it looks to be feasible since the pattern was also reproduced numerically in the stratified water column (summer) by another numerical model, which is based on a completely different architecture and was installed by another group (Crise et al., 2006). This diagonal surface current has to cope with a balance between the Coriolis, surface wind-stress and pressure-gradient force. At depth, in the central and southern part of the Gulf, there is an inflow, which is almost a permanent feature over the whole of the year.

During the summer period, it has been shown using the Lagrangian tracking method that there are several areas of confluence/divergence in which the trajectories of fluid particles amalgamate/bifurcate, more or less in accordance with the conservation of relative vorticity, which is due in part to horizontal shear and in part to the rotating motion in small vortices. However, inside the basin an anticyclonic vortex prevails in the surface layer, which is also a new feature not yet observed experimentally and which needs further study.

A climatic circulation model has also been applied in a study of the ecological impact of potential gas (LNG) terminals, one in the central part of the Gulf, the other on-shore near Trieste. Since both propositions, submitted by private companies to the Italian authorities, utilize sea-water as a heat source for the evaporation of LNG, our numerical model of circulation has modified boundary conditions at some grid-cells. There is no flow through the cells which represent the terminal. There is, however, an inflow in the surface layer and an outflow in the bottom layer which has the temperature and salinity of the surface layer. The numerical model revealed that the temperature (and salinity) pattern of lower temperatures is stretched up to ten km in length, in accordance with the circulation patterns around the terminals. The width of this pattern is smaller than 1 km. Other more critical and complex impacts of the terminals, such as the effect of chlorine compounds and the resuspension of sediments, which are heavily polluted by mercury, are linked to the circulation model results. These model results show the cross-border extent of environmental influences in a climatic sense.

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