# MODELLING OF THE WIND DRIVEN CIRCULATION IN THE GULF OF LIONS

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The Gulf of Lions is characterized all year long by the occurrence of gusty winds (the Mistral and the Tramontane) which, being constrained by the orography, blow from a constant direction (the North and the North-West resp.). As shown from both *in situ* and remotely sensed data (MILLOT, 1979) as well as from former numerical models (HUA, 1981) and specific analyses (CRÉPON *et al.*, 1984) dealing with summer conditions, the upwelling mainly occurs along straight 10-20 km segments of the coastline while the bottom topography doesn't play a major role. This semi-circular gulf is also under the influence of the Northern Current which continuously flows along the continental slope (i.e. along its diameter) and spreads over the shelf when the winds stop. Modelling such an area is thus relatively easy and useful to better understand the circulation in wider areas of upwelling such as North-West Africa, Peru,...

In this work, which is part of the EUROMODEL contribution to the MTP of MAST-2, we use the 3D primitive equations numerical model of LODYC with a cartesian grid and a quite realistic coastline. The domain, extending from Cap de Creux in the South-West to cap Sicié in the North-East (i.e. 300 km x 240 km) is such that a newtonian restoring on initial values of tracers and dynamics is used along the open boundaries to damp inertial waves. Due to the space scale of the phenomena and to the value of the internal radius of deformation (~ 9 km), the horizontal grid size is 3 km. The preliminary computations presented here are done with a constant depth of 100 m. For these particular studies, the model has a vertical resolution (15 levels) ranging from a few metres, allowing a correct representation of the mixed-layer and the thermocline (which has mean depth and thickness of 30 m and 10 m resp.) up to a few tens of metres at depth. These computations have been made with very simple wind conditions (direction of a Tramontane-like wind, constant speed of 9 m/s starting from rest), temperatures of 20°C in the mixed layer and 13°C at depth, and without any general circulation.

After three inertial periods (about 3 x 17.5 h), which is a characteristic time scale for the summer gusts of wind, the distribution of the surface temperature is very similar to the commonly observed one. Upwellings are obviously located along the coast on the left of the wind, and mainly along the straight coastal segments, thus showing a marked discontinuity due to the coastline geometry. The intensity is also different from one upwelling to another, with the lowest temperatures encountered near the coast ranging from 4°C to 5°C below the initial surface temperature. All these features are in good agreement with *in situ* and remotely sensored observations.

The circulation in the surface layer forms an eastward coastal jet of ~50 cm/s along the northern coast. Capes located on the windward side of the the straight coastal segments induce a very local intensification of the jet. In the central part of the gulf, the wind driven circulation is almost on the right hand side of the wind. At the bottom, the coastal circulation is characterized by a westward jet along the northern coast and a northward one along the western coast, each being of a few cm/s. Due to the very large theoritical depth, the currents in most of the gulf are non significant. Most of these features are in agreement with the available observations.

After this study of the effect of a Tramontane-like wind, some experiments will be run with a Mistral-like wind and then with a combination of both. We wants to analyse the effects of the wind strength by increasing its speed (from ~9 m/s to ~15m/s ). Some experiments will be done with a time depending wind to see the role of the succession of the gust of winds in the formation of upwellings and this study will end with actual wind fields, provided by meteorological numerical models such as PERIDOT.

This study is a part of a program of modelling the seasonal and meso-scale variations of the circulation in the Gulf of Lions: we want to study the interactions with the general mediterranean circulation (HERBAUT *et al.*,1994).

## REFERENCES

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