# Wind-induced Stationary Circulation in the Mediterranean Sea.

Giuseppe M.R. Manzella - I.S.D.G.M., C.N.R.
Sergio Sgorbini - C.R.E.A., E.N.E.A.
Forte S. Teresa, 19036 S. Terenzo (La Spezia), Italy

Abstract. The stationary circulation in the Mediterranean Sea is studied by means of an approximate method which is the barotropic part of the Sarkisiyan diagnostic model. The model results show closed circulation patterns all over the Mediterranean in good agreement with the circulation description given in the literature.

*Résumé. La circulation stationnaire de la Méditerranée a été étudiée en appliquant le modèle diagnostic de Sarkisiyan (partie barotropique). Les résultats, concordant avec les données de la littérature, révèlent l'existence d'un ensemble de circulations tourbillonnantes dans toute la Méditerranée.*

The purpose of our work is twofold: to solve a stationary problem on complete circulation in the Mediterranean Sea with realistic shorelines and averaged bottom topography, in the case of a mean wind field, and to infer the Mediterranean dynamics by the hydrological data. In this note we compute the stationary wind-driven circulation by applying the Sarkisiyan (1977) diagnostic model, in the case of a homogeneous sea. The bottom topography has been smoothed by taking into account the dynamics as given in the Literature; a depth-dependent bottom friction has been imposed. The problem consists in solving a linear elliptical equation of the second order with oblique derivatives at boundaries. However, because of the bottom friction behaviour, the formulation is approximated to a Dirichlet problem, by solving first the boundary value problem and then the elliptic equation inside the basin.

A comparison between the circulation pattern in the case of a homogeneous variable depth sea and a constant depth sea shows that the bottom relief intensifies the sea surface topography. The main result is that the wind seems to dissipate its energy inside each basin (Hopkins, 1978). In general, the sea surface pattern shows a higher variability in the Western Mediterranean that in the Eastern Mediterranean, especially in summer when strong winds blow in the western basin. The interaction between the western and the eastern basins seems null, because of a vortex in the Sicilian Channel present in the numerical results. The actual shoreline profile is only in part responsabile for this situation. Qualitatively the flux through the Corsica Channel is greater in summer than in winter, in accordance with the findings of Manzella (1984), but a cyclonic eddy north of the Corsica Channel gives a rather complicated sea surface topography in that area.

In general, the computed pattern agrees fairly well with the known circulation, but important differences indicate that the baroclinic contribution to sea level has to be considered. The extent to which the barotropic or baroclinic factors are influent is still being studied. In particular it must be well studied the influence on the circulation of the non alignement between the density structure and the bottom topography.

Bibliography

Hopkins, S.T. (1978) Physical processes in the Mediterranean BASIN. In: Estuarine Transport Processes. Univ. S. Carolina, 269-310.

Manzella, G.M.R. (1984) Fluxes across the Corsica Channel and coastal circulation in the East Ligurian Sea, North Western Mediterranean. Sub. to Oceanologica Acta.

Sarkisiyan, A.S. (1977) The diagnostic calculation of a large scale oceanic circulation. In: The Sea, Wiley, 6, 363-458.