A central Tyrrhenian Coastal Area as a dynamical test site

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The central Tyrrhenian coastal area extending from the gulf of Naples to the gulf of Gaeta up to Capo Circeo faces a highly urbanized zone, receives industrial pollutant discharges and the runoff of important rivers and includes a variety of coastal and bathymetric features. For these reasons such an area appears to be an ideal test site for coastal dynamical and diffusion studies.

In 1987, on the occasion of the "European Year of the Environment" a Sea Truth operation was carried out in this area, which was surveyed by the LANDSAT satellite, and led to the acquisition of chemical, physical (DE MAIO *et al.*, 1988, 1992) and biological parameters by means of in situ samples taken by ships. More recently, in 1991 two oceanographic cruises were devoted to CTD and direct surface current measurements. As a result a coherent vision of the local hydrology and dynamics has been obtained whose main characteristics will be briefly presented below (they refer to a typical autumn situation).

A homogeneous upper layer of water 20-70 m thick is present, with a temperature of 17.8-18°C (decreasing down to 14°C) and a salinity of 37.80, in which vast regions of less saline water (34-32) due to the Garigliano and Volturno river runoff are observed. The shape of the thermocline and its link with the Levantine Intermediate Water are indicative of baroclinic motions.

The horizontal σt distribution in the upper layer shows clearly the transport directed toward the Circeo, between the isles of Ischia and Ventotene. Moreover, the gradual variation between coastal waters ($\sigma t < 27.5$) and Tyrrhenian waters ($\sigma t > 27.5$) is modified by the intrusion of a tongue of dense water in the area between Circeo and Gaeta. Between Ischia and the mouth of Volturno a lens of denser water with $\sigma t > 27.5$ reveals a dynamic dependence on exterior waters. On the other hand the gulf of Naples appears isolated with respect to this situation, in that it contains less dense waters, especially in its innermost part.

Dynamic calculations based on the hydrological data are in good agreement with the surface currents measured from ship. The northward flow along Ischia and Ventotene turns abruptly to anticyclonic rotation in correspondence to the sill between Ponza and Gaeta, which in fact produces anticyclonic relative vorticity according to the conservation of potential vorticity. More south, NW of the island of Ischia a slow gyral motion is observed. It appears related to the dynamics of the gulf of Naples with which the area is connected through the channels of Ischia and Procida.

Numerical studies based on a sea-breeze model (DALU and PURINI, 1981) and on the shallow water equations for a one-layer and a multi-layer ocean are under way, aimed at reaching a deep understanding of the local dynamics and its dependence on local forcings and on the larger scale circulation. The advectiondiffusion equation is also being used for modelling the intrusion of fresh waters from the rivers runoff.

REFERENCES

DE MAIO A., MORETTI M., SANSONE E. & SPEZIE G., 1988.- Rilevamento dei parametri fisici nelle acque del Golfo di Napoli. In "Anno Europeo dell'Ambiente", *Ist. Idr. Marina*, F.C. 1127, Genova, 9-68.

DE MAIO A., MORETTI M., SANSONE E. & SPEZIE G., 1992.- Lineamenti fisici delle acque delle coste Campane dal fiume Volturno all'isola di Capri in concomitanza di due passaggi del satellite Landsat 5. *Ist. Idr. Marina*, in press.

DALU G.A. & PURINI R., 1981.- A numerical study of the marine surface layer in a sea-breeze regime. *Ocean Management*, 6,111-116.