Modelling of the general circulation in the Western Mediterranean Sea

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The 3D primitive-equation model of LODYC is used to represent the general circulation of the western Mediterranean sea from the strait of Gibraltar to the strait of Sicily. The model is initialized with the Levitus fields. The flux at the straits are not imposed, instead the Western Mediterranean Sea is linked to the Atlantic ocean and the Eastern Mediterranean Sea which are modelled by academic basins in which we use a newtonian relaxation to the initial density. We do not take in account atmospheric forcings. The results of this experiment show a realistic cyclonic circulation in the whole basin, the formation of intensified flows trapped to the coast. The instabilities of the Algerian current and the circulation of the Alboran sea are also well represented, and we can observe at intermediate depth a flow which at the exit of the Sicilian Strait turns right, enters into the Tyrrhenian sea following the Sicilian coast. This experiment also show that the Liguro-Provençal current appears without thermohaline forcing, it is created by the meeting of the western corsican current and the eastern one.

In further experiments we are going to introduce the atmospheric forcings, and to evaluate the influence of the different forcing: sensitivity experiments will be run.

All these experiments are made on a grid of 1/8°*1/10°, sufficient to adequately represent mesoscale phenomena.

A case of non-wind induced upwelling circulation in the Tyrrhenian sea, August 1991

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A hydrographic cruise was conducted on the R/V THETIS from 6 - 11 August 1991 in the Lazio Shelf region between the Islands of Ponza and Giannutri and from the coast out to a depth of 800 m (Fig. 1 a) by SoProMar as a part of a project with the Ministry of Merchant Marine to assess the impact of the Tevere River discharge. The circulation in northern Tyrrhenian is typically described as being dominated by a cyclonic gyre (e.g. KRIVOSHEYA and OVCHINNIKOV, 1973) and in wind-driven models (e.g. ARTALE *et al.*, 1992). While it appears to be an annually persistent feature, its scale and intensity vary in response to the wind field (ARTALE *et al.*, 1992) and to the strong seasonality of the Corsican outflow to the Ligurian Sea (cf. ASTRALDI and GASPARINI, 1991).

The cruise data revealed physical and biological conditions different from what is generally understood to be the normal summer situation. The nearshore zone (~5 km to 30 m) was uncharacteristically cooler than the offshore waters by 1-4°C (Fig. 1a) The Tevere plume was distributed slightly offshore to the south, (Fig. 1b), contrary to its normal tendency along the nearshore to the northwest. The hydrographic data indicated a net onshore flow onto the Lazio shelf (~2500 m^3/s), the difference between a strong onshore flow to the north and a weaker offshore to the south (Fig. 1c). The northwestern corner of the sampled regime appears to have included the cyclonic perimeter of the northern Tyrrhenian gyre as it was impinging on the shelf. In late July of 1991, satellite thermal imagery (BOHM, pers. comm.) suggested the gyre to have been relatively weaker until a 26-27 July westerly wind event that may have caused the gyre to intersect the Italian shelf further to the north than normal. The mean winds during the cruise were light ~2.5 m/s westerlies with a sea-breeze modulation of ~3 m/sec. It is suggested that these winds were insufficient to have set up and maintained the observed shelf circulation and that it likely was initiated by the preceding wind event and sustained by the anomalous offshore circulation. This work provides a preliminary discussion of the role of the circulation in the generation of the unprecedented quantity of mucilaginous algae observed during the cruise period.

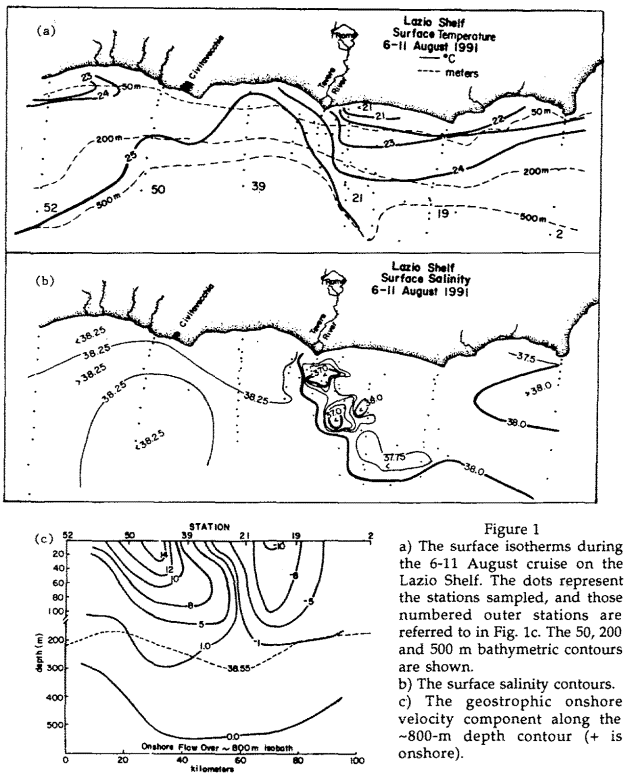

Figure 1
a) The surface isotherms during the 6-11 August cruise on the Lazio Shelf. The dots represent the stations sampled, and those numbered outer stations are referred to in Fig. 1c. The 50, 200 and 500 m bathymetric contours are shown.
b) The surface salinity contours.
c) The geostrophic onshore velocity component along the ~800-m depth contour (+ is onshore).

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