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The Dynamics of the Coastal Region of the Northern Adriatic Sea

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ABSTRACT

The northern half of the Adriatic Sea is constituted by the continental shelf with very shallow depths (20 m) in the northernmost extremity. In particular, the new-coastal region adjacent to the Italian coastline forms a shallow strip, with isobaths running parallel to the coast and a topography gently increasing towards the interior of the basin. In the region immediately south of the Po River delta—the major source of fresh water input into the Adriatic—important eutrophication phenomena have recently occurred in summer. The controversial question thus arises whether these eutrophication phenomena are to be ascribed to nutrient inputs from local sources or from the Po River waters carried southward parallel to the Italian coastline in the general cyclonic gyre characterizing the Adriatic yearly average circulation. The dynamically important question is, then, whether and how a localized source of freshwater drives the nearcoastal shelf circulation.

To answer this question a multi-level hydrodynamic model coupled with equations for temperature and salinity was constructed to study the northern Adriatic circulation, which in the summer season can be approximated by a two-level system. The model was run in a basic numerical experiment, with real input data, from 15 September to 16 October 1978, taken as a typical summer test case. The general conclusion of the investigation is that the “signal” of the Po River water, represented by the salinity field, is lost when progressing towards the coastline, even during intense episodes of northeast wind, when significant advective effects are present. In the new-coastal strip, moreover, the total transport in alongshore direction is most often directed northward contrary to what occurs in winter. Dynamical considerations suggest that the near-coastal circulation is driven by the bottom torque, which dominates the dynamical bounce of forces as soon as an alongshore density gradient is present. The direction of the vertically integrated alongshore flow can be ascribed to this alongshore density gradient, which is significantly influenced by the Po freshwater outflow. Current records and preliminary experimental results seem to confirm the above numerical and dynamical considerations.

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