TOPOGRAPHIC CHARACTERISTICS AND CURRENT SYSTEM IN THE ADRIATIC

Mira ZORE-ARMANDA and Mario BONE
Institute of oceanography and fisheries, Split, Yugoslavia

Characteristics of the mean flow pattern appearing in the region of the topographic barriers in the Adriatic Sea have been considered and connected to some specific hydrographic properties. The mechanism of topographic effect on a current field is described by a simple analytical model.

Dans ce travail ont été déterminées les caractéristiques du champ moyen des courants dans les régions des barrières topographiques de la mer Adriatique. On a signalé qu'ils se manifestent également dans le régime hydrologique spécifique. Le mécanisme des effets topographiques sur les courants a été défini par un modèle analytique simple.

The mean seasonal current system of the Adriatic Sea, presented by geopotential topographies of the sea surface, show that basically the stream lines follow bottom contours. Approaching a topographic barrier, such as a submarine sill, the stream lines show disturbances (simple deflection, wavelike pattern, meander or closed contour).

These disturbances are examined at the central Adriatic sill(Split-Gargano transect) where they are most prominent. The east and west current component at the transect alternate irregularly suggesting a permanent disruption. Disturbed pattern is horizontally well developed extending about 50 miles on both sides of the sill. Salinity data also demonstrate disturbance in the current field, especially in the summer. Typical is the wave-like pattern of isohalines along the sill. There is also a secondary maximum of surface salinity in July, appearing at one part on the west side of the sill

only. It goes along with temperature rise, indicating advection of the saltier and warmer water from the south. The only possible explanation for such an advection, different from the general trend on the west coast, is the wave like structure of the current pattern at the sill. Such advection from the south was not expected here in summer as in this season in the surface layer in the whole Adriatic the outgoing SE current prevails; especially along the west coast as a part of general cyclonic circulation (Zore-Armanda, 1963).

The further explanation of the phenomenon can be done by a simple model. Considering the Adriatic Sea as a plain channel of constant width having a sill of the form $h \exp(-|x|)$ from the McCartney's model (1976), we obtain for the stream function

$$\Psi = \{y - a \exp(-|x|)(1 - \cos y)\} U(z)$$

where x axis is along the channel in an upstream direction from the bottom current and y axis is transvezal axis of the left coordinate system; x and y are scaled by L which characterises the scale of topography and the flow patern is independent of vertical coordinate z; a denotes U_o h/r where U_o is scaled bottom current by mean square velocity, h is scaled bottom depth of the topographic barrier and r is Rossby number. The closed stream lines will appear over the sill if $a<1$. In the case of the Adriatic Sea the basic parameters could be chosen as $U_o=10^{-1}$, $h=10^{-1}$, $r=10^{-2}$, which gives the value $a=1$. As the somewhat bigger and smaller values are equally possible, it means that both, opened and closed stream lines systems could occur. The region considered is extremely simplified but result illustrate well some general feature of the flow at barriers: deflections and possibility of closed stream lines proving the topographic effect as essential cause for the phenomenon observed.

References

McCARTNEY M.S. (1976) The interaction of zonal currents with topography with applications to the Southern Ocean. Deep Sea Research, 23: 413-427.

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