COASTAL GEOSTROPHIC FLOW IN THE NORTHEASTERN ADRIATIC: JUNE-SEPTEMBER 2003

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Abstract
High resolution CTD data collected during 18 cruises from June to September 2003 are used here to compute relative geostrophic currents in the northeastern Adriatic coastal belt. Results indicate a strong southerly outflow in the area throughout the whole period investigated, suggesting a current that flows counter to the accepted general cyclonic circulation of the Adriatic.

Keywords: CTD, geostrophic circulation, northern Adriatic

Introduction

General Adriatic circulation consists of a cyclonic meander with an inflow along the eastern and outflow along the western coast (1). However, results of recent investigations indicate a more complex system where a very strong outflow can occur in the northeastern coastal zone during the warm part of the year, near the Istrian peninsula. These previous studies are based on direct current measurements at several points in the area (2) or on analysis of geostrophic currents derived from low resolution hydrographic data collected monthly at several depths at two stations 24 km apart (3). However, in order to describe the circulation pattern near the northeastern coast of the Adriatic more precisely we report herein an analysis of geostrophic currents, known to be a good approximation of real currents in the area during the warm part of the year (4), computed on the basis of fine resolution hydrographic data as a means for determining the initial conditions before deep water formation processes begin in autumn and winter.

Data and methods

CTD (SeaBird SBE 25) data were collected over a 19 station grid during 18 cruises from June to September 2003 off the Istrian coast of Croatia (Fig. 1). Geostrophic currents, relative to the 20 m depth level, between each two neighboring stations were computed using standard mathematical methods (3) and elaborated graphically using the ODV software package.

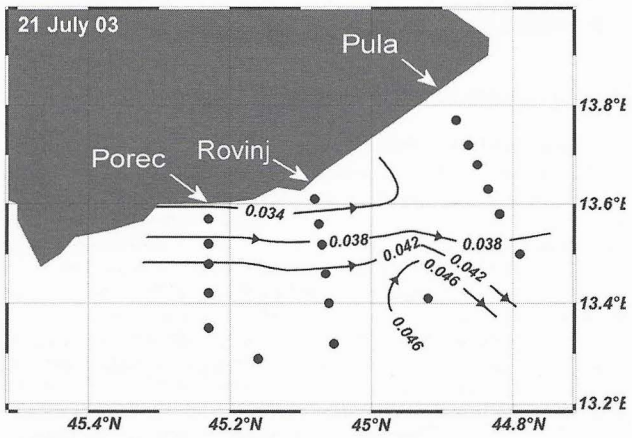

Fig. 1. Oceanographic stations and dynamic heights (dyn m) at 2 m depth relative to the 20 m level.

Results

Dynamic height variations, represented as iso-lines at 2 m depth, indicate a southerly outflow throughout the period concerned, with weekly variations in intensity and extent. On several occasions – as for example on 21 July 2003 - the outflow was strong along the whole western coast of the Istrian peninsula (Fig. 1). Generally, northward movement of water was observed in vertical profiles at all depths corresponding to the mesoscale cyclonic circulation of the Adriatic. However, a southerly outflow of water counter to the normal circulation, localized to a layer extending from the surface to 15 m depth and located close to the coast in a 10 km belt, prevailed at all sections. Relative geostrophic velocities for the Poreć and Rovinj (Fig. 2) profiles typically attained values of about 10 cm s^{-1} for outflow while inflow velocities were about 2 cm s^{-1}. Motions at the Pula section were stronger (typically from 2-5 cm s^{-1} for inflow, and 10-20 cm s^{-1} for outflow) compared to the other sections. This indicates the appearance of a current moving in a southerly direction in the coastal zone off Istria, previously named the Istrian Coastal Countercurrent (ICCC; 3). It is held that the ICCC is part of a closed anti-cyclonic circulation cell in the northern Adriatic in which waters of Po origin are restricted (4). Unusually, this lower salinity pool was also observed in northeastern Adriatic open waters in spring and summer of 2003 in spite of exceptionally low Po discharge rates (D. Degobbis, personal communication).

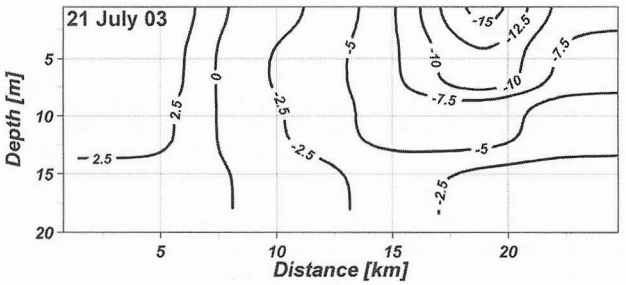

Fig. 2. Vertical profile of the Rovinj section showing relative geostrophic velocities (cm s^{-1}) with respect to the 20 m level. Negative sign denotes southward flow.

Conclusion

Using high resolution temperature and salinity data in the interval from June-September 2003 document in detail for the first time the location, extent and relative magnitude of counter currents to the normal circulation over a large area adjacent to the Istrian coast. Our results show that during the interval concerned there was an almost permanent, or highly prevailing, southerly anti-cyclonic alongshore flow in the region, becoming greater in magnitude towards the south, and may bound a low salinity pool in the middle northern Adriatic.

References

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