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LETTER TO THE EDITOR

The sub-Mediterranean undercurrent

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Dear Editor

ONE OF the main results in a recent paper by AMBAR and HOWE (1979) is the presence of a deep countercurrent at 1500-m depth beneath the westward flowing Mediterranean outflow on the continental slope south of Cape St Vincent between 8°30'W and 9°30'W. It might be worth mentioning that some moored current meter observations were obtained at 36°27.8'N and 8°42.0'W in late spring 1971 (ZENK, 1975). One current meter was deployed at a depth of 1568 m. The water depth was 1714 m. So far only the one-month mean values of these data (3.2 cm s^{-1} towards 272°) have been discussed by Ambar and Howe, showing that this arbitrary average did not agree with their indirectly derived but consistently appearing countercurrent. A detailed inspection of the low passed filtered current meter data, however, demonstrates encouraging results supporting Ambar and Howe's findings at least during certain periods.

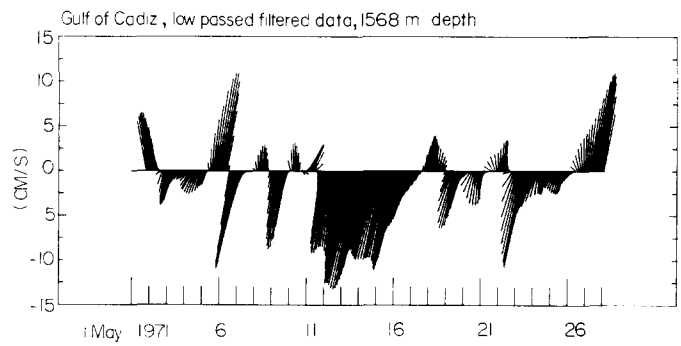

Fig. 1. Vector time series of current observed in the Gulf of Cádiz by an Aanderaa instrument. Prior to plotting, the data were filtered to exclude tidal signals. The coordinate system has been veered by −45° i.e., northeast pointing positive upward.

In Fig. 1 the transient nature of the currents at the proposed depth of the countercurrent can be seen in the two-hourly averaged vector time series from which the tidal signal has been removed. Because of the two predominant directions we conclude that the currents in 1568-m depth are polarized by the bottom topography. We further note a time scale of the counter flow of 0 (1 to 2 days). The reversals of the flow directions take place within periods shorter than 6 h. It is tempting to speculate about the periodicity of the counter flow along

the continental slope of the outer Gulf of Cadiz and to compare it with current observations at site D on the continental rise off New England.

According to RHINES (1977), 6-day oscillations found there could be interpreted as baroclinic waves trapped by the sloping bottom. Transferring this explanation to our case we obtain a natural period $\geqslant (N\nabla h)^{-1} \approx 1.1$ days with Brunt–Väisälä-frequency $N \approx 0.29$ cph and bottom slope $\nabla h \approx 13\,\text{m}\,(100\,\text{m})^{-1}$ for the site and the depth of our current meter in the Gulf of Cádiz. This period is not inconsistent with predominant scales in Fig. 1.

Perhaps these observations might stimulate attention to Ambar and Howe's suggestion of a deep undercurrent and promote the development of a theoretical concept to explain its dynamics.

WALTER ZENK

Institut für Meereskunde
Düsternbrooker Weg 20
2300 *Kiel*
Germany

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