Seasonal transports in the Strait of Sicily: updating results

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Two opposite currents move in the Strait of Sicily: one of Atlantic Water mainly concentrated in a meandering jet and mesoscale gyres seen along a frontal structure which is observed at the boundary of surface water on the Sicily shelf; the other current is of Levantine Intermediate Water below the depth of 150-200 m. It follows the bottom topography and flows into the Western Mediterranean over the sills the deepest of which, North of Pantelleria Island and deep 435 m, is certainly the more important.
The AW and LIW transports through the Strait represent an important element to be considered when modelling the East Mediterranean circulation. Attention is called upon their seasonal and interannual variations because of their links with the climate of the area, as the marine physical conditions depend upon the changing climatic forcing over the Mediterranean sea and the Atlantic Ocean.

In steady-state conditions, admitting salt and mass conservation of the Eastern Mediterranean basin, the transports and the mean salinities in the Strait are related to the water deficit by:

$$Q_{LIW} = \frac{D}{\rho_{LIW}} \frac{\langle S\rangle_{AW}}{\langle S\rangle_{LIW} - \langle S\rangle_{AW}} \qquad \frac{Q_{LIW}}{Q_{AW}} = \frac{\rho_{AW}}{\rho_{LIW}} \frac{\langle S\rangle_{AW}}{\langle S\rangle_{LIW}}$$

Assuming in the Strait the same linear behaviour between the core salinities of both water masses, which are practically constant and namely $S_{AW} = 37.00$,
$S_{LIW} = 38.75$, then

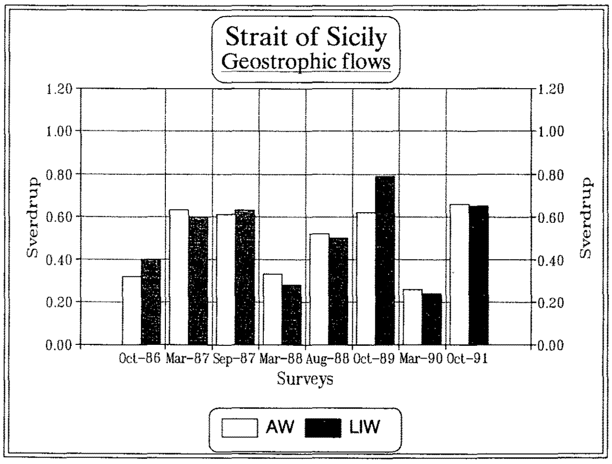
$$Q_{LIW} \approx 20\ D$$

The value of $D = 2 \times 10^3 km^3 y^{-1}$, considered as a realistic approximation of the water deficit in the East Mediterranean area, involves the transport of one Sv.

In the framework of the project POEM (MALANOTTE-RIZZOLI, 1988, ROBINSON *et al.*, 1991, MORETTI *et al.*, 1992), seasonal TS measurements were performed in the Strait with greater concern to a cross section north of Pantelleria in order to evaluate the water transport. The computations gave results spanning between 0.3 and 0.8 Sv.

During the survey of October 1991 the section was somewhat extended and adjiusted with respect to the former in order to obtain a better estimate of the dynamics over the Tunisian shelf. The new result, 0.6 Sv, may be also considered valid for old sections. The graph below reports all the data.

The observed variations of Q_{LIW} estimated as above, confirm a noteworth seasonal variability of the water deficit in the Eastern basin so evidencing the presence of the East basin climate signal.



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A part of the next survey will be devoted to test the possibility of obtaining long current time series in front of the severe environmental conditions of the area. They are necessary for a more exhaustive discussion.

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Modelling the Surface Circulation of the Eastern Mediterranean Sea

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A primitive equation OGCM (Ocean General Circulation Model), see CANDOUNA (1991, [1]) is used to study the circulation of the Eastern Mediterranean Sea and its seasonal variability. The model domain extends westwards to 15°E and northwars to 40°N. Straits and channels are artifically assumed to be closed at all boundaries. The initial and upper surface boundary conditions are prescribed by the monthly mean temperature values and the annual mean salinity values of the climatological LEVITUS data set, LEVITUS (1982, [3]), while the atmospheric forcing by the HELLERMAN and ROSENSTEIN climatological windstress data set, HELLERMAN and ROSENSTEIN (1983, [2]).

The run becomes quasi-stationary after 20 years of integration and the spin up time is about 12 years. Large-scale circulation patterns, such as the Mid Mediterranean Current (MMC), the Ionian Atlantic Stream (IAS) and the Cilician Current can be succecfully simulated by the model. Inconsistencies in the circulation pattern are located where mesoscale eddies are expected; e.g. the West Cyprus Cyclone (WCC) in the northwestern Levantine Basin, the Cretan Sea Cyclone (CSC) and the Rhodes Cyclone (RC), southwest and southeast of Crete. The model forms an anticyclonic eddy at the same location of the Shikmona Anticyclone (SA), but however, there is not any indication of an eddy at the location of the Mersa-Matruh Anticyclone (MMA).

The OGCM used in this study has been developed by Dr. E. MAIER-REIMER at the Max-Planck-Institut for Meteorology. The numerical experiments have been performed there too, as part of the author's M.Sc. thesis.

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