Seasonal Variability of the Eastern and Western Mediterranean Circulation derived from historical data.

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The Eastern and Western basins of the Mediterranean Sea have been the seat of multiple and intense - although fragmented in space and time - observing networks and hydrographic surveys, delivering a substantial amount of information about the general circulation.

In most cases, these data sets have been interpreted individually, in order to investigate regional processes, isolated mechanisms or local hydrographic regimes. The main objective of this study is to construct a unified data set, - using as many *in situ* observations as possible -, to analyse them globally and to extract the seasonal signal of the circulation consistent with the historical data.

The variational inverse method (BRASSEUR and HAUS, 1991) has been applied to reconstruct the three-dimensional temperature and salinity (or density) fields representative of the four seasons. The solutions are derived from a variational principle, taking into account the statistics of the observations to minimize the expected error on the fields. Additionally, a kinematic constraint is shown to be equivalent to anisotropic correlations between the data, as a result of the advection of the scalar properties by the geostrophic circulation.

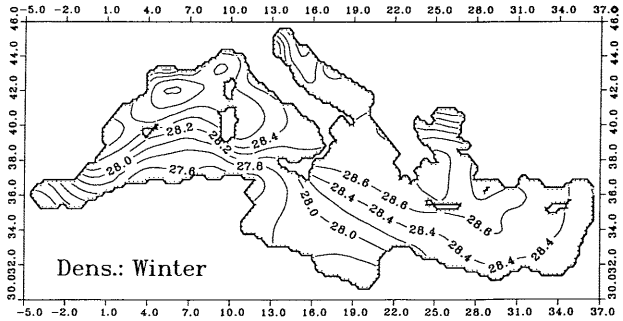

Fig. 1.- Surface density representative of the winter season.
Optimal solution produced by the variational inverse method.

At the seasonal scale, the distribution of the sations is relatively homogeneous and it is possible to observe correctly the seasonal signal in temperature and salinity. Heat and salt budgets are computed for the different water masses and the seasonal volume variations of the surface layer and intermediate water mass are represented.

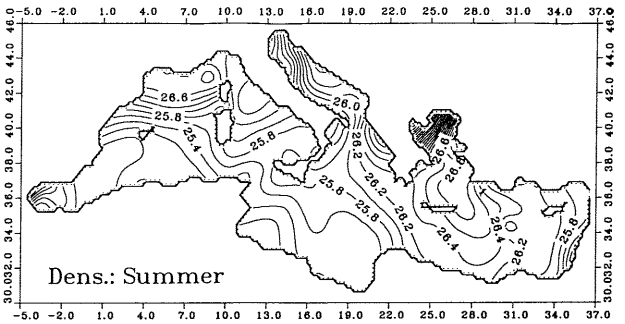

Fig. 2.- surface density representative of the summer season.
Optimal solution produced by the variational inverse method.

At the monthly scale, the stations are typically too sparse to reproduce a significant month-to-month variability from the observations only. Gaps between the data points must be filled in, using a realistic dynamical procedure to interpolate in space and time.

The assimilation of the results of the variational inverse method in the GHER primitive equation model (BECKERS, 1991) is tested using a very simple "restoring" scheme at the surface. The implementation of a more sophisticated procedure (derived from the Kalman filter scheme) is currently investigated.

REFERENCES

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Flow through the Strait of Gibraltar

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A major change in the understanding of the dynamics of flow through straits has occurred over the last few years due to the development of two-layer hydraulic control models and due to new observations of the exchange between the Atlantic and Mediterranean through the Strait of Gibraltar. From the theoretical models, predictions of the outflow of Mediterranean water, the inflow of Atlantic water and the salinity difference between the two water masses can be made for the specific configuration of the Strait of as a function of the net evaporation over the Mediterranean basin. Time series current and salinity observations on the Gibraltar sill during the 1985-86 Gibraltar Experiment determine the actual outflow, inflow, outflow salinity transport, and salinity difference. The observed outflow salinity transport provides a nearly direct estimate for the net evaporation over the Mediterranean basin of 52 cm/yr, that may be more accurate than the usual climatological estimates. The observed inflow is 0.68 Sv and the best estimate of the outflow is 0.72 Sv, with a salinity difference of 2.2 ppt between the inflowing and outflowing waters. For such a net evaporation, predictions of the inflow and outflow transports and the salinity difference between them from hydraulic theory are in reasonable agreement with the observed values, though the theoretical predictions for the transports are about 20% larger than the observed values. Given that present theory does not include important dynamical effects such as rotation and friction that could lower the predicted exchange, the agreement within 20% between the observed and predicted exchanges through the Strait of Gibraltar is encouraging.