# O-II1

## Objective analysis of biological data from P.O.E.M. Cruises

A. BERGAMASCO*, S. RABITTI** and E. PIERAZZO*

*Istituto Studio Dinamica Grandi Masse-CNR, San Polo 1364, 30125 Venezia (Italia)
**Istituto di Biologia del Mar-CNR, Riva dei sette Martiri 1364/A, 30122 Venezia (Italia)

Objective analysis is essentially an interpolation technique used to estimate a given physical quantity at points where there are no measurements, from data available at different locations. This technique is based on the Gauss Markov theorem which gives an expression for the least square error linear estimate of variables, given the measurements at a limited number of data points. In order to have a better correlation function the statistical Baysean theory could be applied to experimental data.

The application of these techniques are shown in processing the P.O.E.M. cruises data (POEM01 10/21-11/8 85, POEM03 11/1-11/14 86, POEM05 8/31-9/14 87) to produce maps of the Ionian distribution of $O_2$, $N\text{-}NO_3$, $N\text{-}NO_2$, $N\text{-}NH_3$, $P\text{-}PO_4$, $Si\text{-}SiO_4$, chlorophyll and total suspended matter.

The typical objective analysis maps will be compared with the dynamic fields obtained from the oceanographic data of the same campaigns.

# O-II2

## The upper layer circulation in the Sea of Marmara as inferred from the hydrographic data

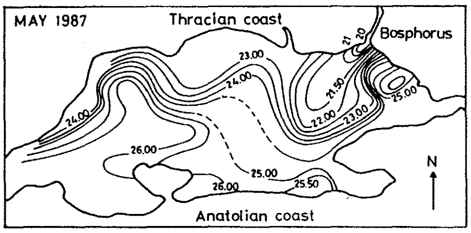
S. BESIKTEPE, T. OGUZ and H.-I. SUR

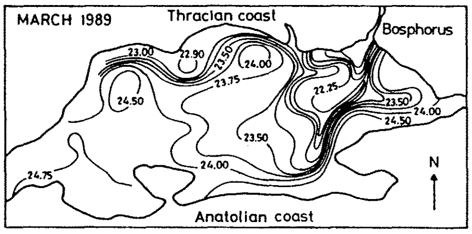
Middle East Technical University, Institute of Marine Sciences, P.O. Box 28, Erdemli, 33731, Icel (Turkey)

The Sea of Marmara, together with the Bosphorus and Dardanelles Straits, forms the Turkish Straits (TS) which constitutes an oceanic system joining two of the world's largest isolated seas with extremely different water mass properties. The low salinity waters of the Black Sea, formed as a result of excess of precipitation and run-off over evaporation, are transported to the Mediterranean through the TS as a surface flow. In return, the saltier and heavier waters of the Mediterranean Sea, generated by the excess of evaporation over fresh water input, flow as an undercurrent to the Black Sea. In evolution through TS, they generate a transitory state between the two extremes found in the adjoining seas, with constraints imposed by the hydrodynamical controls of the two straits as well as the interactions of the straits with the Sea of Marmara and the interactions of the entire system with the atmosphere.

The Bosphorus upper layer flow enters the Bosphorus-Sea of Marmara junction region in the form of a shallow and narrow turbulent buoyant jet with currents in excess of 2 m/s. Immediately south of the junction region, the jet tends to spread asymmetrically with more intense currents concentrated towards the Anatolian side. The surface flow, proceeding in the southerly direction, then bifurcates into two branches. As one branch turns eastward and enters into the Izmit Bay, the main branch turn anticyclonically toward west-northwest in the direction of the Thracian coast. Inside the westward curling main flow, the surface waters form a quasi-permanent sub-basin scale eddy. The size and the strength of the eddy varies depending on the atmospheric conditions and the strength of the outflow from the Bosphorus. Most drastic changes occur when the region is under the effect of south westerlies during the winter months. Under these conditions, the jet core emanating from the Bosphorus tends to deflect towards the Thracian side and the anticyclonic eddy has an elongated shape along the coast. The upper layer flow, upon reaching the Thracian coast of the basin, then proceed westward in the form of a baroclinically unstable meandering rim current along the topographic slope.

For surface outflows having an internal hydraulic control present at the exit to the adjacent basin, as observed in the Bosphorus, the left-hand attachment of the flow immediately outside the channel exit and the resulting generation of the anticyclonic eddy occur when the flow acquires negative relative vorticity with a magnitude comparable to the Coriolis parameter (Wang, 1987). This negative vorticity is generated by strong upward vertical velocity induced during the critical transition of the outflow (Wang, 1987).




The linear baroclinic stability analysis developed for two-layer channel flows with sloping bottom topography (Mysak, 1977), adapted for the Sea of Marmara indicates that the westward moving rim current is indeed baroclinically unstable. The wavelength and period of the most unstable waves are found to be O(90 km) and O(5 days) respectively.

REFERENCES

Mysak, L.A., (1977): On the stability of the California Undercurrent off Vancouver Island. J. Phys. Oceanogr., 7, 904-917.

Wang, D.P., (1987): The strait surface outflow. J. Geophys. Res., 92, 10807-10825.

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