Observations of deep water formation in the Gulf of Lions during THETIS

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From November 1991 to April 1992 an experiment was carried out in the northwestern Mediterranean (Gulf of Lions) convection region. The objective was to study with a variety of methods and on a variety of scales the processes involved in the deep convective overturning of the water column which occurs during periods of strong surface cooling (associated with Mistral and Tramontaine winds). Apart from standard current meter moorings and several hydrographic/tracer cruises with continuous shipboard thermosalinograph and ADCP (Acoustic Doppler Current Profiler) sampling, the experiment comprised a moored array with two components dedicated to the extreme spatial scales of the processes. A small-scale (2km) triangle of moorings with ADCP, thermistor chain, and high-precision temperature/salinity recorders was aimed at resolving the individual convective plume scale. A large-scale (100-200km) array of 6 acoustic tomography moorings was designed to yield the large-scale changes in stratification and the convection patch as a function of time.

Preliminary analysis of the meteorological data and of the vertical currents from the moored instruments shows that some shallow mixing events probably occured during December and January, and that the main deep overturning took place in mid-February during the first days of our longest verification cruise. This enabled us to obtain a good ship survey of the convection patch. Within the fresh patch which could be mapped well with the salinity and density signal from the thermosalinograph, the water column had become extremely homogeneous down to depths of about 1600m. Both moored and shipboard ADCP measurements indicated large downward currents during the event. Subsequently, the patch became more fragmented, with intrusions of stratified water from outside the patch at individual depth ranges. At this stage, both the thermosalinograph tracks and the CTD profiles showed high spatial variability. Depending on the processing stage, a preliminary view of the acoustic tomography data will also be presented. Part of the array was not operational during the period leading up to the main convection event, but the temporal evolution of the stratification should be visible during much of the time along various sections through the array.

Danube water influence on sea water salinity at the Romanian Littoral

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The Danube discharge presents high seasonal variations, the extreme values being between 7 km³ in Oct.-Dec. and 39 km³ in May. The extended interval of the Danube run off is specific in every month of the year and especially in April - June period when Danube discharge reached its maxima average values (Tab.l).

Table 1 - The extreme values and the monthly long term averages of the Danube discharge (km³) on the 1961-1988 period

Month	J	F	M	A	M	J	J	A	S	O	N	D
Min.	10	9	13	11	15	12	10	8	8	7	7	7
Max.	29	25	32	33	39	37	33	23	22	25	28	26
Med.	17	17	21	24	25	22	19	15	12	12	12	16

We mention that annual run off values varied between 165 km³ in 1961 and 293 km³ in 1970, the long term average representing 213 km³.

The great volume of Danube fresh water exerts a major influence on the salinity of the Black Sea. This influence is extremely important at the Romanian littoral as a consequence of its position relative to Danube mouths, but even more because of the general trend of the sea surface currents flowing southward.

The surface salinity, at Constantza, near the shore presented long term monthly averages between 14.09 in May and 15.97 in December. The influence of the Danube discharge oscillations is obvious. Thus, the period of the lowest monthly mean salinities (March-June) corresponds to the highest means of the Danube discharge, while in the period of the lowest discharge (Sept.-Nov.), high salinities were recorded (Fig.1). In the same time one could remark some situations when for close values of the run off, the salinities were much different. In this case, Aug. and Dec. are typical (Fig.1). This proves the different action of the marine currents which favoured fresh water to reach Constantza, in August.

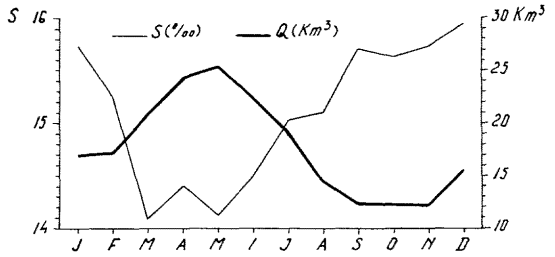

Fig. 1.- Long term monthly means of the sea water salinity at Contantza and Danube run off.

Annual salinity means of the marine waters oscillated between 14.32 and 15.96. The great variations of the salinity reflect the influence of the Danube discharge and of the marine surface circulation as well. Thus, in the years with very reduced discharges, the salinities were very high and in years with high Danube discharge the salinities were diminished (Fig. 2). Strong deviations from this general trend are recorded in several years when the role of the marine currents prevailed.

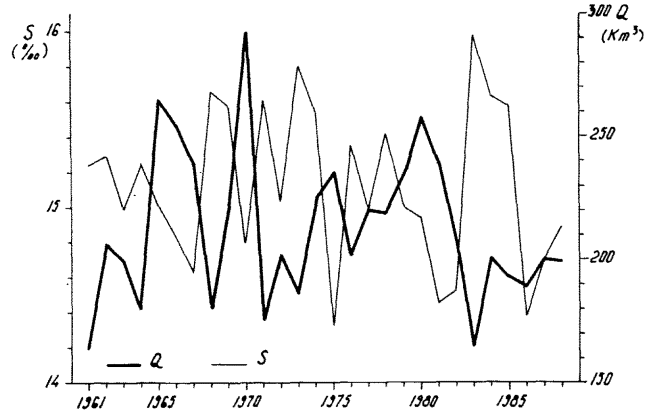

Fig. 2.- Annual values of the sea water salinity at Constantza and Danube run off.

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