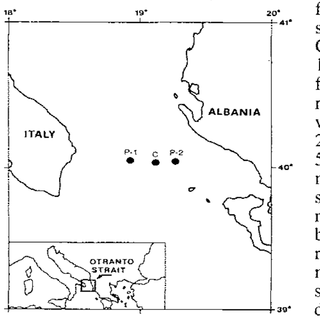
SEASONAL VARIABILITY OF DYNAMICAL AND THERMOHALINE PROPERTIES IN THE OTRANTO STRAIT AREA - 1989/1990

Nenad LEDER, Ante SMIRCIC and Zvonko GRZETIC

Hydrographic Institute of the Republic of Croatia



From November 1989 to August 1990 four seasonal oceanographic cruises were performed in the Otranto Strait area by R.V. "Andrija Mohorovicic". It is supposed that November, March, May and August are representatives for autumn, winter, spring and summer seasons, respectively. Two current meter arrays were moored in the Strait: the first one near the West coast (P-1) and the second one near the East coast (P-2) (Fig. 1). Current meter data are missing for November 1989. Time series of current data is short, from 1 to 5 days. AANDERAA RCM 4 current meters, with 5 minutes sampling interval, were moored at nominal depths of 5, 50, 100, 200, 500 and 650 m (P-1), and 5, 100, 200, 500, 800 and 930 m (P-2). Wind velocity measurements were registered on board the ship at one hour interval. Some preliminary results of these measurements were presented by LEDER *et al.* (1992). Conductivity, temperature and depth (CTD) measurements were made with SEABIRD SBE 17 profiler at three stations: P-1, P-2 and C (Fig. 1). The CTD data were collected during the downcast at sampling frequency of 24 Hz, with a lowering speed of about 1 m/s. Short period current measurements at two stations in the Otranto Strait indicate two layered circulation, sometimes with only one layer, especially at station P-2. The results are in agreement with VUCAK and SKRIVANIC (1986), FERENTINOS and KASTANOS (1988) and MICHELATO and KOVACEVIC (1991) results, obtained also by direct current measurements. General characteristic of the flow is very high intensity. The most intensive flow is usually between 500 m and 800 m. Maximum current speeds were registered at station P-1 at the depth of 500 m in March 1990 (64 cm/s), while at station P-1 at the depth of 5 m in May 1990 (49 cm/s). Measurements in March and May 1990 supported well known structure of exchange of water masses in the Otranto Strait, with inflowing (northward) currents along the Albanian coast, and outflowing (southward) currents along the Italian coast. Such current regime can be called "typical situation". Meanwhile, in August 1990, an opposite nontypical exchange of water masses was registered, with outflowing current along the Albanian coast and inflowing current along the Italian coast. In typical situation inflowing currents were more intensive and stable than the outflowing ones, while in nontypical situation inflowing currents along the Italian coast were more intensive and unstable than outflowing currents along the Albanian coast. At both stations currents were stronger in typical, than in nontypical situations.

Thermohaline properties in the Otranto Strait are subject to seasonal and inter-annual variabilities (BULJAN and ZORE ARMANDA, 1976). Seasonal variability (season 1989/1990) of temperature, salinity and sigma-t at station P-2 is shown in Fig. 2. It is obvious that only surface layer (about 100 m) changes its thermohaline properties, while the rest of the water column has properties of the unique, unchangeable water mass, denoted by ZORE ARMANDA (1963) as A type of the water mass (T=14°C, S=38.7 psu, sigma-t=29.06). This water mass is a result of mixing of the more saline Levantine Intermediate Water (LIW) with the Adriatic Water (J type), therefore it is called Modified Levantine Intermediate water (MLIW). Formation of MLIW in the Otranto Strait indicates that the Adriatic Sea will not be influenced by the phenomenon called "Adriatic ingression" (BULJAN and ZORE ARMANDA, 1976) which is observed in situations when LIW water mass is as dense as the Adriatic water, does not sink and enters the Adriatic unchanged, with salinity higher than 38.8 psu. Vertical profiles of temperature, salinity and sigma t (Fig.2) show that the water column in the Otranto Strait is almost permanently stratified, especially in the surface layer. An interesting phenomenon is the occurence of subsurface salinity minima at the level of seasonal thermocline (Fig.2). The most pronounced salinity minimum was observed in November 1989, coinciding with the dissolved oxygen maximum. A possible explanation is that the ventilation process was due to Ekman pumping produced by the curl in N and NE wind (Bora wind) measured on board the ship a few days before the sampling in the Otranto Strait. A similar process was documented and analyzed by BERGAMASCO and GACIC (1992) in the Southern Adriatic. At station P-1, temperature and salinity are lower than at station P-2, especially in the surface layer, because station P-1 is situated in the vein of cold and fresh water, outflowing the Adriatic Sea along the Italian coast. Thermohaline data at station C (Fig.1) show that this position varies in relation to the outflowing inflowing current system, sometimes being in inflowing and sometimes in outflowing current. Occurence of salinity "patches" suggests turbulent mixing in the zone between currents of opposite directions.

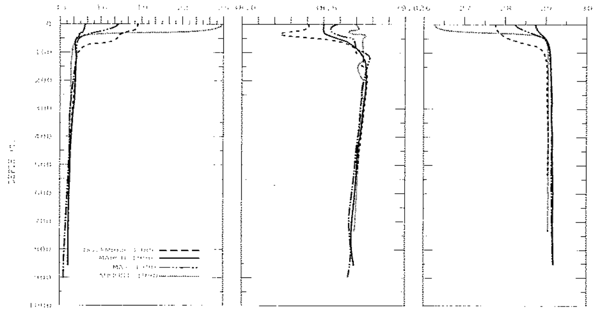


Figure 2. Annual course of temperature, salinity and sigma-t in the Otranto strait, station P2

REFERENCES

BERGAMASCO A. and M. GACIC, 1992. *Rapp. Comm. int. Mer Medit.*, 33: 329.
BULJAN M. and M. ZORE ARMANDA, 1976. *Mar. Biol. Ann. Rev.*, 14: 11-98.
FERENTINOS G. and N. KASTANOS, 1988. *Continental Shelf Research*, 8: 1025-1041.
LEDE, N., A. SMIRCIC, M. FERENCAK and Z. VUCAK, 1992. *Acta Adriatica*, 33, in press.
MICHELATO A. and V. KOVACEVIC, 1991. *Bol. di oceanologia teorica ed applicata*, 9: 39-51.
VUCAK Z. and A. SKRIVANIC, 1986. Hidrografski godisnjak 1984-1985 : 85-102.
ZORE ARMANDA M., 1963. *Acta Adriatica*, 10 (3) : 1-38.