O-VI12

FLOW THROUGH THE CORSICA CHANNEL DURING THE SUMMER PERIOD

M. ASTRALDI, G.P. GASPARINI and G.M.R. MANZELLA
Stazione Oceanografica, ISDGM, c/o CREA,
Pozzuolo di Lerici, La Spezia (Italia)

ABSTRACT

The Corsica Channel plays an important role on the circulation of the North Western Mediterranean, as it was firstly recognized by Bethoux et al. (1982), who, computing the annual fluxes in the Nizza - Calvi transect, indirectly deduced the flow along the Channel. This flow had a seasonal variability and in particular had a maximum in winter, while strongly reduced in summer.
Direct measures in spring and in fall (Manzella, 1985) confirmed this trend.
In order to better focus the hydrological and dynamic conditions of the Channel during summer a series of current, sea level and CTD measurements were effected from July to September 1985.
A generally weak flow was recorded at three sampling levels (-47m,-99m,-178m): over the thermocline the flow was Northwards (4.3 cm/s) and could be related to the sea level variations, while at 99m it seemed to move from the Ligurian Sea to the Tyrrhenian basin (-2.4 cm/s) and at 178m it presented a nul mean value.
The lack of correlation in the vertical suggests a prevalence of a baroclinic dynamics. This is confirmed by the behaviour of the baroclinic shear achieved by the hydrological data, which tightly corresponded to the mean values of each current time series; the barotropic component could be estimated of about 2 cm/s.
From the space distribution of hydrological properties a frontal structure appeared South of the sill, which induced a reversal of the Southward current at 100m, thus creating a condition of no flow between the surface layers of Ligurian and Tyrrhenian Seas. On the contrary near the bottom, a prevalent tendency of the maximum temperature level to line up along a North-South direction indicates a quite regular flow of the Intermediate water from the Tyrrhenian to the Ligurian sea, with a speed of about 2 cm/s, corresponding to a Northward flow of ~0.02 Sv. Then also these data confirm the idea of a marked seasonal variability in the Corsica Channel flow.

References

- Bethoux J.P., Prieur L., Nyffeler F., 1982. The water circulation in the North-Western Mediterranean Sea, its relation with wind and atmospheric pressure, in: Hydrodynamics of semi-enclosed seas, edited by J.C.J. Nihoul, Elsevier, Amsterdam, 129-142.

- Manzella G.M.R., 1985. Fluxes across the Corsica Channel and coastal circulation in the East Ligurian Sea. North-Western Mediterranean, Oceanol. Acta, 8, 1, 29-35.

O-VI13

VARIABILITY IN CURRENT METER RECORDS IN THE NORTHWESTERN AEGEAN SEA : THERMAIKOS BAY

E.Th. BALOPOULOS [(1)], M.B. COLLINS [(2)] and A.E. JAMES [(2)]

(1) National Centre for Marine Research, Hellinikon (Greece)
(2) Department of Oceanography, University College, Swansea, Wales (U.K.)

ABSTRACT

Eulerian current meter data, collected during 1976, are used to investigate spatial and temporal variations of mid-depth and near-bottom residual currents, in a coastal embayment of the northwestern Aegean Sea (Thermaikos Bay).

INTRODUCTION

Thermaikos Bay, is a shallow-water embayment in the north-west Aegean region of the eastern Mediterranean Sea (Fig. 1). The area is of special interest for environmental studies because it receives discharges from large river systems and also sewage and industrial effluents from the city of Thessaloniki, which has more than 1,200,000 inhabitants. Although the general pattern of water circulation in the area has been investigated recently (1, 2, 3), variability in the dynamical regime, require further analysis. In this contribution, residual currents from long-term current observations in Thermaikos Bay are presented and the variability in direction and speed of the measured residual flow is investigated.

METHODS

Currents were measured at 4 Stations (A, B, C and D, Fig 1 and Table 1). Self-recording current meters (Aanderaa RCM4) were used in all cases; these were deployed using an L-shaped mooring array, with two anchors and subsurface buoyancy. Eulerian residual currents were obtained, using the Doodson Xo filter. Progressive vector diagrams (P.V.D.) were analysed, to examine the vector mean flow and changes, with time, of the residual currents. The variability in direction of the residual currents with time is described in terms of the "steadiness" factor "B". The variability in the speed of residual flow is assessed in terms of the standard errors of the resolved components (1).

RESULTS AND DISCUSSION

At Station A, near-bed residual currents ranged throughout from 1 cm s^{-1} to 3 cm s^{-1}(Table 1). Residual flow during all the measuring periods was towards the northwest. The mid-depth residual current was in the same direction but slightly higher in magnitude (4 cm s^{-1}). At Station B, the near-bed residual currents were consistently towards the southwest, at around 3 cm s^{-1}. At mid-depth, at this location, the residual flow on some occasions was towards the west/southwest; on others, it was easterly/southeasterly. Mid-depth currents, were, in all cases, around 3 cm s^{-1}. However, the magnitude of the residual flow in June was notably higher (approximately 6 cm s^{-1}) than the other periods. The residual current in June, was assessed on the basis of 7 days of observations; hence, it might not be expected to represent long-term meteorological conditions. At Stations C and D the residual flow was towards the southwest in all cases. The magnitudes of the residual currents varied from 2 cm s^{-1} to 4 cm s^{-1}. Near-bed residual currents in Thermaikos Bay represent intrusion of Aegean Sea water along the eastern coastline, with southerly flow in the west. This residual movement suggests, that a weakly rotating counter-clockwise water circulation pattern is dominant.

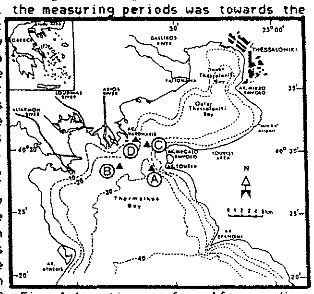

Fig. 1 Locations of self-recording current meter Stations. Bathymetry in metres.

Examination of progressive vector diagrams, based upon daily residuals (obtained by applying the Xo filter), show that, at some stations, there was considerable variability with time and water depth, in the daily residual current speed and direction. In other cases, the residual flow was large and consistently in one direction. At Station A, there are only small changes in daily residual current directions. Residual flow is, in general, towards the northwest. Daily residual currents with an onshore component (eastward), at Station A, occur infrequently and for up to 3 days; these are also characterized by relatively low speeds. An exception is the data obtained near the bottom at this location, during the period of August-September; they indicate daily residual currents towards the southeast with speeds of the order of 6-11 cm s^{-1}. The outflows of the rivers (Fig. 1) are very low during this period of the year (1). It might be expected, therefore, that the relatively high daily residuals towards the southeast are meteorologically induced. The steadiness factor ranges overall from 70% to 90%; it reduces to 63% during the August-September period. There are small changes in direction for the near-bed daily residual currents at Station B. Daily residual currents are predominantly towards the southwest. The steadiness factor varies between 79-88%; it reduces to 54% during the August-September period. Mid-depth daily residual currents, at this location, show considerable changes in direction with the steadiness factor varying from 52% to 63%. Daily residual currents at Station C are highly variable with a steadiness factor ranging from 21% to 67%. There are only small changes in the direction of the daily residual flow at Station D. The derived steadiness factor is 71%.
Standard errors of residual currents at Station C range from 30% to 78% of the mean speed; i.e. with high variability. Standard errors for the residual currents are small (<30% of the mean speed) at the other Stations.

TABLE 1. SUMMARY OF MEASURED RESIDUAL CURRENTS IN THERMAIKOS BAY AND THEIR VARIABILITY IN DIRECTION AND SPEED (USING DOODSON'S Xo FILTER).

Stn Ref	Mooring Station: Position Longitude (E)	Latitude (N)	H (m)	z (m)	Deployment Period (1976)	Period of "Useful" Data (976)	Residual Current: Scalar Mean (cm s^{-1})	Vector Mean Amplitude (cm s^{-1})	Vector Mean Direction (o)	Steadiness Factor B (%)	$\sigma_{<\bar{v}>}$ (cm s^{-1})	$\sigma_{<\bar{u}>}$ (cm s^{-1})	Length of Record (days)
A	022-48.10	40-28.25	30.5	17	09/04-06/06	09/04-05/06	5.00	3.86	311	77	0.43	0.51	56
				7		09/04-28/04	1.96	1.38	337	71	0.37	0.38	17
B	022-44.45	40-28.80	27.5	17	09/04-06/06	09/04-06/06	5.03	2.67	270	53	0.24	0.66	57
				7		09/04-05/06	3.94	3.13	237	79	0.29	0.32	56
C	022-47.55	40-30.65	27.0	7	09/04-07/06	09/04-02/06	5.33	1.77	206	33	0.84	0.39	52
D	022-46.10	40-30.90	13.5	5	09/04-07/06	09/04-05/06	3.41	2.43	193	71	0.44	0.22	55
A	022-47.90	40-28.25	31.0	7	07/06-15/06	07/06-15/06	2.94	2.63	306	90	0.87	0.37	6
B	022-44.45	40-28.80	27.5	17	06/06-15/06	06/06-15/06	6.93	6.34	85	91	0.76	1.75	7
				7		06/06-15/06	3.29	2.77	225	84	0.65	0.65	7
C	022-47.55	40-30.62	30.0	7	07/06-15/06	07/06-15/06	6.92	4.47	205	65	2.49	1.77	6
A	022-48.00	40-28.25	30.5	7	15/06-16/08	15/06-22/07	2.92	2.30	328	79	0.27	0.38	35
B	022-44.45	40-28.80	27.5	17	15/06-16/08	15/06-30/07	5.00	2.68	258	54	0.32	0.72	44
				7		15/06-14/08	3.50	3.09	235	88	0.29	0.30	58
C	022-47.55	40-30.62	30.0	7	15/06-16/08	15/06-09/07	6.29	4.24	205	67	1.24	0.80	23
A	022-48.08	40-28.20	31.0	7	17/08-18/10	17/08-02/10	4.36	2.77	302	63	0.46	0.50	45
B	022-44.70	40-28.75	28.0	21	17/08-18/10	17/08-15/09	4.73	2.46	63	52	0.41	0.95	28
				7		17/08-02/10	5.96	3.19	231	54	0.45	0.86	43
C	022-47.55	40-30.65	29.0	7	17/08-18/10	17/08-27/09	9.89	2.11	189	21	1.65	1.15	40
B	022-44.70	40-28.75	28.0	21	18/10-05/11	18/10-05/11	4.63	2.94	80	63	0.57	0.95	17

KEY: H is water depth, in metres; z is the elevation above sea-bed, in metres; $\sigma_{<\bar{v}>}$ is the standard error of N-S component of residual flow; $\sigma_{<\bar{u}>}$ is the standard error of E-W component of residual flow.

REFERENCES

(1) BALOPOULOS E.TH.(1982).- Unpub. Ph.D. Thesis, Univ. Wales, 755p.
(2) BALOPOULOS E.TH. and JAMES A.E.(1984).- Thalassographica, 7: 73-94.
(3) BALOPOULOS E.TH., COLLINS M.B. and JAMES A.E.(1986).- Int. Jour. Rem. Sens., 7: (in press).