Current meter measurements in the North Aegean, Eastern Mediterranean Sea (late Winter, 1988)

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INTRODUCTION

Several physical oceanographic studies have been carried out within the last fifteen years to study hydrological conditions and water circulation patterns over the continental shelf of Thermaikos Gulf, in the Northwestern Aegean Sea (Balopoulos and James, 1984; Balopoulos et al., 1986a; Balopoulos et al., 1986b; Balopoulos et al., 1987). The investigations were recently extended (in the framework of the EURECOMARGE Project) over the Sporadhes Basin. However, the study of circulation patterns in the North Aegean Sea and particularly in the straits connecting the northern sea area (Sporadhes and Athos Basins) with the southern region (Chios Basin) requires further investigation. In this contribution, water flow characteristics from long-term current measurements between the Islands Psathoura and Limnos are presented and the variability in direction and speed of the measured residual currents are investigated.

METHODS

Four current meter moorings were maintained in the above mentioned area (Fig. 1) from February 28 to March 22, 1988. Self-recording current meters (Aanderaa RCM5) were used in all cases; these were deployed using a vertical mooring array with subsurface buoyancy.

RESULTS

Mean current speeds at the various stations decreased with increasing depth. They ranged from 21.6-23.4 cm/s in the near-surface layer, 11.1-14.8 cm/s at mid-depth and 7.1-11.8 cm/s in the near-bed layer. Maximum current speeds were in all cases seen in the upper layers. They ranged from 42.1 cm/s (Station B) to 50.2 cm/s (Station D). The numerical estimates for the standard deviation suggest that the current meter data recorded in the upper layers, were, at all stations, the most widely dispersed. The direction frequency distributions for the higher current speeds (up to 33 cm/s) were measured at Station 2. Here, there was indication of a three-layered water circulation. That is, in the near-surface layer the steady water flow was towards the northwest, at mid-depth the residual current was towards the northeast, whilst in the near-bed layer dominated water flows towards the southeast. Analysis of the data further revealed, that oscillating flows with periods near the inertial frequency band seem to be a quite important feature of the mid-depth and deep water motion, in the area.

TABLE 1. SUMMARY OF MEASURED RESIDUAL CURRENTS IN THE NORTH AEGEAN SEA AND THEIR VARIABILITY IN DIRECTION AND SPEED (USING DOODSON'S Xo FILTER).

Stn Ref	z	Scalar Mean (cm/s)	Vector Mean Ampl. (cm/s)	Vector Mean Dir. (o)	Residual Current Steadiness Factor "B" (%)	σ⟨v⟩ (cm/s)	σ⟨u⟩ (cm/s)	Length of Record (days)	Data Cycles
A	365	23.59	22.58	340	96	1.56	1.50	22	3311
	165	14.35	13.82	004	96	1.00	0.83	22	3311
	043	11.59	11.21	017	97	1.17	0.76	22	3311
B	345	17.86	6.11	312	34	3.33	2.13	22	3297
	180	8.95	3.81	317	43	1.70	1.08	22	3297
	030	4.75	1.76	033	37	0.87	0.66	22	3297
C	030	10.72	8.45	226	79	1.33	1.20	22	3283
D	203	21.29	19.58	239	92	1.87	1.68	22	3263
	108	10.91	7.09	268	65	1.59	1.56	22	3263
	033	9.66	8.49	352	88	1.00	0.97	22	3263

KEY: z is the elevation above sea-bed, in metres
σ⟨v⟩ is the standard error of N-S component of residual flow
σ⟨u⟩ is the standard error of E-W component of residual flow

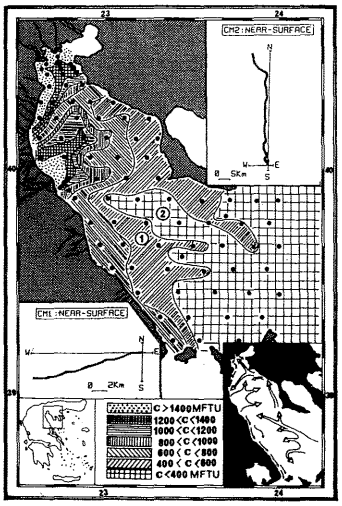

Fig. 1. Distribution of suspended material (mFTU) in the surface layer (<5m) of the northwestern Aegean Sea.

TABLE 1. CURRENT STATISTICS IN THE NORTHWESTERN AEGEAN SEA

Stn.	z	P	Mean	σ	Max.	Min.
CM1	195	V	4.3	2.4	10.5	0.1
		u	-4.1	2.3	-0.1	-9.9
		v	-1.0	1.1	3.1	-3.9
CM1	120	V	2.5	3.1	9.9	0.1
		u	-1.5	2.6	2.3	-8.9
		v	-1.0	2.3	3.5	-7.5
CM1	007	V	4.0	4.5	13.3	0.1
		u	-2.3	2.8	0.1	-9.2
		v	-3.2	3.6	0.2	-10.9
CM2	187	V	16.5	6.7	32.6	2.3
		u	-2.2	6.1	12.6	-18.9
		v	14.6	7.9	32.6	-8.2
CM2	120	V	6.2	3.8	13.8	0.1
		u	3.7	3.9	12.9	-3.8
		v	3.7	3.3	11.6	-2.6
CM2	007	V	2.0	2.5	8.3	0.1
		u	0.8	2.2	7.9	-5.1
		v	-0.7	2.1	5.4	-6.6

z is the elevation above the sea-bed in metres.
P is the parameter.
σ is the standard deviation.
V is the current speed
u is the E-W current component
v is the N-S current component

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Conditions hydrosédimentaires en Méditerranée nord-orientale. Application aux plateformes deltaïques N.O. Mer Egée (plateau de Thermaikos-bassin des Sporades) : Projet EURECOMARGE

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Sur la base de relevés sismiques, morphologiques, mesures in situ (néphélométrie, courantométrie, hydrologie) et de méthodes spécifiques à l'étude des sédiments, une reconstitution des mécanismes hydrosédimentaires actuels et des mécanismes sédimentaires récents (dernière transgression Holocène) est effectuée.

Dans le système deltaïque (Fig. 1) de la plateforme de Thermaikos on reconnaît actuellement :

- Le domaine de stockage sur le plateau interne avec constitution d'un prisme sédimentaire épicontinental (PSE) et progradation forte au niveau des embouchures de trois principaux émissaires (r. Axios, r. Aliakom, r. Pinios). Le taux de sédimentation varie de 2,5 m à 0,05 m par millénaire en allant de la côte Ouest vers la côte Est de ce compartiment. Les phénomènes cycloniques, (BALOPOULOS et al., 1988), liés aux conditions météorologiques et les phénomènes de floculation conduisent à l'envasement précoce. La perte de charge de la couche néphéloïde superficielle est de l'ordre de 50 % à 5 milles de l'embouchure d'Axios. Cette observation est comparable à celle du Rhône. La géométrie du BNL prend une forme prismatique (CHRONIS G. et al., 1988) comparable au prisme sédimentaire holocène.

- Le plateau externe, limité entre les isobathes de 50 et 200 m, est caractérisé par l'amincissement du PSE. Vers le bord du plateau apparaissent les sables reliques wurmiens (LYKOUSSIS et al., 1987). Le taux de sédimentation holocène varie entre 1,5-2,0 m par millénaire. L'évolution du BNL subit une diminution vers le large et vers l'Est. Dans la zone de transition cette couche tend à se détacher du fond indiquant l'influence d'un transport advectif.

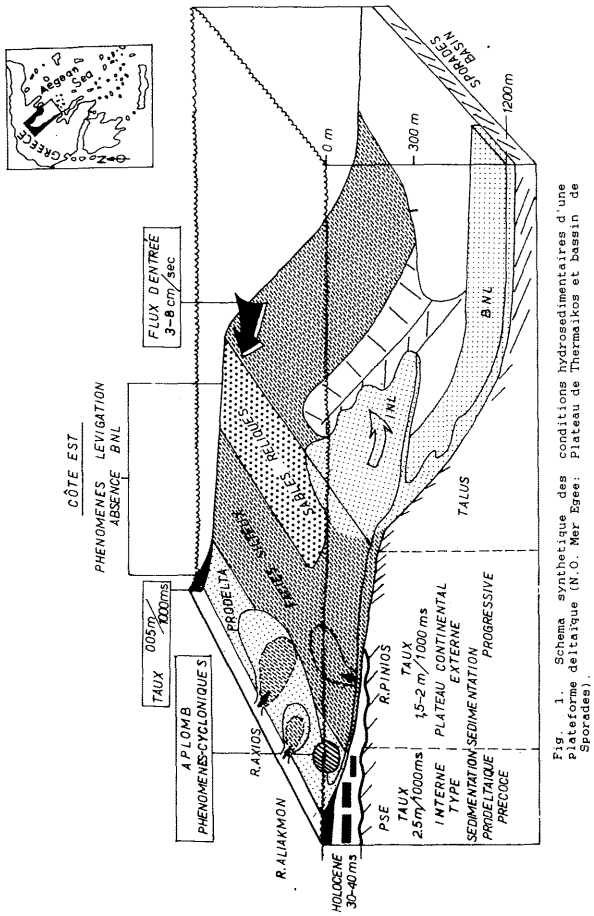

Fig. 1. Schema synthetique des conditions hydrosedimentaires d'une plateforme deltaïque (N.O. Mer Egee: Plateau de Thermaikos et bassin de Sporades).

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