Heat exchange processes at the surface of Elefsis Bay, Greece

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This work aims at determining the fluxes due to heat exchange processes at the surface of Elefsis Bay (Fig. 1), in Saronikos Gulf, Greece. Knowledge of these processes is fundamental, not only for understanding several important oceanographic features of the Bay -such as, inter alia. the seasonal balance of salt and heat, the stratification and the thermohaline circulation- but also for the analysis of the ecosystem of this polluted semi-enclosed shallow coastal embayment.

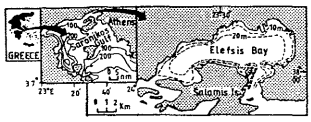

Fig. 1.- Elefsis Bay

The oceanographic data were obtained during twelve monthly cruises, between January and December 1987, by the Greek National Centre for Marine Research. The meteorological data for the same period, were collected at the Elefsis Station of the Greek Meteorological Service; daily mean values, based on three-hourly observations, were used.

The flux of heat across the surface of the sea, Q (Wm^{-2}. positive downwards), is given by:

$$Q = Q_{s\text{-}r} + Q_b + Q_e + Q_h$$

where $Q_{s\text{-}r}$ is the net shortwave radiation. Q_b is the net longwave radiation, Q_e is the latent or evaporative heat flux, and Q_h is the sensible heat flux or turbulent heat conduction. To estimate these fluxes empirical formulas were employed.

The seasonal variations of the surface heat fluxes are displayed graphically in Figure 2, whilst their annual mean values (all in Wm^{-2}) are given below, and represent the annual heat budget for Elefsis Bay :

Solar shortwave radiation		Net longwave radiation		Evaporative heat transfer		Sensible heat transfer		Total heat flux
199	-	68	-	124	-	14	=	-7

Our results show (Fig. 2) that during 1987, the most important heat loss mechanism, from the surface of Elefsis Bay, was evaporation (c), followed by longwave back radiation (b), whilst sensible heat loss was much smaller (d) the total heat loss, from September through February (e), and within the errors involved, was balanced, by the total heat gain, from March through August (e) of that year.

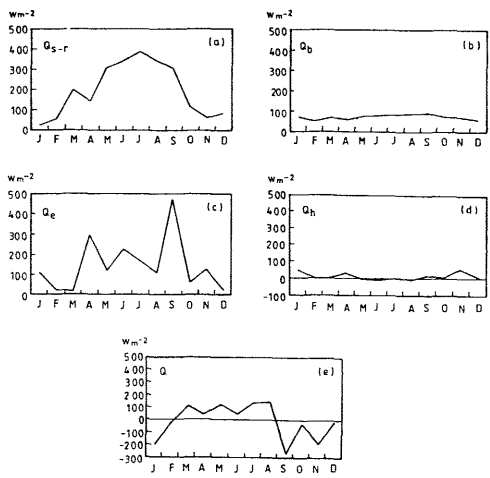

Fig. 2.- The seasonal cycle of surface heat fluxes in Elefsis Bay during 1987.

Our results are in concordance with the findings by BUNKER *et al.* (1982), which hold for the entire Mediterranean Sea. This agreement indicates that the heat exchange processes at the surface of Elefsis Bay are qualitatively and quantitatively identical with the same processes over the broader Mediterranean Sea.

REFERENCES

BUNKER A.F, CHARNOCK H. & GOLDSMITH R.A., 1982.- A note on the heat balance of the Mediterranean and Red Seas. *Journal of Marine Research*, 40, Supplement, 73-84.