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Objective Analysis of P.O.E.M. Greek data : General circulation features and water masses in the Eastern Mediterranean (March/April 1986, September/October 1987)

K. NITTIS*, A. THEOCHARIS** and A. LASCARATOS*

*University of Athens, Department of Applied Physics, 33 Ippokratous str., 10680 Athens (Greece)
**National Centre for Marine Research, Aghios Kosmas, Hellinikon, 16604 (Greece)

During POEM-2-86 (March/April) and POEM-5-87 (September/October) major cruises in the Eastern Ionian, NW Levantine and Southern Aegean, CTD data were collected, using an SBE-profiler on board R/V AEGAIO, from a large number of stations with almost nominal spacing of 0.5 degrees in latitude and longitude.

Measurements were taken at a rate of 33/sec, averaged in situ by software over one second intervals, thus obtaining measurements at about 0.7 decibar intervals, followed by 3 point interpolation to nominal depths (every dbar). CTD salinity was calibrated against water sample salinity, measured by an AUTOSAL salinometer. Intercalibration was carried out, based on common stations occupied by two ships, as simultaneously as possible, in the framework of the POEM coordinated field experiments. Finally, tha data were analysed objectively , using a homogeneous isotropic correlation function, for an optimal estimation of the circulation and water mass distribution during the two above mentioned major seasonal cruises. The produced objective maps of dynamic height reveal an intense mesoscale circulation pattern during both realizations. Various persistent and/or seasonal cyclonic and anticyclonic eddies of different sizes and structure, as well as intense currents are identified in the region.

The objective analysis of the late winter 86 data revealed (fig. 1) : a.- The large meandering cyclonic Rhodes gyre, with an E-W orientation, extending up to the SE of Crete. b.- The western part of the Asia Minor Current is clearly seen boardering the Rhodes gyre to its north and west. An important feature of the winter 1986 circulation is the branching of the Asia Minor Current into the Aegean through the eastern Cretan straits where it transports Levantine waters. c.- The meandering Mid-Mediterranean Current, located between 34 and 35 N, flowing to the east. It carries considerable amounts of AW towards the Levantine Basin. d.- The strong presence of the "Pelops" anticyclonic gyre SW of Peloponnisos in the E. Ionian. e.- The general cyclonic circulation pattern in the Central Cretan Sea, which could be characterized as a continuation of the Asia Minor Current after its entrance in the Aegean through the Kasos strait. f.- The major circulation patterns observed are maintained also in the intermediate depths (300-400 dbars).

During the late summer experiment, a series of large cyclonic and intense anticyclonic gyres predominate in the Levantine and Ionian regions (fig. 2) : a.- The major quasi-permanent cyclonic Rhodes Gyre with an almost N-S orientation, is relatively restricted to the east. b.- West of the Rhodes Gyre and SE of Crete, an intense anticyclone (not present in winter), named "Ierapetra" gyre, is observed.Its presence squeezes the Rhodes Gyre to the east. Geostrophic velocities at the borders of the anticyclone reach 50 cm/sec. Waters coming out

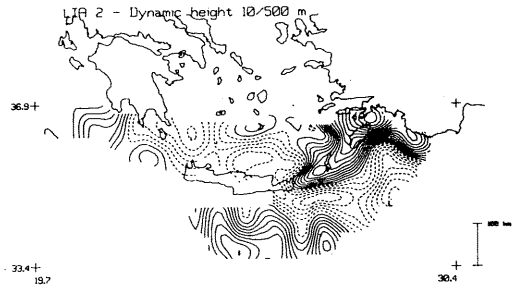

Figure 1.

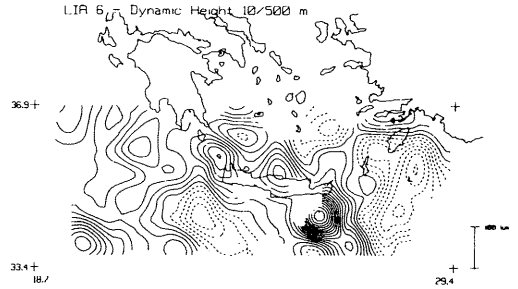

Figure 2.

of the Cretan Sea through the strait of Kasos are canalized between the Ierapetra and Rhodes gyres. c.- The Asia Minor Current meanders around the Rhodes Gyre and bifurcates at Rhodes and Karpathos Straits entering and exiting again the Aegean. Its net transport into the Aegean is minimal compared to that of late winter. d.- The Mid-Mediterranean current is shifted to the south compared to its winter position, between 33.5 and 34 N. e.- In the Ionian, three major circulation features predominate: the persistent Pelops Anticyclone, the large cyclone to the SW of Crete and an anticyclone at the southwesternmost part of the study area (34 N, 19 E). The core of the LIW is trapped by the deep Pelops gyre, while considerable amounts of AW along their eastward route from the Ionian to the Levantine, are recirculated in the Ionian by the cyclone SW of Crete. f.- In the Cretan Sea a series of three anticyclonic eddies predominate, while the meandering circulation is reversed compared to that of the late winter period. g.- The distribution of the salinity minima shows that surface and subsurface layers in the Ionian are occupied by relatively "new" AW, while in the Levantine side the AW can be characterized as "older".

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The Black Sea Circulation: its mesoscale and sub-mesoscale variability as inferred from hydrographic and satellite observations

T. OGUZ*, P.-E. LA VIOLETTE** and U. UNLUATA*

*Middle East Technical University, Institute of Marine Sciences, P.O. Box 28, Erdemli, 33731, Icel (Turkey)
**Naval Oceanographic and Atmospheric Research Laboratory, Stennis Space Center, MS 39529 (U.S.A.)

Quasi-synoptic hydrographic data and satellite imagery are used to describe the circulation and the structural variability of the Black Sea with particular emphasis given to the circulation along the Turkish coast. The data enables to provide several features of the circulation which were not identified earlier and reveals the complexity of the basin-wide cyclonic circulation system. The data indicates that the circulation is characterized by multiple scales of motion and involves, in general, a well-defined meandering rim current and strongly interacting eddy fields ranging from sub-basin scale gyres to sub-mesoscale eddies interconnected with each other by strong jets and filaments. The filaments, often with dipole eddies at their terminus, extend from the shelf-slope region into the offshore waters. The disposition of these offshore filaments imply crucially important dynamical processes related to the shelf-deep basin exchanges. The mesoscale eddies and other fine structure features interact continuously with the mean flow and therefore generates a highly interactive, energetic and temporally variable picture of circulation. The large scale quasi-synoptic features of the general circulation is basically governed by the spatially variable wind stress field and further modified by the thermohaline forcings and the topography.

Along the Turkish coast, the meandering rim current and the mesoscale eddies are confined over the shelf/slope topography conforming to the 200-2000m isobaths. The flow structure is characterized by wave-like disturbances superimposed on the mean flow. The meanders have typical offshore extent of about 75 km from the shelf break and typical alongshore wavelengths of 100-150 km. The features translate eastwards and are often streed by the topography and evolve continuously in time through the instability mechanism. The vertical shear, necessary for the baroclinic instability mechanism, is originated by the strong upper layer flow advecting waters of the cold intermediate layer and relatively weaker flow in the subhalocline waters. Embedded within the meandering rim current, there exists a series of coastal eddies which are all anticyclonic, usually evenly spaced and have alongshore scales of O(100km).

A quantitative evidence for the baroclinic instability mechanism is provided by means of a simple two-layer channel model having uniformly sloping cross-channel topography.

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