

O-I1

Progress in the Understanding of the Eastern Mediterranean Sea

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The basin scale general circulation of the Eastern Mediterranean is now known to consist of a number of sub-basin scale cyclonic and anticyclonic gyres linked by jets and currents. Variabilities include changes in shape, location and strength of the gyres and gyre oscillations, and meander and bifurcations of the currents and jets. Other sub-basin scale vortices and currents are recurrent or transient and jet segments and filaments interleave and interconnect the field of sub-basin scale eddies and gyres. A smaller but energetic synoptic or mesoscale exists, consistent with an internal Rossby radius of ~ 10 km, which interacts with the sub-basin scale features. This new picture has emerged from the coordinated and pooled field data (1985–1987) from the first phase of the POEM program, based on objective analysis of this data set. A systematic taxonomy is presented. Dynamical issues concern the local dynamics of the sub-basin scale features, their linked interactions which constitute the dynamics of the general circulation and the physics of the sub-basin/mesoscale processes. The Harvard dynamical models are initialized with the analyzed fields. The dynamically adjusted and interpolated data provides the best possible three- and four-dimensional fields based on the observations, which are suitable for research requiring detailed transport and dispersion, e.g. biological and chemical studies. Detailed energy and vorticity studies of the physical fields reveal process. The complexity of the system is addressed by initialization and studies of sub-basin scale features and subregions as well as the entire Eastern Mediterranean basin.

O-I2

The General Circulation of the Eastern Mediterranean

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A review is first given of the past phenomenological beliefs and the related structure of the general circulation. Major water mass formation processes are identified and the water masses pathways are discussed. This historical picture is then reanalyzed in view of the most recent observational evidence provided by the general surveys of the POEM program. This new picture of the general circulation reveals sub-basin scale gyres to be the building blocks of the circulation, interconnected by jets and coastal currents that transport and mix the surface and intermediate water masses. The deep circulation is comprised of a single thermohaline cell that originates in the southern Adriatic – northern Ionian sea with the deep water spreading towards the eastern Levantine Basin. Numerical modelling simulations are finally reviewed and discussed with relationship to the above new phenomenology.