THE BLACK SEA CIRCULATION: ITS MESOSCALE AND SUB-MESOSCALE VARIABILITY AS INFERRED FROM HYDROGRAPHIC AND SATELLITE OBSERVATIONS

T. OGUZ[1], P.E. LA VIOLETTE[2], U. UNLUATA[1]

(1) Middle East Technical University, Institute of Marine Sciences, P.O. Box 28, Erdemli, 33731, Icel-TURKEY

(2) Naval Oceanographic and Atmospheric Research Laboratory, Stennis Space Center, MS 39529, USA

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

Rapp. Comm. int Mer Médit., 32, 1990, p. 161

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.