TEMPERATURE, SALINITY AND FLOW VARIATIONS IN THE STRAIT OF ISTANBUL (BOSPHORUS)

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Abstract
Monthly temperature and salinity of the upper and lower layers in the Strait of Istanbul are evaluated between February 1996 and February 2009 to obtain long term changes in physical parameters in the strait. The volume fluxes of the layers are also calculated by using monthly ADCP transects data collected in both exits of the strait, from June 1999 to February 2009. Long term variations of temperature, salinity and volume fluxes supplies calculation of the water budget in the strait.
Keywords: Bosphorus, Temperature, Salinity, Water Transport, Time Series

The Strait of Istanbul (Bosphorus) connects the Sea of Marmara and the Black Sea. It has a two-layer exchange flow system. The upper layer with ~18 psu flows from the Black Sea and the lower layer with ~38 psu flows from the Sea of Marmara [1]. The southward barotropic flow in the upper layer and baroclinic flow in the lower layer are separated from each other by a thin interface. The average volume fluxes of the layers (600 $km^3 year^{-1}$ in the upper layer, 300 $km^3/year^{-1}$ in the lower layer) were calculated in terms of the salt and water budget of the Turkish Sea Straits [1, 2].

The data given in this study were collected in the Strait of Istanbul (Figure 1) by R/V ARAR of the Istanbul University, Institute of Marine Science and Management (IMSM-IU).

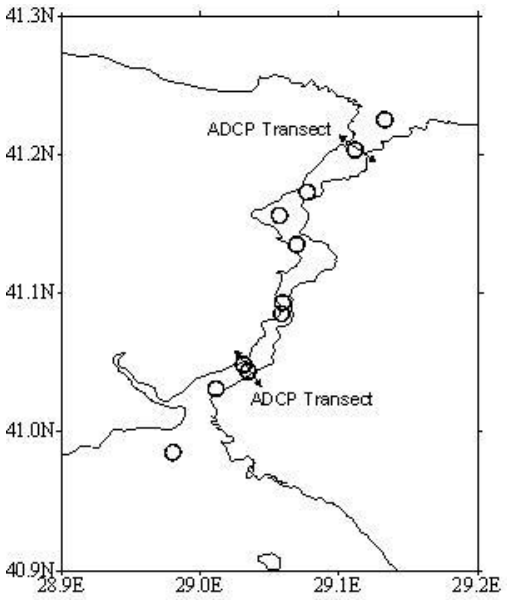

Fig. 1. Stations and ADCP transects locations

Investigation of monthly temperature, salinity and ADCP measurements at the two ends of the strait indicate that these parameters vary in wide range. The temperature changes between 1.9°C in February 1996 and 26.7°C in July 2002 in Black Sea enters. The salinity is in the range of 15.01-18.64 psu.

Our observations indicate that hydraulic control sections agree with a two-layer numerical model [3]. The composite Froude number (G^2) is generally found greater than unity in the southern exit of the strait, in the contraction and in the northern sill. However, current speeds are not high enough to generate hydraulic controls in some situations. For maximal exchange flow two control sections are required in the strait southern exit or the contraction and in the northern sill. We found critical flows at the two ends of the strait at the same time in some months. Usually supercritical flow is observed in only one control section. Especially when the flow is critical in the contraction and southern exit of the strait the lower layer is very thin in the northern section.

The flow exchange is mostly influenced by the hydraulic conditions, the geometry of the strait and rapid changes in the atmospheric conditions [3]. In the strait of Istanbul, the volume fluxes given in Figure 2 vary in an extensive range (upper layer: 5-1051 km^3y^{-1} lower layer: 0.6-866 km^3y^{-1}in the northern exit; upper layer: 0-1216 km^3y^{-1} lower layer: 0-654 km^3y^{-1}in southern exit).

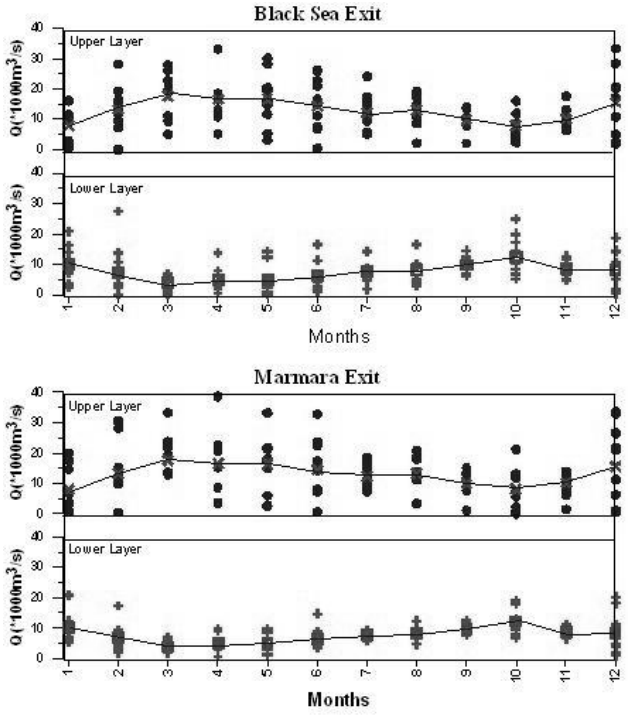

Fig. 2. Monthly volume fluxes

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