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# Observing the Black Sea with Profiling Floats

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## LONG-TERM GOALS

It is the long-term goal of this work to gain a better understanding of the circulation of the Black Sea. While the nations bordering the Black Sea each have individual programs in scientific exploration and analysis of the Sea, these efforts have not generally been well coordinated, and the most modern technology has not been used. It is the goal of this work to begin a coordinated effort to study the Black Sea with modern profiling floats.

## OBJECTIVES

The objective of this work was to collect a large number of high quality temperature and salinity profiles from the Black Sea during all seasons, over the course of several years, in order to be able to examine the circulation in the upper 1500 m. The circulation below 500 m in the Black Sea has not been previously well-observed over long periods, and it is planned to examine this circulation for the first time in this work.

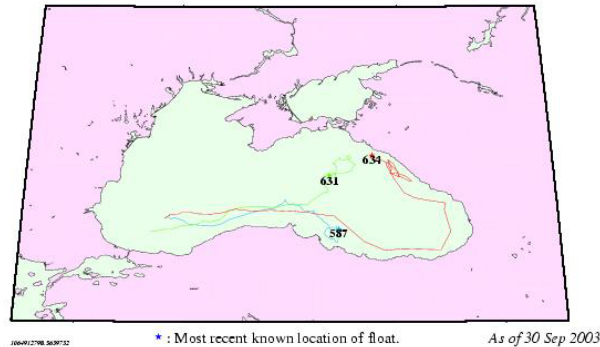
## APPROACH

In order to carry out this work, 5 profiling floats are being deployed in the Black Sea between 2002 and 2004. A parking depth of near 1500 m was chosen for all of the floats, with CTD profiles collected every 7 days.

## WORK COMPLETED

Three floats were deployed in the Black Sea in the summer of 2002, as shown in Figure 1. These floats have now been in the water for over one year and have revealed the existence of a significant cyclonic flow at depths near 1500 m in the Sea. This deep flow, with average speeds in excess of 2 cm/sec, was previously unknown. It is hypothesized that this flow is barotropic, and the existence of this flow is now being examined in numerical models of the Black Sea. During FY2003 it was

planned to deploy a 4th float in the Black Sea. This float was constructed at UW and prepared for deployment in May 2003, and is awaiting shipment from Seattle to Turkey. Owing to present international conditions we have had some difficulties in making customs arrangements for delivering this float to our Turkish colleagues. We believe that these difficulties have now been overcome and the float should be shipped to Turkey and deployed before the end of calendar 2003.



**Figure 1. Trajectories of 3 floats deployed in the Black Sea during 2002.**

## RESULTS

The flows revealed by the floats at depths near 1500 m are generally in excess of 2 cm/sec and sometimes are as large as 10 cm/sec. Flows of this magnitude are generally unexpected at depth in the Black Sea. As additional instruments are deployed in other parts of the Black Sea (the northwest region, for example), it is anticipated that other deep flows might be found.

## IMPACT/APPLICATIONS

Eventually these data will be used to compare to model results from the Black Sea; there is a vigorous modeling effort underway at MHI in Sebastopol. A number of scientists from the region are also interested in data assimilation in models, and the data generated by the floats is ideal for assimilating into circulation models. It is hoped that once the utility of profiling float data in the Black Sea can be clearly demonstrated, the nations of the region will invest in their own float arrays.