

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, 3 profiling floats were 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. Two of these floats were recovered after being stranded in shallow water late in 2004 and early in 2005; one of these was damaged and was returned to UW for repair. This float was subsequently returned to Turkey. The refurbished float and the second float that was recovered were redeployed in the Black Sea in 2005, and in 2006 two additional floats supplied by UW were deployed. At the present time 4 floats purchased and fabricated as part of this grant are operating in the Black Sea, all with nominal parking depths of 1500 m.

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WORK COMPLETED

Three floats were deployed in the Black Sea in the summer of 2002, as shown in Figure 1. One of these floats (Float 587) lasted for a year and a half before grounding along the Turkish coast in the southeastern Black Sea. The other two also eventually grounded on shore, but not before working for over 100 profiles through April of 2005. These floats 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.

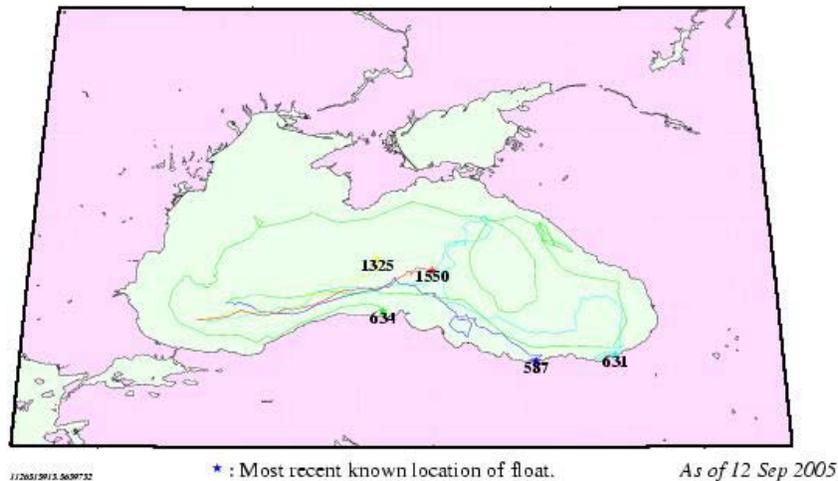


Figure 1. Trajectories of 5 floats deployed in the Black Sea between 2002 and 2005.

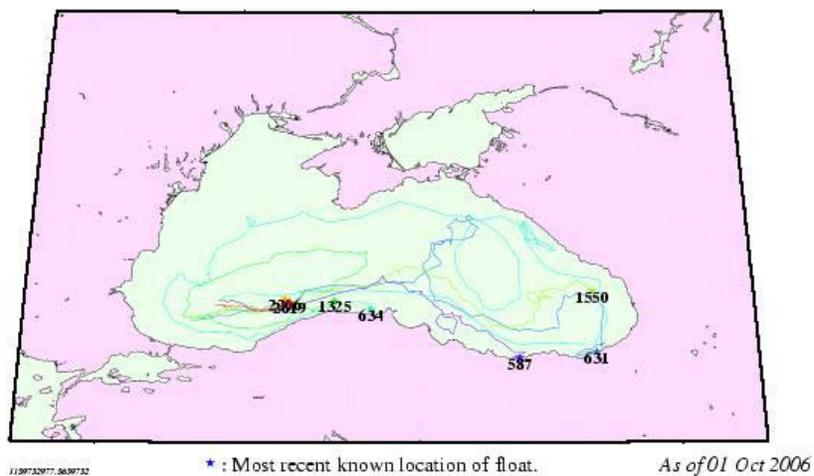


Figure 2. Trajectories of 4 floats deployed in 2005 and 2006.

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. These are the first long-term observations of deep flow, in the anoxic zone, of the Black Sea and will eventually prove useful for comparison to model scenarios of the Black Sea circulation.

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.

RELATED PROJECTS

The UW group is one of the US centers for deployment of profiling floats as part of the international Argo project. As such, we have built and deployed over 120 floats in the world ocean for Argo in the past year, as well as carrying out several smaller cooperative efforts with scientists in other nations such as this Black Sea effort. We are carrying out a similar project in the Aegean Sea with scientists from Greece (see <http://flux.ocean.washington.edu/uoa>).

PUBLICATIONS

A paper describing these results will appear late in 2006 in a special issue of *Deep-Sea Research* devoted to the Black Sea. The reference for this paper is:

Oguz, T., G. Korotaev, and S. Riser (2006) Observing the Black Sea with profiling floats. *Deep-Sea Research* [in press, refereed].