Dr. Amy Bower
Previous Research Projects

[Red Sea Outflow Experiment]

co-PIs: Amy Bower and Dave Fratantoni (WHOI), Bill Johns and Hartmut Peters (RSMAS)

The Red Sea Outflow Experiment (REDSOX) is a joint effort between the University of Miami's Rosenstiel School of Marine and Atmospheric Science (RSMAS) and WHOI. The purpose of the program is to conduct measurements of the outflow of high salinity water from the Red Sea and its mixing with ambient waters in the Gulf of Aden. The main objectives of REDSOX are: 1) to describe the pathways and downstream evolution of the descending outflow plumes of Red Sea Water in the western Gulf of Aden, 2) to quantify the process that controls the final depth of the equilibrated Red Sea Outflow Water, and 3) to identify the transport processes and mechanisms that advect Red Sea Outflow Water and its properties through the Gulf of Aden and into the Indian Ocean. The program is funded by NSF.

[Atlantic Climate and Circulation Experiment]

Warm Water Pathways and Intergyre Exchange in the Northeastern North Atlantic

co-PIs: Amy Bower and Phil Richardson (WHOI)

The North Atlantic Current, which transports subtropical water northeastward from the Gulf Stream, and the Poleward Eastern Boundary Current, which carries Mediterranean Outflow Water northward along the European continental slope have been proposed as the two most likely sources of the warm, salty water that is transformed into intermediate and deep water in the subpolar region. We are studying the circulation in this region using isopycnal, acoustically-tracked RAFOS floats that have been deployed in these two currents with the overall goal of describing the pathways of warm water towards the subpolar region. Our specific objectives are to 1) provide a quantitative description of the bifurcation of the North Atlantic Current east of the Mid-Atlantic Ridge; 2) assess the importance of meridional eddy fluxes, compared to large-scale advection, in the northward flux of heat and salt in the northeastern North Atlantic; and 3) establish the degree of continuity of the Poleward Eastern Boundary Current to the entrance to the Norwegian Sea and the fate of the Mediterranean Outflow Water carried by this current.

[Arabian Marginal Seas and Gulfs]

co-PIs: Amy Bower and Jim Price (WHOI)

We have analyzed hydrographic data collected by the U. S. Naval Oceanographic Office (NAVOCEANO) in the outflow region of two important marginal seas; the Red Sea and the Persian Gulf. Our goal was to describe the synoptic scale structure of the outflow hydrography, with particular emphasis on (1) mixing of the outflow currents with the oceanic environment; (2) the occurrence of eddy formation (i.e. Reddies) and (3) the effect of the outflows on the adjacent seas. The primary data resource for this analysis was the synoptic AXBT surveys acquired by NAVOCEANO in the Gulf of Aden and Gulf of Oman. We have also used the one-dimensional outflow plume model of Price and Baringer (1994) to investigate the dynamics of these two outflows.

[Mediterranean Outflow and Meddies]

co-PIs: Amy Bower (WHOI), Lawrence Armi (SIO/UCSD), Isabel Ambar (U. Lisbon), and Phil Richardson (WHOI)

The Mediterranean salt tongue is a prominent feature of the North Atlantic Ocean at mid-depths. The discovery of isolated lenses of salty Mediterranean Water (meddies) in the last decade has challenged the traditional view of this tongue as a purely advective/diffusive feature. The role of these meddies in the salt and heat budgets of the North Atlantic is not well-understood. We studied the dispersion of Mediterranean Water into the North Atlantic via meddies and other processes. In 1993-1994, we seeded the Mediterranean Undercurrent near its source with Lagrangian drifters. Forty-nine RAFOS floats were launched sequentially in the Mediterranean Undercurrent south of Portugal and tracked for up to 11 months. Our specific objectives to date have been 1) to identify the most important meddy formation site(s); 2) to make the first direct estimate of the frequency of meddy formation; 3) to document the pathways of meddies and their life histories; and 4) to determine the pathways by which Mediterranean Water which is not trapped in the meddies enters the North Atlantic. The trajectories of floats caught in meddies are easily recognizable due to the persistent and rapid anticyclonic motion associated with these features. As a result of this study, we advanced our understanding of how Mediterranean Water enters the subtropical gyre of the North Atlantic.

[Deep Western Boundary Current]

co-PIs: Amy Bower (WHOI), Robert Pickart (WHOI) and William Smethie (LDEO)

In this study, hydrography, tracer measurements and float observations were combined to obtain the first comprehensive description of the North Atlantic Deep Western Boundary Current (DWBC) variability over a large path segment. The hydrographic portion consisted of two occupations (six months apart) of six finely resolved sections across the DWBC from the Grand Banks of Newfoundland to Cape Hatteras. Over this distance (roughly 1700 km) the DWBC encounters diverse conditions, including variations in bottom slope and roughness, as well as proximity to the Gulf Stream. The main objectives of the hydrographic study were to determine the synoptic velocity and water mass structure of the DWBC in order to investigate the nature and cause of the observed variability. Lagrangian RAFOS floats were launched at different locations in the DWBC during the hydrographic cruises and tracked for two years. The main objectives of the Lagrangian study were to determine fluid parcel pathways in the DWBC and identify regions of exchange with the interior. A total of 30 floats were launched, half in the upper chlorofluorocarbon (CFC) maximum associated with Upper Labrador Sea Water (~800 meters) and half near the deep CFC maximum associated with Denmark Straits Overflow Water (~3000 meters).

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