

ENDEAVOR 257 CRUISE SUMMARY: A STUDY OF DEEP WESTERN BOUNDARY CURRENT VARIABILITY

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In November 1994 the first of two cruises was completed as part of an intensive study of the North Atlantic Deep Western Boundary Current (DWBC). The overall goal of BOUNCE (for boundary current experiment) is to gain a better understanding of the nature and cause of the current's variability in order to help sort out the role of upstream versus local forcing. The approach is to use hydrography and geochemical tracers together with Lagrangian drifters to obtain a comprehensive description of the current's structure and path throughout the Middle Atlantic Bight. The first cruise (BOUNCE I) was aboard R/V ENDEAVOR from 5 November to 28 November, during which five sections were occupied across the current and 24 RAFOS floats launched at various locations and depths. BOUNCE II is scheduled for May, 1995 and will re-occupy the sections (including some additional lines) and deploy 6 more floats. Below is a brief description of the different components of the first cruise.

Hydrography and Tracers

Because the cruise was scheduled for November it was expected that some bad weather would be encountered. However, we experienced particularly harsh weather over the entire month, and as a result could occupy only 5 out of 9 planned sections. Out of the 24 ship days, 8 days were lost because of weather, and typical working conditions over most of the remaining days consisted of winds of over 20 knots. Hence, the fact that 5 full sections were completed speaks to the hard work and dedication of the crew and scientists involved.

all of which were along TOPEX/POSEIDON altimetric sub-tracks. A typical station consisted of a CTD cast to the bottom, with 24 water samples for measurement of salinity, oxygen and CFCs. A lowered Acoustic Doppler Current Profiler (ADCP) was attached to the CTD frame, providing the first-ever velocity measurements of this kind in the DWBC. At the end of each cast a POGO float was deployed to obtain a direct measure of the vertically integrated current. The type of float used was a new-generation GPS-POGO float built specifically for this project, which internally records the satellite position at launch and upon surfacing. The ADCP and POGO data will be used in concert to obtain sections of absolute velocity, and used as well for referencing the geostrophic velocities and comparison with the altimeter data.

During the course of the cruise the water sample salinity was used to refine the calibration of the CTD. In addition, the water sample oxygen and CFCs were merged with the CTD Pressure, temperature, and salinity for creating vertical sections. This information helped guide the deployment of the RAFOS floats (see next section). Figure 2 shows the vertical sections of temperature, CFC-11, and Along-isobath ADCP velocity for the section at 55 degrees W (which incidently is the third such occupation over the past decade). The dark solid circles indicate the locations of the RAFOS floats launched along this section. The topography was obtained from digitizing the shipboard sonic data in near real time. Perhaps the most striking aspect to the section (and the others as well) is the large amount of newly ventilated Labrador Sea Water (LSW) at mid-depth (evident as a high CFC-11 core near the boundary between 1000-2000m depth). This represents a drastic change in this portion of the DWBC, which for the decade of the 1980's was nearly void of new LSW. The other striking feature is the overall character of the velocity field which shows alternating equatorward and poleward bands of flow. This was also a common feature in most of the sections and is perhaps indicative of large meso-scale activity. One of the objectives of this project is to sort out such variability and relate it to the presence and behavior of the DWBC. The re-occupation next spring, along with the Lagrangian trajectories, will provide invaluable information for interpreting the complex structure in these sections.

RAFOS Floats

We had planned to launch 30 acoustically tracked RAFOS floats for two-year missions along eight of the nine planned CTD sections. Four floats were to be launched along each of seven lines, two tagging the deep CFC maximum, and two tagging the upper CFC maximum. Due to the unusually bad weather, and the subsequent reduction in the number of sections, only 24 of the 30 floats were deployed. Four floats were launched along the first, second and fifth sections, and six floats were launched along sections three and four. Figure 3 shows the locations of the float deployments. All but one of the floats were set to their planned target depths: deep floats to 3000 m, and shallow, isopycnal floats to $\sigma_t = 27.73$ (800 m, nominal depth). To one deep float, launched at the southern end of section 4 (# 281), we added 4 3/8" washers to increase the target depth to about 3320 m. This was done in an attempt to get one float closer to the center of the deep CFC maximum. The six remaining floats will be deployed during BOUNCE II in May, 1995.