

## **Deepglider Pilot Observations of Full Water Column Structure near Bermuda and Relevance to AMOC Estimation**

*C. C. Eriksen*

*School of Oceanography, University of Washington, Seattle, WA 98195-5351, USA*

*email: [eriksen@uw.edu](mailto:eriksen@uw.edu)*

Estimates of the Atlantic Meridional Overturning Circulation (AMOC) are derived from mass, heat, and fresh water transports, which in turn, are based on observations of spatially and temporally varying current, temperature, salinity and tracer fields. We describe using a long-range autonomous underwater Deepglider to continuously survey the full open deep ocean water column near the Bermuda Atlantic Time Series (BATS) site 90 km southeast of Bermuda through spring 2014.

A Deepglider recently completed an 89-day test mission, launched from a small boat within sight of Bermuda and recovered by a research vessel. It operated for 12 days as a 'virtual mooring' at Hydrostation S, after which it surveyed an 80 km corner-to-corner bow-tie pattern centered on the BATS site, repeating the pattern fortnightly. Deepglider completed 22 dive cycles to depths between 3000 and 4000 m near Hydrostation S and 59 dive cycles to depths between 4000 and 4833 m in the repeat survey. These dive cycles produced 156 profiles of temperature, salinity, and dissolved oxygen at 0.5-3 m resolution from the top meter of the water column to within 30 m of the ocean bottom. All data and control commands were transmitted between dive cycles at the sea surface via Iridium data telemetry, typically in a single call lasting ~10 minutes. For calibration comparison, collocated monthly shipboard CTD casts were carried out simultaneously with Deepglider dives. Processing to evaluate Deepglider data quality and illustrate capabilities relevant to AMOC observation is underway, with results to be presented at the meeting.

In addition to gathering hydrographic sections, each Deepglider dive cycle returns an estimate of depth-average current from comparing distance between successive GPS fixes with horizontal displacement through the water computed from a flight model. Because Deepglider was making full-depth dives, these estimates are of the rarely observed *barotropic* mode. They serve as a reference to integrated shear inferred from lateral density gradients to give profiles of absolute geostrophic current. Barotropic currents in the BATS region were persistently to the southwest at speeds in the range 0.05-0.15 m/s, except during the passage of a submesoscale anticyclone. This eddy, distinguished by cool, fresh water nearly saturated in dissolved oxygen between ~1000 m and ~2000 m depth, induced even stronger, swirling, barotropic currents.

Based on power consumption near BATS, Deepglider mission endurance is 18 months and range is 10,000 km, making it capable of full-depth sections across Atlantic basins or portions thereof, of the kind useful to observing AMOC structure and variability. Per mission and fabrication costs are comparable to the cost of operating a research vessel for 1 and 4 days, respectively.