

# Float of the month

June 2010

## Formation of 18 degree water

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Float #4900159 was launched Dec. 12th, 2001 in the subtropical North Atlantic. The WHOI built SOLO float returned 206 profiles over a 6 year lifetime. Figure 1 is an index map illustrating the float trajectory and positions of reported profiles. The overall journey of the float reflects the large-scale clock-wise circulation of the subtropical gyre. The structure of the subtropical thermocline is revealed in Figure 2 which shows a general deepening of isohalines consistent with overall "bowling" of the thermocline towards the west. In addition to recording the large-scale thermocline structure, the float was located in a region recognized for the formation of North Atlantic Subtropical Mode Water (18°-Water).

Significant events of the mission are summarized in the captions for Figure 1 and described in more detail below. In September 2003, the float observed several profiles of anomalous temperature-salinity structure. While first considered to be a sensor malfunction, comparison with satellite altimetry (courtesy Stephanie Guinehut) confirmed that the anomalously cold, fresh water was due to the presence of a cold-core ring.

The observed temperature (Figure 2) provides a good illustration of the yearly formation and destruction of the temperature-stratified seasonal thermocline. The time series of sea surface temperature (SST) is shown in Figure 4. Mixed layer depth (Figure 5) was calculated using SST and a delta-temperature of 0.05°C. Deep mixed layers associated with the formation of 18°-Water are observed every winter but were especially intense during the winters of 2003-04 and 2004-05. The locations of the deepest observed mixed layers are indicated on the index map in Figure 1.

After 5.5 years of generally westward drift, the float was entrained into the Gulf Stream and carried rapidly northward. As this was an early float, the surface-time was programmed to 24 hours to ensure satellite transmission. The long period spent at the surface is particularly apparent in the Gulf Stream where sizable drift displacements are evident at each surfacing. The maximum observed surface velocity in the Gulf Stream was 1.7 m/s. Profiles within the Gulf Stream were significantly cooler and fresher than the overall record and can be seen here as regions of tightly packed isopleths Figures 2 and 3.

After the brief transit in the Gulf Stream, float #4900159 spun off into the region of strong recirculation to the south of the Stream. The float circled within this area for a few more months with the last profile reported on Nov. 24th 2007. While we are uncertain of the cause of failure, the float appears to have remained at the surface after this, reporting its location every 10 days until April 28th, 2008 after which no

further transmissions were received.

The overall data return (206 profiles) and data quality for this float was excellent. The most notable failure is the, as yet, unexplained absence of reports for 10 profiles during the summer of 2004. Application of Owens & Wong (2009) calibration method reveals no evidence of drift of the SeaBird 41CP conductivity sensor over the 6 year float lifetime.

