

Wayward Water?

The Argo float of the month for October 2008 is WMO# 4900691. This Scripps Institution of Oceanography float was deployed from the R/V Kaharoa on the 20th of January, 2006 in the eastern sub-tropical North Pacific. Since then it has generally drifted towards the Hawaiian Islands (West by Southwest, figure 1) following the general sub-tropical gyre circulation.

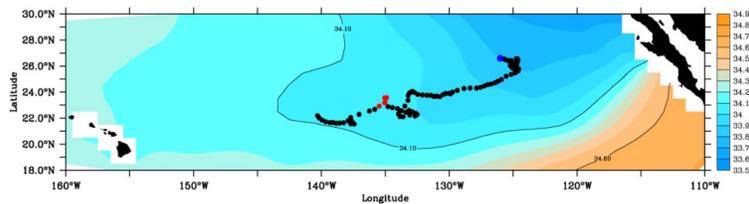


Figure 1. Profile positions for WMO# 4900491 (black). The first profile is highlighted by a blue circle. Profiles which were recorded within the eddy are highlighted in red. The background contouring is the salinity on the 11 degree C isotherm computed from WOA05 (Boyer et al., 2006).

Over the first 2 years, the float's recorded temperature and salinity data is unremarkable, being consistent with historical data. In particular, at 11°C, salinity values are fresher than 34.1 psu in the vicinity of the float (figure 1). However at cycle 81 (February 29th, 2008) the float sampled a subsurface lens (eddy) of warm, saline ('spicy') water, most easily identified in its Temperature-Salinity signature (figure 2). The core of the lens was saline by ~0.5 psu and ~2°C warm. A temperature inversion at the top of the lens allowed the water column to remain stably stratified in the presence of this strong, subsurface salinity increase.

The float sampled this anomalous water for 5 cycles (81-85). During these cycles the float was observed to have a slight anticyclonic (clockwise) revolution (figure 1). After cycle 85 the float returned to sampling locally consistent water properties and resumed its drift towards Hawaii.

Figure 3 shows the time evolution (represented by cycle number) of temperature and salinity from float SIO-4900691. The anomaly over cycles 81-85 appears restricted to the subsurface pressure range of 250-800db. There is no obvious temperature or salinity surface signature.

Were there any other Argo floats in the vicinity able to corroborate these salinity and temperature values? A University of Washington Argo float, WMO# 5901055, deployed on the same Kaharoa voyage, simultaneously sampled the same eddy feature. In fact, the UW float was trapped within the eddy for over a year.

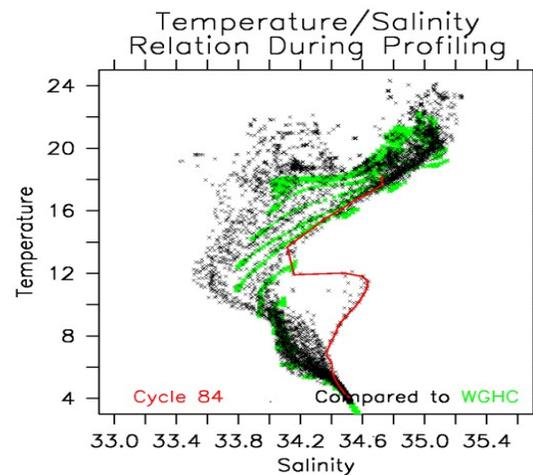


Figure 2. T/S relation from float 4900691 (black). Cycle 84 is highlighted in red to show the water mass characteristics of the eddy. The WOCE Global Hydrographic Climatology is shown in green (Gouretski and Koltermann, 2004).

Using the position data from UW-5901055 (figure 4) the eddy moved towards the WSW at just over 4 cm/s. Just as in the SIO-4900691 positions, the same anticyclonic revolutions can be observed. The diameter of the floats revolutions, $O(70 \text{ km})$, estimate a lower limit to the size of the eddy.

Many studies utilize the relationship between altimetric and subsurface anomalies to identify eddies (e. g. Gilson *et al.*, 1998). However the spiciness (warm and saline) of this eddy, results in a small seasonally adjusted steric height anomaly. Neither does Aviso altimetry have a strong sea surface height signal at this time and location (Ducet *et al.*, 2000). Argo and altimetry strongly complement each other, but neither provides a complete oceanic picture.

Eddies with similar characteristics (high spiciness, anticyclonic, subsurface, westward drifting, little sea surface height signal) have previously been studied in the California Current system (e. g. Huyet *et al.*, 1998; Cornuelle *et al.*, 2000; Chereskin *et al.*, 2000). Acknowledging their similarity to 'meddies' in the eastern North Atlantic, Garfield (1999) labeled these California Undercurrent spawned eddies 'cuddies'. The California Undercurrent flows poleward carrying warmer and saltier (figure 1) eastern Pacific Equatorial waters along the west coast of the Baja Peninsula and the United States.

Thus it is likely that SIO Argo float WMO# 4900691 sampled a wayward eddy, spun off the California Undercurrent, as it drifted westward into the Pacific.

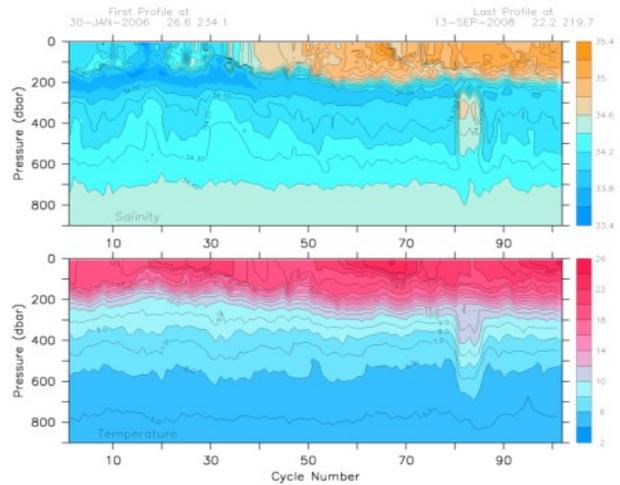


Figure 3. Contour of salinity (top) and temperature (bottom) from float 4900691.

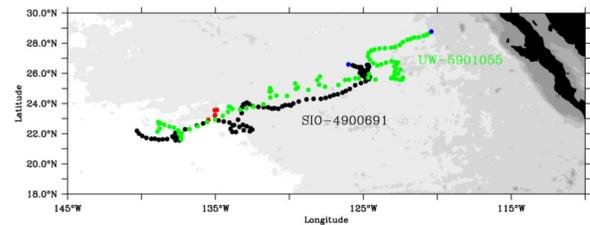


Figure 4. Locations of SIO-4900691 (same as figure 1) and UW-5901055 (green) cycles.

References

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