

Float of the month

August 2009

Tracking North Pacific Central Mode Water for six years

Toshio Suga (Tohoku University and JAMSTEC)

The Argo float of the month for August 2009 is WMO ID **2900281**. This float was deployed during RV Hakuho-Maru Cruise KH-03-1 at 36°N and 180°E on 22 May 2003 near the northern edge of the North Pacific subtropical gyre. It has been measuring temperature and salinity for 6 years and 2 months and still active. This JAMSTEC float is an isopycnal APEX aiming to follow North Pacific Central Mode Water (NPCMW; Nakamura, 1996; Suga et al., 1997), which is a major agent to ventilate the lower part of the subtropical ventilated pycnocline (e.g. Suga et al., 2008).

The shipboard CTD measurement just prior to the float deployment detected thick pycnostad at $s_q = 25.8\text{-}26.0 \text{ kgm}^{-3}$, which was considerably lighter than typical NPCMW pycnostad ($s_q = 26.2\text{-}26.4 \text{ kgm}^{-3}$) in this area according to the climatology (e.g. Suga et al., 2004). We thus decided to set the target isopycnal at $s_q = 26.35 \pm 0.10 \text{ kgm}^{-3}$, hoping that the float would be kept by typical NPCMW pycnostad in the course of its journey. Its preset profiling depth is 2000 db and the profiling cycle is 10 days.

Immediately after the deployment, the float faced unexpected difficulty. It appeared that the float was too light probably due to inappropriate ballasting. As a result, the float couldn't descend to the target isopycnal and struggled near the sea surface for the first 5 days; it then gradually descended and reached to $s_q = 26.28 \text{ kgm}^{-3}$ (~500 db) just before it made the first vertical profile from 637 db to the surface. During the second cycle, the float reached to its target isopycnal and has been following it since then. But it still cannot descend to the preset profiling depth and its actual profiling depth has been 750-850 db. Never mind. Life is not so bad. Owing to the operation at shallow depths with spending less energy, the float has been enjoying a long life-span.

After about a year from the deployment, around the 40th profile (late June 2004), the float was kept by typical NPCMW pycnostad, as we had wished, and appears to have been tracking it since then. The NPCMW pycnostad was prominent at 150-350 db until the end of the following winter (panel c). The pycnostad became much weaker after that but still distinct with having a patchy core (potential vorticity minimum) between 250 db and 400 db. Its zonal excursion of ~2000 km for the last 5 years or so is consistent with the climatological geostrophic flow speed of $\sim 1 \text{ cms}^{-1}$ in the NPCMW pycnostad around $s_q = 26.4 \text{ kgm}^{-3}$ (Suga et al., 2004). The isopycnal deepening of ~50 m during the same period (panel b) is also consistent with the climatological annual mean Ekman velocity of ~10 m/year in this region (Suga et al., 2008). The accidental long life of this float is likely to make unique contribution to revealing the life of NPCMW.

Reference

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Suga, T., Y. Aoki, H. Saito, and K. Hanawa, 2008: Ventilation of the North Pacific subtropical pycnocline and mode water formation. *Prog. Oceanogr.*, **77**, 285-297.

(a) The migration path of JAMSTEC float WMO ID 2900281. The positions of profiles are indicated by dots with colors according to the year of the observation.

