RBR

Argo float WMO5906299: Analysis of fresh salinity anomalies

Summary

Argo float number WMO5906299 was deployed near Hawaii in 2020, equipped with the RBRargo^3 CTD. After about 30 profiles, a clear and sudden fresh salinity anomaly was identified in the salinity measurements. After analysis, the float was found to have spent an abnormally long amount of time at the surface on several occasions, often preceding a clear salinity anomaly event. It is hypothesized that the extended surfacing time of the float in tropical water led to biofouling growth on the CTD.

Evidence of drift

A time series of the salinity measured at 2000 dbar reveals clear and sudden fresh anomalies in the salinity (Figure 1). These fresh anomalies in salinity are confirmed in the T-S diagram including the first 102 profiles, demonstrating a homogeneous drift through depth. The homogeneity throughout the profiles suggests that the salinity anomalies are not pressure-related, but rather linked to a change in the electric field of the conductivity cell with respect to calibration (Figure 2).

Float abnormal behavior

The float metadata included with each profile was used to estimate the amount of time spent at the surface. The variables **TimeStartDescent** and **TimeStopProfile** were used to compute the surfacing time preceding a profile, and reveal that the float often spent an abnormal amount of time at the surface, starting at profile 23 (Figure 1). Over the first 22 profiles, time spent at the surface generally did not exceed 30 min. However, on several occasions, surfacing times were much longer: for example, the float spent over 33 hours at the surface before profile 23. While not every prolonged surfacing leads to a clear and obvious salinity anomaly, one can often link sudden salinity changes observed in the data to a prolonged surfacing time (red lines in Figure 1). This sustains the hypothesis that salinity anomalies are likely caused by biofouling developing during these extended surfacing times in tropical waters ($T > 25^{\circ}C$). This is further supported by both the direction of the anomaly (i.e., fresh), and the fact that salinity measurements at 2000 dbar sometimes "recover" (e.g., profile 56), revealing that the cause for the salinity error is reversible and thus likely external to the CTD.

This abnormal behavior has been linked to an identified malfunction in the pneumatic bladder on some Apex floats [1], which has prolonged surfacings of floats and thus likely permitted a more substantial biological growth on the CTD.

Conclusion and recommendation

It is hypothesized that the abnormally long surfacing times of the float led to biofouling growth on the CTD. Salinity measurements collected after profile 22 should be carefully evaluated.

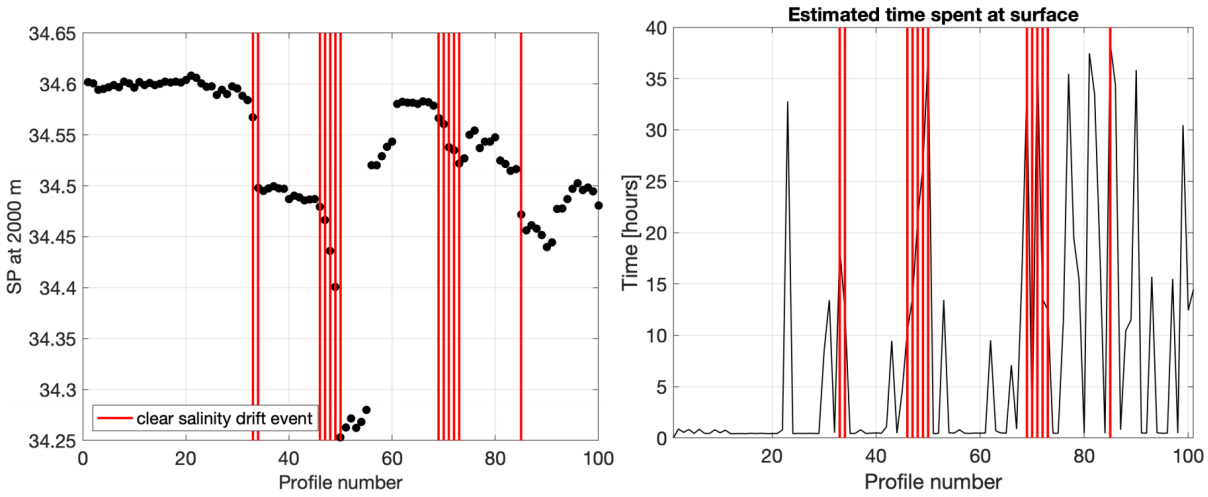

Figure 1: [left] Salinity measurement at 2000 dbar for each Argo profile completed by WMO5906299. Vertical lines highlight clear, sudden salinity anomalies with respect to the previous profile. [right] Estimated time spent at the surface. Salinity anomalies seem to appear after a prolonged surfacing of the float.

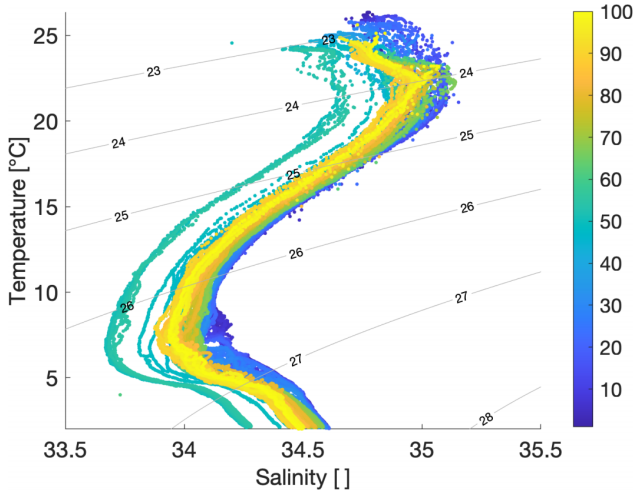

Figure 2: T-S diagram for WMO5906299, showing fresh salinity anomalies that are homogeneous throughout the water column.

References

[1] Dana Swift Apex Pneumatic Bladder Air Entrapment & Darcy Loss. Retrieved from: https://argo.ucsd.edu/wp-content/uploads/sites/361/2021/03/PneumaticBladderAirEntrapment.pdf

Revision Log

Rev	Revised by	Date	Description of Change
A	Mathieu Dever	Jun 22, 2021	Initial release