Note of Delayed Mode Quality Control of Argo float WMO 6903268

For more detailed: Antonella Gallo agallo@ogs.it

This note includes the results of OWC performed for the WMO 6903268 float. The reference dataset used is composed of the following CTD and Argo historical datasets:

CTD:
CMEMS:

- INSITU_MED_PHYBGCWAV_DISCRETE_MYNRT_013_035
- Coriolis: CTD_for_DMQC_2024V01
- Historical CTD profiles provided through personal contact

Argo:

- ARGO_for_DMQC_2022V03

Float 6903268 is the Arvor float, where the pressure sensor is auto corrected and no adjustment is required. This float is a deep float. For this type of floats, the salinity data show a bias that is dependent on pressure. Therefore, is necessary to correct for pressure effects on conductivity (CPcor correction) before applying DMQC analysis.
The OWC was run to estimate a salinity offset and a salinity drift (Cabanes et al., 2016).

CPcor correction

The three CPcor values: the nominal CPcor value used by Sea-Bird, the recommended standard CPcor_new values and the optimized estimate of CPcor_new, are applied to correct the salinity bias due to the pressure effect. The CTD profile used to estimate the optimized CPcor correction is shown in figure 1. This CTD cast was done few months before the deployment and it can be considering quite close in time to the float deployment.

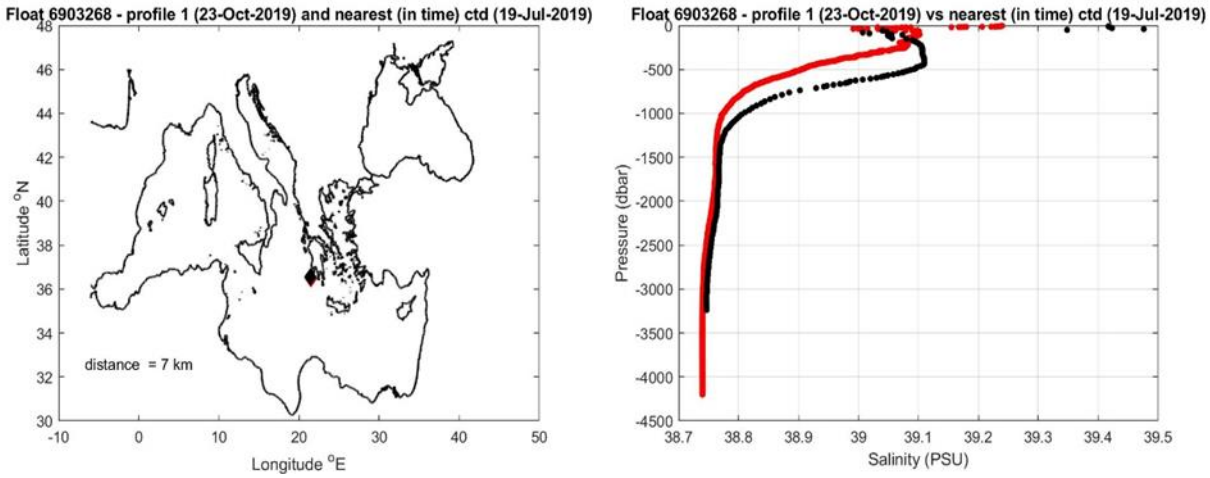

Figure 1: The salinity float profile number 1 (black dots) are compared to the nearest in time reference profile (red dots). The locations of the two profiles and their distance is given in the left panel.

Figure 2 shows the comparison between the effect of CPcor corrections to salinity profiles. Both CPcor correction with default and optimized value leads to the positive deviation from CTD. The best result was obtained applying the nominal CPcor value.

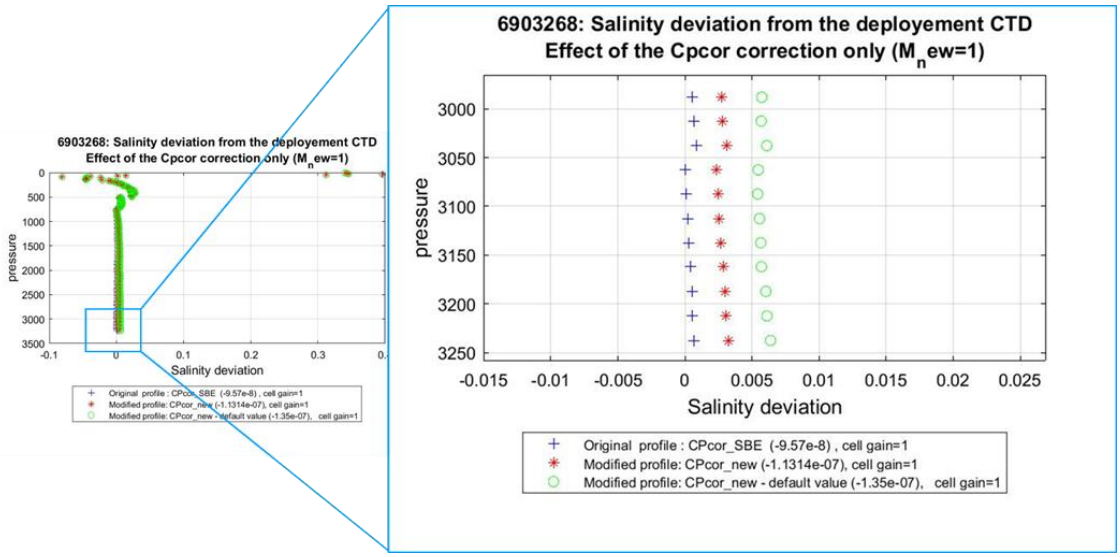

Figure 2: Salinity deviation from the deployment CTD due to the CPcor correction using three values: the nominal CPcor value from SeaBird, the CPcor_new default value obtained by Argo deep team and optimized CPcor value obtained in delayed-mode by comparing a deep float profile to a reference profile.

Configurations

Parameters	Value
CONFIG_MAX_CASTS	300
MAP_USE_PV	1
MAP_USE_SAF	0
MAPSCALE_LONGITUDE_LARGE	4
MAPSCALE_LONGITUDE_SMALL	1.33
MAPSCALE_LATITUDE_LARGE	4
MAPSCALE_LATITUDE_SMALL	1.33
MAPSCALE_PHI_LARGE	0.5
MAPSCALE_PHI_SMALL	0.1
MAPSCALE_AGE	10
MAP_P_EXCLUDE	700
MAP_P_DELTA	250
use_theta_lt	13.5
breaks	65

OWC Results

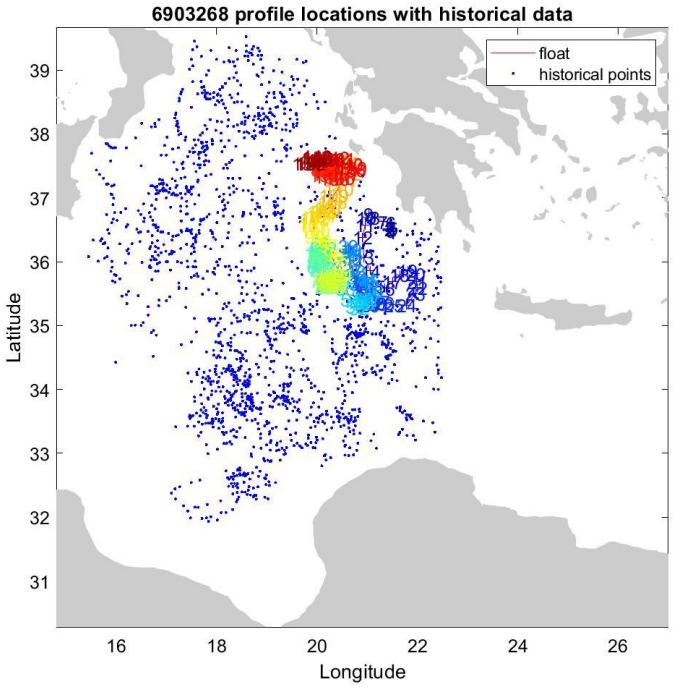

Figure 3: Location of the float profiles (red line with colored numbers) and the reference data selected for mapping (blue dots).

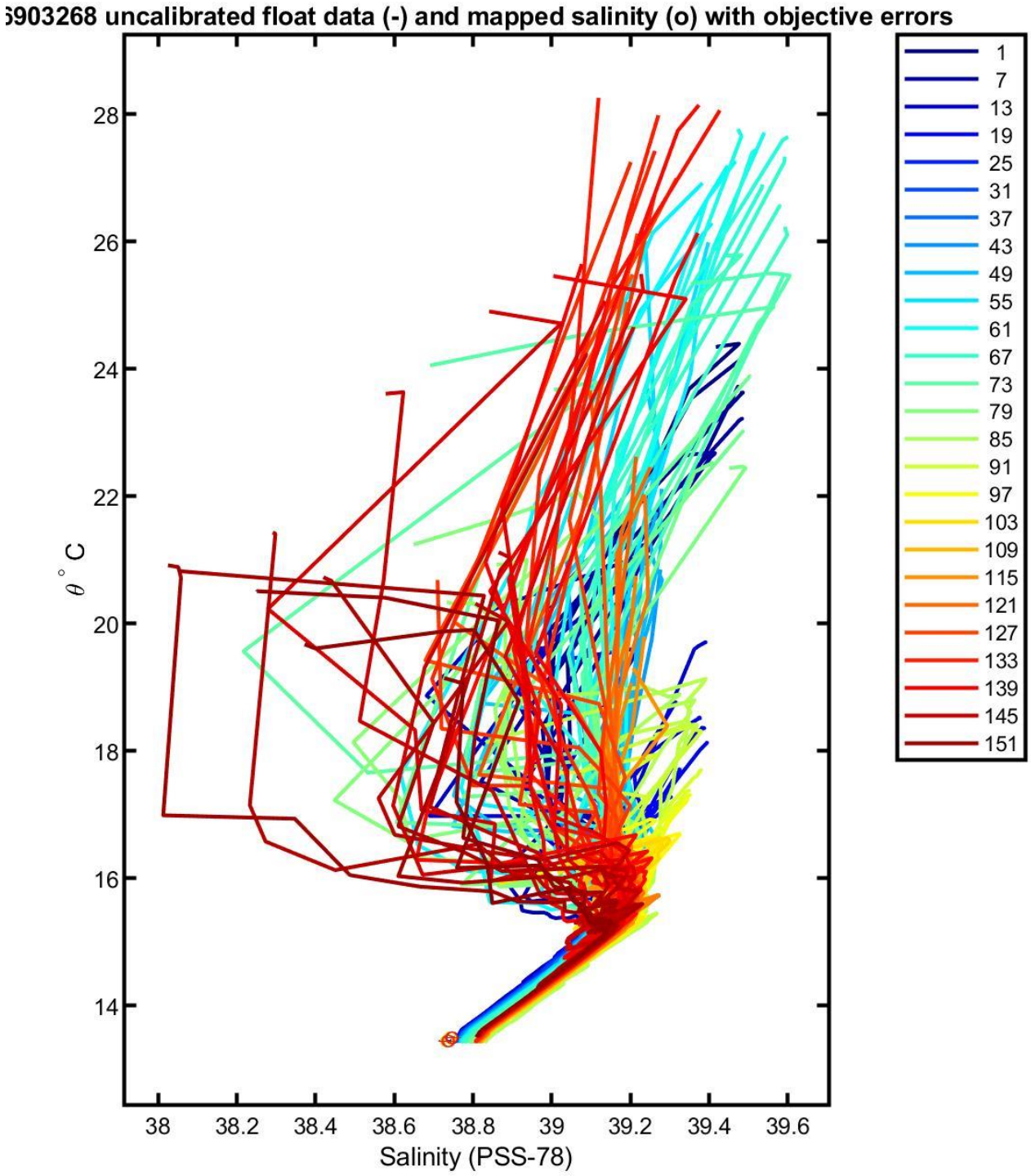

Figure 4: Plot the original float salinity and the objectively estimated reference salinity at the 10 float theta levels that are used in calibration.

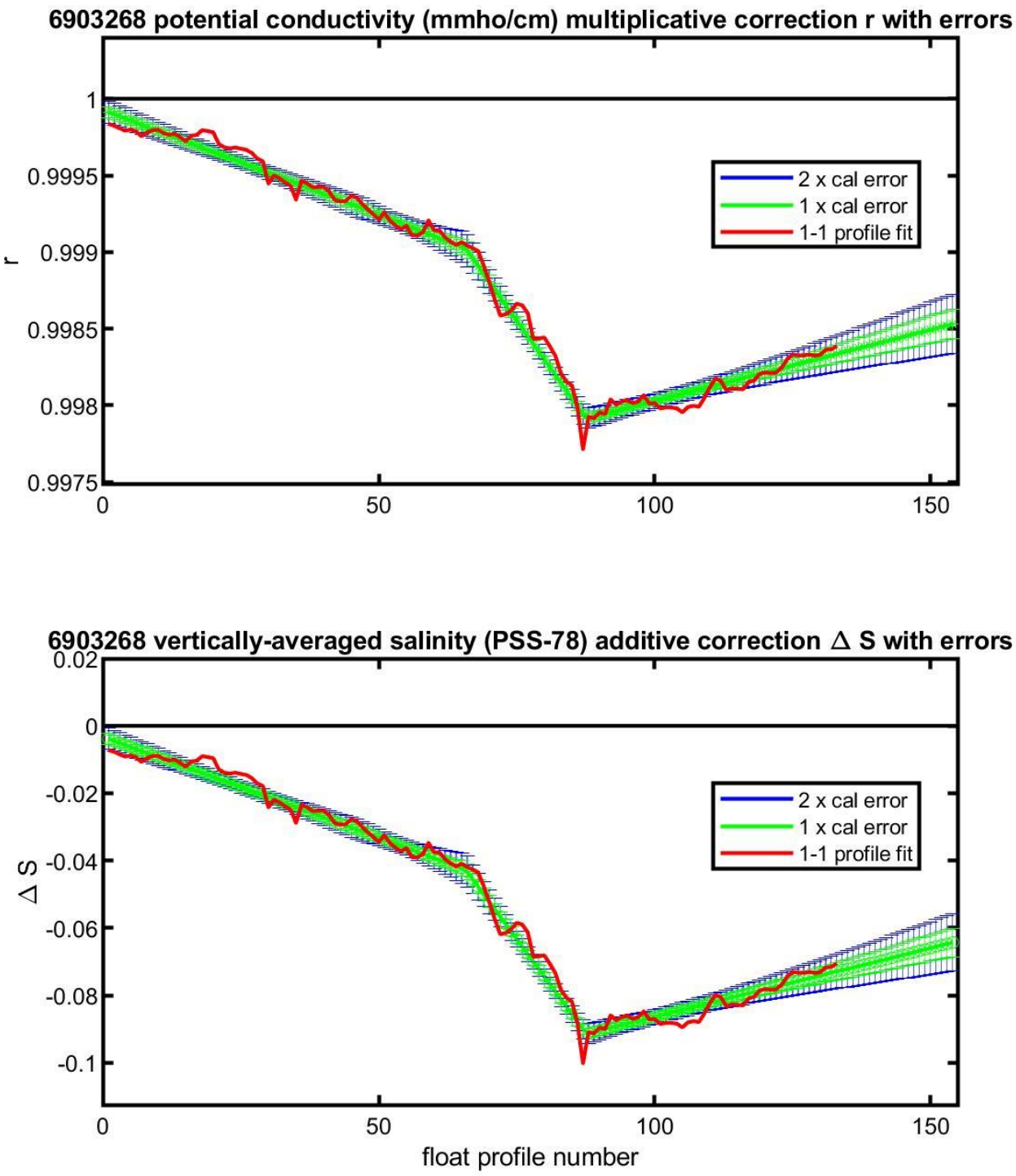

Figure 5: Evolution of the suggested adjustment with time. The top panel plots the potential conductivity multiplicative adjustment. The bottom panel plots the equivalent salinity additive adjustment. The red line denotes one-to-one profile fit that uses the vertically weighted mean of each profile. The red line can be used to check for anomalous profiles relative to the optimal fit.

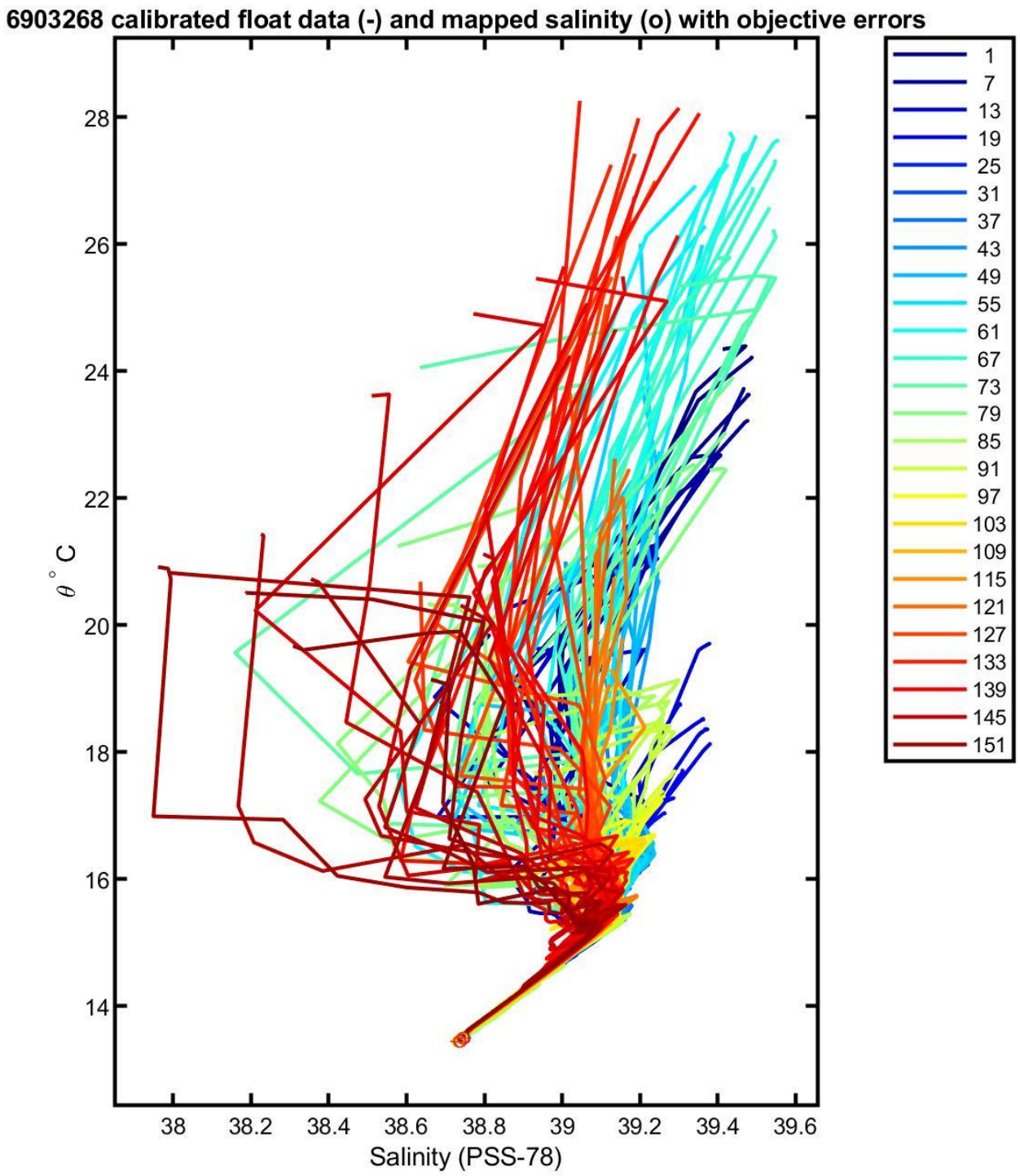

Figure 6: The plot of calibrated float salinity and the objectively estimated reference salinity at the 10 float theta levels that are used in calibration.

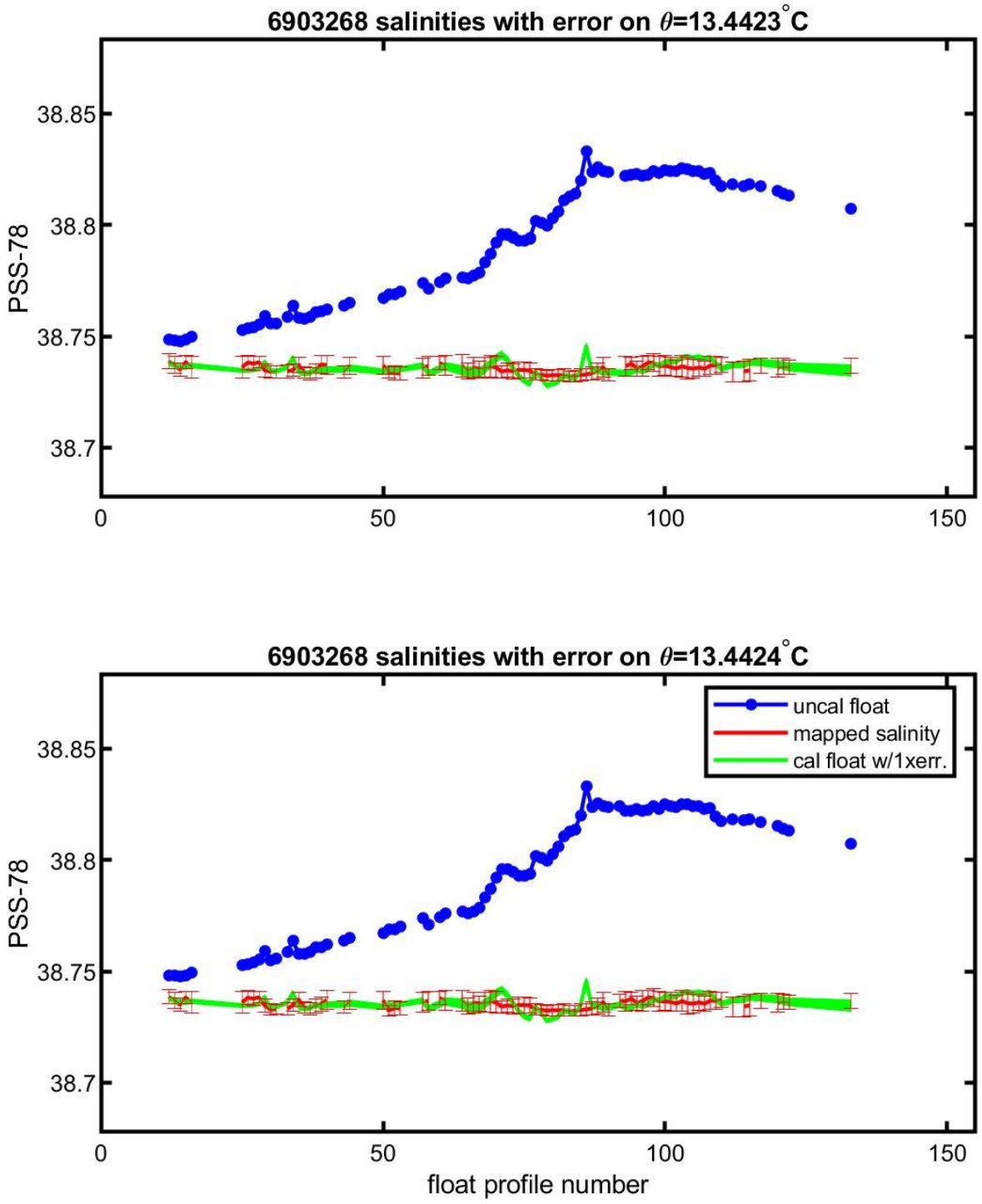

Figure 7: Plots of the evolution of salinity with time along with selected theta levels with minimum salinity variance.

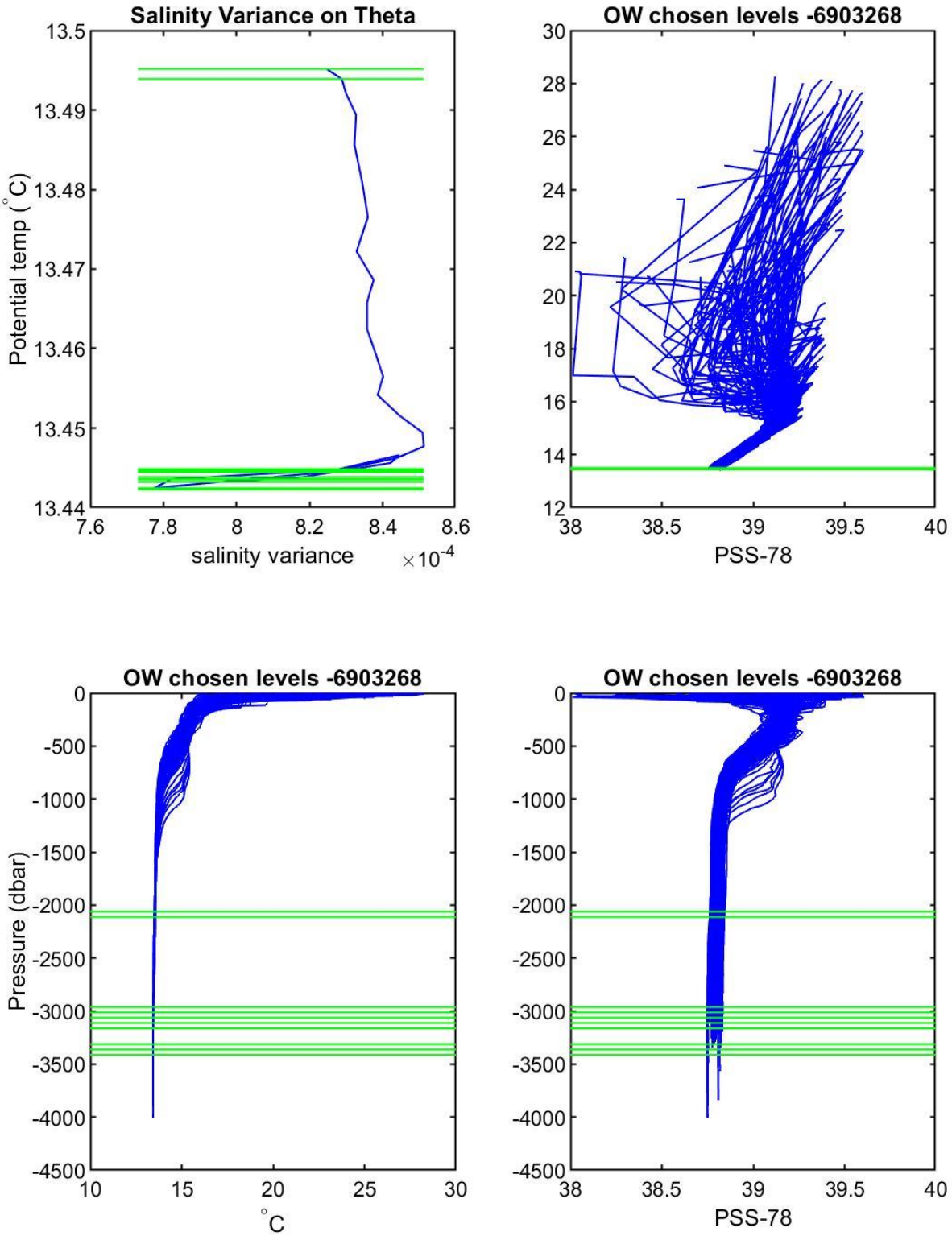

Figure 8: Plots include the theta levels chosen for calibration: Top left: Salinity variance at theta levels. Top right: T/S diagram of all profiles of Argo float. Bottom left: potential temperature plotted against pressure. Bottom right: salinity plotted against pressure.

Summary

Float WMO 6903268 was deployed in the Ionian sub-basin, in the Mediterranean Sea. This float has already been subjected to DMQC that a delayed mode correction has been applied for cycles 1 to 64 with QC 1. Cycles 65 to 140 are incorrect and not adjustable (correction exceeds 0.05).
The OWC analysis confirmed the previous analysis, showing a significant salinity drift. Figure 5 reveals that the least square fit is quite reliable. The correction proposed by OWC suggests a correction over the Argo requested accuracy (0.004) from cycle 1. After cycle 65 drift increases. Figure 7 shows a positive drift on selected θ-levels. Additional analyses (the visual inspection of the deepest portion of the θ-S diagram, the comparison of selected float salinity profiles with the nearby historical CTD profiles) are applied in complement of the OWC method, to provide the best quality control analysis. This float has some characteristics of a fast salty drifter: the correction gets larger than 0.01 within 1yr after deployment and reaches 0.05 within 3 years after deployment.
After several investigation, the last decision is that the salinity data of float WMO 6903268 need a delayed mode correction from cycle 1 to 64. QC 1 is applied. In addition, the analysis confirms that cycles from 65 to 140 are bad and not adjustable (correction exceed 0.05). QC 4 is applied.

PSAL_ADJUSTED= PSAL+ ΔS from cycle 1 to 64

PSAL_ADJUSTED= PSAL from cycle 65 to 154

The quality flags applied are the following:

PSAL_ADJUSTED_QC='1' from cycle 1 to 64

PSAL_ADJUSTED_QC='4' from cycle 65 to 154

The delayed-mode files (Dfiles) have been created accordingly and sent to the Coriolis GDAC.

References

Cabanes, C., Thierry, V., & Lagadec, C. (2016). Improvement of bias detection in Argo float conductivity sensors and its application in the North Atlantic. Deep-Sea Research Part I: Oceanographic Research Papers, 114, 128–136. https://doi.org/10.1016/j.dsr.2016.05.007