DELAYED MODE QUALITY CONTROL OF ARGO SALINITY DATA IN THE MEDITERRANEAN AND BLACK SEA

FLOAT WMO 1900603

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1. Float data

The float data were downloaded on July 2009 from the Coriolis Data centre IFREMER (a GDAC centre), Brest, France, in NetDCF format. The data were converted in Matlab binary file.

2. Status of the float

The float was deployed in the Cretan Passage (Figure 1) in April 2006 and performed more than 100 cycles (Table 1). The salinity and temperature sections along the float trajectory are depicted in Figures 2 and 3, respectively.

Model	**WMO**	**Argos**	**Deploy Date**	**Lat**	**Lon**	**Cycle**	**Last Date**	**Lat**	**Lon**	**Status**
PROVOR-CTS3	1900603	63568	23-Apr-2006 04:06	33.6	26	103	20-Feb-2009 11:47	34.43	24.11	Dead

Table 1. Status of the float.

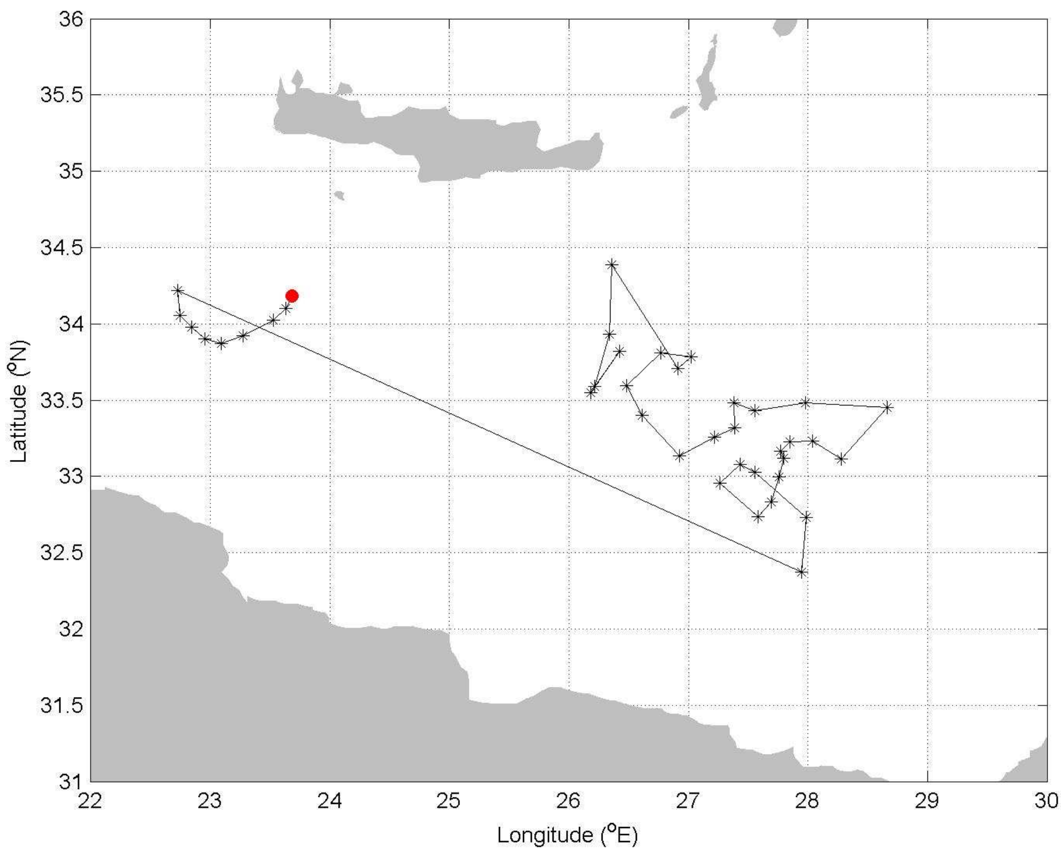


Figure 1. Float trajectory (the red dot represents the last float position).

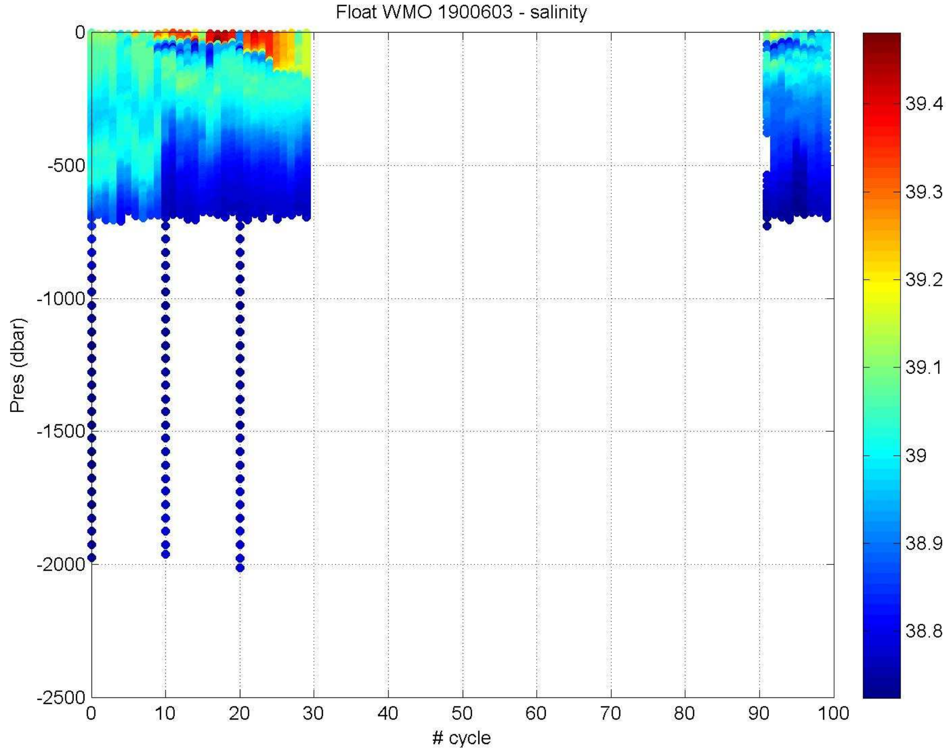


Figure 2. Salinity section along the float trajectory.

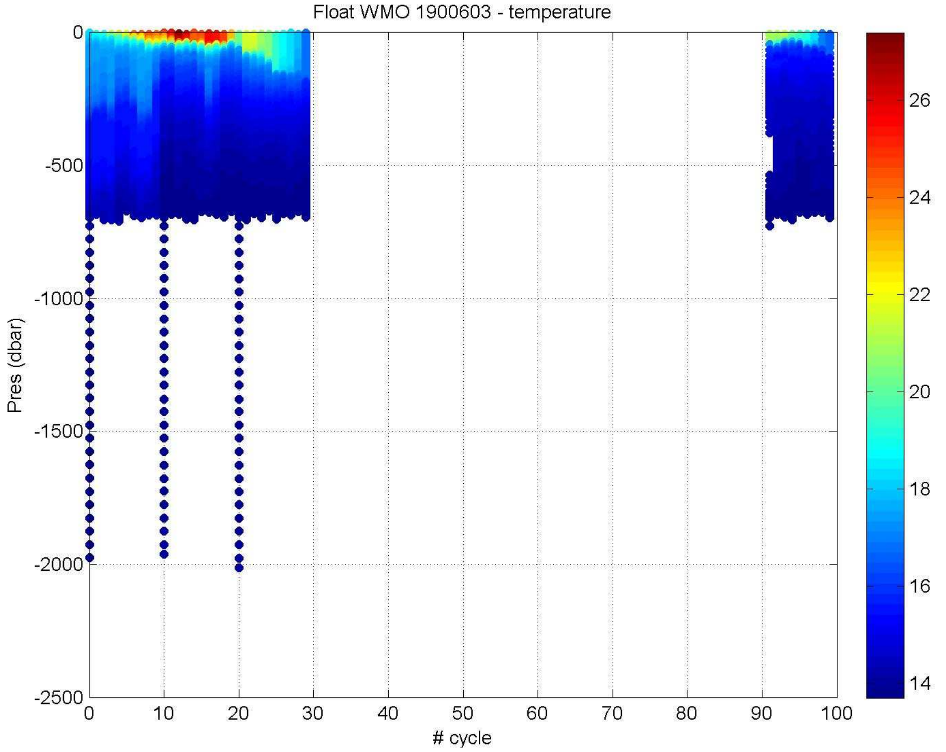


Figure 3. Temperature (° C) section along the float trajectory.

3. Surface pressure

The surface pressure is plotted in Figure 4. These values are extracted from the Argo technical file: the variable name is "PRES_SurfaceOffsetBefore_1dBarResolution_dBAR". This kind of float autocorrects the pressure, so no adjustment is required.

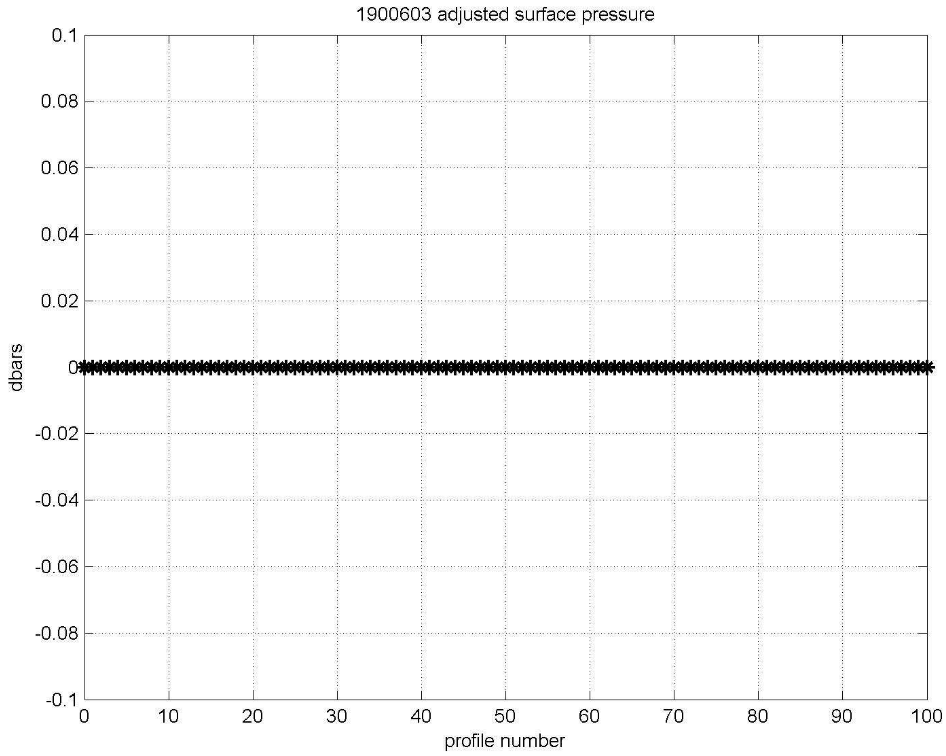


Figure 4. Surface pressure values versus time.

4. Manual inspection and identification of major spikes in temperature and salinity

No major spikes or jumps were detected in both temperature (Figure 5) and salinity (Figure 6) profiles.

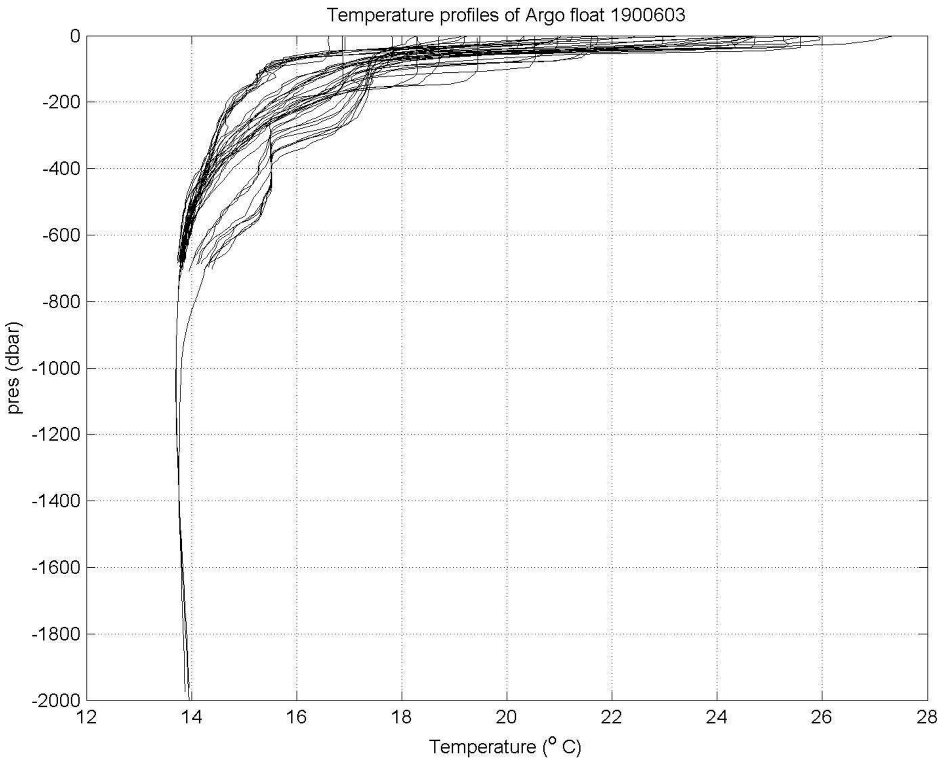


Figure 5. Temperature profiles as they are in real time correction mode at Coriolis Data Centre.

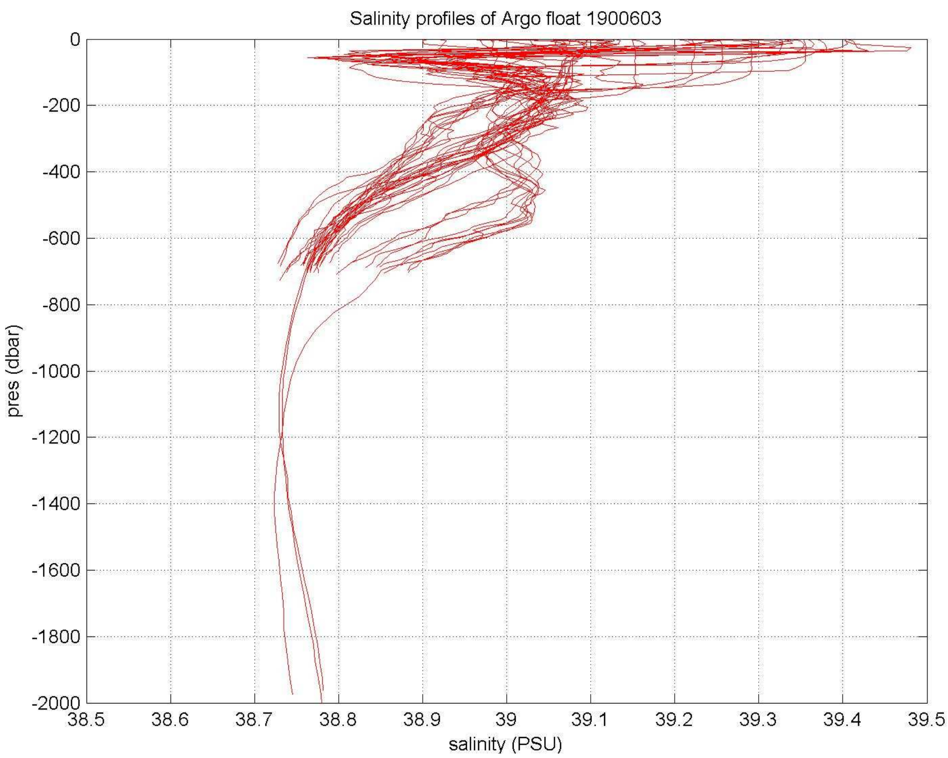


Figure 6. Salinity profiles as they are in real time correction mode at Coriolis Data Centre.

5. Reference dataset

The reference dataset used in the delayed mode quality control (DMQC) method (see the historical CTD locations in Figure 7), as of October 2009, is composed of the following databases:

- Ref. Database Eflubio-2 (2005)
- Ref. Database Eflubio-3 (2004)
- Ref. Database Coriolis 2008V02 (1990-2008)
- Ref. Database Egitto-1 (2006)
- Ref. Database Enea (Borghini – 2004-2006)
- Ref. Database Enea (Santoleri - 2004)
- Ref. Database MFSTEP (2003)
- Ref. Database MREA07 – IT_NAVY Aretusa (2007)
- Ref. Database MREA07 – IT_NAVY Galatea (2007)
- Ref. Database MREA07 – NURC Leonardo (2007)
- Ref. Database MREA07 NURC Leonardo LASIE07 (2007)
- Ref. Database MREA07 – TNO Snellius (2007)
- Ref. Database NODC odv-1 (2000)
- Ref. Database NODC odv-2 (2006)
- Ref. Database SESAME IT2 (2008)
- Ref. Database MEADAR/MEDATLAS (1975-1997)

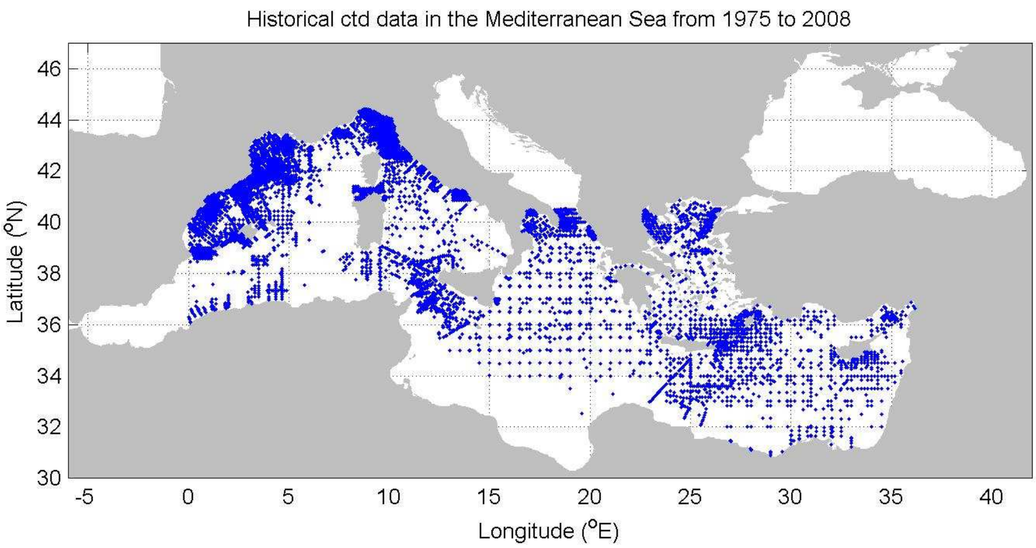


Figure 7. Location of the historical CTD data, spanning from 1975 to 2008, used in the DMQC.

6. Qualitative comparison between float and historical CTD profiles

In Figure 8 the float trajectory and the historical CTD locations are plotted. The salinity profiles of the Argo float are superimposed on the spatially closest historical profiles in Figure 9.

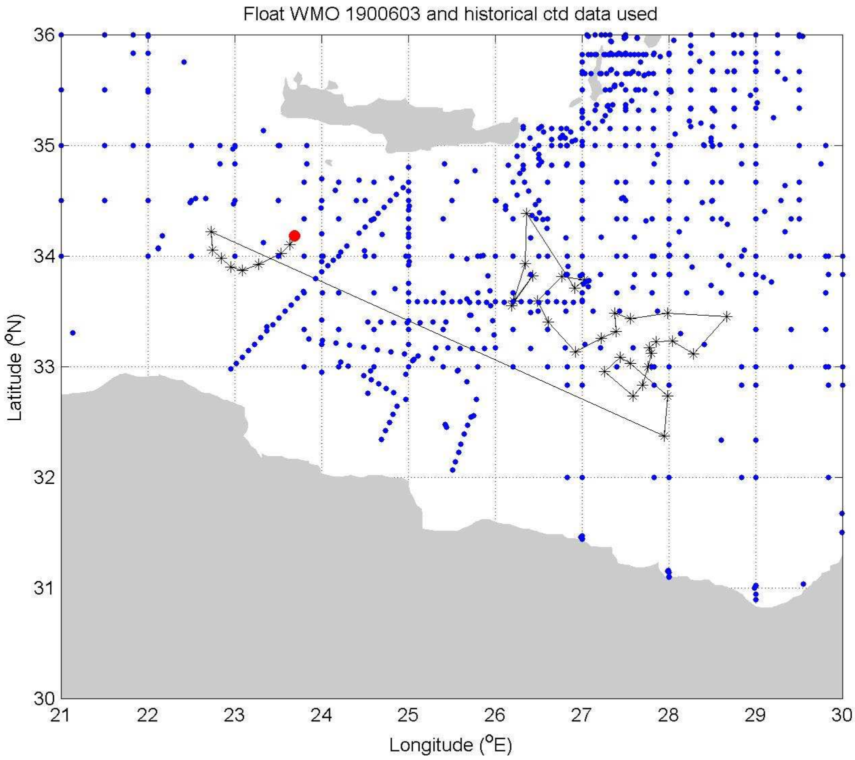


Figure 8. Float trajectory (black line; the last float position is depicted by a red dot) and locations of the historical CTD data.

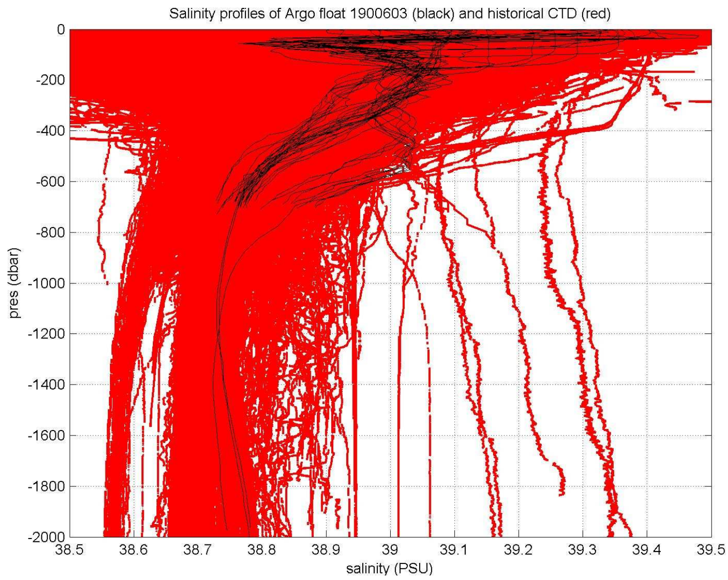


Figure 9. Salinity profiles of the Argo float (black lines) and historical CTD (red lines).

In Figure 10, three float profiles are selected to perform a comparison (in time and space) with the historical data. The float profile is depicted in black while other colours represent the reference profiles. The red colour means that the historical data are more recent with respect to the float ones, while magenta states that the float data are more recent than the historical ones (the maximal difference is 3 years). A time difference between 3 and 6, 6 and 9 and larger than 9 years is depicted in green, cyan and blue, respectively.

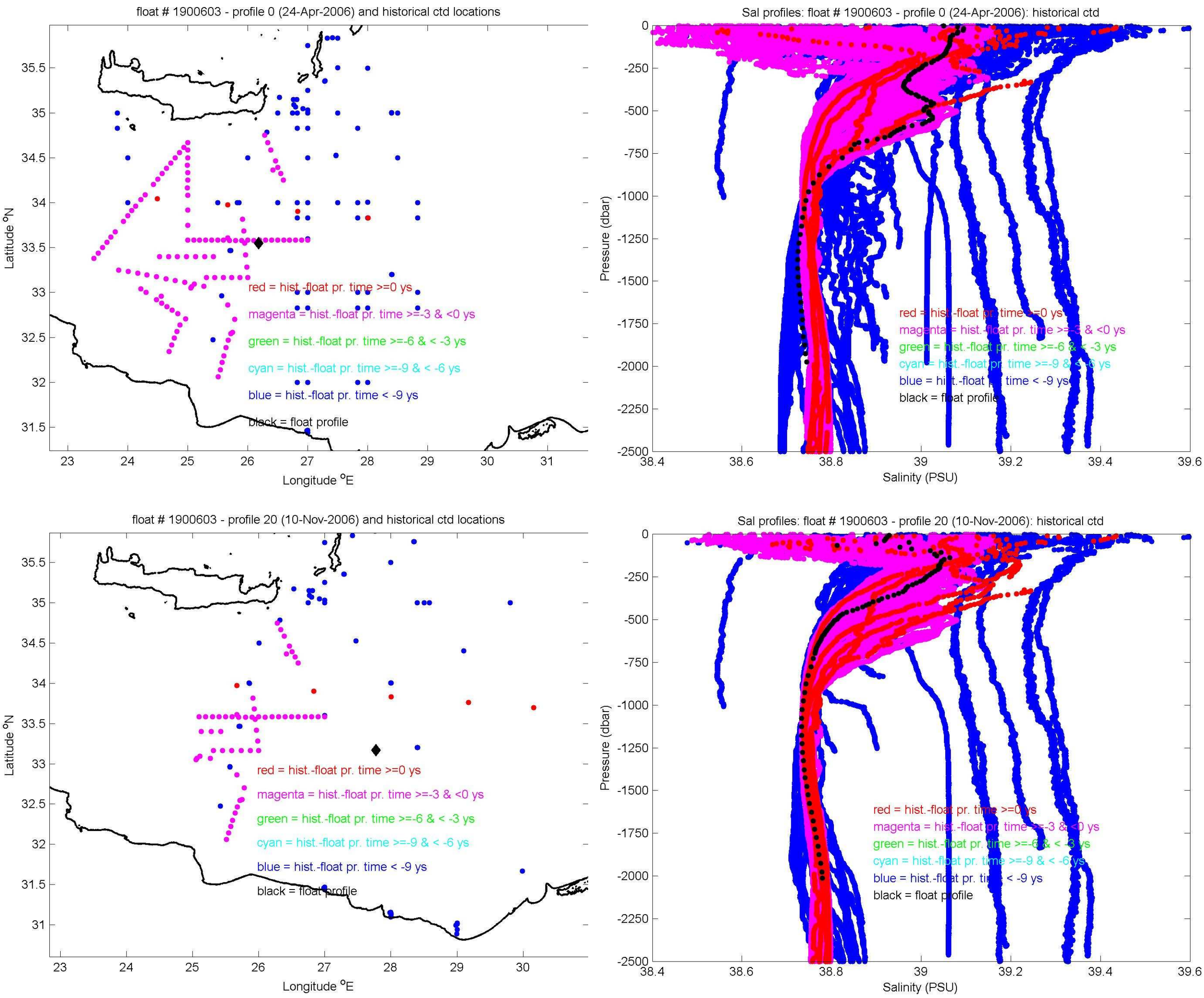


Figure 10. Location of selected float profiles and historical CTD data (left panels) and the respective salinity profiles (right panels).

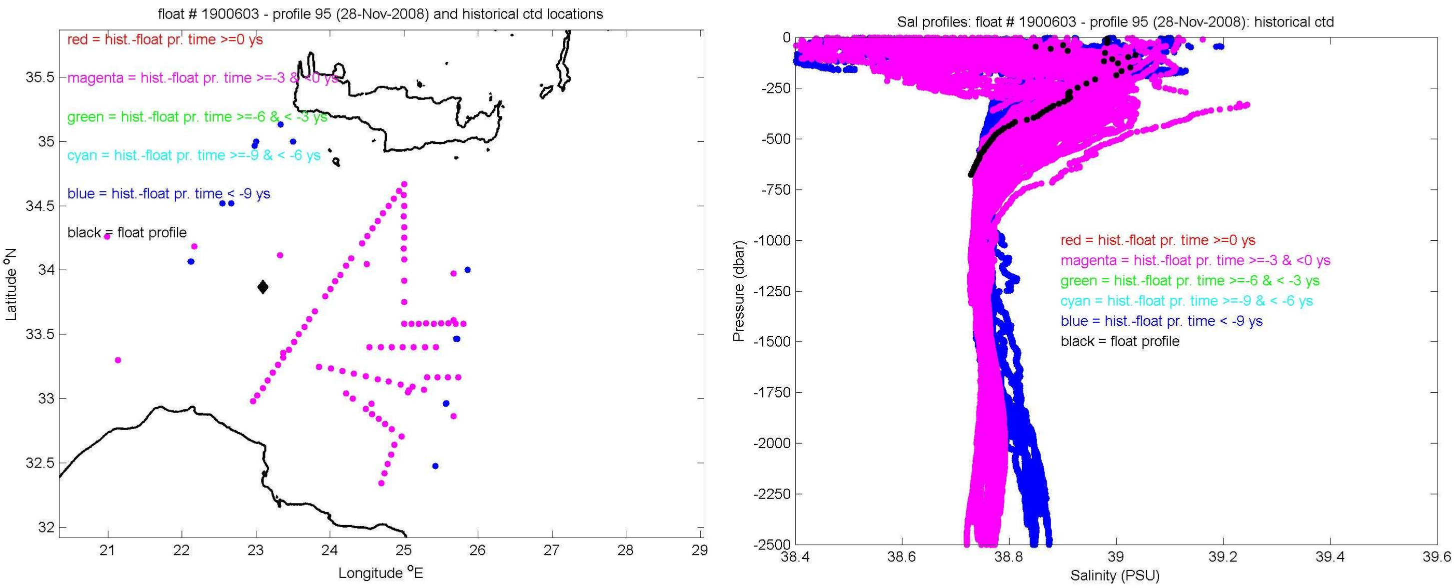


Figure 10. Continued.

The smallest temporal difference between the two datasets is observed for the float profile number 0: the float data are more recent than the historical ones by about 10 hours.

7. DMQC: configuration and results

We applied the DMQC method of Owens and Wong, referred to as OW hereafter (Owens and Wong, 2009) to floats operating in the Mediterranean and Black Sea (Notarstefano and Poulain, 2008). The parameters used for the objective mapping are listed in Table 2. A maximum of 4 break points are allowed in the piece-wise linear fit.

Parameters	Value
CONFIG_MAX_CASTS	300
MAP_USE_PV	1
MAP_USE_SAF	0
MAPSCALE_LONGITUDE_LARGE	6
MAPSCALE_LONGITUDE_SMALL	2
MAPSCALE_LATITUDE_LARGE	5
MAPSCALE_LATITUDE_SMALL	1.67
MAPSCALE_PHI_LARGE	0.5
MAPSCALE_PHI_SMALL	0.1
MAPSCALE_AGE	1
MAP_P_EXCLUDE	200
MAP_P_DELTA	250

Table 2. Objective mapping parameters of the OW method.

The results of the OW method are presented in Figures from 11 to 14. The 10 θ-levels chosen for the correction are reported in Figure 11. The corrected and uncorrected float salinity and the mapped salinity on θ-levels are depicted in Figure 12. The float data corrected by the OW method are presented in Figure 13. The correction proposed (Figure 14) is between 0 and about 0.01 PSU for the first 30 float profiles and a bit larger for the last profiles; the correction term ***r*** is computed by the piece-wise liner fit and the additive correction ***ΔS*** is calculated using:

$$\Delta S = (r-1)\cdot C_0 + (r-1)\cdot C'$$

where C_0 is the vertical mean conductivity and C' is the variation around C_0.

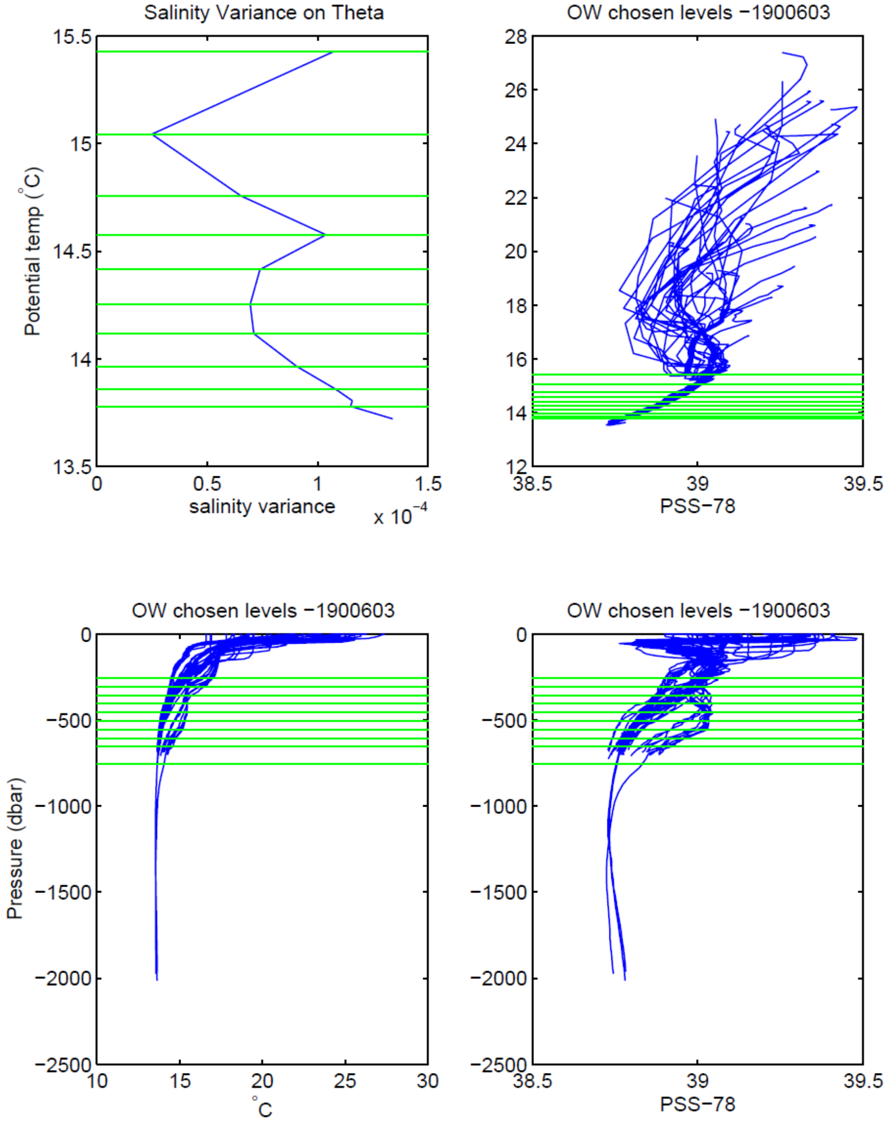


Figure 11. The 10 θ-levels chosen for the correction.

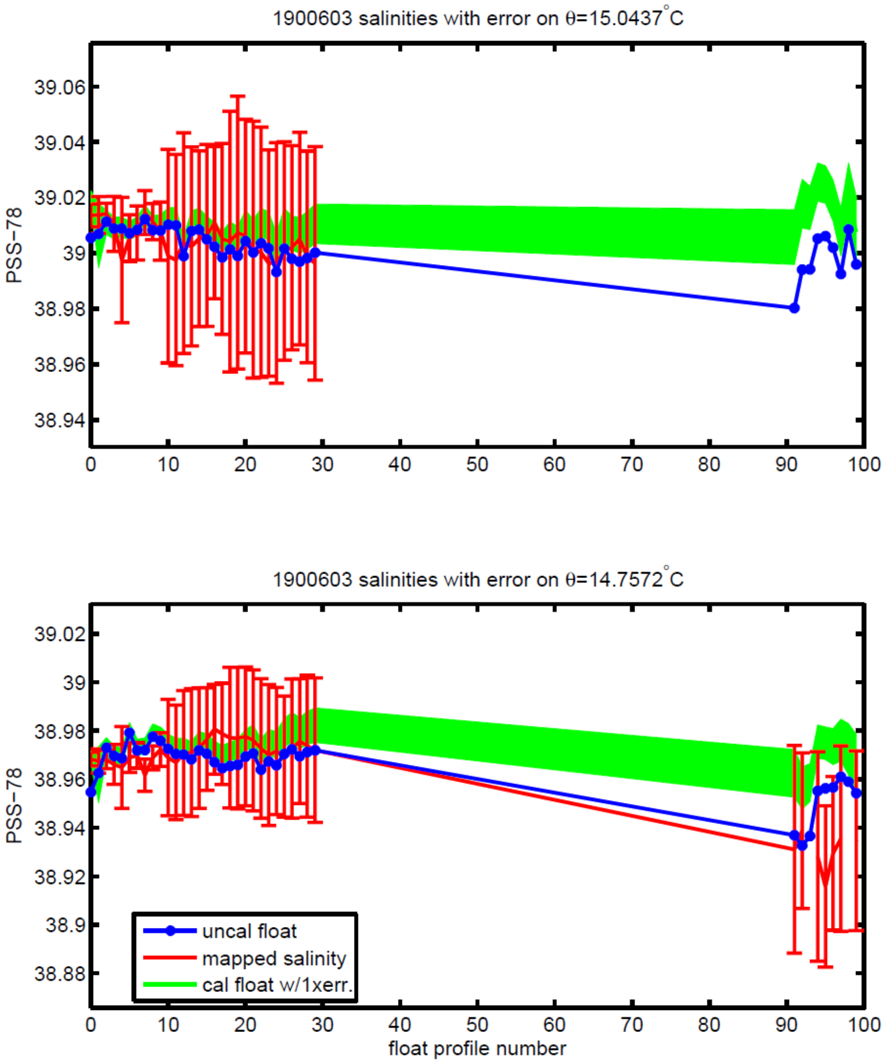


Figure 12. Comparison between the float salinity data and the mapped salinity, on θ-levels.

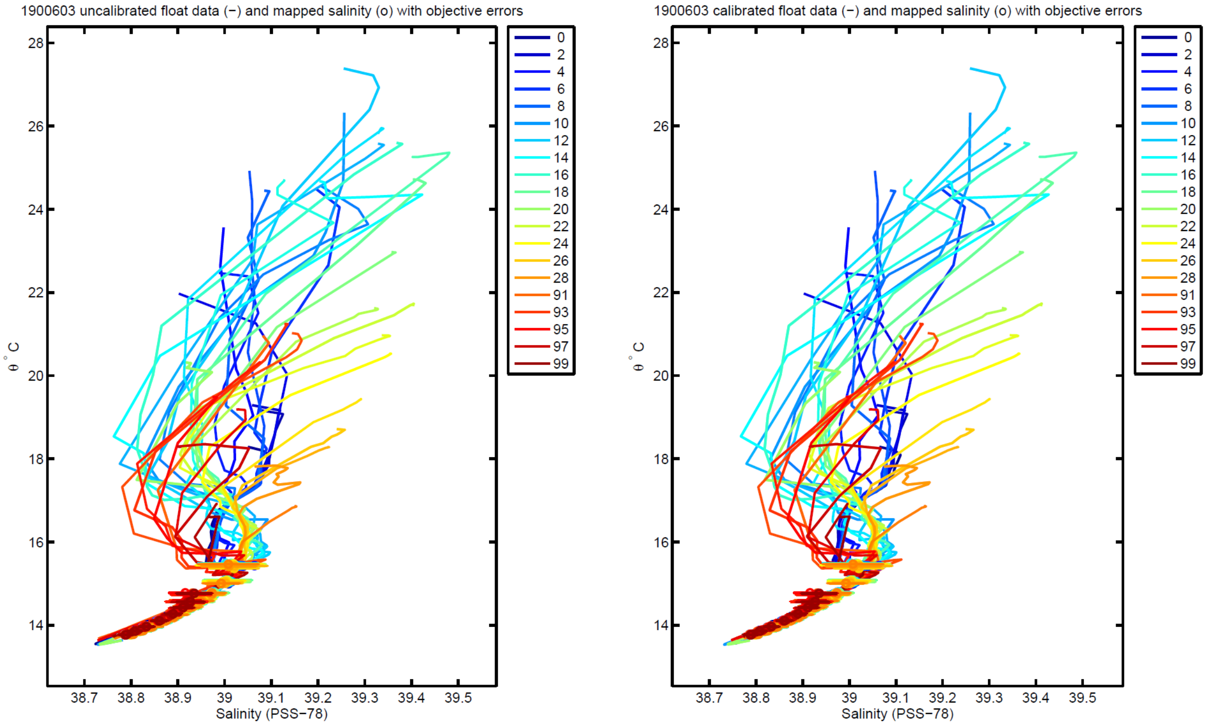
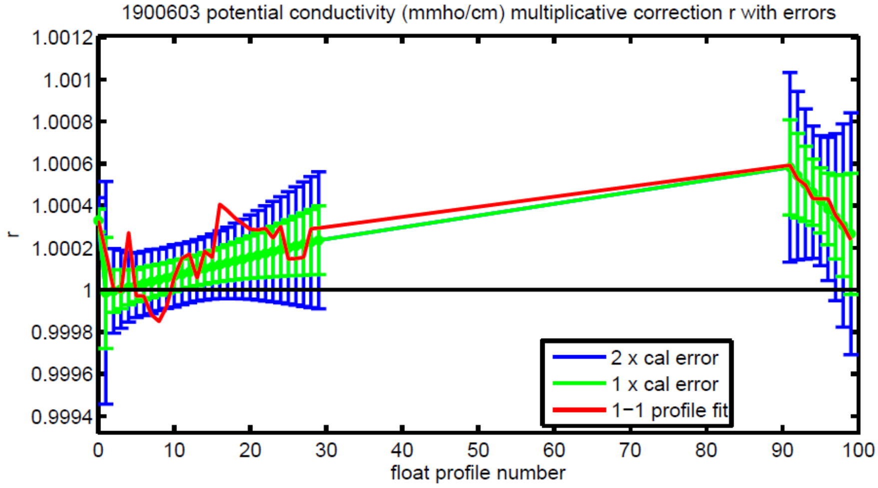


Figure 13. θ-S diagram of uncorrected (left) and corrected data (right).



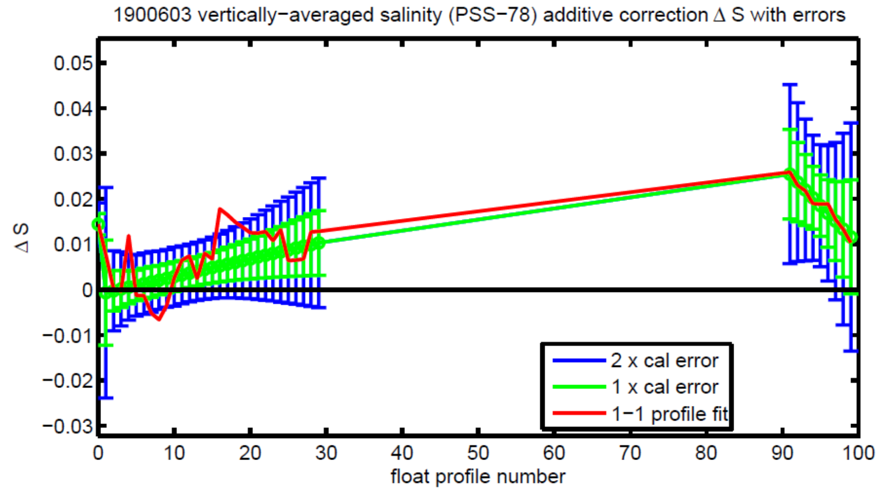


Figure 14. Correction proposed by the OW method.

8. Conclusions

The correction proposed (Figure 14) is between 0 and 0.01 PSU for the first 30 float profiles and a between about 0.01 and 0.025 PSU for the last profiles. Figure 12 shows that the salinity of the float (blue line) and the mapped salinity (red line) are not quite constant on various θ-levels and hence the results of the OW method are affected by this high variability of the water column. However, the float salinity profiles are enclosed by the historical profiles and this means that any potential salinity drift is smaller than the variability of the reference dataset. Moreover, the three selected float salinity profiles (Figure 10) are in a good agreement with the closest (in time) historical profiles. We can conclude that there is no evidence of a potential salinity drift in the float measurements. Hence, the salinity data of Float WMO 1900603 can be considered of good quality and no delayed mode correction is deemed necessary.

References

Notarstefano G. and Poulain P.-M. (2008). Delayed mode quality control of Argo floats salinity data in the Tyrrhenian Sea. Rel 2008/125 OGA 43 SIRE, Trieste, Italy, 33 pp.

Owens W. B. and Wong A. P. S. (2009). An improved calibration method for the drift of the conductivity sensor on autonomous CTD profiling floats by θ-S climatology, Deep Sea Research Part I: Oceanographic Research Papers, 56(3), 450-457.