Delayed Mode Quality Control of Argo float 6903577

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DMQC summary

Float number 6903577 was deployed on 08/05/2021 southeast in the Norwegian Basin (NB) and stayed there for the first 60 cycles, then by little more than 10 cycles it has moved north along the Vøring Plateau slope and into the Lofoten Basin (LB), cycling the basin cyclonically since. Hydrography is relatively invariable below 1000 m in the profiles.

All profiles have been visually inspected. Only one bad RTQC salinity flag was reversed and 8 new added, and all 3 temperature flags reversed, affecting only 4 profiles. The sea surface pressure data are not displaying values below 0 dbar and there are no indications of negative pressure drift. The initial comparison between Argo float data and reference data, shows that temperature and salinity data are within normal values. The comparison with satellite altimeter data suggested no notable discrepancies.

The OWC analysis showed a weak fresh offset for the first 40 or so profiles, which is supported by more recent CTD profiles near deployment (Figure 20), however the offset goes to zero when moving away from the initial region, and is stable at negligible levels thereafter. Hence, no correction is done at this stage.

This float is still active and further monitoring is required.

Contents

1 Introduction

This report concerns the delayed mode quality control performed for Argo-float number 6903577. For more information about this float use, for instance, the following link:

http://www.ifremer.fr/argoMonitoring/float/6903577.

Before the analysis, real-time QC flags were visually inspected and modified if necessary. In addition, a few stricter tests necessary before the salinity calibration were applied (and flags modified if necessary). Every single profile has been visually inspected, and the validity of all flags previously assigned flags considered and changed if deemed necessary, and new flags assigned. Then, the satellite altimeter comparison plot between the sea surface height and dynamic height anomaly, constructed for this float by Ifremer, was analysed. Part of this analysis are also time series plots of pressure, temperature, and salinity.

The salinity calibration has been performed using the configuration and objective mapping parameters included in Section 3.1.1. The Argo float data were compared to nearby CTD and Argo profiles from the following reference databases:

`ARGO_for_DMQC_2022V03_1XXX, ARGO_for_DMQC_2022V03_7XXX, CTD_for_DMQC_2021V02_1, and CTD_for_DMQC_2021V02_7`

Reference data are distributed by Ifremer. A simple visual check on the reference data is done prior to analysis (see Appendix B). The OWC toolbox version 3.0.0 (https://github.com/ArgoDMQC/matlab_owc) was run to estimate a salinity offset and a salinity drift (Cabanes et al., 2016).

Note that the concepts “cycle number” and “profile number” are not the same, as there might be missing cycles, while only existing profiles are input to OWC. “Cycle number” refers to the actual cycle number parameter and file naming of R/D-files.

Only results for ascending profiles are included in this report, as these are of primary interest and the only ones used for the estimation of calibration. However, any existing descending profiles have been tested and inspected the same way as the ascending profiles, and for cycles where calibration has been decided, the same correction is done on descending as on ascending profile.

Technical info on the float is given in Table 1 and an overview of the float trajectory and T&S data is shown in Figure 1.

Table 1: Technical information about float 6903577.

WMO float-number	6903577
DAC	Coriolis
Float SNR	P41306-20EU001
Platform type	PROVOR-III
Transmission system	IRIDIUM
CTD Sensor model	SBE41CP
CTD Sensor SNR	13199
Other sensors	FLOATCLOCK-MTIME, CTD-PRES, OPTODE-DOXY, RADIOMETER-DOWN-IRR380, RADIOMETER-DOWN-IRR412, RADIOMETER-DOWN-IRR490, RADIOMETER-PAR, FLUOROMETER-CHLA, BACKSCATTERINGMETER-BBP700, and FLUOROMETER-CDOM
Other sensor models	FLOATCLOCK, SBE41CP, AANDERAA-OPTODE-4330, SATLANTIC-OCR504-ICSW, SATLANTIC-OCR504-ICSW, SATLANTIC-OCR504-ICSW, SATLANTIC-OCR504-ICSW, ECO-FLBBCD, ECO-FLBBCD, and ECO-FLBBCD
Other sensors SNR	, 11569194, 3459, 42070, 72070, 42070, 42070, 6464, 6464, and 6464
Deployment	08/05/2021
Dep. Lat	64.66
Dep. Lon	-0.01
Park Depth	1000 m
Profile depth	2000 m
Cycle time	2 days
Ship	JOHAN HJORT
PI	Kjell Arne Mork
Float Status	Active
Age	1.92 yrs
Last Cycle	141
Missing Cycles	
Grey list	

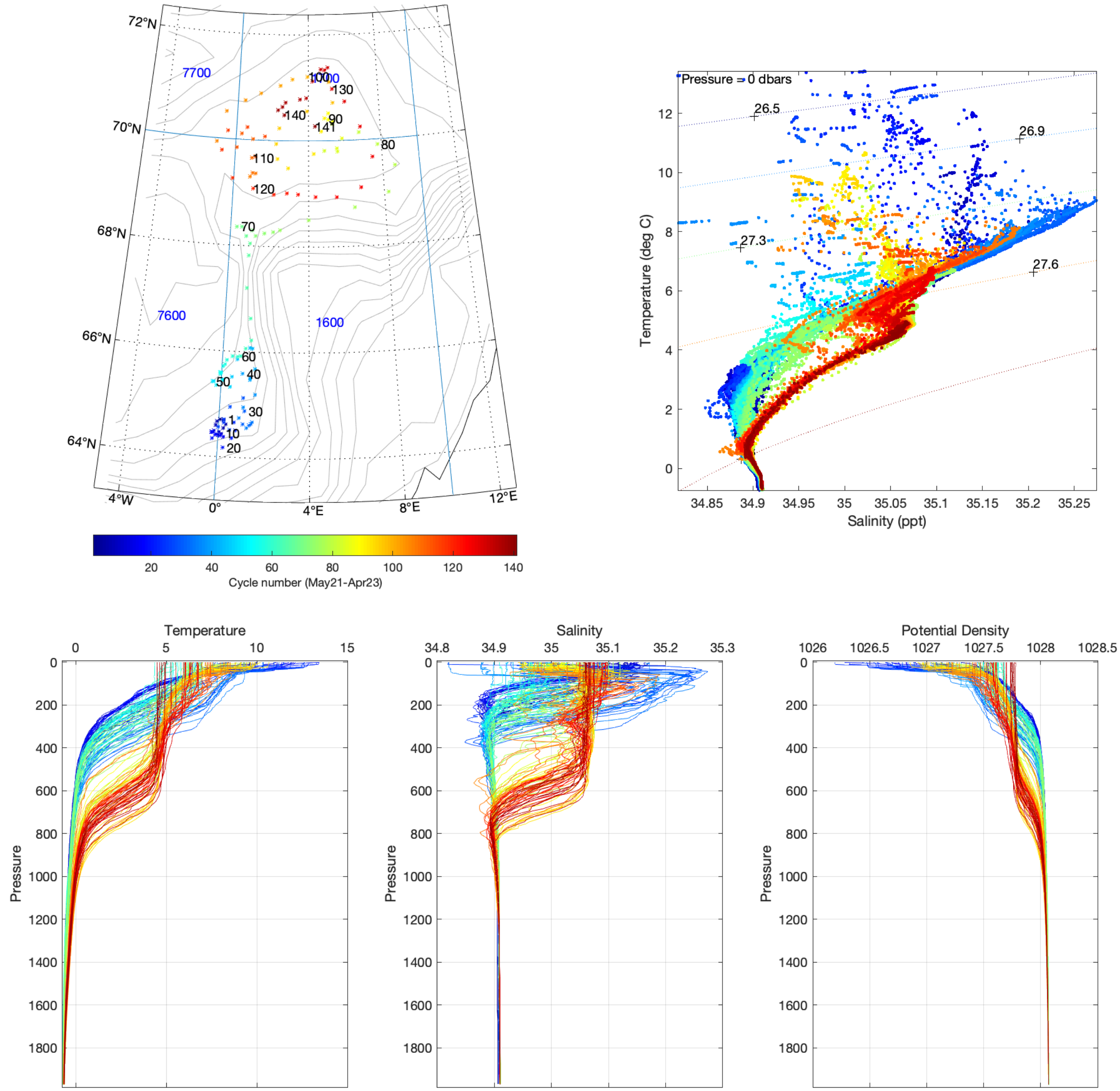


Figure 1: Float 6903577. Map shows the locations of float profiles (numbers in black show the first, every 10th, and the last cycle number in the data set; numbers in blue with corresponding squares/lines show WMO-squares). The grey contours in map indicate bathymetry. The following plots are TS-diagram, temperature profiles, salinity profiles, and density profiles for all profiles. The profiles shown have undergone pre-OWC analysis DMQC (as described in Section 2). Colour shading in all panels indicate cycle number (see colourbar under map). Note that for floats with ASD, uncorrectable salinity profiles are not shown here.

2 Quality Check of Argo Float Data

The DMQC prior to OWC is performed in four phases, after each the found erroneous data are removed before the following phase:

1. Delayed-mode procedures for coordinates
2. Sea Surface Pressure Adjustment (for APEX floats only)
3. Automated tests prior to visual control
4. Visual control of all profiles and flags
5. Overall comparison with the reference data

The tests are described in the following subsections and all results are shown in Table 2. Direction 'D' profiles have been checked for float 6903577, but results are not shown in this report.

Note that the flagging summarised and shown in this section, does not include any flags resulting from OWC analysis (Section 3). See the discussion and conclusions (Section 4) about any extra flagging based on the OWC analysis.

Table 2: Overview and results for Float 6903577 in terms of number of flags for each variable, from both RTQC and DMQC. Flags based on OWC findings are not shown here.

Variable	Flag	RTQC	DMQC reversed to '1'	DMQC new	Affected cycles (cycle numbers)
POS	'2'	0	0	0	
	'3'	0	0	0	
	'4'	0	0	0	
	'8'	0	0	0	
	'9'	0	0	0	
JULD	'2'	0	0	0	
	'3'	0	0	0	
	'4'	0	0	0	
	'8'	0	0	0	
	'9'	0	0	0	
PRES	'2'	0	0	0	
	'3'	0	0	0	
	'4'	0	0	0	
	'9'	0	0	0	
PSAL	'2'	0	0	0	
	'3'	0	0	0	
	'4'	3	1	8	38, 68, 100, and 126
	'9'	0	0	0	
TEMP	'2'	0	0	0	
	'3'	0	0	0	
	'4'	3	3	0	100
	'9'	0	0	0	

2.1 Delayed-mode procedures for coordinates

First the coordinates JULD, LATITUDE, LONGITUDE were checked as prescribed in Section 3.2 of Wong et al. (2021). Chronology of JULD was tested by a simple automated test and any missing or erroneous values replaced by linear interpolation.

Position outliers were checked for visually in a map such as in Figure 1 but based on original data, and also in a time-series reprsentation using the same manual checking tool as described in Section 2.4. Any missing positions have been replaced by 2D linear interpolation when possible.

2.2 Sea Surface Pressure Adjustment

Sea surface pressure adjustments should be done for APEX floats (Wong et al., 2021). This is an PROVOR-III float. Instead, upper panel of Figure 2 shows the surface pressure from the top of each profile.

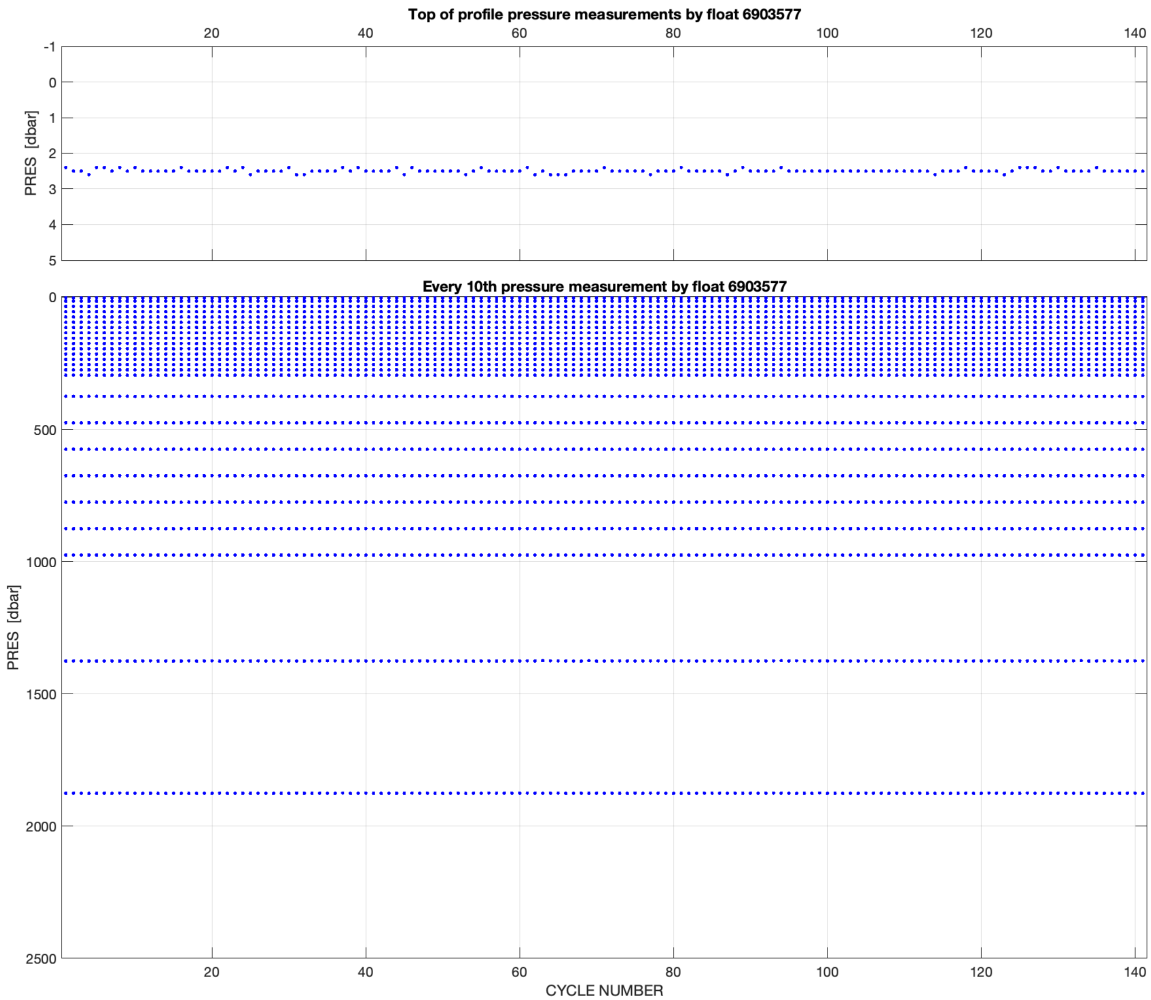


Figure 2: Float 6903577 pressure data. Upper panel: Top of profile pressure series. Lower panel: Pressure data for all profiles presented by every 10th (and the deepest) measurement in each profile. Blue dots indicate pressure value in the real-time. Any extra marks show RTQC and DMQC flags as explained in the legend. Any '4', or '8' are shown regardless of depth, not just at every 10th.

2.3 Automated tests prior to visual control

In addition to RTQC, the following automated tests are necessary before OWC as double checks using same critera as RTQC (see Wong et al., 2021) and in some aspects stricter based on experience in the region:

- Pressure increasing test / monotonically increasing pressure test in waters deeper than 400 m.
- Double-pointed spike tests on PSAL and TEMP (see Section 2.3.1).
- Spike tests on PSAL and TEMP (with 0.02 PSU criterion for pressures greater than or equal to 500 dbar, and 0.005 PSU deeper than 1000 dbar; and the addition of temperature criterion 1°C deeper than 1000 dbar).
- Gradient test on TEMP and PSAL (declared obsolete from RTQC in 2019, but implemented here nevertheless).
- Density inversion test.

2.3.1 The double-pointed spike test

The double-pointed spike tests the deviation of subsequent pairs of values instead of single points, from the neighbouring values in a profile, as this is not an uncommon form of spikes. The test values are formed according to

$$TV = \left| \frac{V_i + V_{i+1}}{2} - \frac{V_{i-1} + V_{i+2}}{2} \right| - \left| \frac{V_{i+1} - V_i}{2} \right| - \left| \frac{V_{i+2} - V_{i-1}}{2} \right|, \tag{1}$$

where TV is the test value and V_i are the subsequent points in a profile. The first term is the difference between the average of two values forming a double-spike and the average of their two neighbouring values. Subtracted are the half width between the respective averaged values, so that the actual test value is the difference between the nearest two points of the compared pairs.

As the test values are assigned to the i-th point in the profile (i.e., the upper point of the pair forming the spike), any testvalues exceeding the criteria results in flagging of both V_i and V_{i+1}. The double-pointed spike test uses the same criteria as the single-point spike test (see bullet list above). It is applied before the single-point spike test, since the latter may remove one of the values in a double-point spike and render the double-pointed spike test useless.

2.4 Visual control of all profiles and flags

Firstly, an overall check on pressure consistency is done looking at the lower panel of Figure 2.

Then, as prescribed in Section 3.3–3.5 of Wong et al. (2021), PRES, TEMP, and PSAL are compared to temporally close profiles from same float, as well as surrounding reference data. This is done by inspecting individual cycles in detail using the tool *check_profiles* from the toolbox https://github.com/evenrev1/evenmat.git. In this tool, profiles for all three parameters as well as their derived density are plotted on backdrops of profiles from the three preceeding and three succeeding cycles and localised historical reference data. Both NRTQC flags and DMQC flags (Section 2.3) are marked and can be changed, or new flags can be added, interactively. Examples are shown in Figure 3.

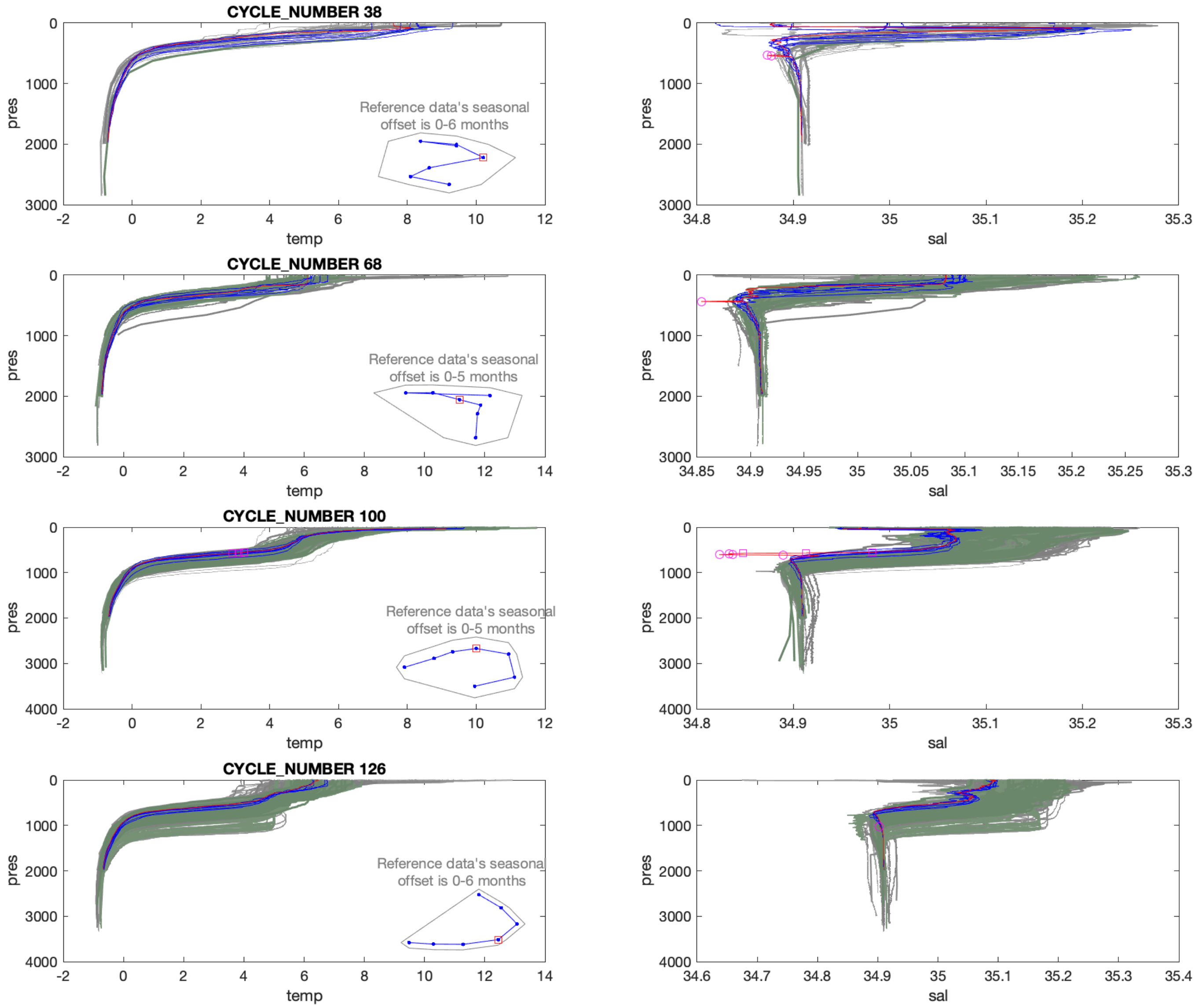


Figure 3: Float 6903577. Profiles that have bad RTQC or DMQC flags (red) compared to float profiles before and after (blue) and nearby reference data (grey with darker shading and thicker lines for similar time of year, and green tint for same season). Temperature in left and salinity in right panels. Flagged data are marked with magenta squares (RTQC) and circles (DMQC), while pressure flags have green marks. The inlays in left panels show the piece of float track in blue and the areas of origin of reference data as grey enclosures. These panels show the first flagged profiles for this float (or all; see Table 2). For geography, refer to Figure 1 Panel 1.

2.5 Overall comparison with the reference data

In addition to the visual control of individual profiles (Section 2.4), the overall state of the dataset can be viewed in Figures 1 and 7, as well as all profiles in relation to reference data in the vicinity of the float in Figure 4.

Trends in salinity in the same reference data are also compared to float data (Figure 5) in order to aid interpretation of the calibration results in Section 3.1.2.

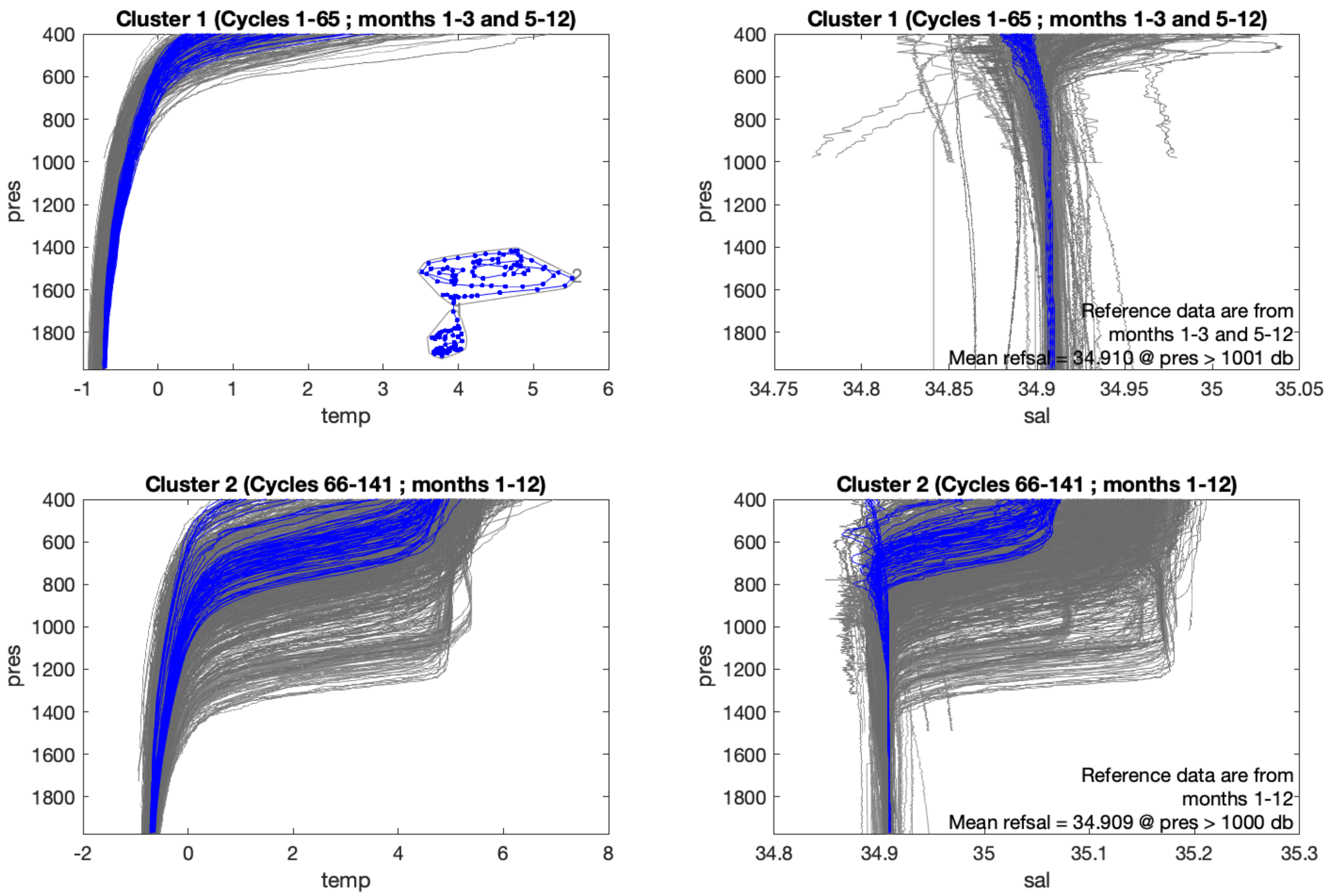


Figure 4: Float 6903577 compared to nearby reference data. Float profiles (blue lines) are divided into clusters based on positions, and compared to nearby profiles from the reference data set (grey lines with darker shading for similar time of year). Temperature in left and salinity in right panels, and one row per cluster. The upper 400 m are omitted as these depths are ignored in the OWC-analysis. The inlay in first panel shows areas of origin of reference data used as grey enclosures around the clusters of positions on the blue float track. For geography, refer to Figure 1 Panel 1. Note that for floats with ASD, uncorrectable salinity profiles are not shown here.

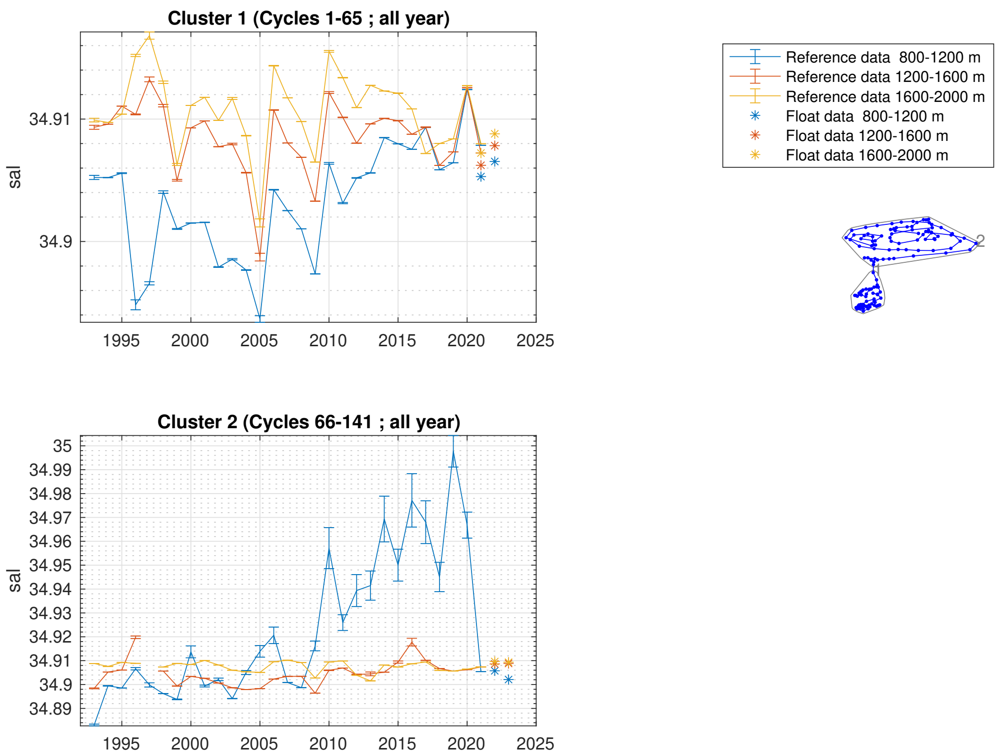


Figure 5: Temporal evolution of data from Float 6903577 and reference data (by cluster as in Figure 4). Time series of annual means of reference data in depth bins (see legend) are plotted as coloured lines with error bars representing the bin variance, and annual bin means of float data by the same method plotted with asterisks. Annual bins are centered around new year (i.e., winter). The sketch under the legend shows areas of origin of reference data used as grey enclosures around the clusters of positions on the blue float track. For geography, refer to Figure 1 Panel 1.

2.6 Satellite Altimeter Report

Figure 6 shows the comparison with altimetry.

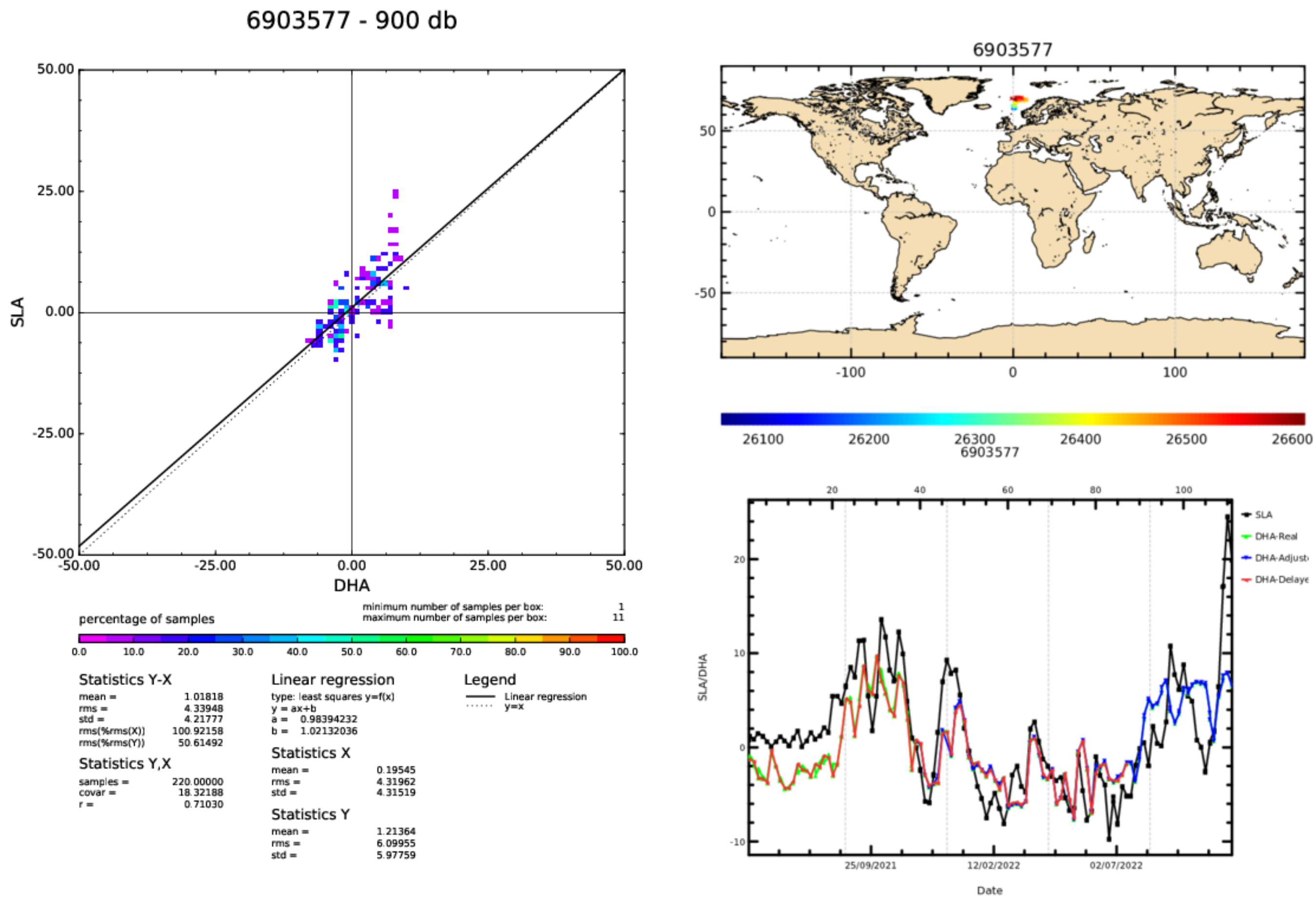
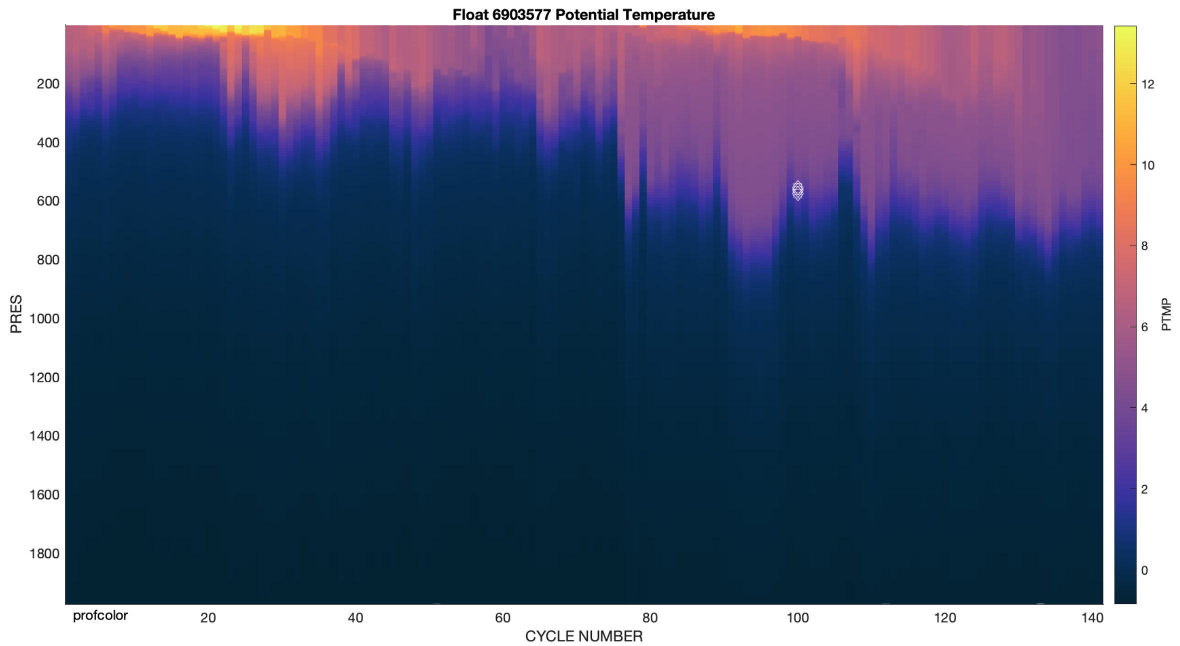


Figure 6: Float 6903577. The comparison between the sea level anomaly (SLA) from the satellite altimeter and dynamic height anomaly (DHA) extracted from the Argo float temperature and salinity. The figure is created by the CLS/Coriolis, distributed by Ifremer (ftp://ftp.ifremer.fr/ifremer/argo/etc/argo-ast9-item13-AltimeterComparison/figures/).

2.7 Time Series of Argo Float Temperature and Salinity

Figure 7 shows Hov-Möller plots of temperature and salinty, respectively, disregarding flags but with flagged data marked. Note that for floats with previously assigned uncorrectable profiles, full profile '4' flags will precede full profile '3' flags, in which case the latter are the new profiles subject to the latest DMQC session.

a)



b)

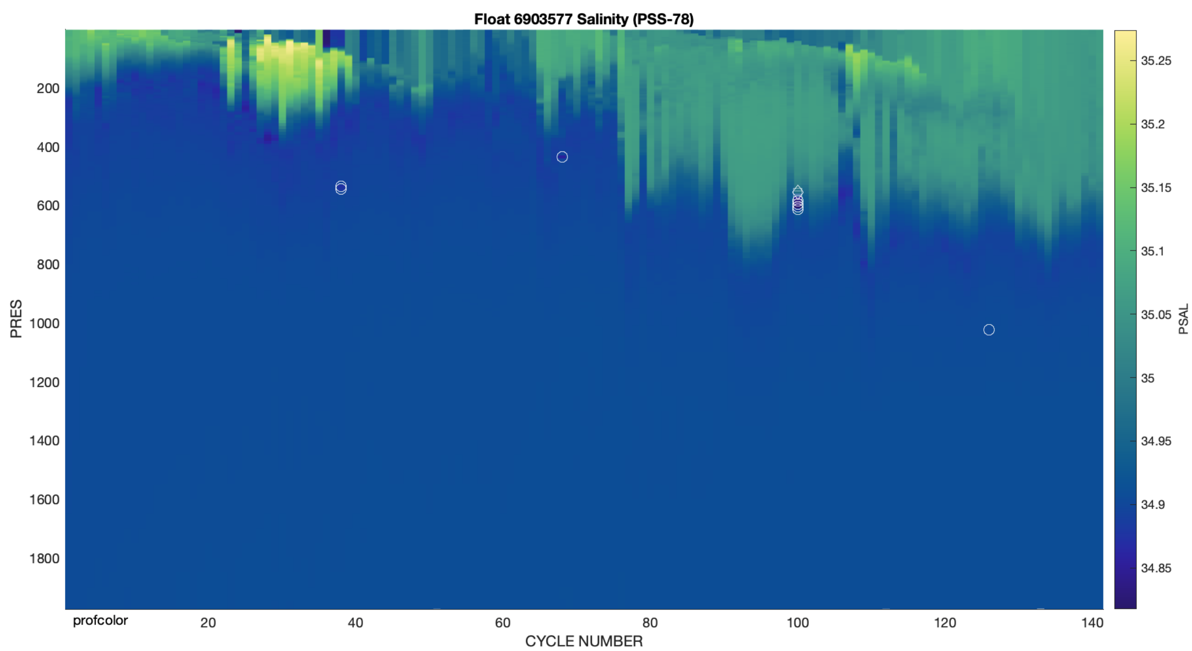


Figure 7: Float 6903577. Time series of Argo float potential temperature (a; ˚C) and salinity (b; PSS-78). Any white squares and circles indicate data that has been flagged '4' by RTQC and DMQC, respectively. A diamond indicates the rare occurence of DMQC reversal of an RTQC flag to '1'. White points indicate RTQC flags of '2' or '3'. Flags based on (the current) OWC findings are not shown here (see Section 4 about any extra flags).

3 Correction of Salinity Data

3.1 Comparison between Argo Float and CTD and Argo Climatology

The OWC-toolbox uses reference data in order to investigate potential salinity drift and calculate calibration offsets. Figure 8 shows the positions of reference data actually used in mapping. In Appendix B profile plots of reference data from the WMO squares (1600, 1700, 7600, and 7700) traversed by the float, can be found.

For floats with previously assigned uncorrectable profiles, these profiles are still included in the current OWC analysis in order to avoid gaps in the presentation of the mapping and calibration (esp. Figure 9).

3.1.1 Configuration

The following are the mapping configuration parameters set in `ow_config.txt` file of the OWC toolbox with the parameters set for the final correction:

```
      CONFIGURATION_FILE: ow_config.txt
    HISTORICAL_DIRECTORY: ~/Arkiv/data/matlab_owc/climatology
   HISTORICAL_CTD_PREFIX: /historical_ctd/ctd_
HISTORICAL_BOTTLE_PREFIX: /historical_bot/bot_
  HISTORICAL_ARGO_PREFIX: /argo_profiles/argo_
  FLOAT_SOURCE_DIRECTORY: ~/Arkiv/data/matlab_owc/float_source/
    FLOAT_SOURCE_POSTFIX: .mat
  FLOAT_MAPPED_DIRECTORY: ~/Arkiv/data/matlab_owc/float_mapped/
     FLOAT_MAPPED_PREFIX: map_
    FLOAT_MAPPED_POSTFIX: .mat
   FLOAT_CALIB_DIRECTORY: ~/Arkiv/data/matlab_owc/float_calib/
      FLOAT_CALIB_PREFIX: cal_
  FLOAT_CALSERIES_PREFIX: calseries_
     FLOAT_CALIB_POSTFIX: .mat
   FLOAT_PLOTS_DIRECTORY: ~/Arkiv/data/matlab_owc/float_plots/
        CONFIG_DIRECTORY: ~/Arkiv/data/matlab_owc/constants/
       CONFIG_COASTLINES: coastdat.mat
        CONFIG_WMO_BOXES: wmo_boxes.mat
              CONFIG_SAF: TypicalProfileAroundSAF.mat
        CONFIG_MAX_CASTS: 250
              MAP_USE_PV: 1
             MAP_USE_SAF: 0
MAPSCALE_LONGITUDE_LARGE: 1.6
MAPSCALE_LONGITUDE_SMALL: 0.4
 MAPSCALE_LATITUDE_LARGE: 1
 MAPSCALE_LATITUDE_SMALL: 0.3
      MAPSCALE_PHI_LARGE: 0.5
      MAPSCALE_PHI_SMALL: 0.1
      MAPSCALE_AGE_SMALL: 5
      MAPSCALE_AGE_LARGE: 10
           MAP_P_EXCLUDE: 400
             MAP_P_DELTA: 100
```

The calseries parameters are set in `set_calseries.m` file as follows:

```
          breaks: []
      max_breaks: -1
       calseries: 1-141
calib_profile_no: [1x141 double]
    use_theta_lt: []
    use_theta_gt: []
     use_pres_gt: 1000
     use_pres_lt: []
  use_percent_gt: 0.25
```

3.1.2 Results

Figures 8 through 15 show the results of the comparison and correction of the salinity data. Notes made about this float during the different rounds of DMQC, can be found in Appendix A.

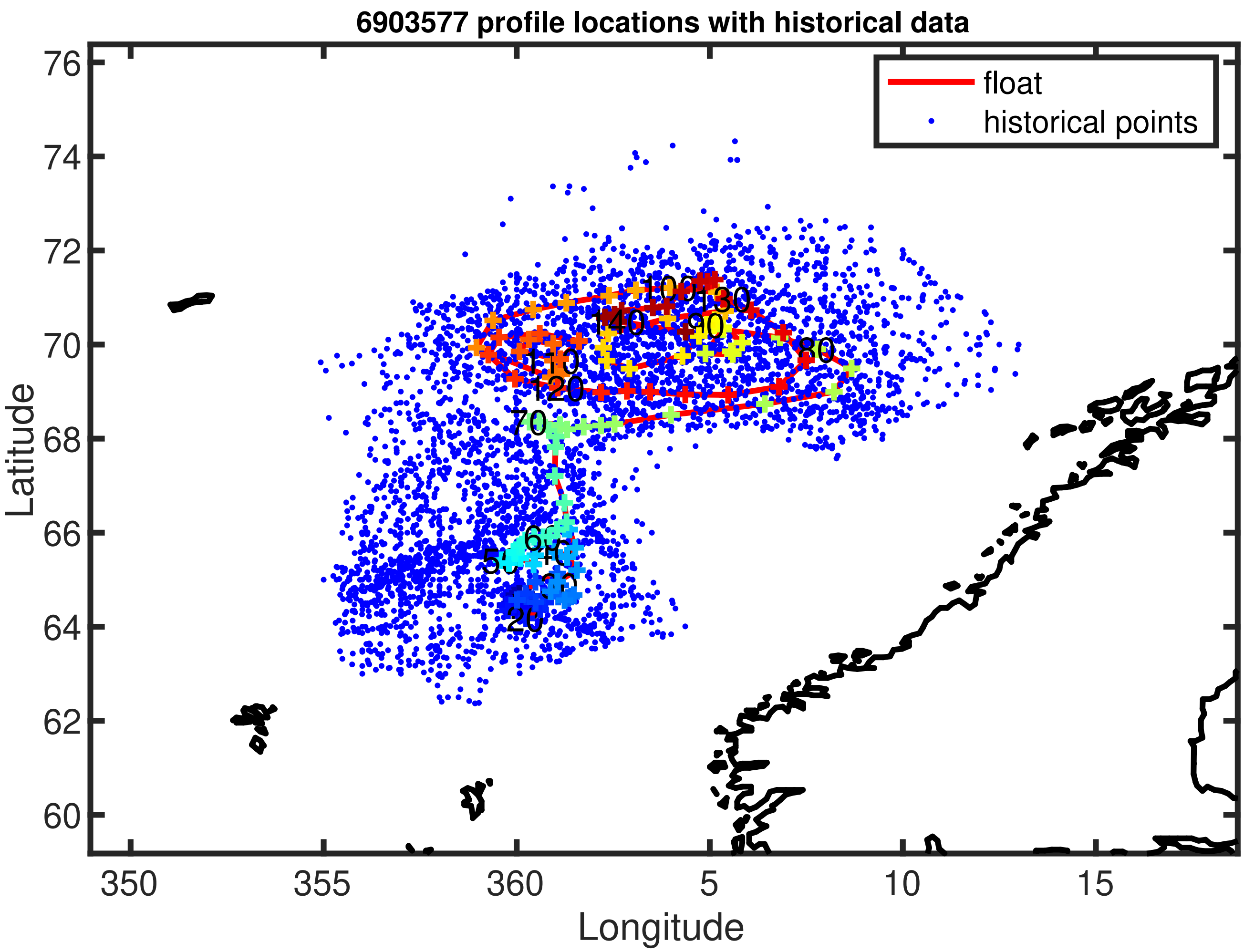


Figure 8: Float 6903577. Location of the float profiles (red line with black numbers) and the reference data selected for mapping (blue dots). Note that missing cycles are not included into OWC, so profile numbers do not match cycle numbers.

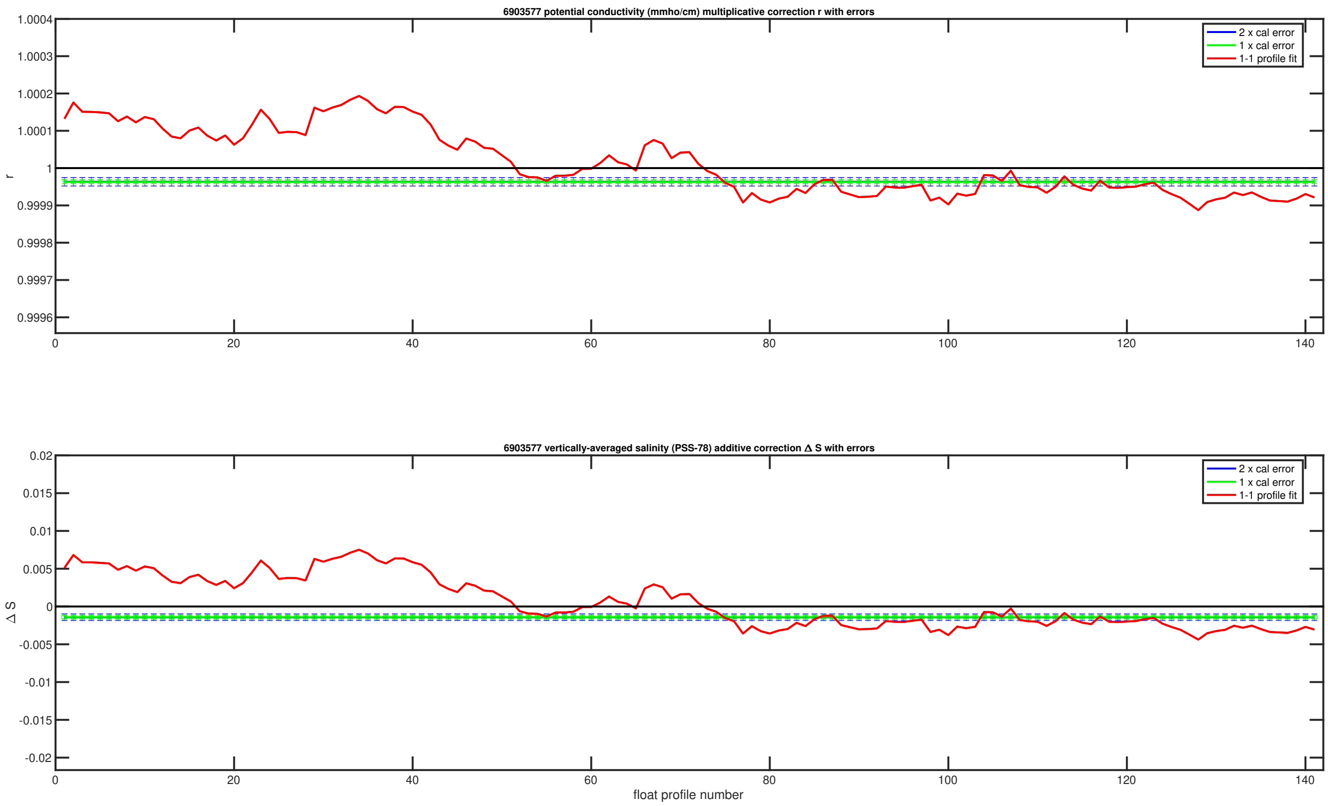


Figure 9: Float 6903577. Evolution of the suggested adjustment with time. The top panel plots the potential conductivity multiplicative adjustment. The bottom panel plots the equivalent salinity additive adjustment. The red line denotes one-to-one profile fit that uses the vertically weighted mean of each profile. The red line can be used to check for anomalous profiles relative to the optimal fit. Note that missing cycles are not included into OWC, so profile numbers do not necessarily match cycle numbers.

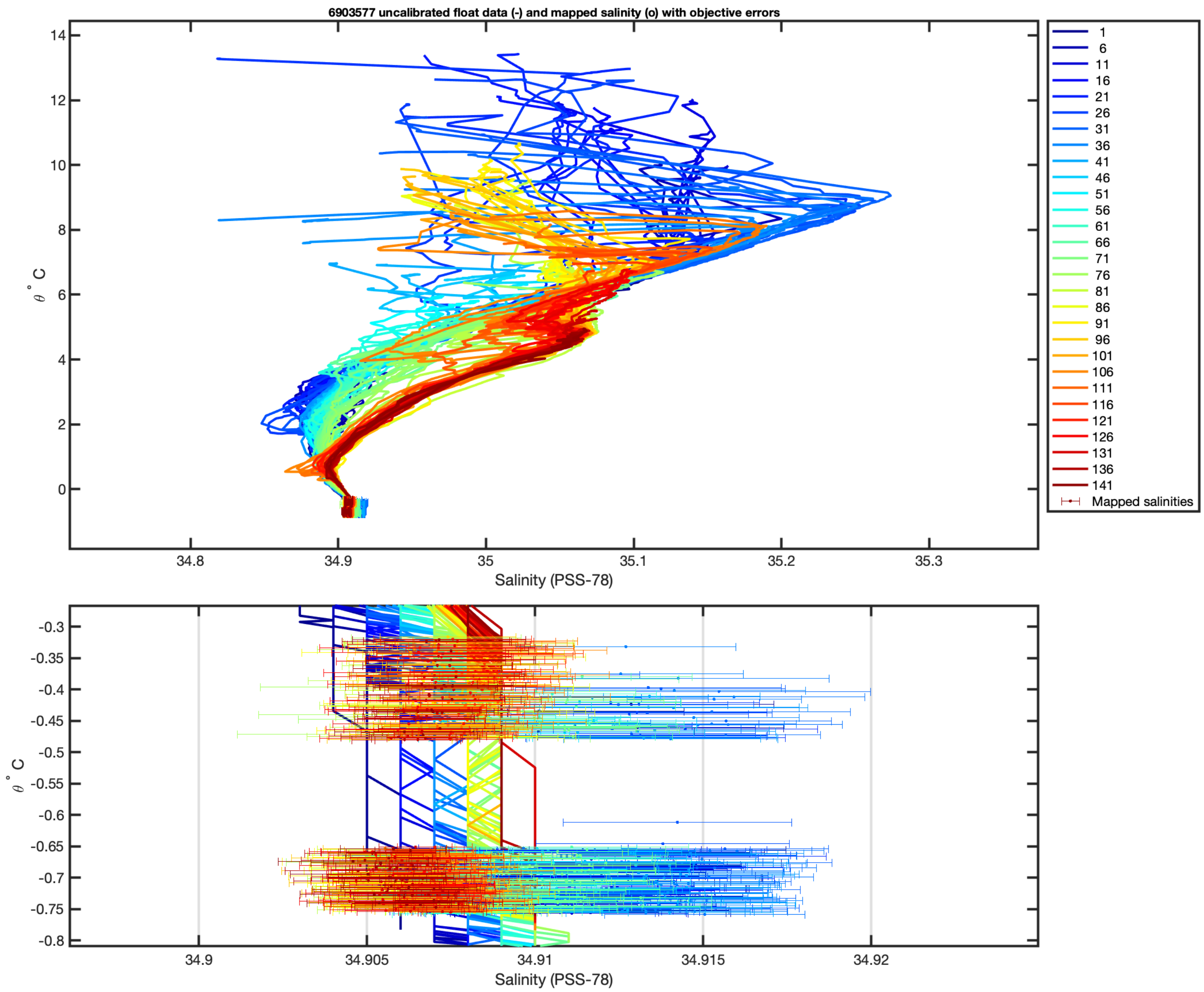


Figure 10: Float 6903577. The original float salinity and the objectively estimated reference salinity at the 10 float theta levels that are used in calibration as errorbars. Lower panel is a zoom to the latter. Note that missing cycles are not included into OWC, so profile numbers in legend do not necessarily match cycle numbers.

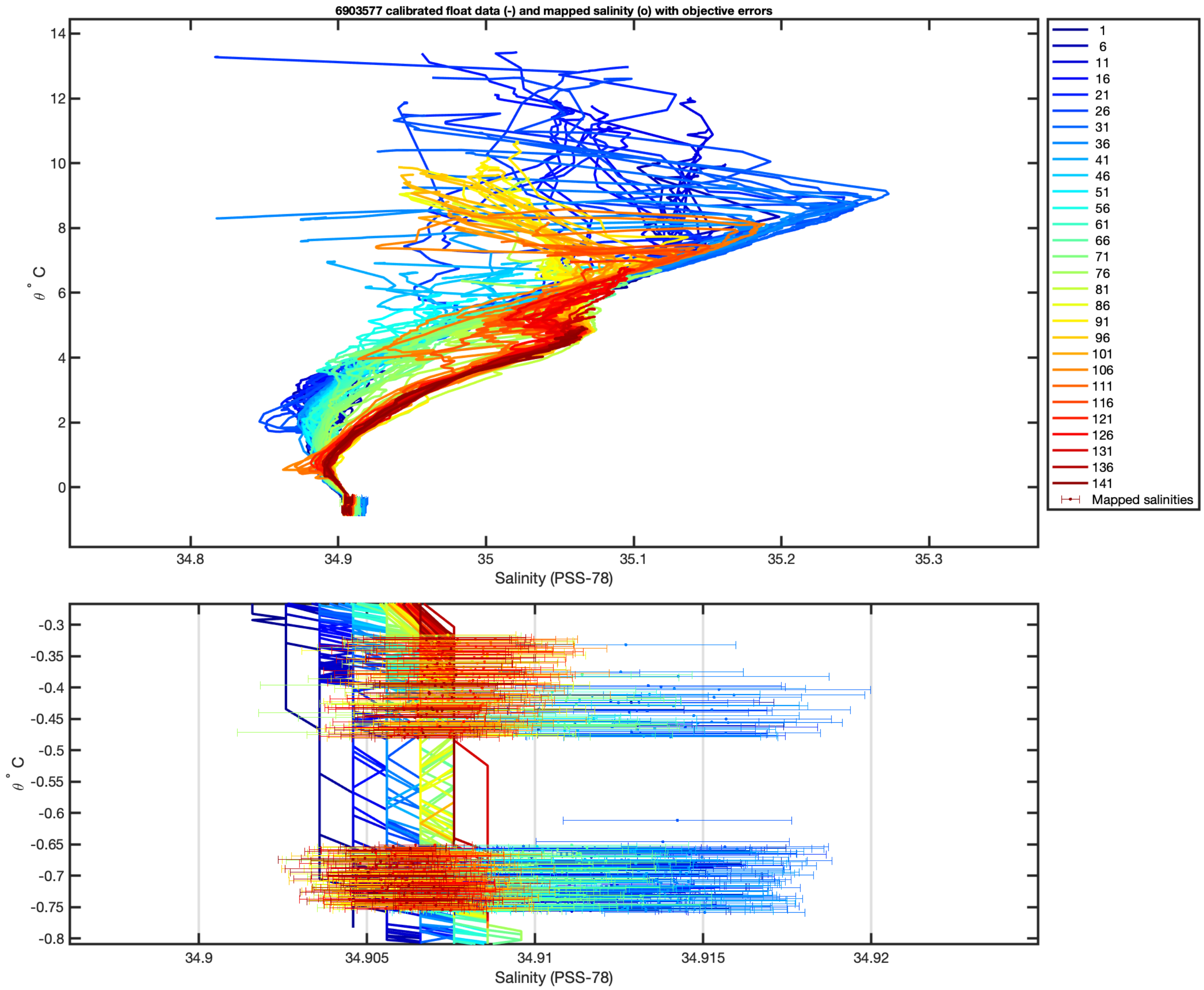


Figure 11: Float 6903577. Plots of calibrated float salinity and the objectively estimated reference salinity at the 10 float theta levels that are used in calibration as errorbars. Lower panel is a zoom to the latter. Note that missing cycles are not included into OWC, so profile numbers in legend do not necessarily match cycle numbers.

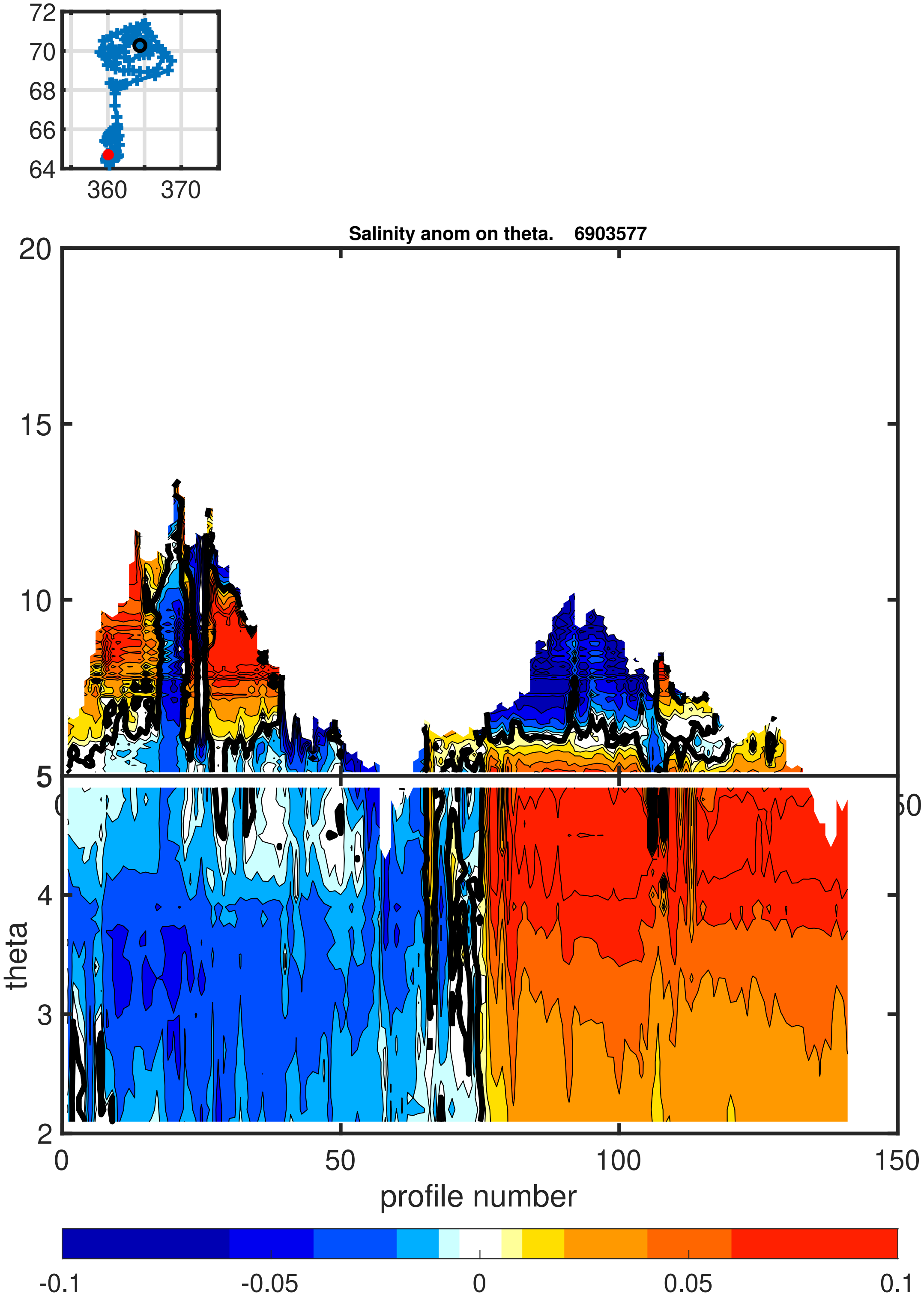


Figure 12: Float 6903577. Salinity anomaly on theta levels. Note that missing cycles are not included into OWC, so profile numbers do not necessarily match cycle numbers.

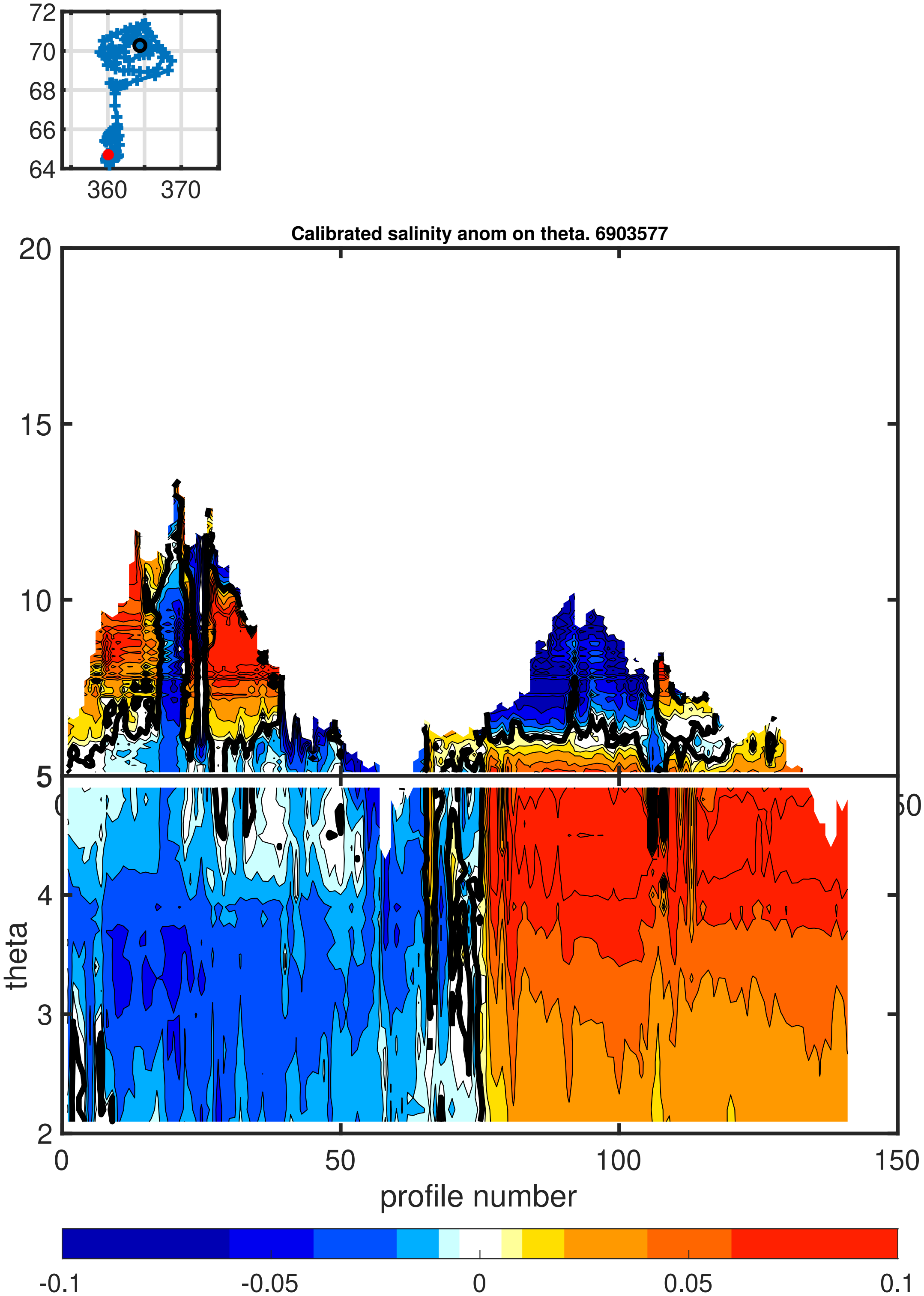


Figure 13: Float 6903577. C alibrated salinity anomaly on theta levels. Note that missing cycles are not included into OWC, so profile numbers do not necessarily match cycle numbers.

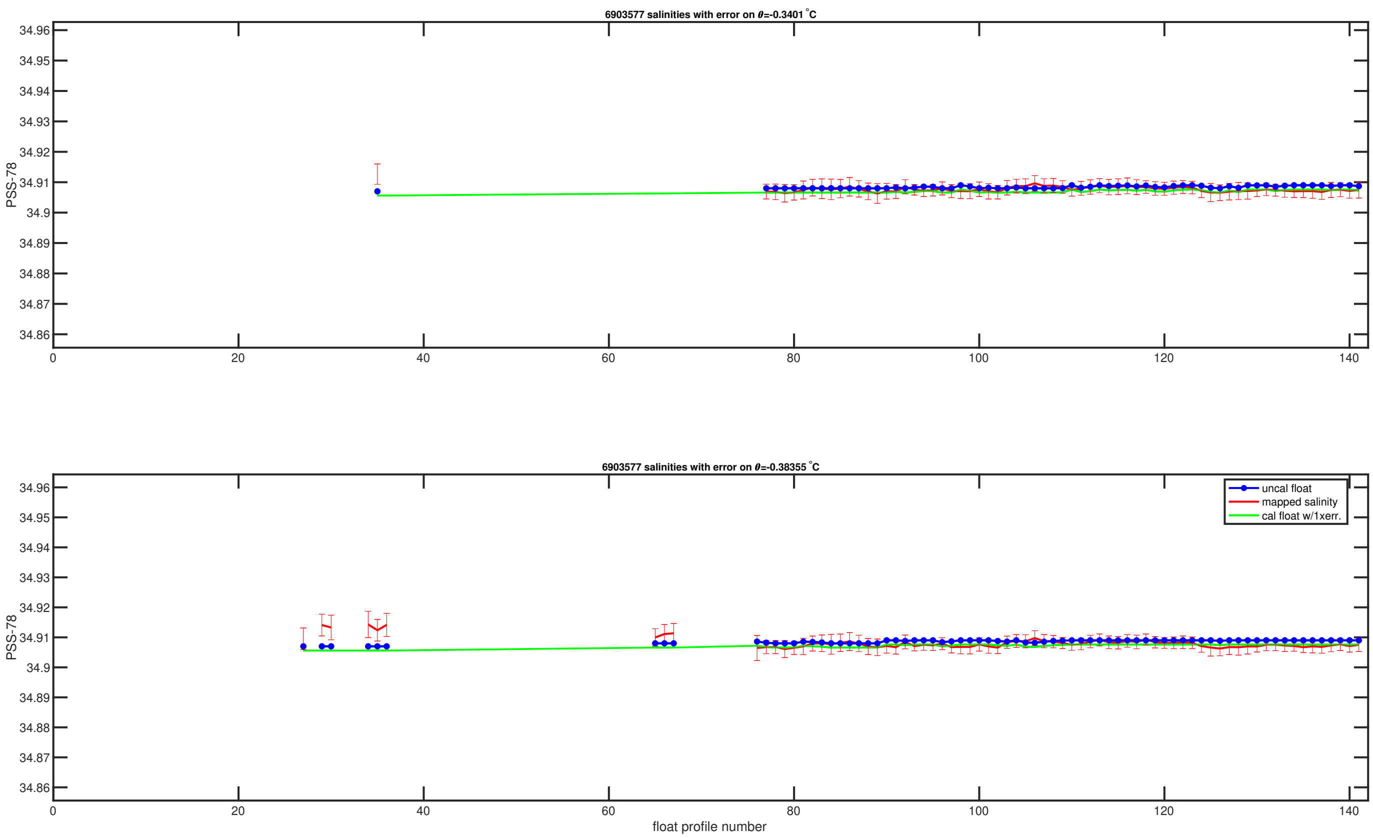


Figure 14: Float 6903577. Plots of the evolution of salinity with time along with selected theta levels with minimum salinity variance. Note that missing cycles are not included into OWC, so profile numbers do not necessarily match cycle numbers.

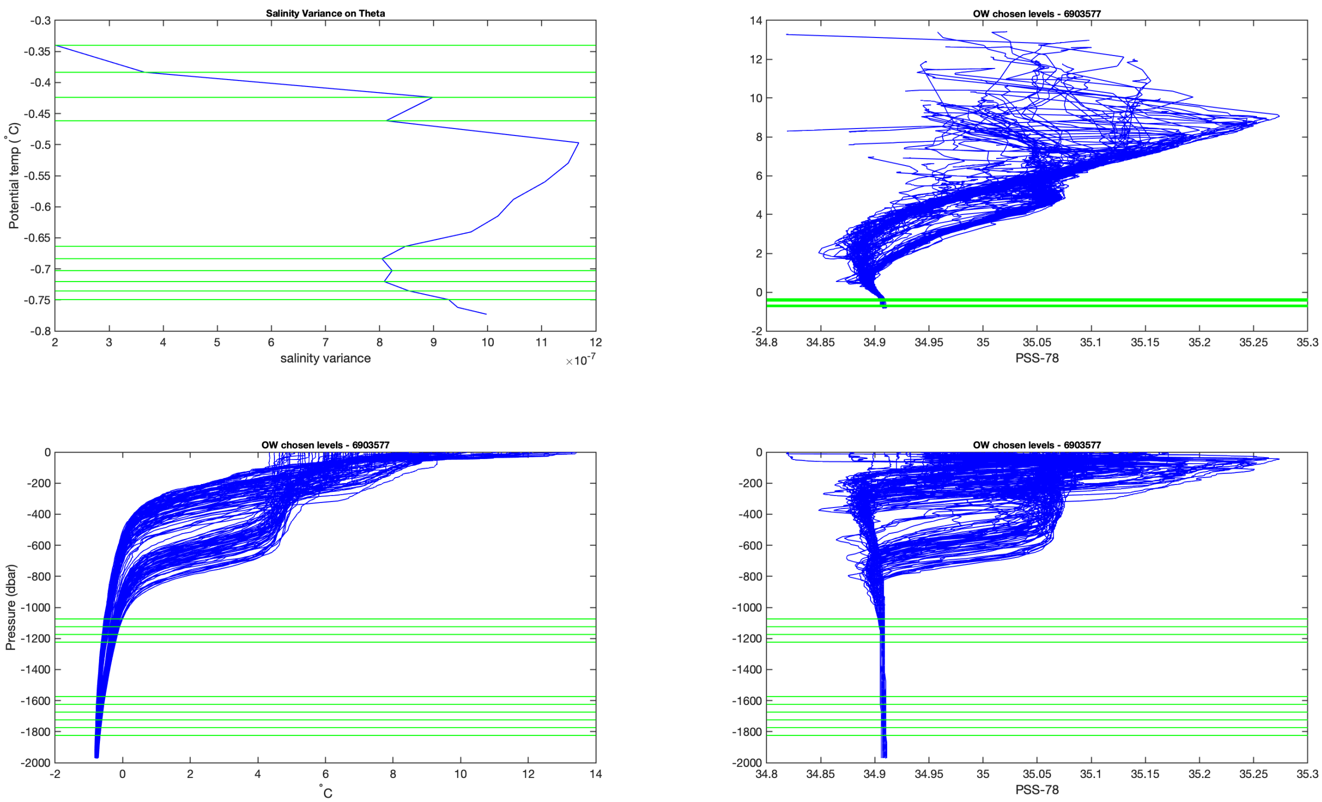


Figure 15: Float 6903577. Plots include the theta levels chosen for calibration: Top left: Salinity variance at theta levels. Top right: T/S diagram of all profiles of Argo float. Bottom left: potential temperature plotted against pressure. Bottom right: salinity plotted against pressure.

4 Discussion and conclusions

Float number 6903577 was deployed on 08/05/2021 southeast in the Norwegian Basin (NB) and stayed there for the first 60 cycles, then by little more than 10 cycles it has moved north along the Vøring Plateau slope and into the Lofoten Basin (LB), cycling the basin cyclonically since. Hydrography is relatively invariable below 1000 m in the profiles.

All profiles have been visually inspected. Only one bad RTQC salinity flag was reversed and 8 new added, and all 3 temperature flags reversed, affecting only 4 profiles. The sea surface pressure data are not displaying values below 0 dbar and there are no indications of negative pressure drift. The initial comparison between Argo float data and reference data, shows that temperature and salinity data are within normal values. The comparison with satellite altimeter data suggested no notable discrepancies.

The OWC analysis showed a weak fresh offset for the first 40 or so profiles, which is supported by more recent CTD profiles near deployment (Figure 20), however the offset goes to zero when moving away from the initial region, and is stable at negligible levels thereafter. Hence, no correction is done at this stage.

This float is still active and further monitoring is required.

Acknowledgments

This report is based on the template given in the DM-REPORT-TEMPLATE Matlab/LaTeX toolbox provided at https://github.com/euroargodev/dm-report-template.git and adapted to own needs (this version is provided in https://github.com/imab4bsh/DMQC-fun.git). Calibration of conductivity sensor drift was done using the Matlab OWC toolbox provided at https://github.com/ArgoDMQC/matlab_owc. The map in Figure 1 was made using the M_MAP toolbox (Pawlowicz, 2020; `http://www.eoas.ubc.ca/~rich/map.html`). The visual DMQC tool CHECK_PROFILES and other supporting functions can be found in the author's own distribution at https://github.com/evenrev1/evenmat.git.

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.

Johnson, G. C., Toole, J. M., & Larson, N. G. (2007). Sensor corrections for Sea-Bird SBE-41CP and SBE-41 CTDs. Journal of Atmospheric and Oceanic Technology, 24(6), 1117–1130. https://doi.org/10.1175/JTECH2016.1.

Pawlowicz, R., 2020. "M_Map: A mapping package for MATLAB", version 1.4m, [Computer software], available online at `http://www.eoas.ubc.ca/~rich/map.html`.

Annie Wong, Robert Keeley, Thierry Carval, and the Argo Data Management Team (2023). Argo Quality Control Manual for CTD and Trajectory Data. http://dx.doi.org/10.13155/33951.

5 Appendix A: File information and notes

Operator's notes

The following notes have been made about this float:

```
'6903577'

-- 20211118: --
% Norwegian Basin E; 39 profiles.
% Looking good. Maybe fresh.
% LBmap, KAMage, KAMphi. All mapped w/o warning.
% Free => offset ~ 0.004. Relatively stable.
% All levels below 700 m and pycnocline. Low variance.
% Ref data relatively well confined. Old refdata.
% Small offset;
% DO NOT CORRECT (cal_action=0).
-- 2022.07.19: --
87 profiles. Mapped and calibrated w/o warnings.
Has moved north along the Vøring Plateau slope and into the LB, central in the latest 10 cycles.
All levels below the thermocline, but forcing > 1000 to be sure.
Best model found with 3 break points. Small deviations all relatable to changing regions.
Forcing offset, and then it is 0.
DO NOT CORRECT.
-- 2023.04.11: --
141 profiles mapped w/o errors.
Forced offset w/o error.
Negligible offset, which shifts sign upon changing basins.
DO NOT CORRECT.

%%% Local Variables:
%%% mode: plain-tex
%%% TeX-master: "DMQCreport_float"
%%% End:
```

Scientific calibration information

The scientific calibration information written to the D-files are summarized in Tables 3–11. Note that adjustements are done and registered regardless of the amount of valid data, hence some cycles will record scientific calibration information even when the whole profile consists of fillvalues.

Table 3: Information filled in the SCIENTIFIC_CALIB section for MTIME in the D-files. Empty string means parameter not present in file.

Parameter	Field	Cycles/files	String
MTIME	EQUATION	1-141	not applicable
	COEFFICIENT	1-141	not applicable
	COMMENT	1-141	not applicable
	DATE	1-141	20230411215718

Table 4: Information filled in the SCIENTIFIC_CALIB section for TEMP_STD in the D-files. Empty string means parameter not present in file.

Parameter	Field	Cycles/files	String
TEMP_STD	EQUATION	1-141	not applicable
	COEFFICIENT	1-141	not applicable
	COMMENT	1-141	not applicable
	DATE	1-141	20230411215718

Table 5: Information filled in the SCIENTIFIC_CALIB section for PSAL_STD in the D-files. Empty string means parameter not present in file.

Parameter	Field	Cycles/files	String
PSAL_STD	EQUATION	1-141	not applicable
	COEFFICIENT	1-141	not applicable
	COMMENT	1-141	not applicable
	DATE	1-141	20230411215718

Table 6: Information filled in the SCIENTIFIC_CALIB section for PRES_MED in the D-files. Empty string means parameter not present in file.

Parameter	Field	Cycles/files	String
PRES_MED	EQUATION	1-141	not applicable
	COEFFICIENT	1-141	not applicable
	COMMENT	1-141	not applicable
	DATE	1-141	20230411215718

Table 7: Information filled in the SCIENTIFIC_CALIB section for TEMP_MED in the D-files. Empty string means parameter not present in file.

Parameter	Field	Cycles/files	String
TEMP_MED	EQUATION	1-141	not applicable
	COEFFICIENT	1-141	not applicable
	COMMENT	1-141	not applicable
	DATE	1-141	20230411215718

Table 8: Information filled in the SCIENTIFIC_CALIB section for PSAL_MED in the D-files. Empty string means parameter not present in file.

Parameter	Field	Cycles/files	String
PSAL_MED	EQUATION	1-141	not applicable
	COEFFICIENT	1-141	not applicable
	COMMENT	1-141	not applicable
	DATE	1-141	20230411215718

Table 9: Information filled in the SCIENTIFIC_CALIB section for PRES in the D-files. Empty string means parameter not present in file.

Parameter	Field	Cycles/files	String
PRES	EQUATION	1-141	PRES_ADJUSTED = PRES.
	COEFFICIENT	1-141	none
	COMMENT	1-141	The quoted error is manufacturer specified accuracy.
	DATE	1-141	20230411215718

Table 10: Information filled in the SCIENTIFIC_CALIB section for PSAL in the D-files. Empty string means parameter not present in file.

Parameter	Field	Cycles/files	String
PSAL	EQUATION	1-141	PSAL_ADJUSTED = PSAL.
	COEFFICIENT	1-141	none
	COMMENT	1-141	No significant salinity offset or drift detected. The quoted error is max[0.01, statistical uncertainty] in PSS-78.
	DATE	1-141	20230411215718

Table 11: Information filled in the SCIENTIFIC_CALIB section for TEMP in the D-files. Empty string means parameter not present in file.

Parameter	Field	Cycles/files	String
TEMP	EQUATION	1-141	TEMP_ADJUSTED = TEMP.
	COEFFICIENT	1-141	none
	COMMENT	1-141	The quoted error is manufacturer specified accuracy with respect to ITS-90 at time of laboratory calibration.
	DATE	1-141	20230411215718

6 Appendix B: Reference data

Here follows overview plots of the reference data in the WMO-squares traversed by Float 6903577.

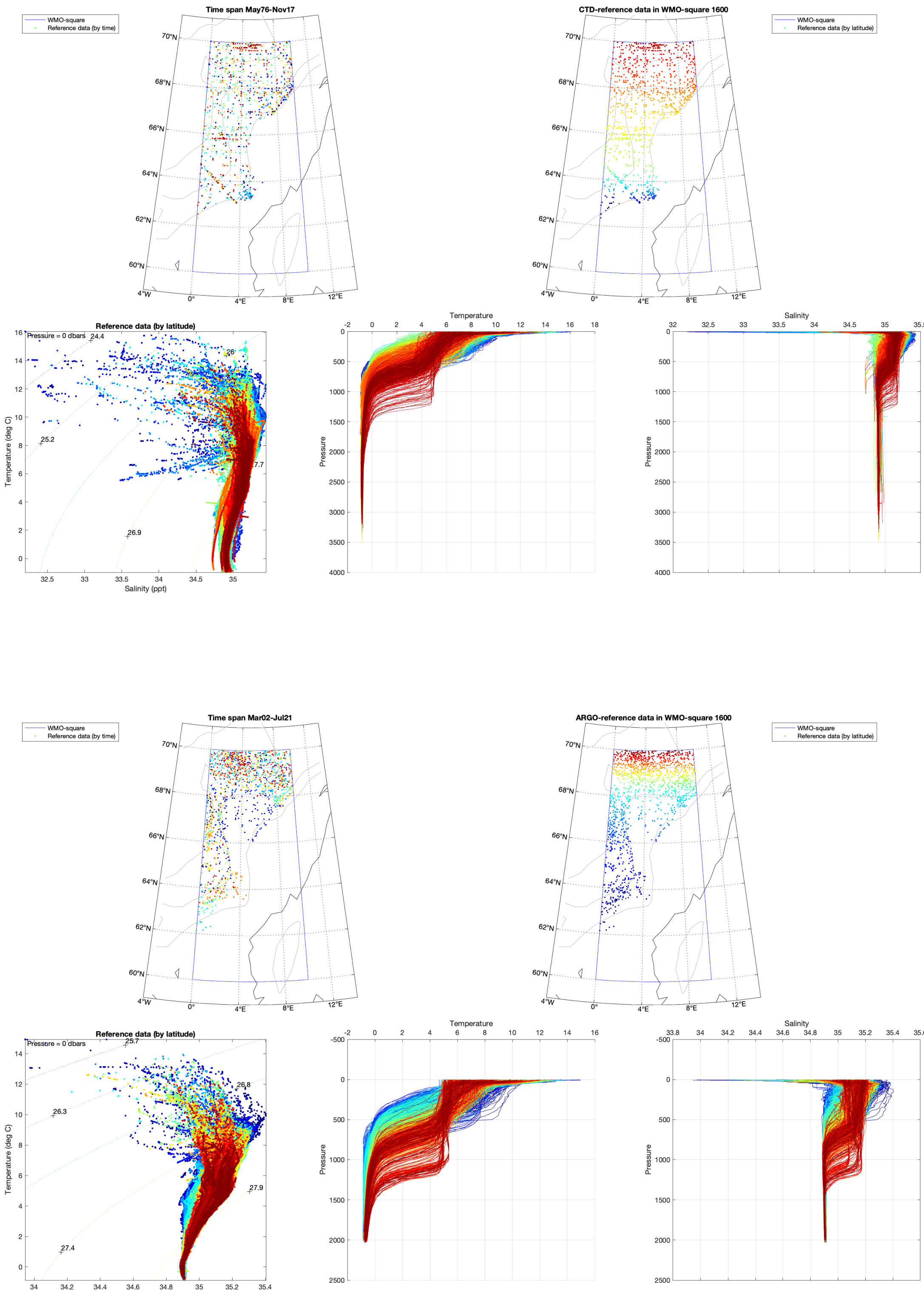


Figure 16: Overview of reference data in WMO square 1600 which is traversed by Float 6903577. Upper set of graphs are for CTD reference data, and lower set is for historical ARGO data. Colouring of positions in map pairs illustrate temporal coverage and latitude, respectively. The following TS and profile plots use the latter colormap.

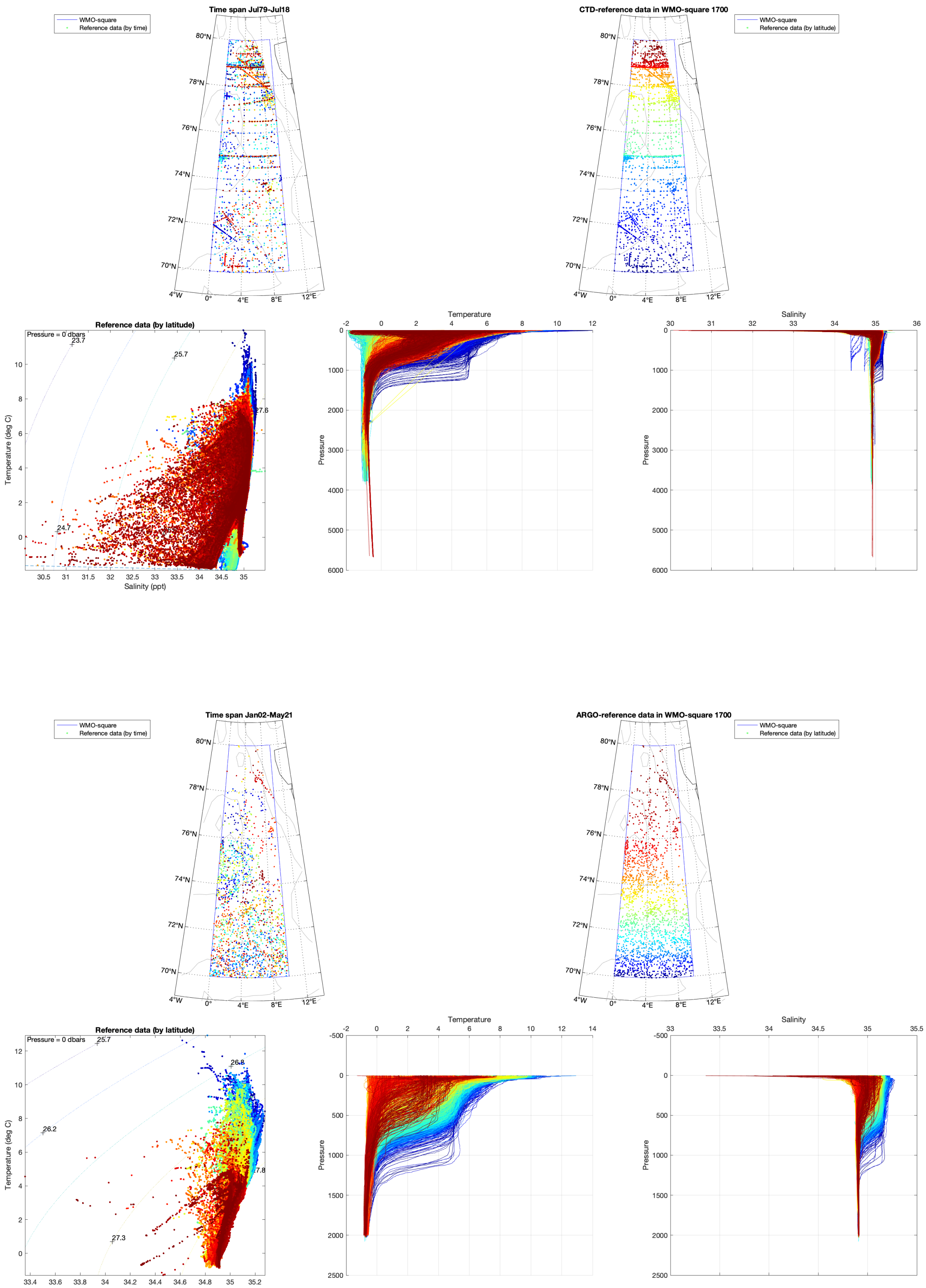


Figure 17: Overview of reference data in WMO square 1700 which is traversed by Float 6903577. Upper set of graphs are for CTD reference data, and lower set is for historical ARGO data. Colouring of positions in map pairs illustrate temporal coverage and latitude, respectively. The following TS and profile plots use the latter colormap.

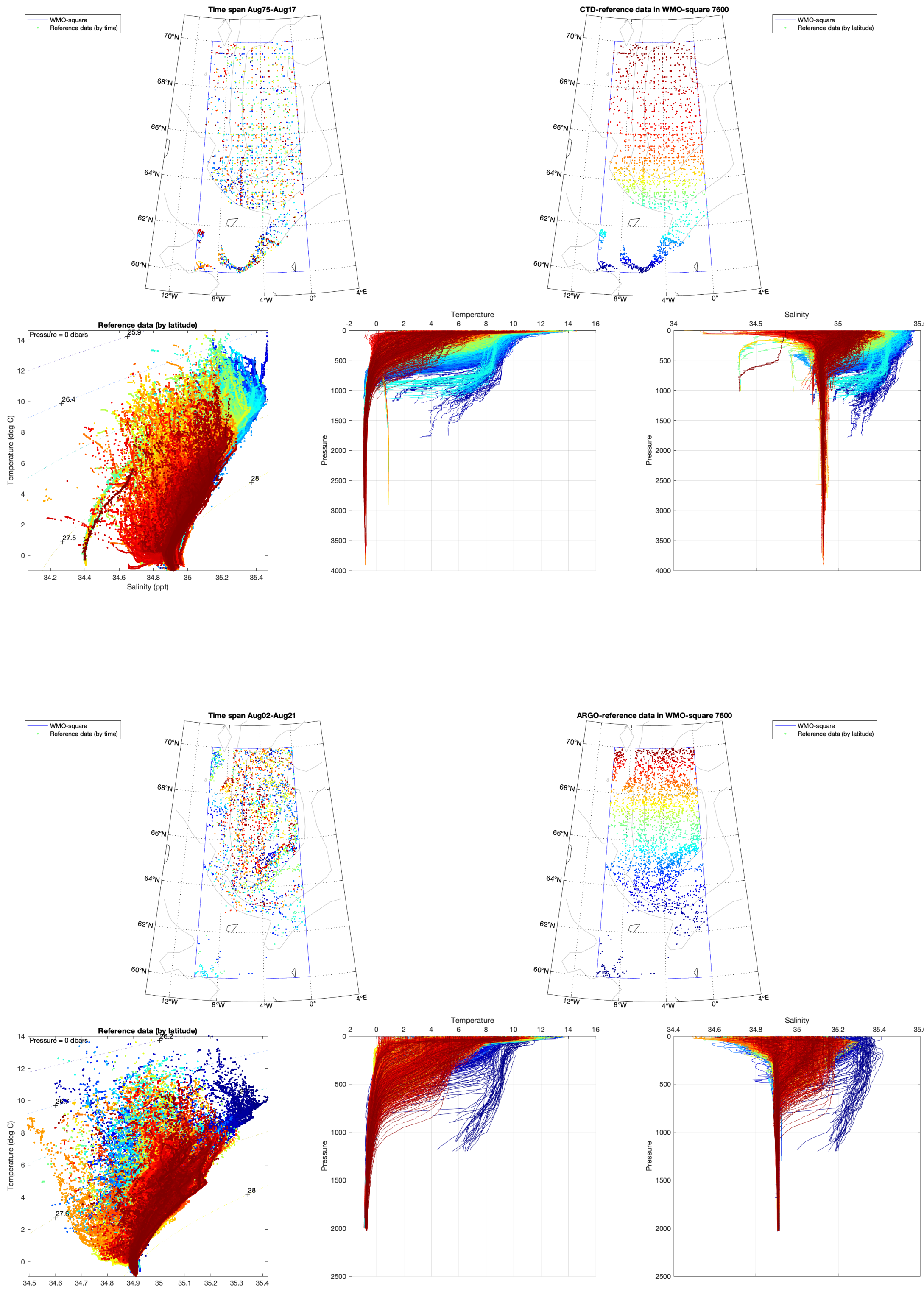


Figure 18: Overview of reference data in WMO square 7600 which is traversed by Float 6903577. Upper set of graphs are for CTD reference data, and lower set is for historical ARGO data. Colouring of positions in map pairs illustrate temporal coverage and latitude, respectively. The following TS and profile plots use the latter colormap.

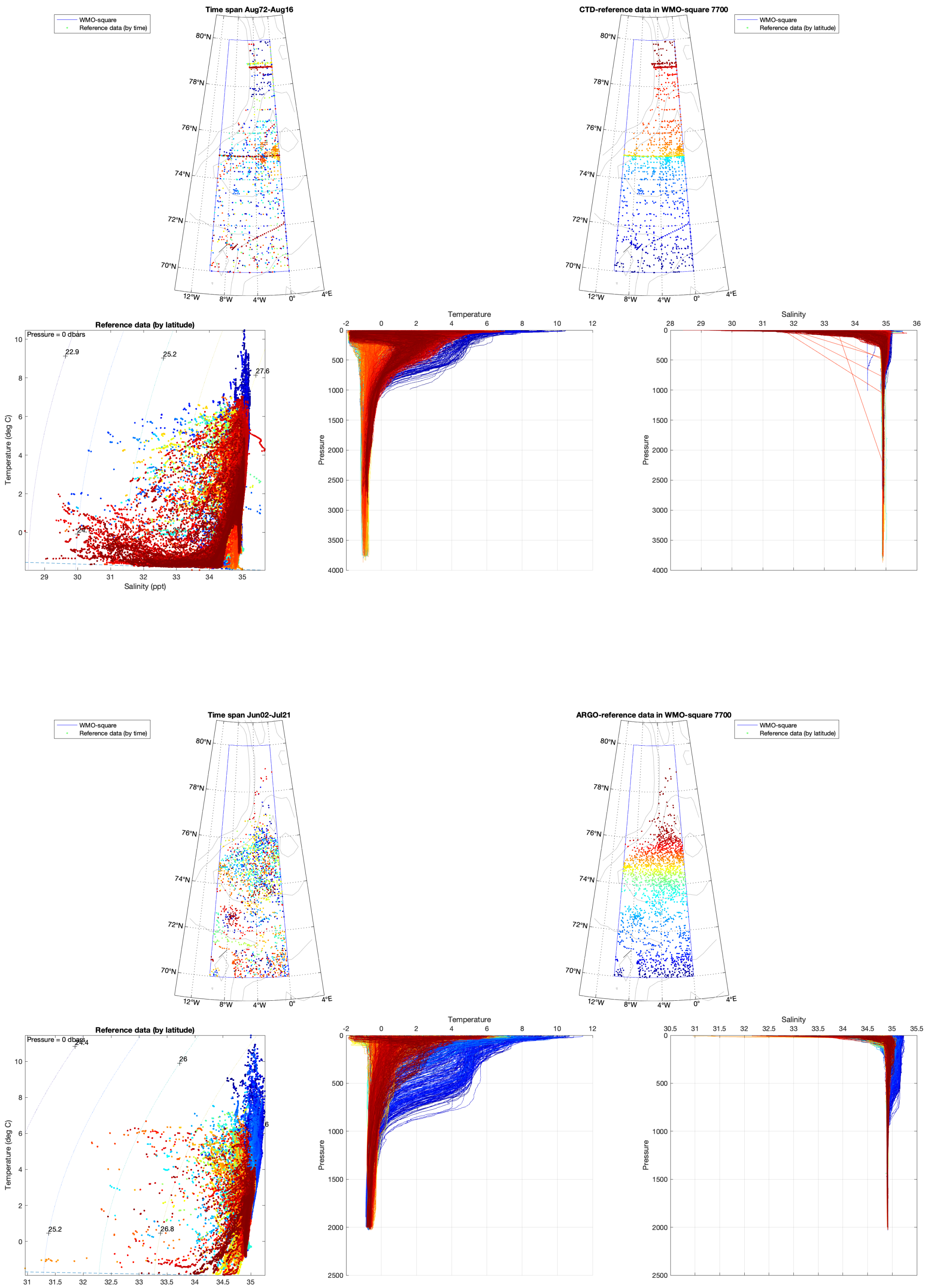


Figure 19: Overview of reference data in WMO square 7700 which is traversed by Float 6903577. Upper set of graphs are for CTD reference data, and lower set is for historical ARGO data. Colouring of positions in map pairs illustrate temporal coverage and latitude, respectively. The following TS and profile plots use the latter colormap.

7 Appendix C: Supplementary information

7.1 Comparison with ship CTD

The 1st salinity profile from the float is compared with ship CTD profile in Figure 20. The average offset of the argo and ship CTD salinities on potential temperature levels less than -0.4 (corresponding to depths of more than 1075 dBar) is found to be -0.009.

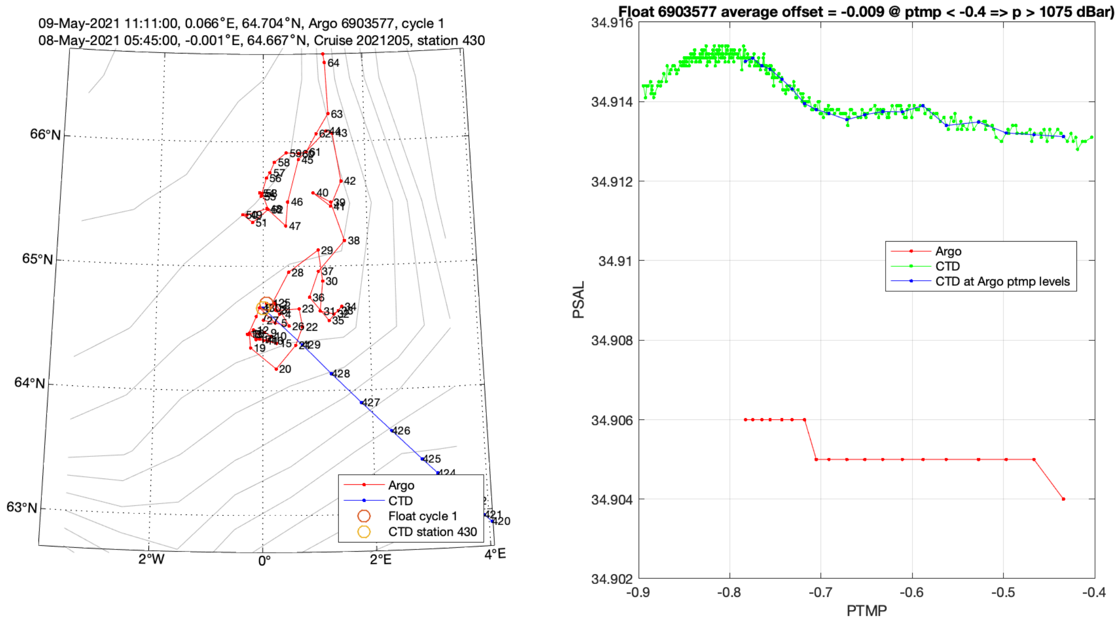


Figure 20: Float 6903577 compared to nearby ship CTD from deployment cruise. Left panel shows positions of float profiles (red) and ship CTD stations (blue), with the compared profiles circled. Right panel shows comparison of salinities in the colder deeper parts of these profiles.