Delayed mode quality control of Argo float 1901909

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Summary

OWC correction is applied to salinity. The correction has been applied from the CTD and Argo reference data combined.

WMO number	DM correction
1901909	OWC correction applied

Table 1: Correction applied in delayed mode.

Contents

1 Introduction

Delayed mode analysis was performed for float number 134529 (1901909) where salinity and temperature values were separately compared to nearby historical CTD profiles and nearby Argo profiles as a reference database. The OWC (Cabanes et al., 2016) method was run to estimate a salinity offset and/or a salinity drift. For more information about float 134529 (1901909) click on the following link: http://www.ifremer.fr/argoMonitoring/float/1901909

2 Quality Check of Argo Float Data

2.1 Time Series of Vertical Distribution of Data

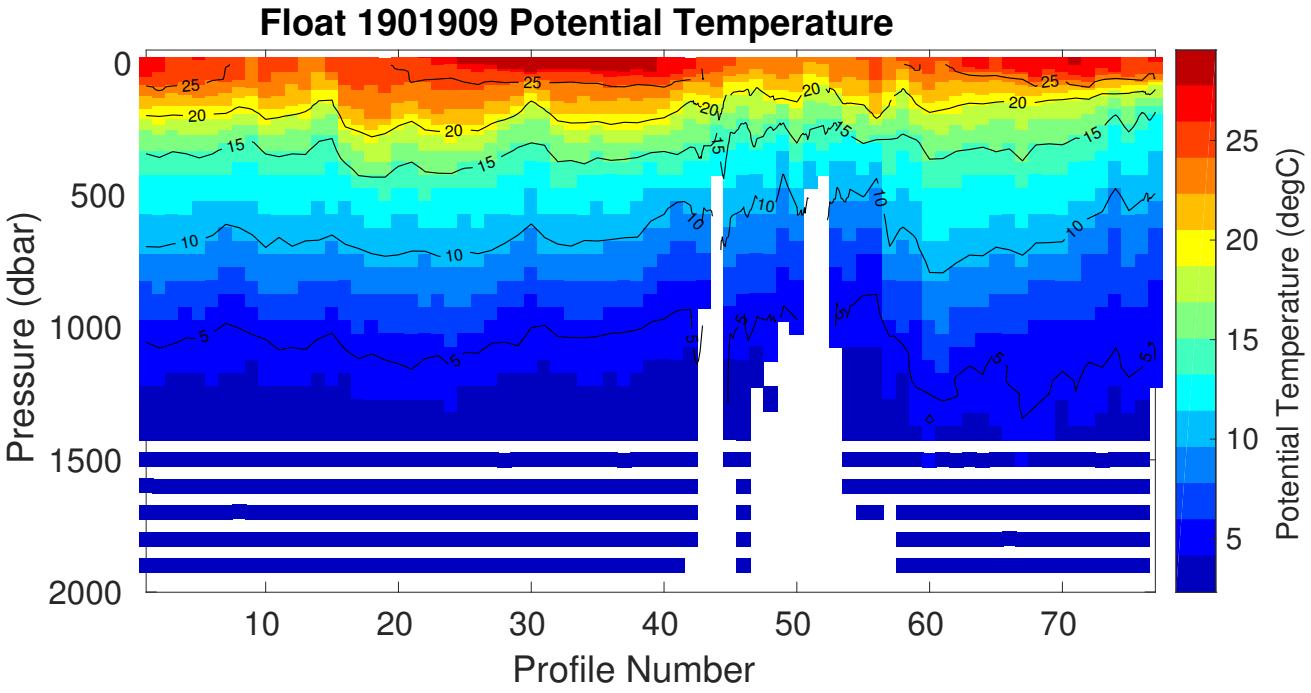

Figure 1: Float 1901909. Time series of the vertical distribution of potential temperature (°C).

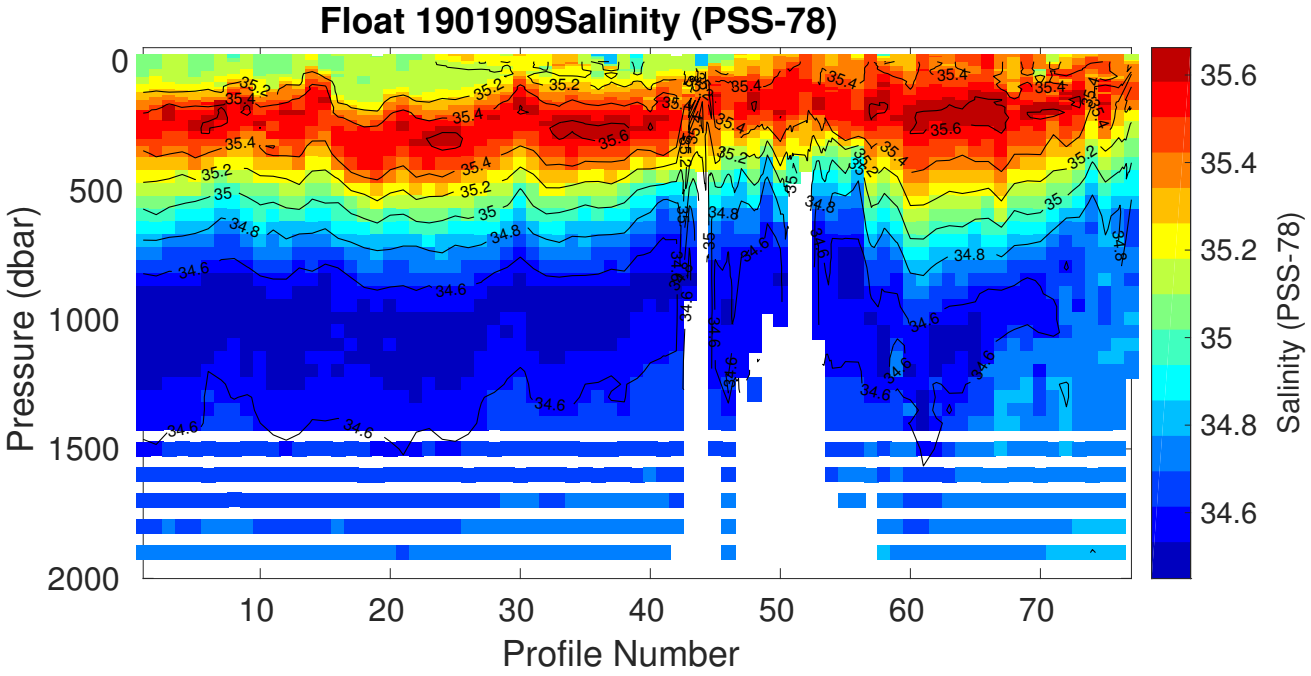

Figure 2: Float 1901909. Time series of the vertical distribution of practical salinity (PSU).

2.2 Comparison between Argo Float and Climatology

The comparison between float 1901909 and data from WMO boxes +/- 10°of latitude and longitude shows that the Argo profiles fit within the expected ranges (Figures 3, 4 and 5). This result confirms that float 1901909 represents relatively stable and consistent with the expected physical conditions in this region.

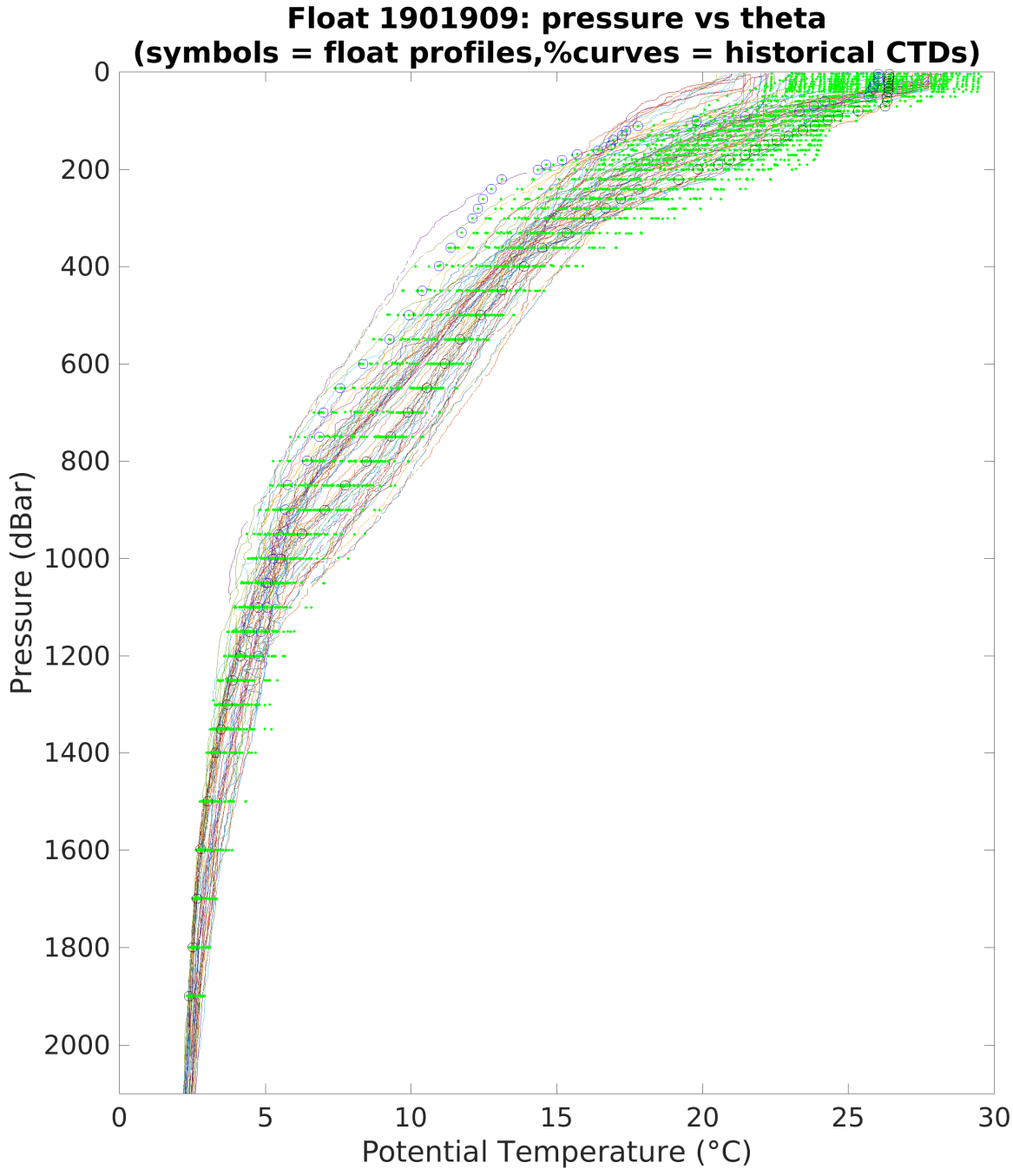

Figure 3: Float 1901909. Float profile of potential temperature (˚C) plotted with climatology from the spatial range of 10 ˚. The black and blue cycles indicates the first and the last Argo profile, respectively. Green symbols represent other Argo profiles.

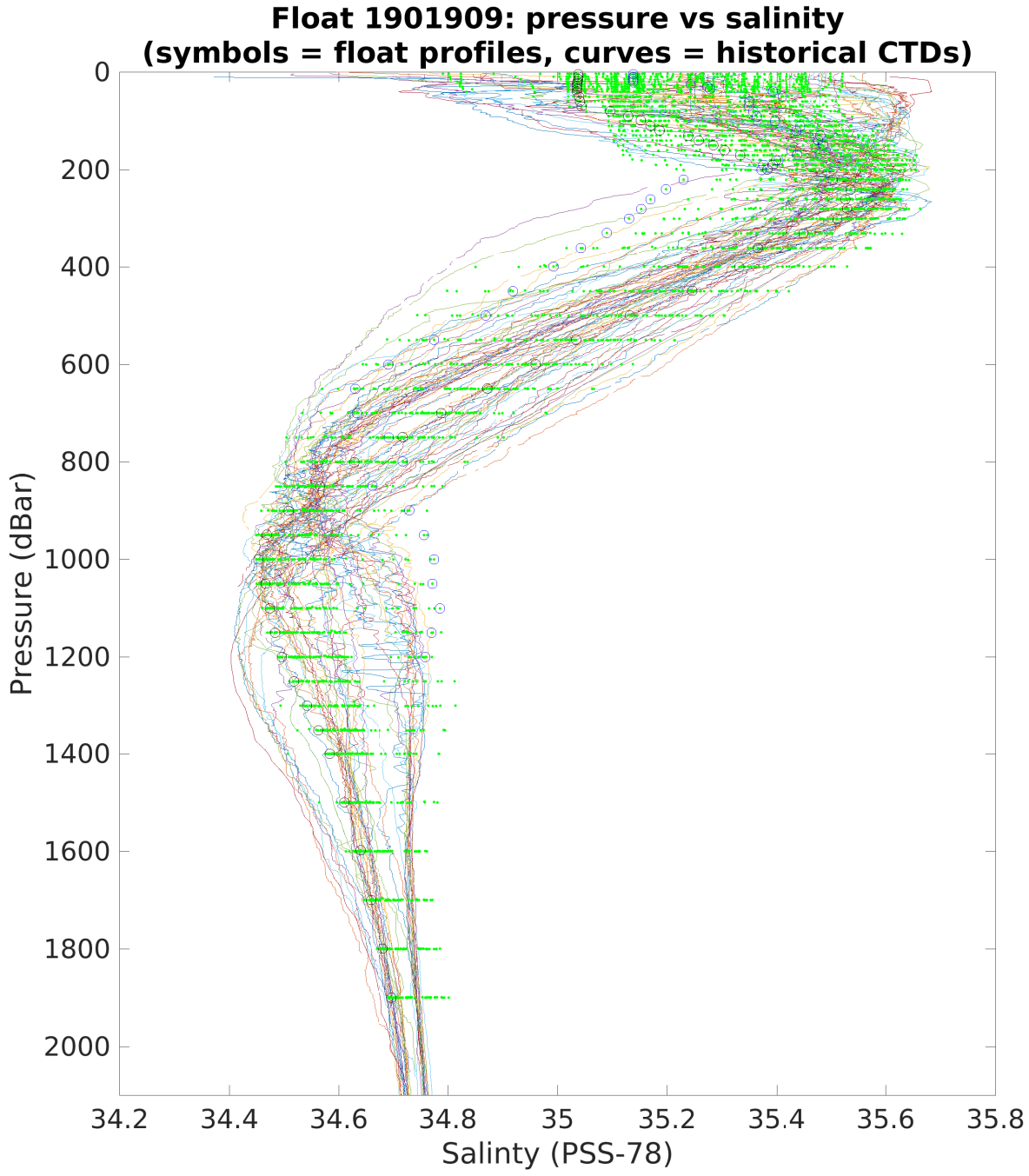

Figure 4: Float 1901909. Float profile of salinity (dimensionless) plotted with climatology from the spatial range of 10 ˚. The black and blue cycles indicates the first and the last Argo profile, respectively. Green symbols represent other Argo profiles.

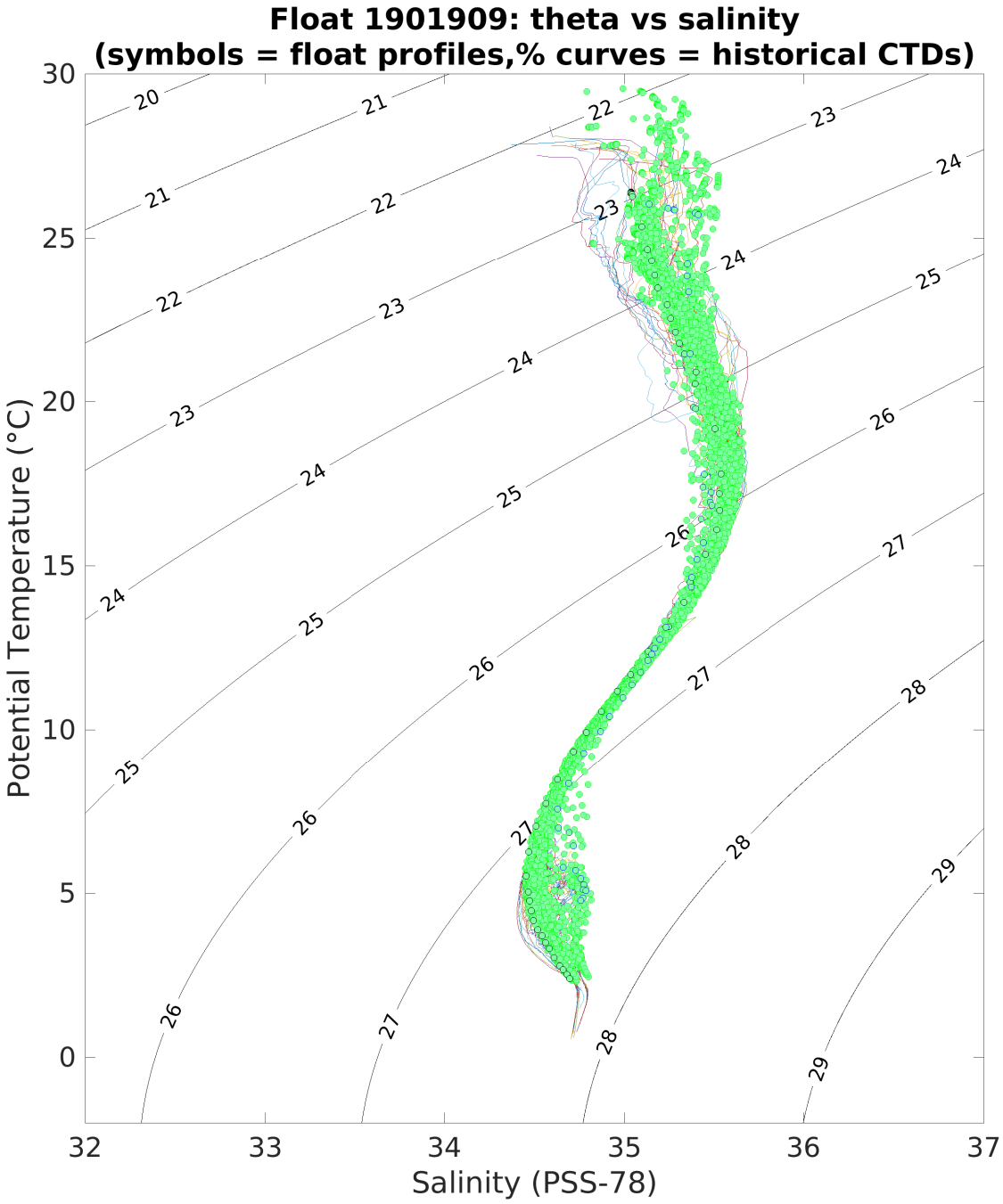

Figure 5: Float 1901909. Theta/S plotted with climatology from the spatial range of 10 °. The black and blue cycles indicates the first and the last Argo profile, respectively. Green symbols represent other Argo profiles.

2.3 Satellite Altimeter comparison

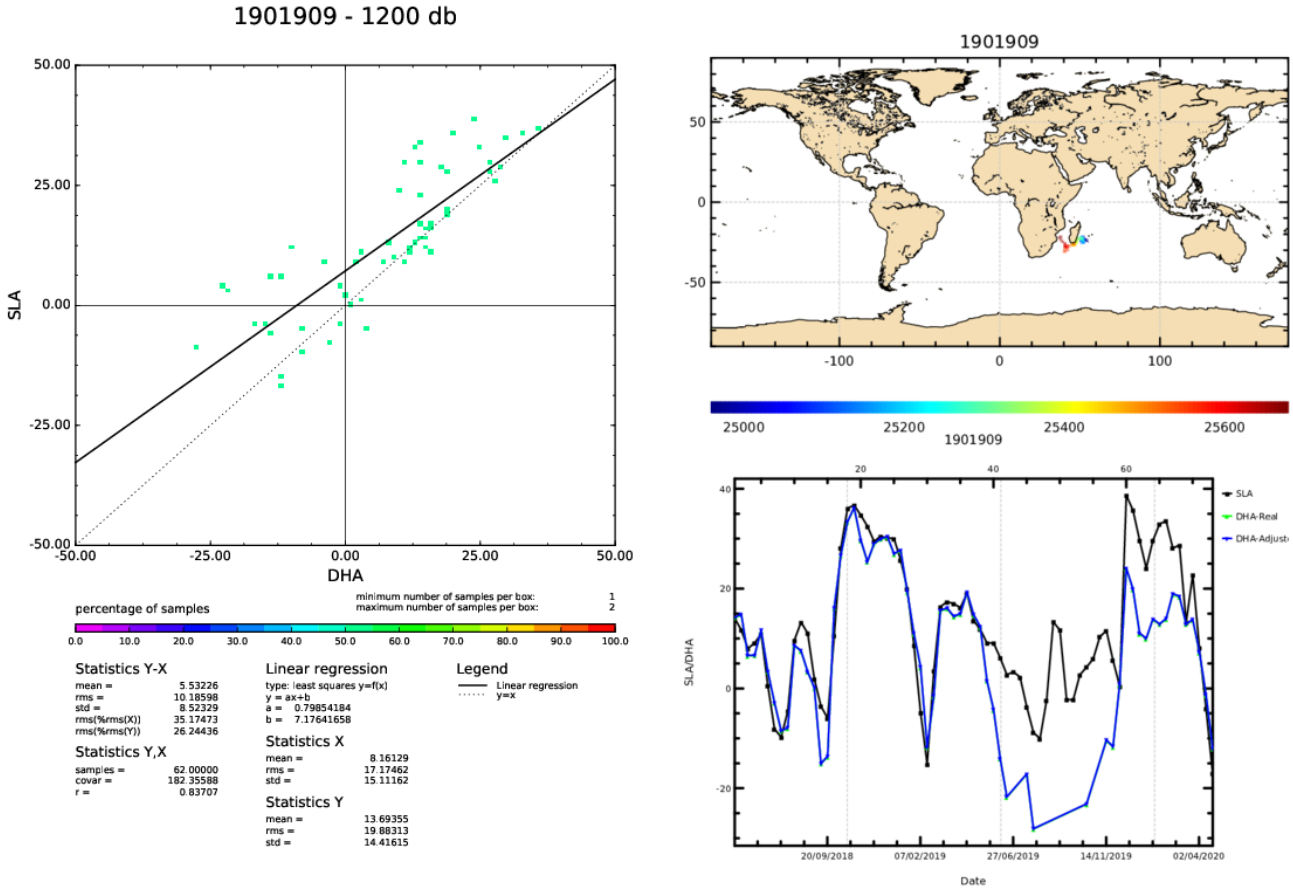

Figure 6: Float 1901909. The comparison betweeen the Sea Surface Height(SSH) from the satellite altimetry and Dynamic Height Anomaly(DHA)extracted from the Argo float temperature and salinity data

3 Pressure Adjustment for APEX Floats

Float 1901909 is the Apex float, where the pressure sensor is not auto-corrected to zero while at the sea surface, hence the pressure data in Apex float have to be corrected during processing in delayed-mode. The procedures of adjusting sea surface pressure are described in Argo User's Manual, 2017 (https://archimer.ifremer.fr/doc/00228/33951/32470.pdf). The pressure sensor in Apex float 1901909 is not truncated, QC=1, error = 2.4 dbar (Figure 7).

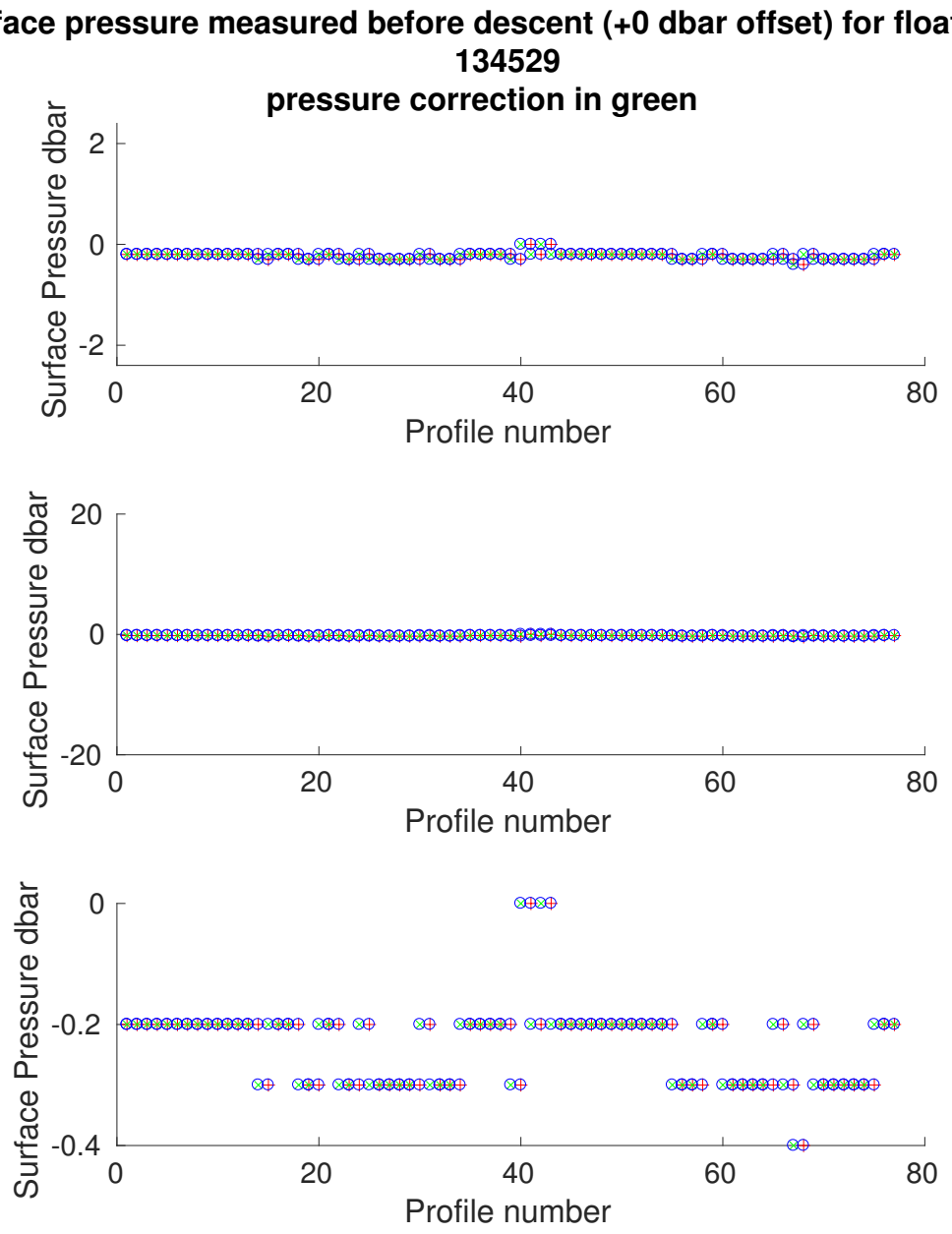

Figure 7: Float 1901909. Sea surface pressure data. The red cross indicate the raw pressure before float descent, recorded after sending data to GDAC. Blue circle indicate pressure value in the real-time. Green rotated cross shows the pressure correction applied from the previous float cycle.

4 Correction of Salinity Data

4.1 Comparison between Argo floats and CTD+Argo Climatlogy combined below 1500m

4.1.1 Configuration

```
% ================================
%
%    Climatology Data Input Paths
%

HISTORICAL_DIRECTORY=/users/argo/climatology
HISTORICAL_CTD_PREFIX=/historical_ctd/CTD_for_DMQC_2019V01/ctd_
HISTORICAL_BOTTLE_PREFIX=/historical_bot/WOD2001_v2/bot_
HISTORICAL_ARGO_PREFIX=/argo_profiles/ARGO_for_DMQC_2020V01/argo_

% ================================
%
%    Float Input Path
%

FLOAT_SOURCE_DIRECTORY=/users/argo/ow/matlabow-2.0.1/data/float_source/
FLOAT_SOURCE_POSTFIX=.mat

% ================================
%
%    Mapping Output Path
%

FLOAT_MAPPED_DIRECTORY=/users/argo/ow/matlabow-2.0.1/data/float_mapped/ctd/
FLOAT_MAPPED_PREFIX=map_
FLOAT_MAPPED_POSTFIX=.mat

% ================================
%
%    Calibration Output Path
%

FLOAT_CALIB_DIRECTORY=/users/argo/ow/matlabow-2.0.1/data/float_calib/ctd/
FLOAT_CALIB_PREFIX=cal_
FLOAT_CALSERIES_PREFIX=calseries_
FLOAT_CALIB_POSTFIX=.mat

% ================================
```

```
%
%    Diagnostic Plots Output Path
%

FLOAT_PLOTS_DIRECTORY=/users/argo/ow/matlabow-2.0.1/data/float_plots/ctd/

% ================================
%
%    Constants File Path
%

CONFIG_DIRECTORY=/users/argo/ow/matlabow-2.0.1/data/constants/
CONFIG_COASTLINES=coastdat.mat
CONFIG_WMO_BOXES=wmo_boxes_ctd_argo.mat
CONFIG_SAF=TypicalProfileAroundSAF.mat

% ================================
%
% max number of historical casts used in objective mapping
CONFIG_MAX_CASTS=310

% 1=use PV constraint, 0=don't use PV constraint, in objective mapping
MAP_USE_PV=1

% 1=use SAF separation criteria, 0=don't use SAF separation criteria, in objective mapping
MAP_USE_SAF=1

% spatial decorrelation scales, in degrees
MAPSCALE_LONGITUDE_LARGE=6
MAPSCALE_LONGITUDE_SMALL=3
MAPSCALE_LATITUDE_LARGE=4
MAPSCALE_LATITUDE_SMALL=2

% cross-isobath scales, dimensionless, see BS(2005)
MAPSCALE_PHI_LARGE=0.1
MAPSCALE_PHI_SMALL=0.02

% temporal decorrelation scale, in years
MAPSCALE_AGE=10
MAPSCALE_AGE_LARGE=20

% exclude the top xxx dbar of the water column
MAP_P_EXCLUDE=100

% only use historical data that are within +/- yyy dbar from float data
MAP_P_DELTA=200
```

4.1.2 Results

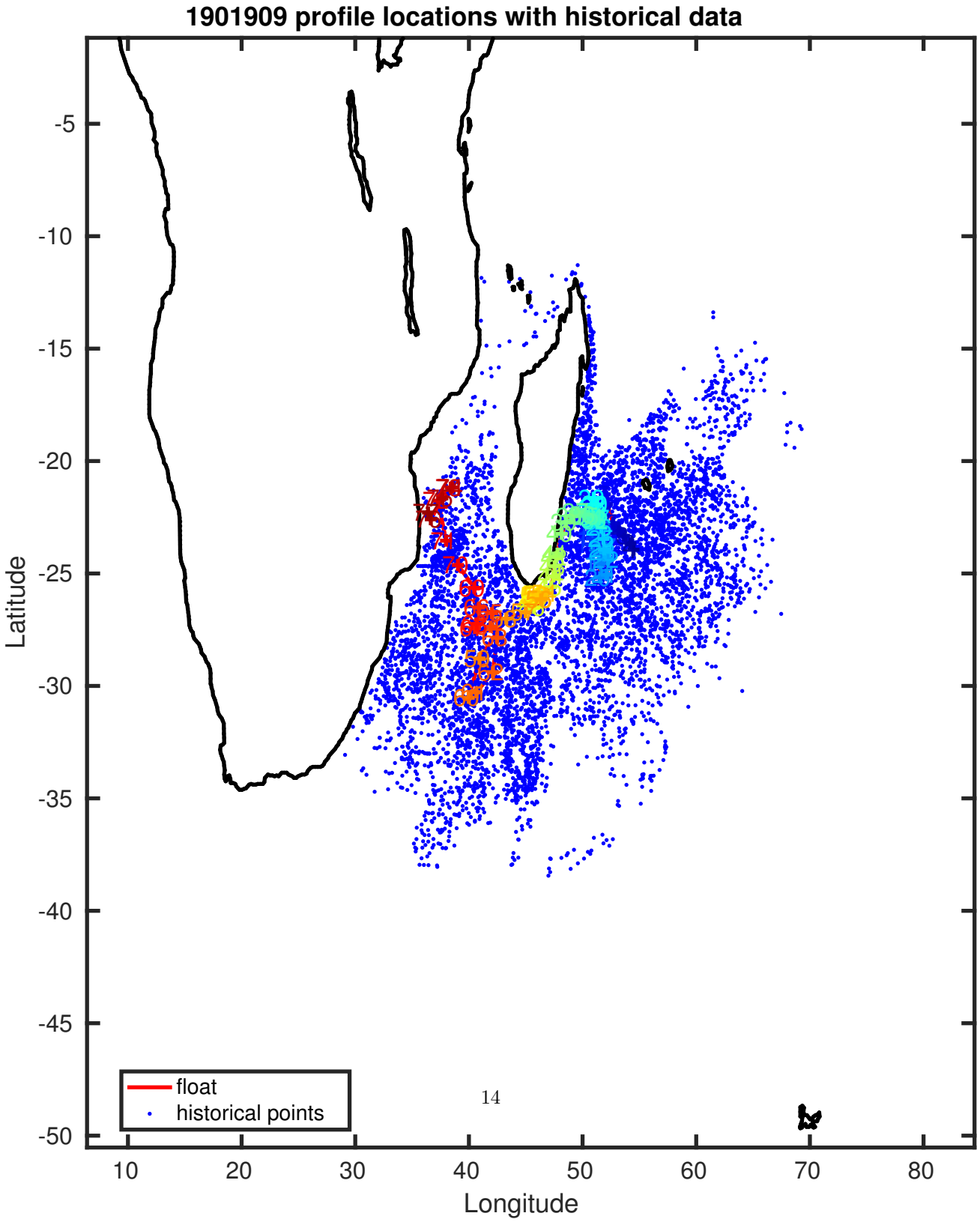

Figure 8: Float 1901909. Trajectory of the float with historical CTD data. The black contours indicate the bathymetry at 0, 200, 1000 and 2000 m.

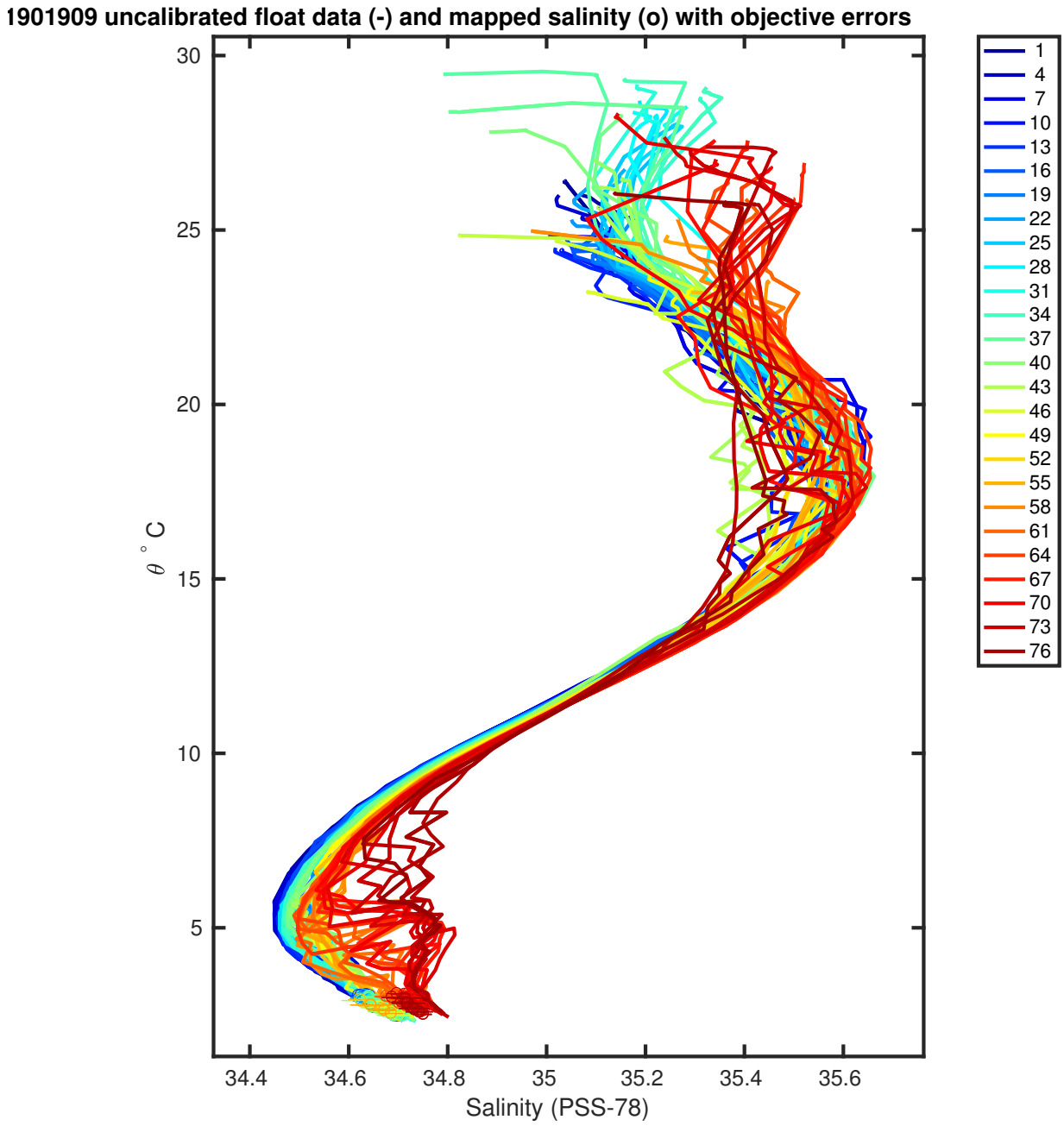

Figure 9: Float 1901909. Uncalibrated float data and mapped salinity.

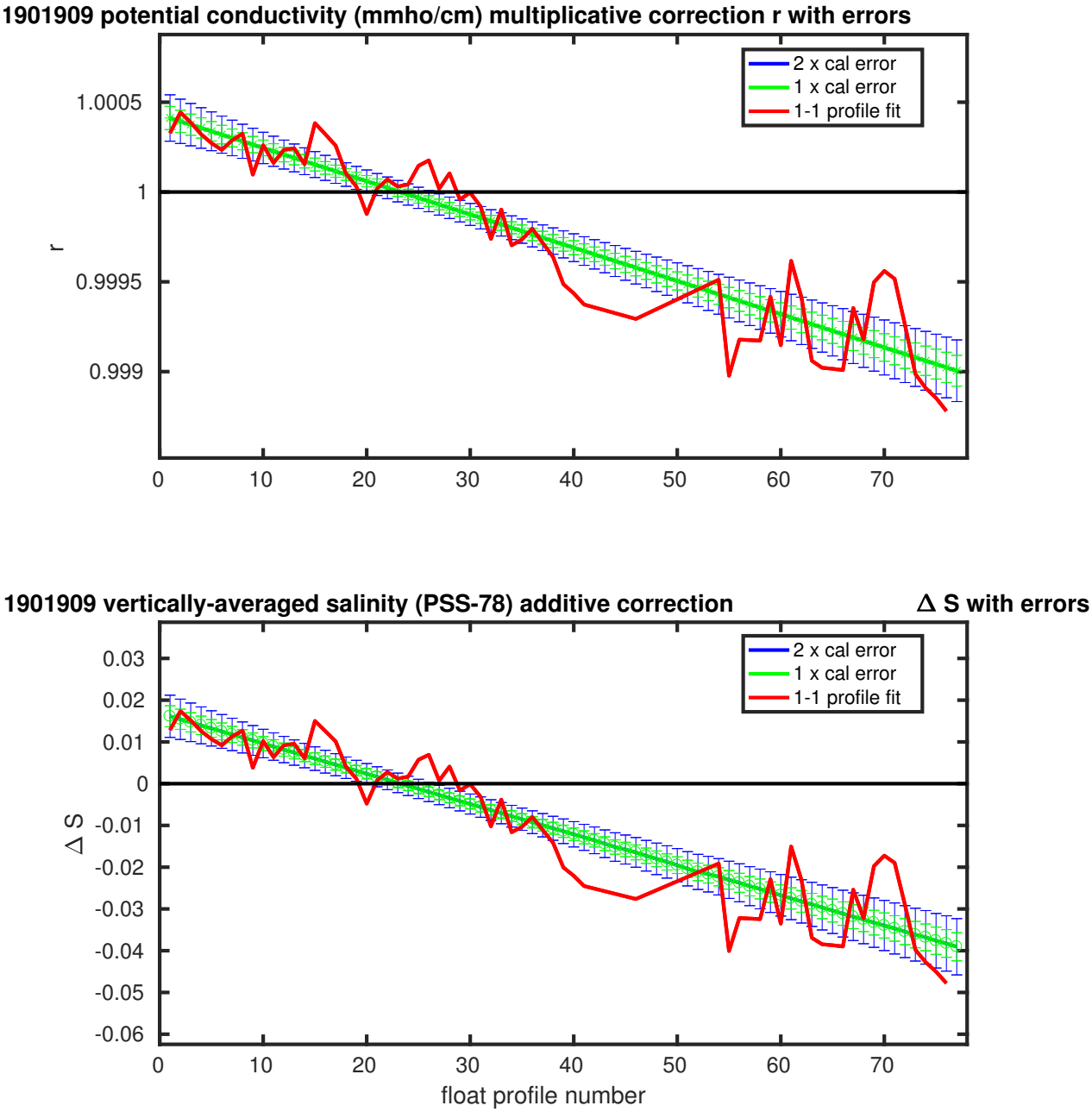

Figure 10: Float 1901909. Potential conductivity (top) and vertically averaged salinity (bottom) with errors.

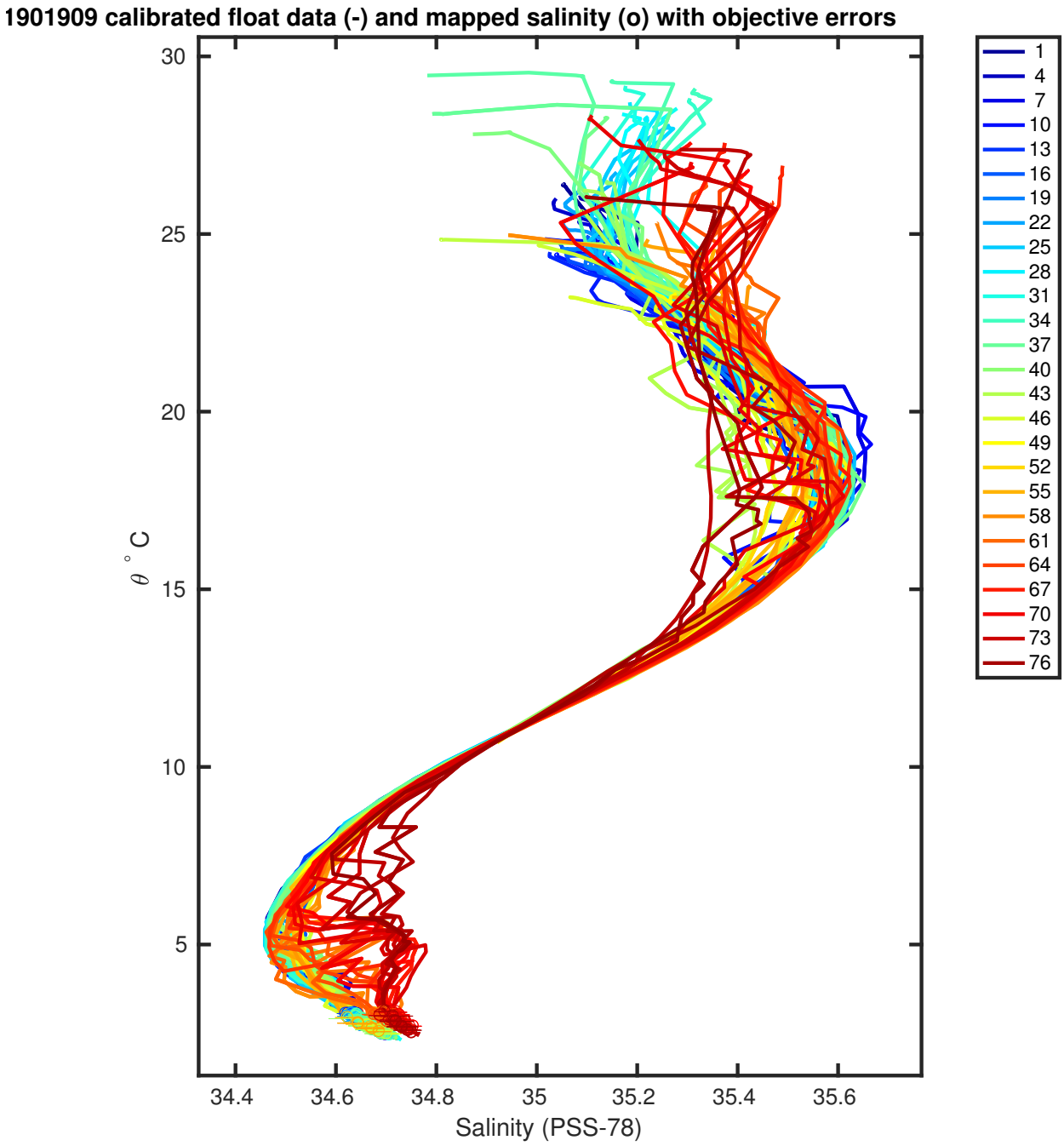

Figure 11: Float 1901909. Calibrated float data and mapped salinity.

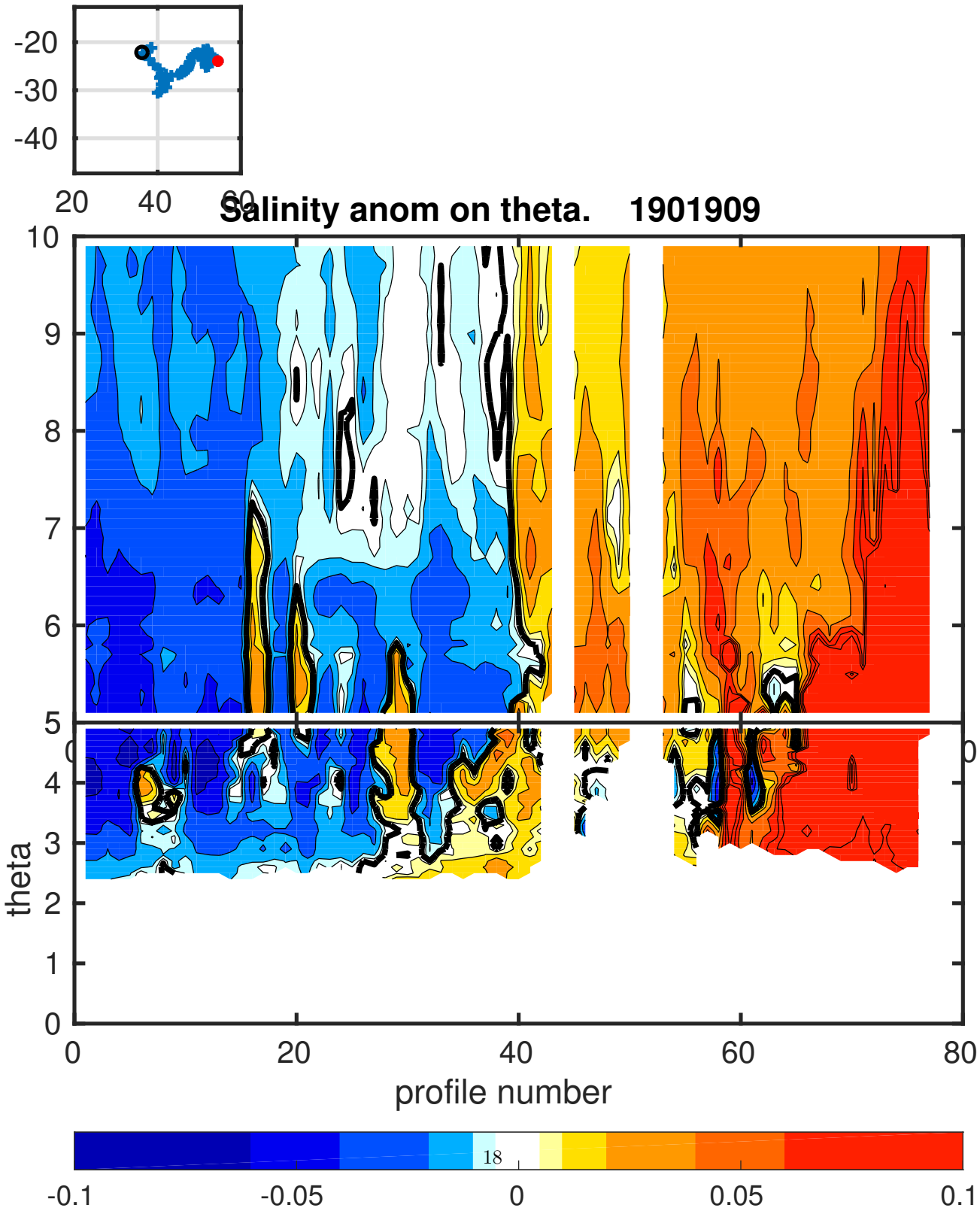

Figure 12: Float 1901909. Salinity anomaly on θ levels.

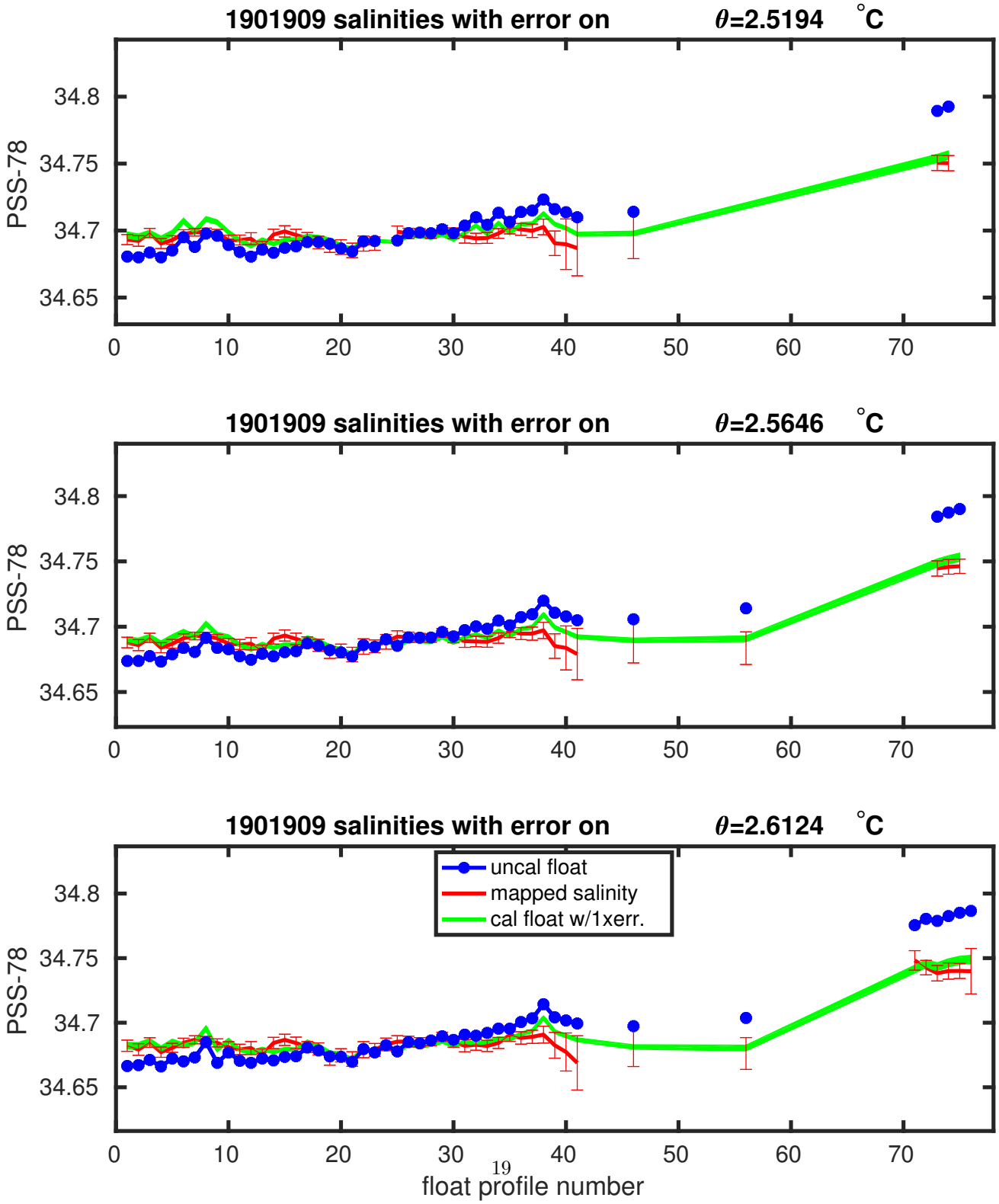

Figure 13: Float 1901909. Salinities with errors on θ levels.

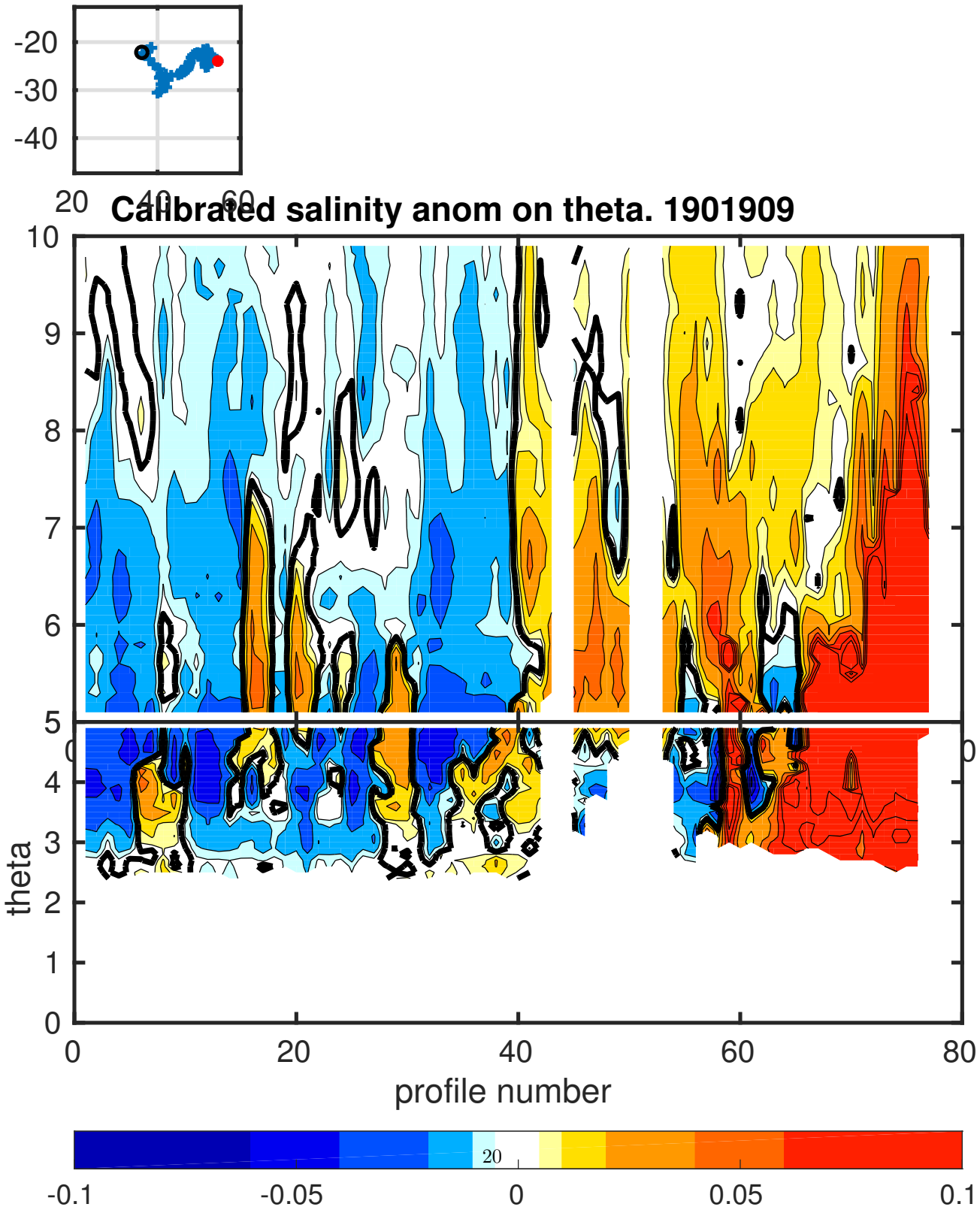

Figure 14: Float 1901909. Calibrated salinity anomaly on θ levels.

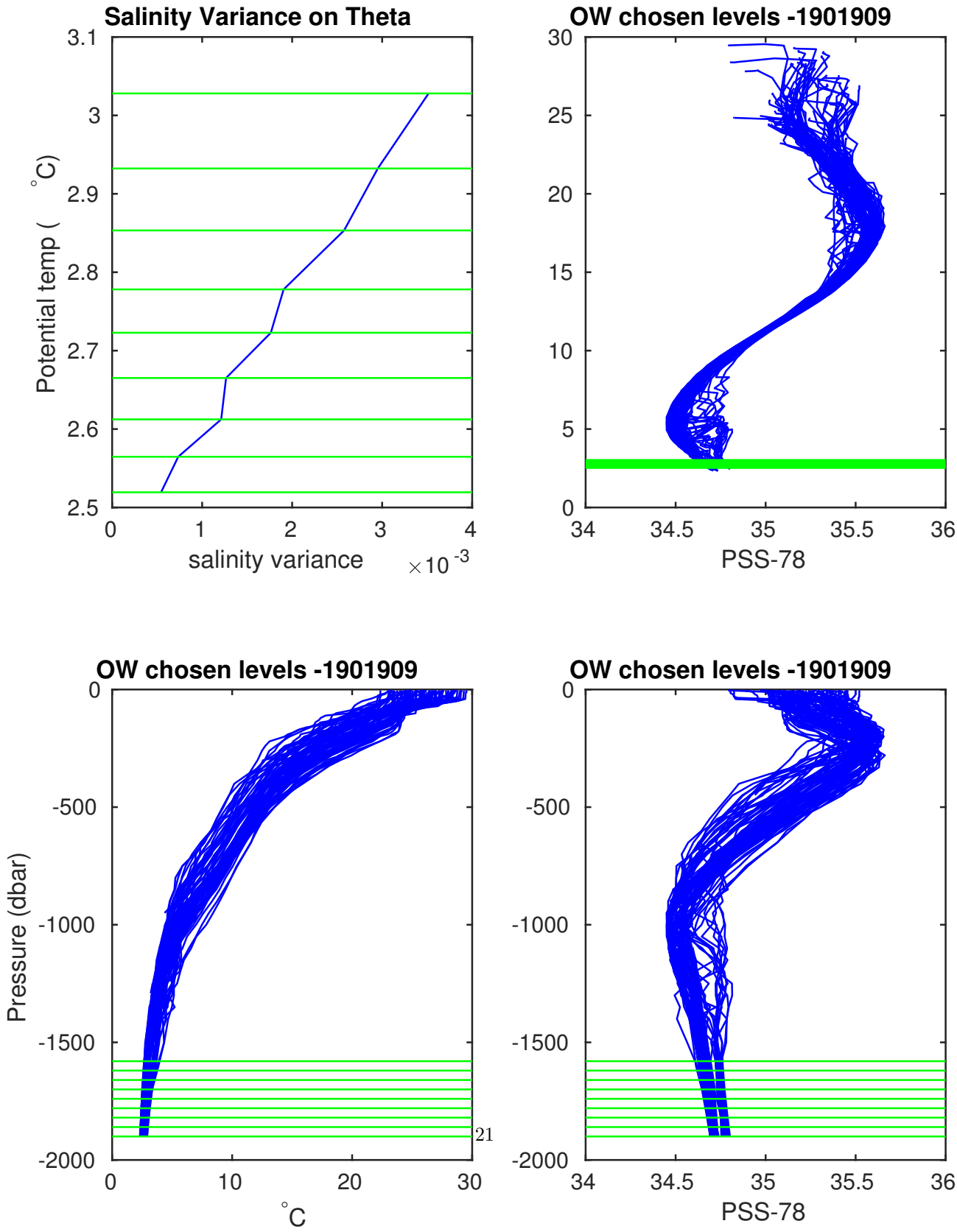

Figure 15: Float 1901909. Salinity, salinity variance on theta and OW chosen levels.

4.2 Comparison between Argo floats and CTD+Argo Climatlogy combined between 7-12 °C

4.2.1 Configuration

```
% ================================
%
%    Climatology Data Input Paths
%

HISTORICAL_DIRECTORY=/users/argo/climatology
HISTORICAL_CTD_PREFIX=/historical_ctd/CTD_for_DMQC_2019V01/ctd_
HISTORICAL_BOTTLE_PREFIX=/historical_bot/WOD2001_v2/bot_
HISTORICAL_ARGO_PREFIX=/argo_profiles/ARGO_for_DMQC_2020V01/argo_

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FLOAT_MAPPED_DIRECTORY=/users/argo/ow/matlabow-2.0.1/data/float_mapped/ctd/
FLOAT_MAPPED_PREFIX=map_
FLOAT_MAPPED_POSTFIX=.mat

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%
%    Calibration Output Path
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FLOAT_CALIB_DIRECTORY=/users/argo/ow/matlabow-2.0.1/data/float_calib/ctd/
FLOAT_CALIB_PREFIX=cal_
FLOAT_CALSERIES_PREFIX=calseries_
FLOAT_CALIB_POSTFIX=.mat

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%    Diagnostic Plots Output Path
```

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%

FLOAT_PLOTS_DIRECTORY=/users/argo/ow/matlabow-2.0.1/data/float_plots/ctd/

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%    Constants File Path
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CONFIG_DIRECTORY=/users/argo/ow/matlabow-2.0.1/data/constants/
CONFIG_COASTLINES=coastdat.mat
CONFIG_WMO_BOXES=wmo_boxes_ctd_argo.mat
CONFIG_SAF=TypicalProfileAroundSAF.mat

% ================================
%
% max number of historical casts used in objective mapping
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% 1=use PV constraint, 0=don't use PV constraint, in objective mapping
MAP_USE_PV=1

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% spatial decorrelation scales, in degrees
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MAPSCALE_LONGITUDE_SMALL=3
MAPSCALE_LATITUDE_LARGE=4
MAPSCALE_LATITUDE_SMALL=2

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MAPSCALE_PHI_LARGE=0.1
MAPSCALE_PHI_SMALL=0.02

% temporal decorrelation scale, in years
MAPSCALE_AGE=10
MAPSCALE_AGE_LARGE=20

% exclude the top xxx dbar of the water column
MAP_P_EXCLUDE=100

% only use historical data that are within +/- yyy dbar from float data
MAP_P_DELTA=200
```

4.2.2 Results

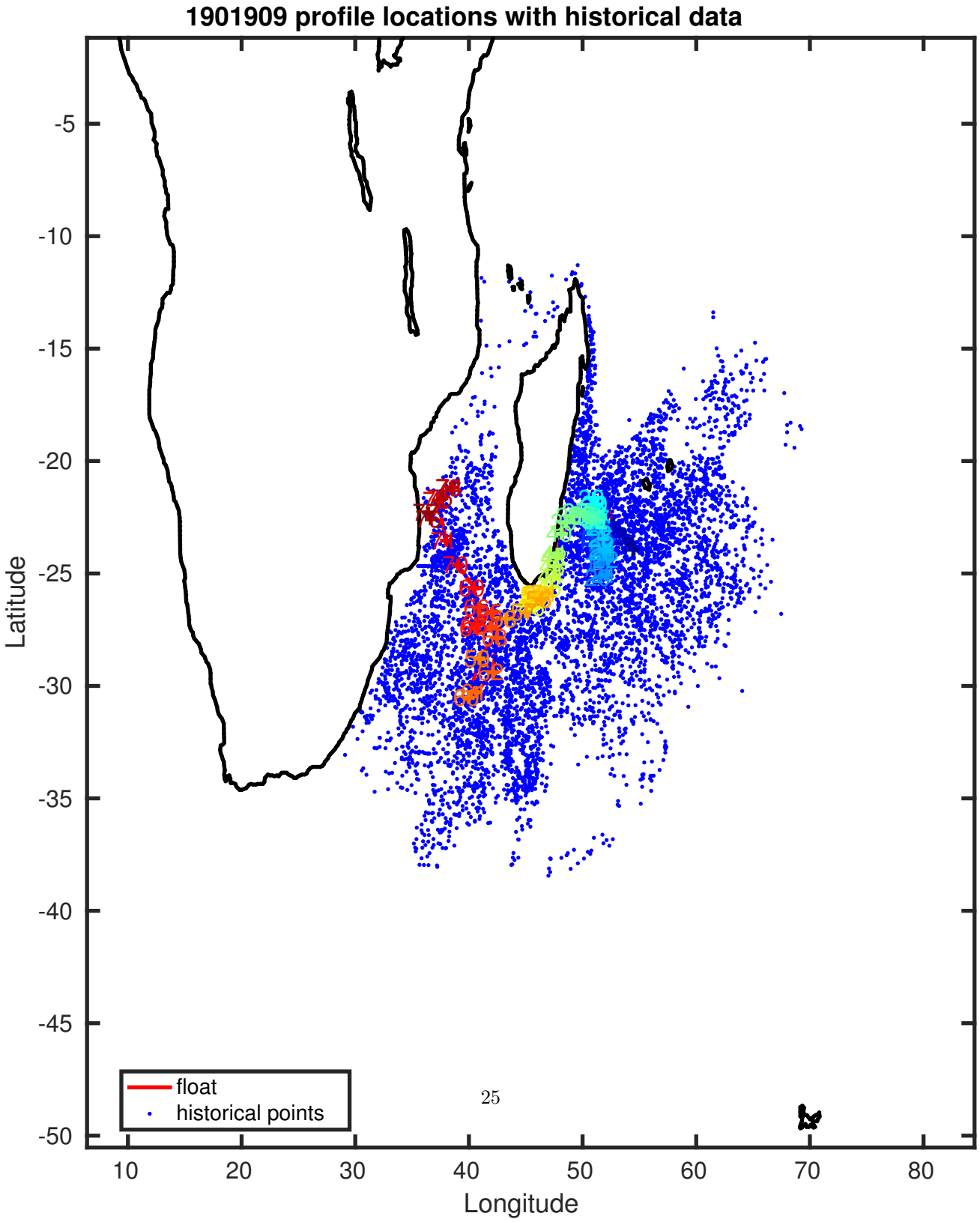

Figure 16: Float 1901909. Trajectory of the float with historical CTD data. The black contours indicate the bathymetry at 0, 200, 1000 and 2000 m.

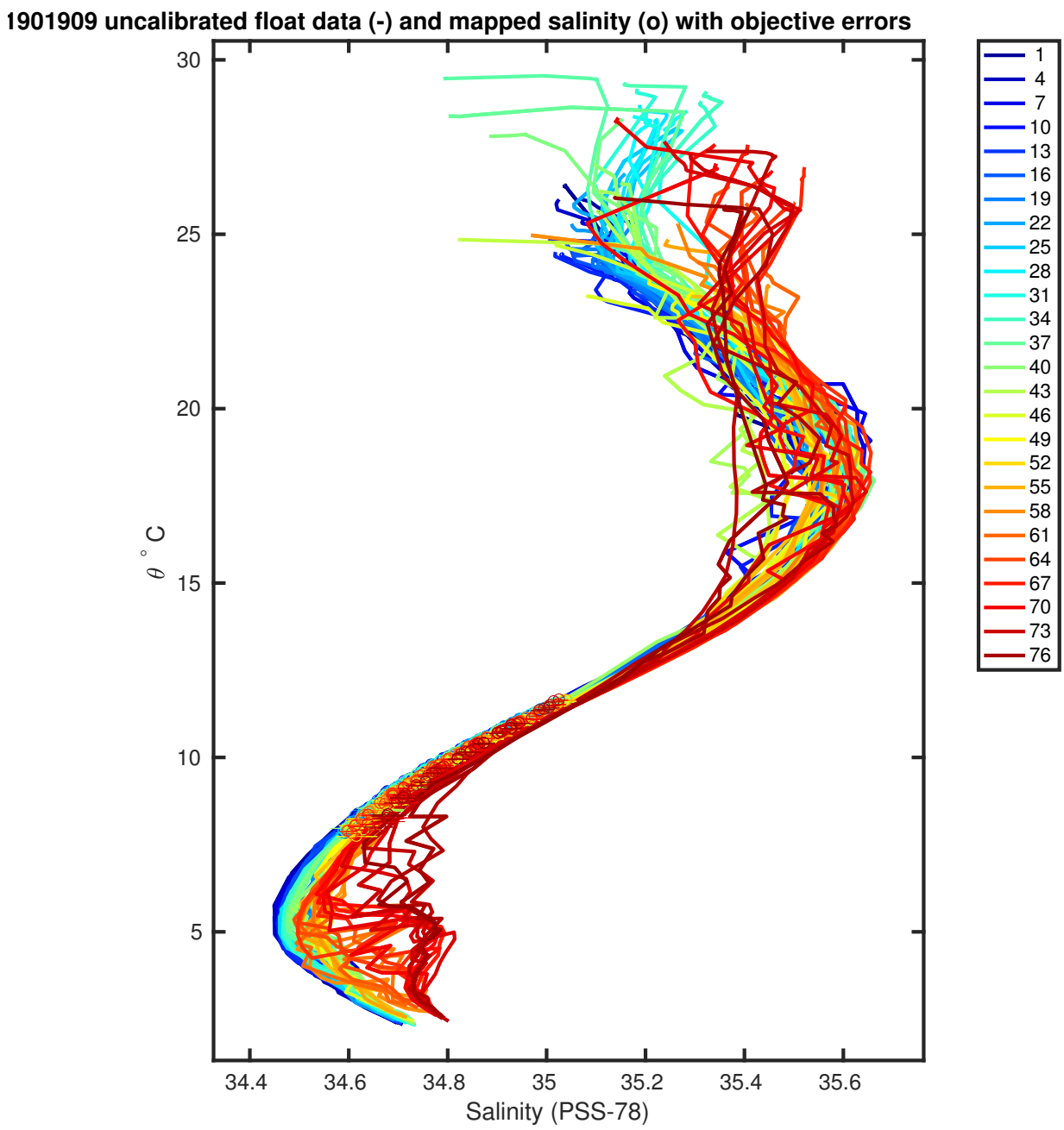

Figure 17: Float 1901909. Uncalibrated float data and mapped salinity.

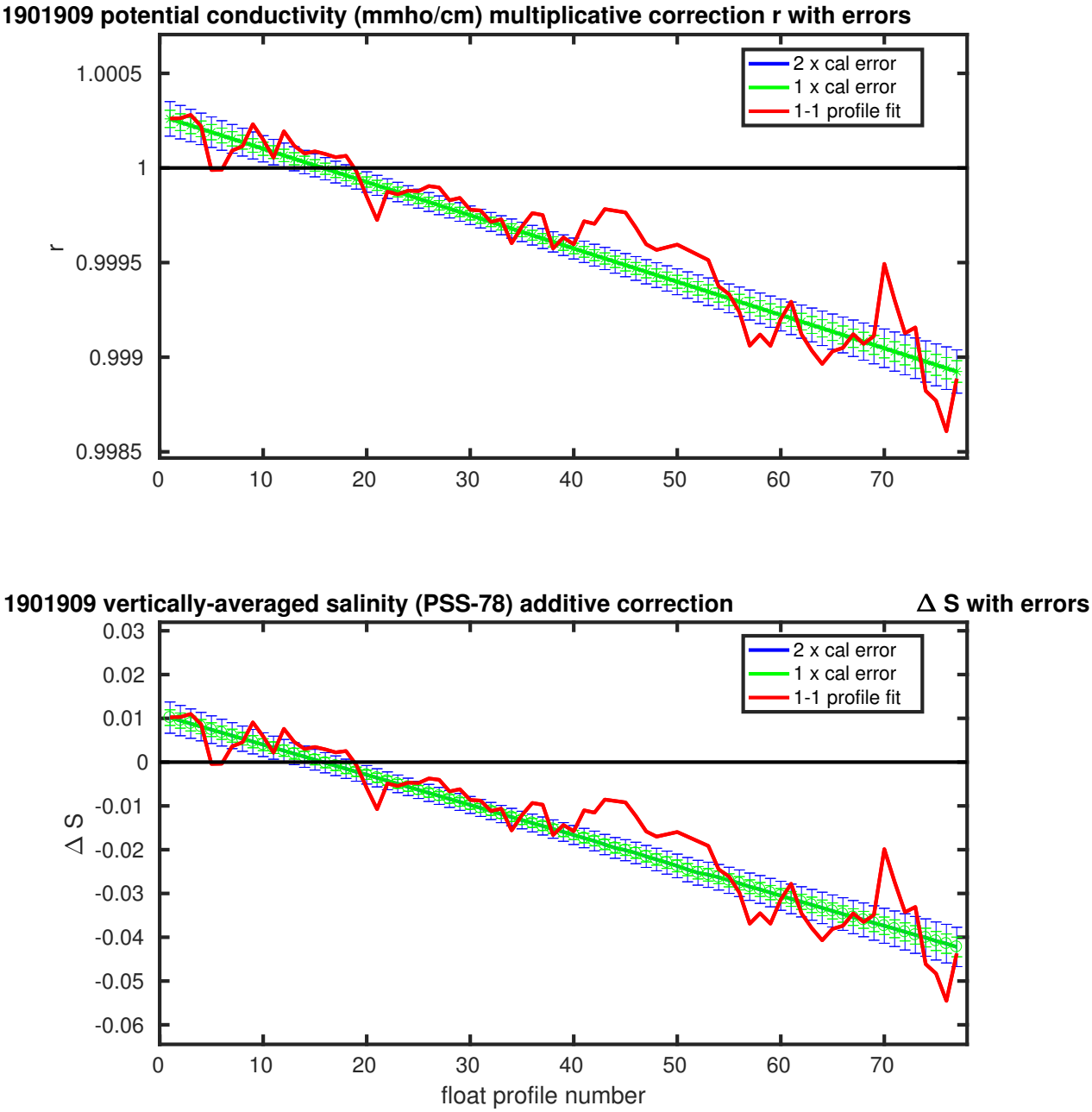

Figure 18: Float 1901909. Potential conductivity (top) and vertically averaged salinity (bottom) with errors.

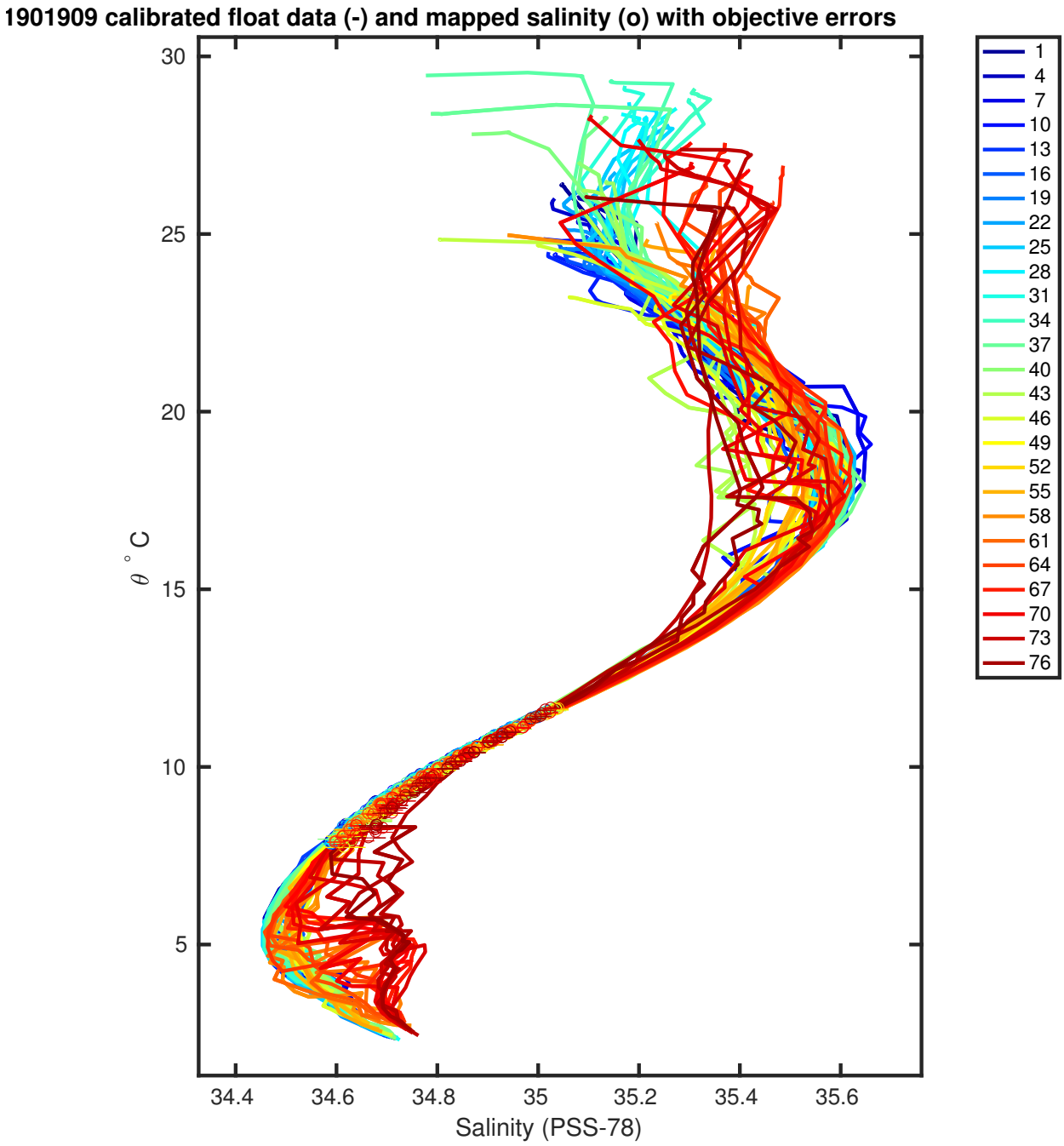

Figure 19: Float 1901909. Calibrated float data and mapped salinity.

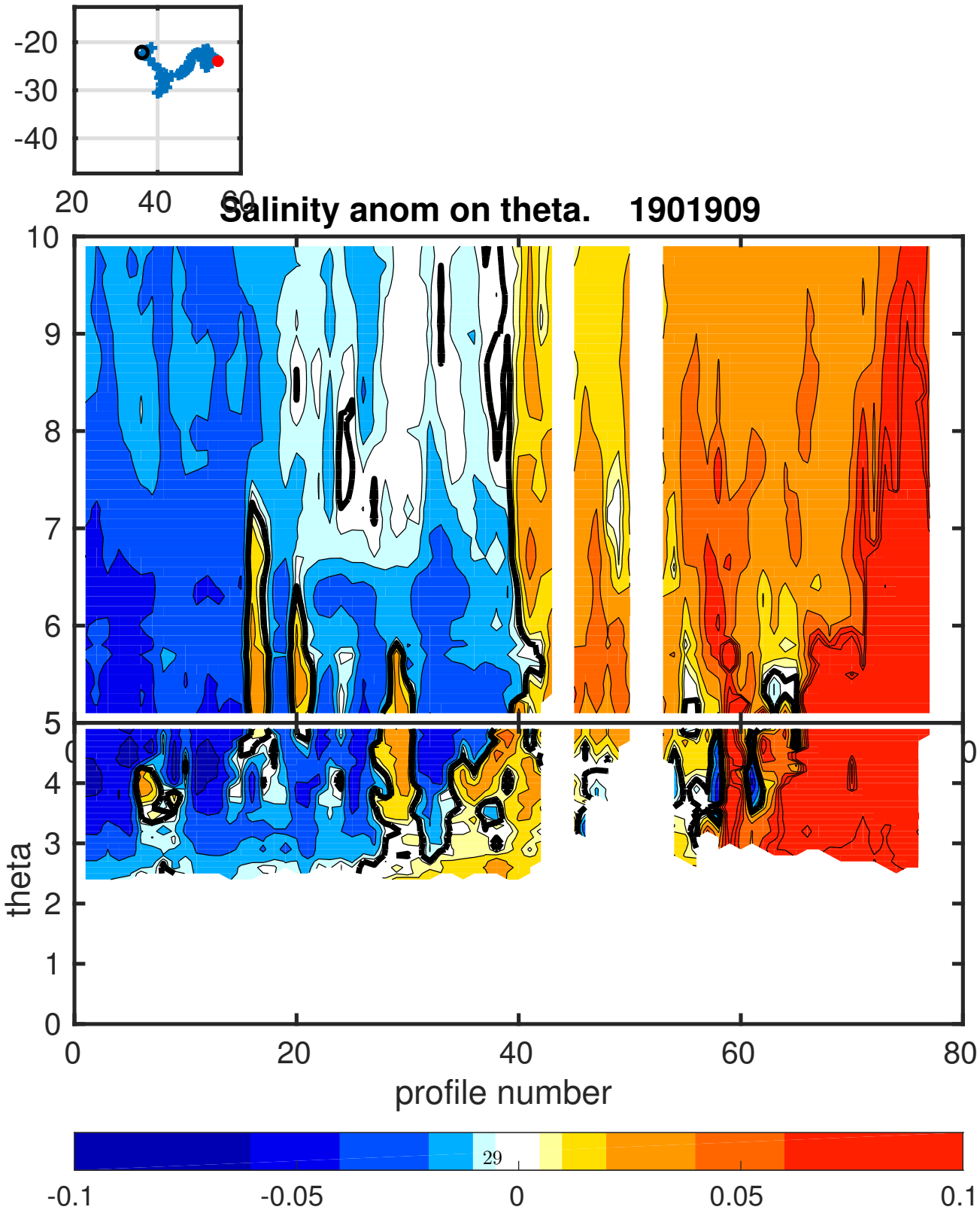

Figure 20: Float 1901909. Salinity anomaly on Theta

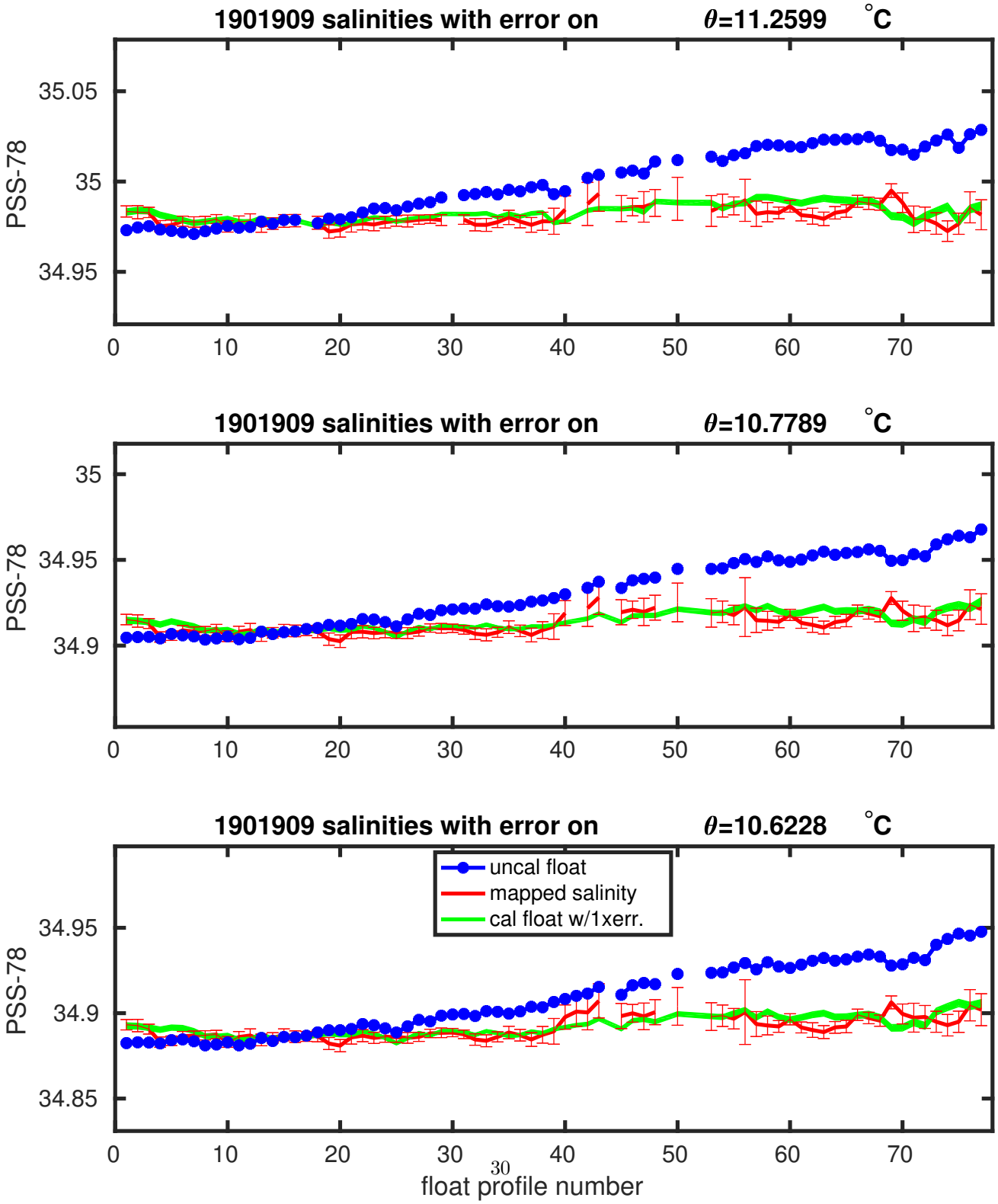

Figure 21: Float 1901909. Salinities with errors on θ.

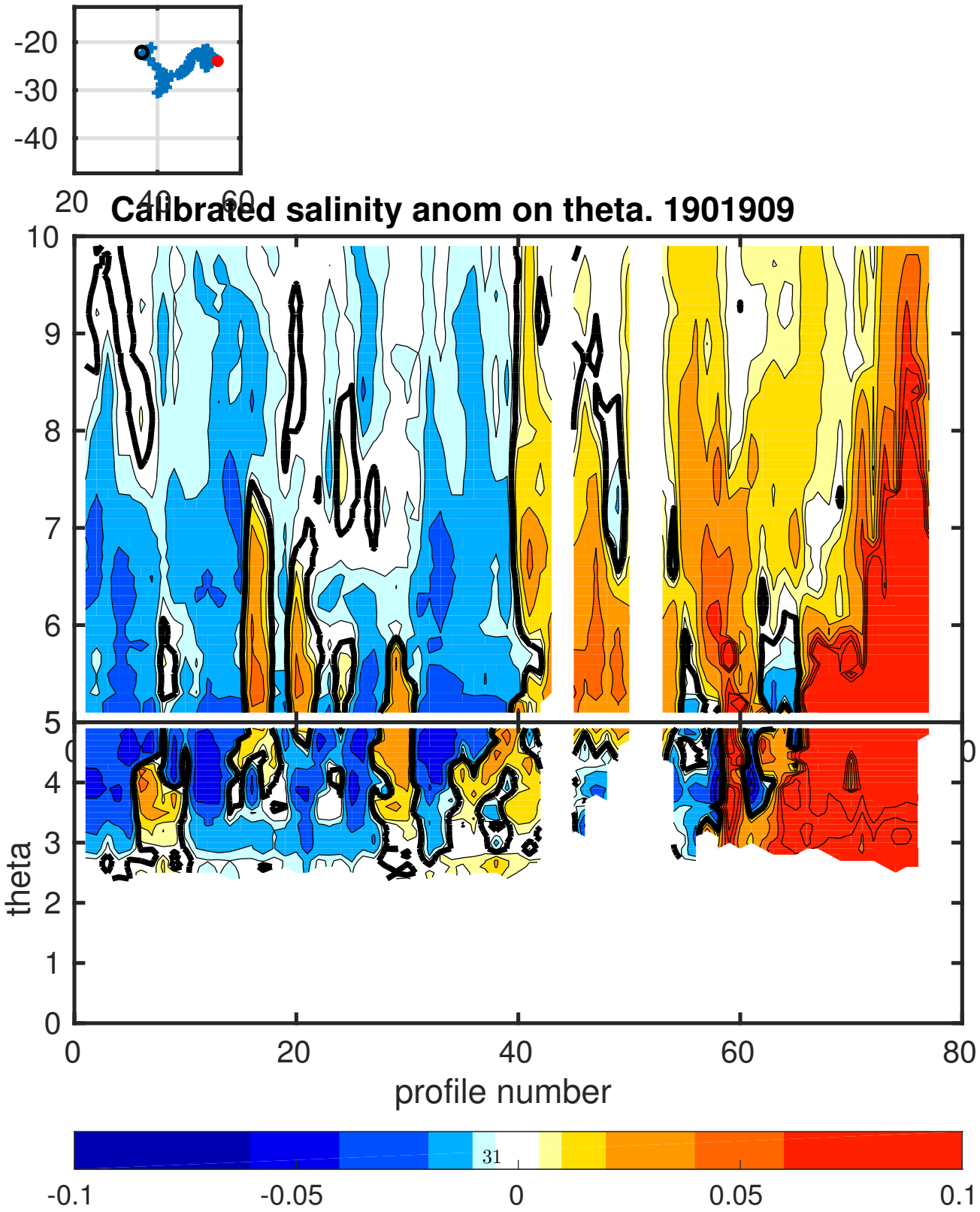

Figure 22: Float 1901909. Calibrated salinity anomaly on θ.

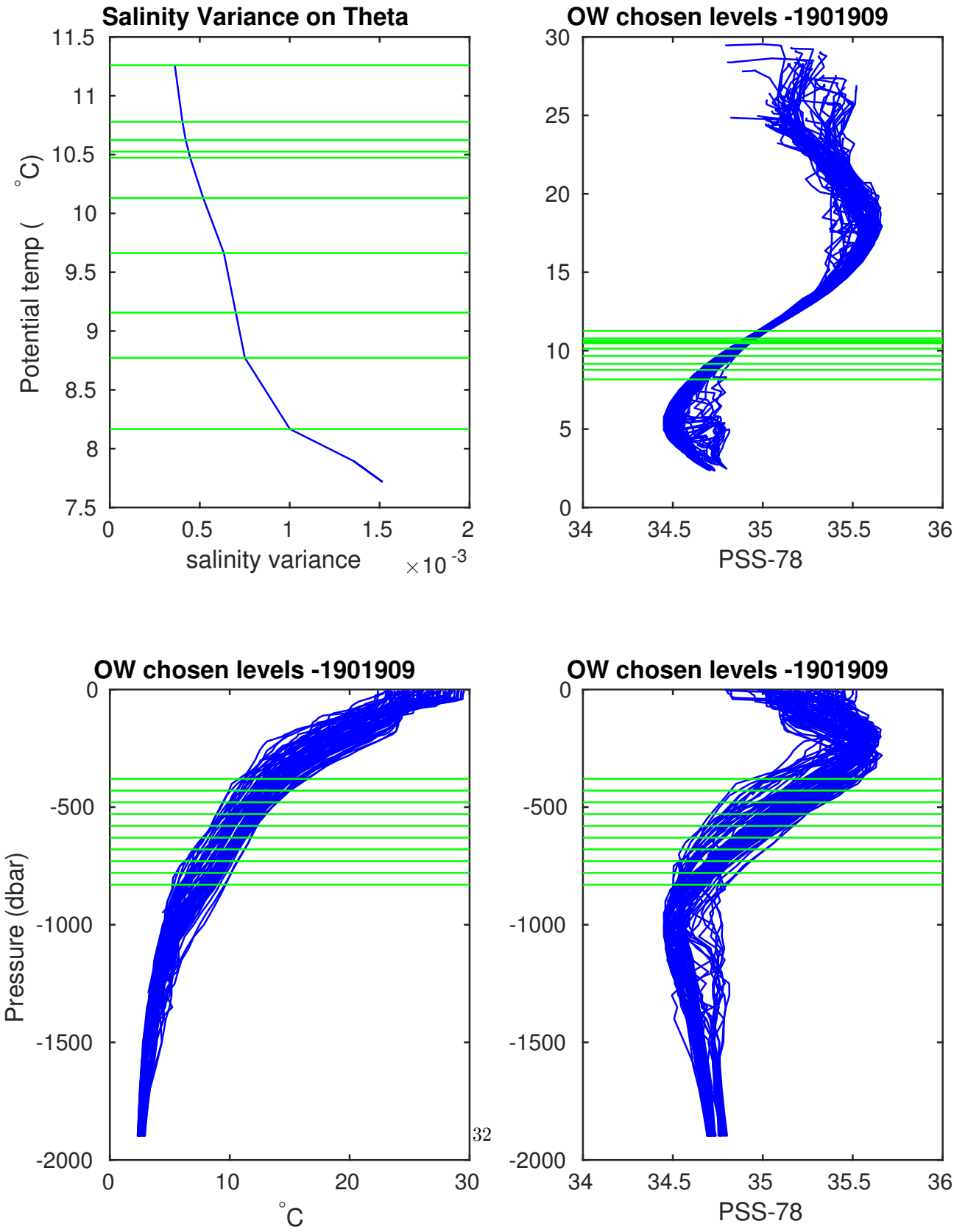

Figure 23: Float 1901909. Salinity, salinity variance on theta and OW chosen levels.

4.3 Summary and Conclusions

OWC correction is applied to salinity. The correction has been applied from the CTD and Argo reference data combined. There appears to be a positive drift in salinity which needs to be checked during the next DM analysis. This drift is seen in bith the deep and the mode water analysis.

References

[*Owens, W.B. and A.P.S. Wong* (2009)] An improved calibration method for the drift of the conductivity sensor on autonomous CTD profiling floats by Θ - S climatology. Deep-Sea Res. Part I, 56, 450-457.doi:10.1016/j.dsr.2008.09.008.

[*Cabanes, C., Thierry, V. and 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. 10.1016/j.dsr.2016.05.007.