

# Delayed mode quality control of Argo float 6901192

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## Summary

The comparison between reference (CTD, Argo) data shows a potential drift after cycle 55. From cycle 1 to 60 float looks correct and does not require corrections, QC=1, error  $\leq 0.01$ . From cycle 61 to 111 there was reported very strange behaviour of float where it is drifting. The assessed QC =2 with salinity error is  $< 0.02$ . The pressure sensor in Apex float is not truncated with a negative pressure drift, QC=1, error = 2.4 dbar.

WMO number	DM correction
6901192	Correction applied

Table 1: Correction applied in delayed mode.

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# 1 Introduction

Delayed mode analysis was performed for float number 154199 (6901192) 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 154199 (6901192) click on the following link: <http://www.ifremer.fr/argoMonitoring/float>

## 2 Quality Check of Argo Float Data

### 2.1 Time Series of Vertical Distribution of Data

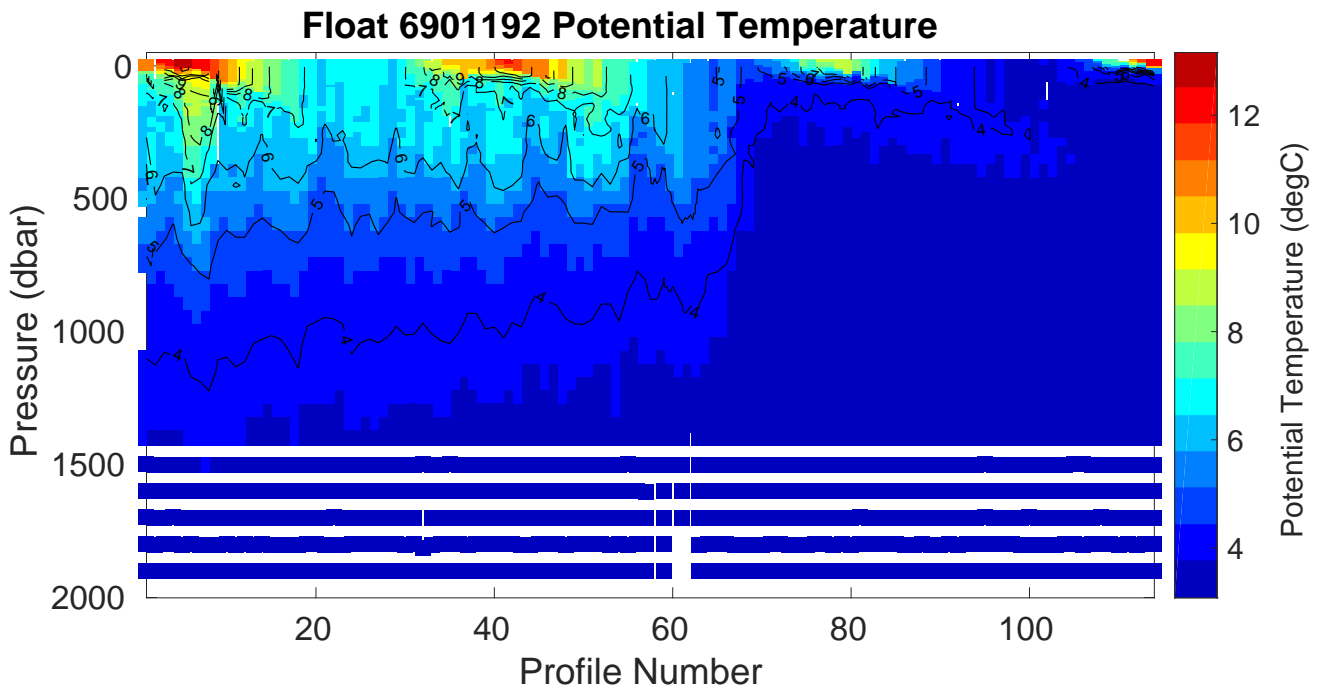


Figure 1: Float 6901192. Time series of the vertical distribution of potential temperature ( $^{\circ}\text{C}$ ).

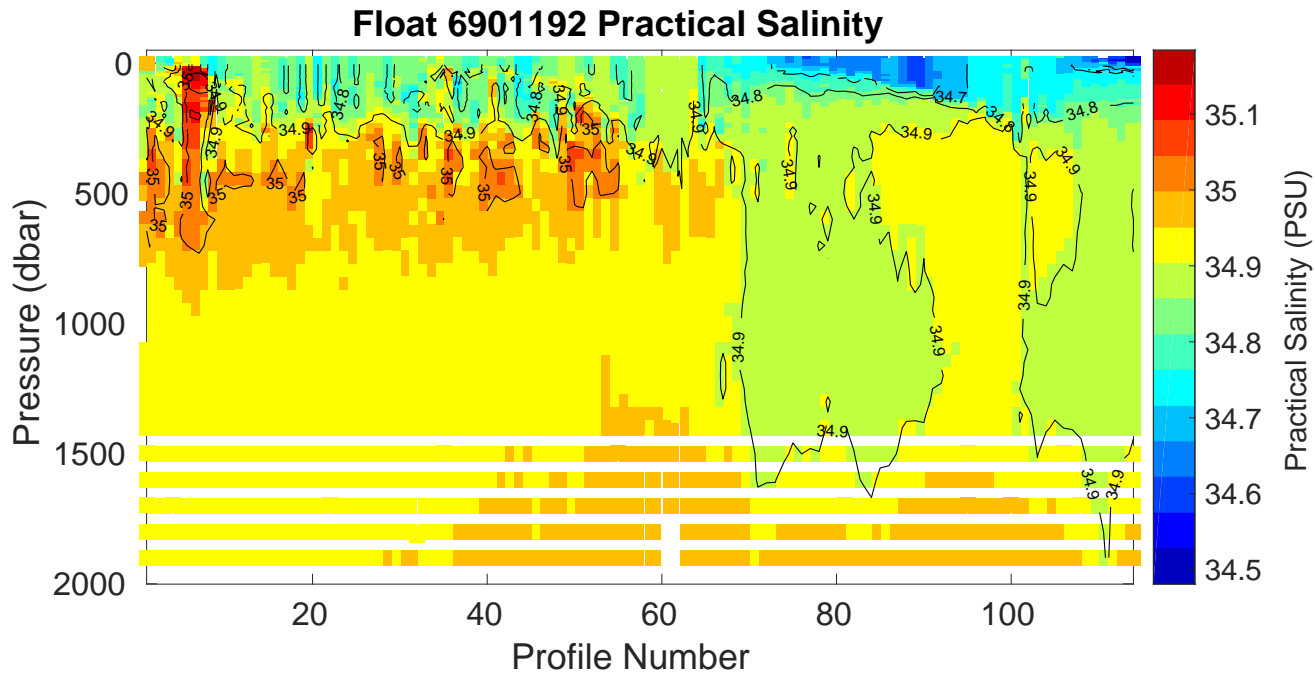


Figure 2: Float 6901192. Time series of the vertical distribution of practical salinity (PSU).

## 2.2 Comparison between Argo Float and Climatology

The comparison between float 6901192 and data from WMO boxes  $\pm 10^\circ$  of latitude and longitude shows that the Argo profiles fit within the expected ranges (Figures 3, 4 and 5). This result confirms that float 6901192 represents relatively stable and consistent with the expected physical conditions in this region.

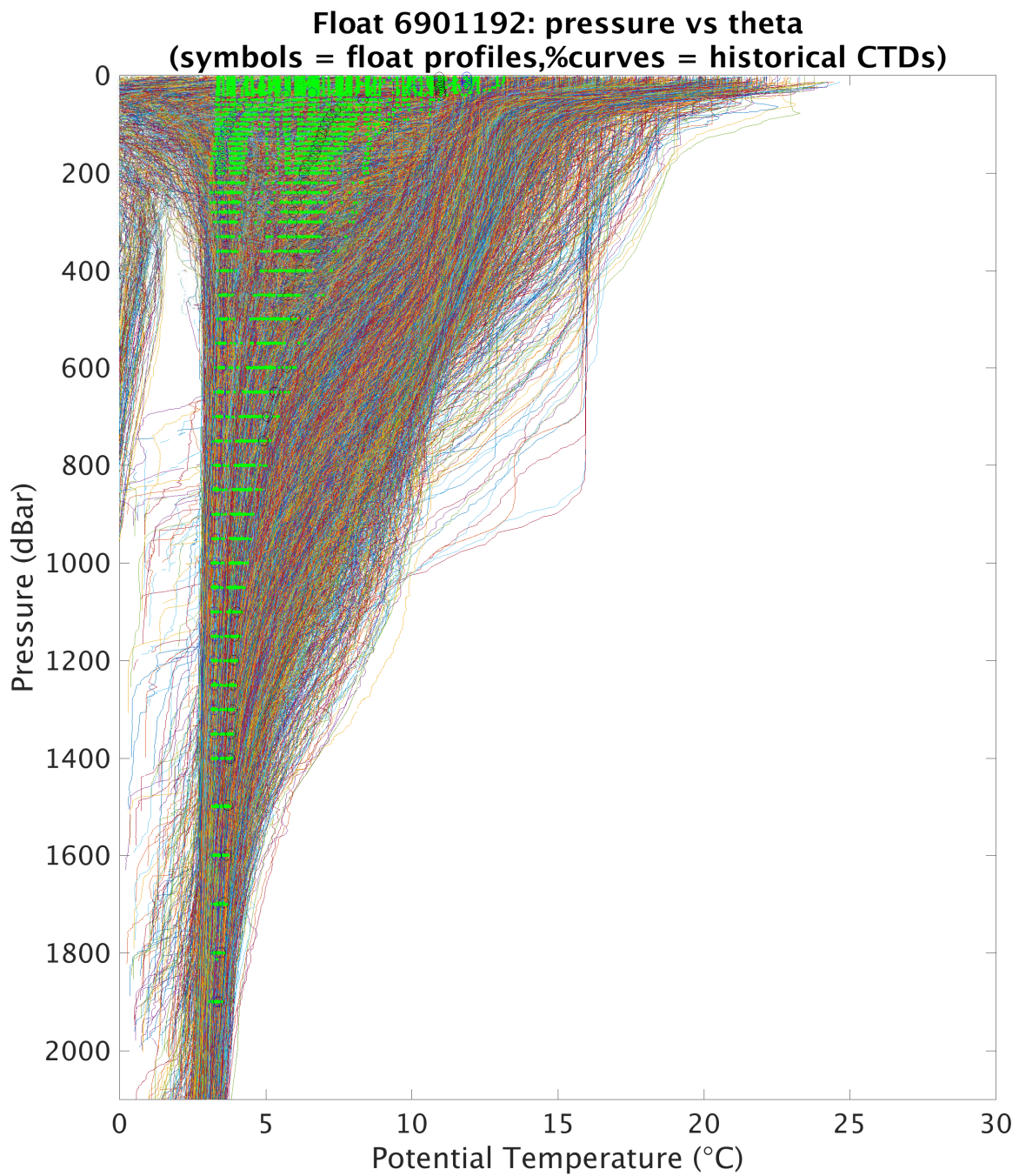


Figure 3: Float 6901192. Float profile of potential temperature (°C) plotted with climatology from the spatial range of 10 °. The black and blue cycles indicates the first and the last Argo profile, respectively. Green symbols represent other Argo profiles.

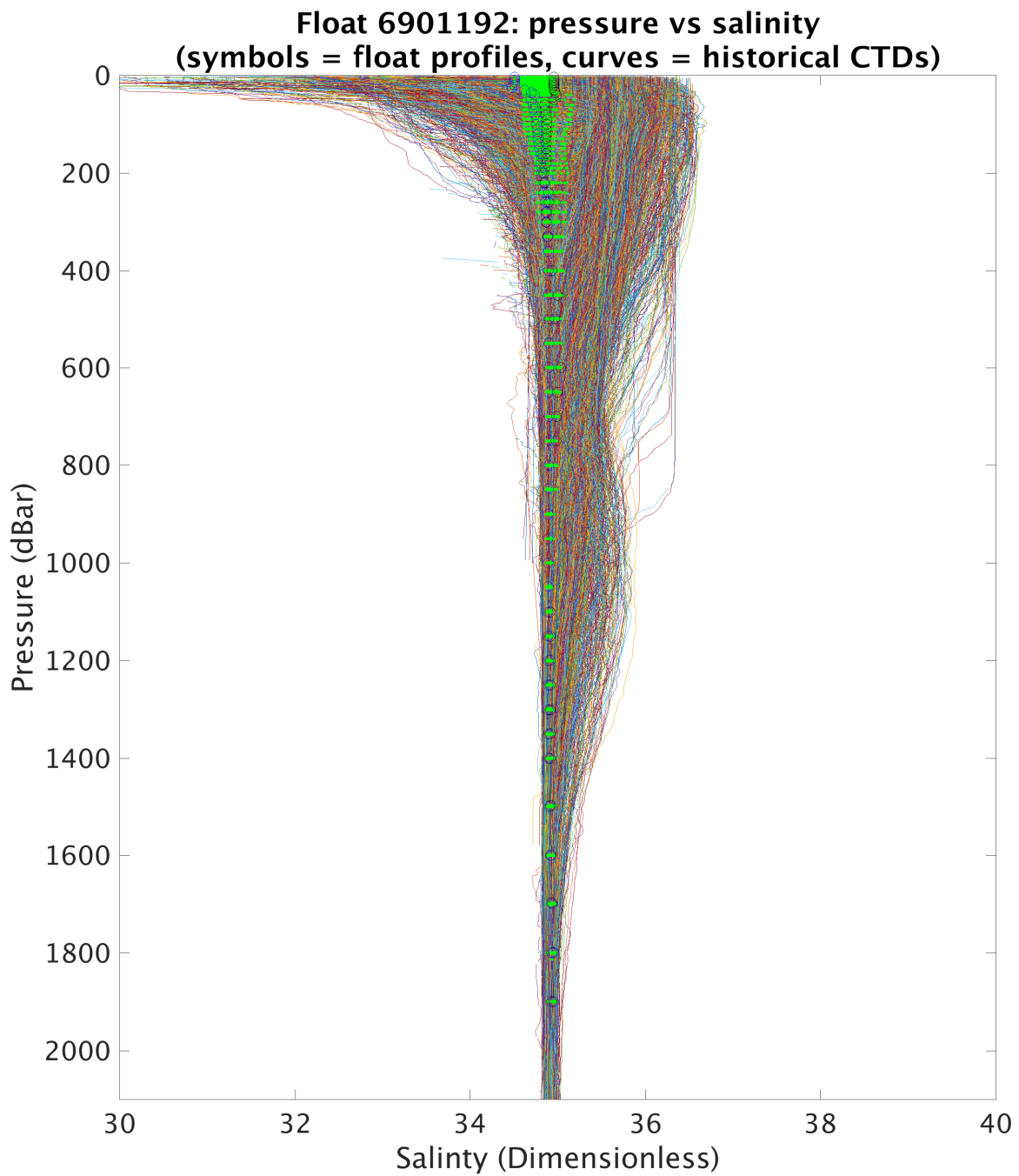


Figure 4: Float 6901192. Float profile of salinity (dimensionless) plotted with climatology from the spatial range of  $10^\circ$ . The black and blue cycles indicates the first and the last Argo profile, respectively. Green symbols represent other Argo profiles.

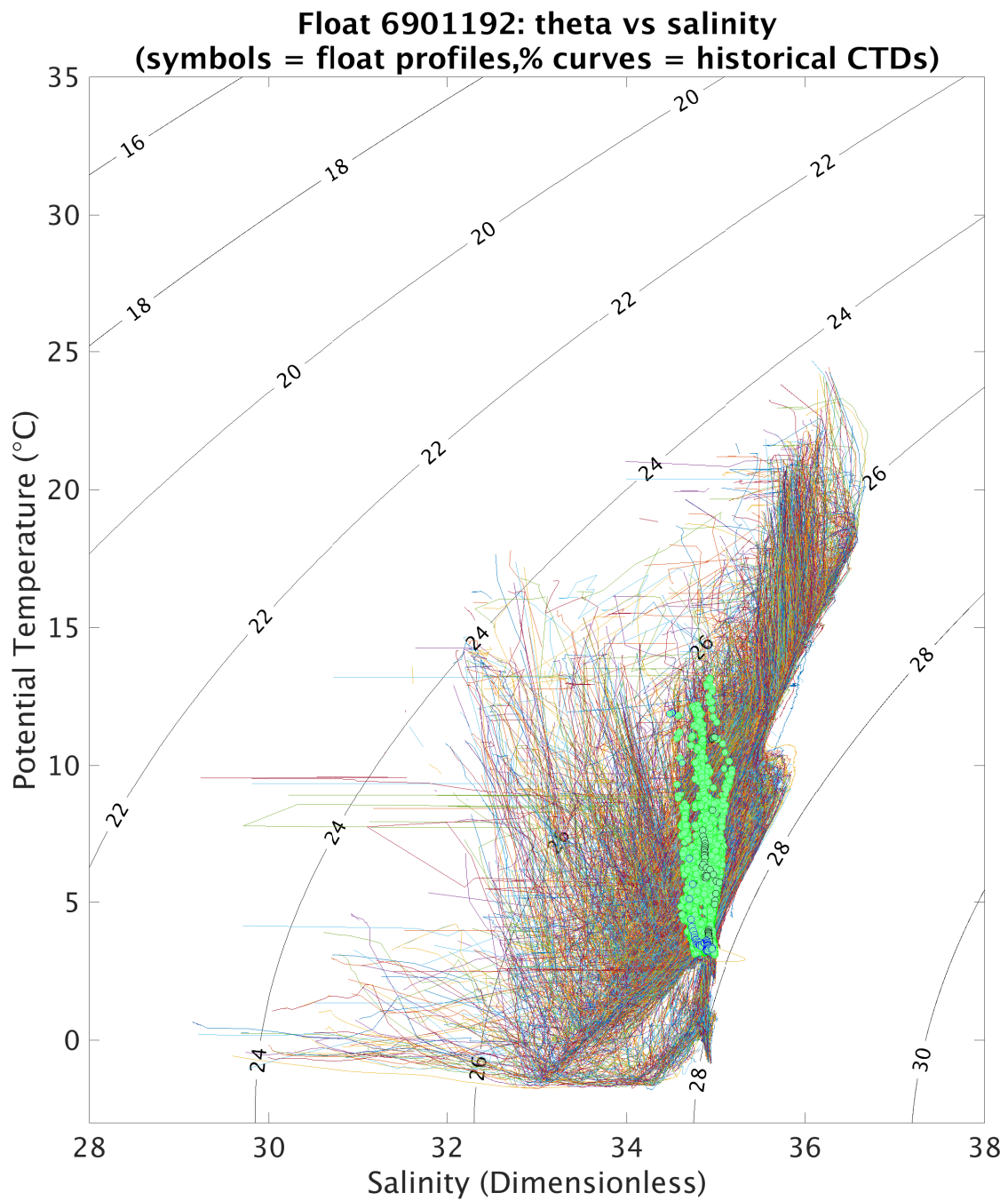


Figure 5: Float 6901192. Theta/S plotted with climatology from the spatial range of 10°. The black and blue cycles indicates the first and the last Argo profile, respectively. Green symbols represent other Argo profiles.

## 2.3 Satellite Altimeter comparison

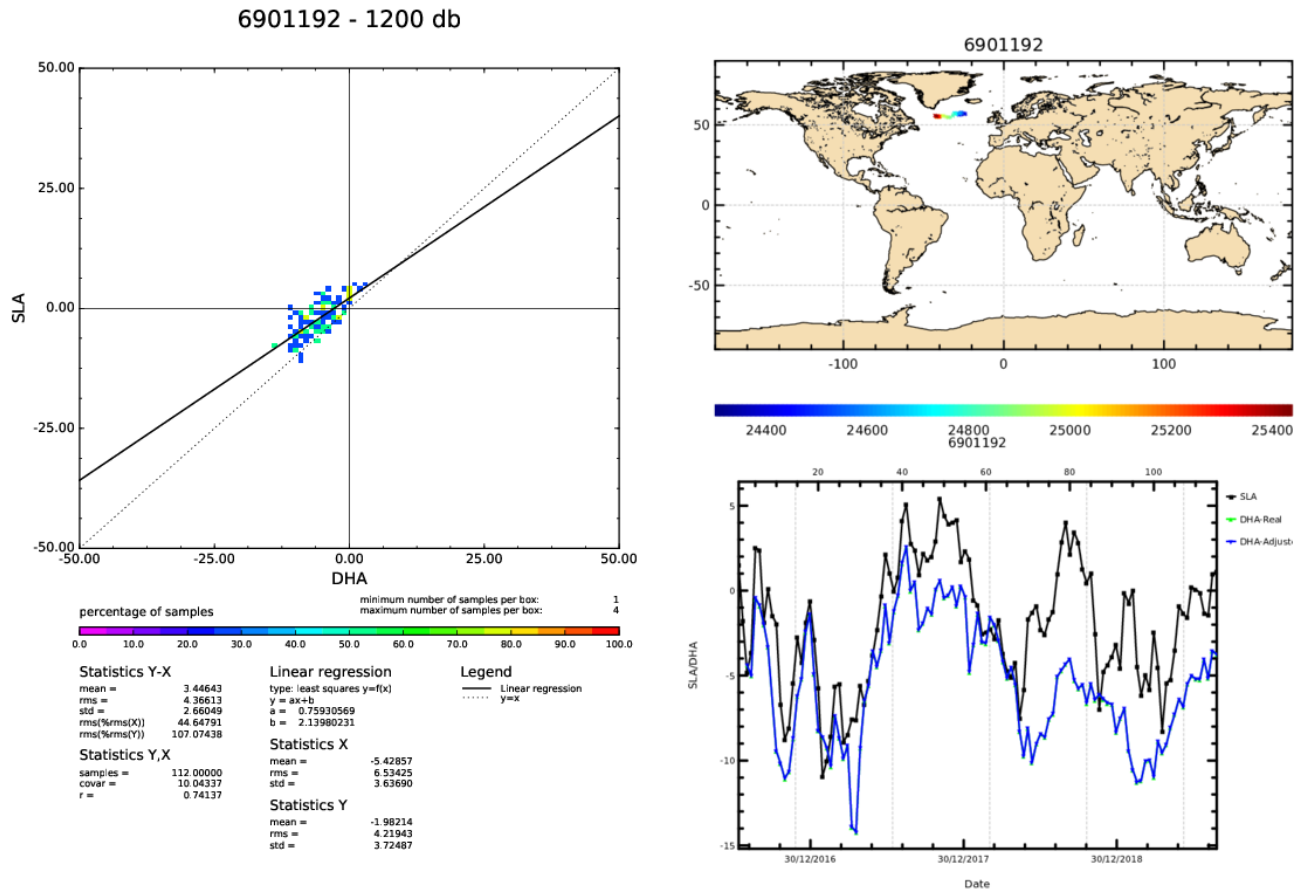


Figure 6: Float 6901192. The comparison between the Sea Surface Height (SSH) from the satellite altimetry and Dynamic Height Anomaly (DHA) extracted from the Argo float temperature and salinity data

## 3 Pressure Adjustment for APEX Floats

Float 6901192 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 6901192 is not truncated, QC=1, error = 2.4 dbar (Figure 7).



Raw surface pressure measured before descent (+0 dbar offset) for float  
154199  
pressure correction in green

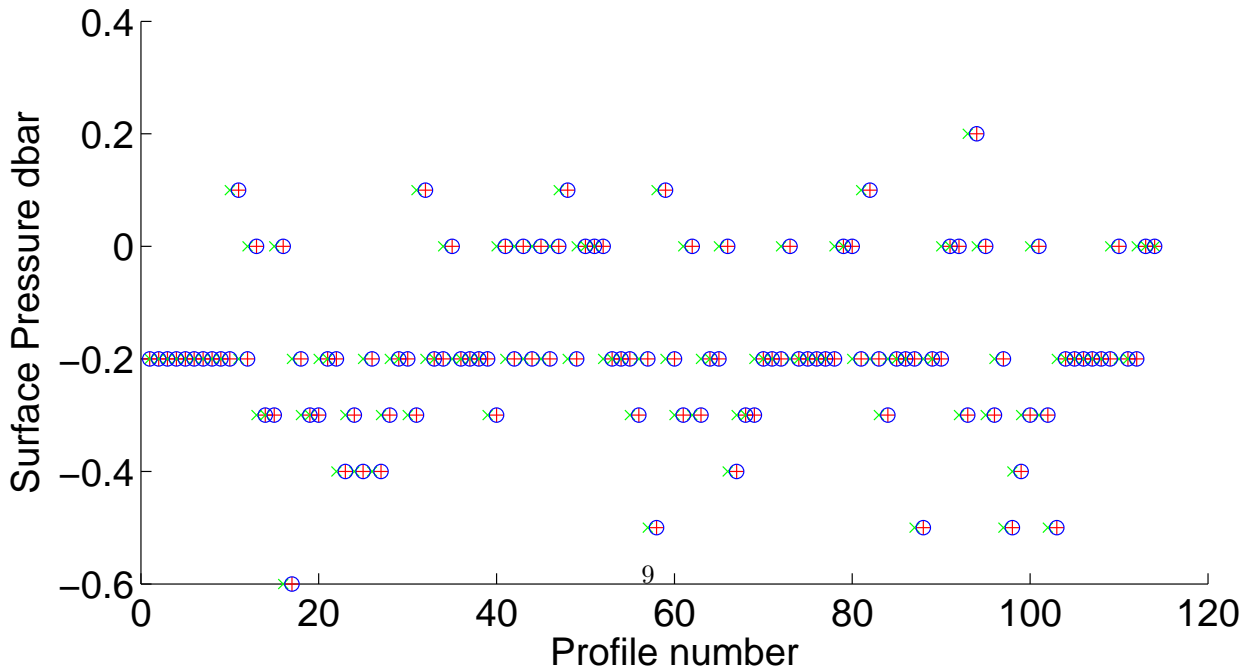
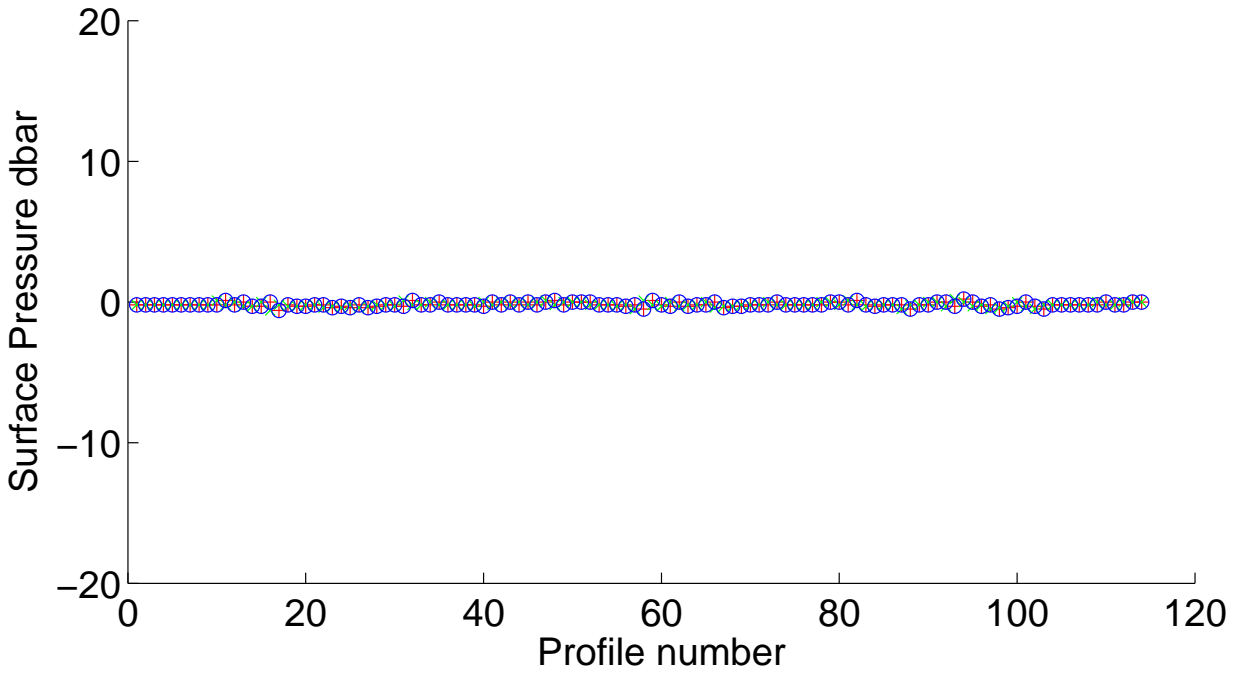


Figure 7: Float 6901192. Sea surface pressure data. The red cross indicate the raw pressure before float descent, recorded after sending data to GDAC. Blue circle indicate pressure value in the real-time. Green rotated cross shows the pressure correction applied from the previous float cycle.

## 4 Correction of Salinity Data

### 4.1 Comparison between Argo floats and CTD Climatology

#### 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/bot_  
HISTORICAL_ARGO_PREFIX=/argo_profiles/ARGO_for_DMQC_2018V01/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.mat
CONFIG_SAF=TypicalProfileAroundSAF.mat

% =====
%
% Objective Mapping Parameters
%

% max number of historical casts used in objective mapping
CONFIG_MAX_CASTS=300

% 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=0

% spatial decorrelation scales, in degrees
MAPSCALE_LONGITUDE_LARGE=3.2
MAPSCALE_LONGITUDE_SMALL=0.8
MAPSCALE_LATITUDE_LARGE=2
MAPSCALE_LATITUDE_SMALL=0.5

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

% temporal decorrelation scale, in years
MAPSCALE_AGE=0.69
MAPSCALE_AGE_LARGE=5

% 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=250
```



#### 4.1.2 Results

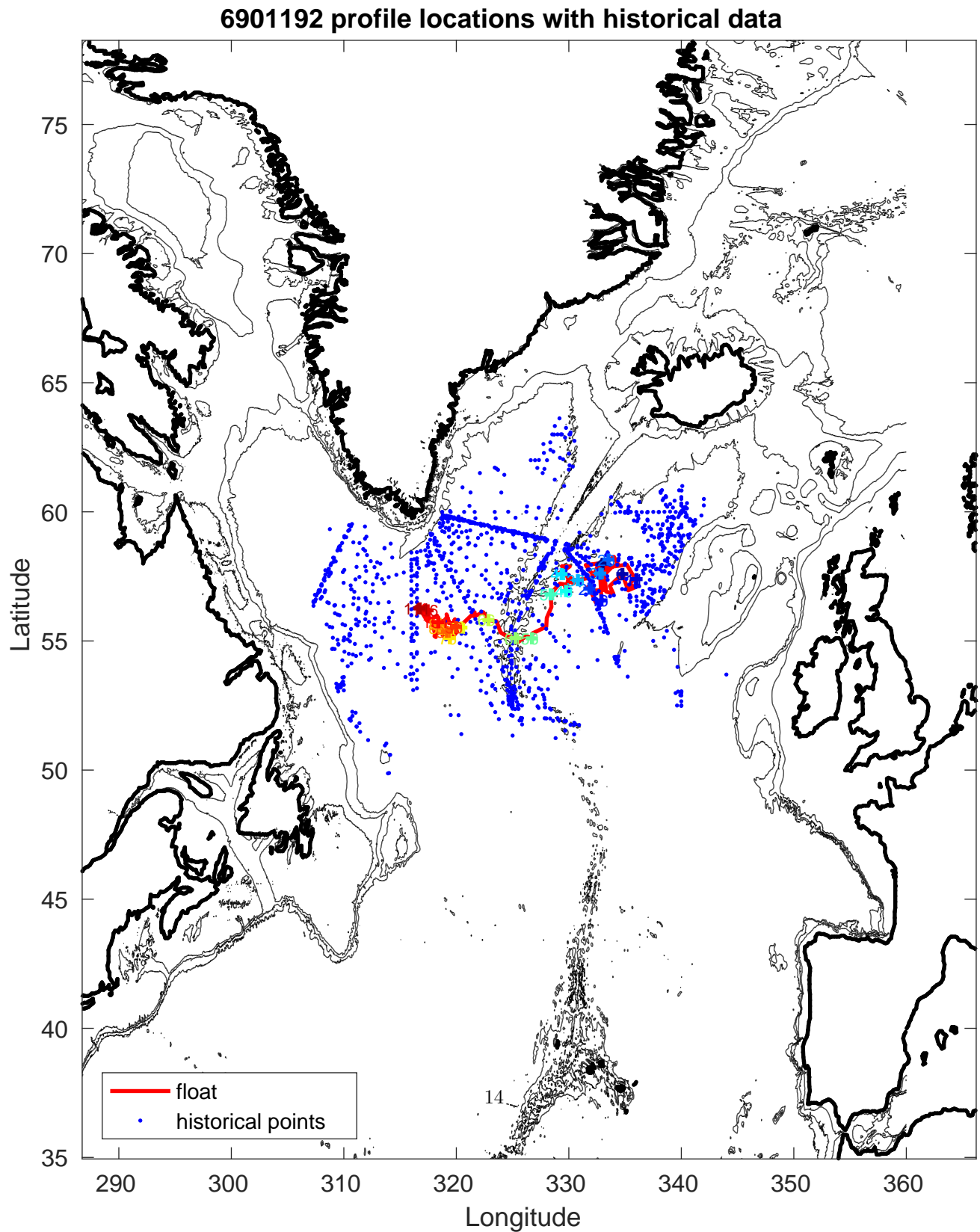


Figure 8: Float 6901192. Trajectory of the float with historical CTD data. The black contours indicate the bathymetry at 0, 200, 1000 and 2000 m.

6901192 uncalibrated float data (-) and mapped salinity (o) with objective errors

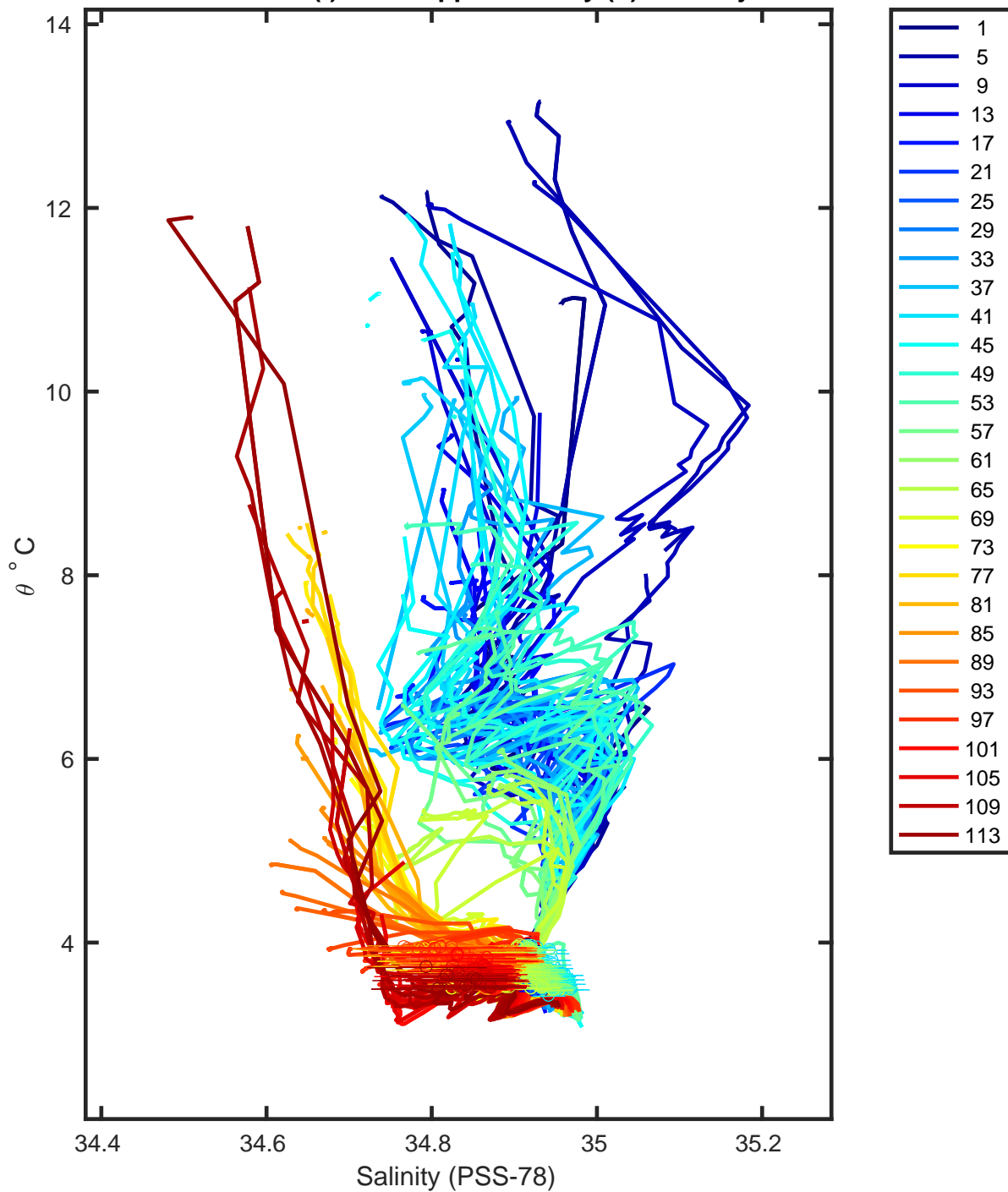
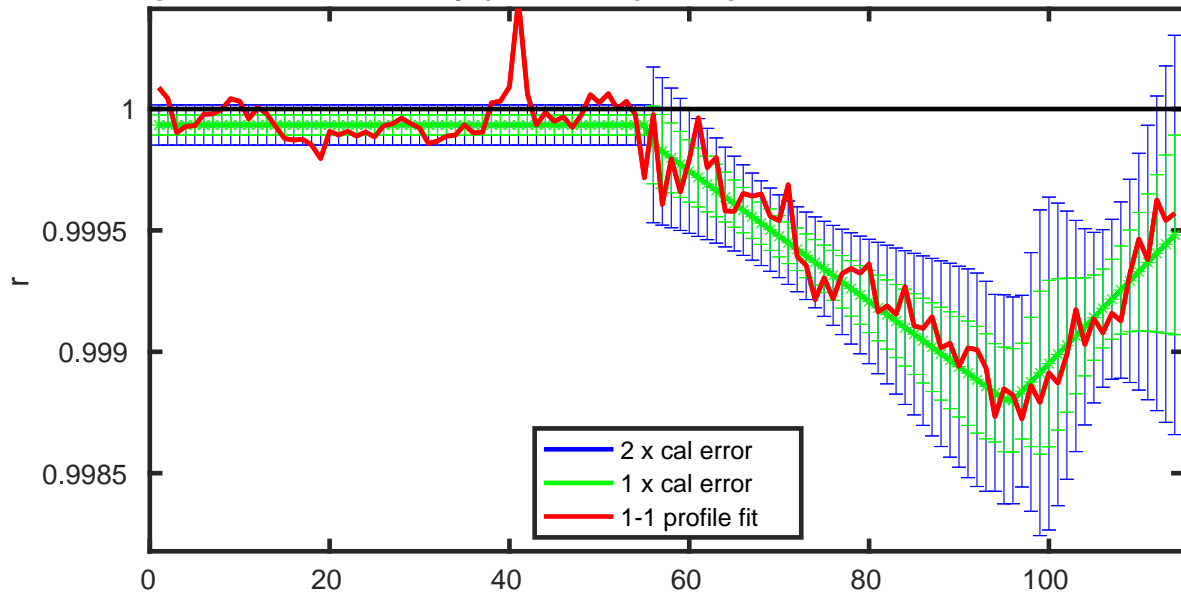


Figure 9: Float 6901192. Uncalibrated float data and mapped salinity.

6901192 potential conductivity (mmho/cm) multiplicative correction r with errors



6901192 vertically-averaged salinity (PSS-78) additive correction  $\Delta S$  with errors

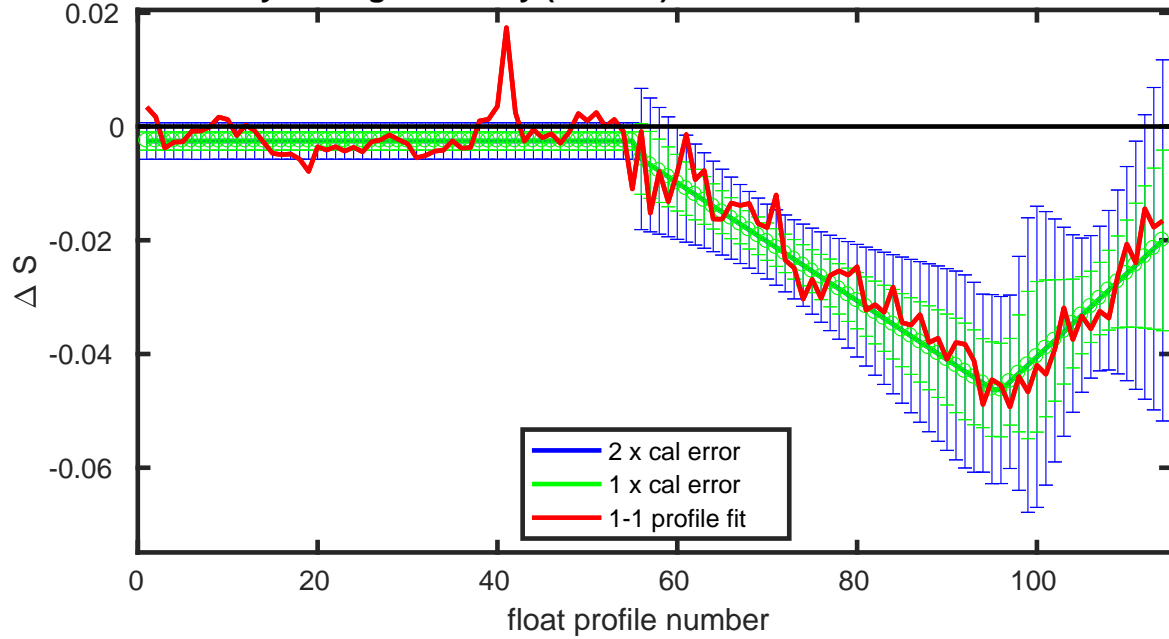


Figure 10: Float 6901192. Potential conductivity (top) and vertically averaged salinity (bottom) with errors.



6901192 calibrated float data (-) and mapped salinity (o) with objective errors

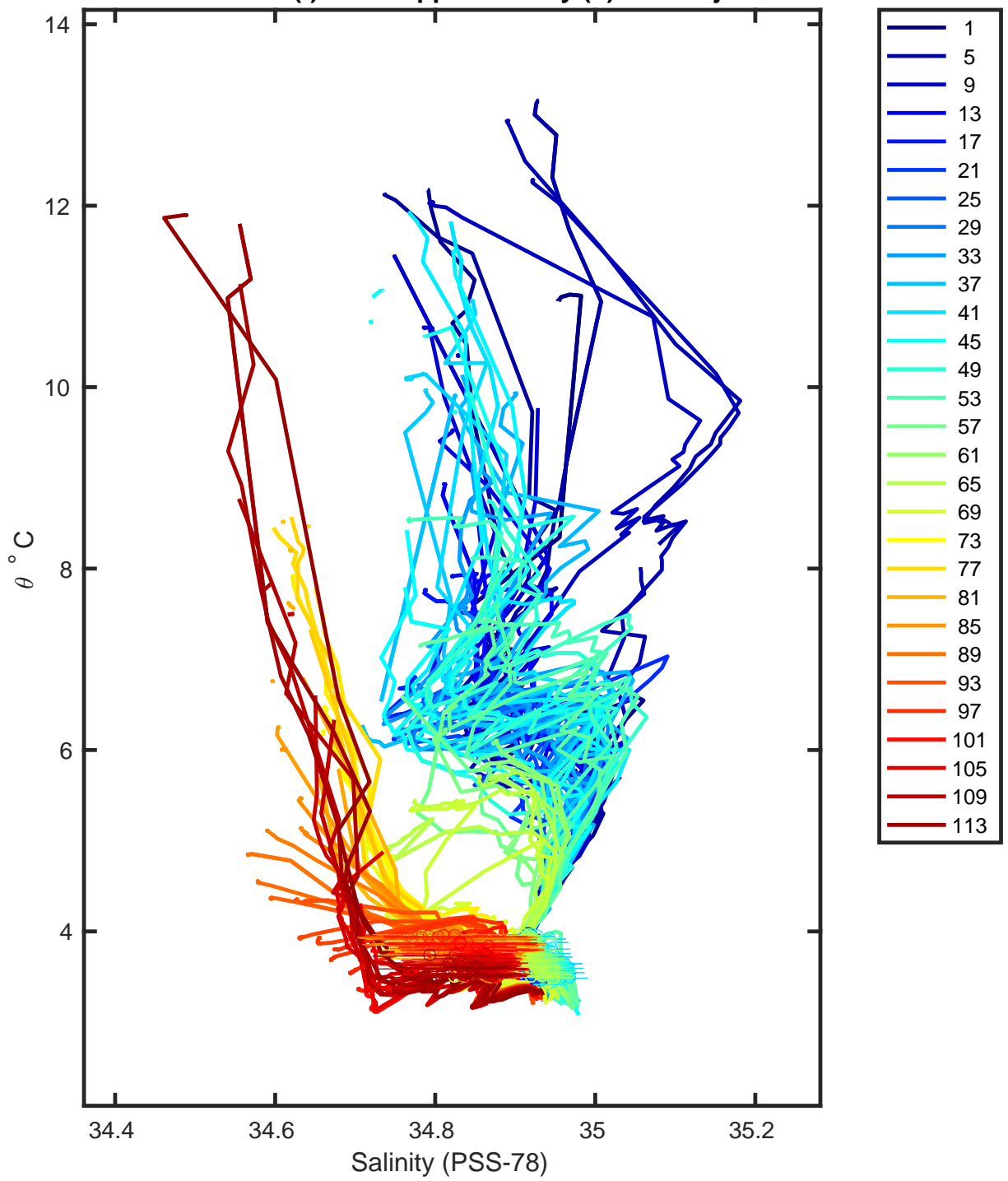


Figure 11: Float 6901192. Calibrated float data and mapped salinity.

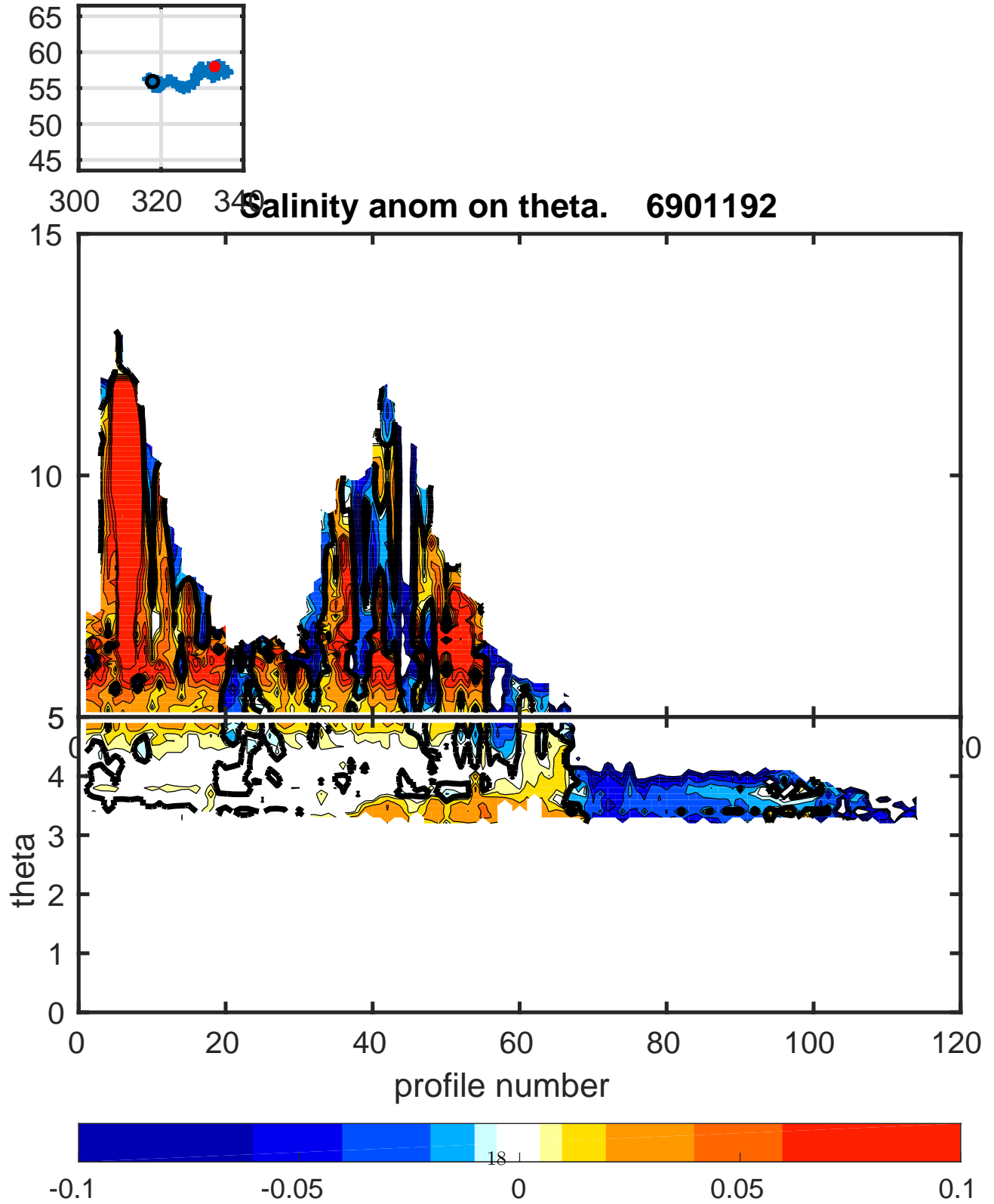


Figure 12: Float 6901192. Salinity anomaly on  $\theta$  levels.

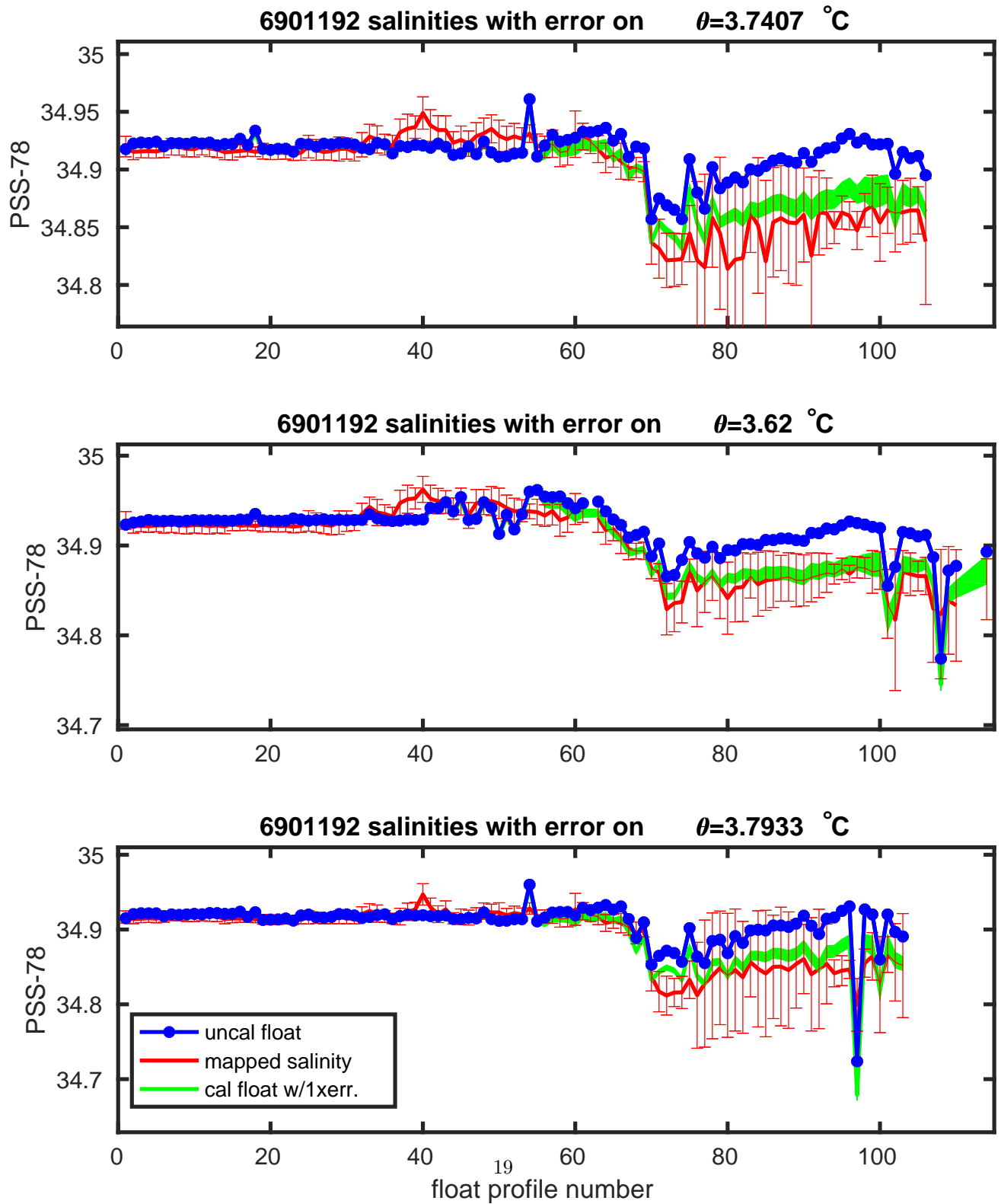


Figure 13: Float 6901192. Salinities with errors on  $\theta$  levels.

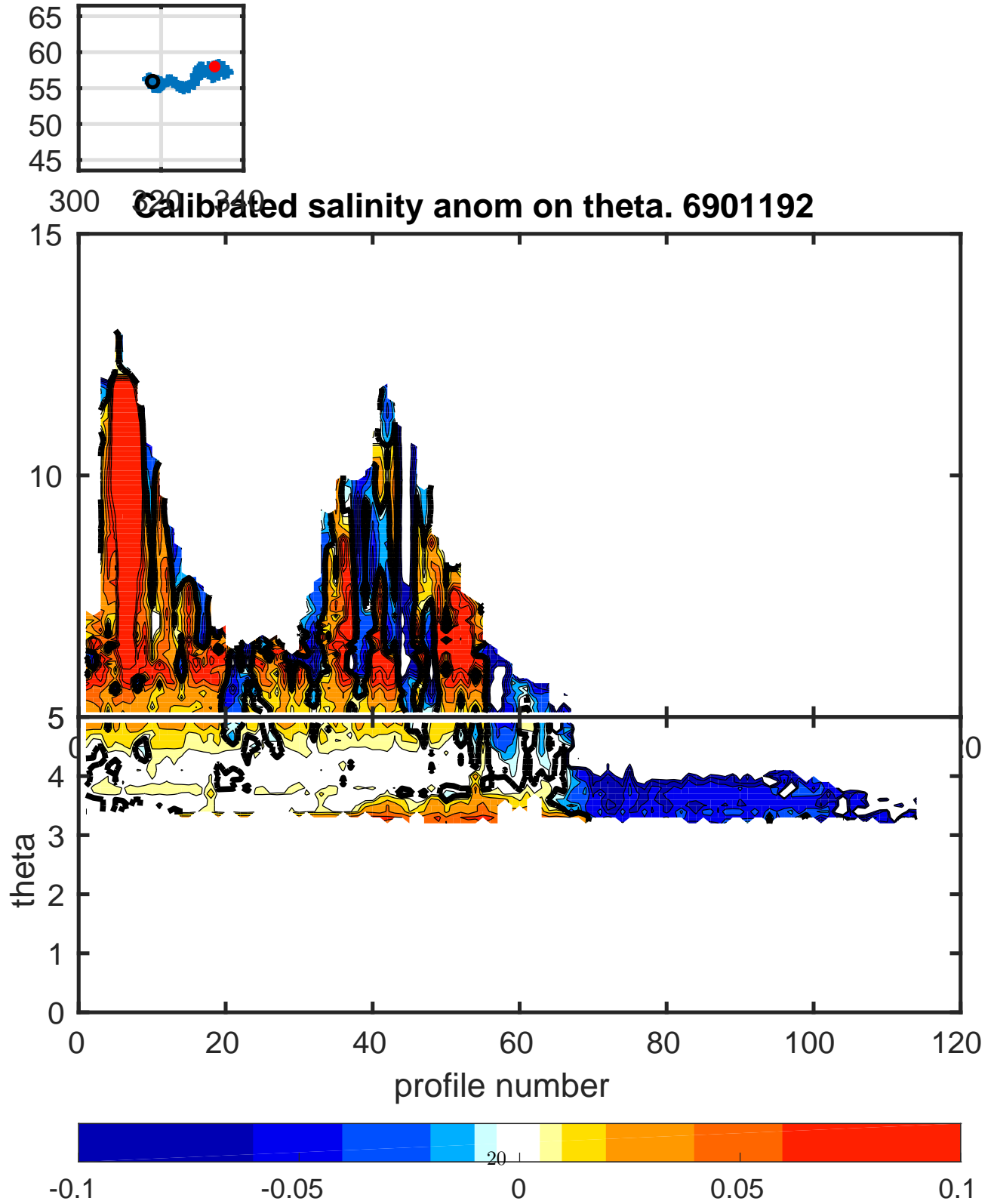


Figure 14: Float 6901192. Calibrated salinity anomaly on  $\theta$  levels.

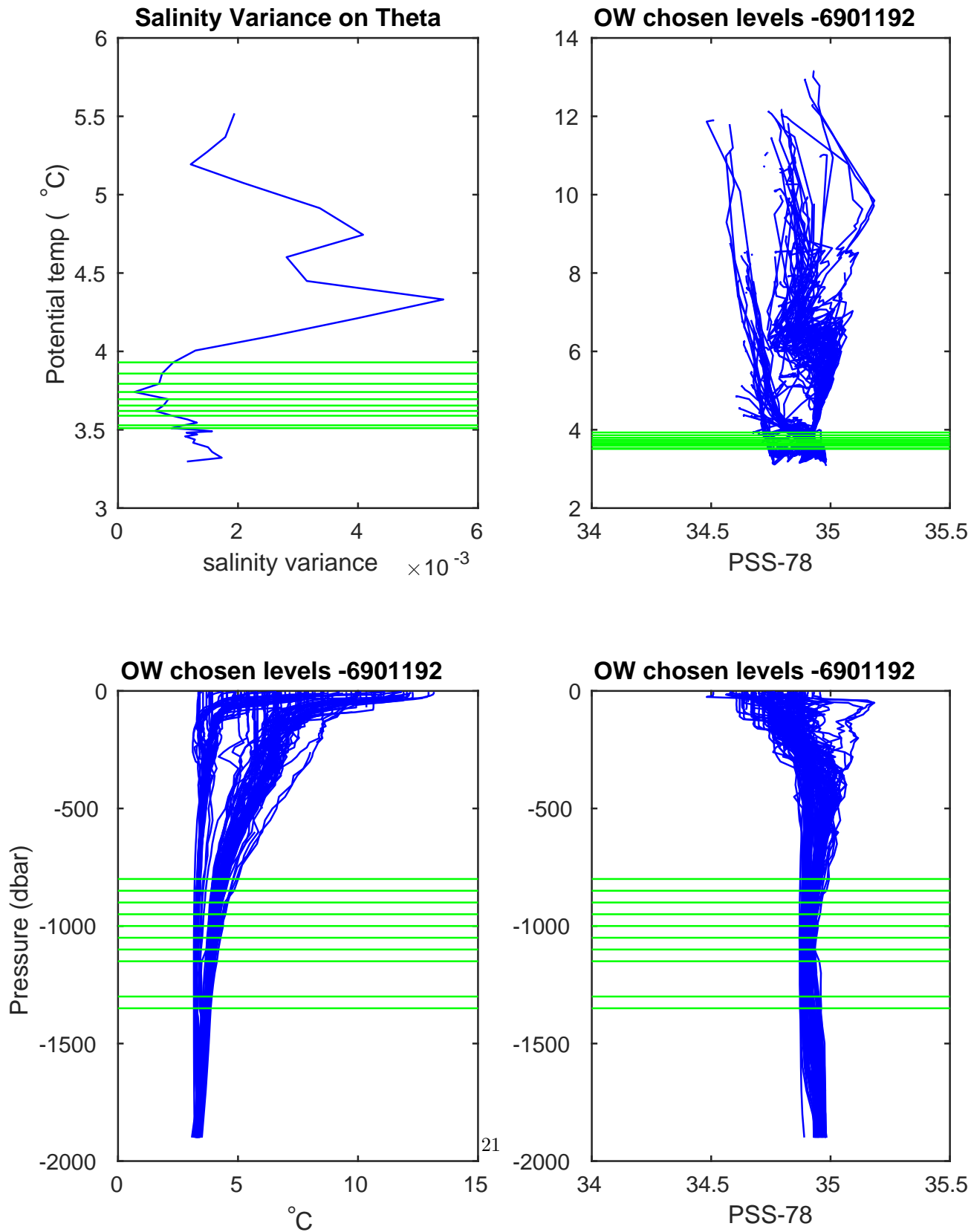


Figure 15: Float 6901192. Salinity, salinity variance on theta and OW chosen levels.

## 4.2 Comparison between Argo floats and Argo Climatology

### 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/bot_  
HISTORICAL_ARGO_PREFIX=/argo_profiles/ARGO_for_DMQC_2018V01/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/argo/  
FLOAT_MAPPED_PREFIX=map_  
FLOAT_MAPPED_POSTFIX=.mat  
  
% =====  
%  
%   Calibration Output Path  
%  
  
FLOAT_CALIB_DIRECTORY=/users/argo/ow/matlabow-2.0.1/data/float_calib/argo/  
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/argo/

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

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

% =====
%
%   Objective Mapping Parameters
%

% max number of historical casts used in objective mapping
CONFIG_MAX_CASTS=300

% 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=0

% spatial decorrelation scales, in degrees
MAPSCALE_LONGITUDE_LARGE=3.2
MAPSCALE_LONGITUDE_SMALL=0.8
MAPSCALE_LATITUDE_LARGE=2
MAPSCALE_LATITUDE_SMALL=0.5

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

% temporal decorrelation scale, in years
MAPSCALE_AGE=0.69
MAPSCALE_AGE_LARGE=5

% 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=250

```







#### 4.2.2 Results

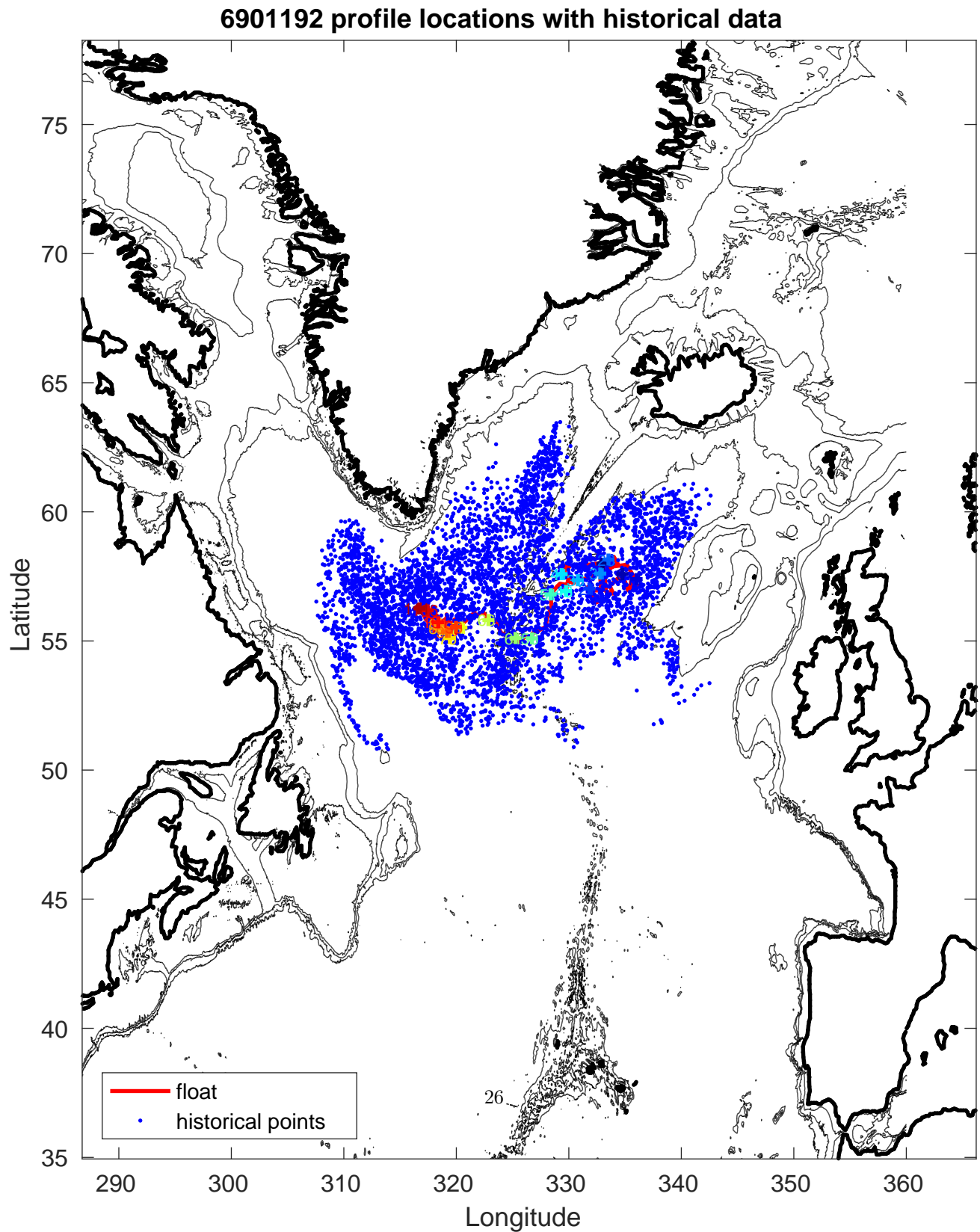


Figure 16: Float 6901192. Trajectory of the float with historical CTD data. The black contours indicate the bathymetry at 0, 200, 1000 and 2000 m.

6901192 uncalibrated float data (-) and mapped salinity (o) with objective errors

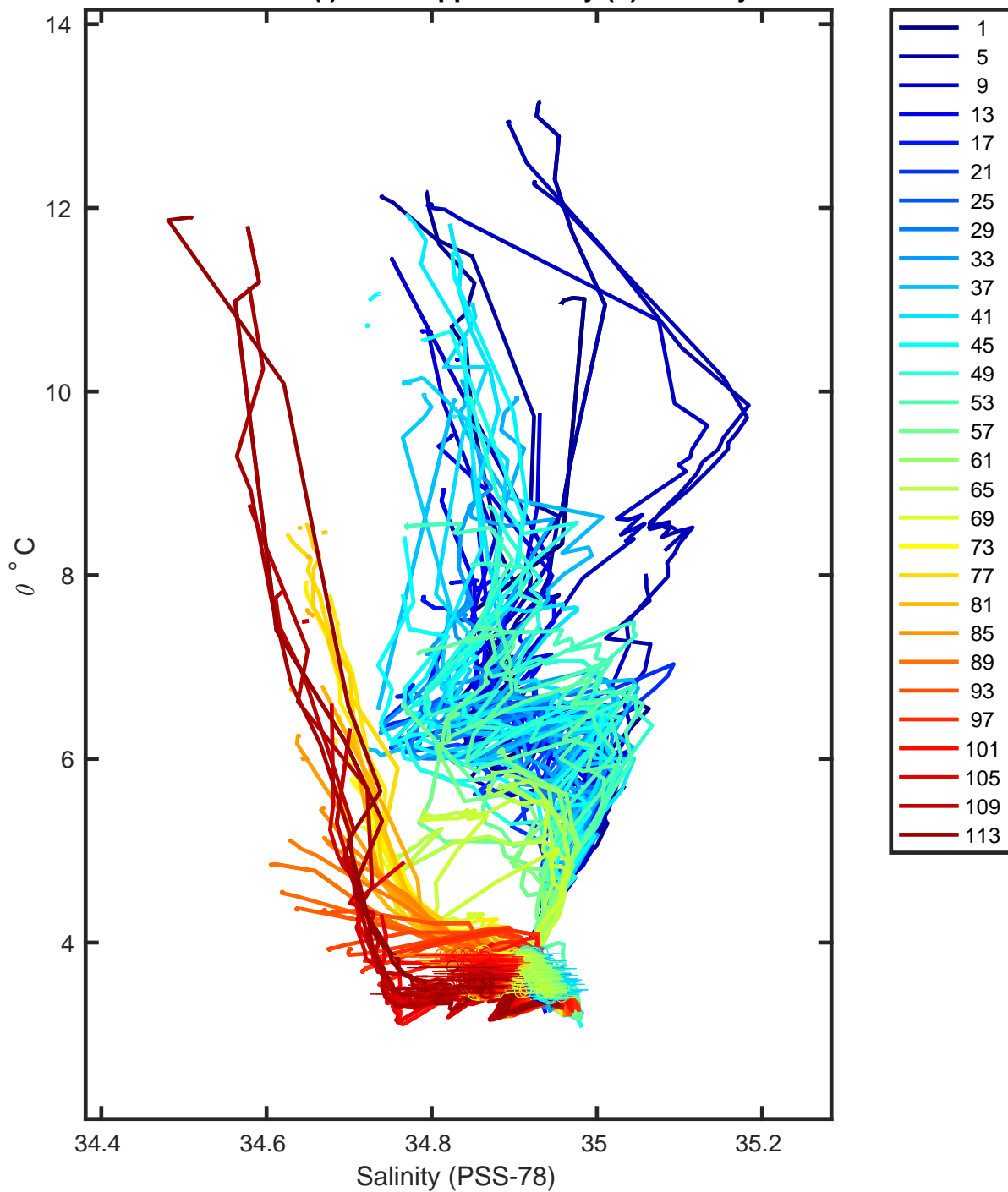
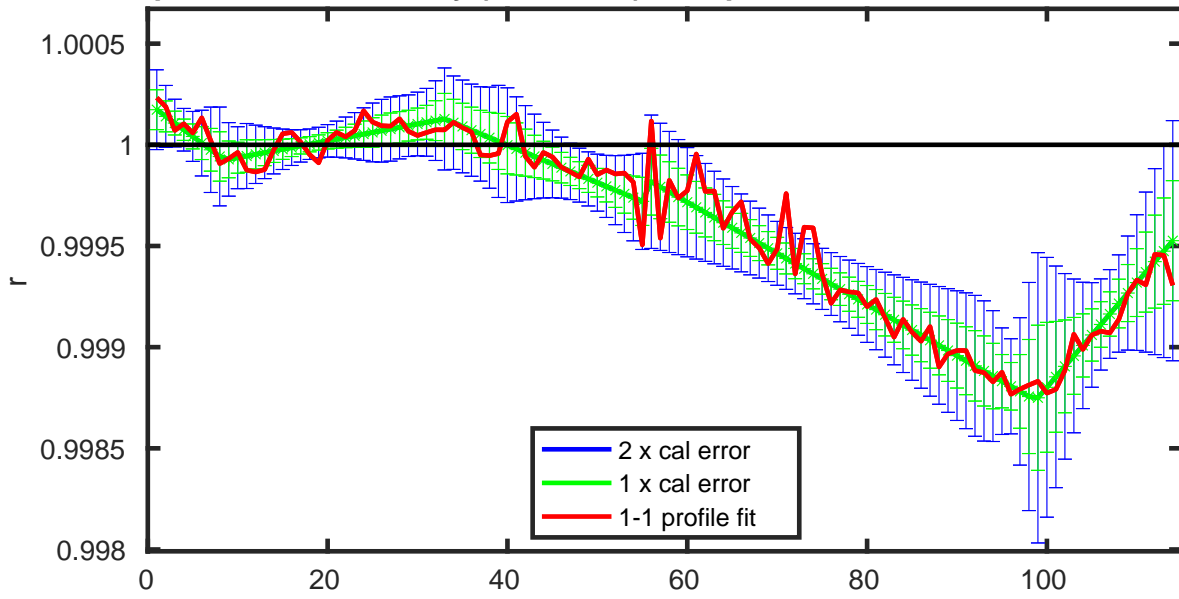


Figure 17: Float 6901192. Uncalibrated float data and mapped salinity.

6901192 potential conductivity (mmho/cm) multiplicative correction r with errors



6901192 vertically-averaged salinity (PSS-78) additive correction  $\Delta S$  with errors

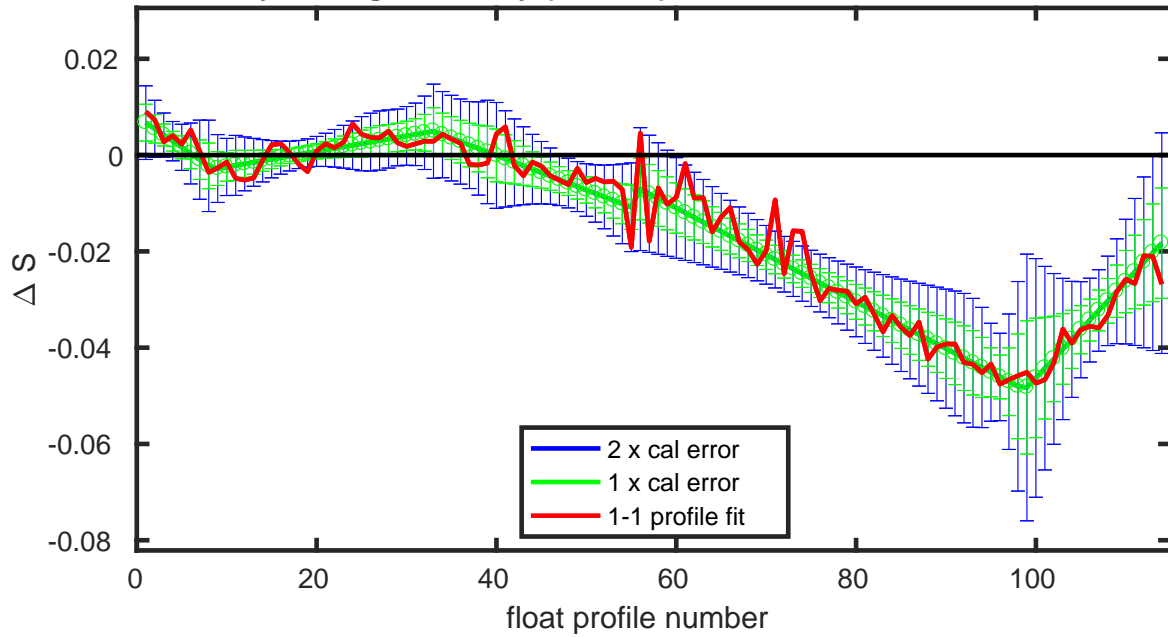


Figure 18: Float 6901192. Potential conductivity (top) and vertically averaged salinity (bottom) with errors.

6901192 calibrated float data (-) and mapped salinity (o) with objective errors

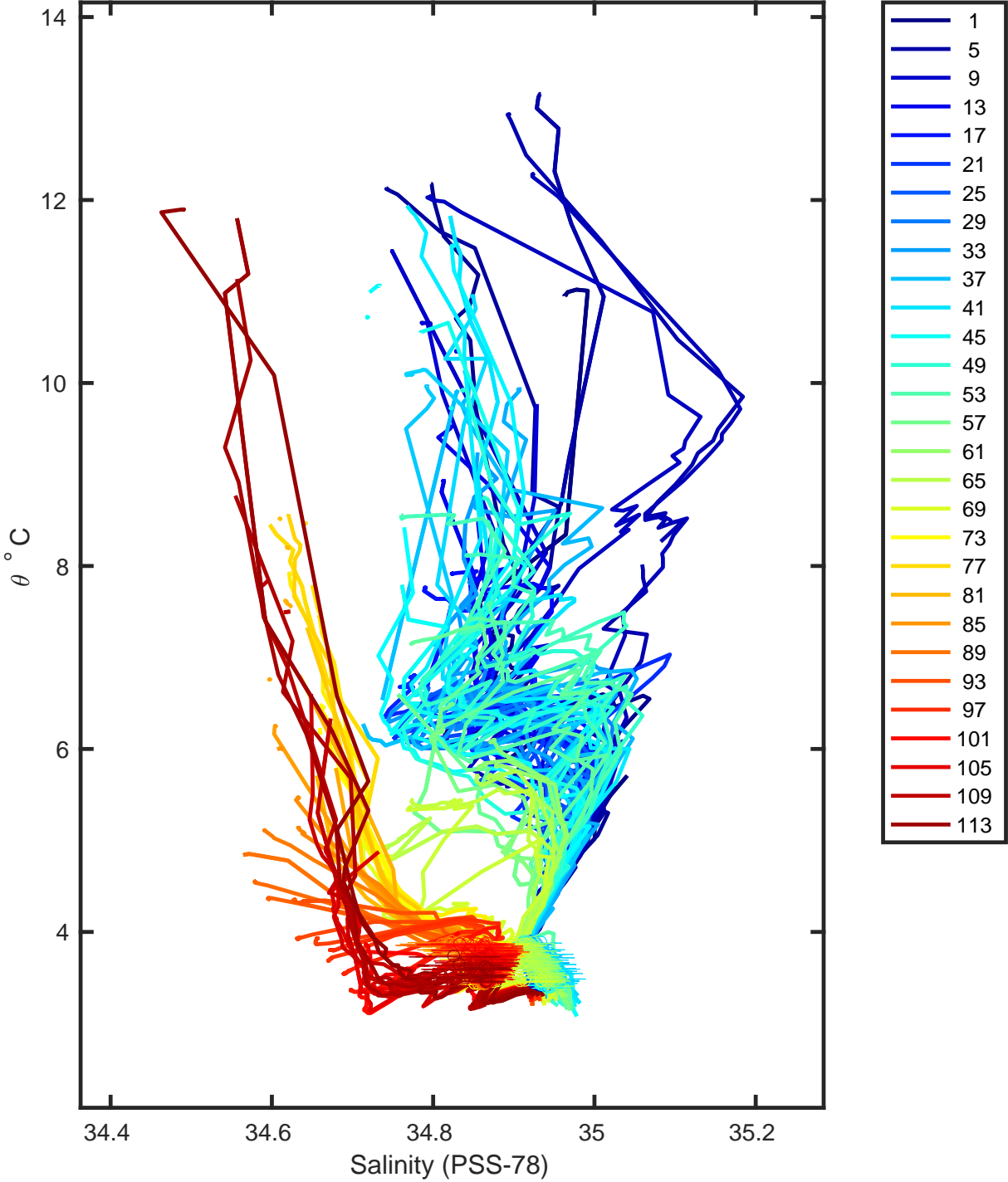


Figure 19: Float 6901192. Calibrated float data and mapped salinity.

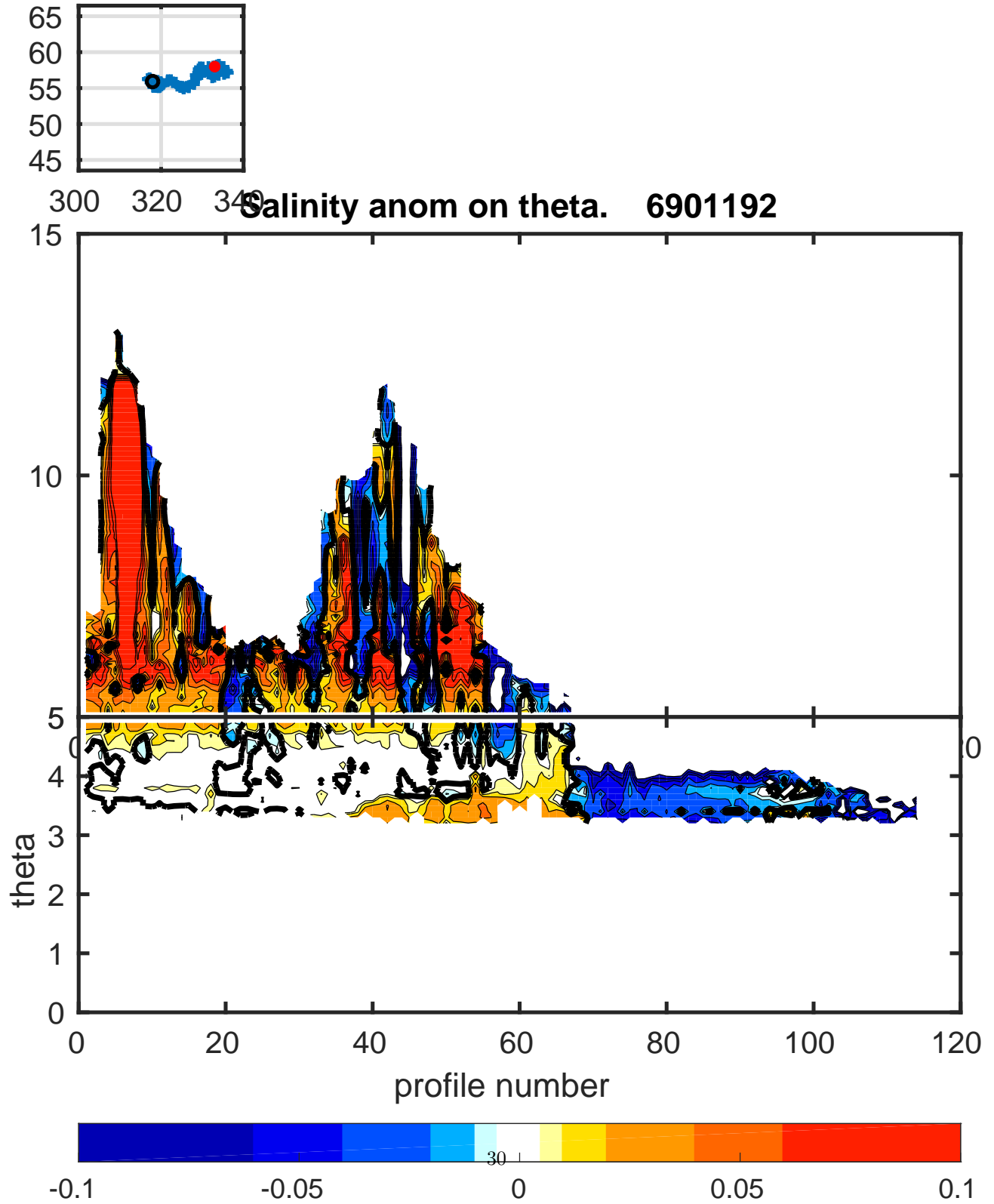


Figure 20: Float 6901192. Salinity anomaly on Theta

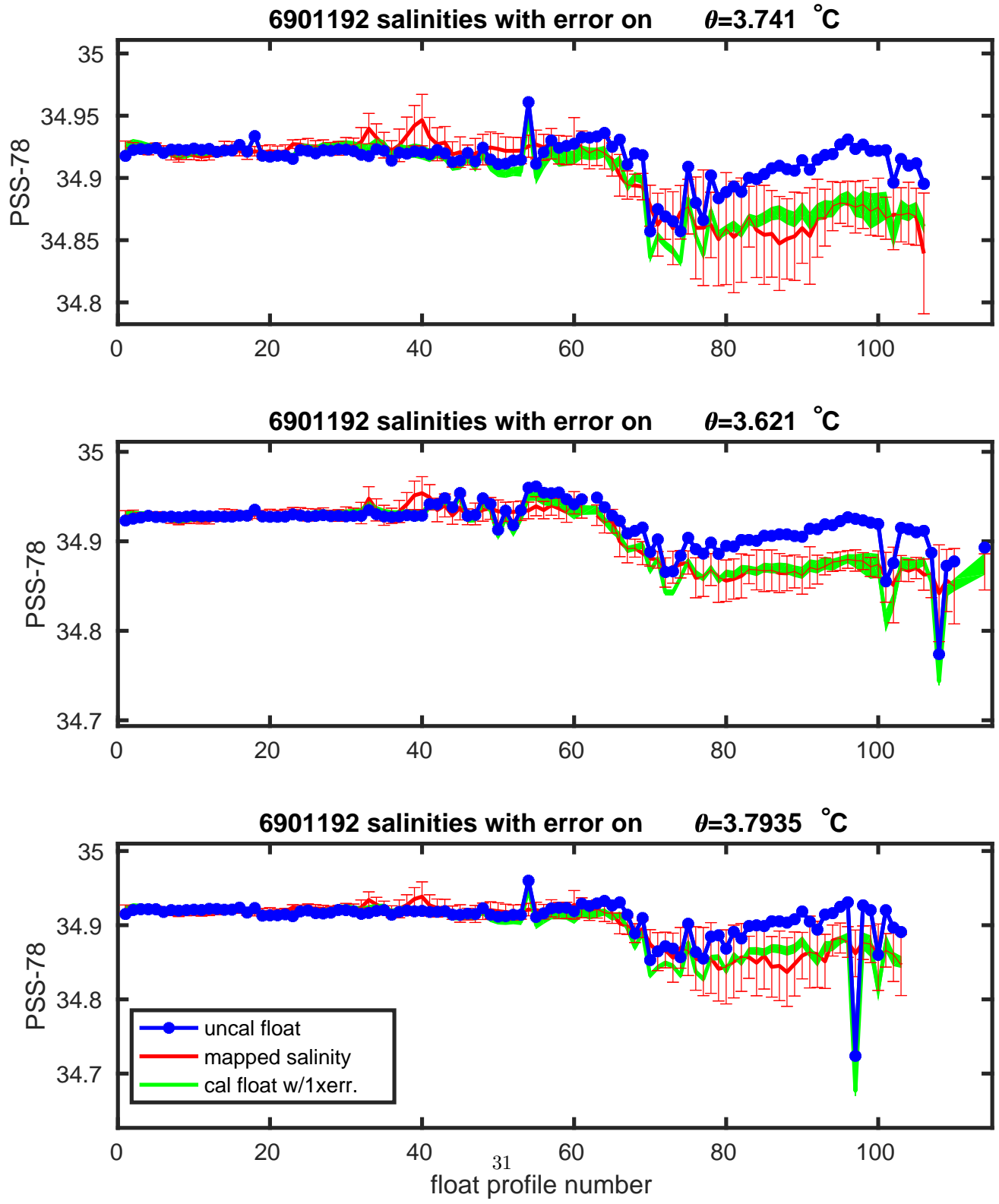


Figure 21: Float 6901192. Salinities with errors on  $\theta$ .

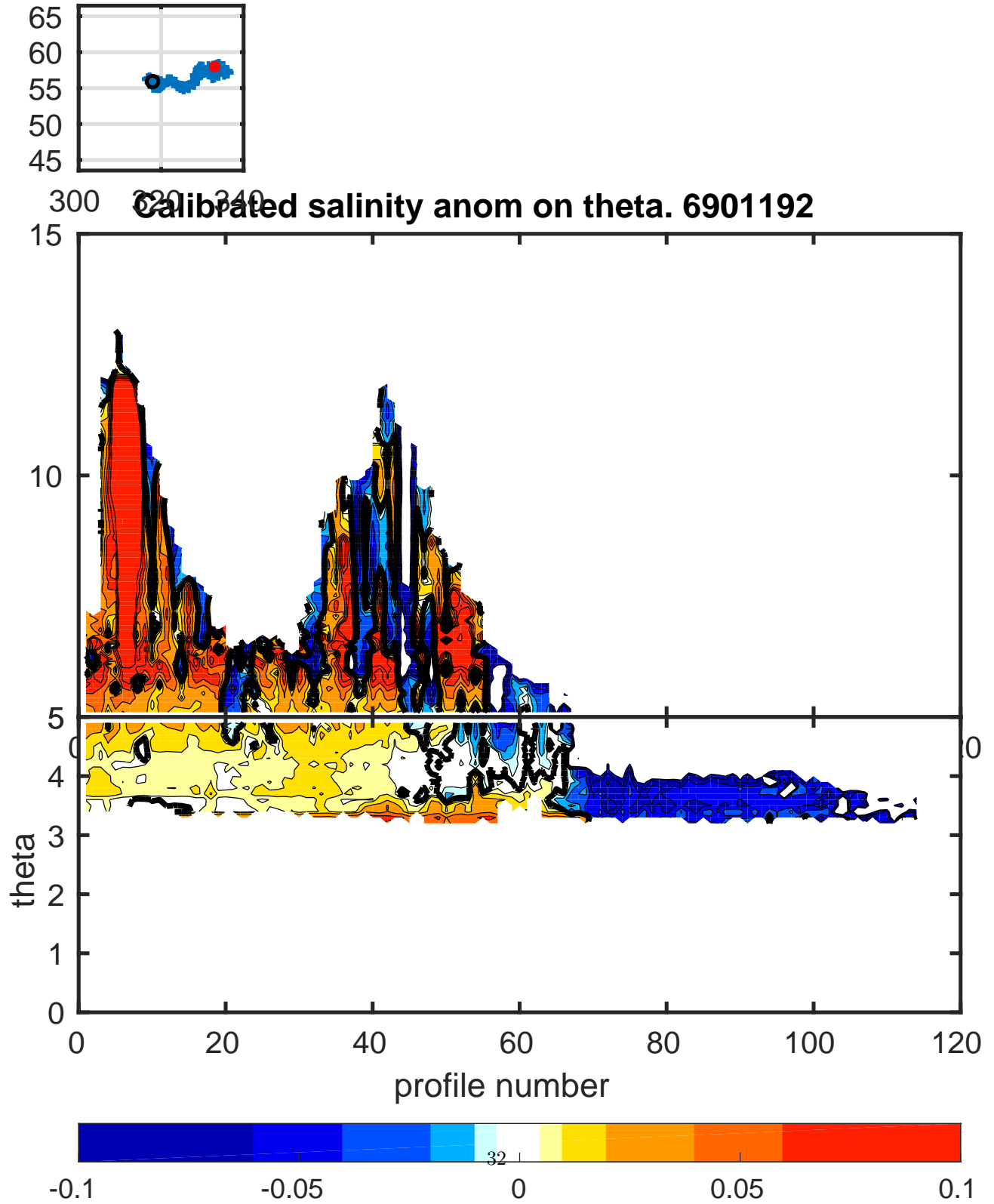


Figure 22: Float 6901192. Calibrated salinity anomaly on  $\theta$ .



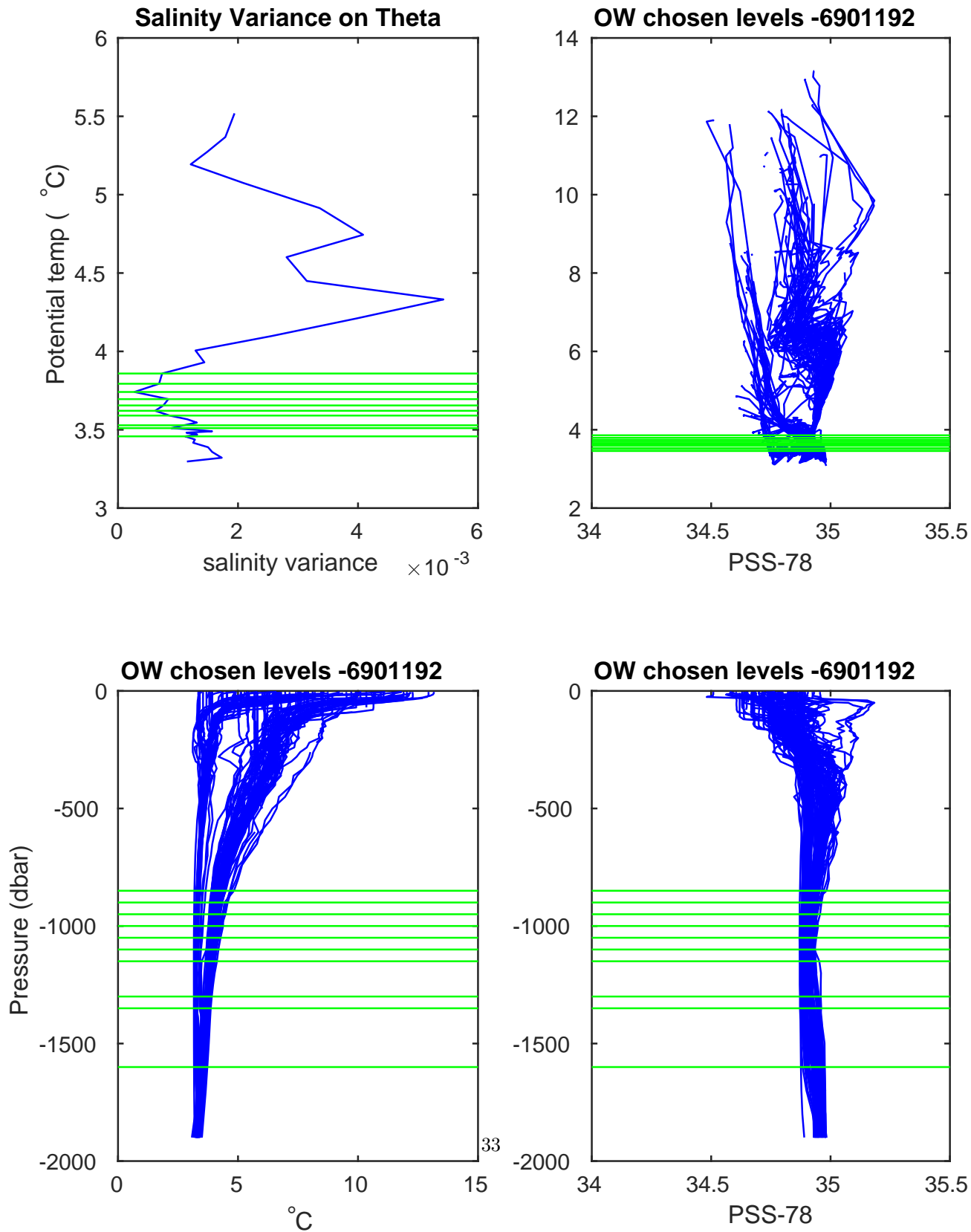


Figure 23: Float 6901192. Salinity, salinity variance on theta and OW chosen levels.

### 4.3 Summary and Conclusions

The Apex float was adjusted using the sea surface pressure data. The pressure sensor is not truncated, QC=1, error=2.4 dbar. The configurations of the objective mapping parameters, set for float 6901192, were applied separately for CTD and Argo reference data. In the setcalseries we separate time series onto two: 1-55 and 56-111 due to crossing the Mid-Atlantic Ridge by float. From cycle 1 to 60 float looks correct and does not require corrections, QC=1, error  $\leq 0.01$ . From cycle 61 to 111 there was reported very strange behaviour of float where it is drifting. The assessed QC =2 with salinity error is  $< 0.02$ .

## 5 Final Checks

Figure 24: Float 6901192. Time series of applied pressure corrections.

Figure 25: Float 6901192. Time series of applied temperature corrections.

Figure 26: Float 6901192. Time series of applied salinity corrections.