

# Delayed Mode Quality Control of Argo float 6901192

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## **Float decision**

The pressure sensor propagate well with QC=1, err= 2.4 dbar. Cell Thermal Mass corrections applied. Profile 1-50 QC=1, error=0.01. Profiles 51-115, QC=1, error=0.03. Profiles 116-154, QC=1, error = 0.02.

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# 1 Introduction

Delayed mode analysis was performed for float number 154199 (WMO: 6901192) where salinity and temperature values were separately compared to nearby historical CTD profiles and nearby Argo profiles as a reference database. The OWC (Cabanès et al., 2016) method was run to estimate a salinity offset and a salinity drift. For more information about float 6901192 click on the following link: <http://www.ifremer.fr/argoMonitoring/float/6901192>

## 2 Quality Check of Argo Float Data

### 2.1 Satellite Altimeter comparison

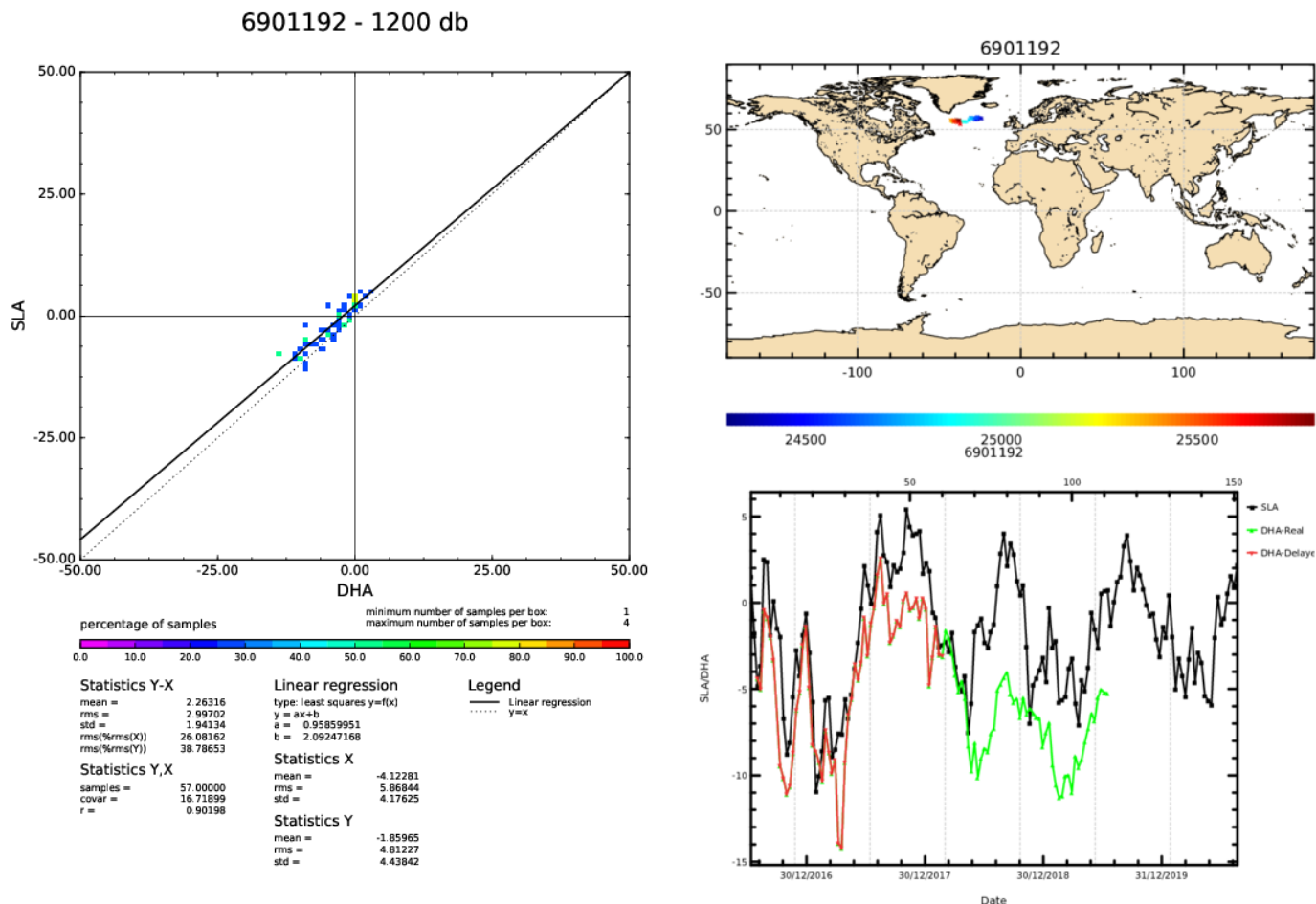


Figure 1: Float 6901192. The comparison between the Sea Surface Height (SSH) from the satellite altimetry and Dynamic Height Anomaly (DHA) extracted from the Argo float temperature and salinity data (<ftp://ftp.ifremer.fr/ifremer/argo/etc/argo-ast9-item13-AltimeterComparison/figures/>).

## 2.2 Time Series of Vertical Distribution of Data

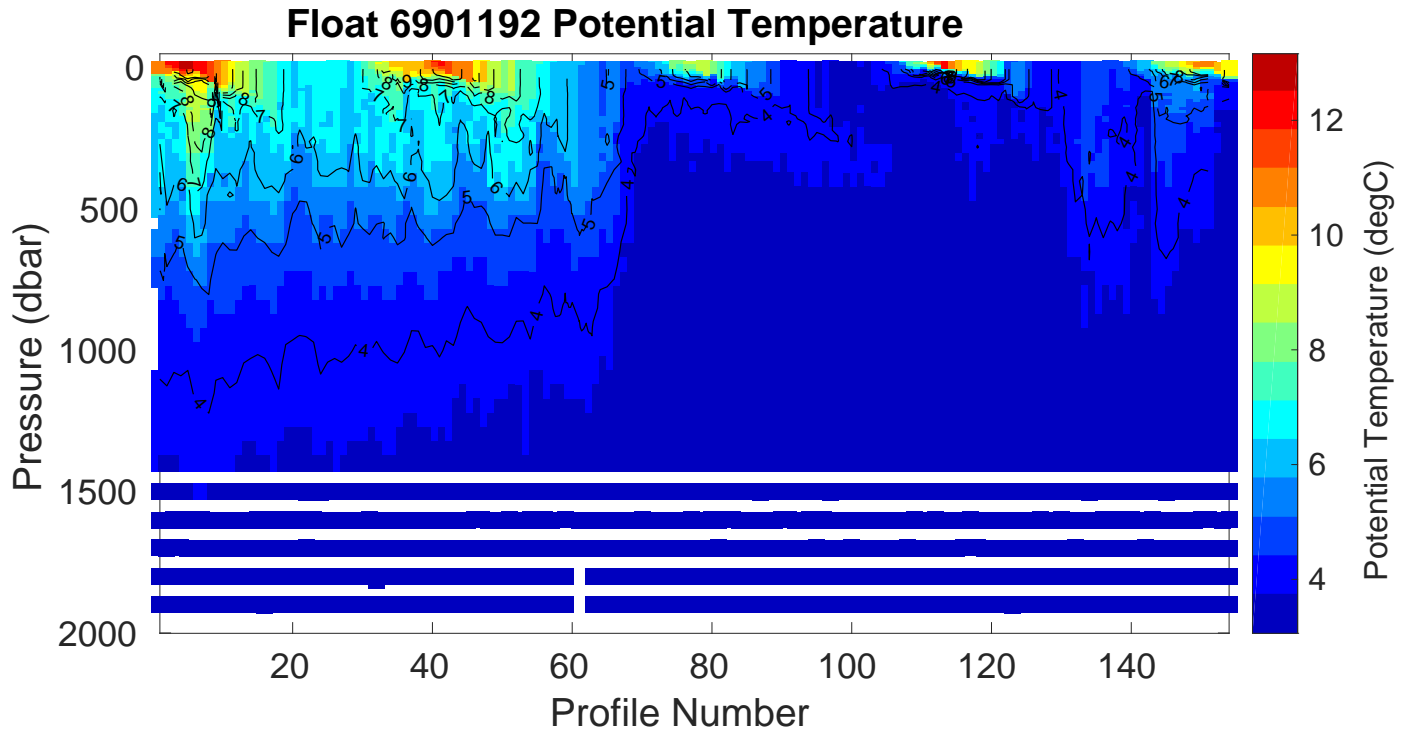


Figure 2: Float 6901192. Time series of the vertical distribution of potential temperature ( $^{\circ}\text{C}$ ).

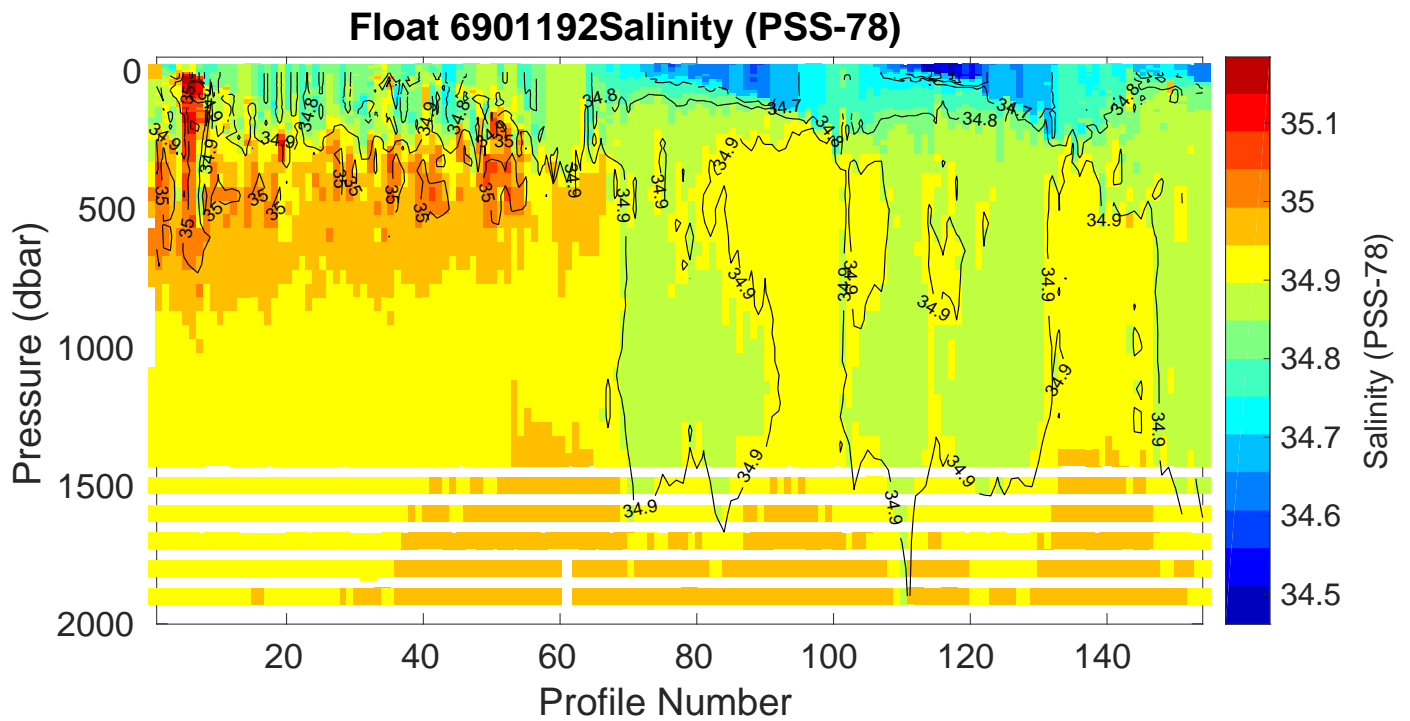


Figure 3: Float 6901192. Time series of the vertical distribution of salinity (PSS-78).

### 2.3 Comparison between Argo Float and Climatology

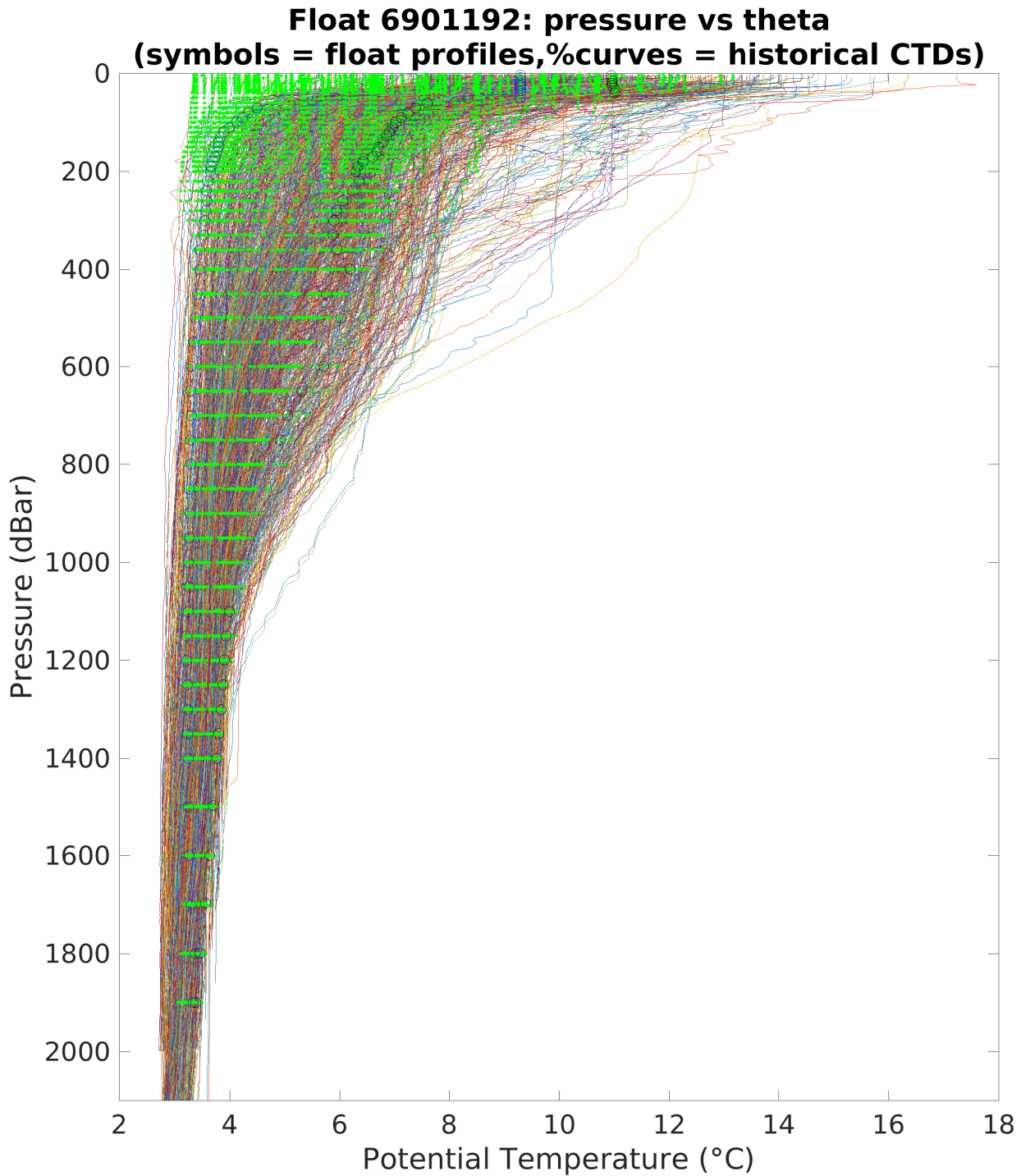


Figure 4: Float 6901192. Potential temperature (°C) plotted with pressure (dBar) and data from WMO boxes of CTD reference data (CTD for DMQC 2019V01) +/- 10 °of latitude and longitude. The black and blue cycles indicates the first and the last Argo profile, respectively. Green symbols represent other Argo profiles from this float. The thin colors lines indicate the reference data

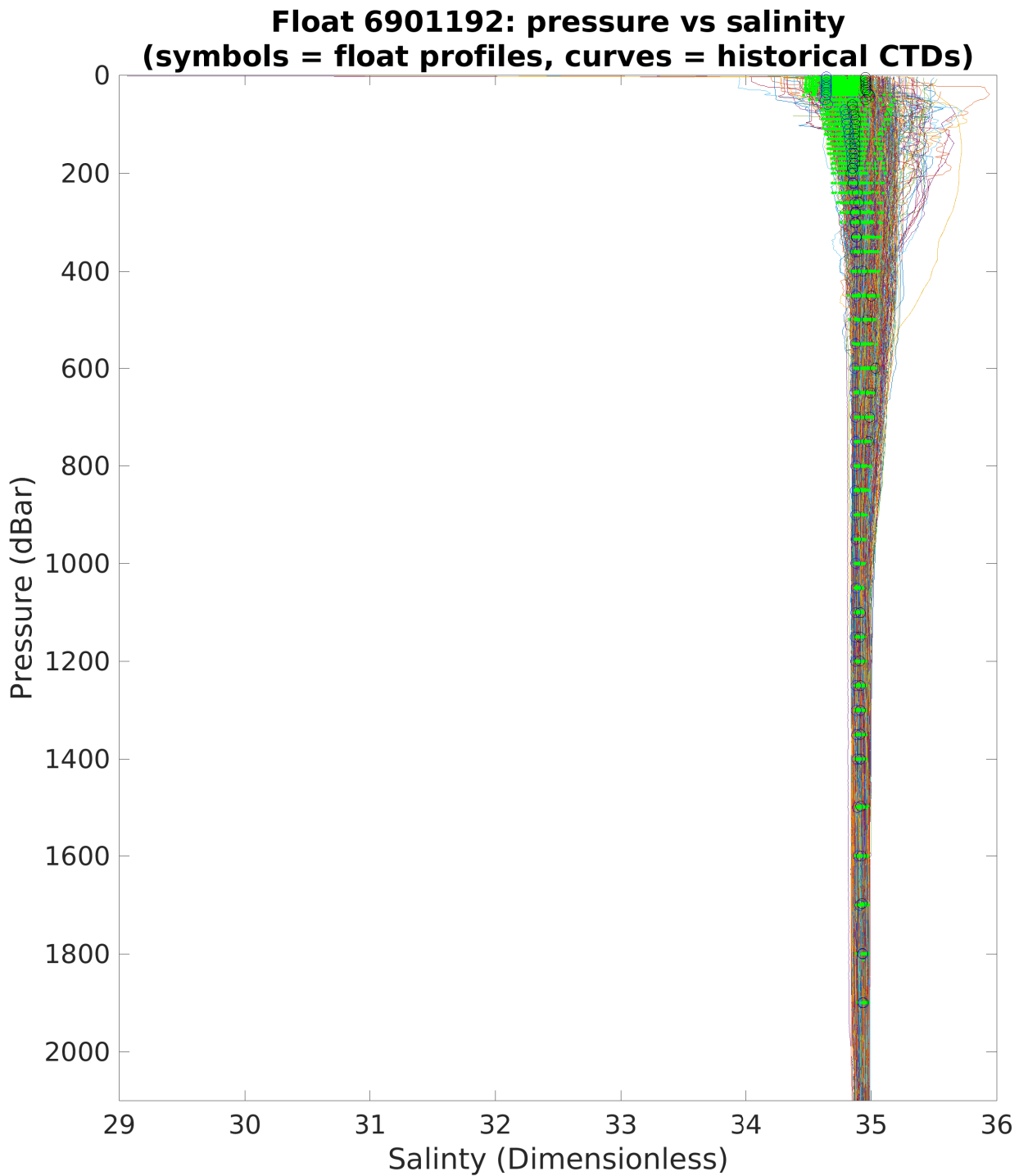


Figure 5: Float 6901192. Salinity (PSS-78) plotted with pressure (dBar) and data from WMO boxes of CTD reference data (CTD for DMQC 2019V01)  $\pm 10^\circ$  of latitude and longitude. The black and blue cycles indicates the first and the last Argo profile, respectively. Green symbols represent other Argo profiles from this float. The thin colors lines indicate the reference data.

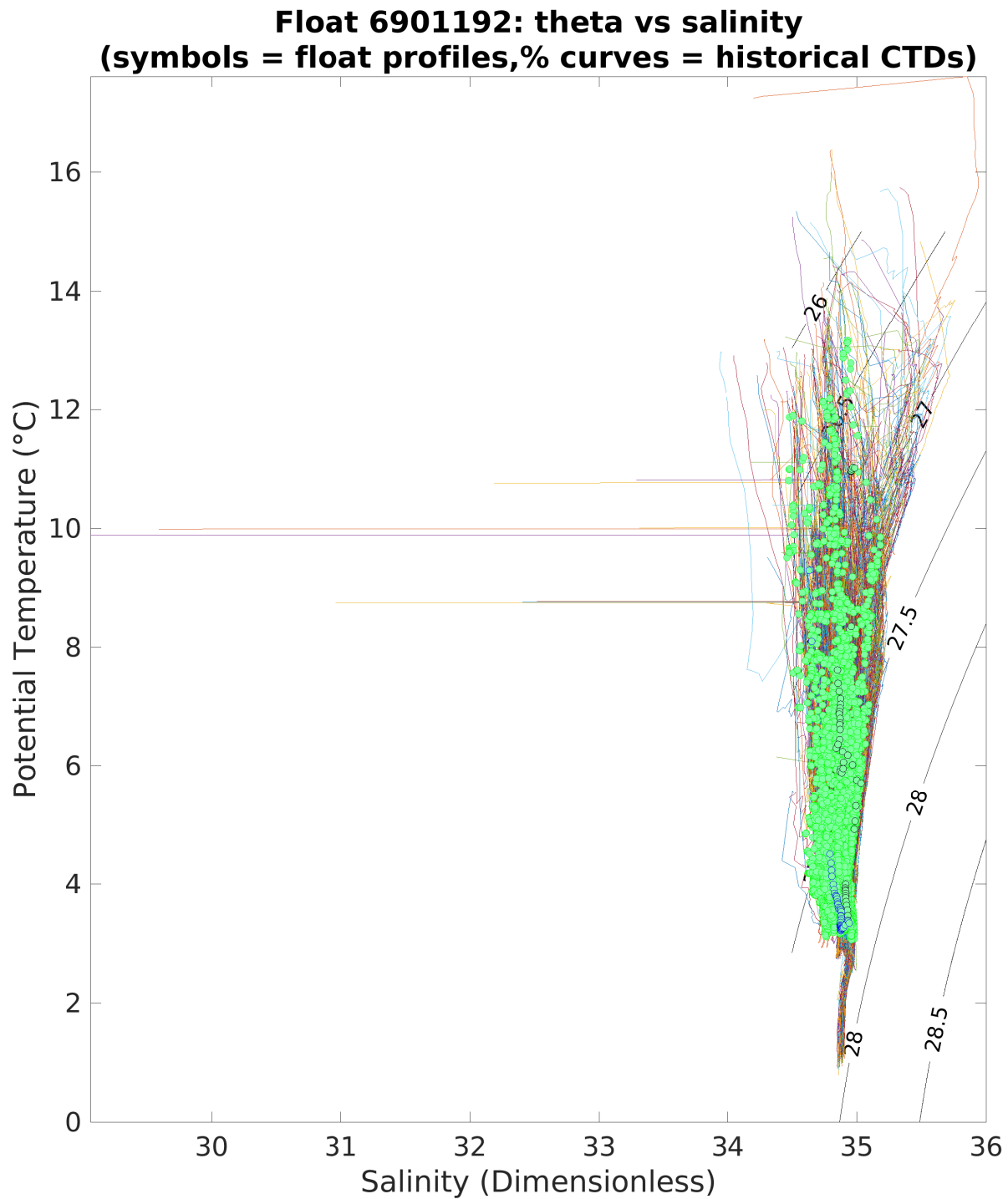


Figure 6: Float 6901192. T/S diagram plotted with and data from WMO boxes of CTD reference data (CTD for DMQC 2019V01) +/- 10° of latitude and longitude. The black and blue cycles indicates the first and the last Argo profile, respectively. Green symbols represent other Argo profiles from this float.

### 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

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

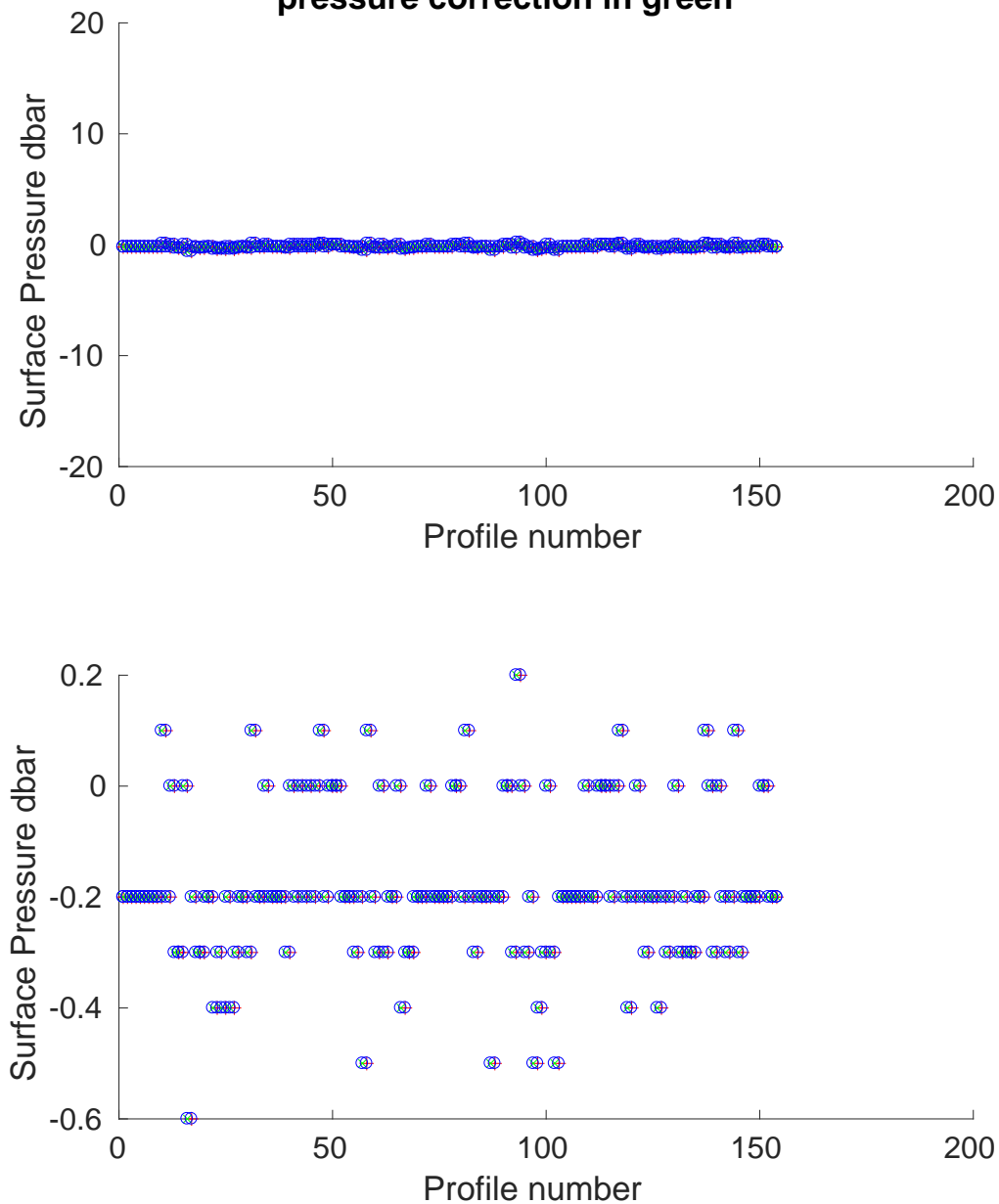


Figure 7: Float 6901192. Sea surface pressure data. The red cross indicate the raw pressure before float descent, recorded after sending data to GDAC. Blue circle indicate pressure value in the real-time. Green rotated cross shows the pressure correction applied from the previous float cycle. Top plot- data constrained between -2.4 and 2.4 dbar, middle plot- data constrained to -20 and 20 dbar, bottom plot- data with the max range of data.

## 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_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.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=2.5
MAPSCALE_LONGITUDE_SMALL=0.8
MAPSCALE_LATITUDE_LARGE=1.5
MAPSCALE_LATITUDE_SMALL=0.5

% cross-isobath scales, dimensionless, see BS(2005)
MAPSCALE_PHI_LARGE=0.3
MAPSCALE_PHI_SMALL=0.08

% 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

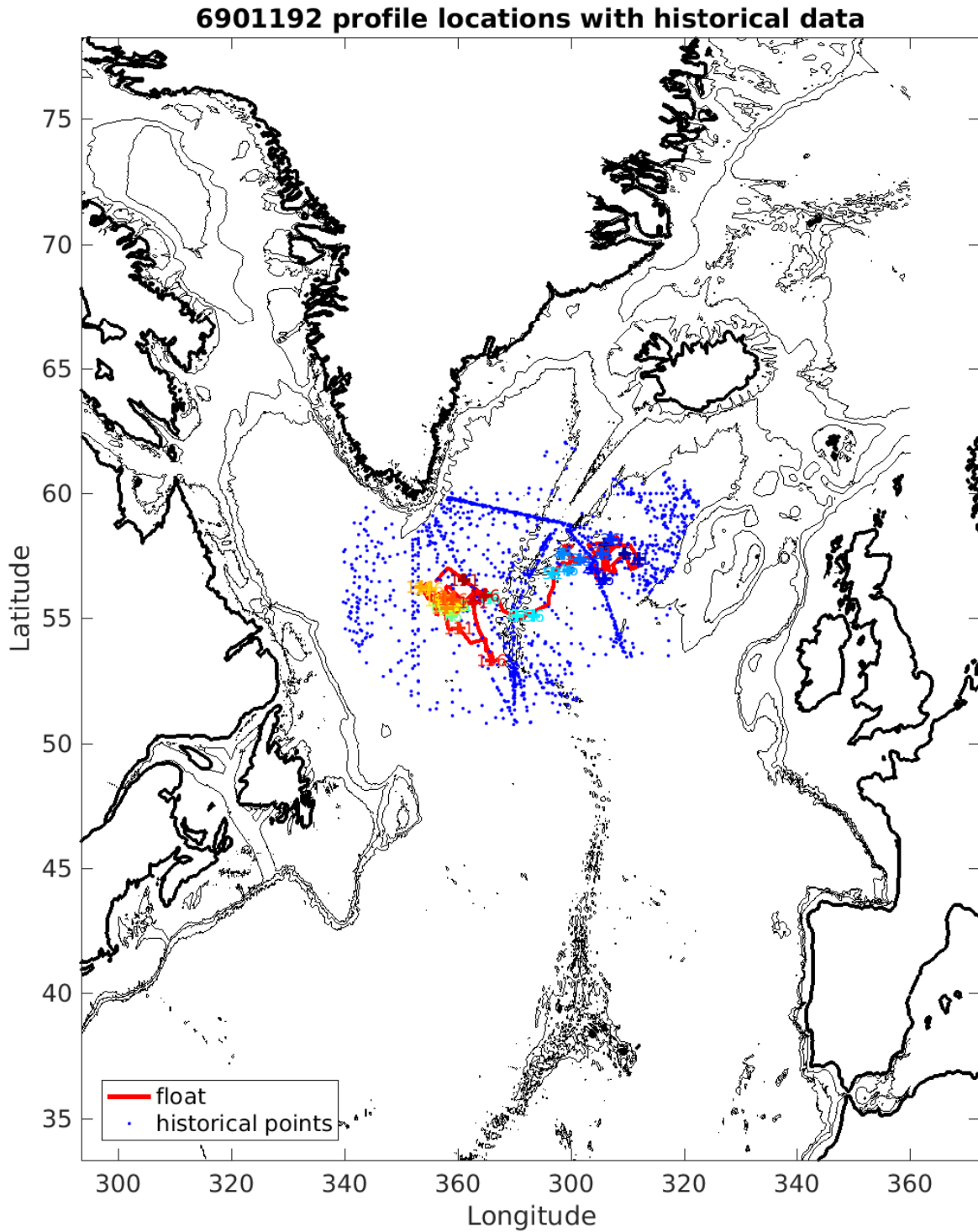


Figure 8: Float 6901192. Location of the float profiles (red line with coloured numbers) and the CTD reference data selected for mapping (blue dots). The black contours indicate the bathymetry at 0, 200, 1000 and 2000 m.

**L92 uncalibrated float data (-) and mapped salinity (o) with objective errors**

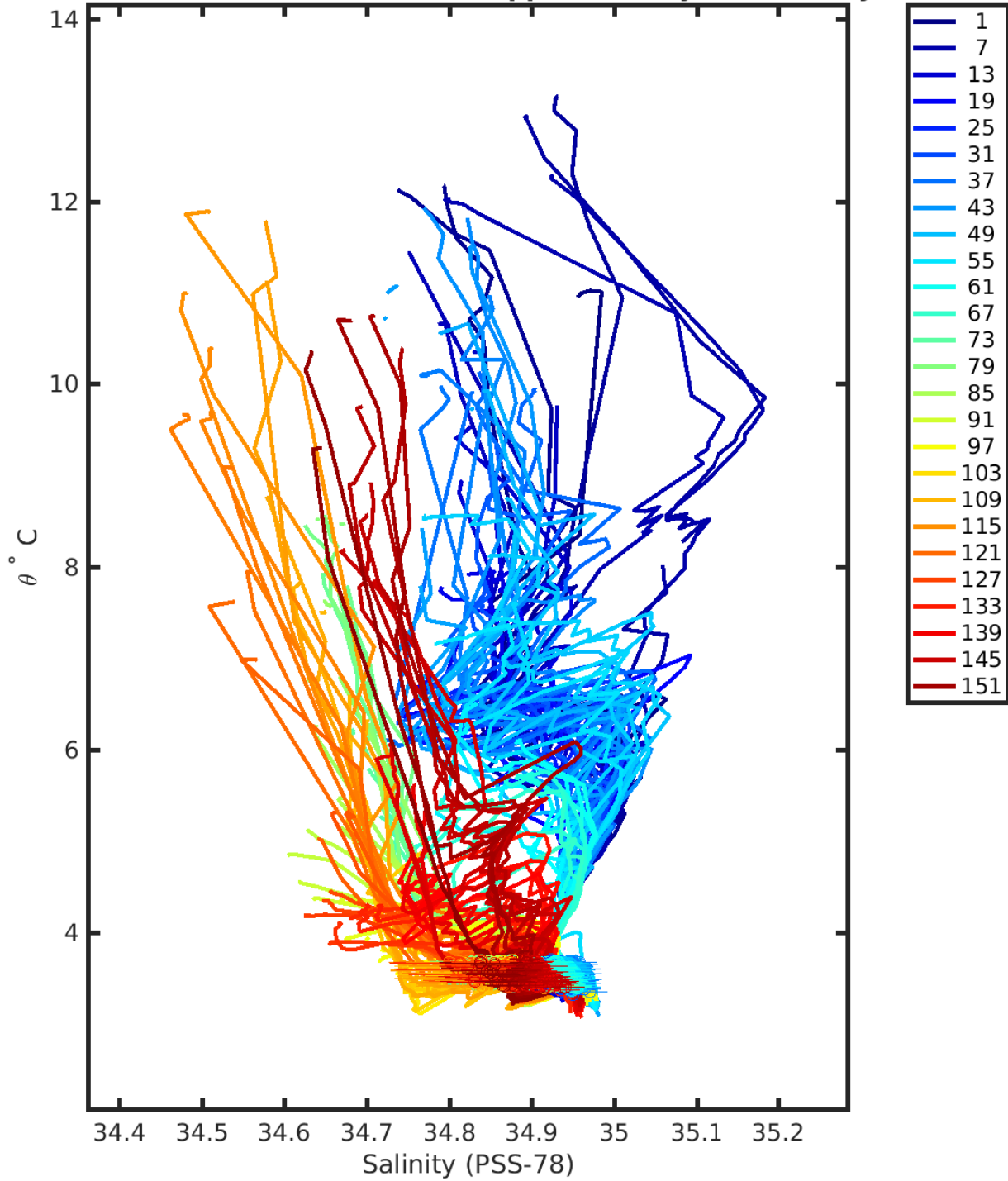
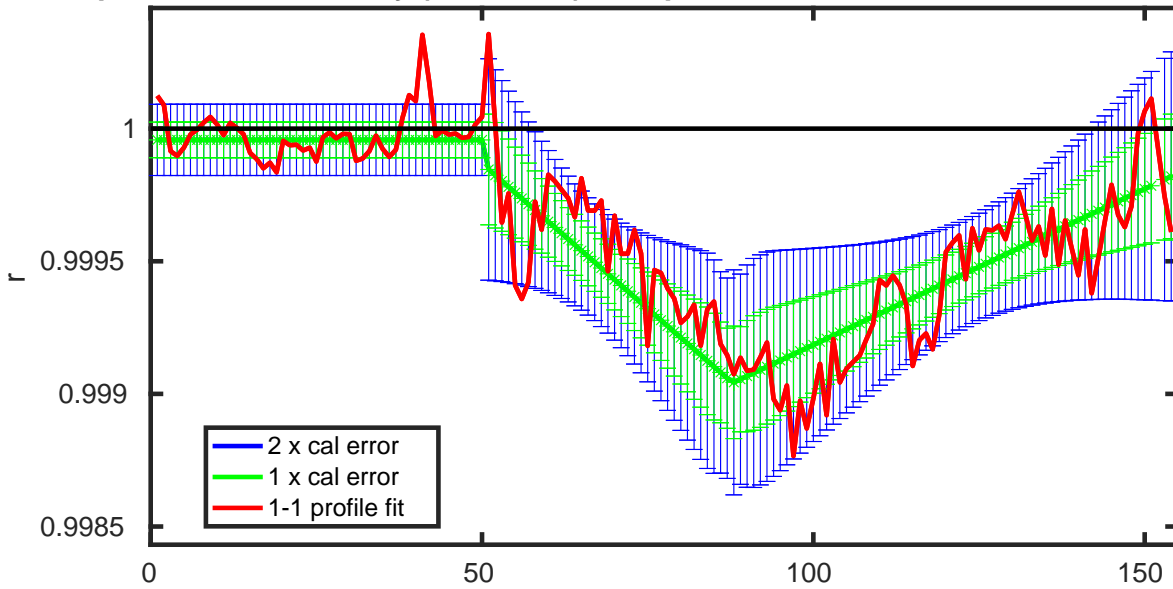


Figure 9: Float 6901192. Plots the original float salinity and the objectively estimated reference salinity at the 10 float theta levels that are used in calibration.

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



### 6901192 vertically-averaged salinity (PSS-78) additive correction

$\Delta S$  with errors

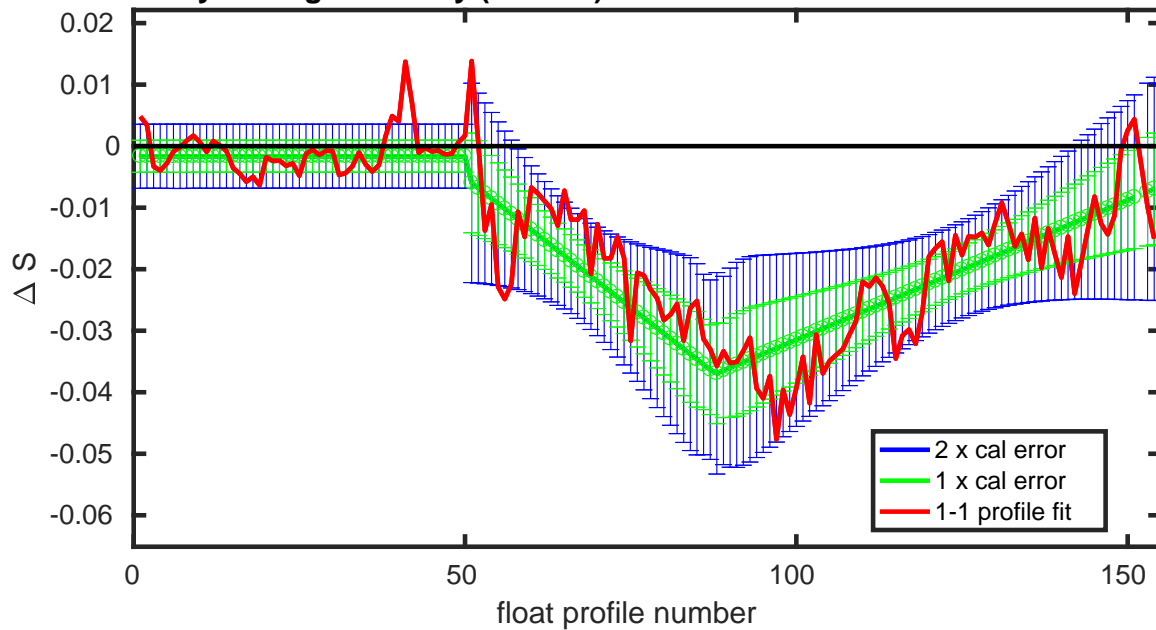


Figure 10: Float 6901192. Evolution of the suggested adjustment with time. The top panel plots the potential conductivity multiplicative adjustment. The bottom panel plots the equivalent salinity additive adjustment. The red line denotes one-to-one profile fit that uses the vertically weighted mean of each profile. The red line can be used to check for anomalous profiles relative to the optimal fit.

**L192 calibrated float data (-) and mapped salinity (o) with objective errors**

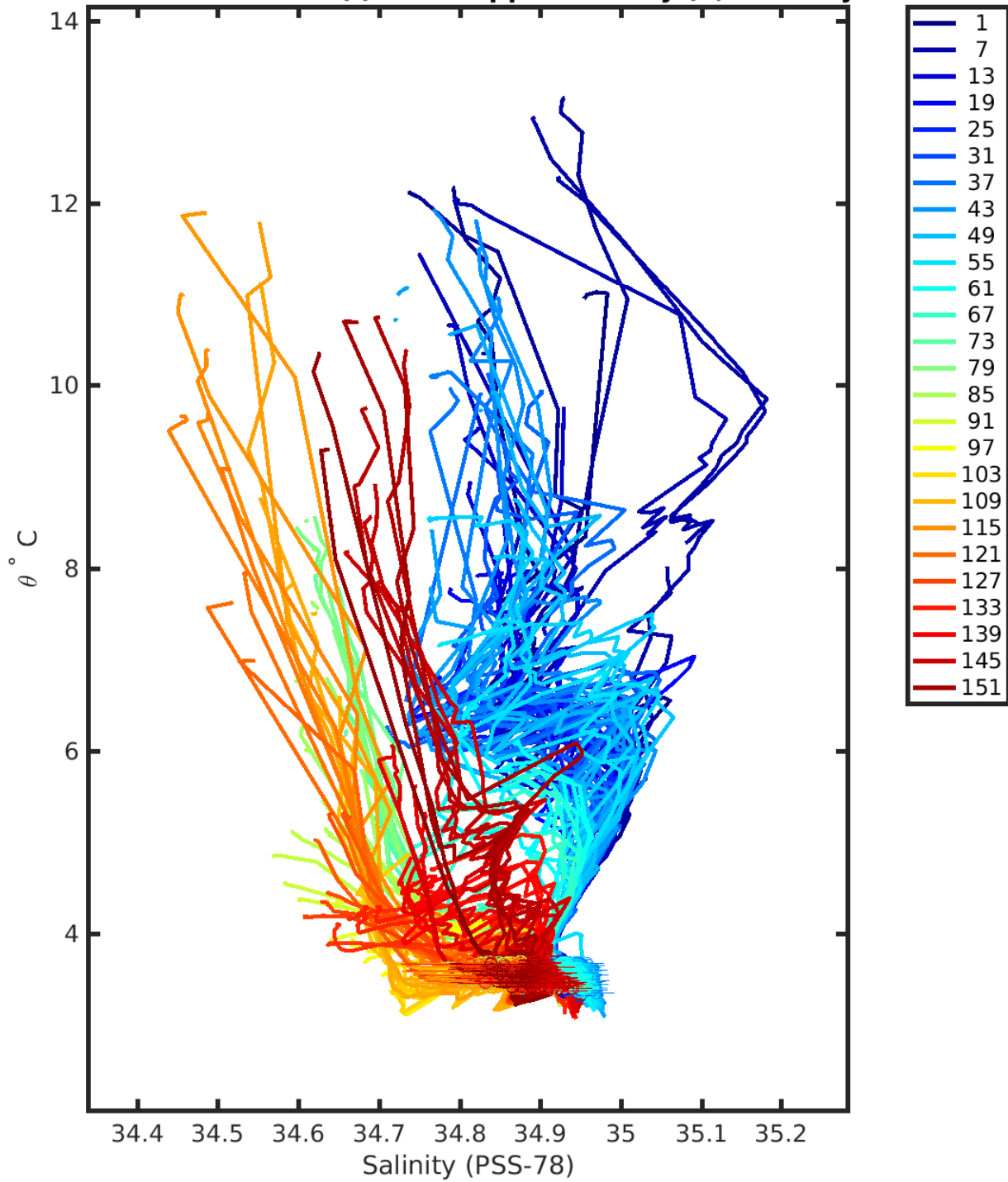


Figure 11: Float 6901192. Plots of calibrated float salinity and the objectively estimated reference salinity at the 10 float theta levels that are used in calibration.

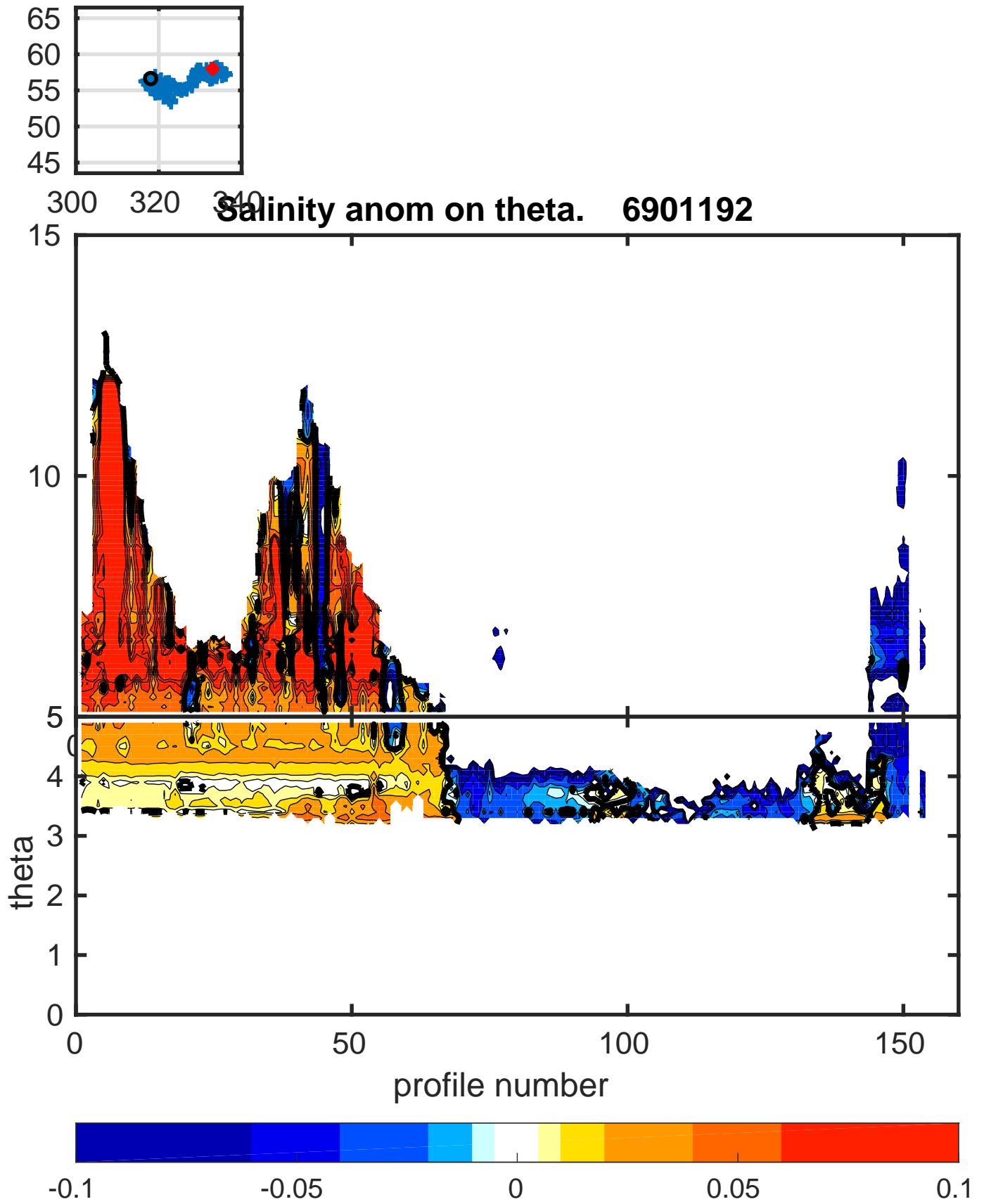


Figure 12: Float 6901192. Salinity anomaly on theta levels.

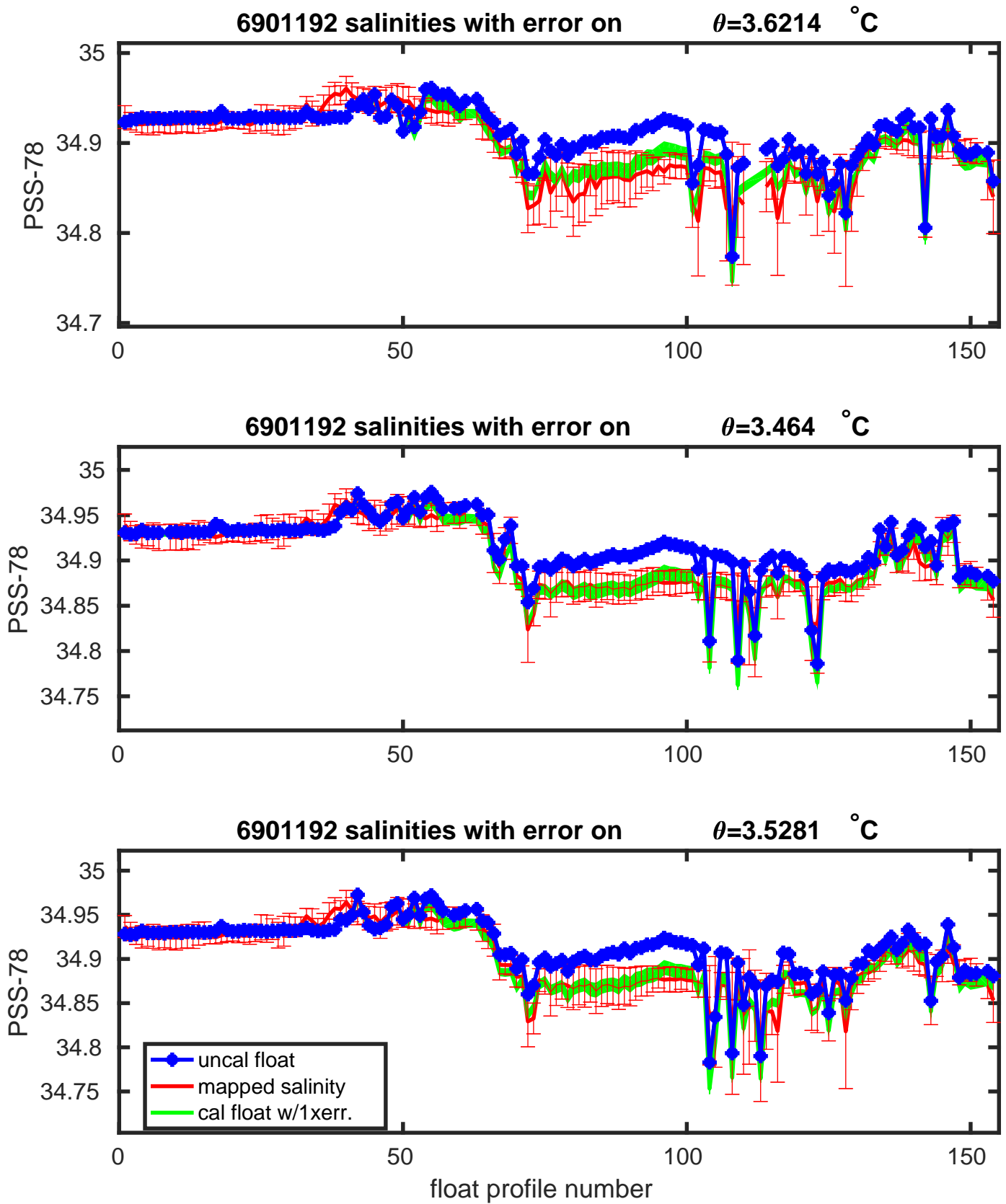


Figure 13: Float 6901192. Plots of the evolution of salinity with time along with selected theta levels with minimum salinity variance.



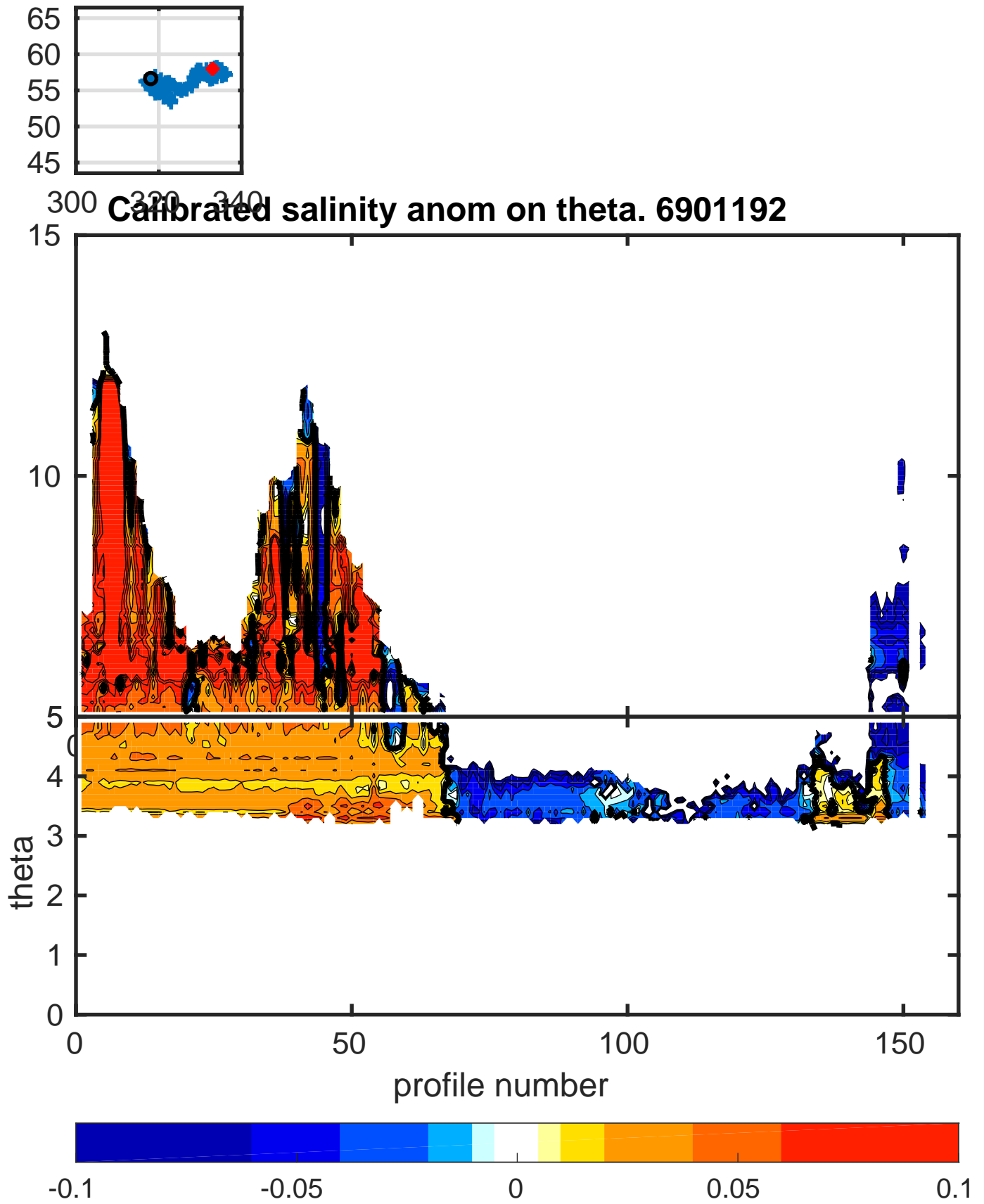


Figure 14: Float 6901192. Calibrated salinity anomaly on theta levels.

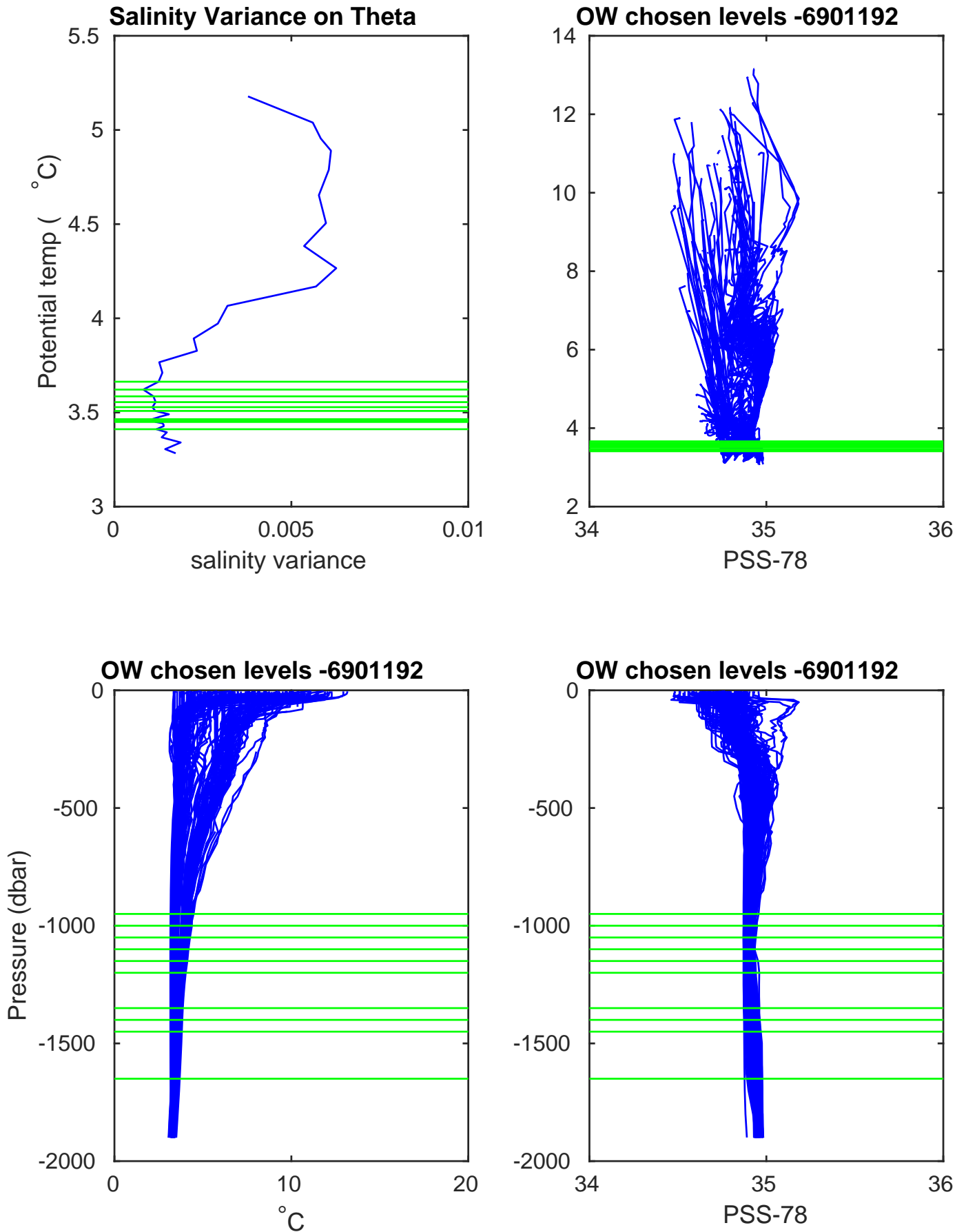


Figure 15: Float 6901192. Plots including the theta levels chosen for calibration: Top left: Salinity variance at theta levels. Top right: T/S diagram of all profiles of Argo float. Bottom left: potential temperature plotted against pressure. Bottom right: salinity plotted against pressure.

## 4.2 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_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/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=2.5  
MAPSCALE_LONGITUDE_SMALL=0.8  
MAPSCALE_LATITUDE_LARGE=1.5  
MAPSCALE_LATITUDE_SMALL=0.5  
  
% cross-isobath scales, dimensionless, see BS(2005)  
MAPSCALE_PHI_LARGE=0.3  
MAPSCALE_PHI_SMALL=0.08  
  
% 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

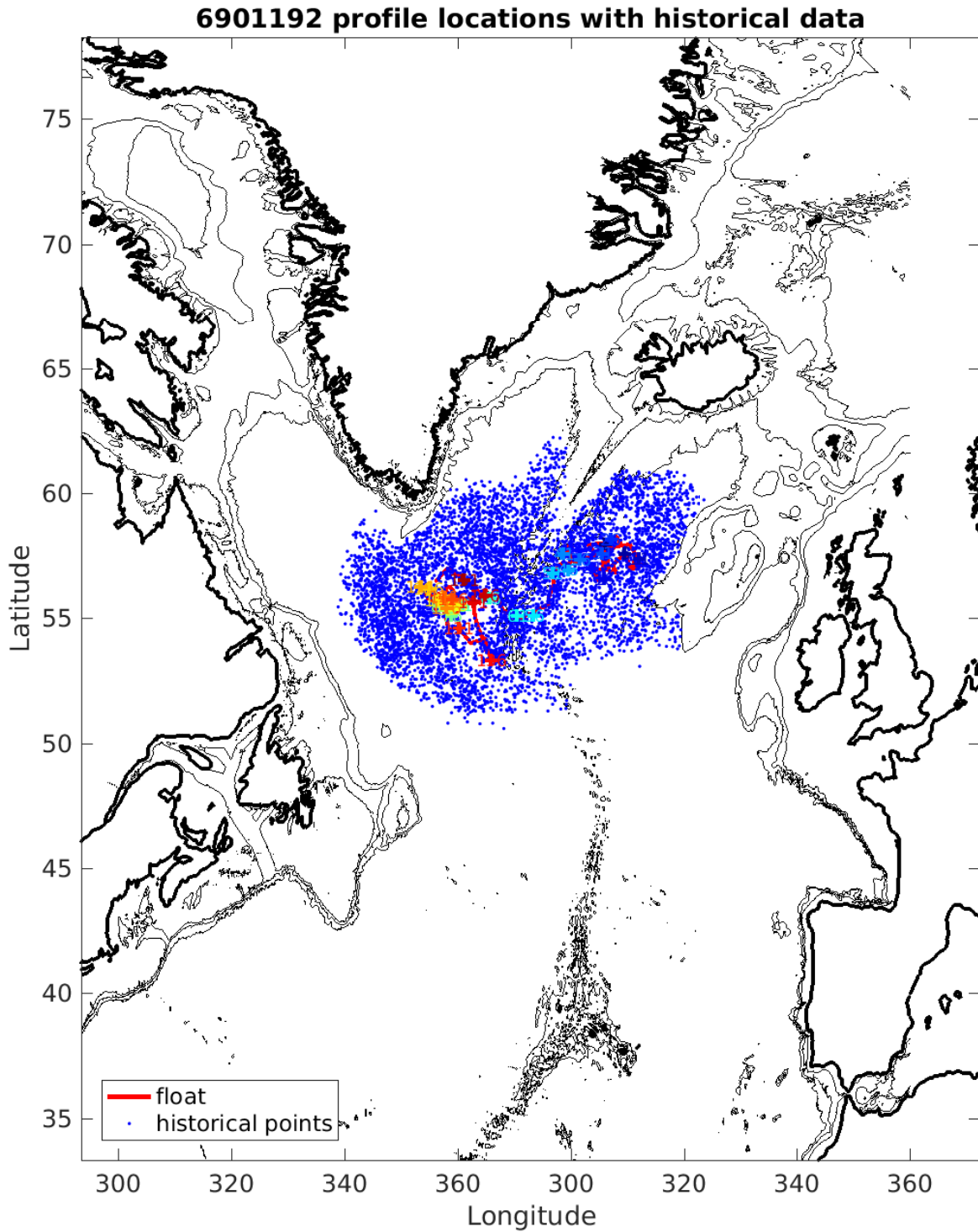


Figure 16: Float 6901192. Location of the float profiles (red line with coloured numbers) and the CTD reference data selected for mapping (blue dots). The black contours indicate the bathymetry at 0, 200, 1000 and 2000 m.

**L92 uncalibrated float data (-) and mapped salinity (o) with objective errors**

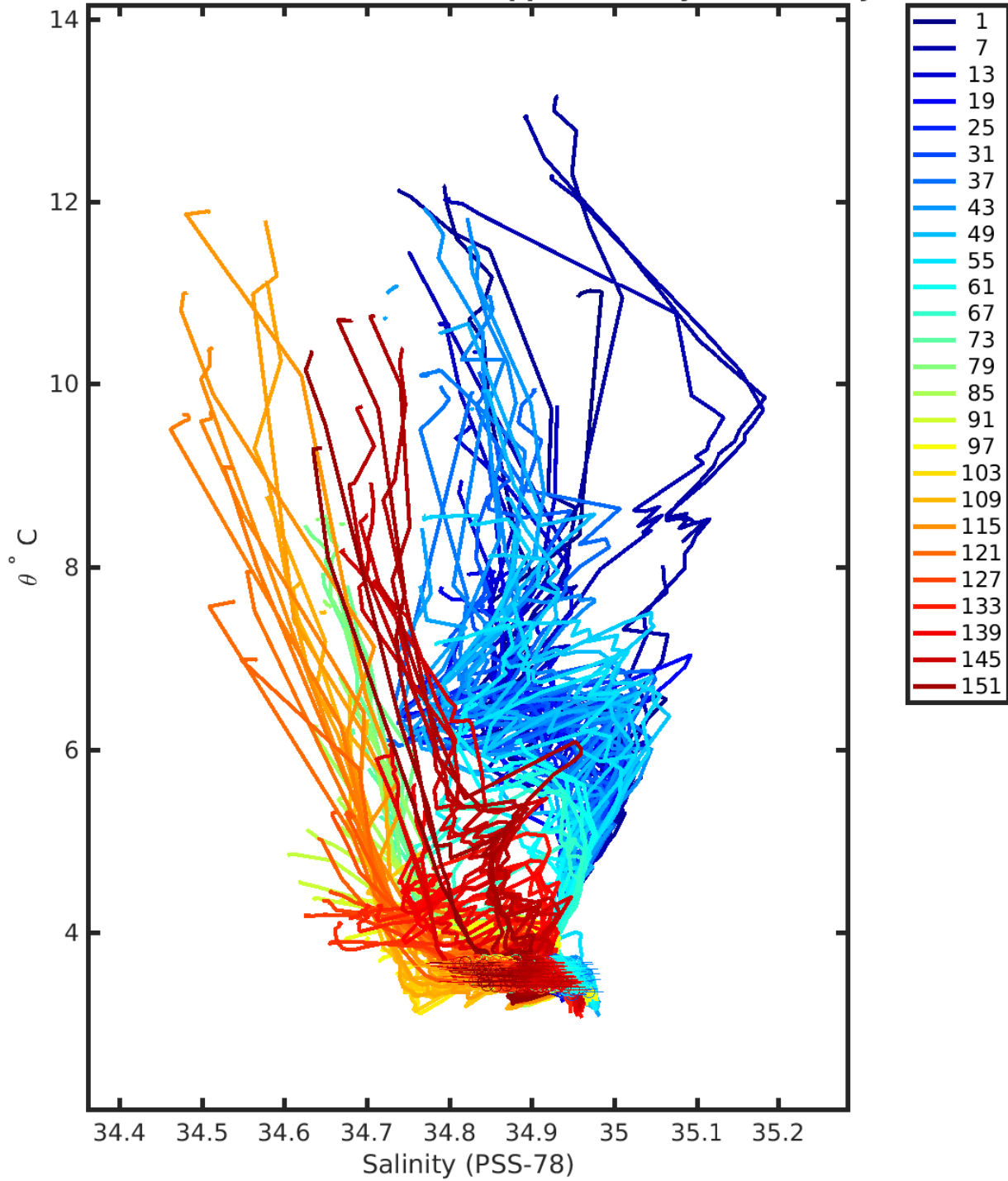
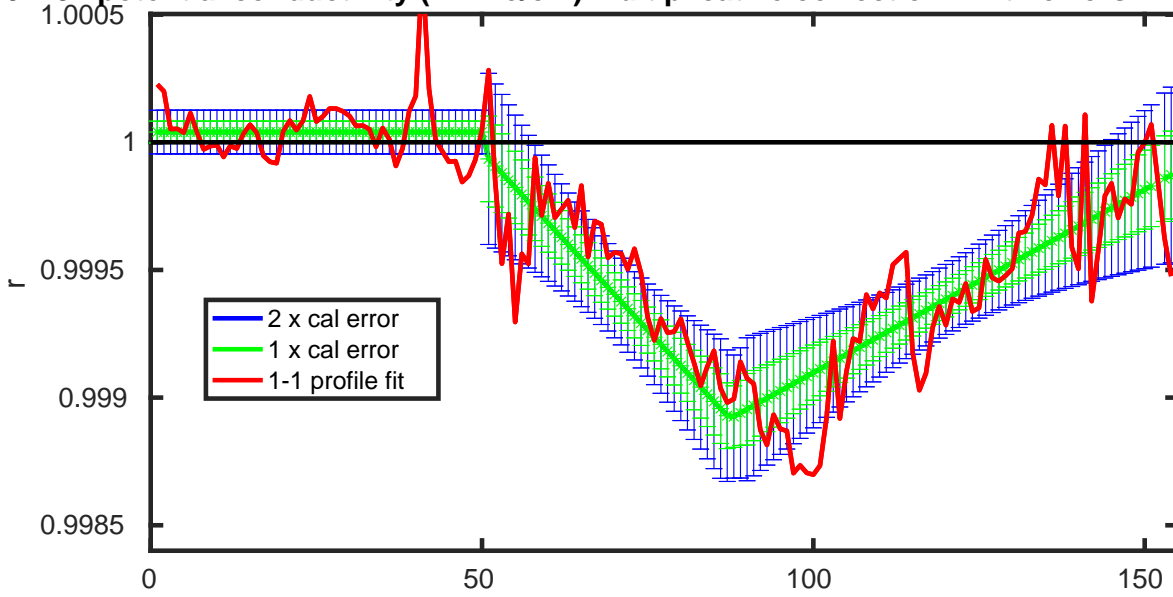


Figure 17: Float 6901192. Plots the original float salinity and the objectively estimated reference salinity at the 10 float theta levels that are used in calibration.

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



6901192 vertically-averaged salinity (PSS-78) additive correction

$\Delta S$  with errors

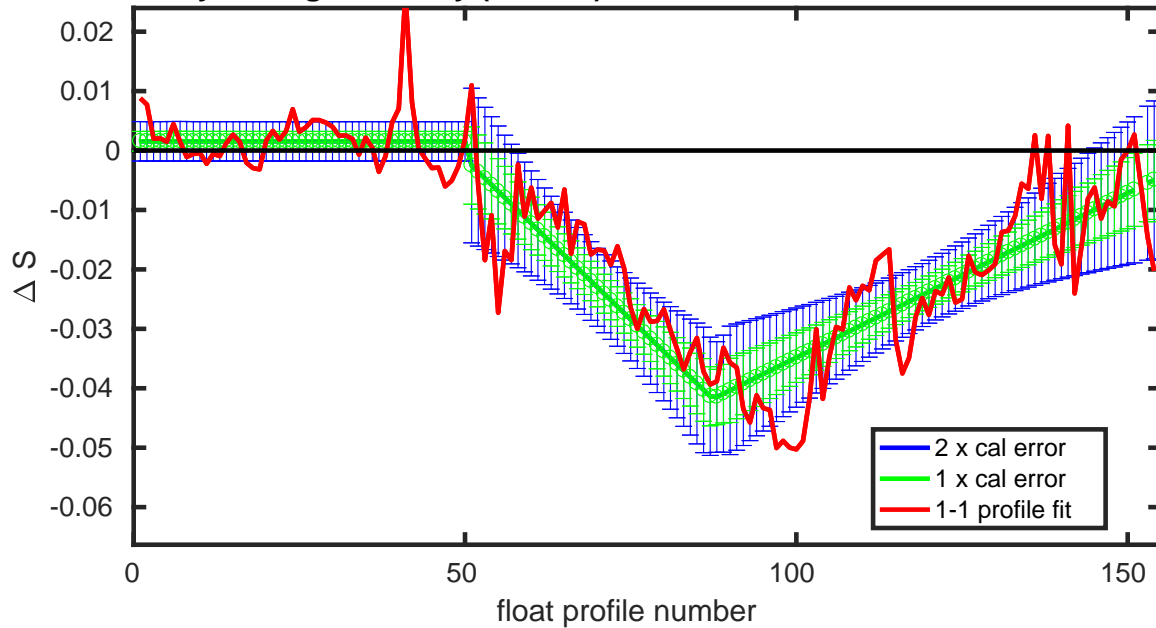


Figure 18: Float 6901192. Evolution of the suggested adjustment with time. The top panel plots the potential conductivity multiplicative adjustment. The bottom panel plots the equivalent salinity additive adjustment. The red line denotes one-to-one profile fit that uses the vertically weighted mean of each profile. The red line can be used to check for anomalous profiles relative to the optimal fit.

**L192 calibrated float data (-) and mapped salinity (o) with objective errors**

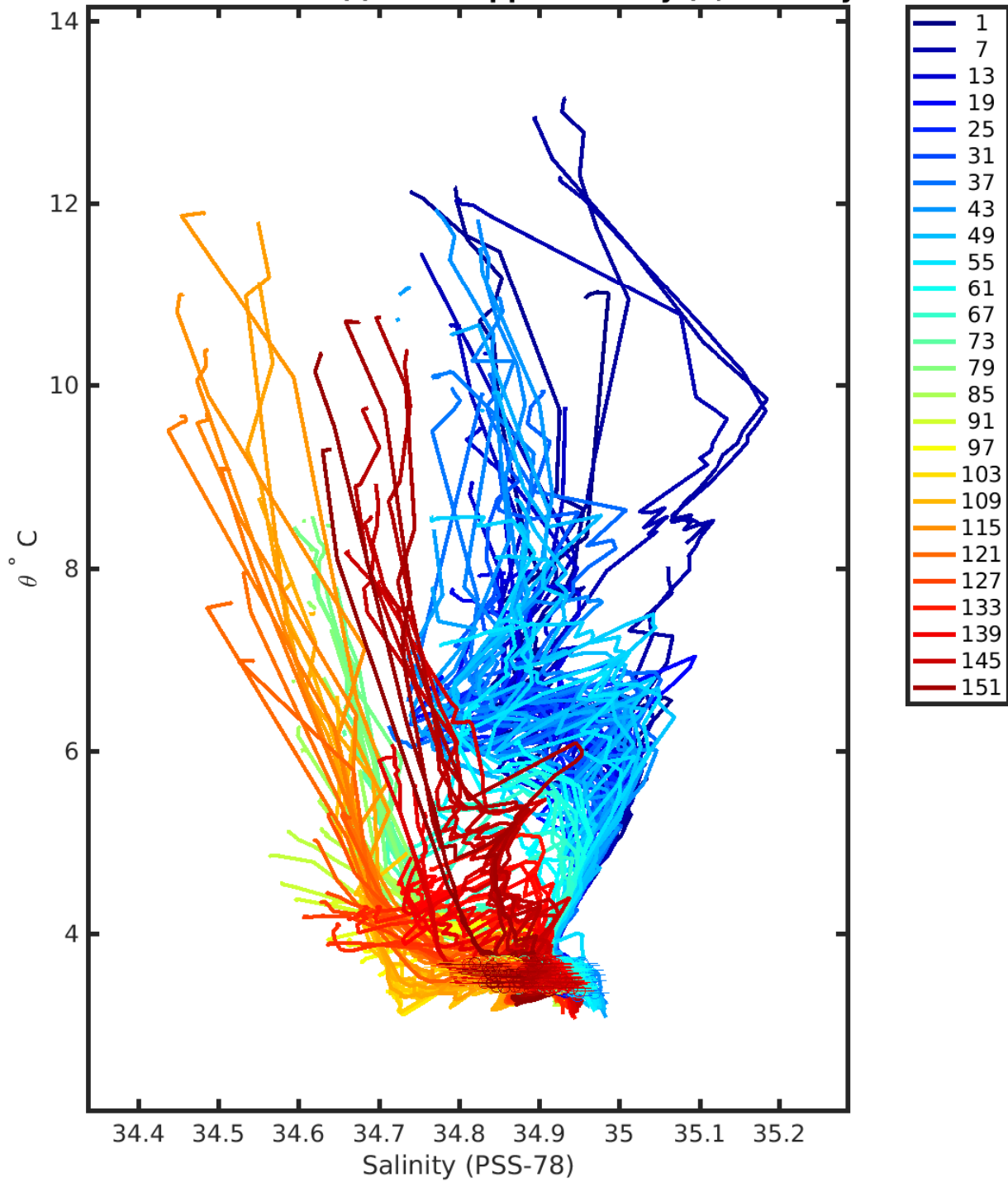


Figure 19: Float 6901192. Plots of calibrated float salinity and the objectively estimated reference salinity at the 10 float theta levels that are used in calibration.



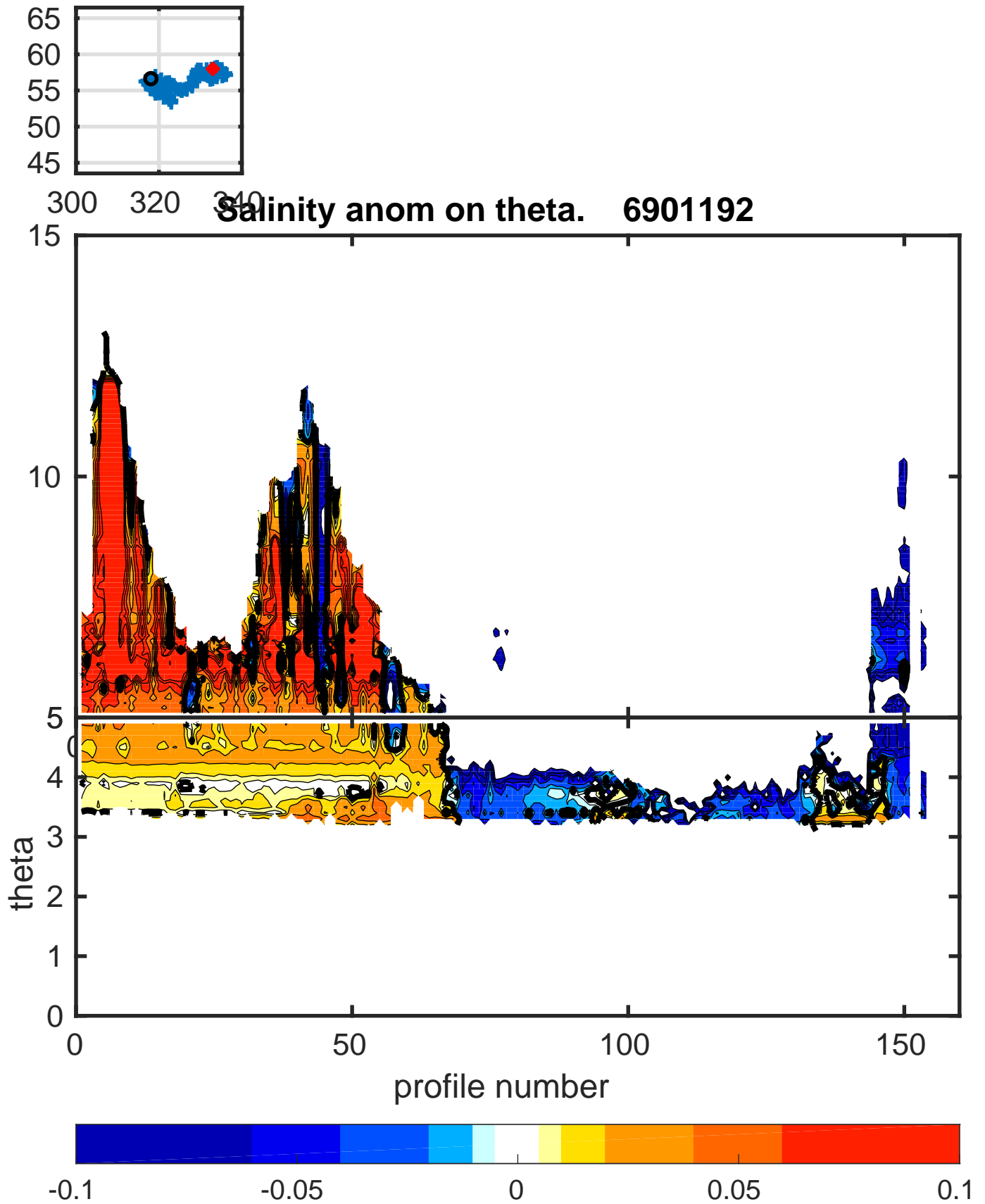


Figure 20: Float 6901192. Salinity anomaly on theta levels.

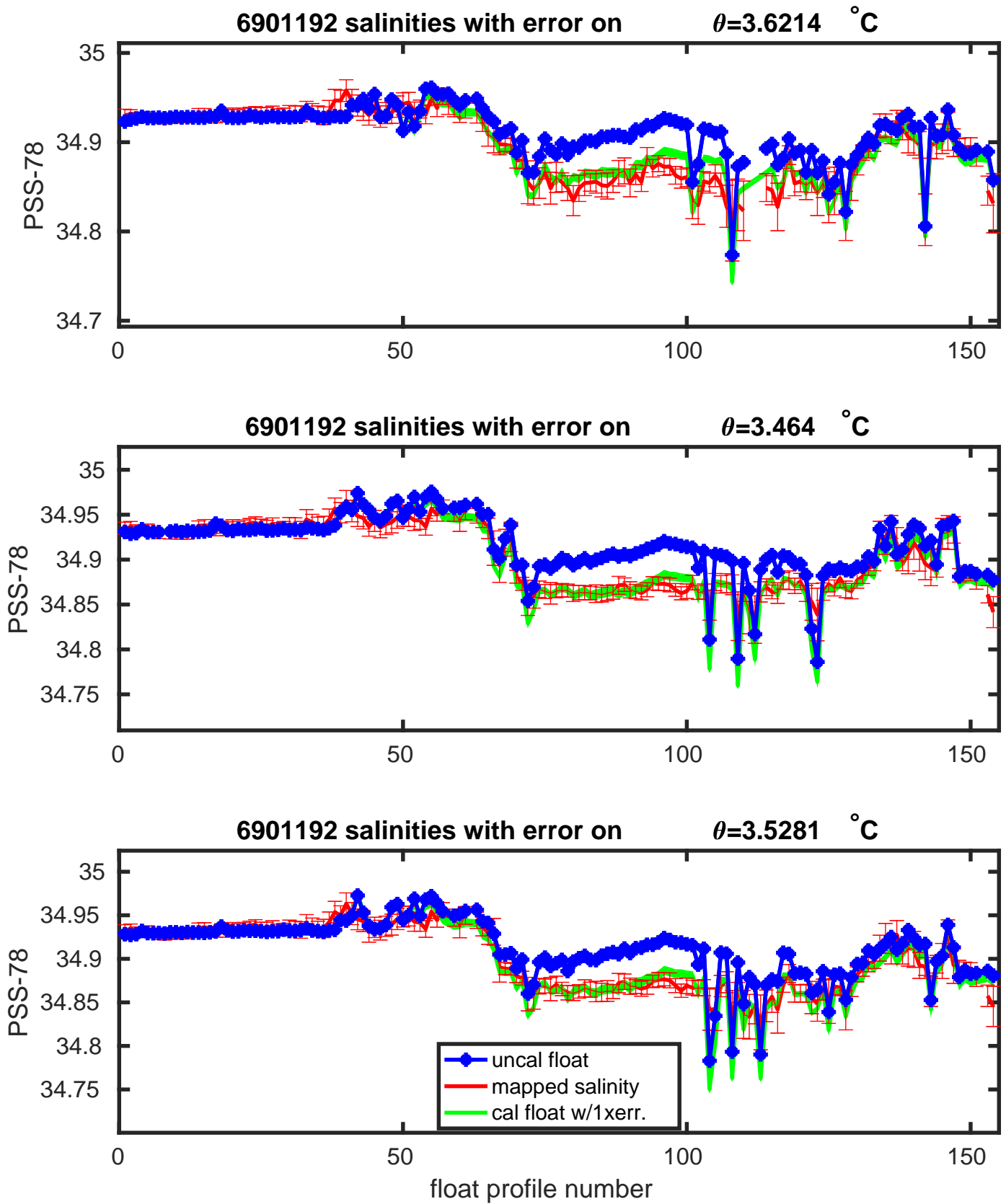


Figure 21: Float 6901192. Plots of the evolution of salinity with time along with selected theta levels with minimum salinity variance.

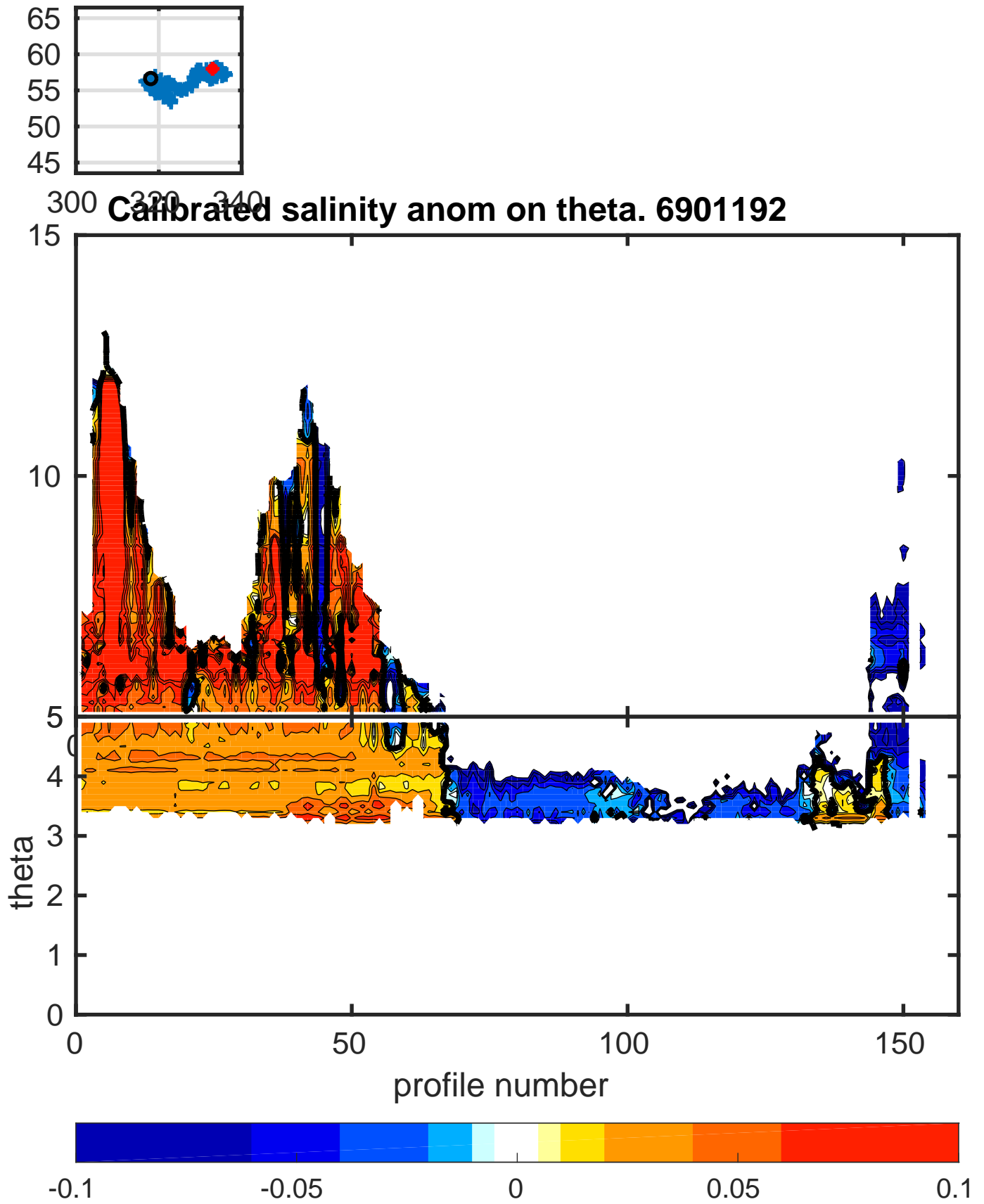


Figure 22: Float 6901192. Calibrated salinity anomaly on theta levels.

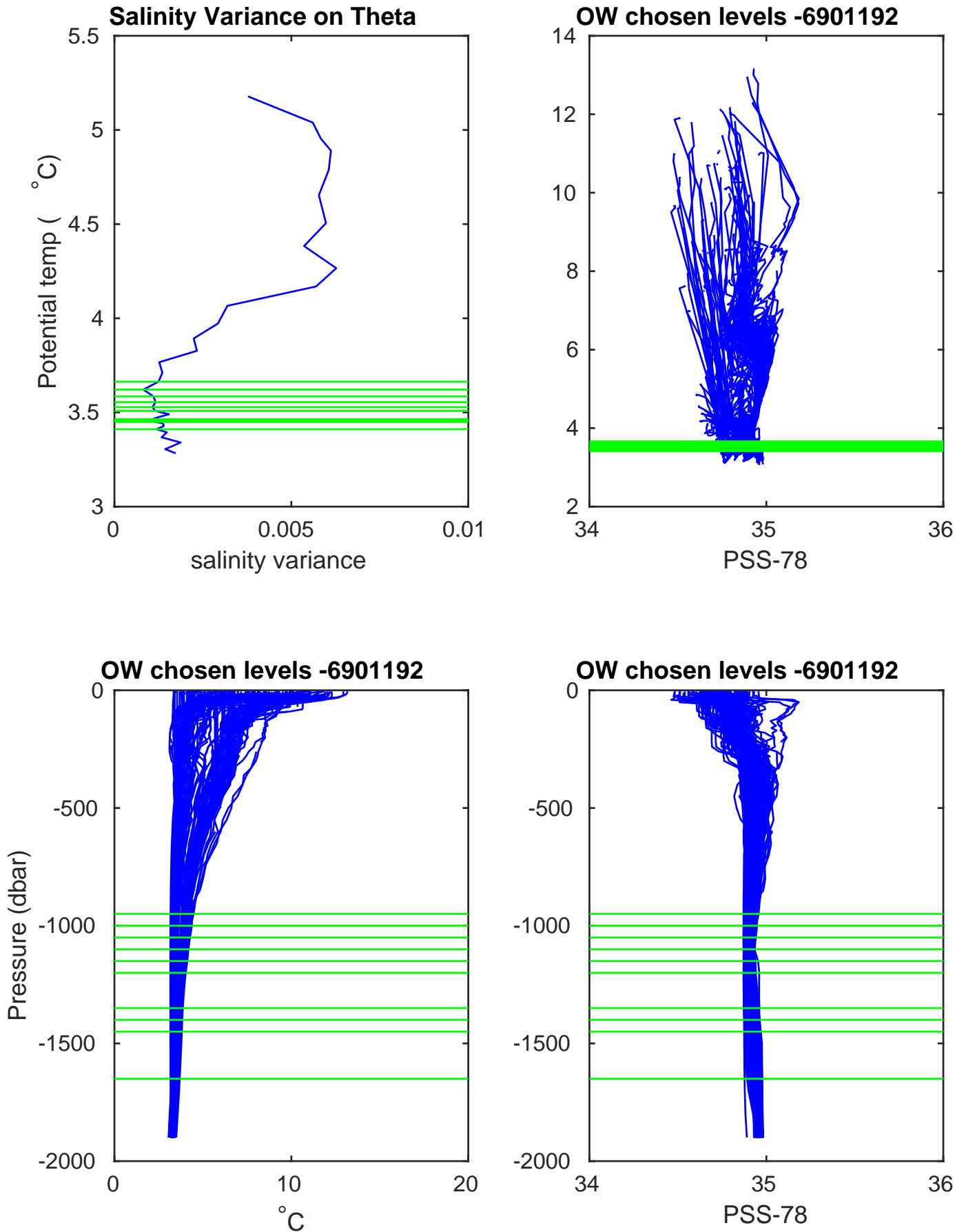


Figure 23: Float 6901192. SPlots including the theta levels chosen for calibration: Top left: Salinity variance at theta levels. Top right: T/S diagram of all profiles of Argo float. Bottom left: potential temperature plotted against pressure. Bottom right: salinity plotted against pressure.

### 4.3 Summary and Conclusions

This float was deployed in the North Atlantic at the eastern side of the Reykianes Ridge. For the first around 50 profiles float was in the Iceland Basin, where further it crossed the Ridge to the Irminger Basin with a relatively different cooler and less saline water masses. Initially we were suspected drift after profiles 50 to 115, where salinity difference was in order of 0.035, but it more reflect high natural variability in this region. After around profile 115 float is reflecting much better fit to the reference data. The decision was to do not applying the OWC corrections for this float. Instead we increased error for profiles 51-115 to 0.03.