

Delayed Mode Quality Control of Argo float 6901121

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Float decision

The pressure sensor propagate well with QC=1, err= 2.4 dbar. Cell Thermal Mass corrections applied. Profile 1-308, small salty drift detected, OWC applied, QC=1, error=0.01.

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1 Introduction

Delayed mode analysis was performed for float number 55669 (WMO: 6901121) 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 a salinity drift. For more information about float 6901121 click on the following link: <http://www.ifremer.fr/argoMonitoring/float/6901121>

2 Quality Check of Argo Float Data

2.1 Satellite Altimeter comparison

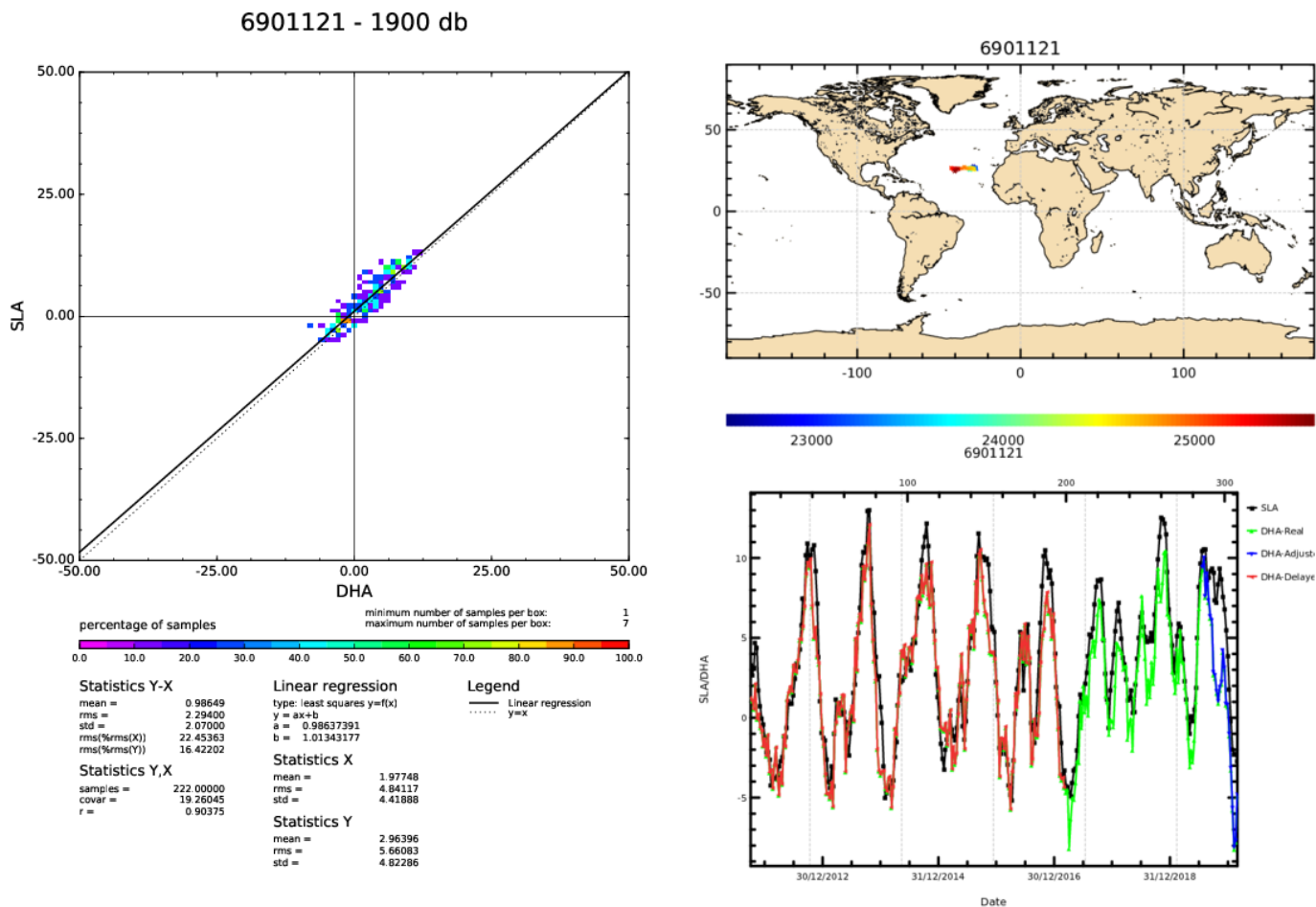


Figure 1: Float 6901121. The comparison between the Sea Surface Height (SSH) from the satellite altimetry and Dynamic Height Anomaly (DHA) extracted from the Argo float temperature and salinity data (<ftp://ftp.ifremer.fr/ifremer/argo/etc/argo-ast9-item13-AltimeterComparison/figures/>).

2.2 Time Series of Vertical Distribution of Data

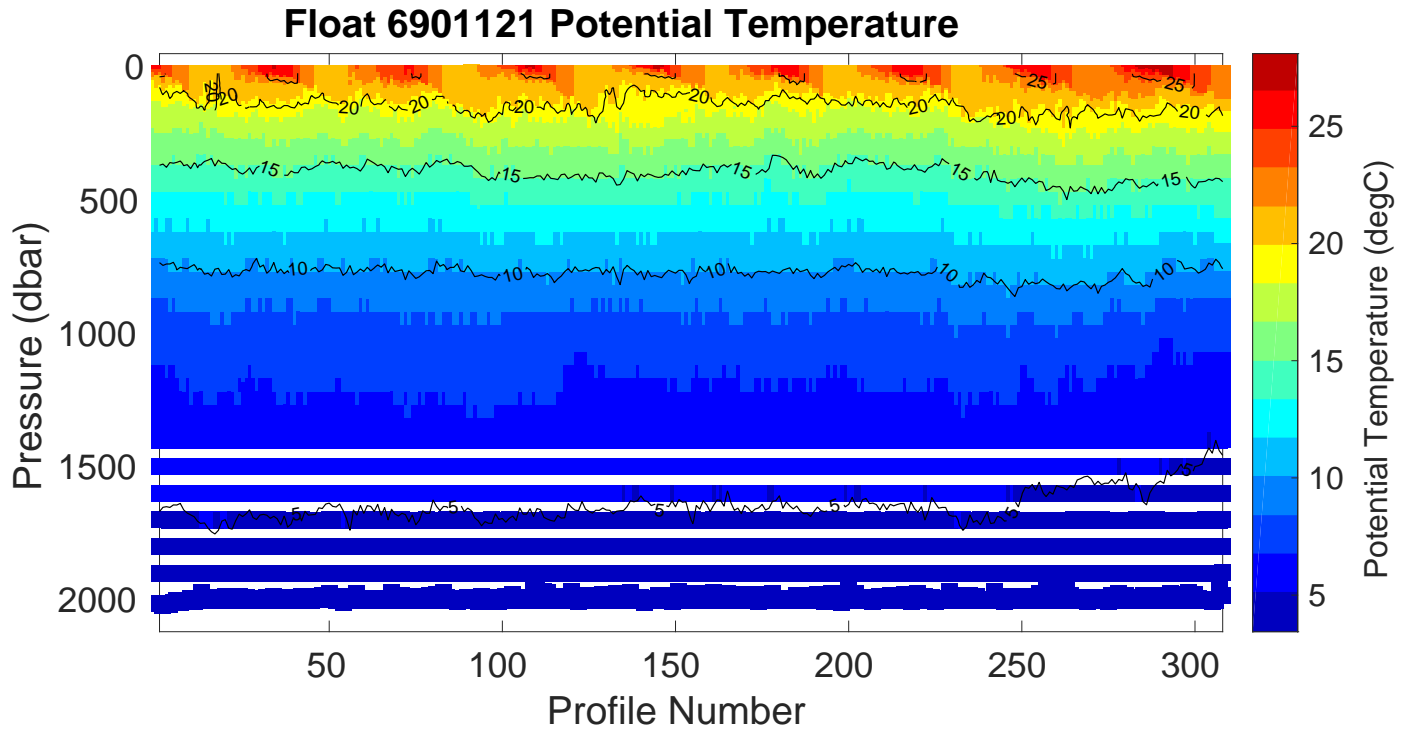


Figure 2: Float 6901121. Time series of the vertical distribution of potential temperature ($^{\circ}\text{C}$).

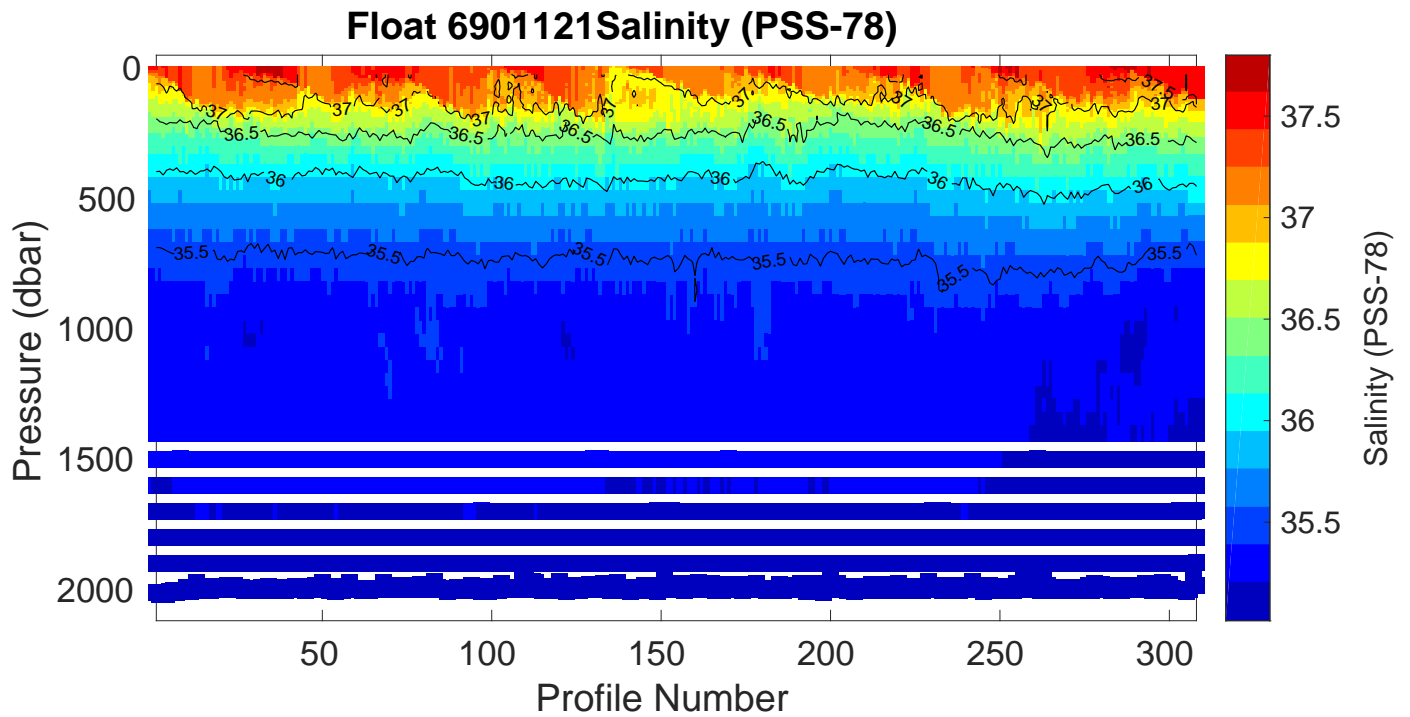


Figure 3: Float 6901121. Time series of the vertical distribution of salinity (PSS-78).

2.3 Comparison between Argo Float and Climatology

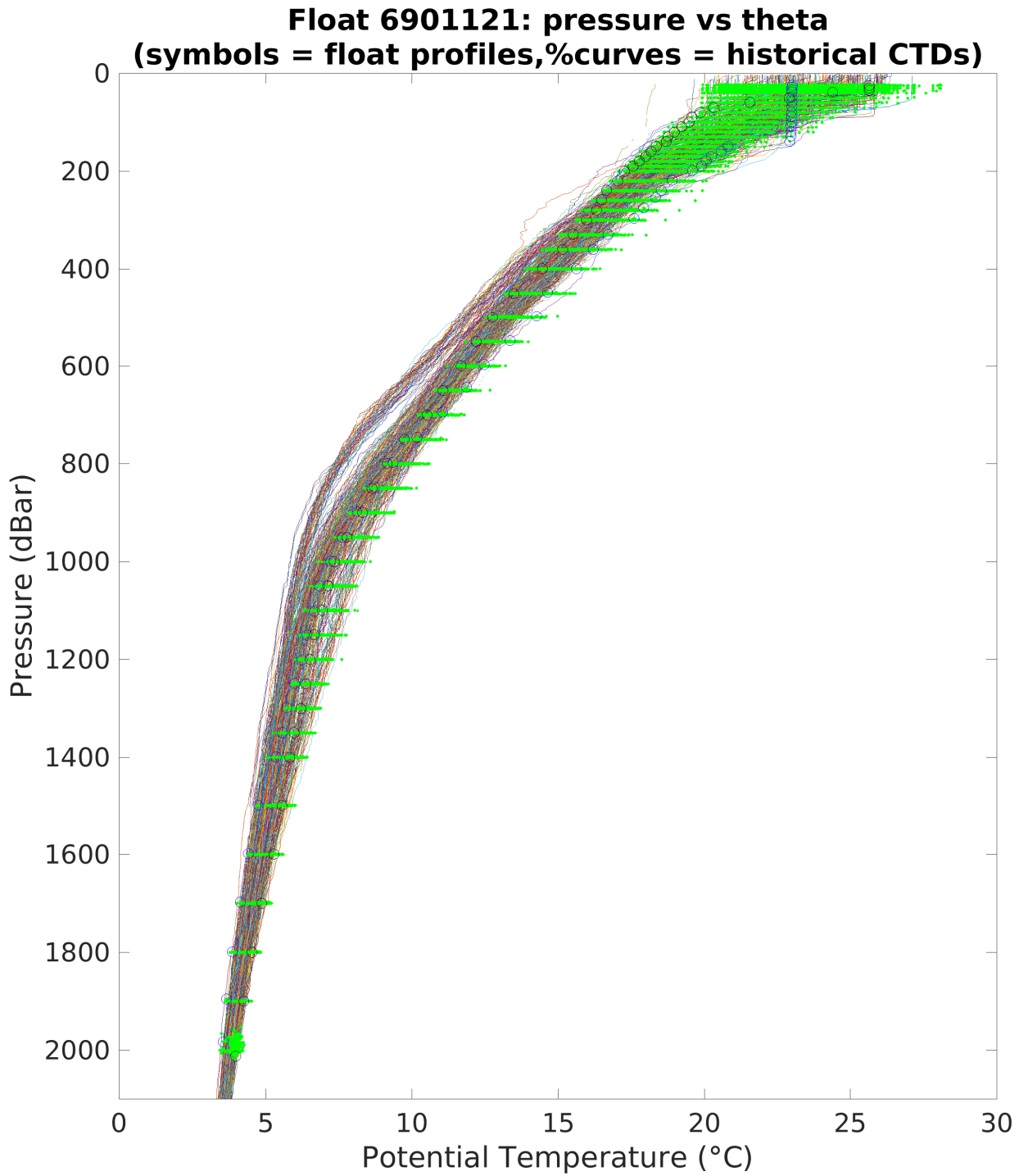


Figure 4: Float 6901121. Potential temperature ($^{\circ}\text{C}$) plotted with pressure (dBar) and data from WMO boxes of CTD reference data (CTD for DMQC 2019V01) $\pm 10^{\circ}$ of latitude and longitude. The black and blue cycles indicates the first and the last Argo profile, respectively. Green symbols represent other Argo profiles from this float. The thin colors lines indicate the reference data

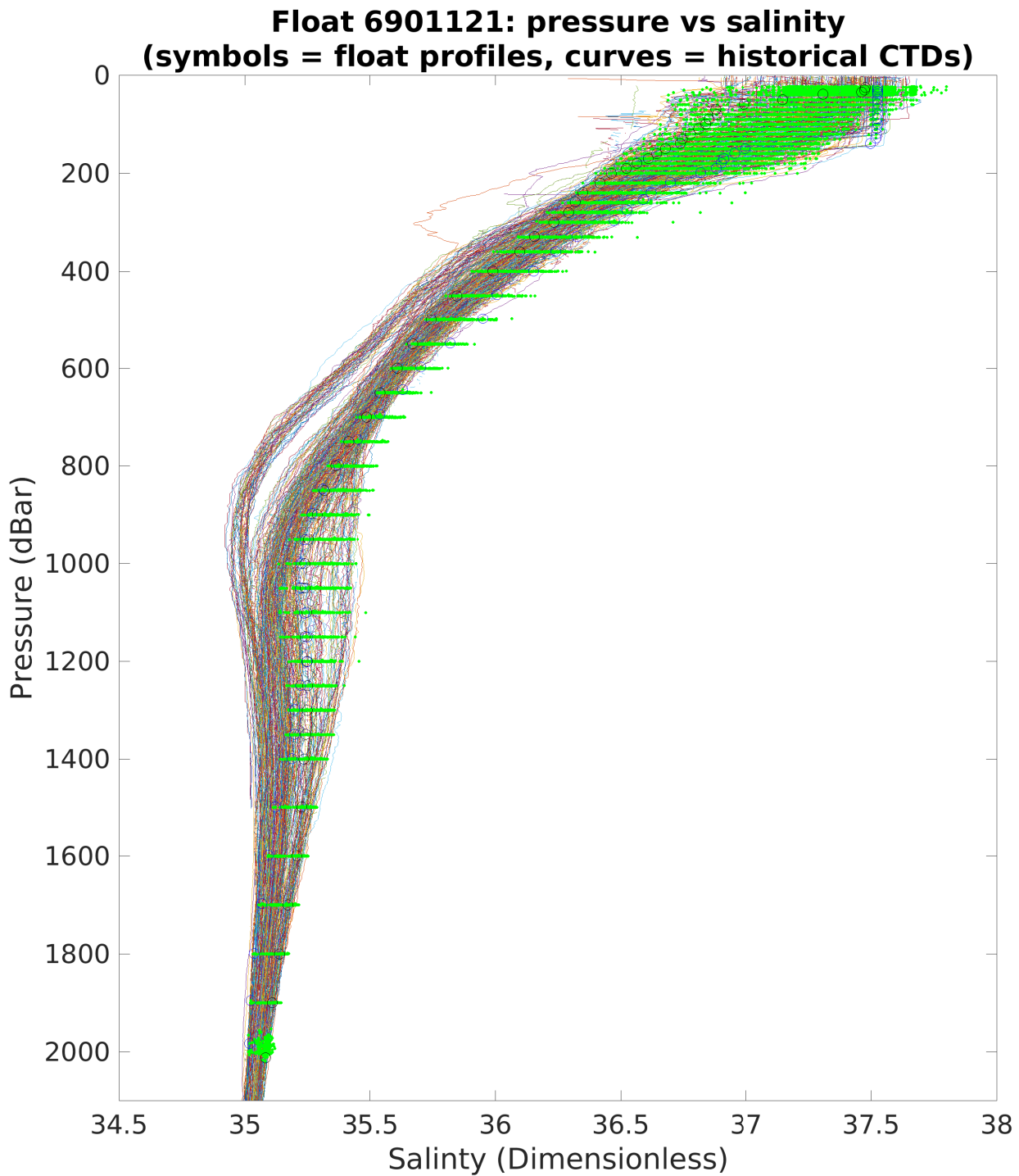


Figure 5: Float 6901121. Salinity (PSS-78) plotted with pressure (dBar) and data from WMO boxes of CTD reference data (CTD for DMQC 2019V01) $\pm 10^\circ$ of latitude and longitude. The black and blue cycles indicates the first and the last Argo profile, respectively. Green symbols represent other Argo profiles from this float. The thin colors lines indicate the reference data.

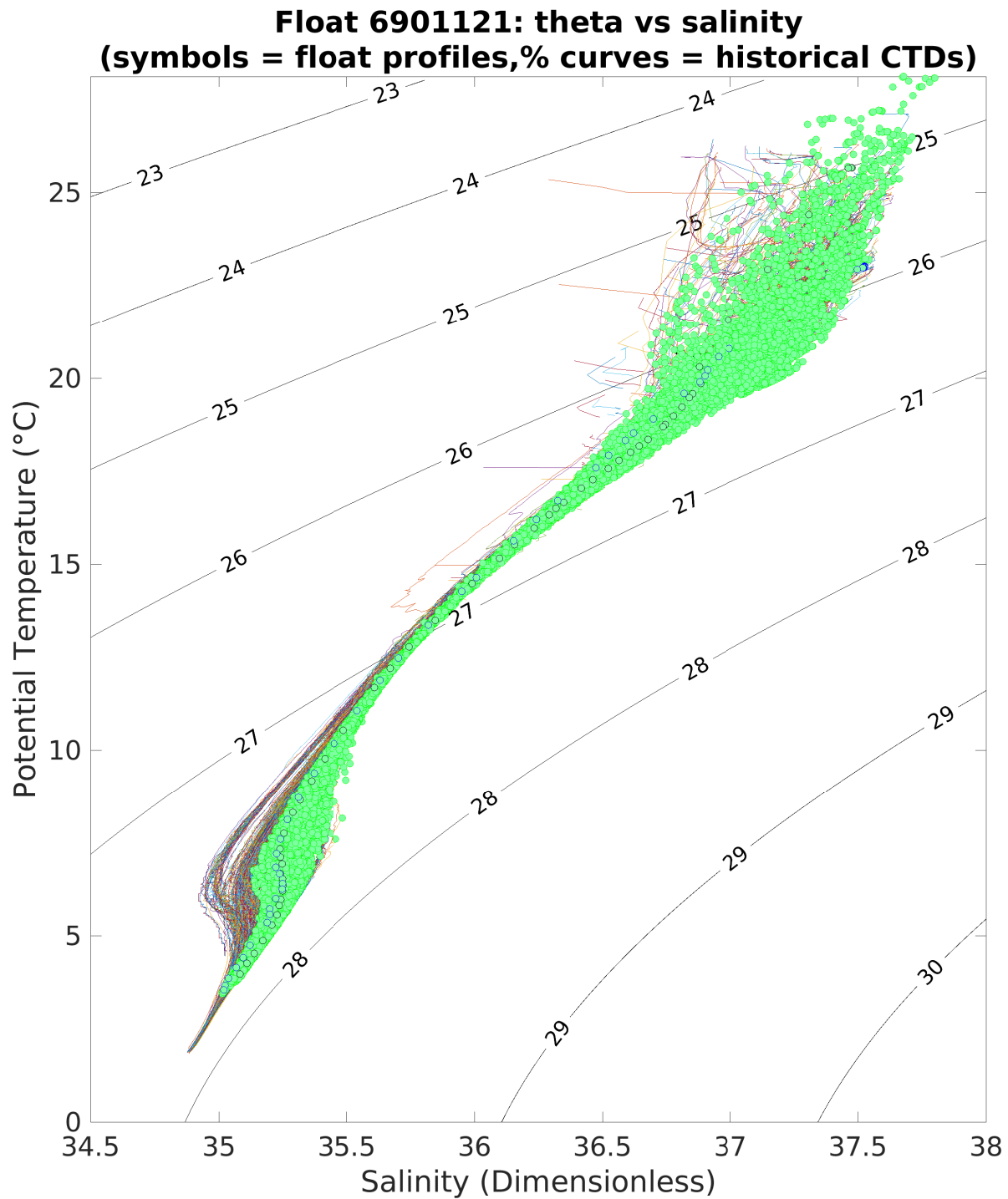


Figure 6: Float 6901121. T/S diagram plotted with and data from WMO boxes of CTD reference data (CTD for DMQC 2019V01) +/- 10° of latitude and longitude. The black and blue cycles indicates the first and the last Argo profile, respectively. Green symbols represent other Argo profiles from this float.

3 Pressure Adjustment for APEX Floats

Float 6901121 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 55669
pressure correction in green

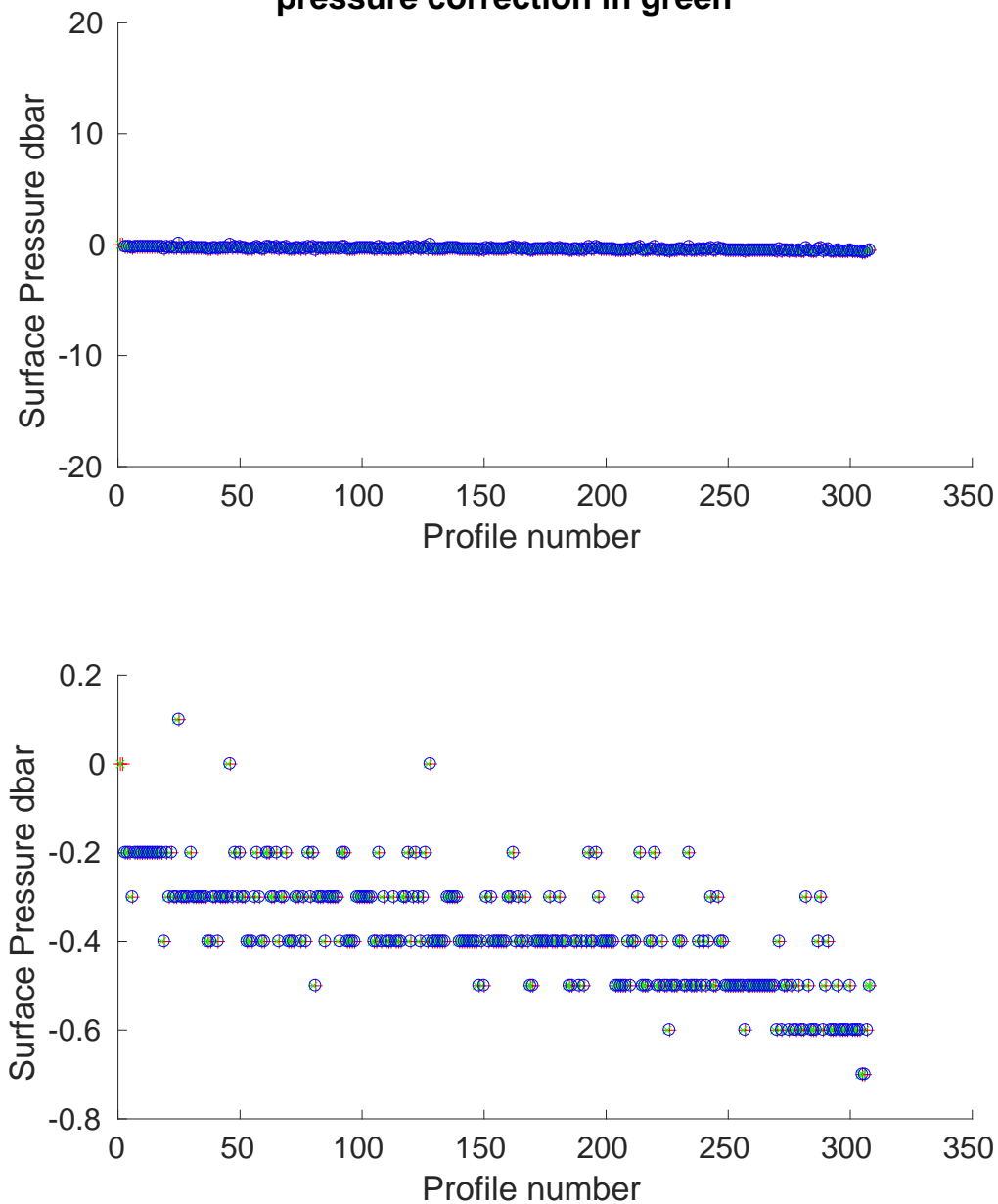


Figure 7: Float 6901121. Sea surface pressure data. The red cross indicate the raw pressure before float descent, recorded after sending data to GDAC. Blue circle indicate pressure value in the real-time. Green rotated cross shows the pressure correction applied from the previous float cycle. Top plot- data constrained between -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
```

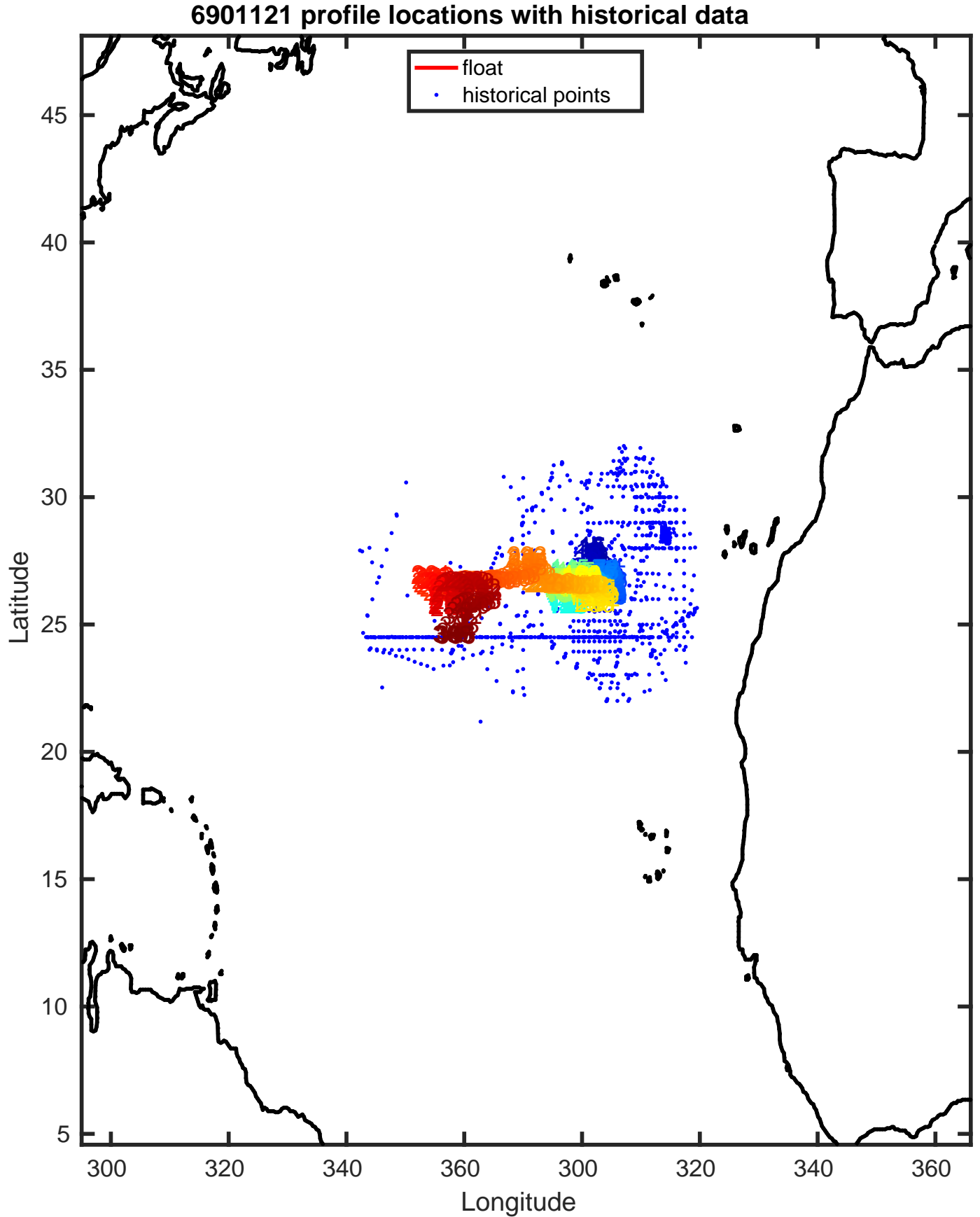



Figure 8: Float 6901121. Location of the float profiles (red line with coloured numbers) and the CTD reference data selected for mapping (blue dots). The black contours indicate the bathymetry at 0, 200, 1000 and 2000 m.

L21 uncalibrated float data (-) and mapped salinity (o) with objective errors

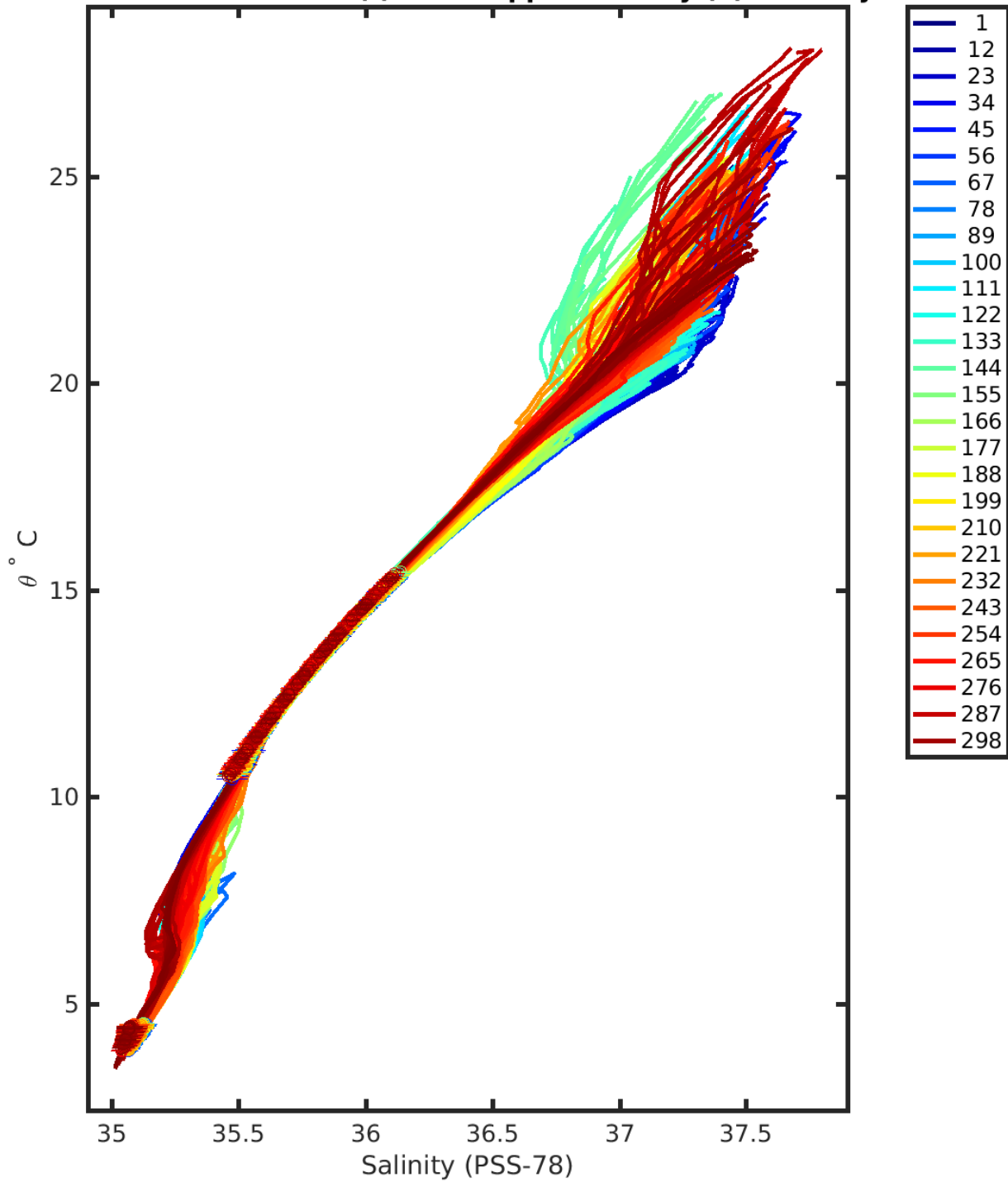
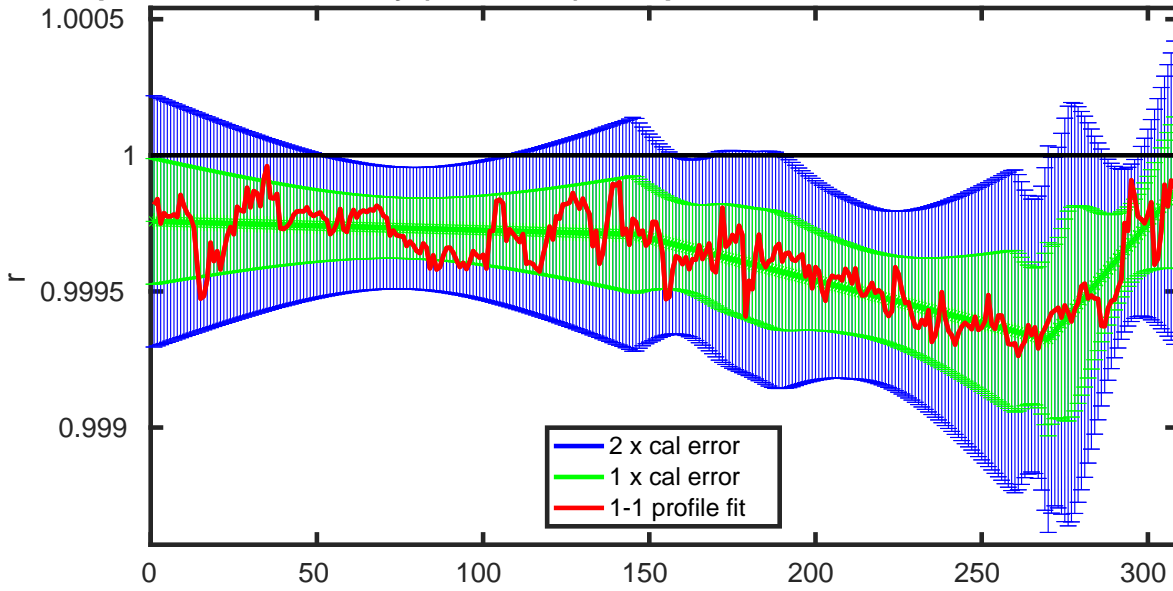


Figure 9: Float 6901121. Plots the original float salinity and the objectively estimated reference salinity at the 10 float theta levels that are used in calibration.

6901121 potential conductivity (mmho/cm) multiplicative correction r with errors



6901121 vertically-averaged salinity (PSS-78) additive correction

ΔS with errors

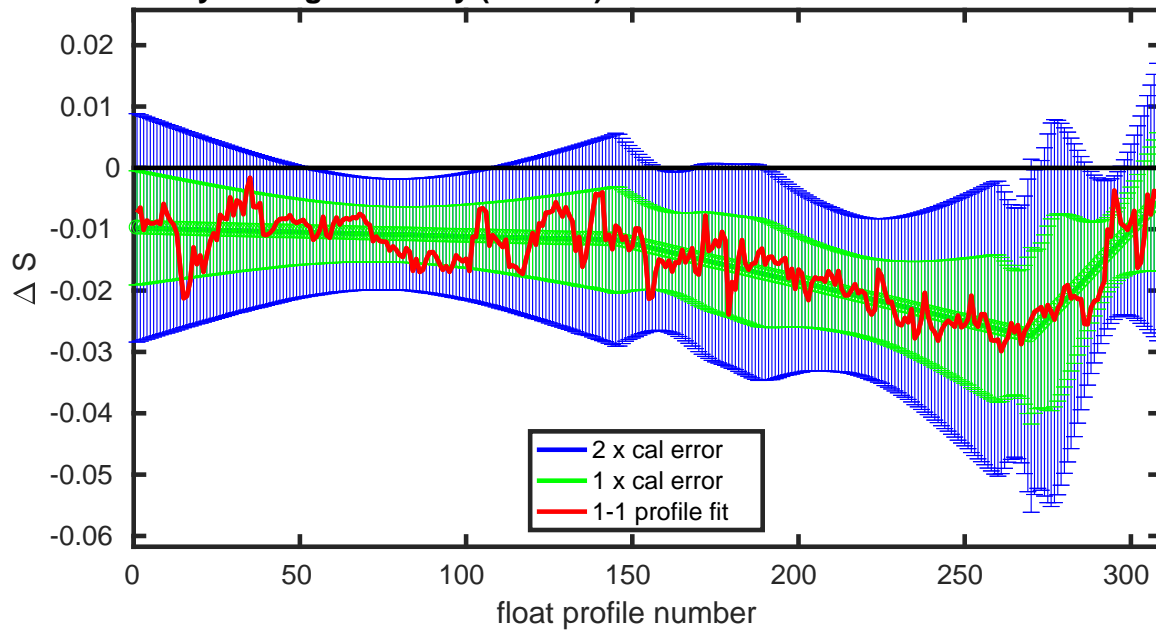
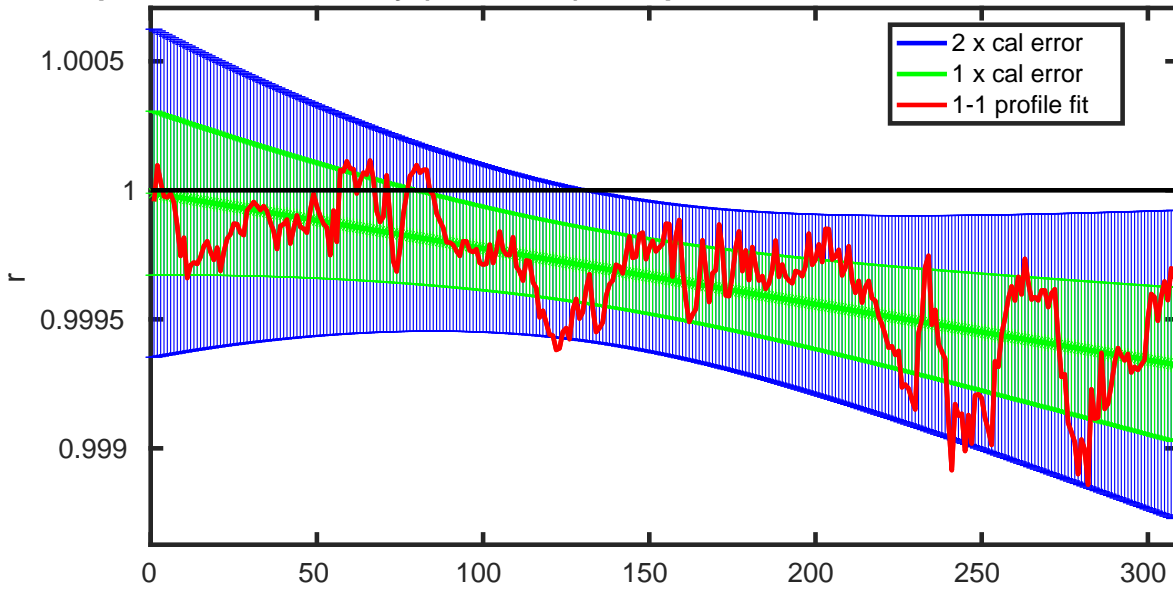


Figure 10: Float 6901121. Evolution of the suggested adjustment with time. The top panel plots the potential conductivity multiplicative adjustment. The bottom panel plots the equivalent salinity additive adjustment. The red line denotes one-to-one profile fit that uses the vertically weighted mean of each profile. The red line can be used to check for anomalous profiles relative to the optimal fit.

6901121 potential conductivity (mmho/cm) multiplicative correction r with errors



6901121 vertically-averaged salinity (PSS-78) additive correction

ΔS with errors

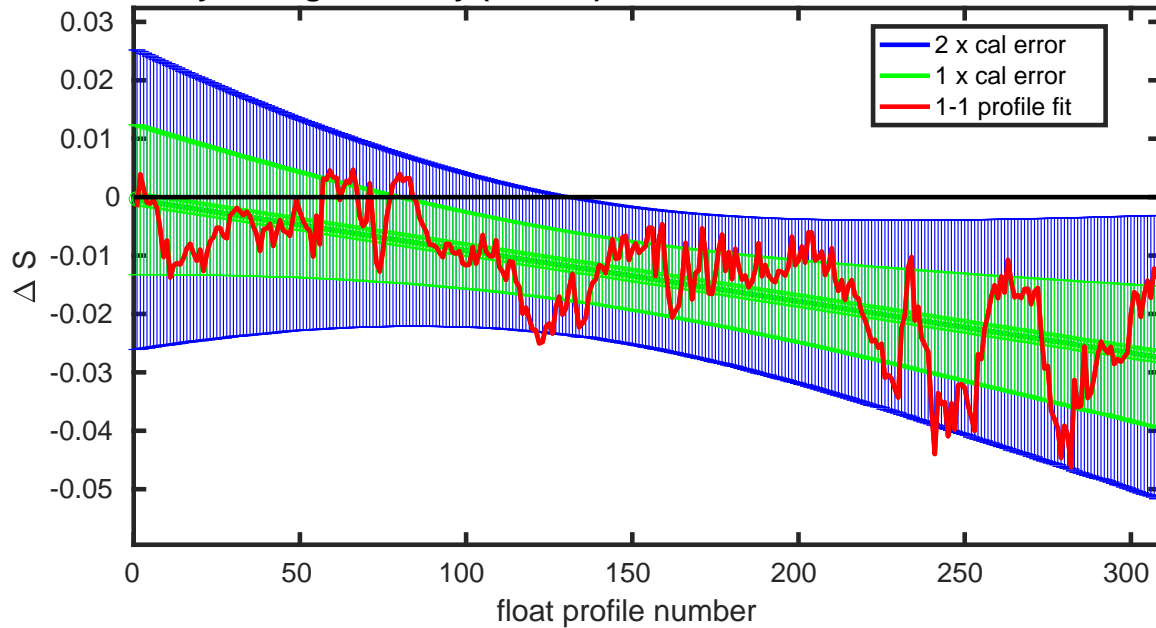


Figure 11: Float 6901121. Evolution of the suggested adjustment with time. The top panel plots the potential conductivity multiplicative adjustment. The bottom panel plots the equivalent salinity additive adjustment. The red line denotes one-to-one profile fit that uses the vertically weighted mean of each profile. The red line can be used to check for anomalous profiles relative to the optimal fit.

L121 calibrated float data (-) and mapped salinity (o) with objective errors

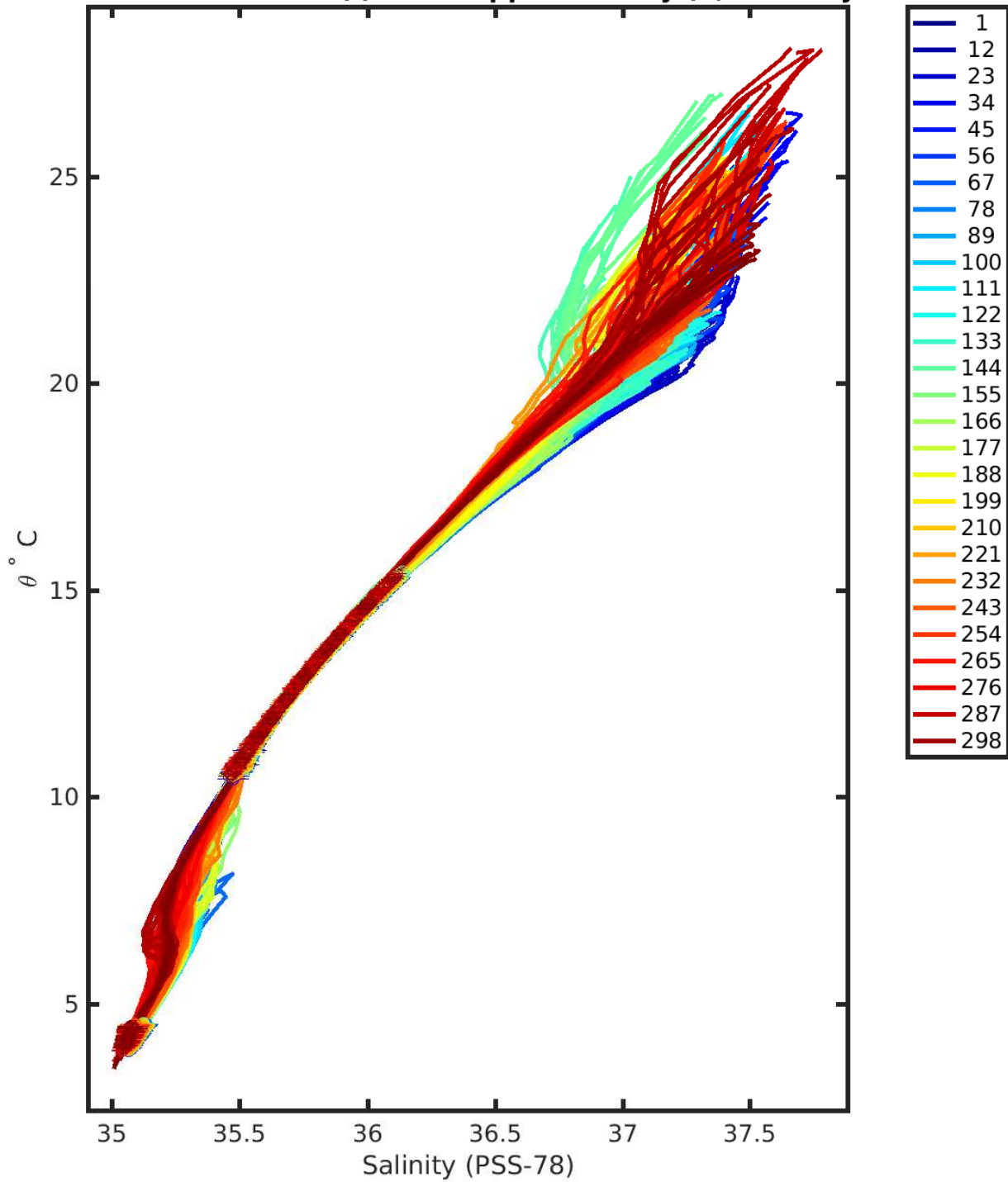


Figure 12: Float 6901121. Plots of calibrated float salinity and the objectively estimated reference salinity at the 10 float theta levels that are used in calibration.

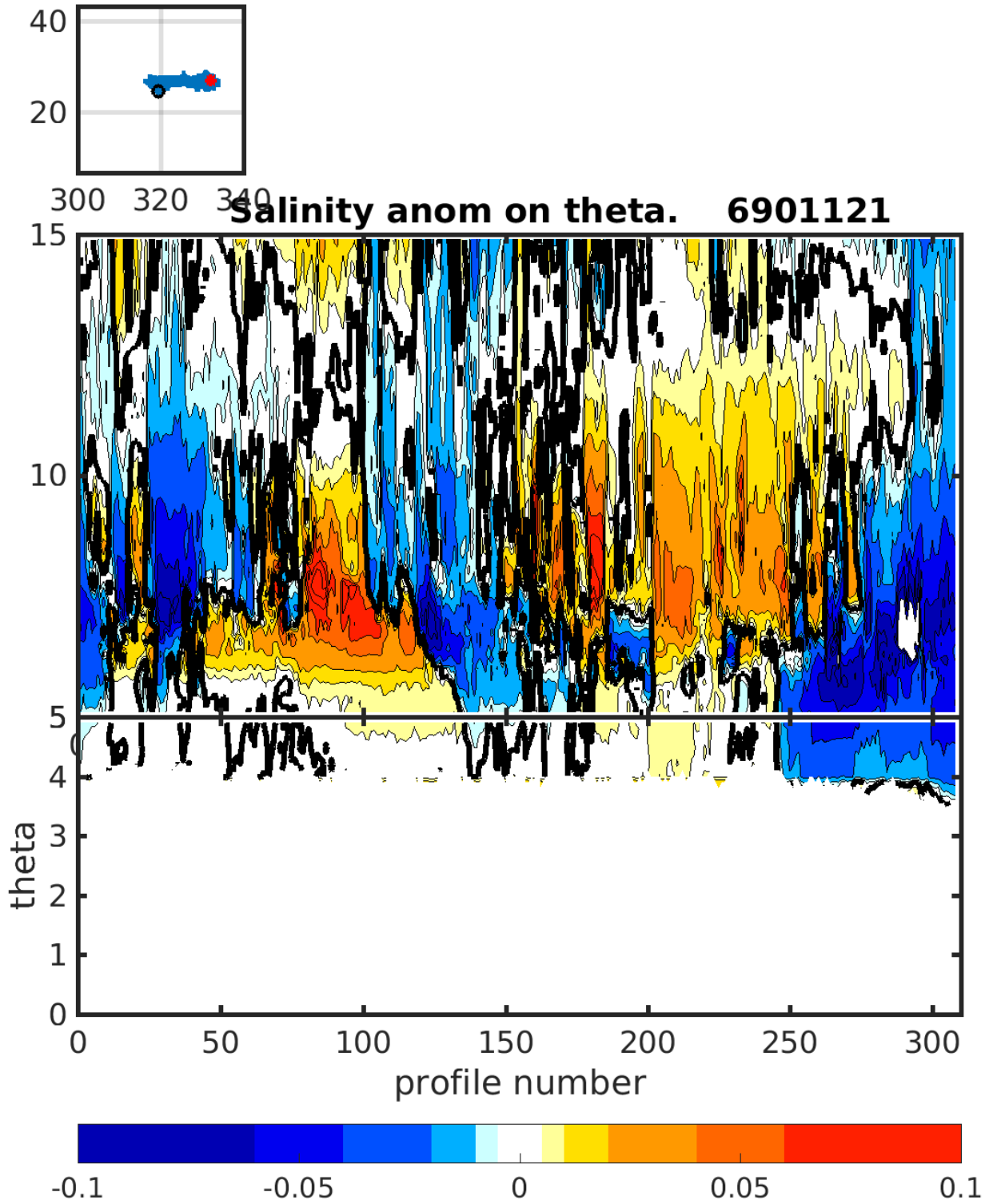


Figure 13: Float 6901121. Salinity anomaly on theta levels.

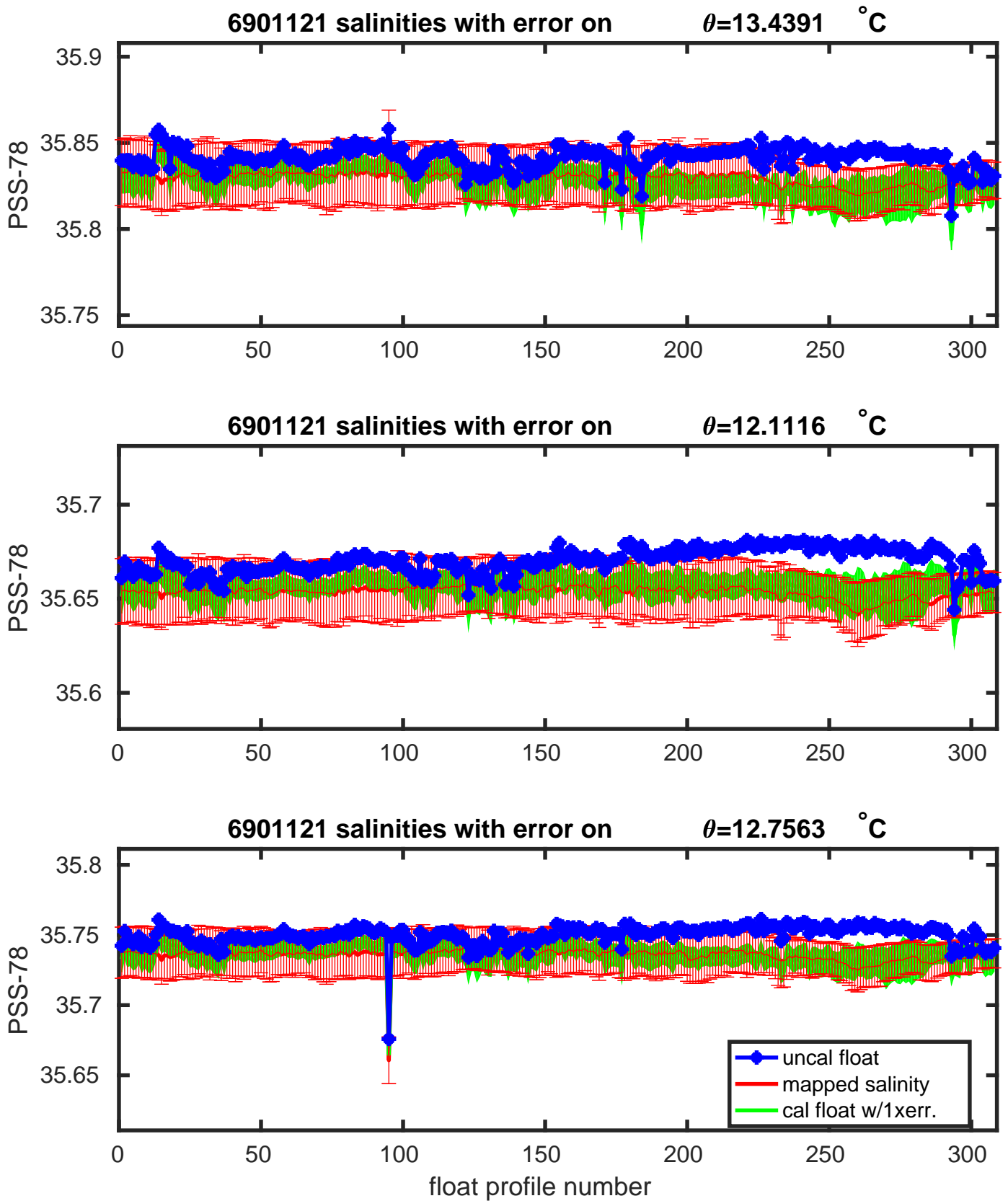


Figure 14: Float 6901121. Plots of the evolution of salinity with time along with selected theta levels with minimum salinity variance.

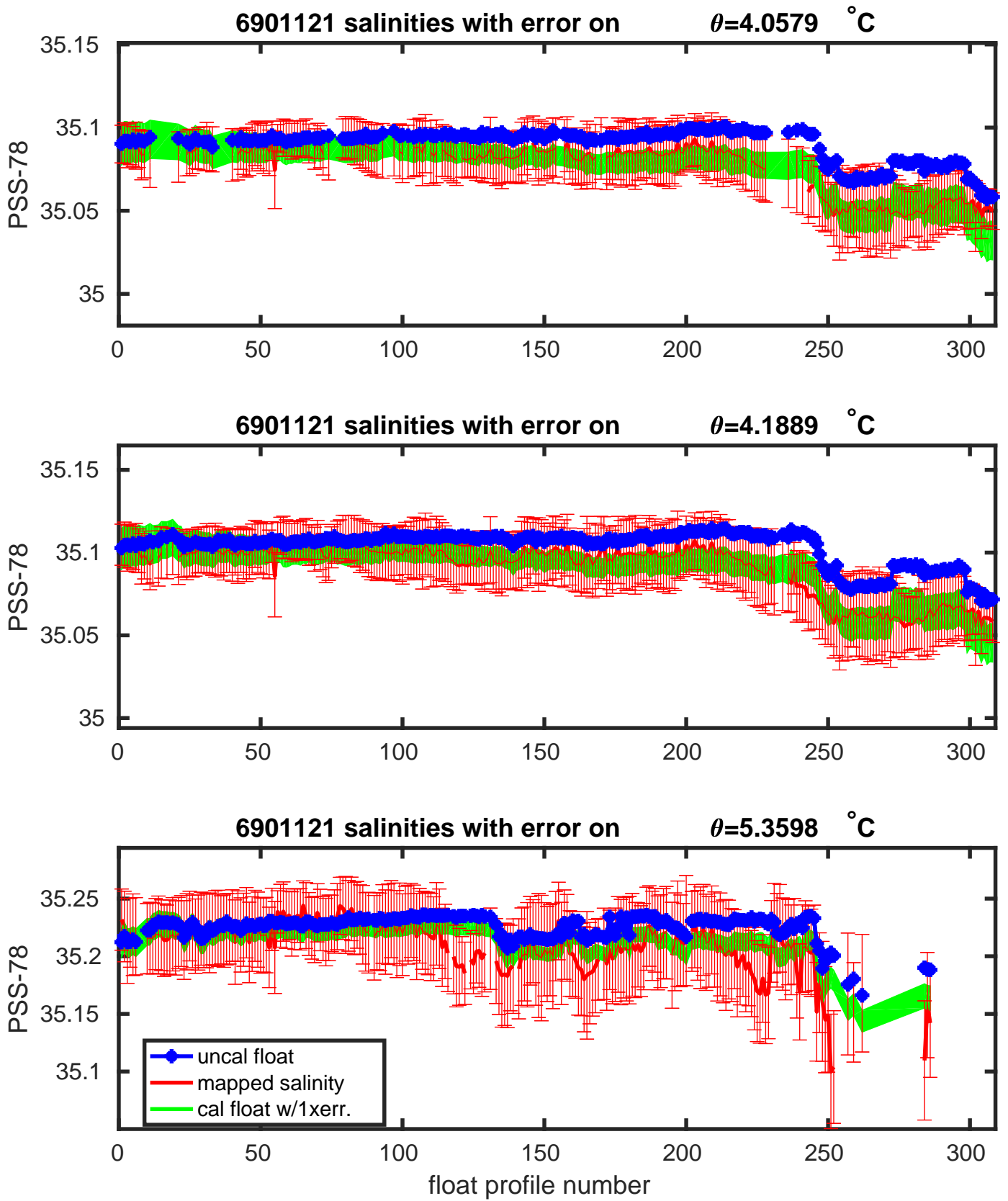


Figure 15: Float 6901121. Plots of the evolution of salinity with time along with selected theta levels with minimum salinity variance.

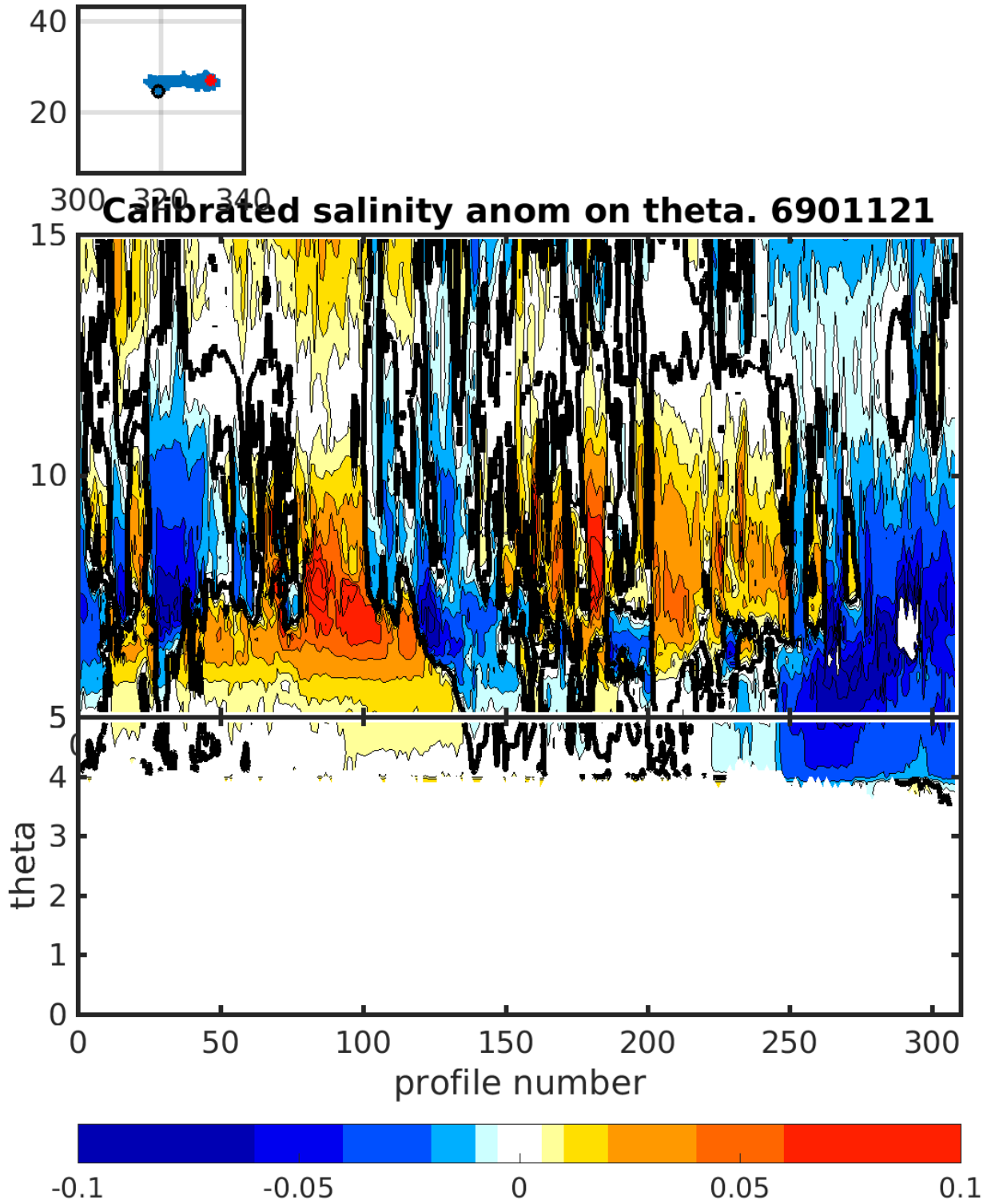


Figure 16: Float 6901121. Calibrated salinity anomaly on theta levels.

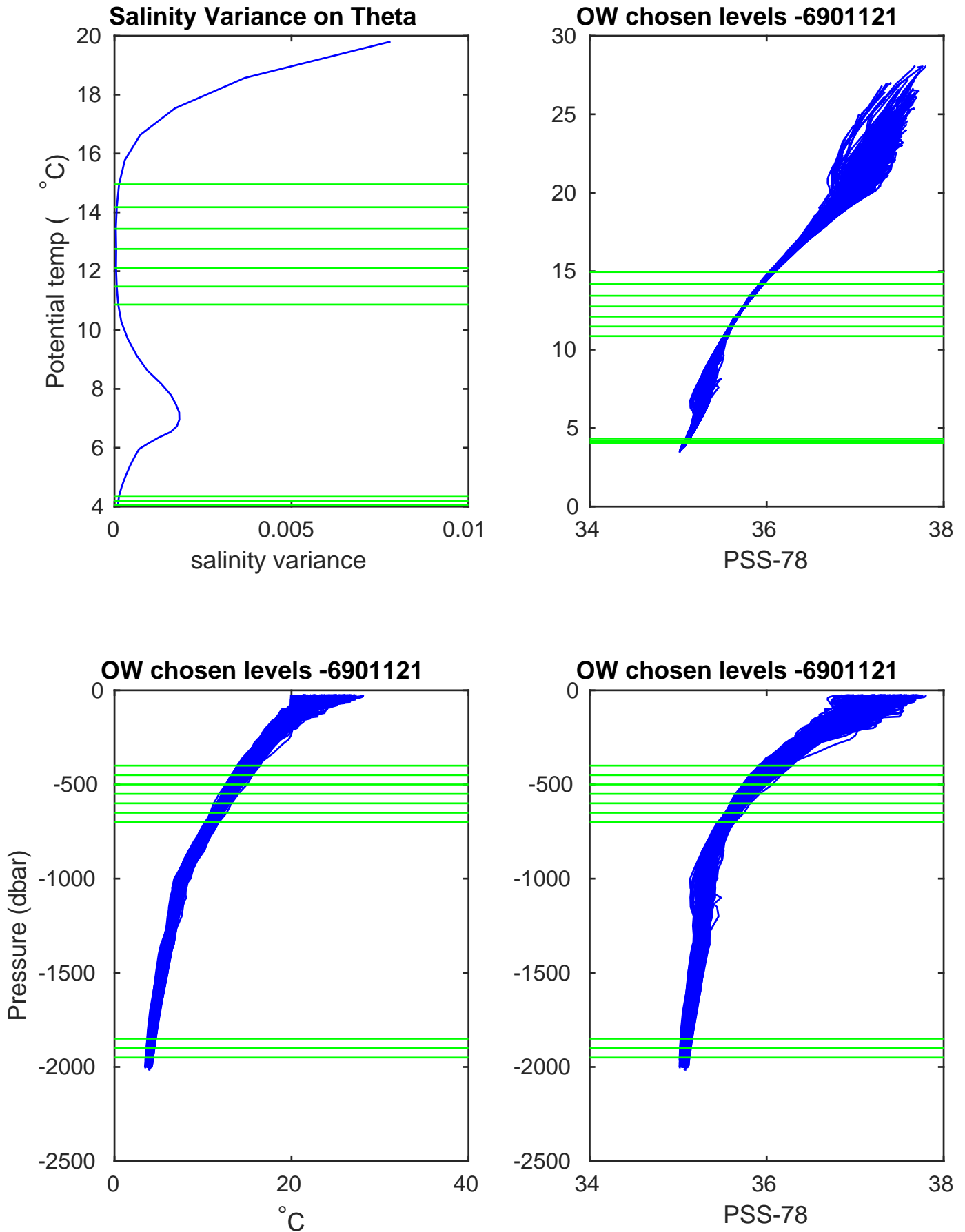


Figure 17: Float 6901121. Plots including the theta levels chosen for calibration: Top left: Salinity variance at theta levels. Top right: T/S diagram of all profiles of Argo float. Bottom left: potential temperature plotted against pressure. Bottom right: salinity plotted against pressure.

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
```

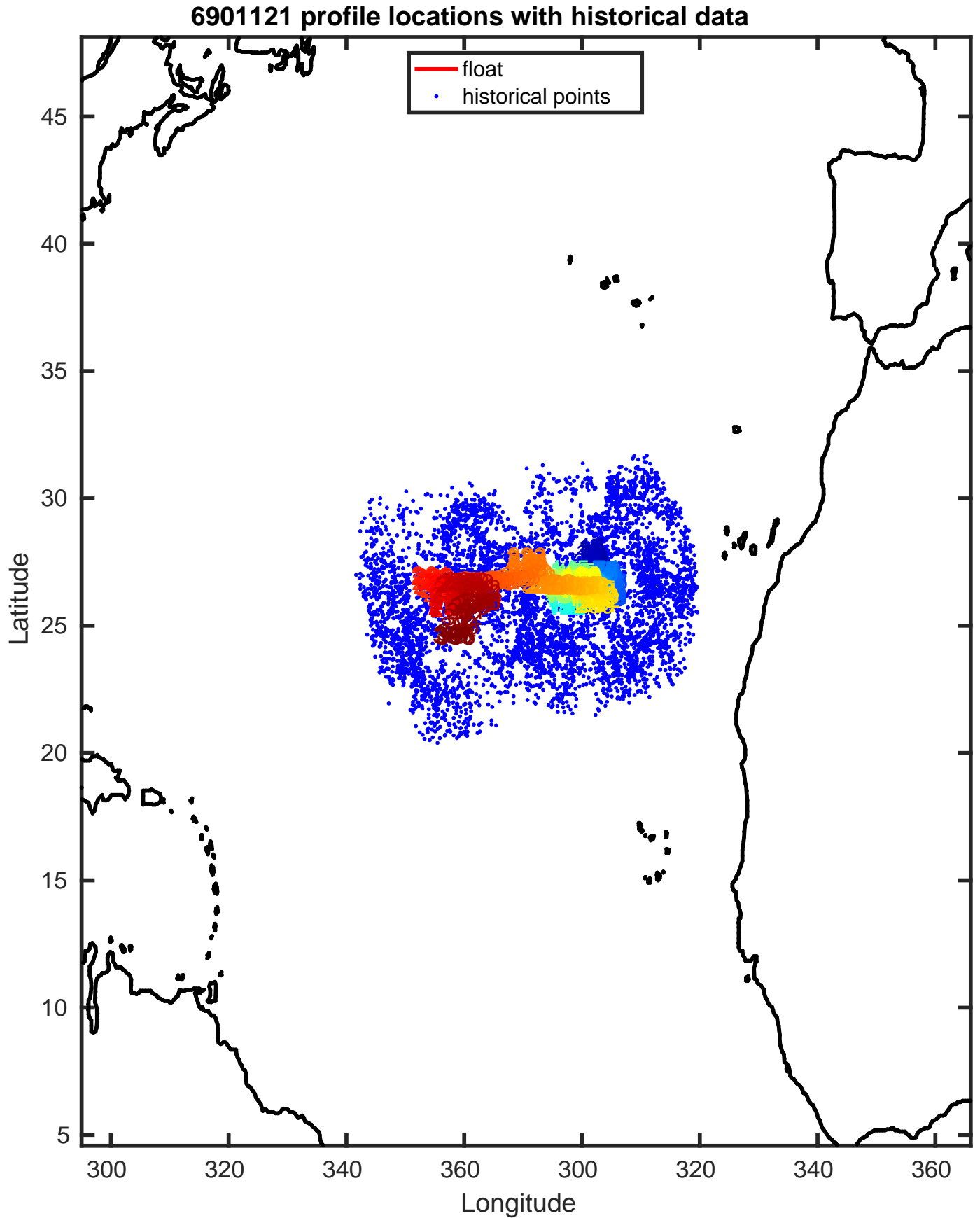



Figure 18: Float 6901121. Location of the float profiles (red line with coloured numbers) and the CTD reference data selected for mapping (blue dots). The black contours indicate the bathymetry at 0, 200, 1000 and 2000 m.

L21 uncalibrated float data (-) and mapped salinity (o) with objective errors

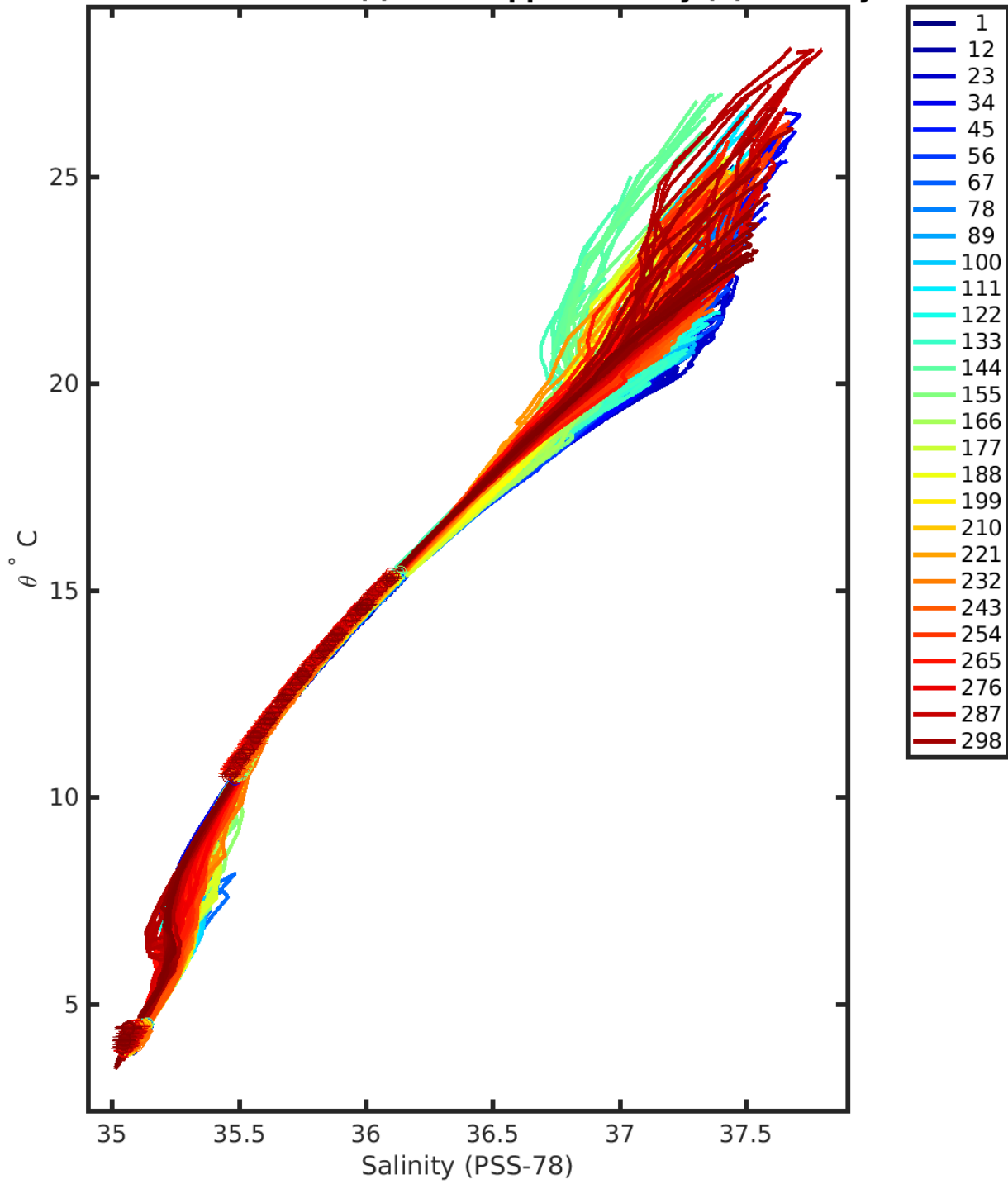
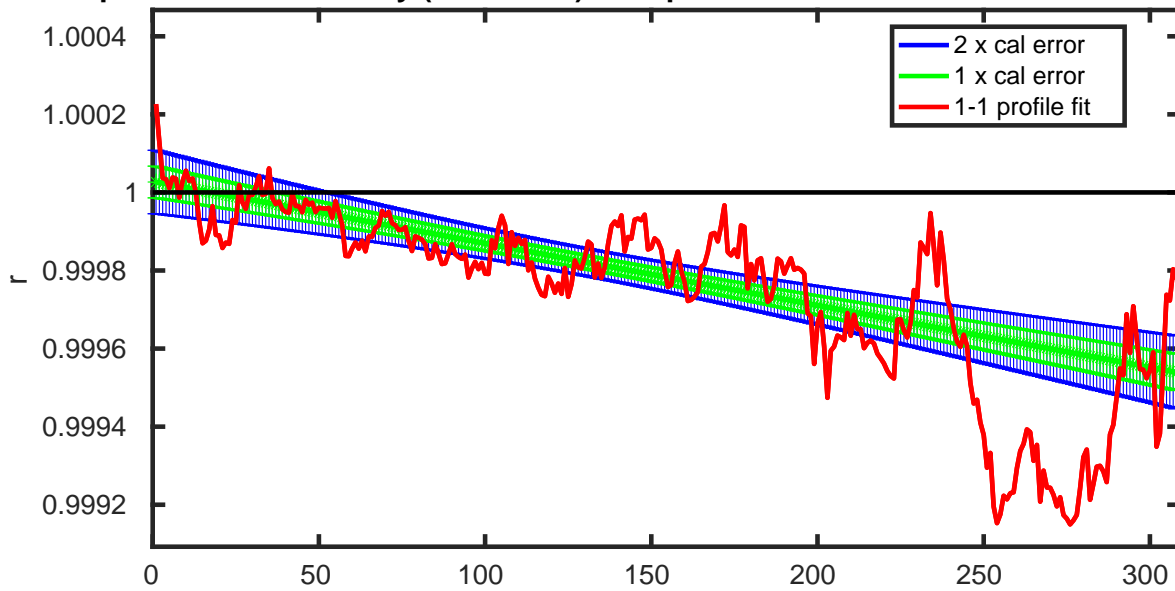


Figure 19: Float 6901121. Plots the original float salinity and the objectively estimated reference salinity at the 10 float theta levels that are used in calibration.

6901121 potential conductivity (mmho/cm) multiplicative correction r with errors



6901121 vertically-averaged salinity (PSS-78) additive correction ΔS with errors

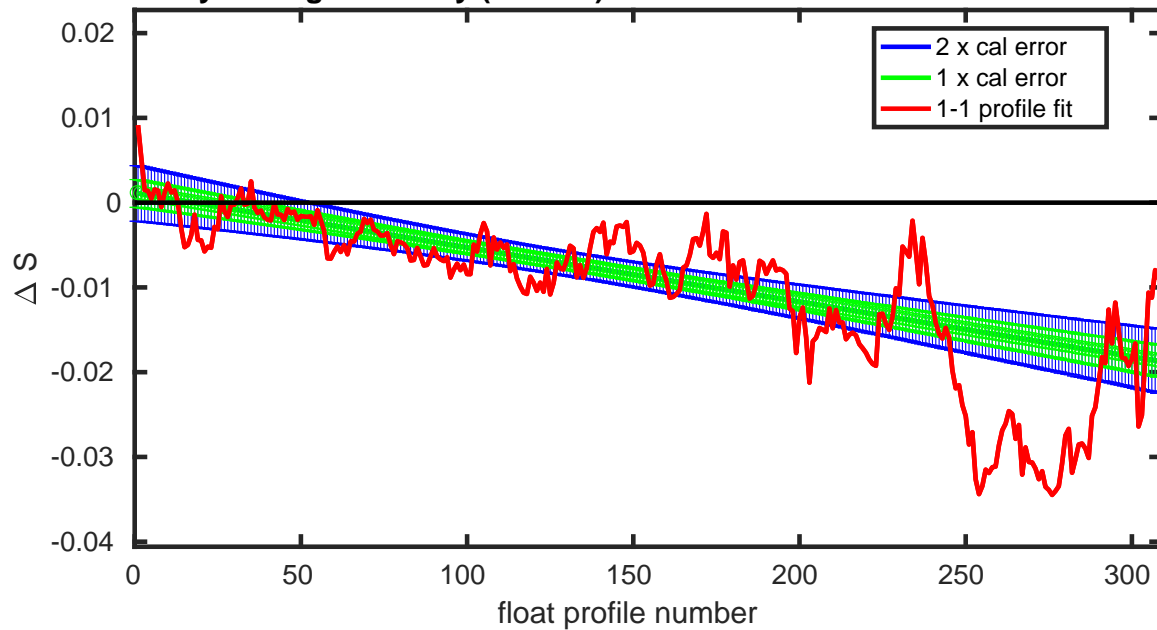
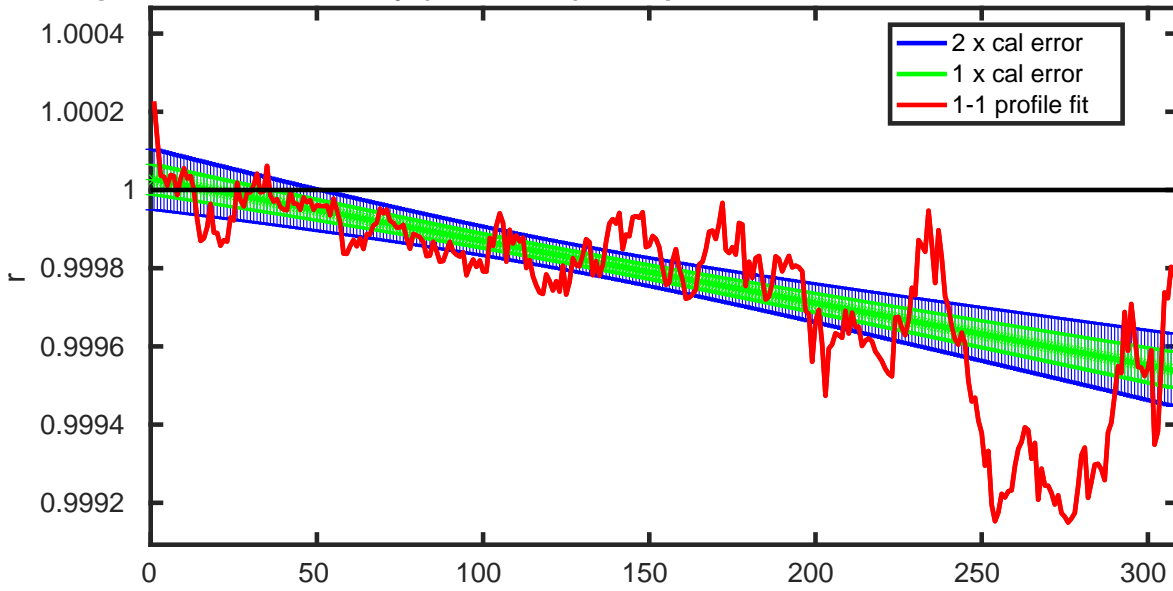


Figure 20: Float 6901121. Evolution of the suggested adjustment with time. The top panel plots the potential conductivity multiplicative adjustment. The bottom panel plots the equivalent salinity additive adjustment. The red line denotes one-to-one profile fit that uses the vertically weighted mean of each profile. The red line can be used to check for anomalous profiles relative to the optimal fit.

6901121 potential conductivity (mmho/cm) multiplicative correction r with errors



6901121 vertically-averaged salinity (PSS-78) additive correction

ΔS with errors

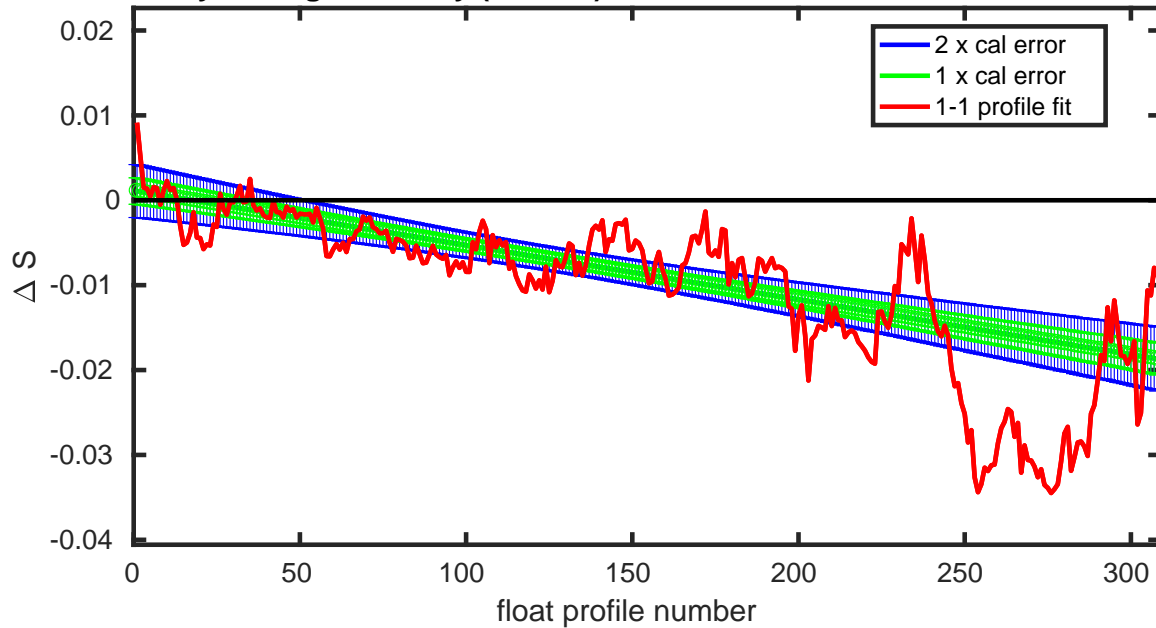


Figure 21: Float 6901121. Evolution of the suggested adjustment with time. The top panel plots the potential conductivity multiplicative adjustment. The bottom panel plots the equivalent salinity additive adjustment. The red line denotes one-to-one profile fit that uses the vertically weighted mean of each profile. The red line can be used to check for anomalous profiles relative to the optimal fit.

L121 calibrated float data (-) and mapped salinity (o) with objective errors

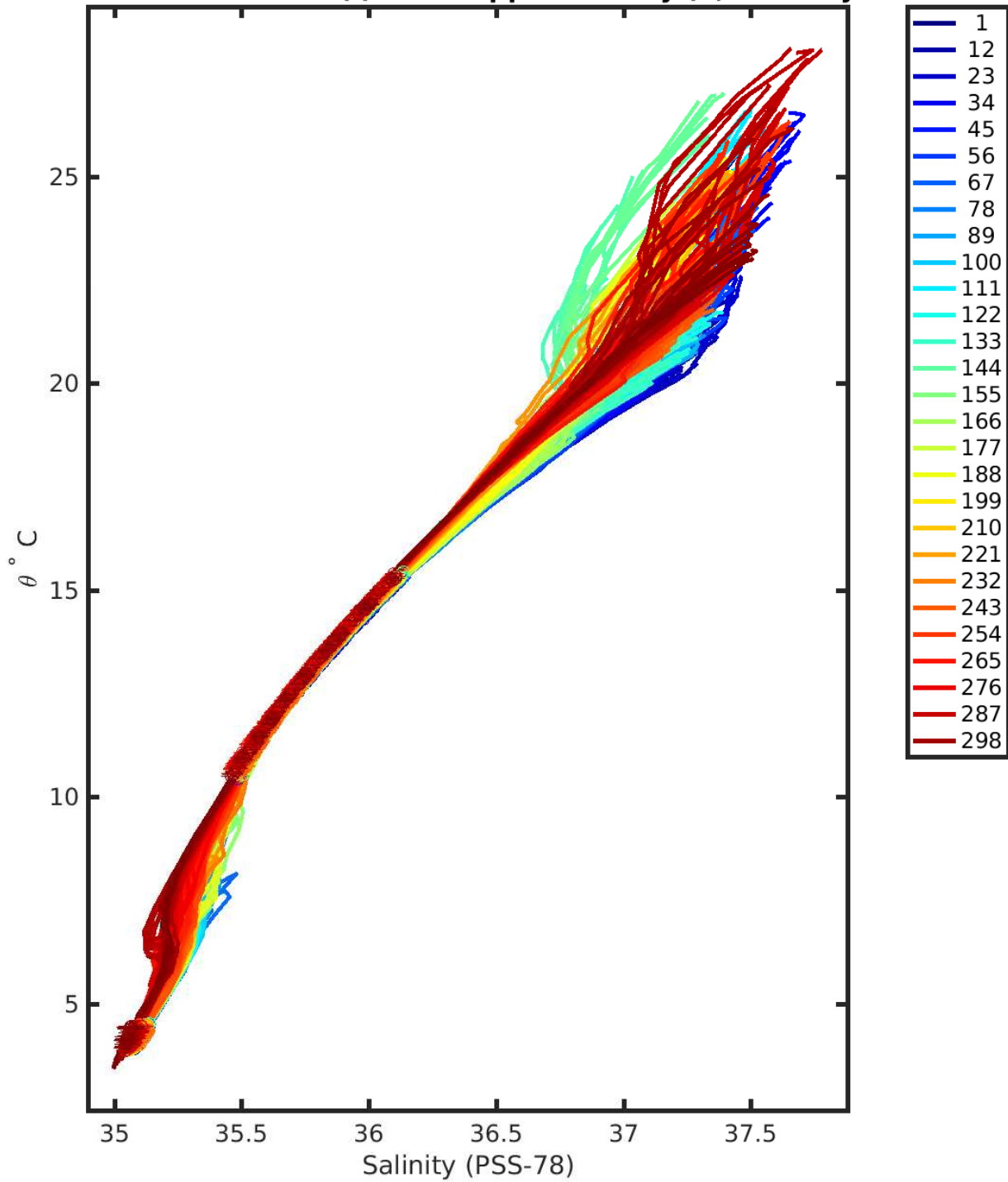


Figure 22: Float 6901121. Plots of calibrated float salinity and the objectively estimated reference salinity at the 10 float theta levels that are used in calibration.

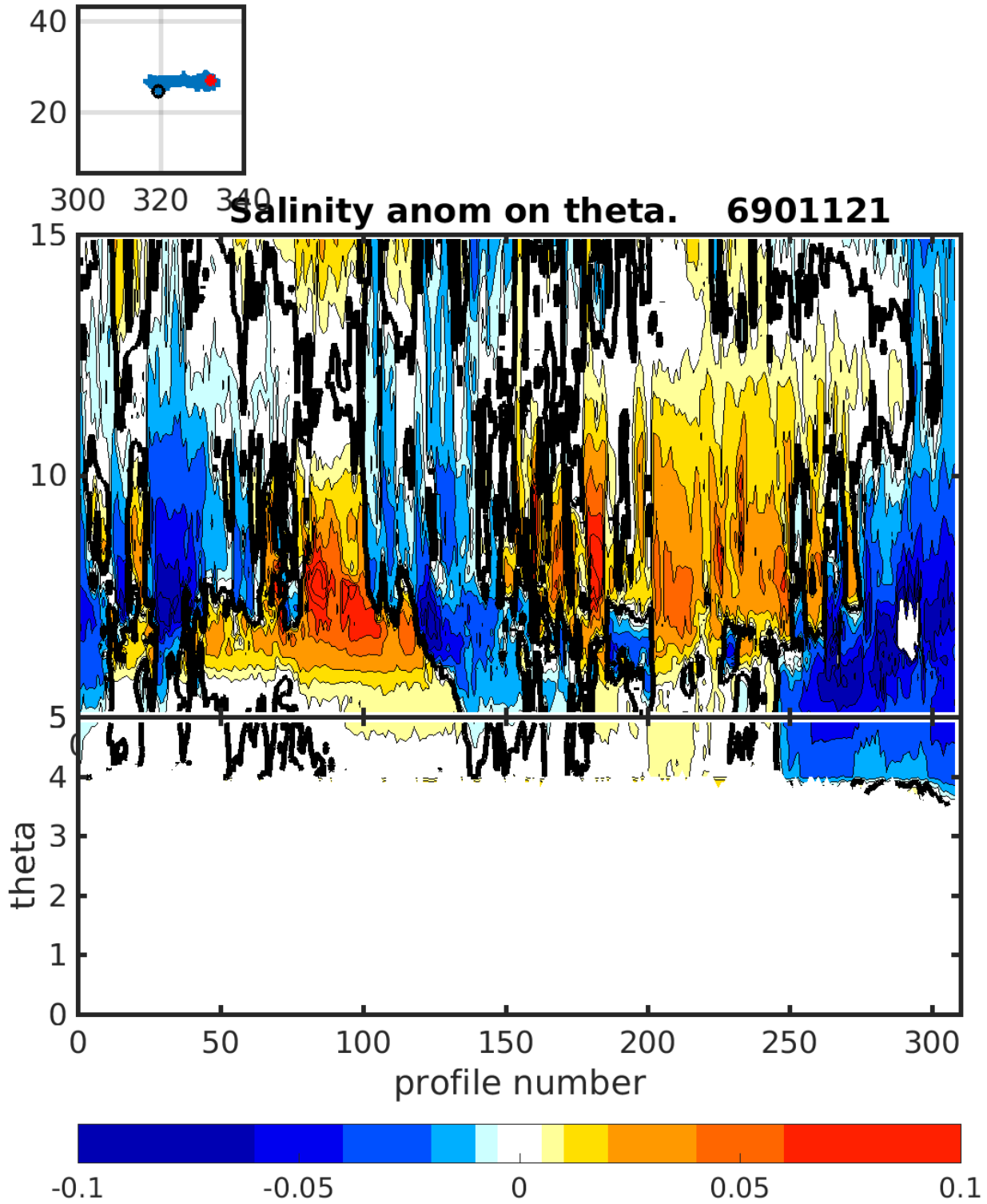


Figure 23: Float 6901121. Salinity anomaly on theta levels.

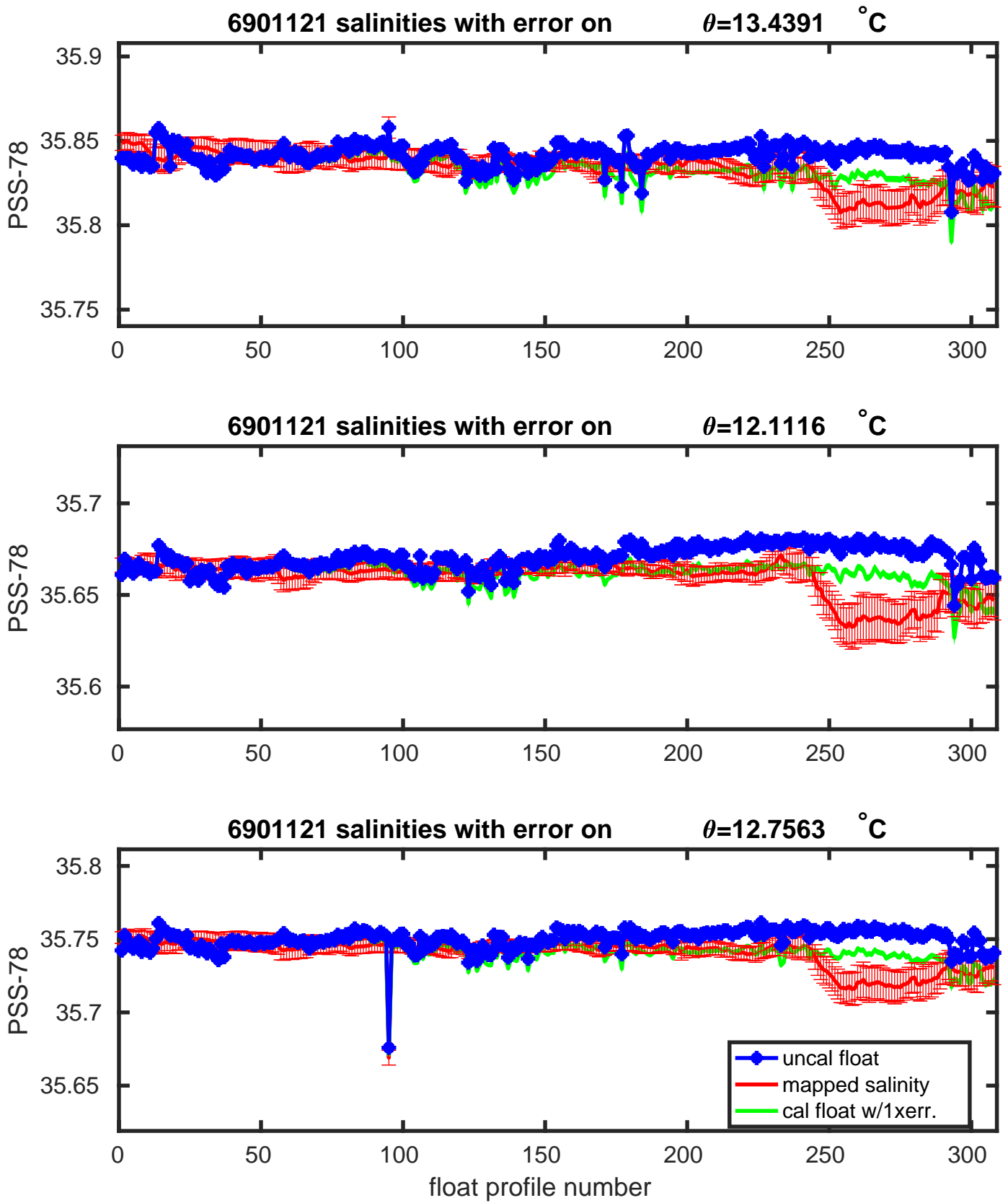


Figure 24: Float 6901121. Plots of the evolution of salinity with time along with selected theta levels with minimum salinity variance.

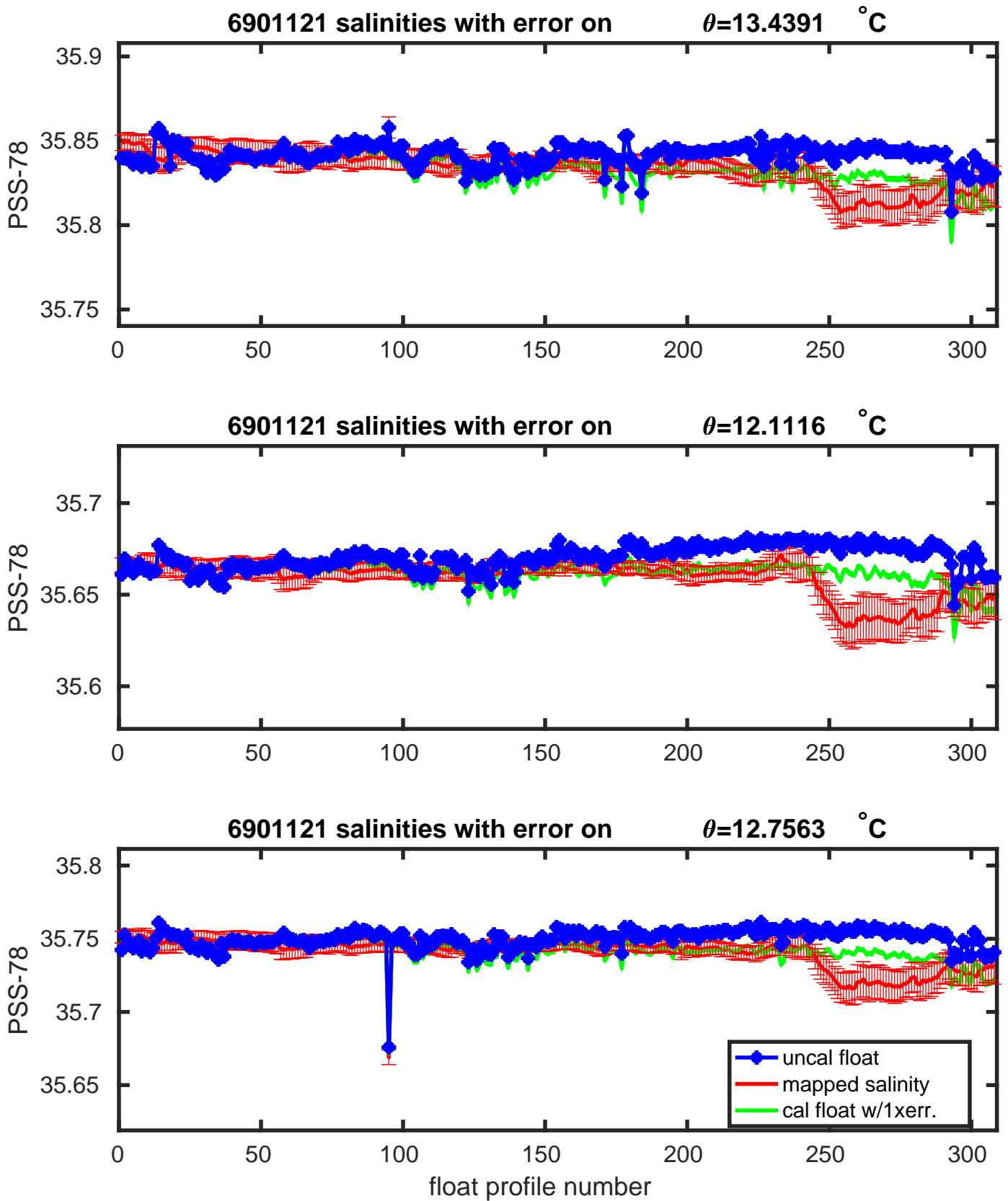


Figure 25: Float 6901121. Plots of the evolution of salinity with time along with selected theta levels with minimum salinity variance.

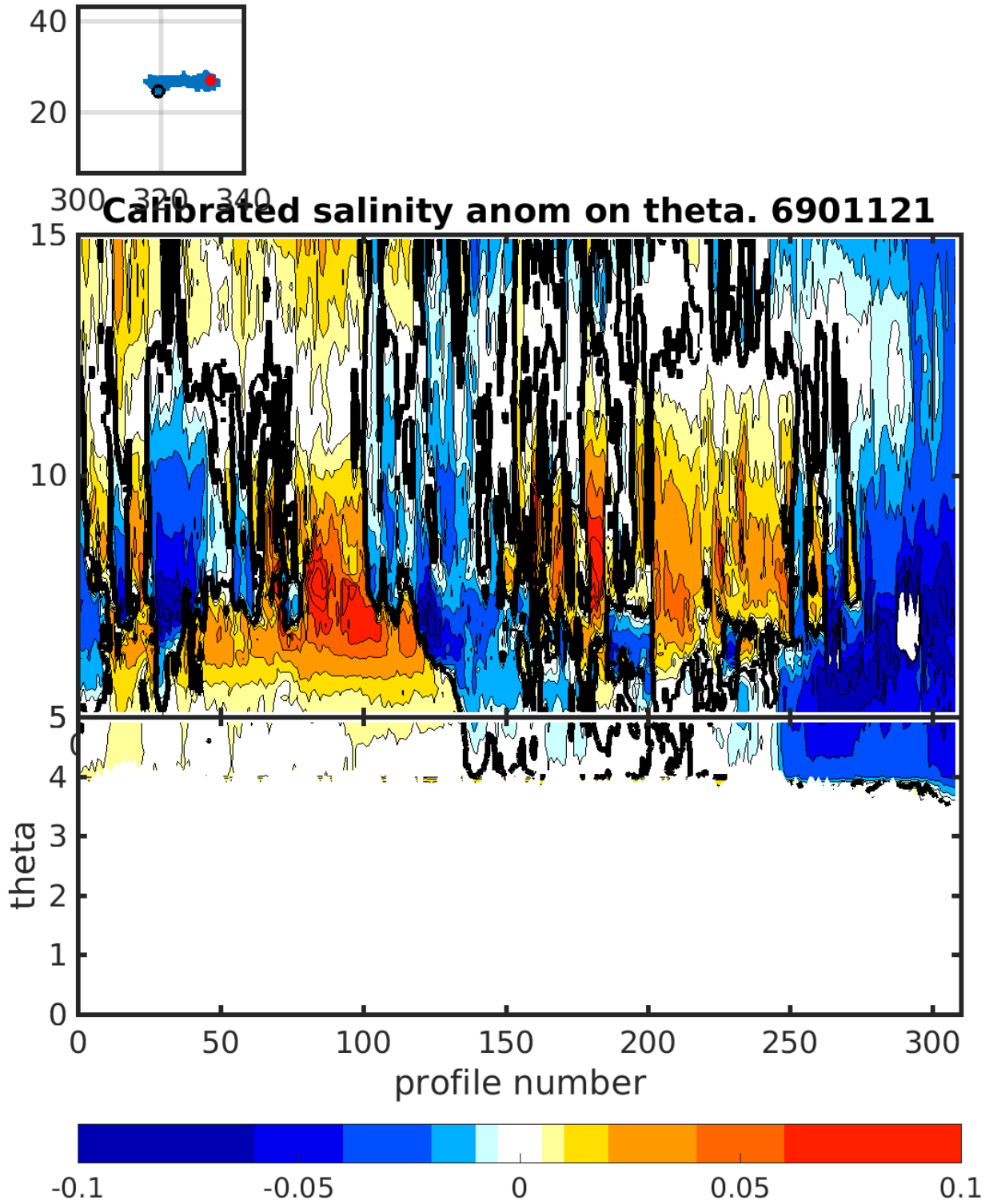


Figure 26: Float 6901121. Calibrated salinity anomaly on theta levels.

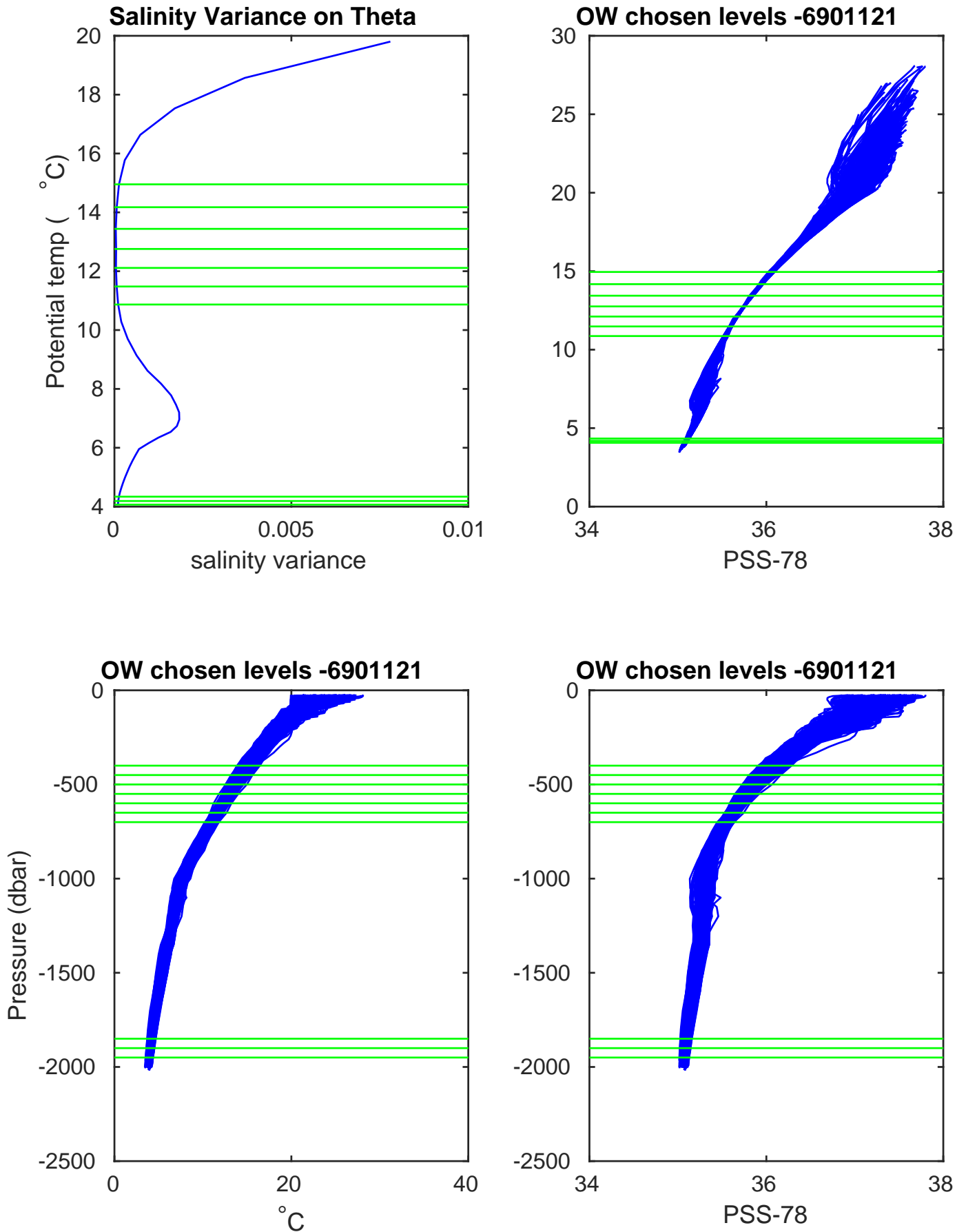


Figure 27: Float 6901121. SPlots including the theta levels chosen for calibration: Top left: Salinity variance at theta levels. Top right: T/S diagram of all profiles of Argo float. Bottom left: potential temperature plotted against pressure. Bottom right: salinity plotted against pressure.

4.3 Summary and Conclusions

Float was deployed in the Cape Verde Basin and it propagated westward, toward the Mid-Atlantic Ridge. The OWC analysis has been run without setting any theta levels boundaries, then we run it for below 5 degree and between 11 and 15 degree, respectively. This report include results from the entire range of the temperatures. The OWC analysis showed an evidences of the salty drift, with intensification after around profiles 170. The OWC corrections has been applied for the entire float life, with QC=1 and error =0.005.