

Delayed Mode Quality Control of Argo float 3901511

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Short Summary

The pressure sensor propagate well with QC=1, err 2.4dbar. Cell Thermal Mass corrections applied. Float showed salty drift from the beginning of the float life. From profile 1 to 54 OWC correction applied, QC=2, error 0.016. From 55 to 131 QC=4.

WMO number	DM correction
3901511	Drift detected

Table 1: Correction applied in delayed mode.

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1 Introduction

Delayed mode analysis was performed for float number 135801 (WMO: 3901511) 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 3901511 click on the following link:

<http://www.ifremer.fr/argoMonitoring/float/3901511>

2 Quality Check of Argo Float Data

2.1 Satellite Altimeter comparison

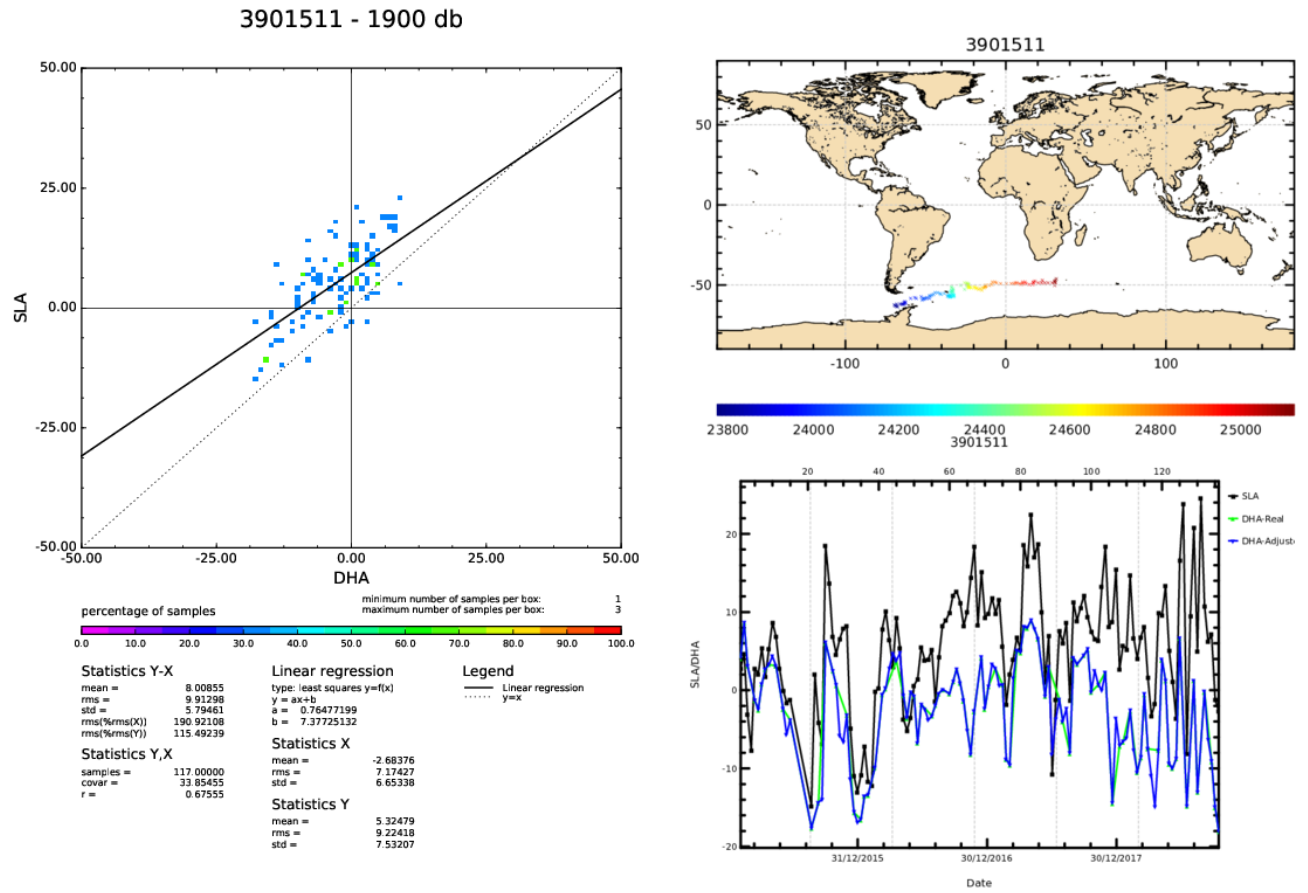


Figure 1: Float 3901511. The comparison between the Sea Surface Height (SSH) from the satellite altimetry and Dynamic Height Anomaly (DHA) extracted from the Argo float temperature and salinity data (<ftp://ftp.ifremer.fr/ifremer/argo/etc/argo-ast9-item13-AltimeterComparison/figures/>).

2.2 Time Series of Vertical Distribution of Data

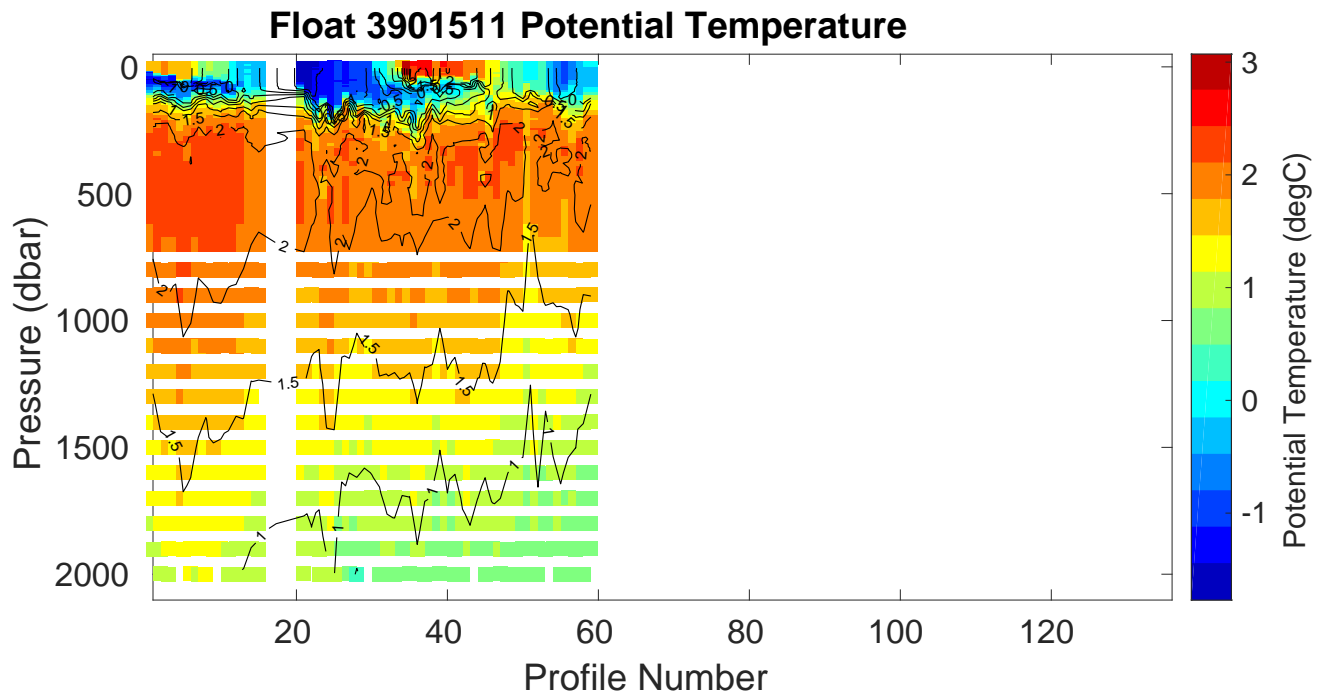


Figure 2: Float 3901511. Time series of the vertical distribution of potential temperature ($^{\circ}\text{C}$).

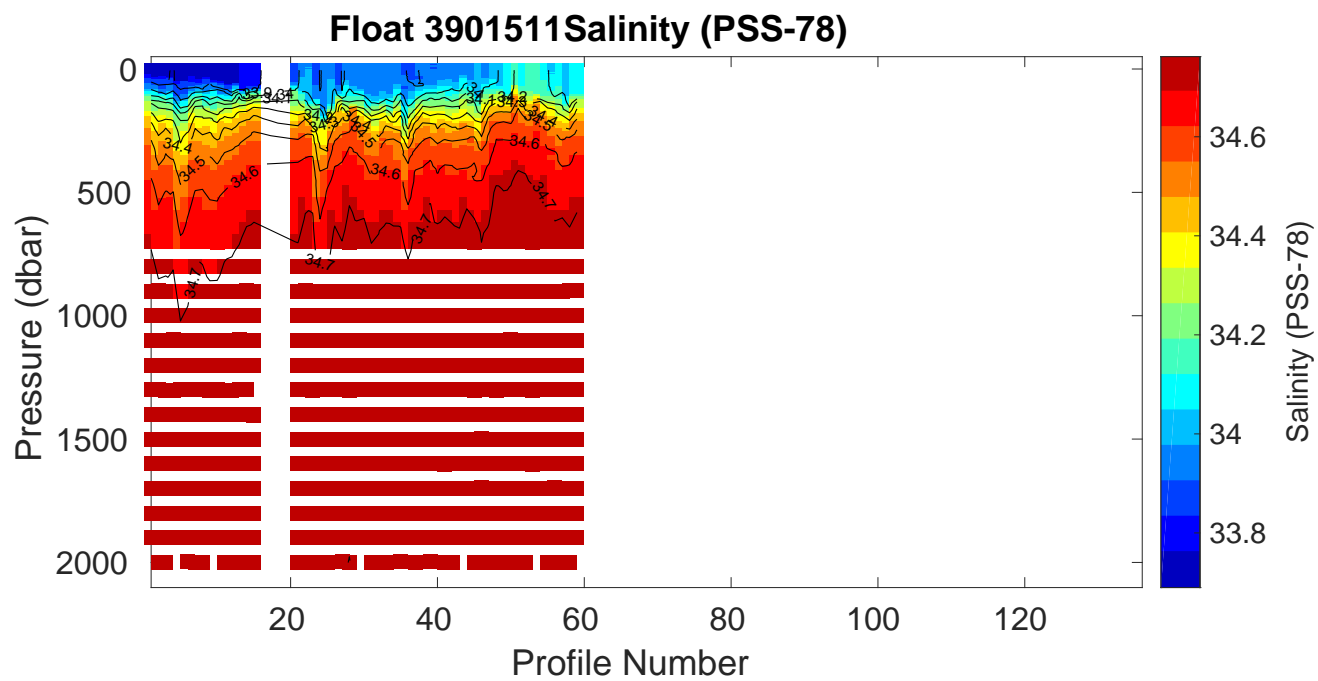
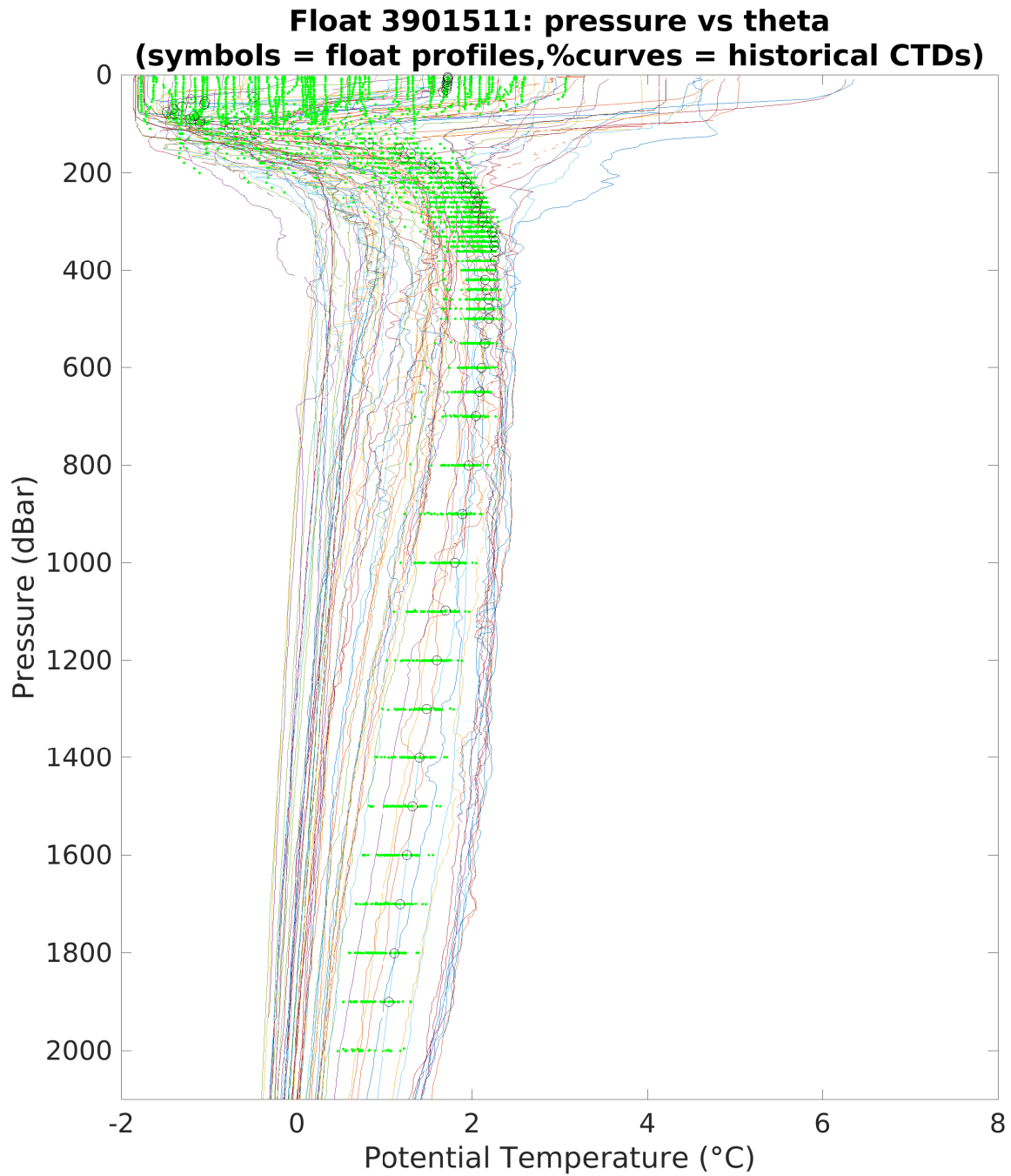


Figure 3: Float 3901511. Time series of the vertical distribution of salinity (PSS-78).

2.3 Comparison between Argo Float and Climatology



8

Figure 4: Float 3901511. 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

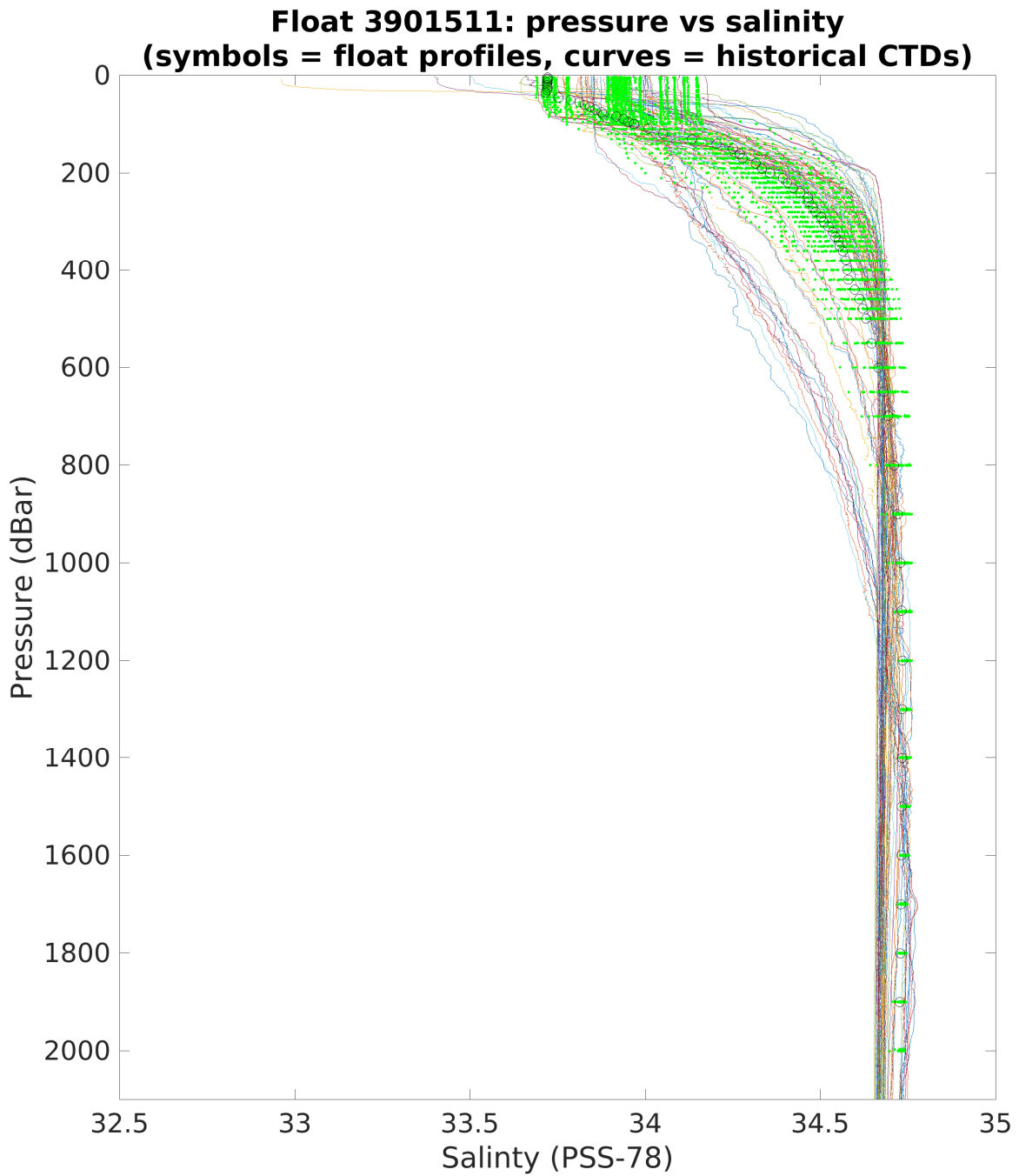


Figure 5: Float 3901511. Salinity (PSS-78) plotted with pressure (dBar) and data from WMO boxes of CTD reference data (CTD for DMQC 2019V01) $\pm 10^\circ$ of latitude and longitude. The black and blue cycles indicates the first and the last Argo profile, respectively. Green symbols represent other Argo profiles from this float. The thin colors lines indicate the reference data.

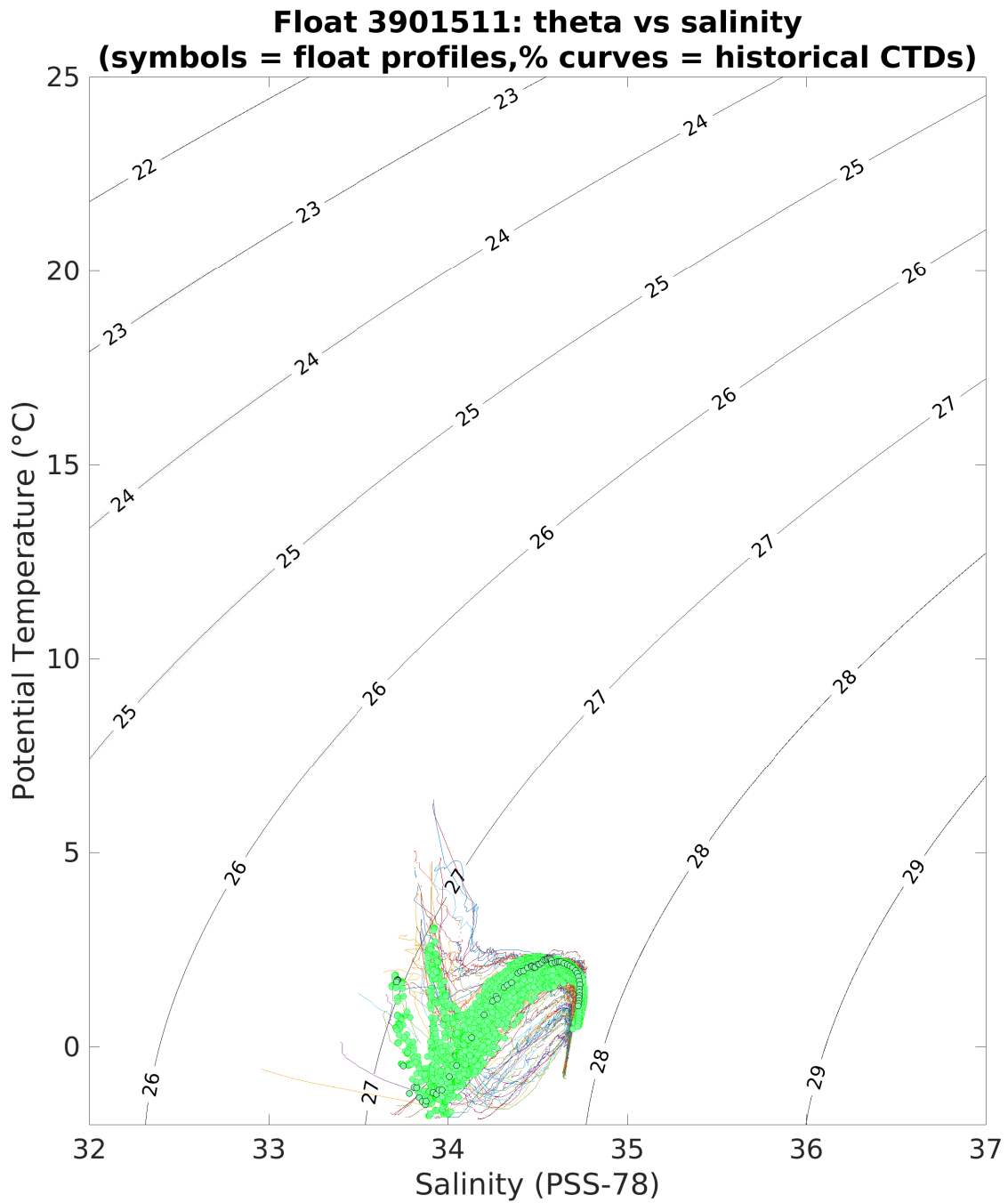


Figure 6: Float 3901511. T/S diagram plotted with and data from WMO boxes of CTD reference data (CTD for DMQC 2019V01) +/- 10° of latitude and longitude. The black and blue cycles indicates the first and the last Argo profile, respectively. Green symbols represent other Argo profiles from this float.

3 Pressure Adjustment for APEX Floats

Float 3901511 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>).

Raw surface pressure measured before descent (+0 dbar offset) for float
135801
pressure correction in green

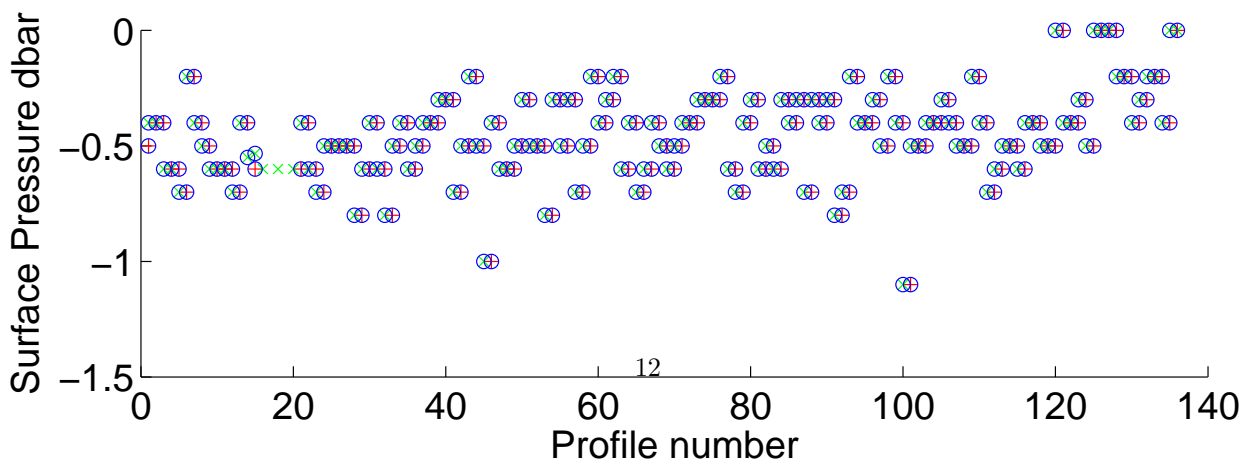
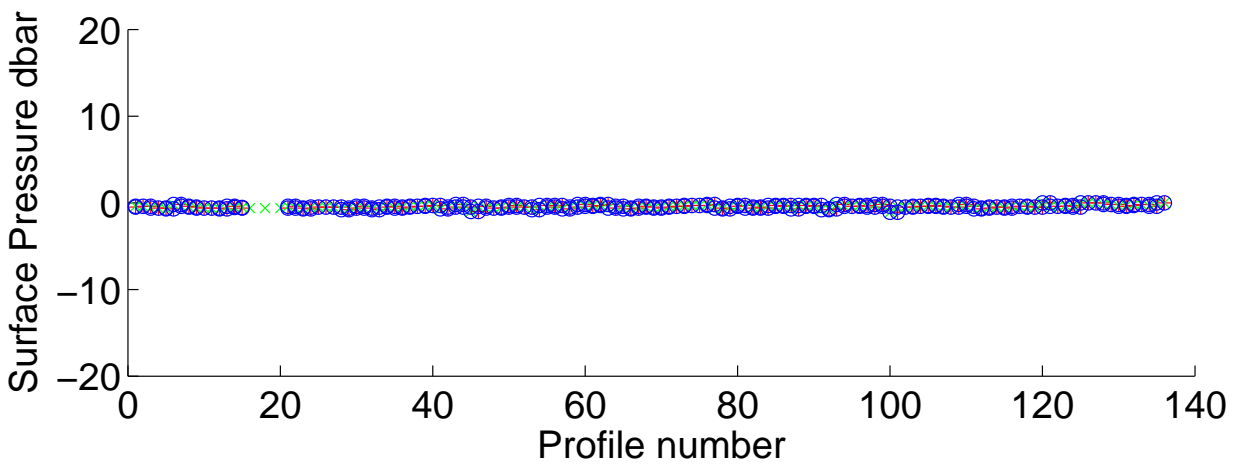
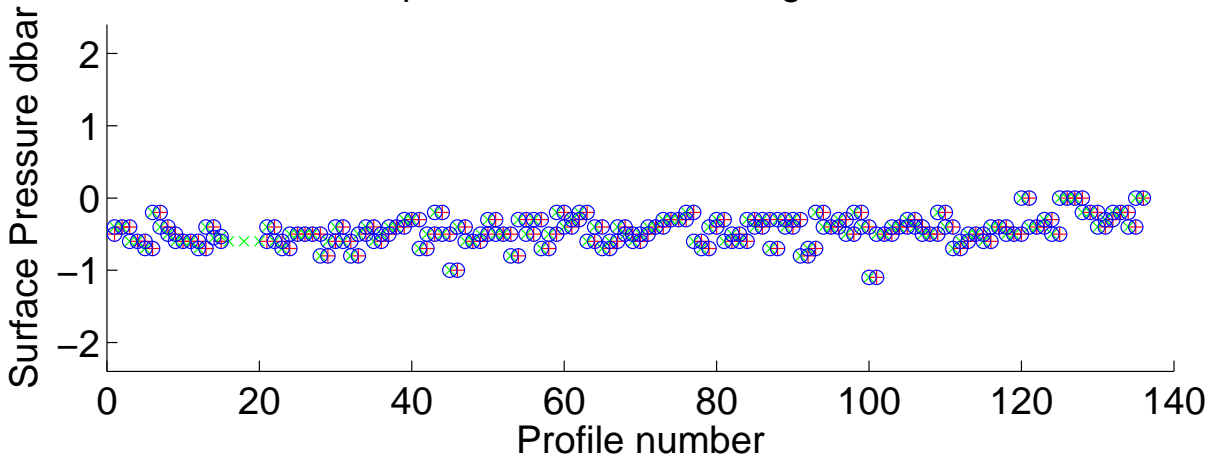


Figure 7: Float 3901511. Sea surface pressure data. The red cross indicate the raw pressure before float descent, recorded after sending data to GDAC. Blue circle indicate pressure value in the real-time. Green rotated cross shows the pressure correction applied from the previous float cycle.

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/WOD2001_v2/bot_  
HISTORICAL_ARGO_PREFIX=/argo_profiles/ARGO_for_DMQC_2019V03/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

% =====
%
% 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

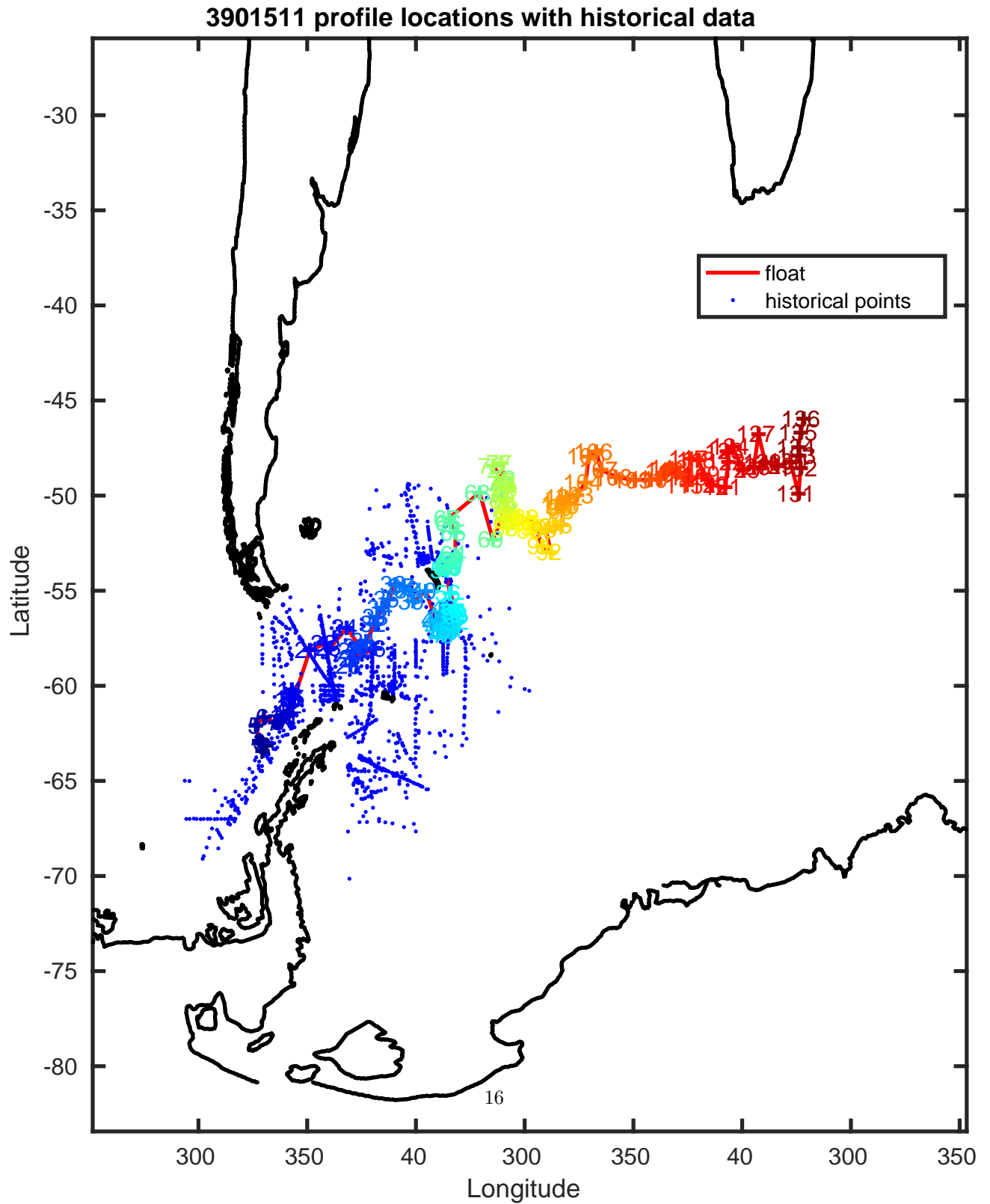


Figure 8: Float 3901511. Location of the float profiles (red line with coloured numbers) and the CTD reference data selected for mapping (blue dots). The black contours indicate the bathymetry at 0, 200, 1000 and 2000 m.

3901511 uncalibrated float data (-) and mapped salinity (o) with objective errors

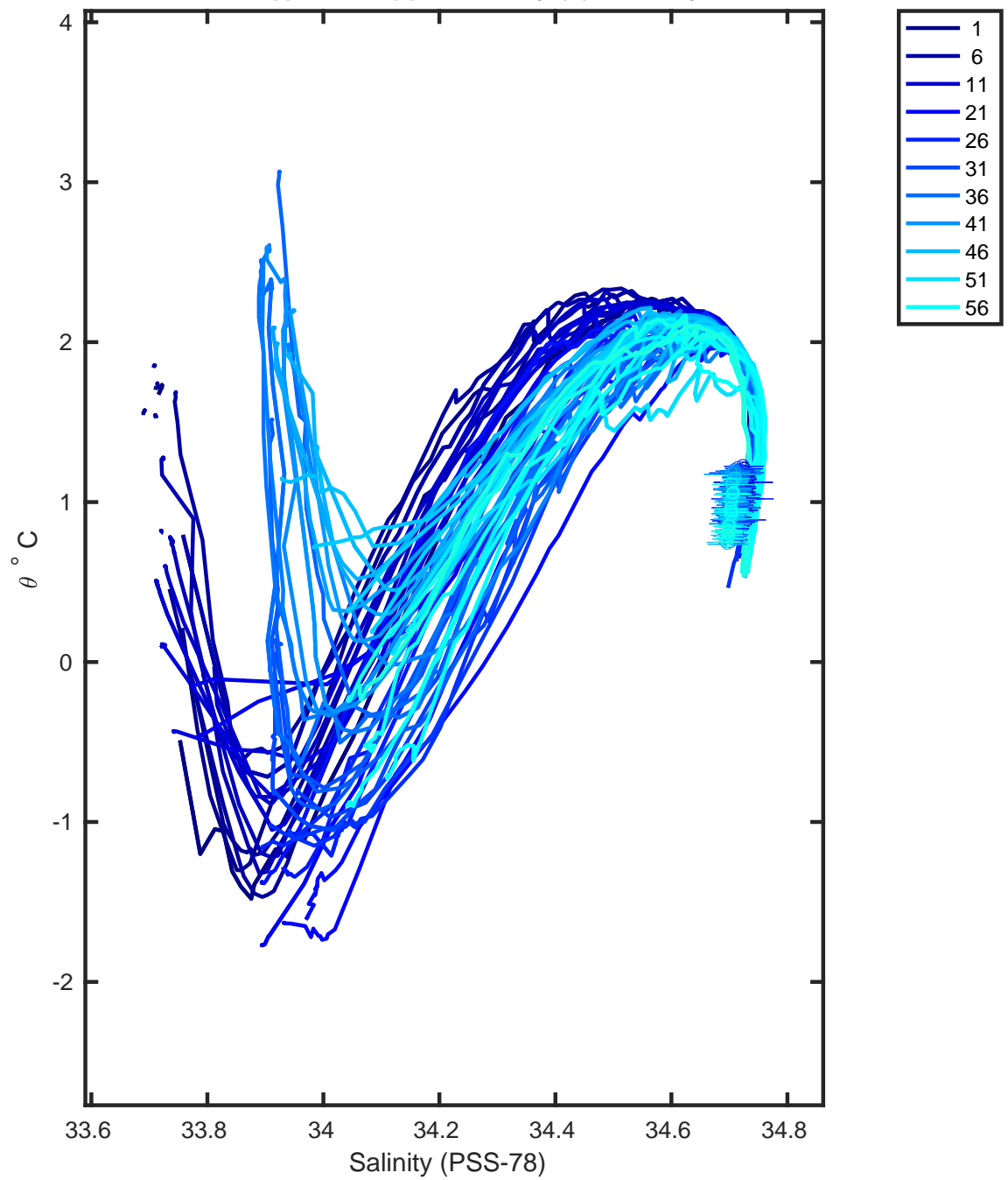
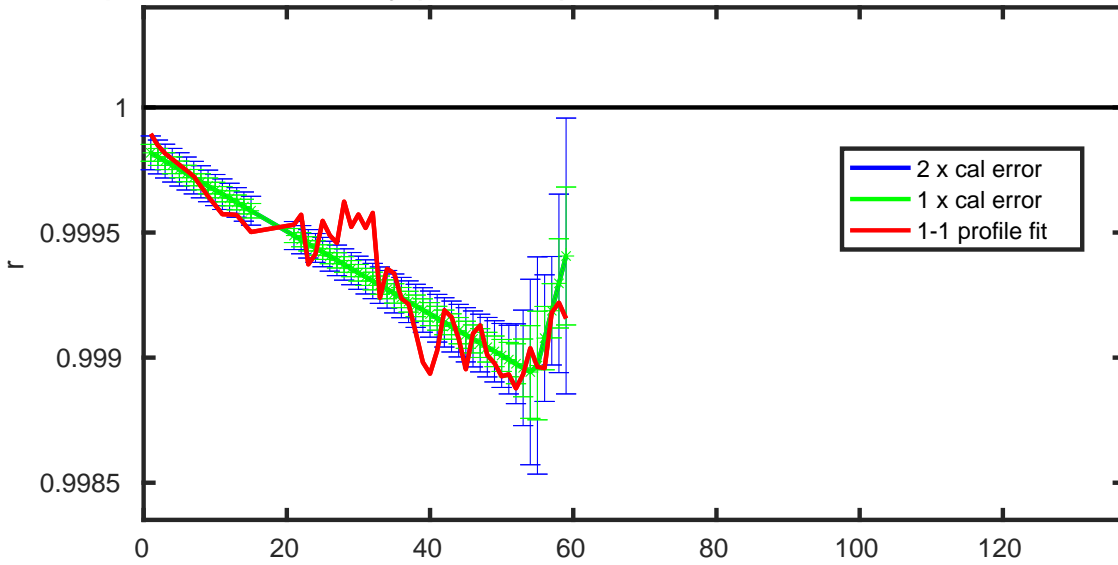


Figure 9: Float 3901511. Plots the original float salinity and the objectively estimated reference salinity at the 10 float theta levels that are used in calibration.

3901511 potential conductivity (mmho/cm) multiplicative correction r with errors



3901511 vertically-averaged salinity (PSS-78) additive correction

ΔS with errors

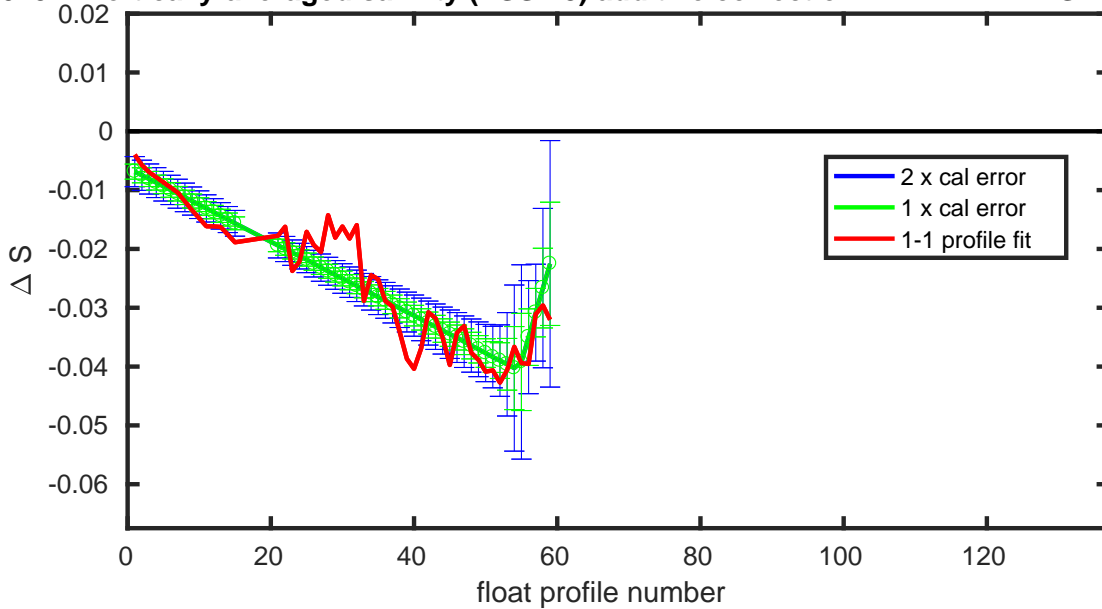


Figure 10: Float 3901511. Evolution of the suggested adjustment with time. The top panel plots the potential conductivity multiplicative adjustment. The bottom panel plots the equivalent salinity additive adjustment. The red line denotes one-to-one profile fit that uses the vertically weighted mean of each profile. The red line can be used to check for anomalous profiles relative to the optimal fit.

3901511 calibrated float data (-) and mapped salinity (o) with objective errors

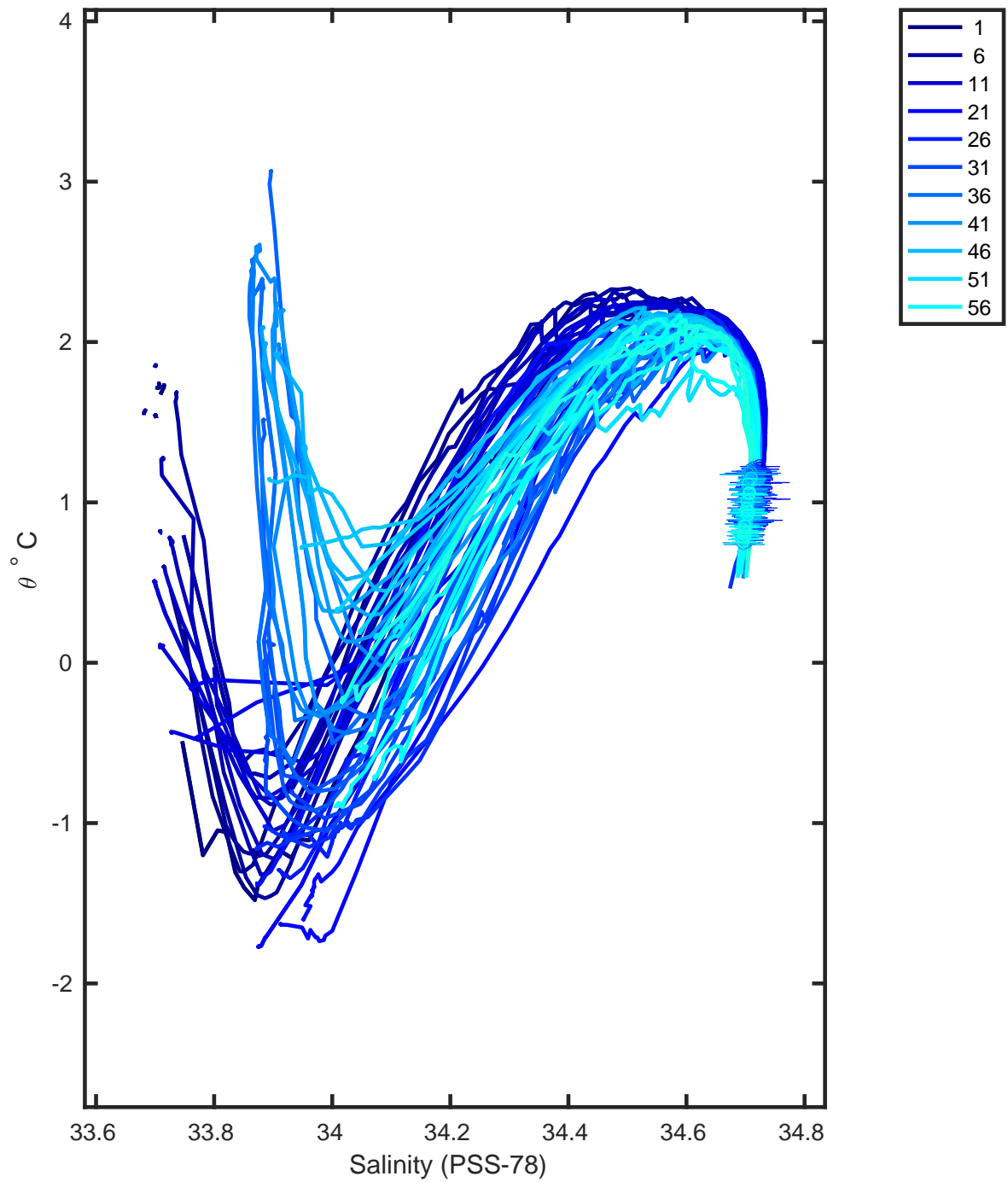


Figure 11: Float 3901511. Plots of calibrated float salinity and the objectively estimated reference salinity at the 10 float theta levels that are used in calibration.

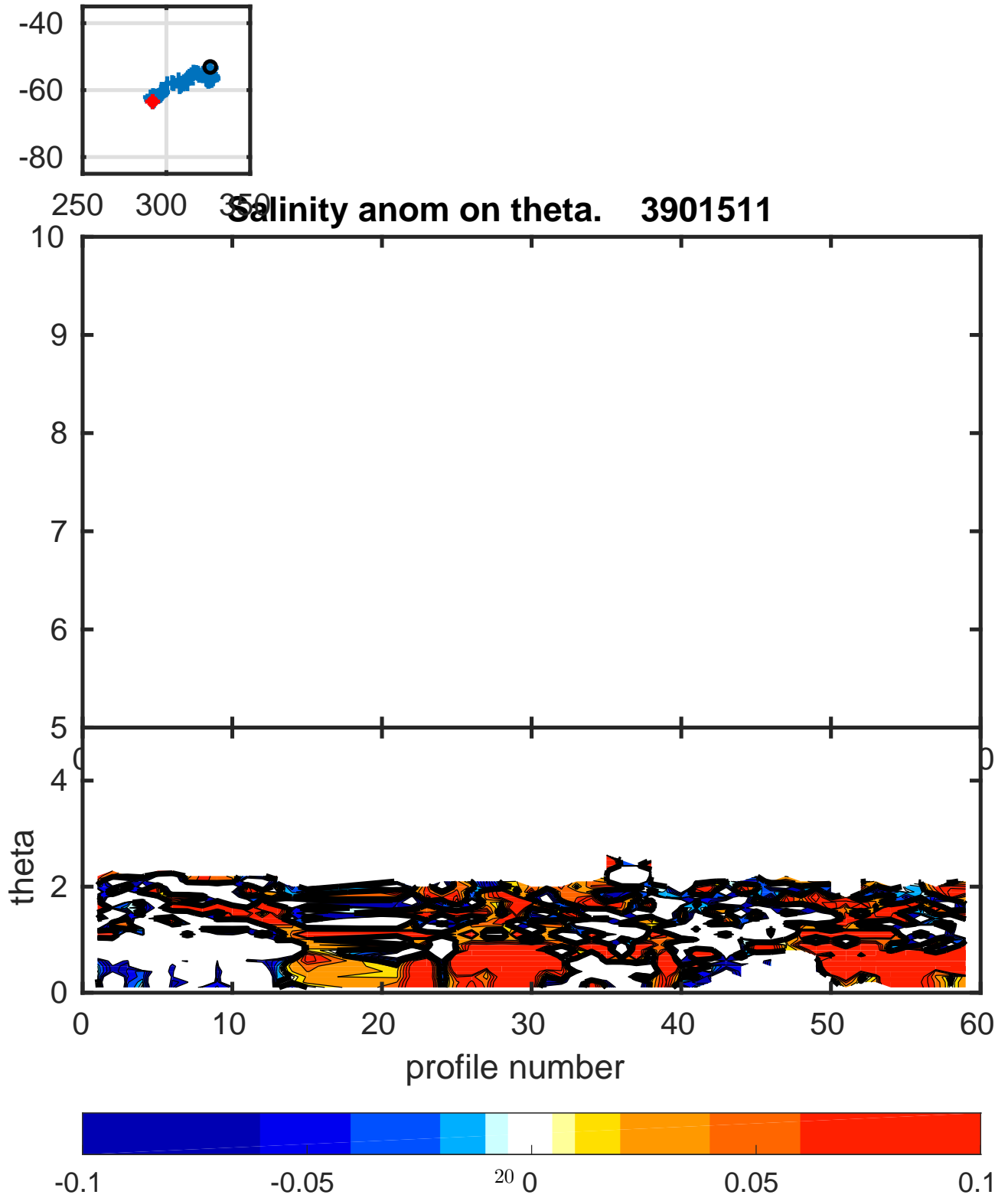


Figure 12: Float 3901511. Salinity anomaly on theta levels.

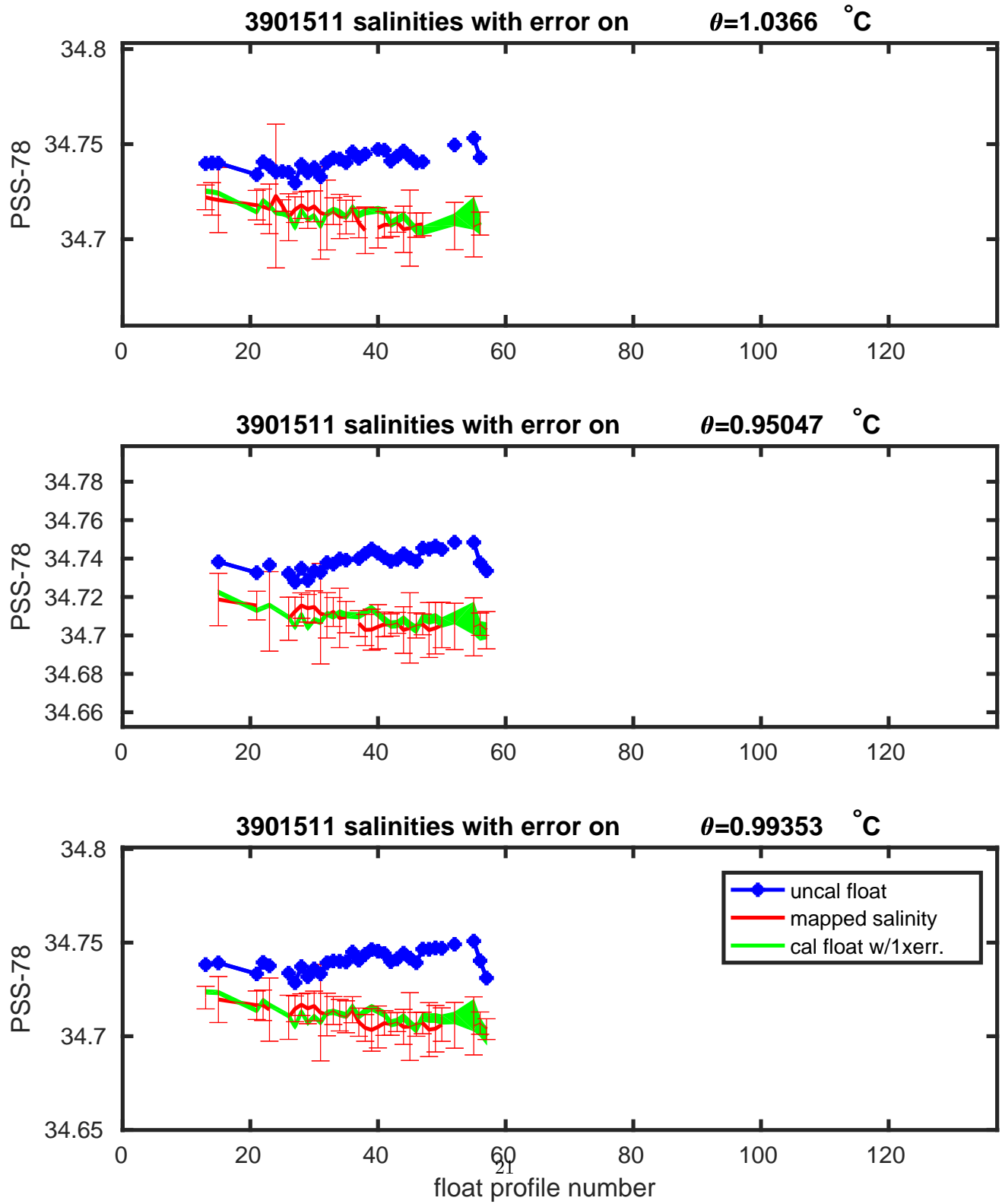


Figure 13: Float 3901511. Plots of the evolution of salinity with time along with selected theta levels with minimum salinity variance.

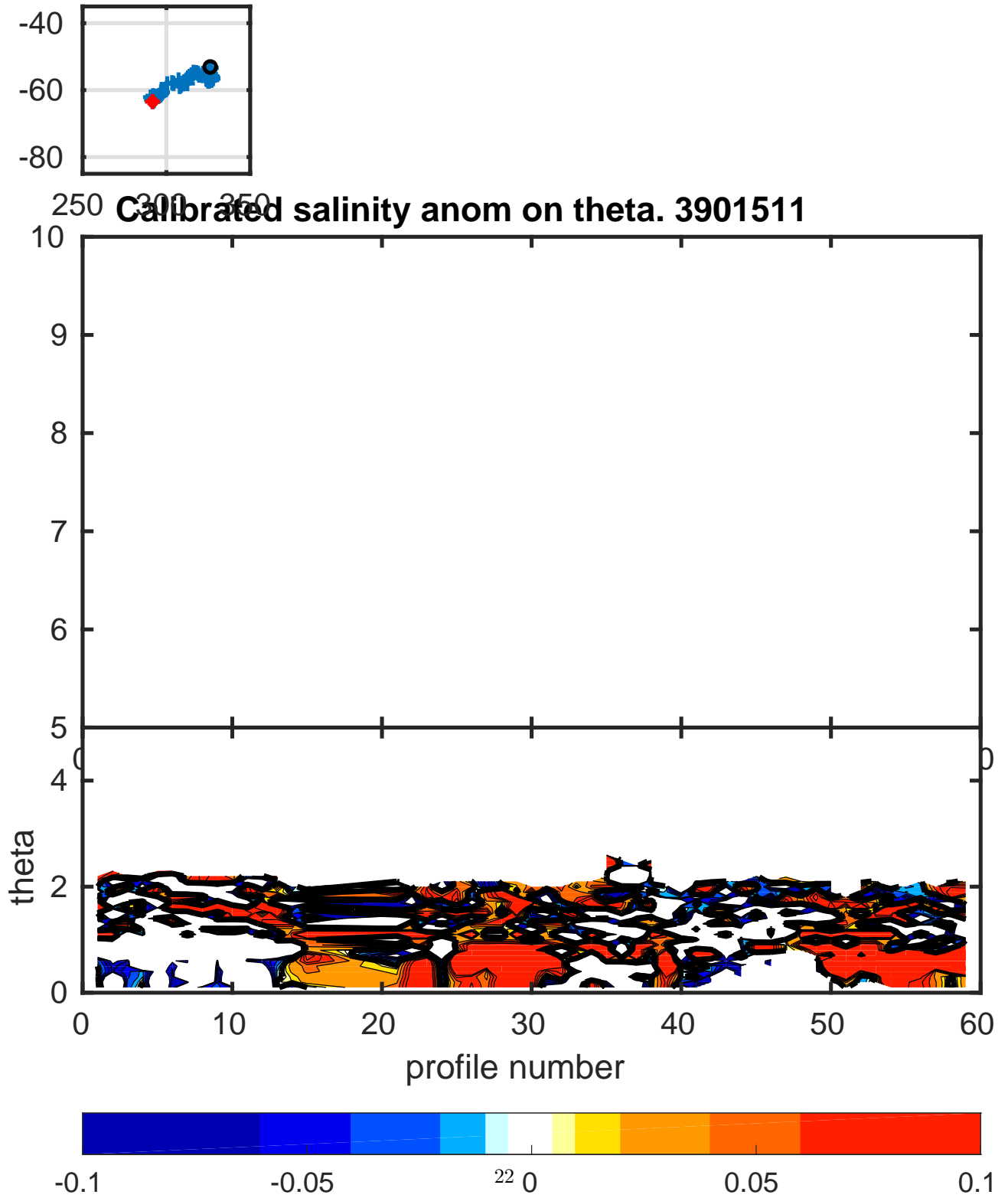


Figure 14: Float 3901511. Calibrated salinity anomaly on theta levels.

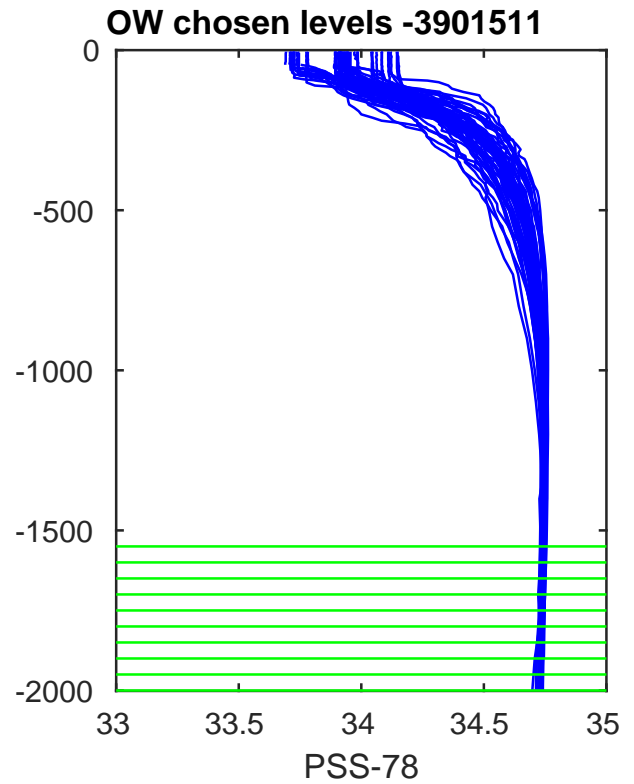
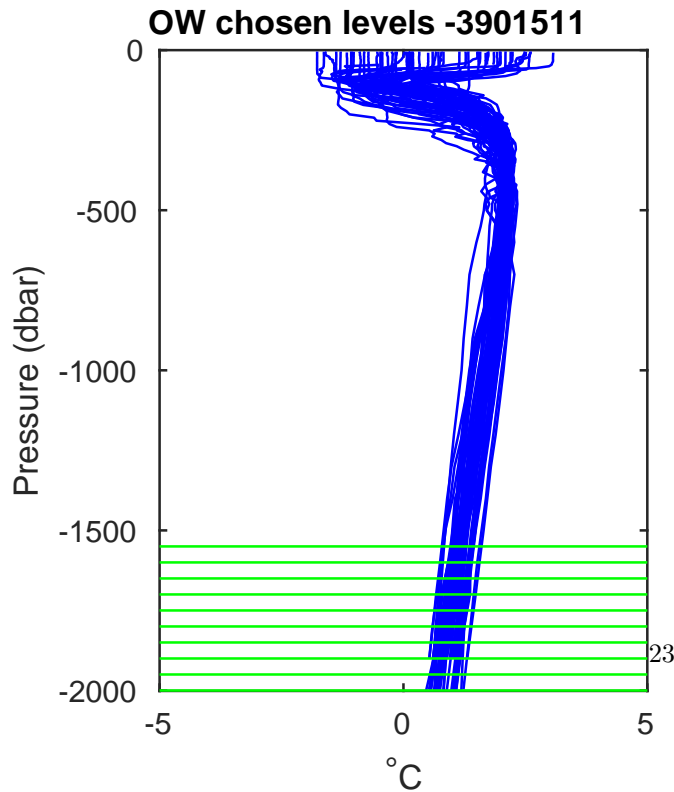
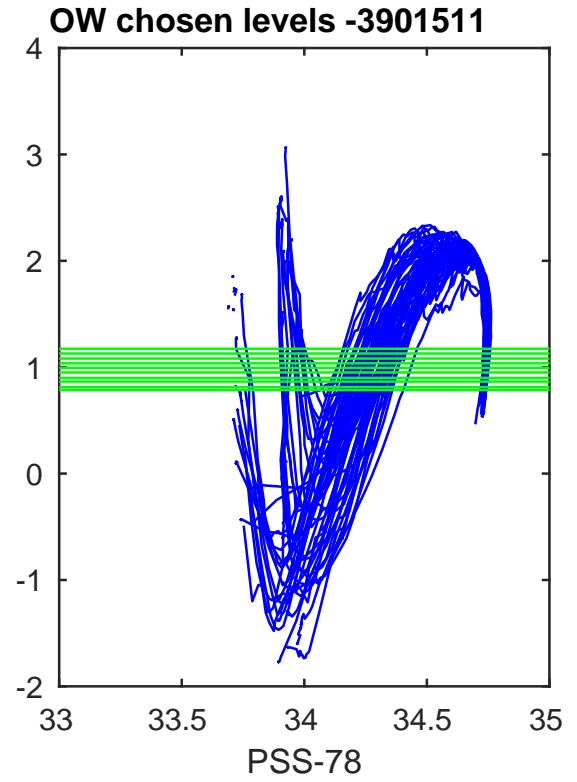
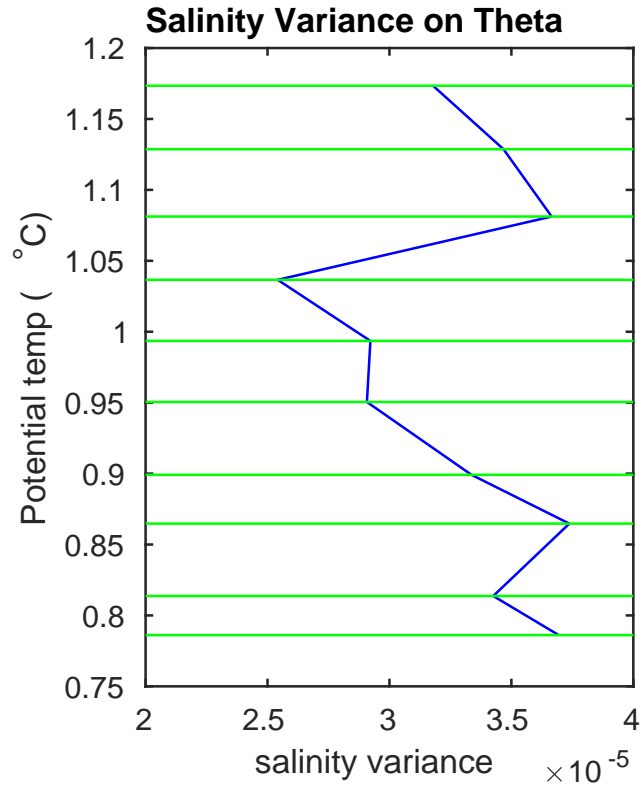


Figure 15: Float 3901511. Plots including the theta levels chosen for calibration: Top left: Salinity variance at theta levels. Top right: T/S diagram of all profiles of Argo float. Bottom left: potential temperature plotted against pressure. Bottom right: salinity plotted against pressure.

4.2 Comparison between Argo floats and Argo Climatology

4.2.1 Configuration

```
% =====  
%  
%   Climatology Data Input Paths  
%  
  
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HISTORICAL_ARGO_PREFIX=/argo_profiles/ARGO_for_DMQC_2019V03/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/

% =====
%
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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

```


4.2.2 Results

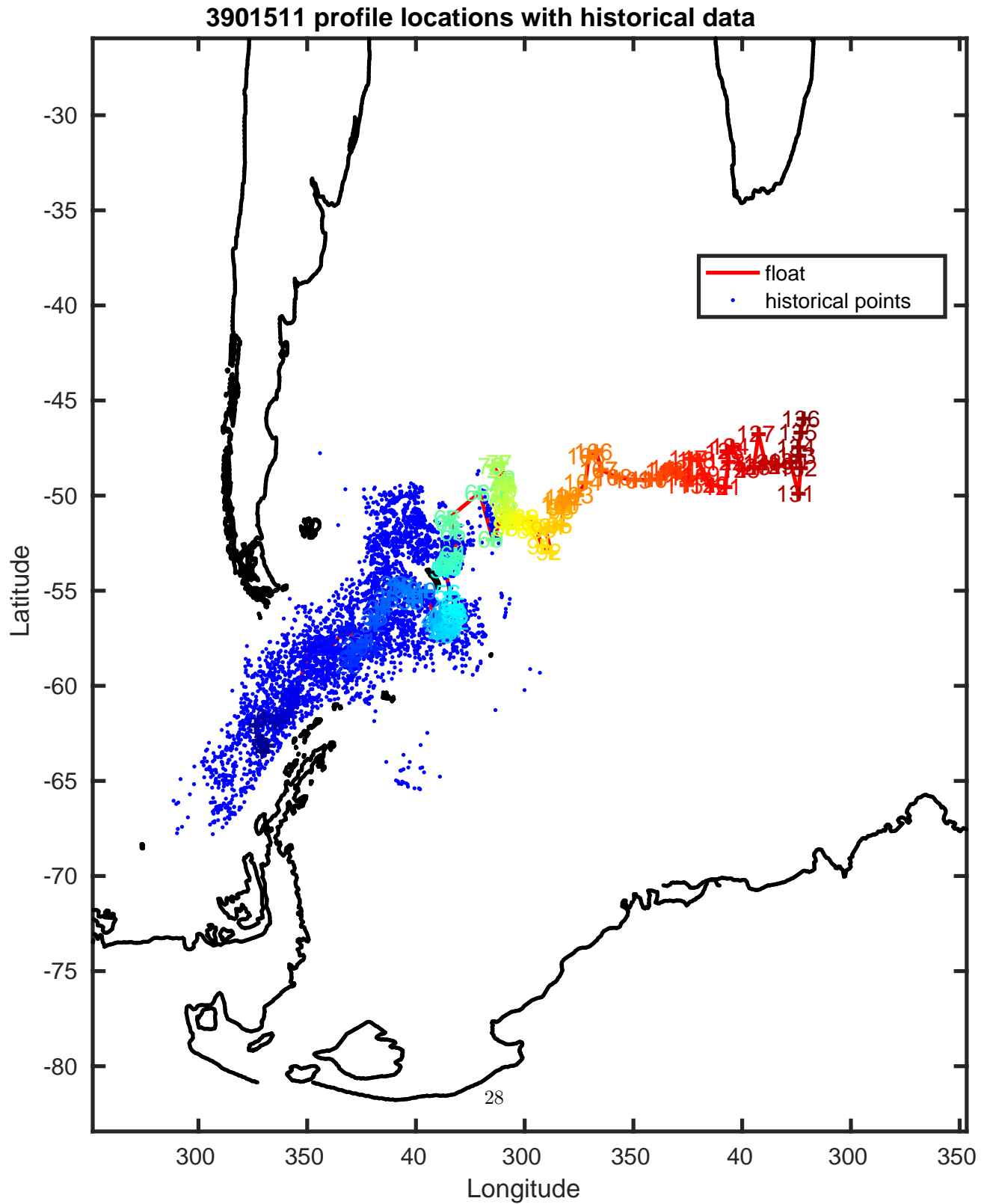


Figure 16: Float 3901511. Location of the float profiles (red line with coloured numbers) and the CTD reference data selected for mapping (blue dots). The black contours indicate the bathymetry at 0, 200, 1000 and 2000 m.

3901511 uncalibrated float data (-) and mapped salinity (o) with objective errors

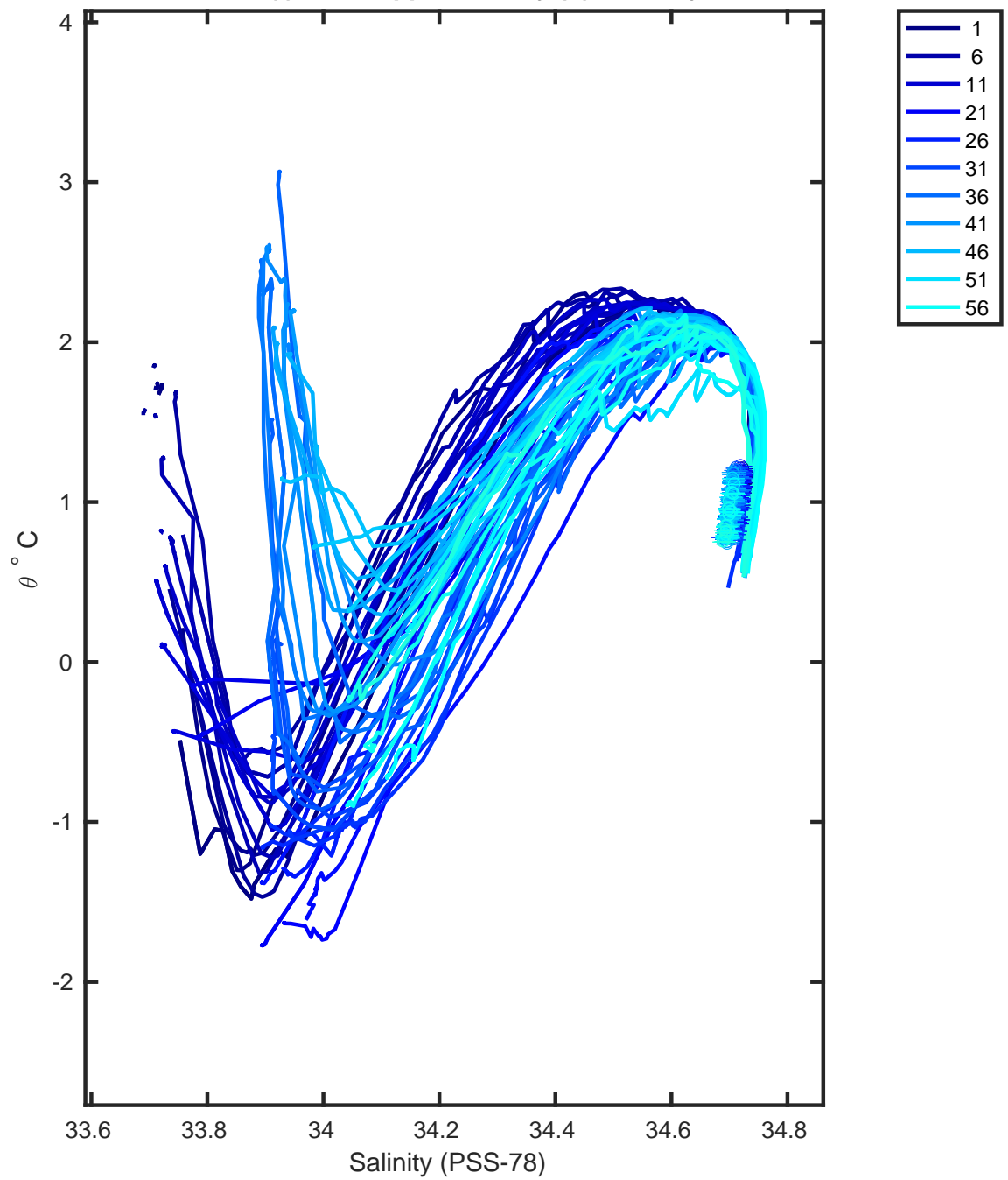
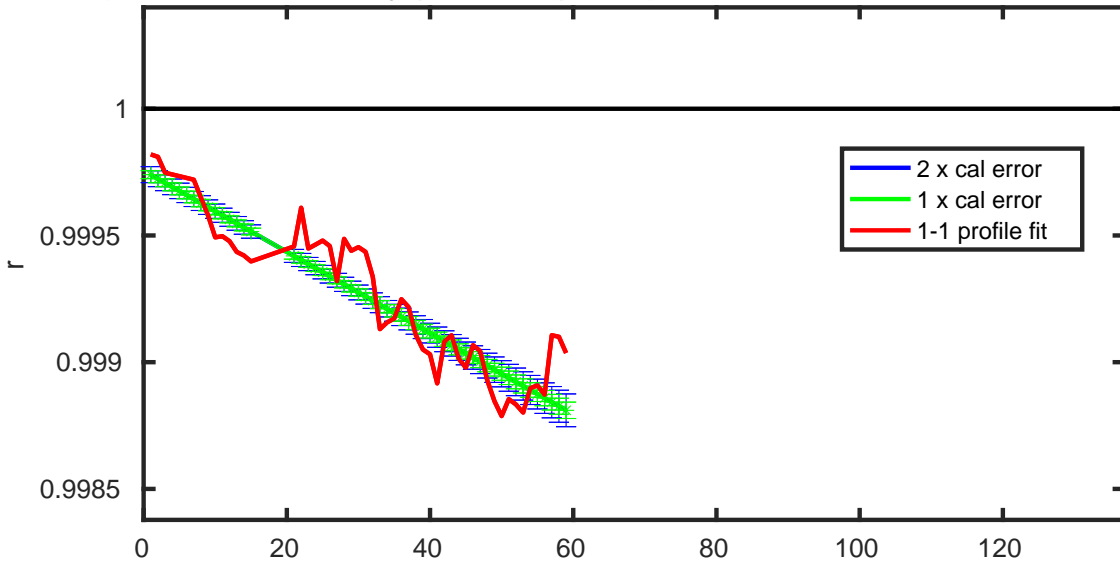


Figure 17: Float 3901511. Plots the original float salinity and the objectively estimated reference salinity at the 10 float theta levels that are used in calibration.

3901511 potential conductivity (mmho/cm) multiplicative correction r with errors



3901511 vertically-averaged salinity (PSS-78) additive correction

ΔS with errors

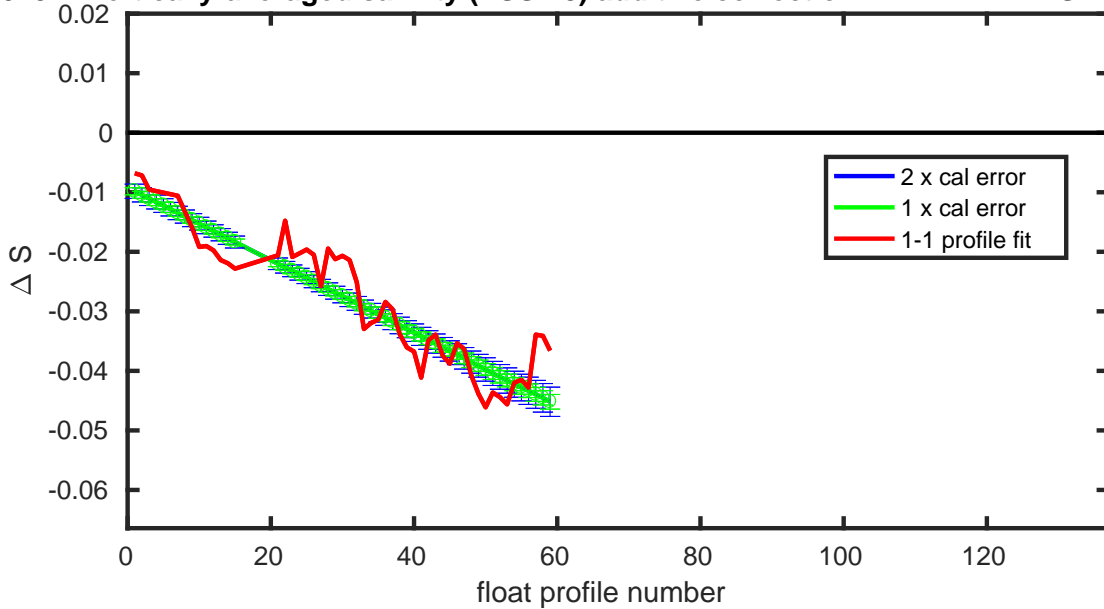


Figure 18: Float 3901511. Evolution of the suggested adjustment with time. The top panel plots the potential conductivity multiplicative adjustment. The bottom panel plots the equivalent salinity additive adjustment. The red line denotes one-to-one profile fit that uses the vertically weighted mean of each profile. The red line can be used to check for anomalous profiles relative to the optimal fit.

3901511 calibrated float data (-) and mapped salinity (o) with objective errors

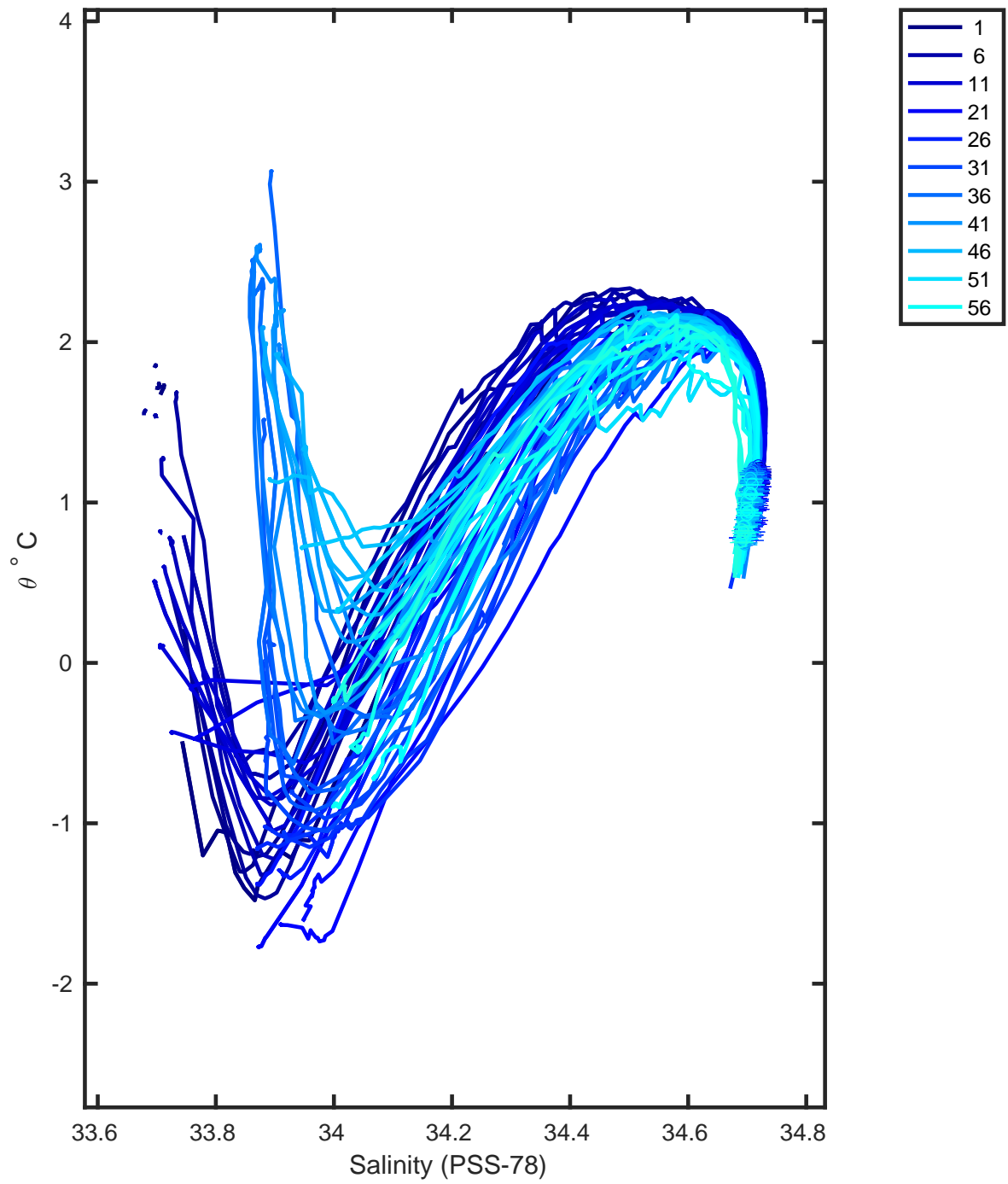


Figure 19: Float 3901511. Plots of calibrated float salinity and the objectively estimated reference salinity at the 10 float theta levels that are used in calibration.

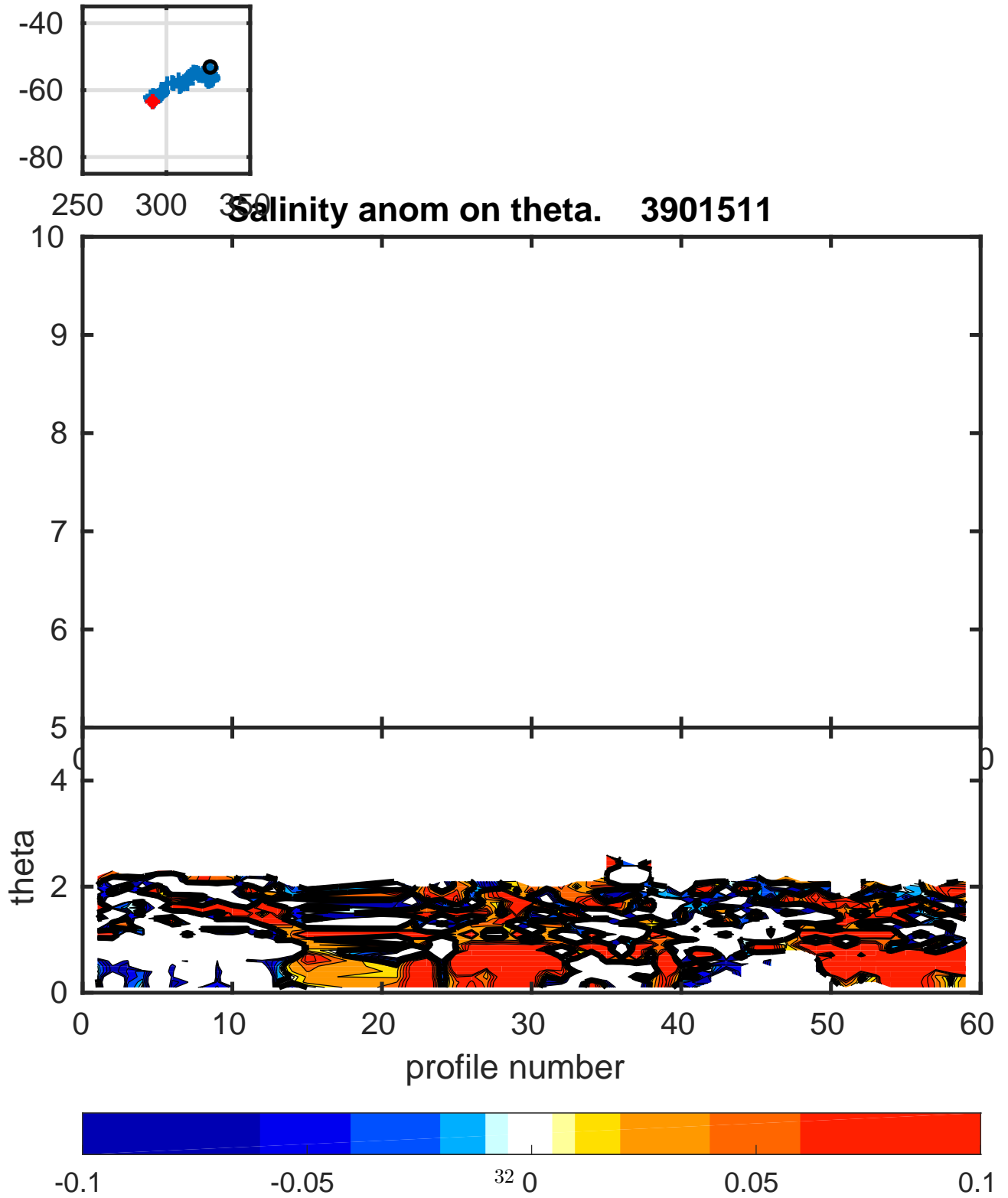


Figure 20: Float 3901511. Salinity anomaly on theta levels.

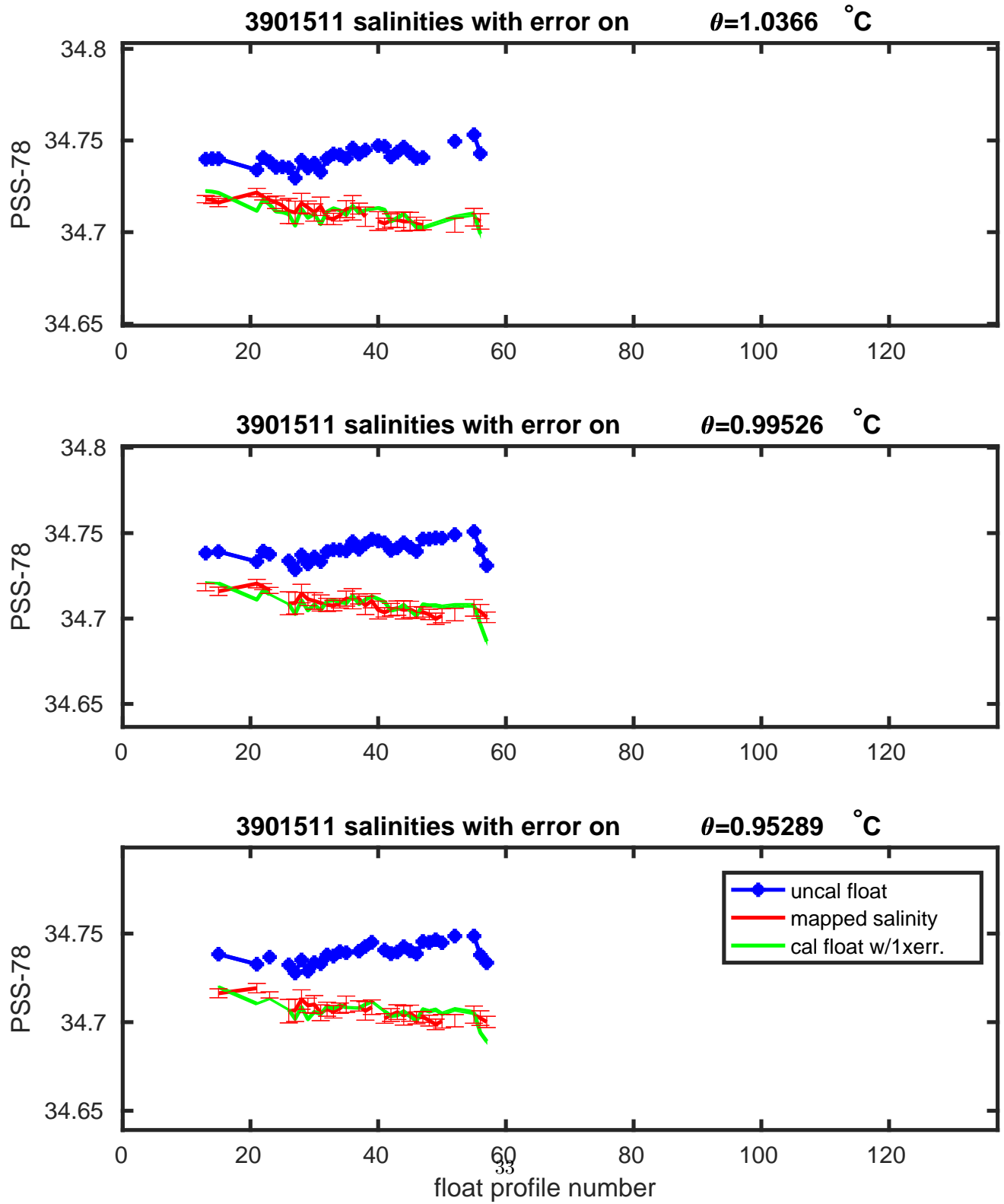


Figure 21: Float 3901511. Plots of the evolution of salinity with time along with selected theta levels with minimum salinity variance.

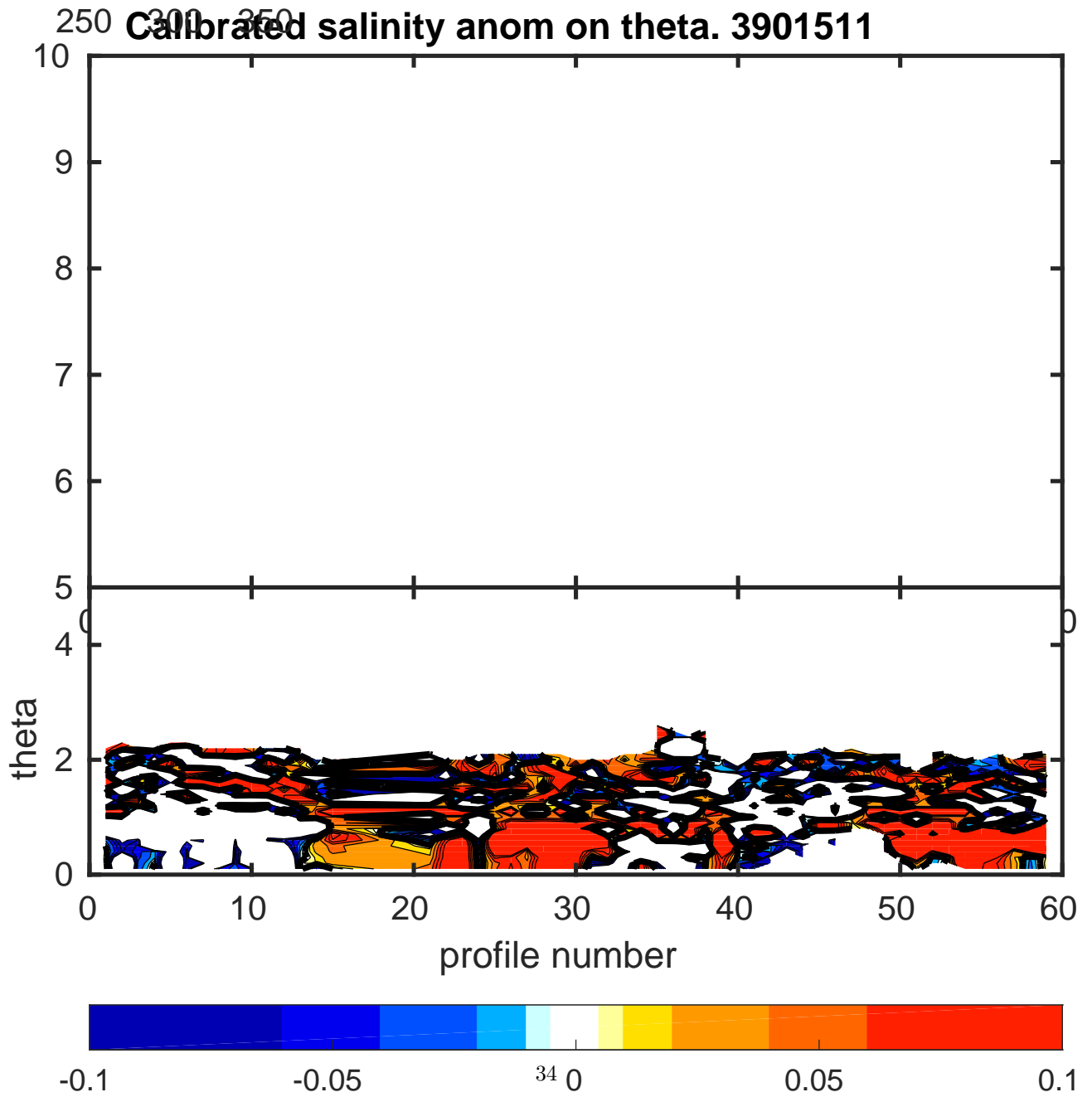
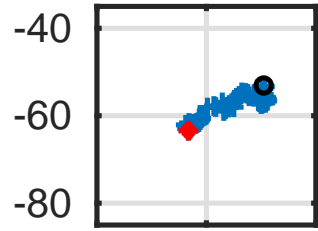


Figure 22: Float 3901511. Calibrated salinity anomaly on theta levels.

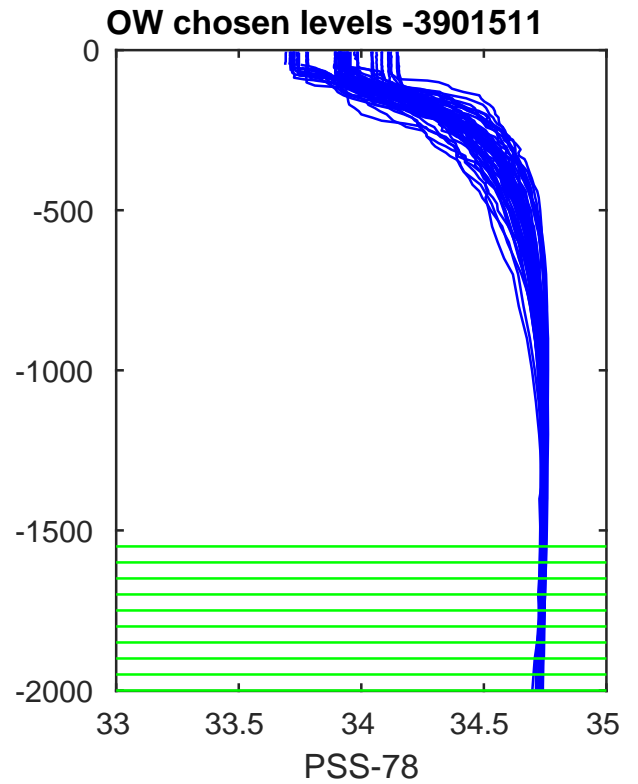
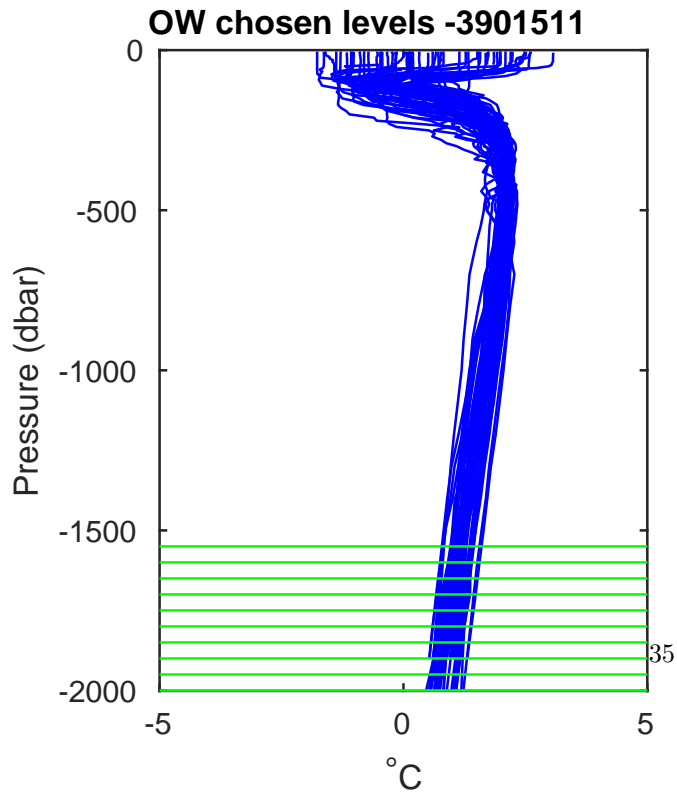
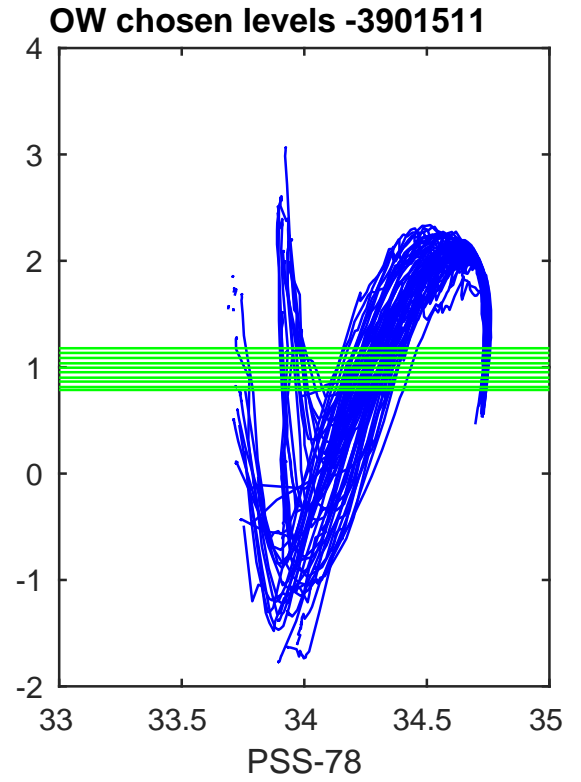
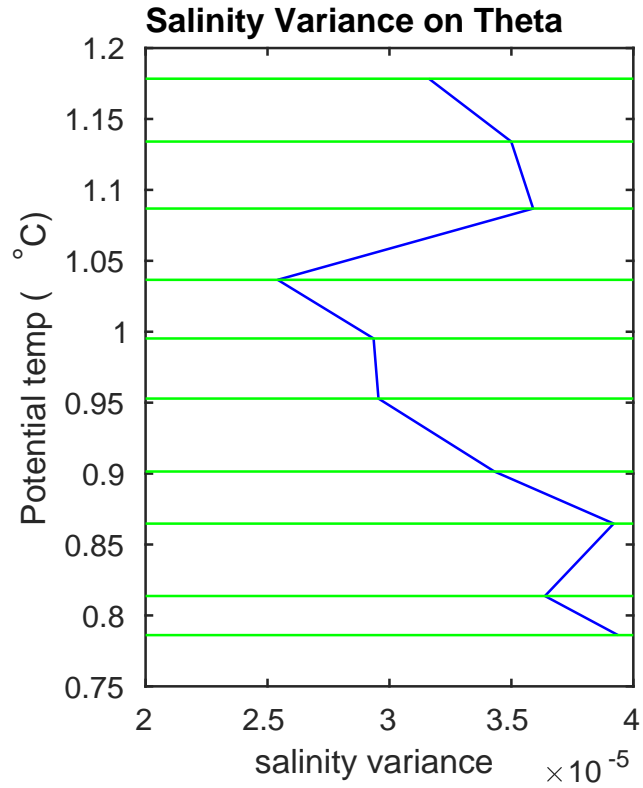


Figure 23: Float 3901511. SPlots including the theta levels chosen for calibration: Top left: Salinity variance at theta levels. Top right: T/S diagram of all profiles of Argo float. Bottom left: potential temperature plotted against pressure. Bottom right: salinity plotted against pressure.

4.3 Summary and Conclusions

Float showed strong salinity drift from the beginning of the float life. Float belong to group of float with salty drifts s/n number of CTD 6546. In the set cal series the theta has been set to be below 1500 m. From profile 1 to 54 float can be correctable by applying OWC correction. For rest of the profiles QC remains 4.

5 References