

Delayed Mode Quality Control of Argo float 3901888

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Float decision

Profile 1-95 QC=1, error=0.01. No corrections required. Profiles 96-112, QC=2, error =0.01, salty drift detected, OWC applied. Profiles 113-131 QC=4.

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1 Introduction

Delayed mode analysis was performed for float number 390720 (WMO: 3901888) 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 3901888 click on the following link: <http://www.ifremer.fr/argoMonitoring/float/3901888>

2 Quality Check of Argo Float Data

2.1 Satellite Altimeter comparison

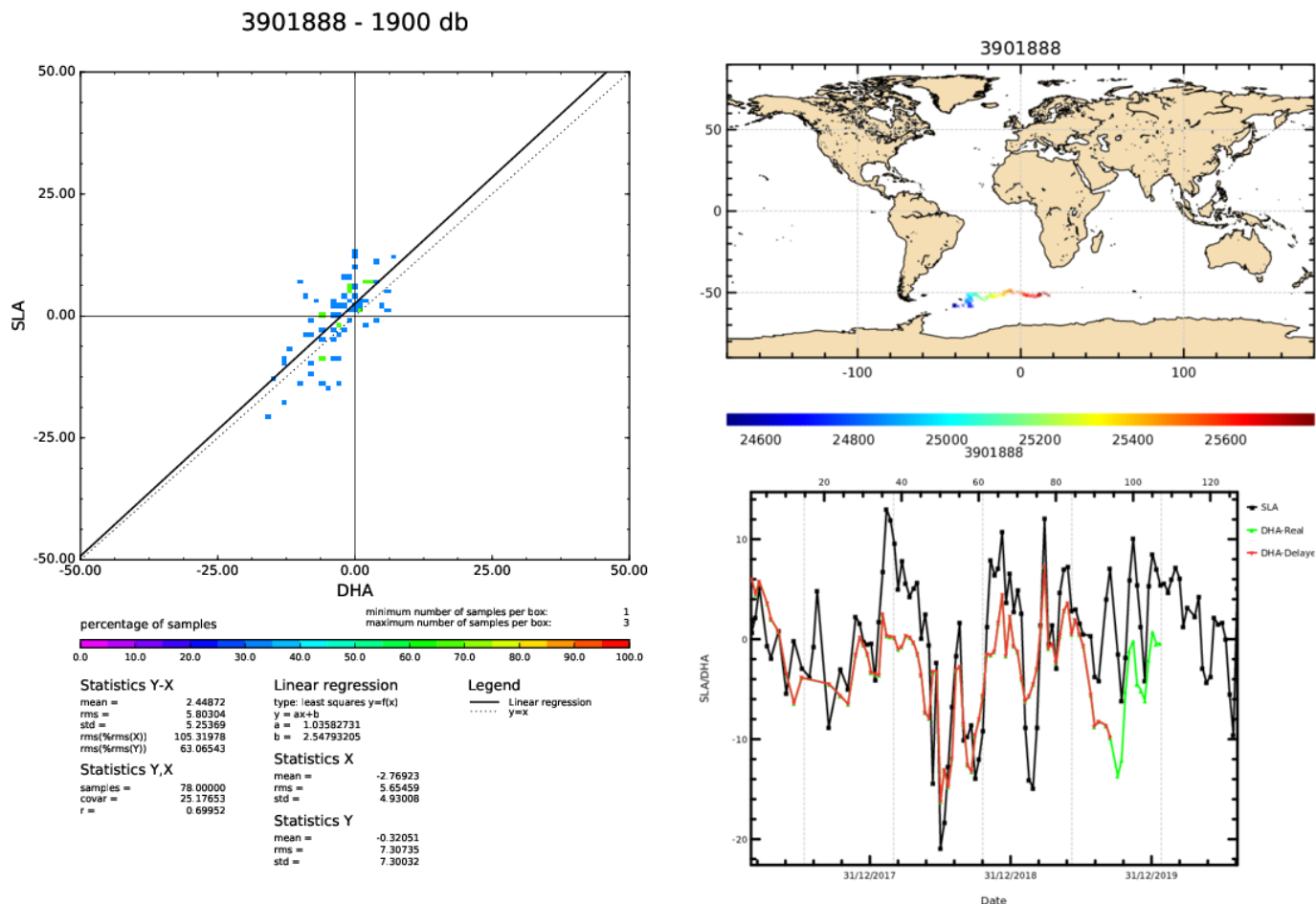


Figure 1: Float 3901888. The comparison between the Sea Surface Height (SSH) from the satellite altimetry and Dynamic Height Anomaly (DHA) extracted from the Argo float temperature and salinity data (<ftp://ftp.ifremer.fr/ifremer/argo/etc/argo-ast9-item13-AltimeterComparison/figures/>).

2.2 Time Series of Vertical Distribution of Data

Float 3901888 Potential Temperature

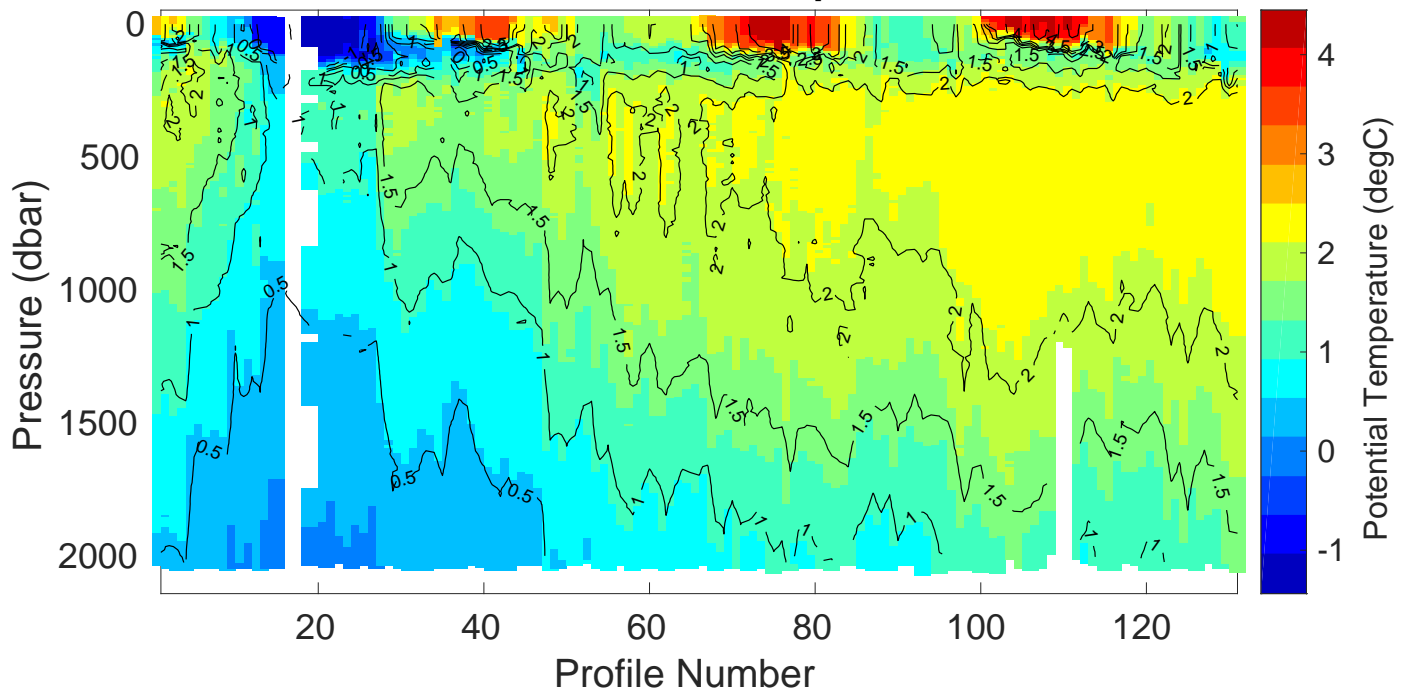


Figure 2: Float 3901888. Time series of the vertical distribution of potential temperature ($^{\circ}\text{C}$).

Float 3901888 Salinity (PSS-78)

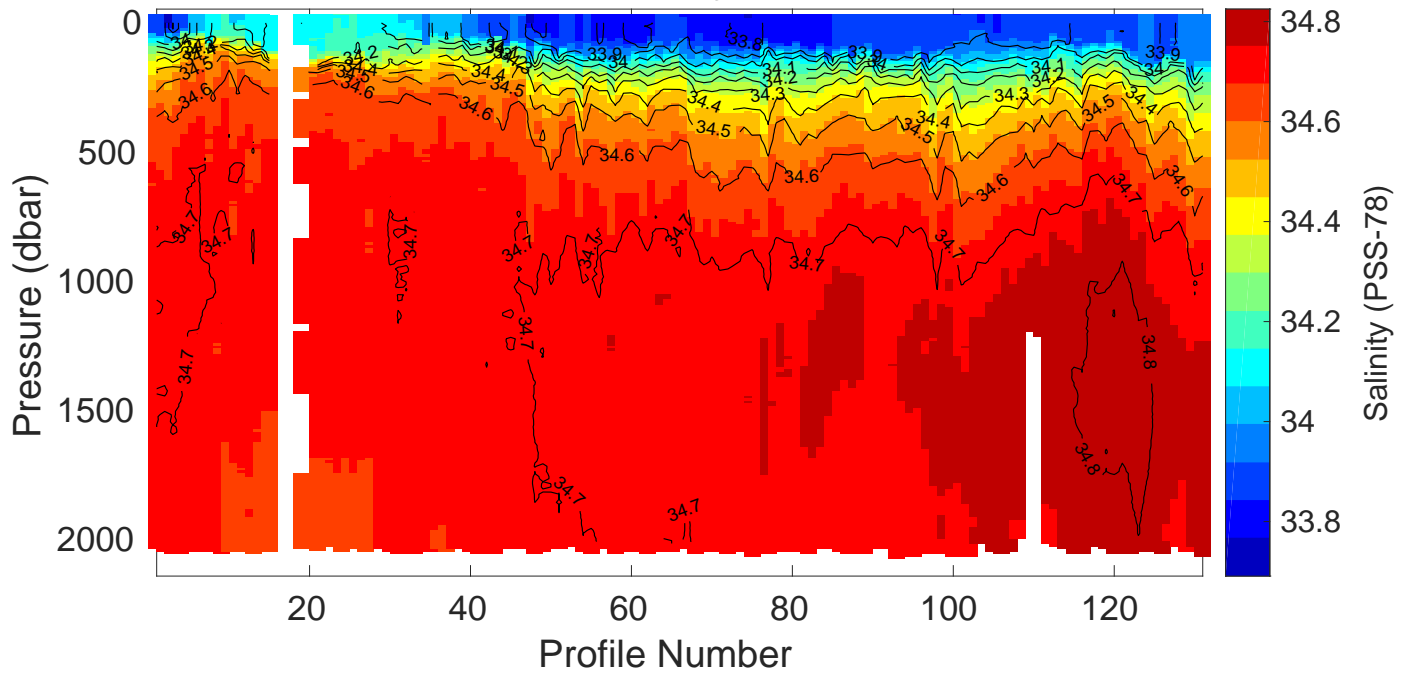


Figure 3: Float 3901888. Time series of the vertical distribution of salinity (PSS-78).

2.3 Comparison between Argo Float and Climatology

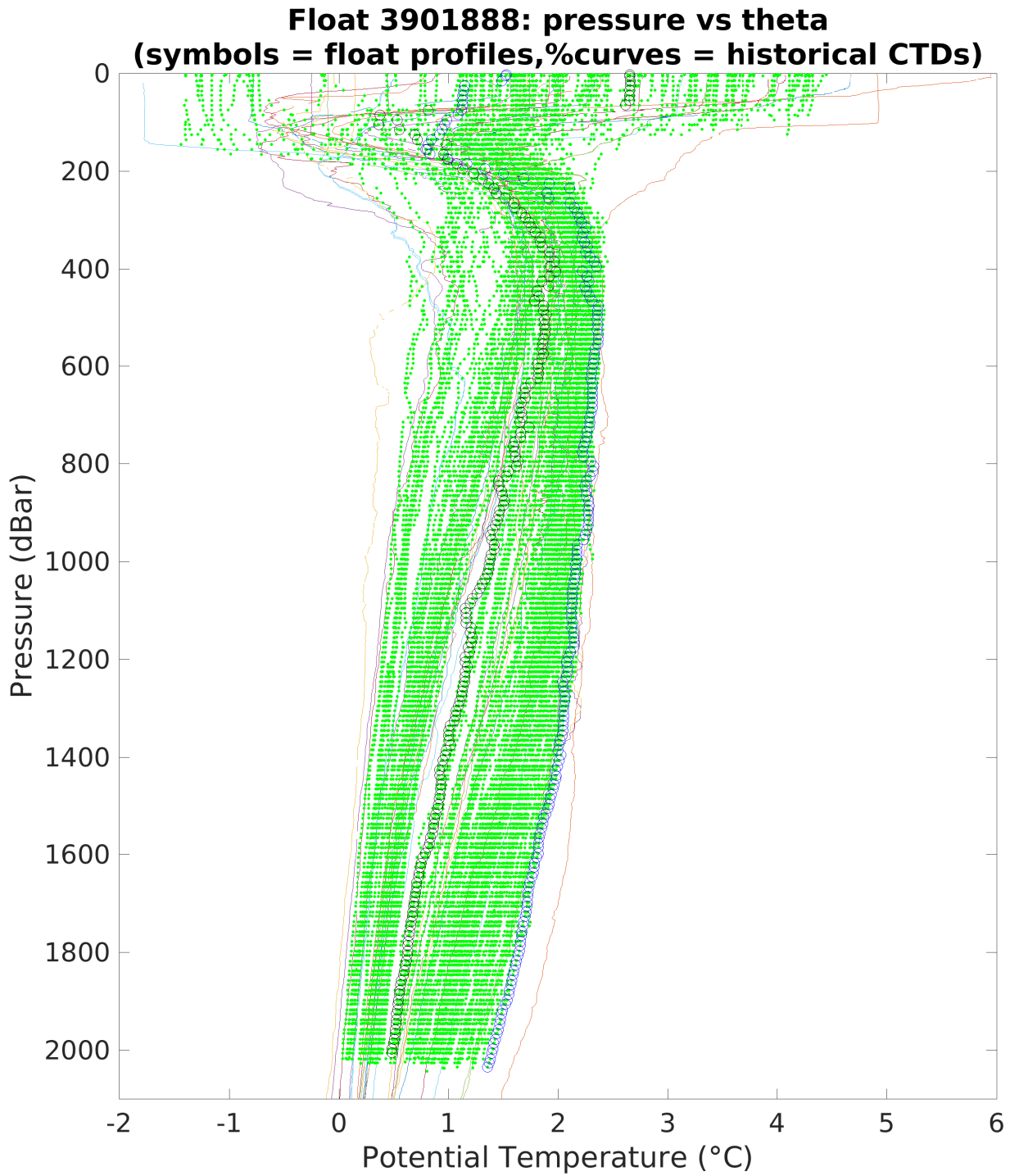


Figure 4: Float 3901888. Potential temperature (°C) plotted with pressure (dBar) and data from WMO boxes of CTD reference data (CTD for DMQC 2019V01) +/- 10 °of latitude and longitude. The black and blue cycles indicates the first and the last Argo profile, respectively. Green symbols represent other Argo profiles from this float. The thin colors lines indicate the reference data

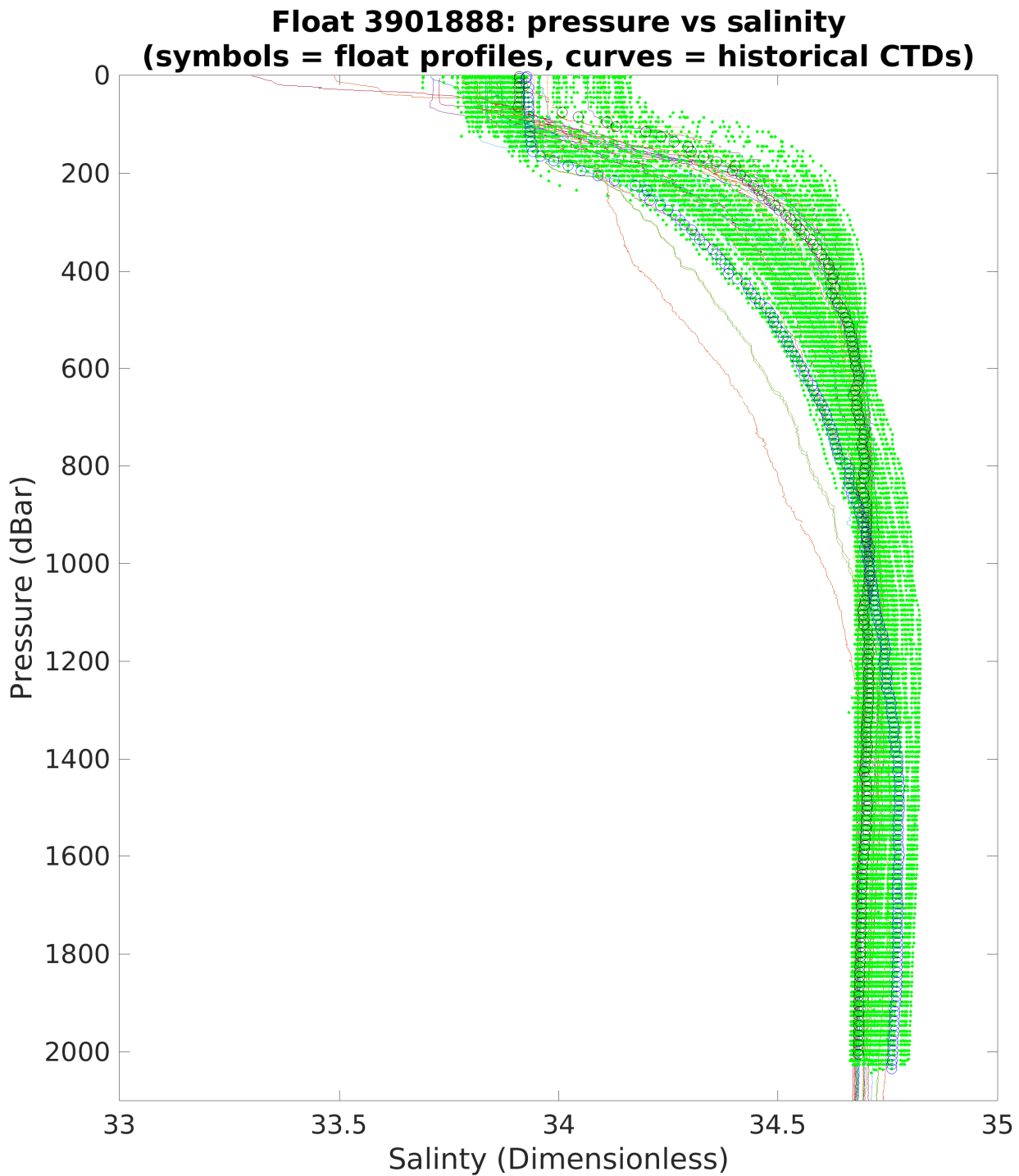


Figure 5: Float 3901888. Salinity (PSS-78) plotted with pressure (dBar) and data from WMO boxes of CTD reference data (CTD for DMQC 2019V01) $\pm 10^\circ$ of latitude and longitude. The black and blue cycles indicates the first and the last Argo profile, respectively. Green symbols represent other Argo profiles from this float. The thin colors lines indicate the reference data.

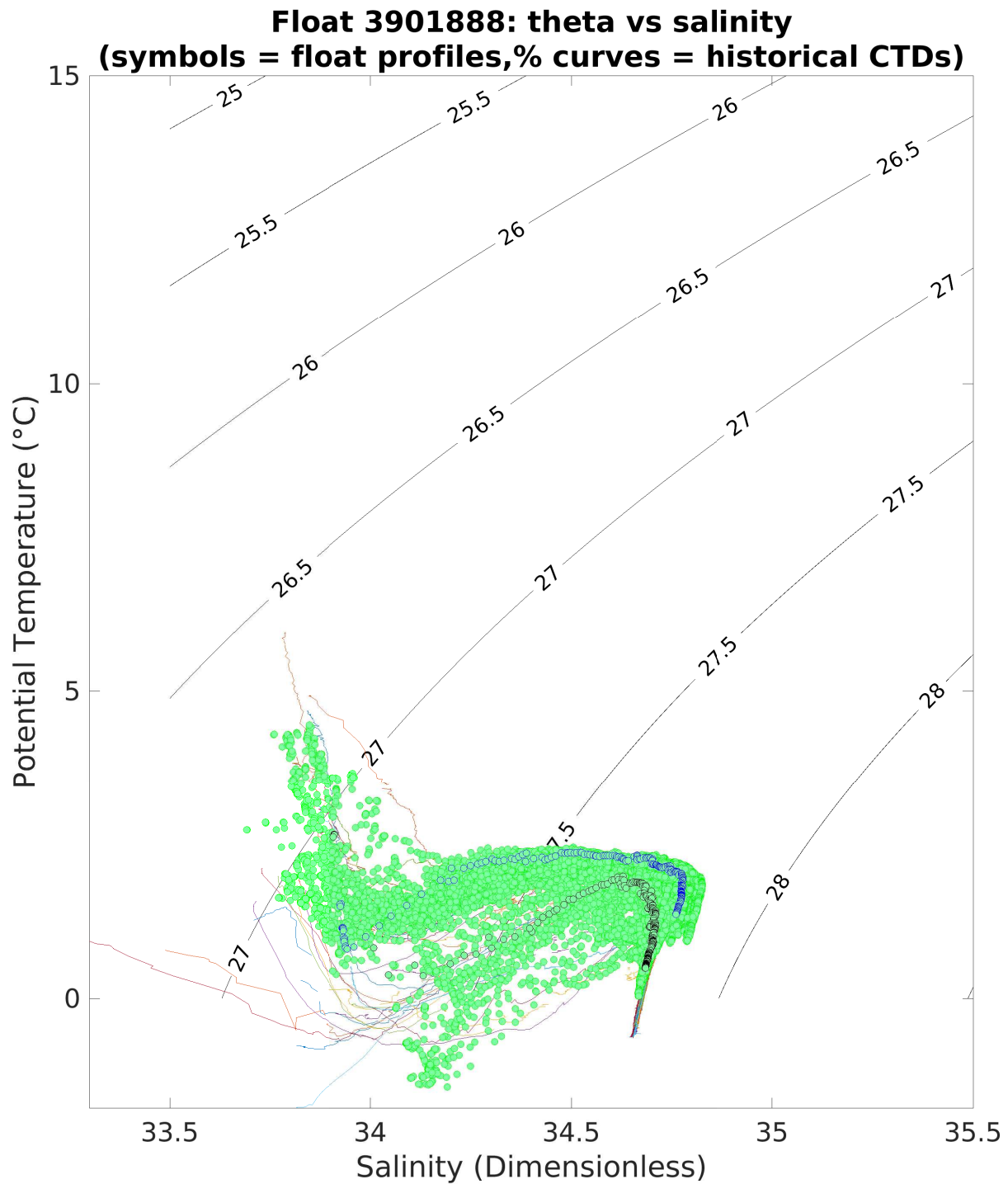


Figure 6: Float 3901888. T/S diagram plotted with and data from WMO boxes of CTD reference data (CTD for DMQC 2019V01) +/- 10° of latitude and longitude. The black and blue cycles indicates the first and the last Argo profile, respectively. Green symbols represent other Argo profiles from this float.

3 Correction of Salinity Data

3.1 Comparison between Argo floats and CTD Climatlogy

3.1.1 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.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=5  
MAPSCALE_AGE_LARGE=10  
  
% 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
```


3.1.2 Results

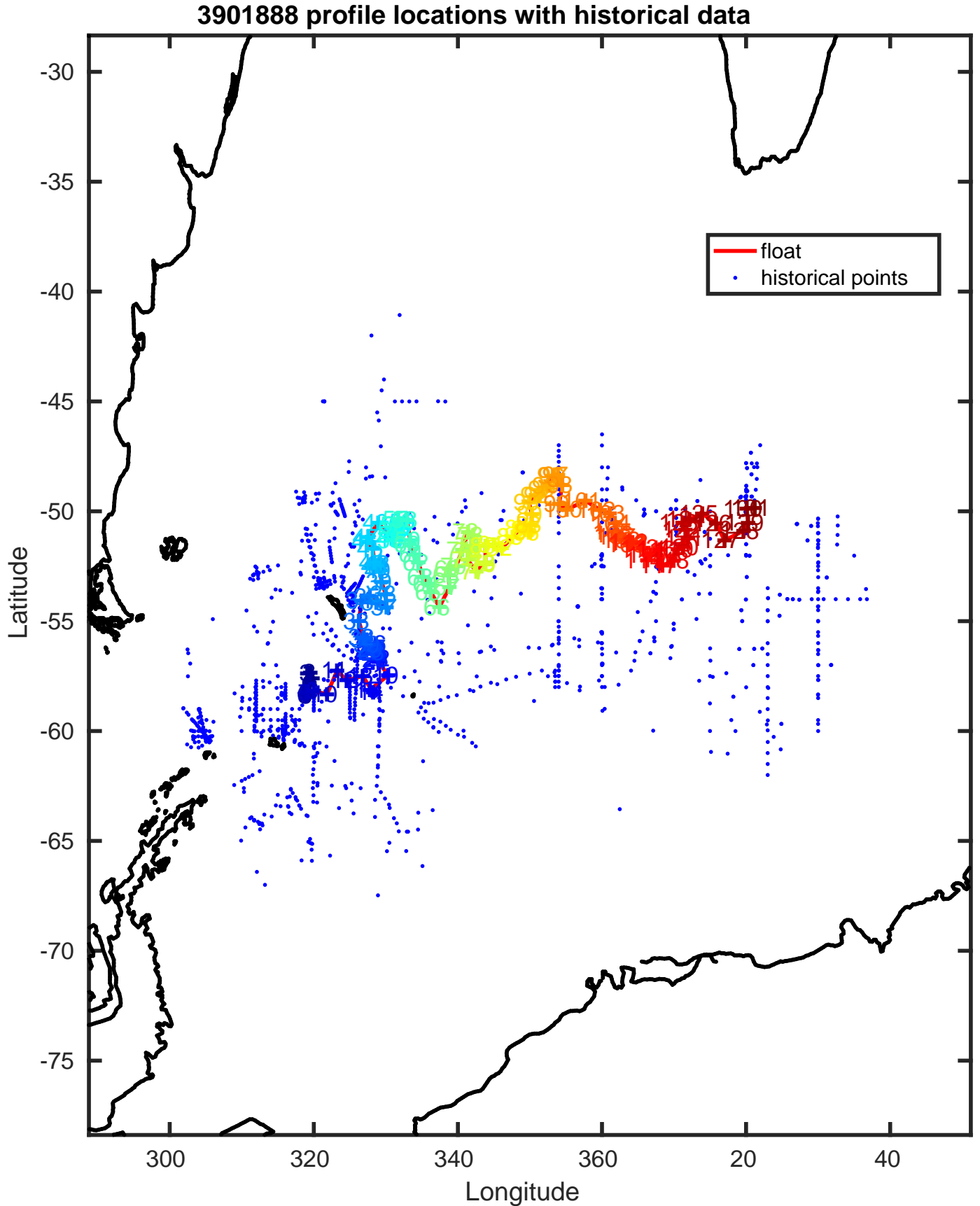


Figure 7: Float 3901888. Location of the float profiles (red line with coloured numbers) and the CTD reference data selected for mapping (blue dots). The black contours indicate the bathymetry at 0, 200, 1000 and 2000 m.

3901888 uncalibrated float data (-) and mapped salinity (o) with objective errors

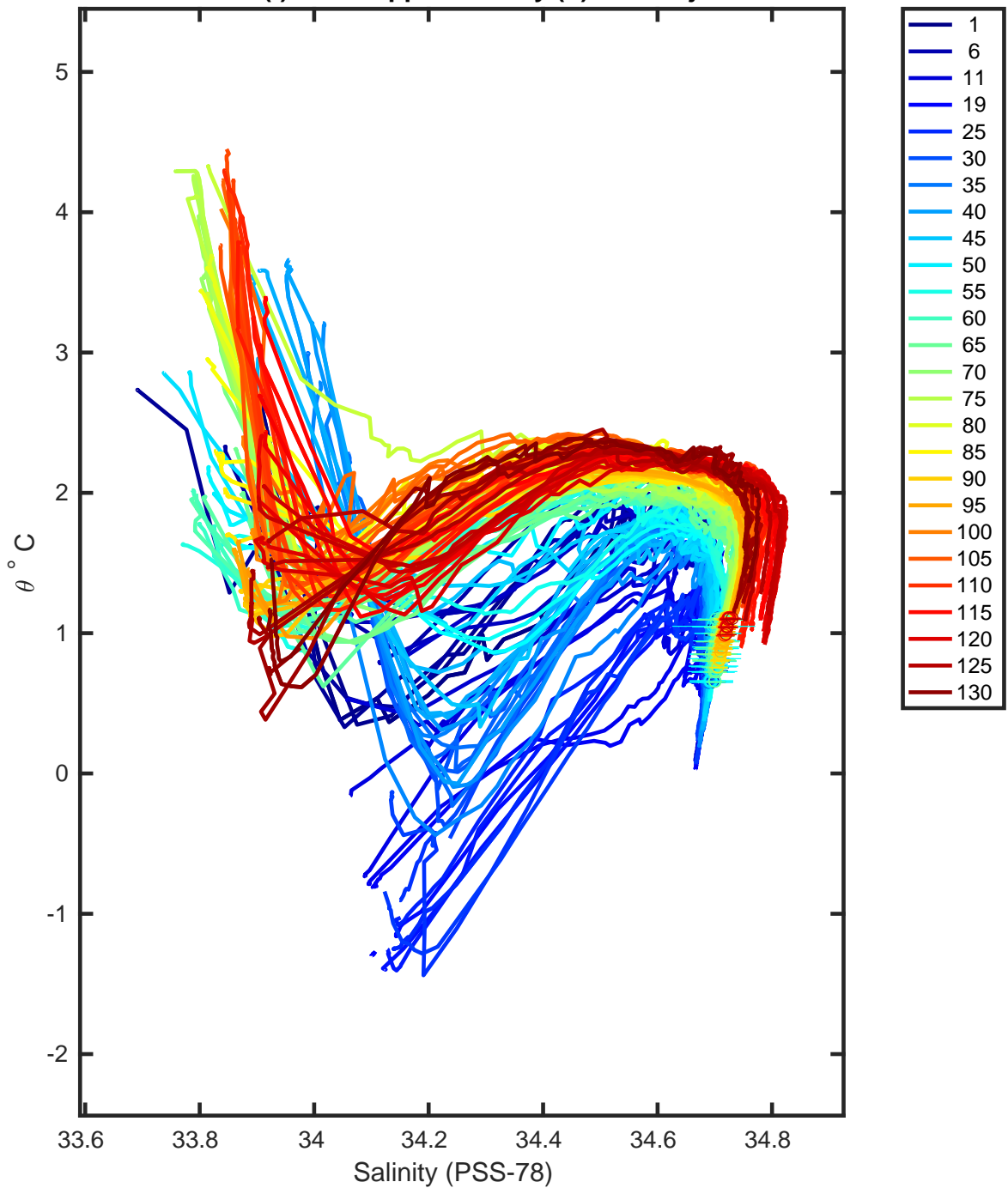
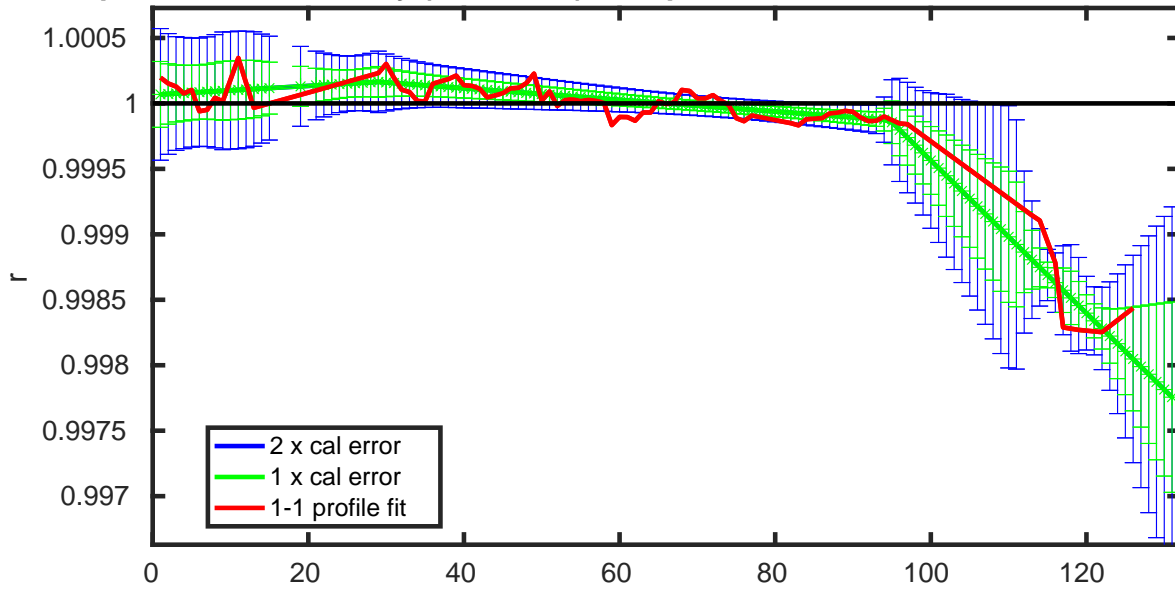


Figure 8: Float 3901888. Plots the original float salinity and the objectively estimated reference salinity at the 10 float theta levels that are used in calibration.

3901888 potential conductivity (mmho/cm) multiplicative correction r with errors



3901888 vertically-averaged salinity (PSS-78) additive correction

ΔS with errors

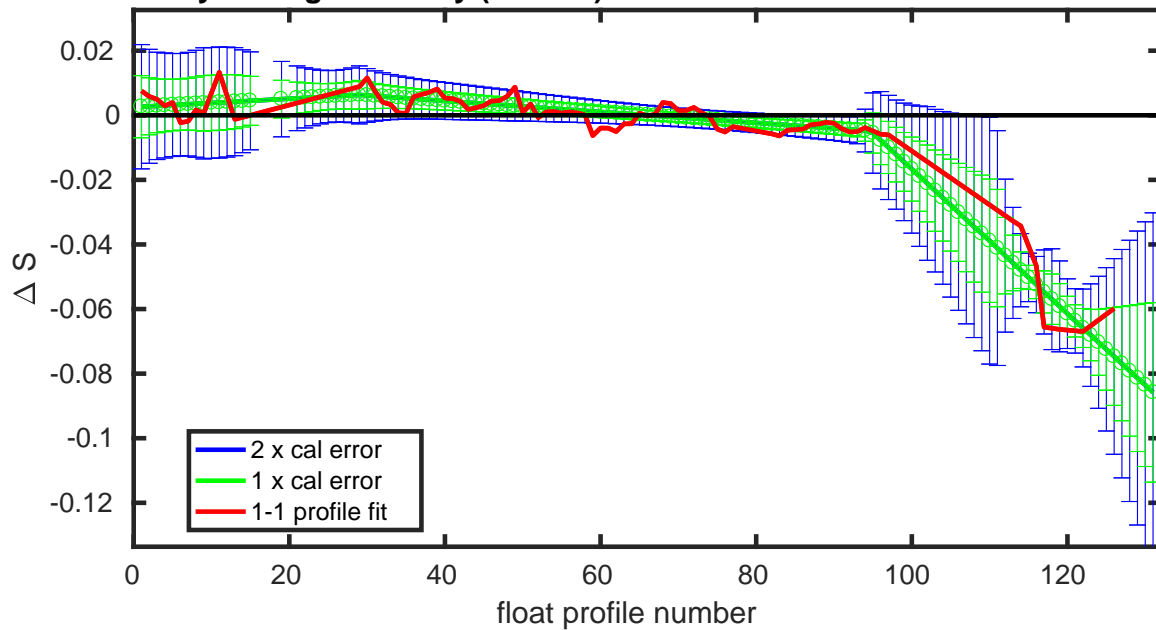


Figure 9: Float 3901888. Evolution of the suggested adjustment with time. The top panel plots the potential conductivity multiplicative adjustment. The bottom panel plots the equivalent salinity additive adjustment. The red line denotes one-to-one profile fit that uses the vertically weighted mean of each profile. The red line can be used to check for anomalous profiles relative to the optimal fit.

3901888 calibrated float data (-) and mapped salinity (o) with objective errors

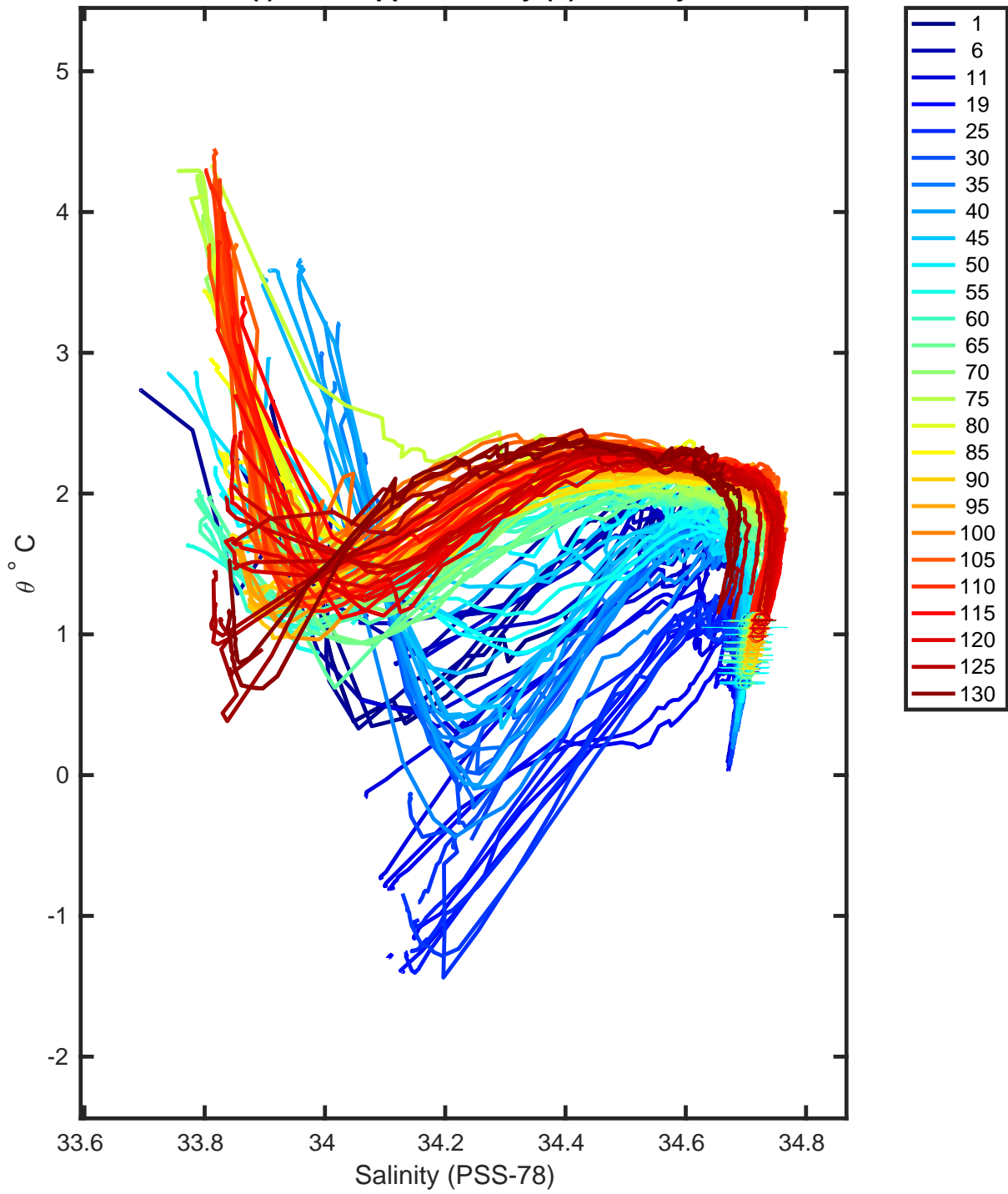


Figure 10: Float 3901888. Plots of calibrated float salinity and the objectively estimated reference salinity at the 10 float theta levels that are used in calibration.

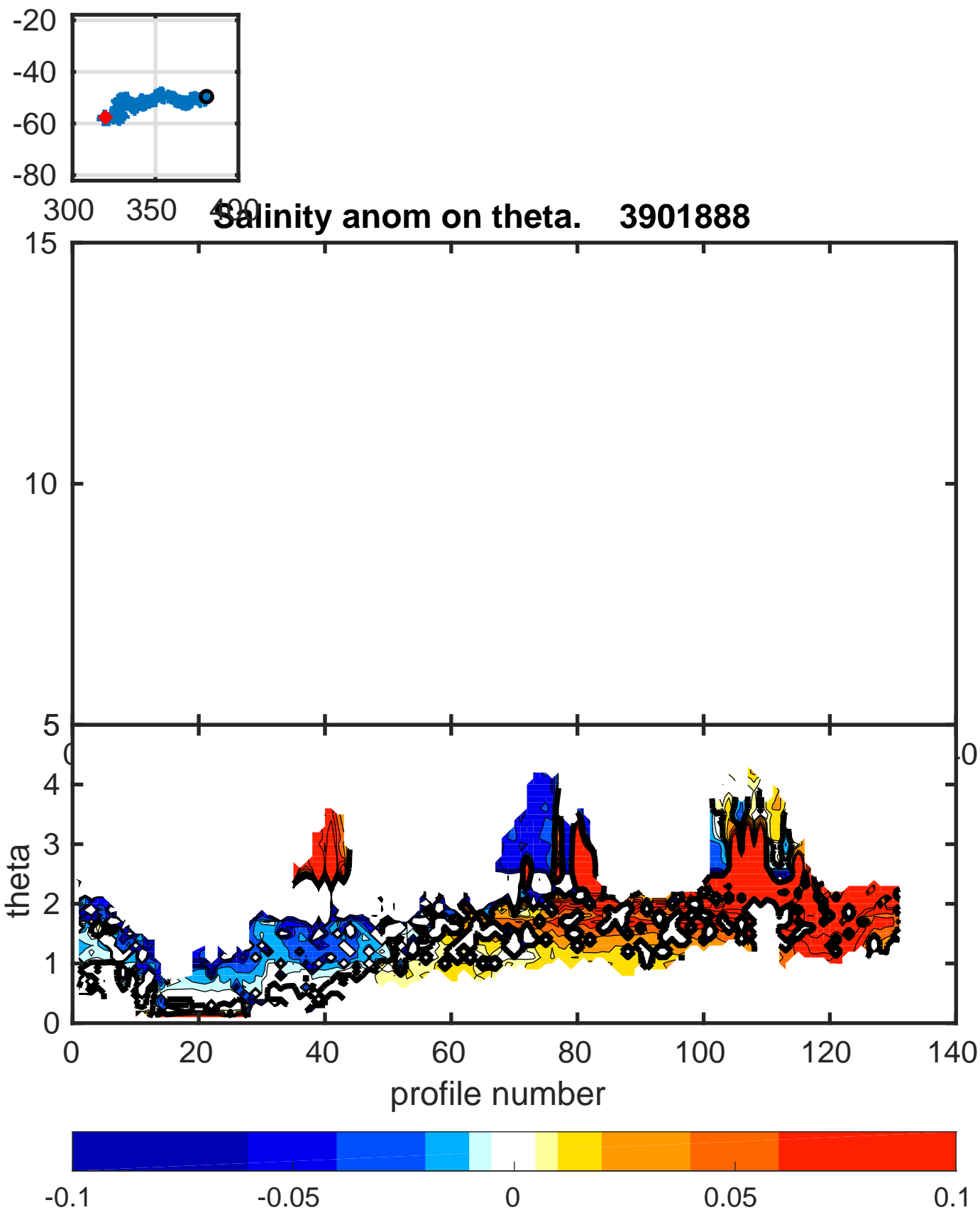


Figure 11: Float 3901888. Salinity anomaly on theta levels.

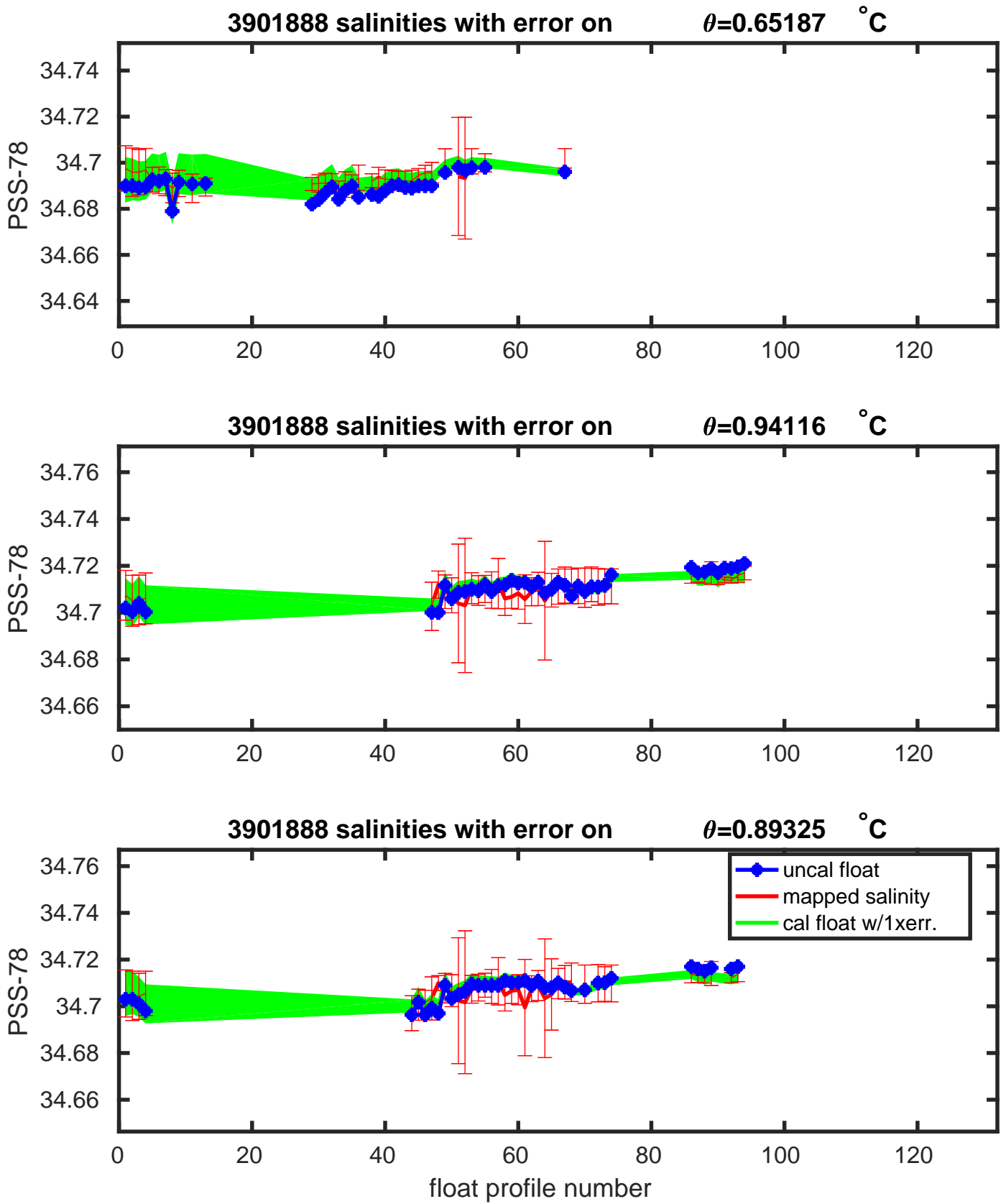


Figure 12: Float 3901888. Plots of the evolution of salinity with time along with selected theta levels with minimum salinity variance.

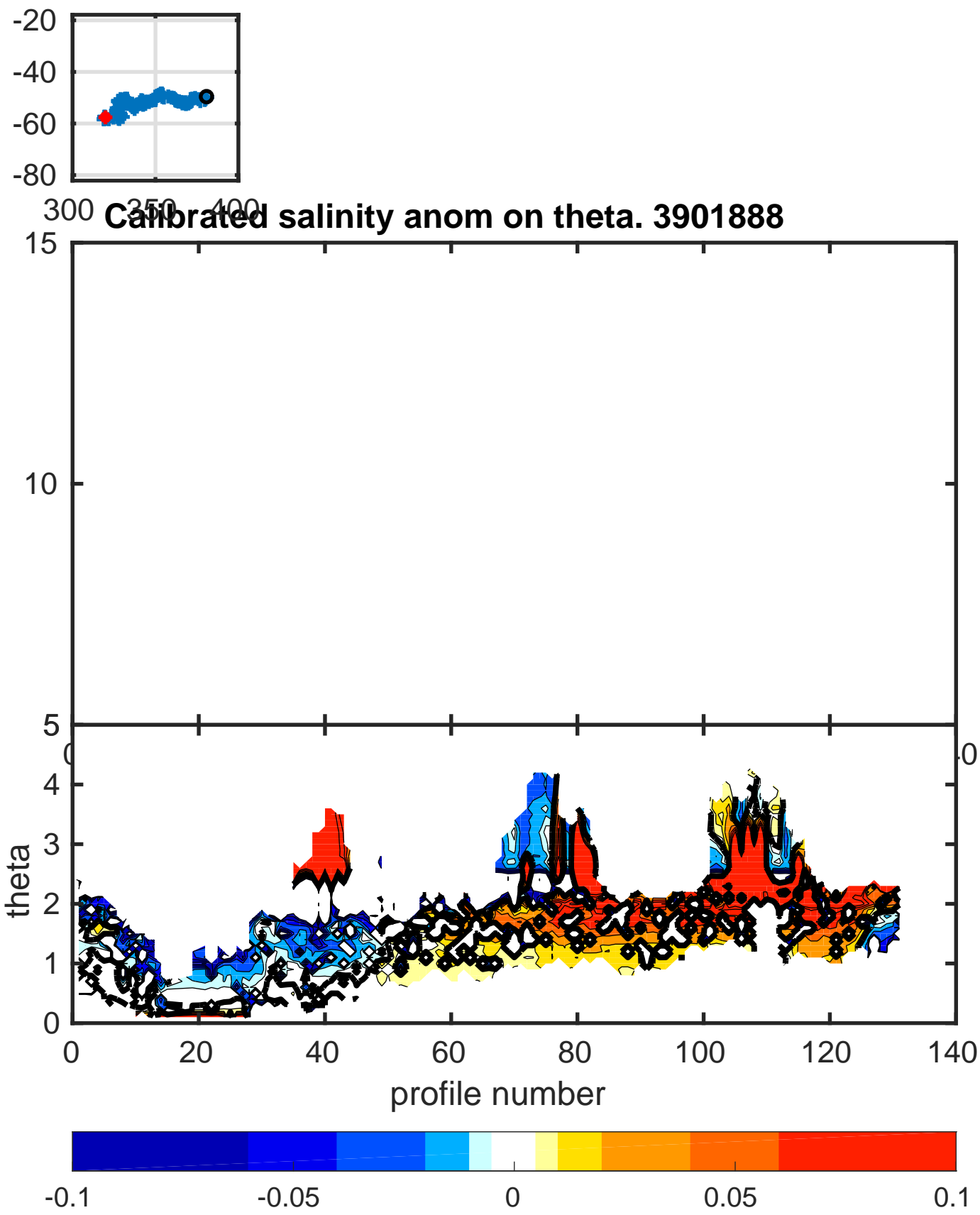


Figure 13: Float 3901888. Calibrated salinity anomaly on theta levels.

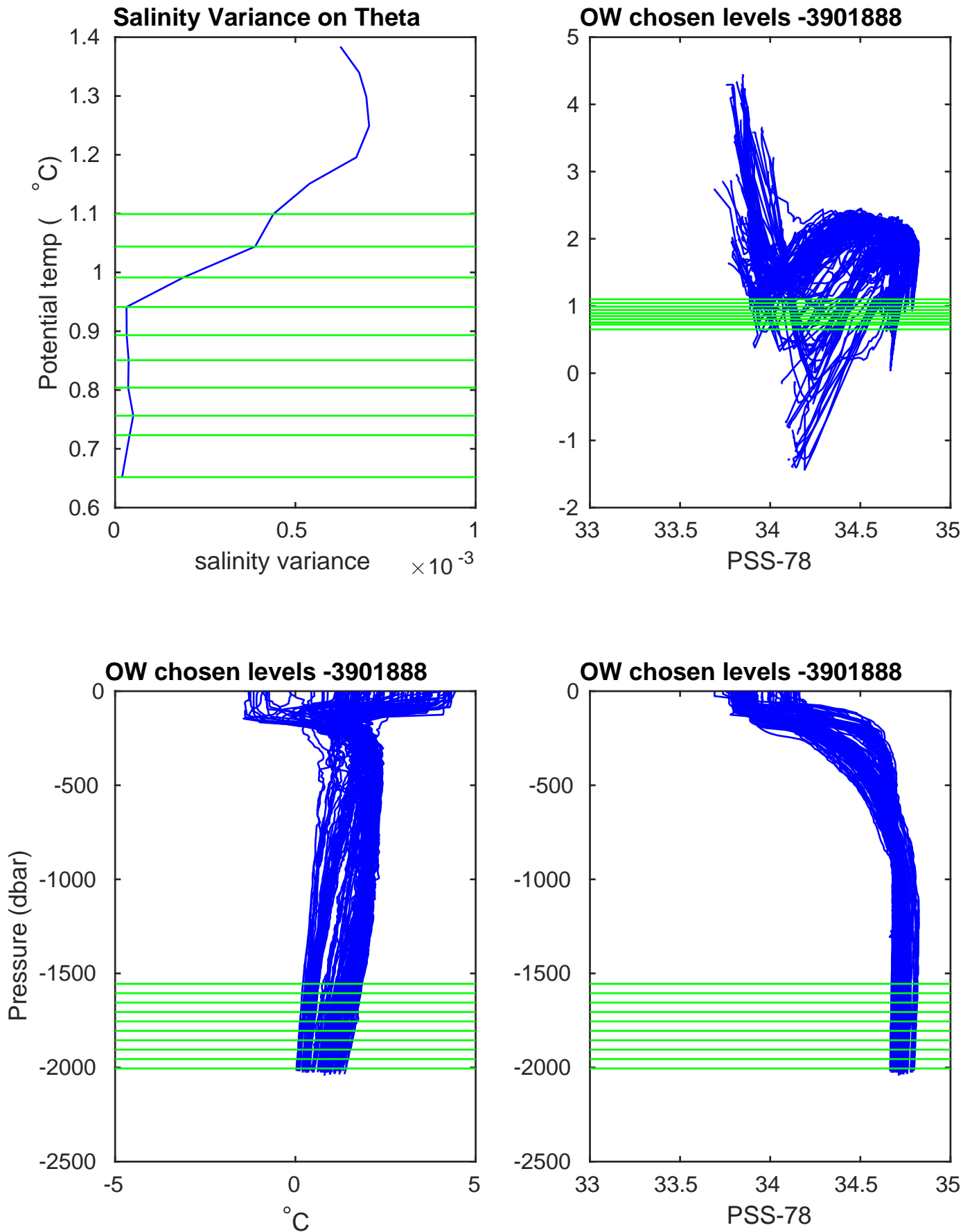


Figure 14: Float 3901888. Plots including the theta levels chosen for calibration: Top left: Salinity variance at theta levels. Top right: T/S diagram of all profiles of Argo float. Bottom left: potential temperature plotted against pressure. Bottom right: salinity plotted against pressure.

3.2 Comparison between Argo floats and Argo Climatology

3.2.1 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=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=5  
MAPSCALE_AGE_LARGE=10  
  
% 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
```


3.2.2 Results

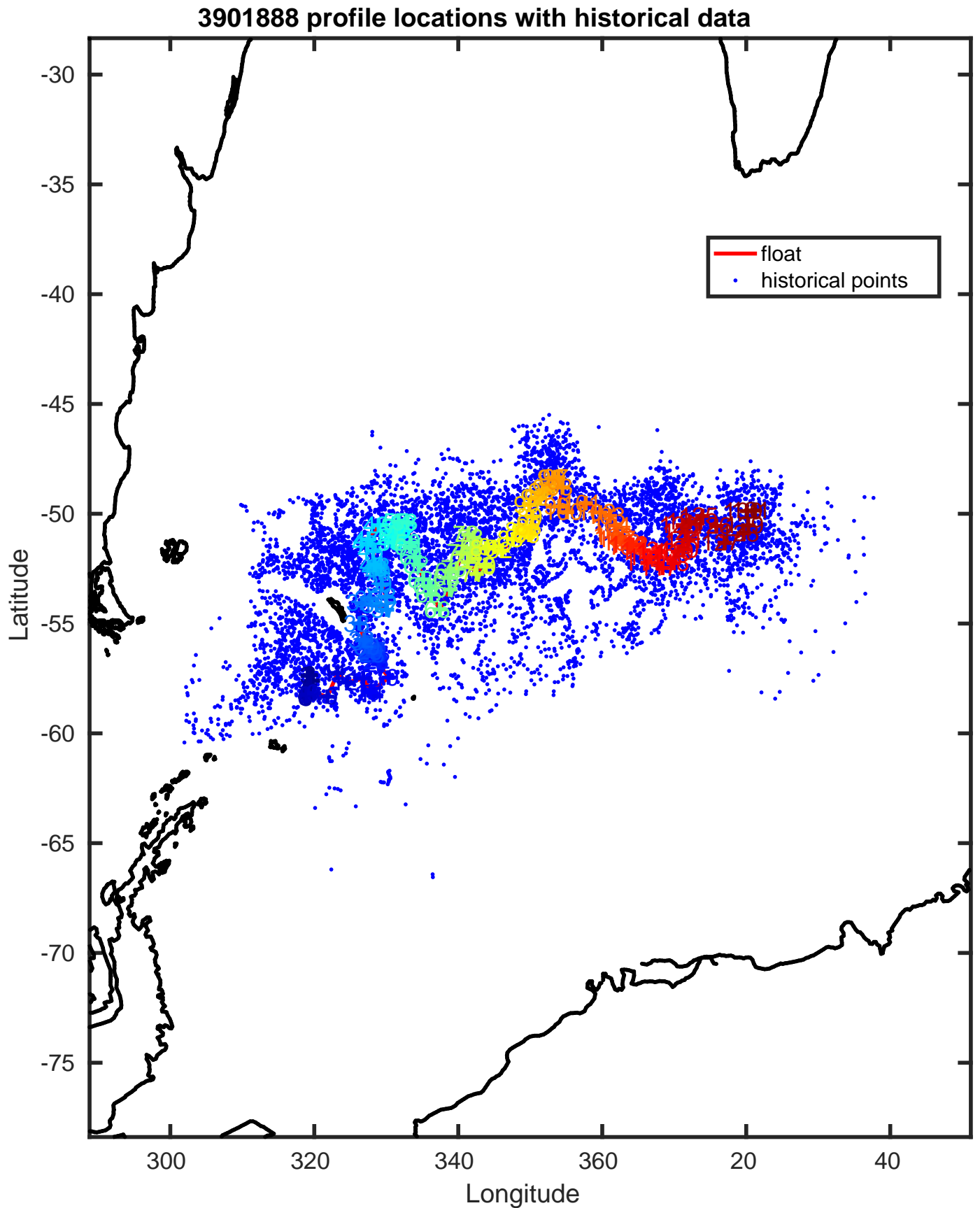


Figure 15: Float 3901888. Location of the float profiles (red line with coloured numbers) and the CTD reference data selected for mapping (blue dots). The black contours indicate the bathymetry at 0, 200, 1000 and 2000 m.

3901888 uncalibrated float data (-) and mapped salinity (o) with objective errors

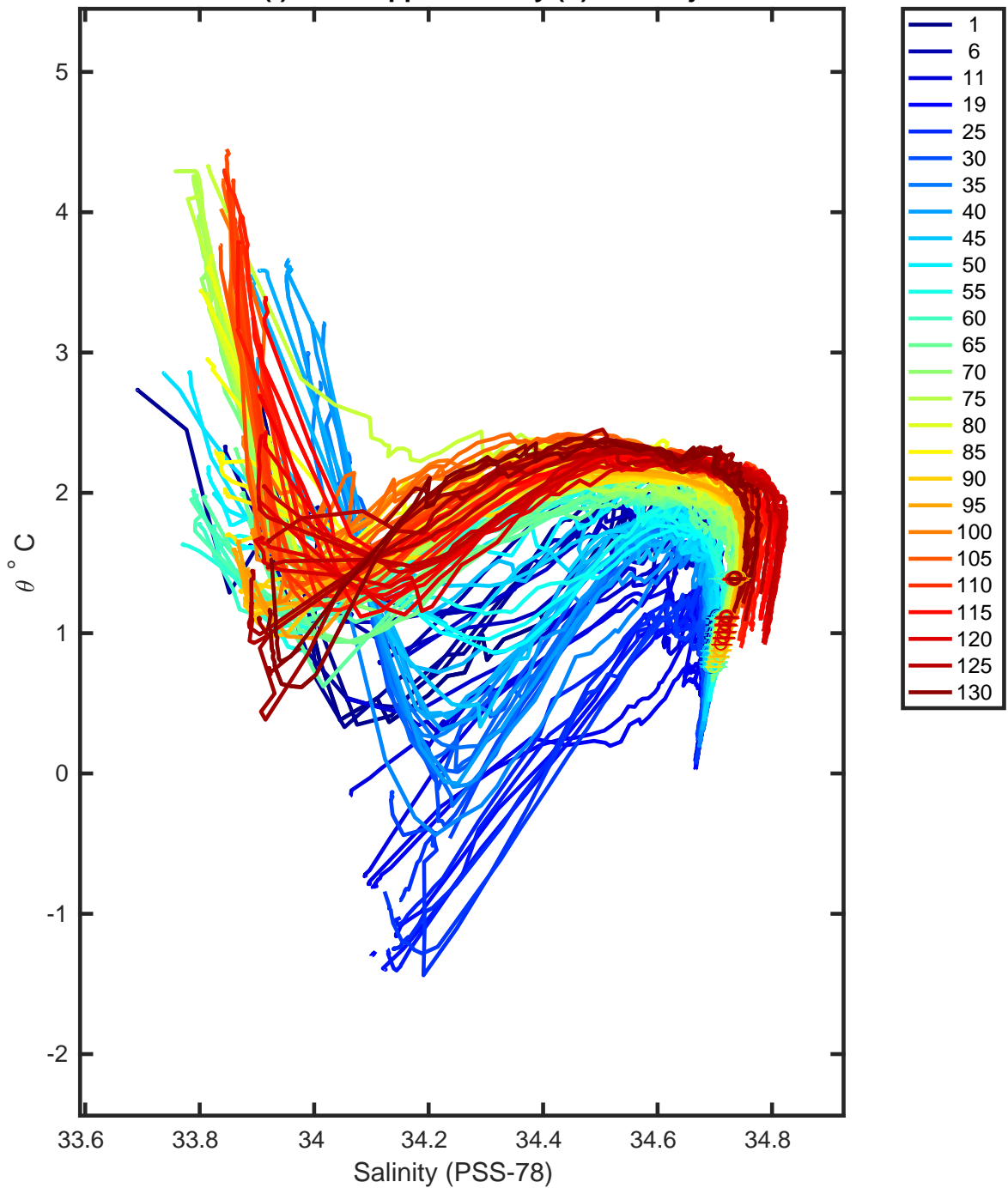
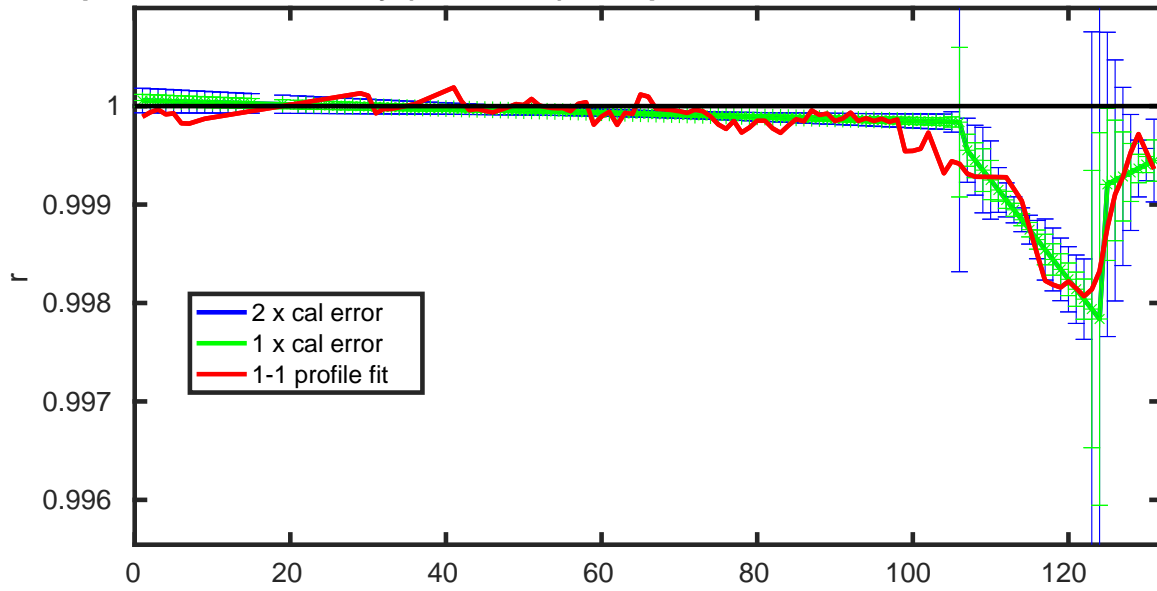


Figure 16: Float 3901888. Plots the original float salinity and the objectively estimated reference salinity at the 10 float theta levels that are used in calibration.

3901888 potential conductivity (mmho/cm) multiplicative correction r with errors



3901888 vertically-averaged salinity (PSS-78) additive correction

ΔS with errors

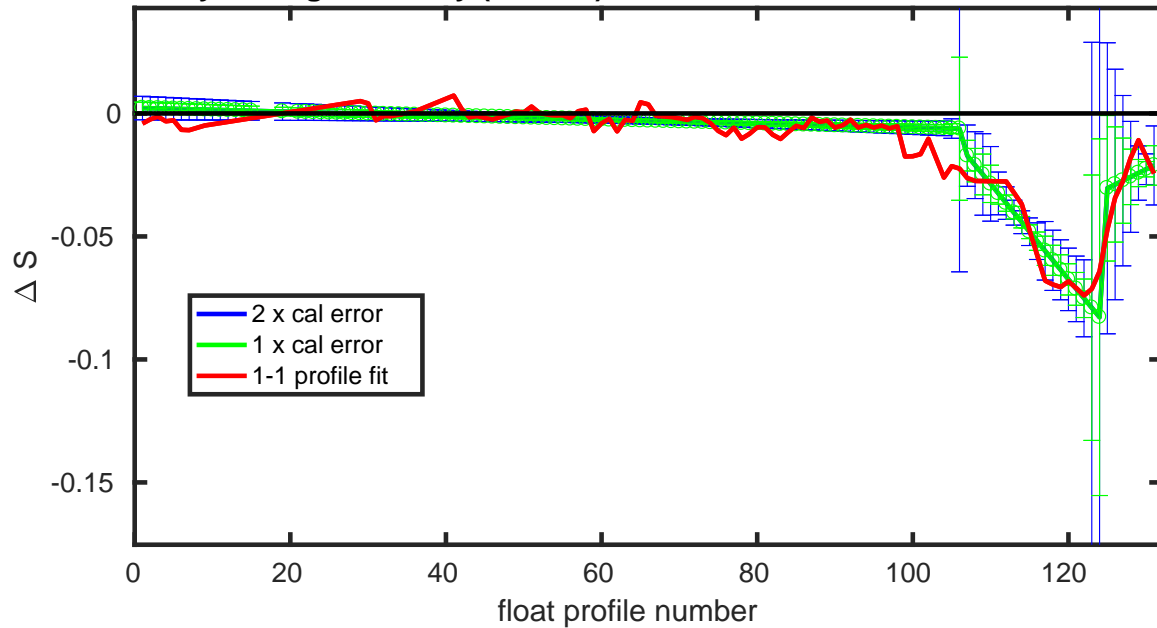


Figure 17: Float 3901888. Evolution of the suggested adjustment with time. The top panel plots the potential conductivity multiplicative adjustment. The bottom panel plots the equivalent salinity additive adjustment. The red line denotes one-to-one profile fit that uses the vertically weighted mean of each profile. The red line can be used to check for anomalous profiles relative to the optimal fit.

3901888 calibrated float data (-) and mapped salinity (o) with objective errors

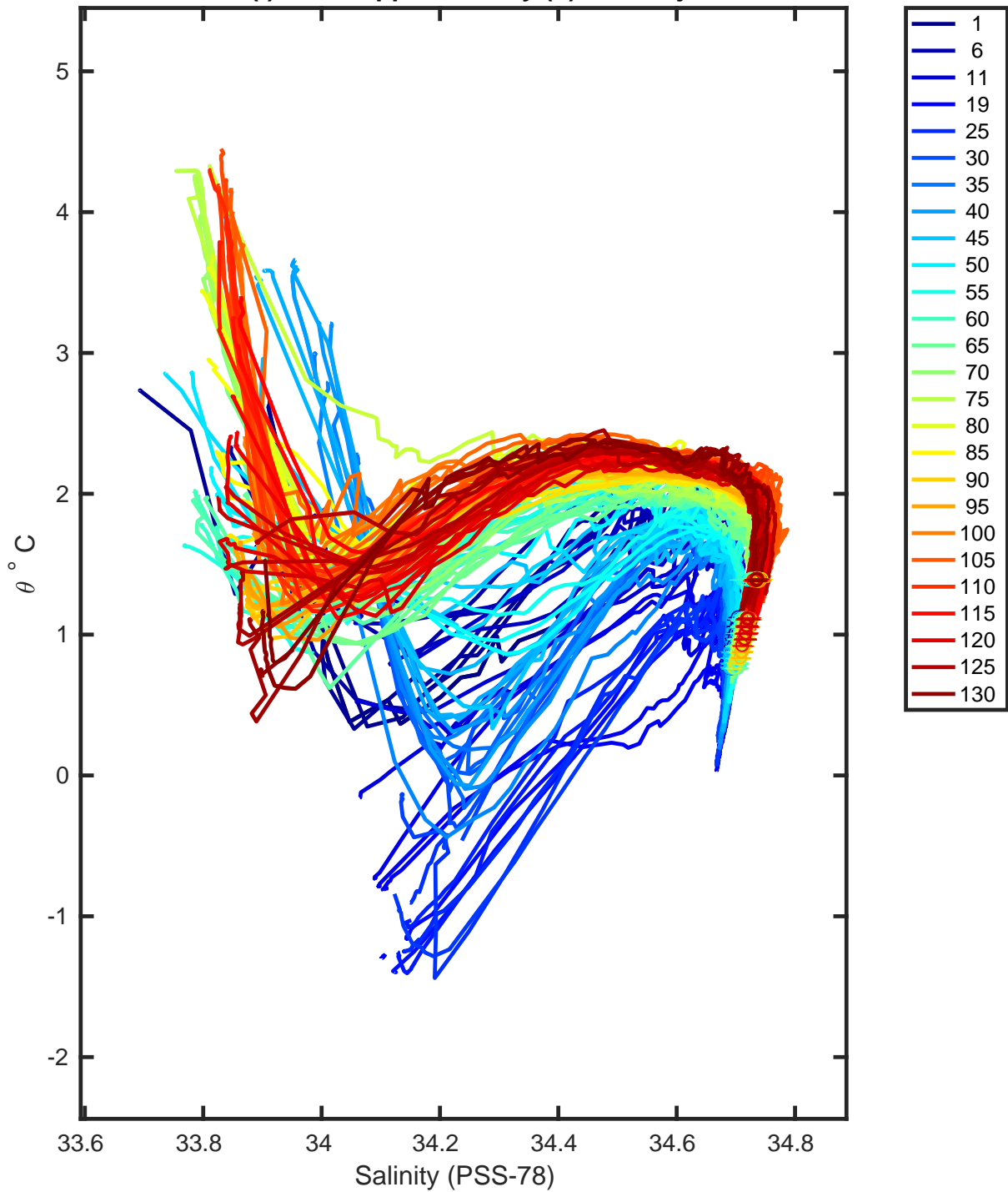


Figure 18: Float 3901888. Plots of calibrated float salinity and the objectively estimated reference salinity at the 10 float theta levels that are used in calibration.

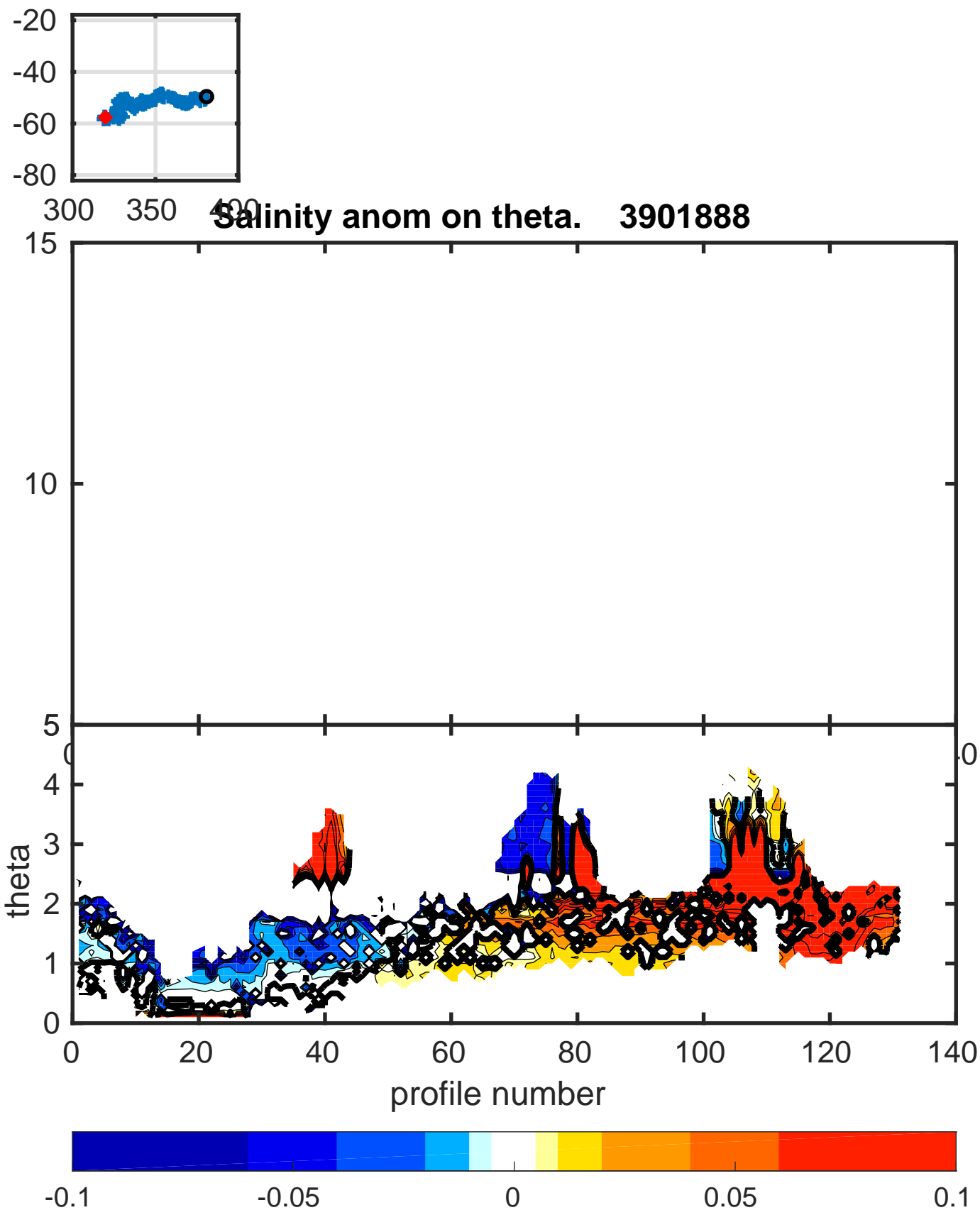


Figure 19: Float 3901888. Salinity anomaly on theta levels.

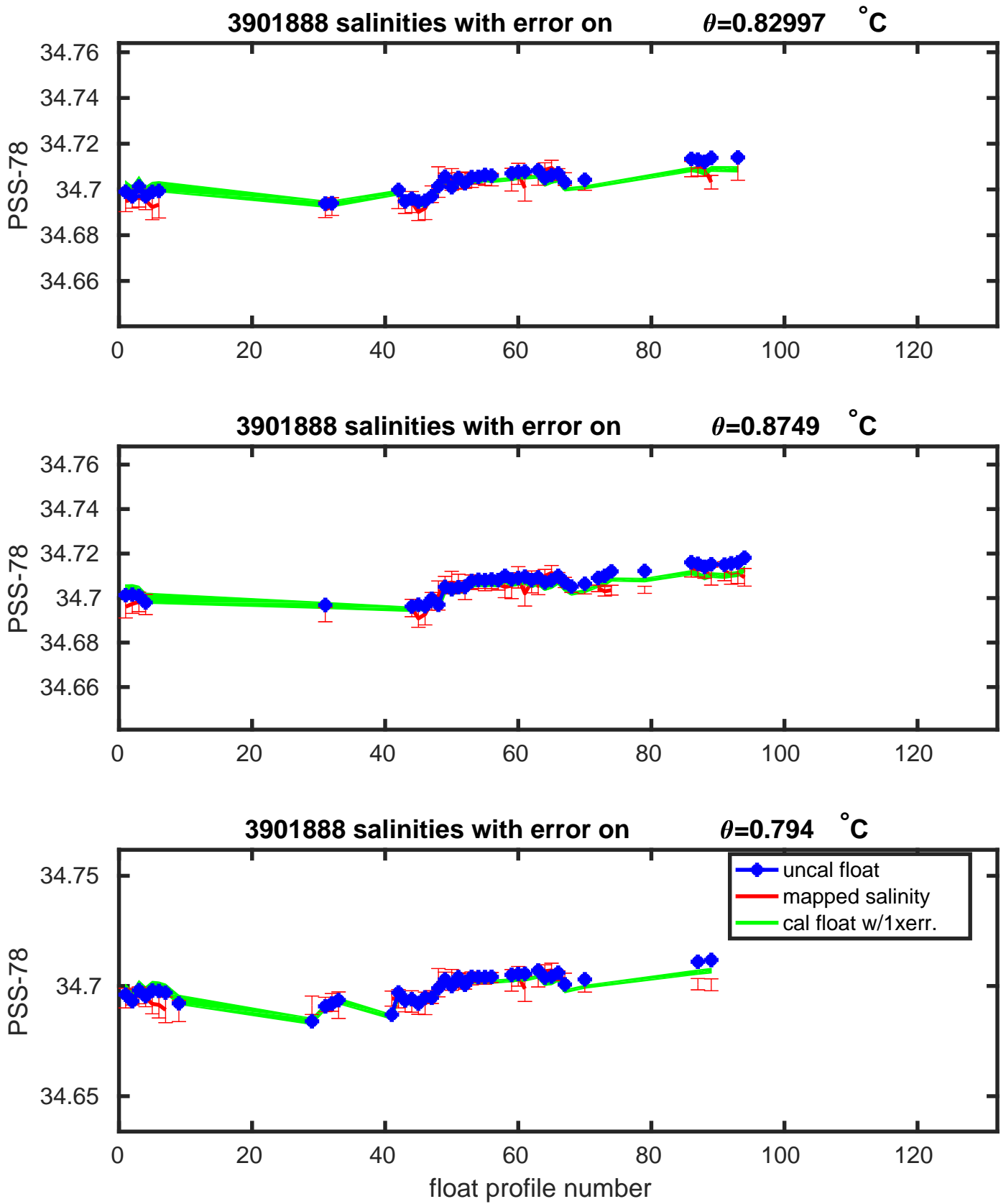


Figure 20: Float 3901888. Plots of the evolution of salinity with time along with selected theta levels with minimum salinity variance.

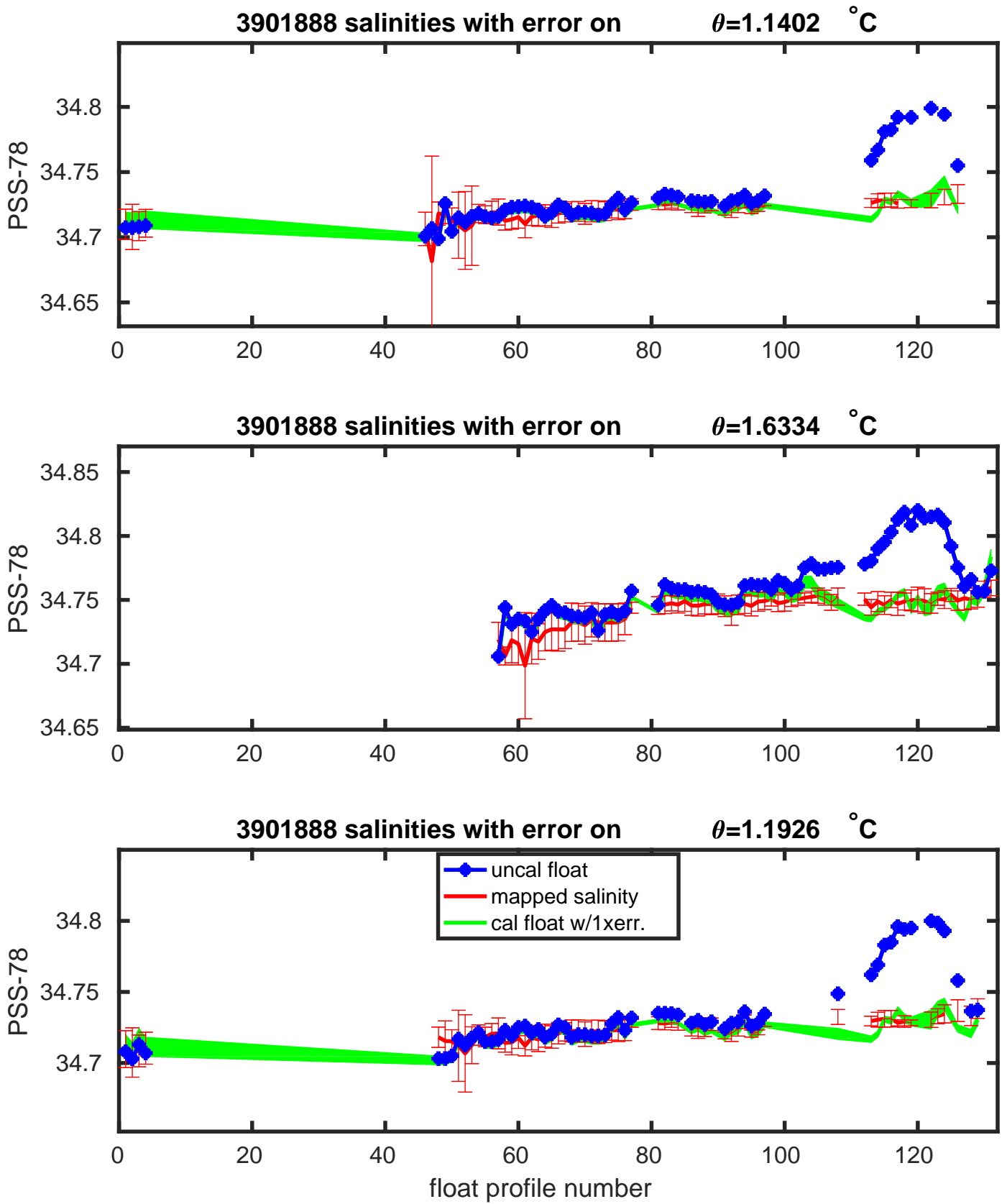


Figure 21: Float 3901888. Plots of the evolution of salinity with time along with selected theta levels with minimum salinity variance.

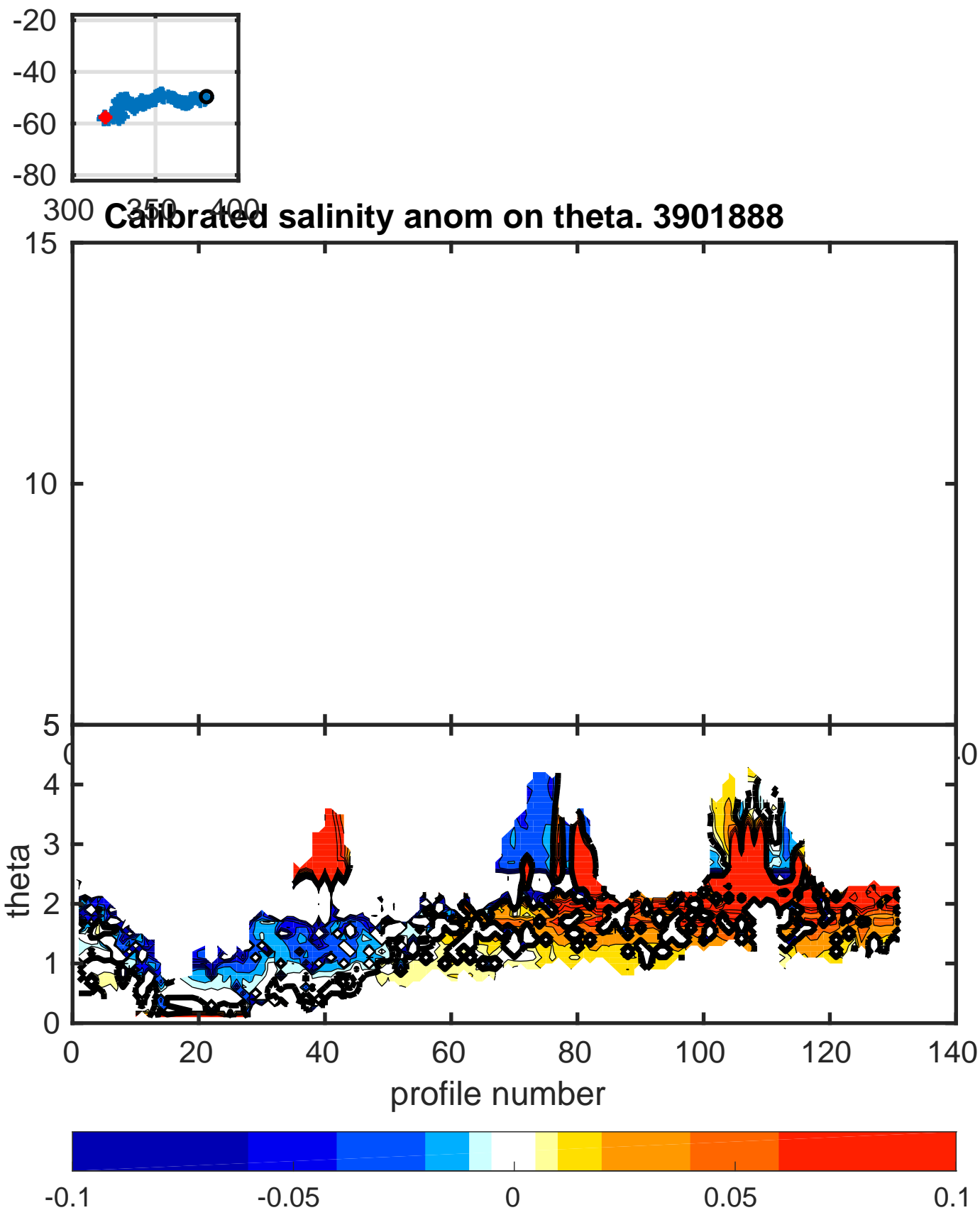


Figure 22: Float 3901888. Calibrated salinity anomaly on theta levels.

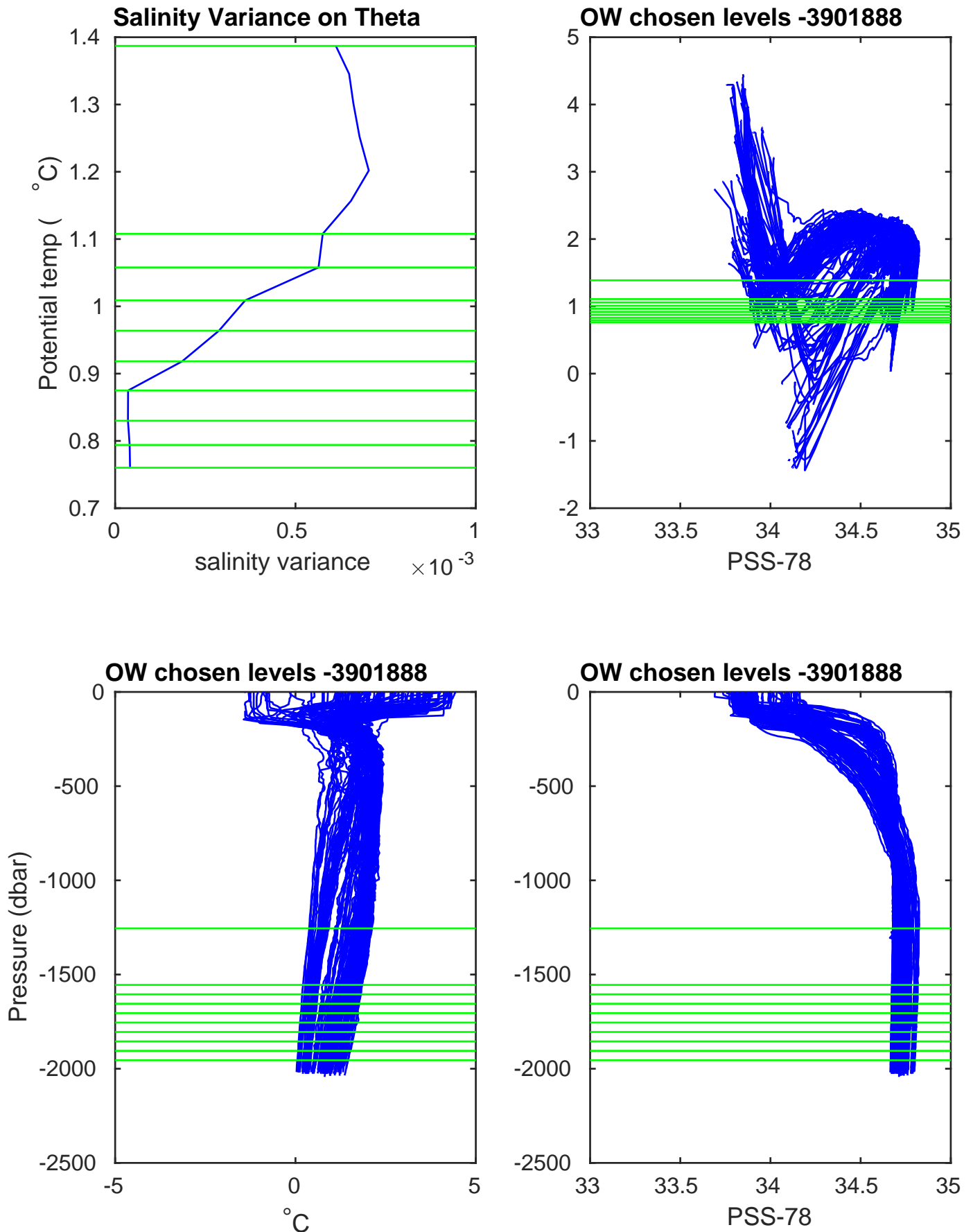


Figure 23: Float 3901888. SPlots including the theta levels chosen for calibration: Top left: Salinity variance at theta levels. Top right: T/S diagram of all profiles of Argo float. Bottom left: potential temperature plotted against pressure. Bottom right: salinity plotted against pressure.

4 Final Checks

x

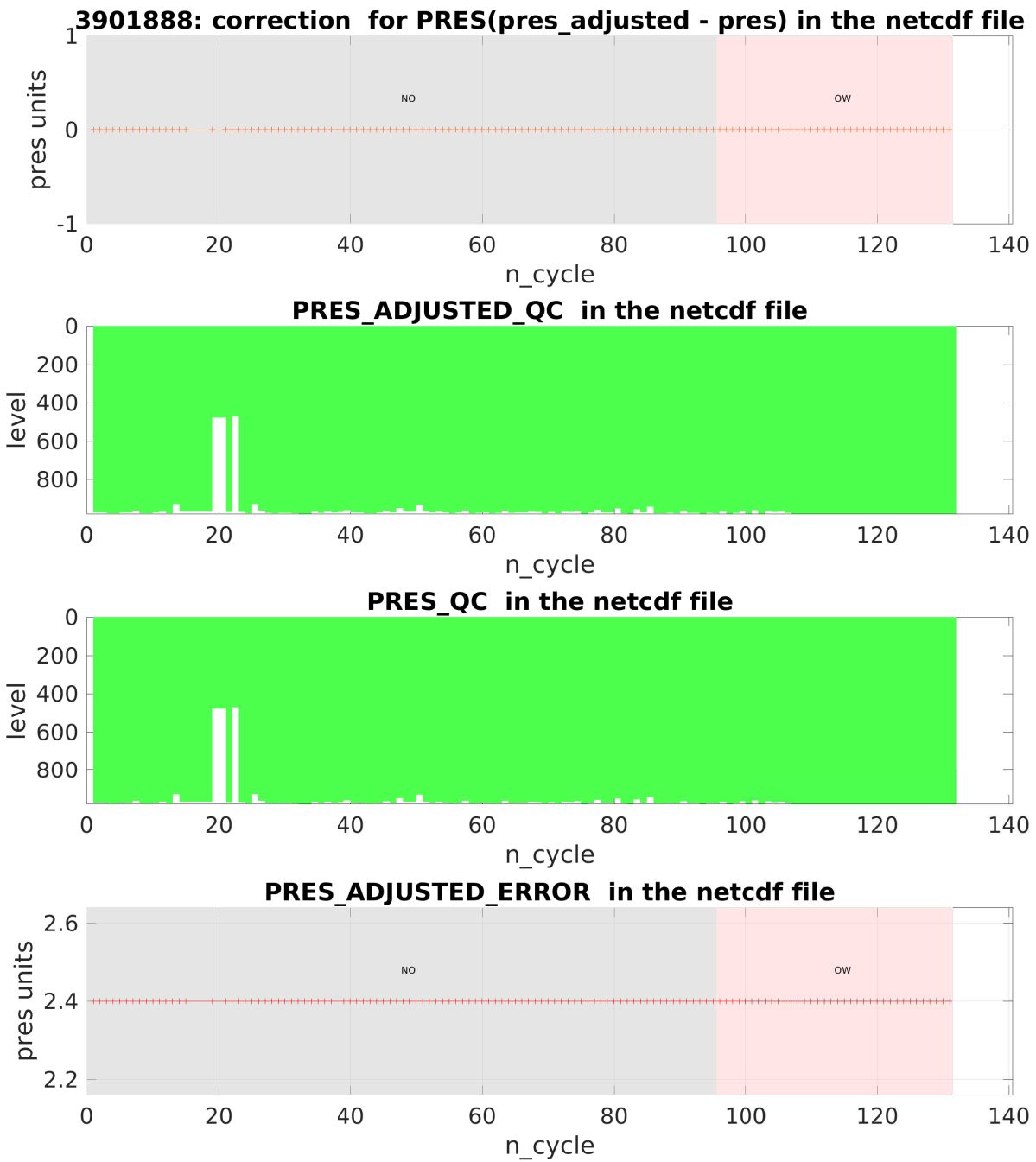


Figure 24: Float 3901888. Time series of applied pressure corrections.

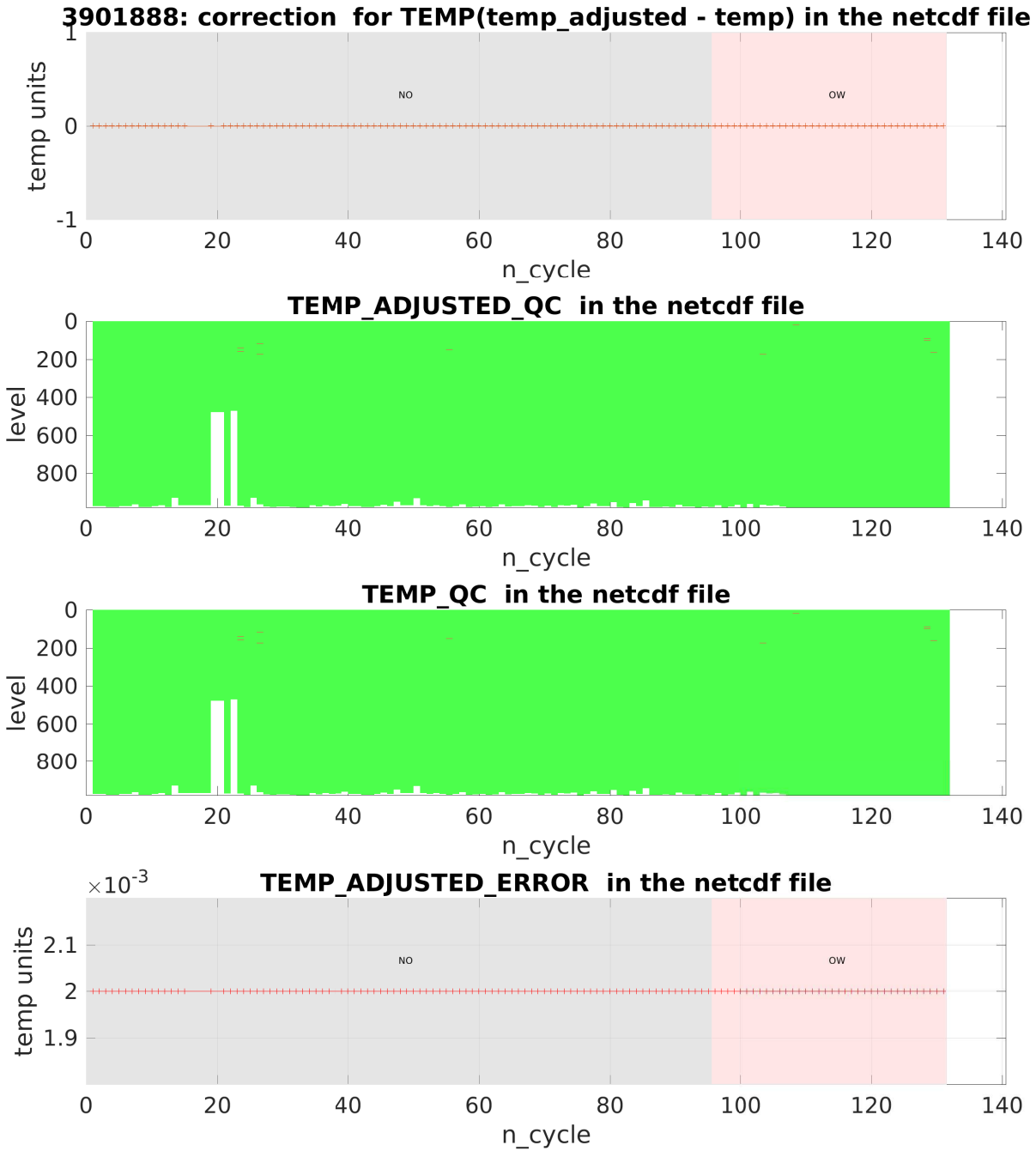


Figure 25: Float 3901888. Time series of applied temperature corrections.

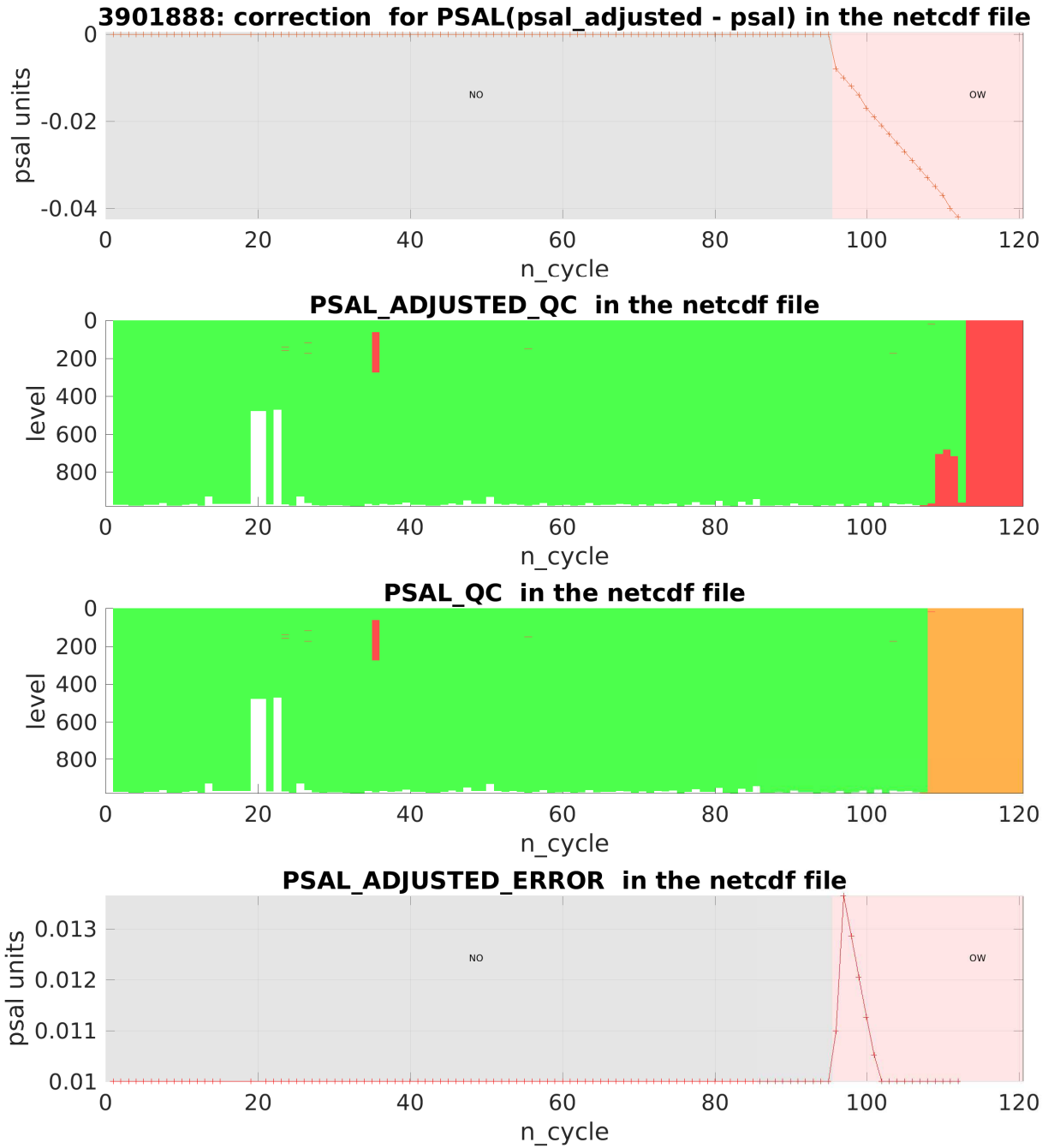


Figure 26: Float 3901888. Time series of applied salinity corrections.

4.1 Summary and Conclusions

Flat was deployed in the Drake Passage, where further driven eastern by the Subantarctic Front. For the first 95 profiles, float was behaving well and no adjusted was needed. From profiles 96 float started to drift salty compared to climatology and then unexceptionally back to more fresher salinities. For profiles 96-112 the OWC was applied, however further profiles from 113 showed much stronger differences in order of around -0.07. These looks like some issue with the salinity sensor. The profiles between 113 and 131 was flagged 4. Further investigation and monitoring of this float is necessary.