



**Laboratoire d'Océanographie Physique et Spatiale  
UMR6523 - CNRS-IFREMER-IRD-UBO**  
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**DELAYED MODE QUALITY CONTROL  
AND OXYGEN CORRECTION  
OF OVIDE ARGO DATA  
FLOAT WMO 1901214**

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Auteur(s) : Lagadec Catherine  
Thierry Virginie  
Cabanes Cécile

Référence :Rapport Interne LOPS 17-21

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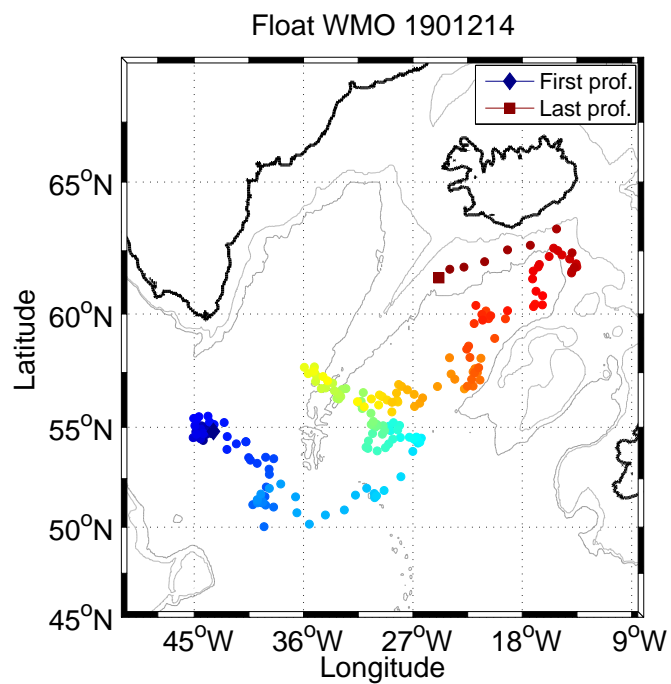
# DELAYED MODE QUALITY CONTROL OF OVIDE ARGO DATA FLOAT WMO 1901214

## Internal Report LPO 17-21

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C. Lagadec - V. Thierry - C. Cabanes

November 7, 2017



## 1 Presentation and DMQC summary

|                       |                                   |                    |
|-----------------------|-----------------------------------|--------------------|
| Number                | Deployment (cycle 1D)<br>cycle 1D | Last cycle<br>204A |
| Provor<br>WMO 1901214 | 21/07/2011<br>16h50               |                    |
| CTS3 DO               | N 54.83655<br>W 34.4558           |                    |
| Pcutoff               | 5                                 |                    |
| Soft version          | sup. to 5816A00                   |                    |
| Date of control       | Float status                      | Last cycle         |
| September 2013        | Active                            | 10/09/2013         |
| Coriolis transmission |                                   | 12/10/2015         |
| Date of last control  | Float status                      | Last cycle         |
| October 2017          | DEAD                              | 01/02/2017         |
| Coriolis transmission |                                   | 10/10/2017         |

Table 1: Status of the float

**Warning :** Note that all the figures are plotted with the latest QC flag values (the modifications mentioned table 2 are taken into account).

### 1.1 QC flag checks and interesting profiles

| Cycle | Para-<br>meter | Vertical level | Old<br>flag | New<br>flag | Comments | Scoop correction |
|-------|----------------|----------------|-------------|-------------|----------|------------------|
| 15A   | PSAL           | entire profile | 3           | 1           |          | 19/11/13         |

Table 2: Float 1901214. Summary of the modifications of the real-time QC flags and of the interesting or suspicious data.

Warning : the resolution is equal to 10 dbar from the surface to 500 dbar, then 25 dbar from 500 to 2000 dbar. Salinity data between 0 and 5 dbar are suspicious because they are acquired when the pump of the CTD is turned off.

### 1.2 Salinity correction from the OW method

We cannot see any evidence of a drift or bias in the salinity measurement. We thus conclude that it is not necessary to correct the salinity data. Errors bars are maximum value between 0.01 and those determined from the OW method with parameters from the OW configuration 129.

## 2 Data



|                          |              |
|--------------------------|--------------|
| OW CONFIGURATION         | 129          |
| CONFIG_MAX_CASTS         | 250          |
| MAP_USE_PV               | 1            |
| MAP_USE_PV_ELLIPSE       | 1            |
| MAP_USE_FACTEUR          | 1            |
| MAPSCALE_LONGITUDE_LARGE | 3.2          |
| MAPSCALE_LONGITUDE_SMALL | 0.8          |
| MAPSCALE_LATITUDE_LARGE  | 2            |
| MAPSCALE_LATITUDE_SMALL  | 0.5          |
| MAPSCALE_PHI_LARGE       | 0.1          |
| MAPSCALE_PHI_SMALL       | 0.02         |
| MAPSCALE_AGE             | 0.69         |
| MAP_P_EXCLUDE            | 500          |
| MAP_P_DELTA              | 250          |
| Reference data base      | CTD and ARGO |

Table 3: Parameters of the OW method.

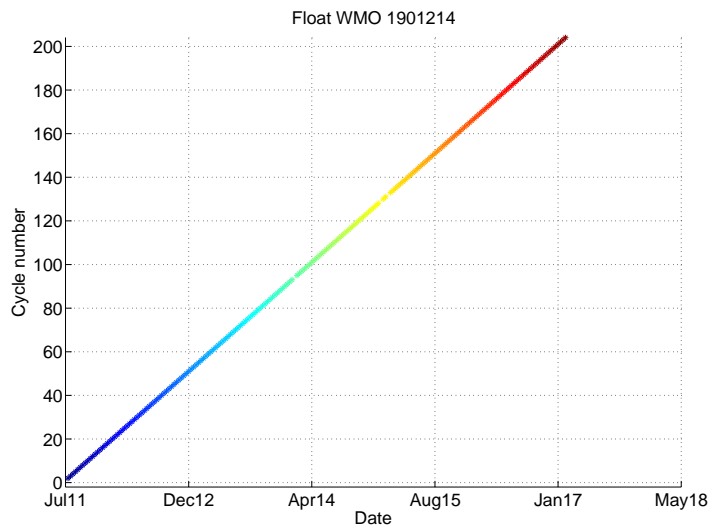
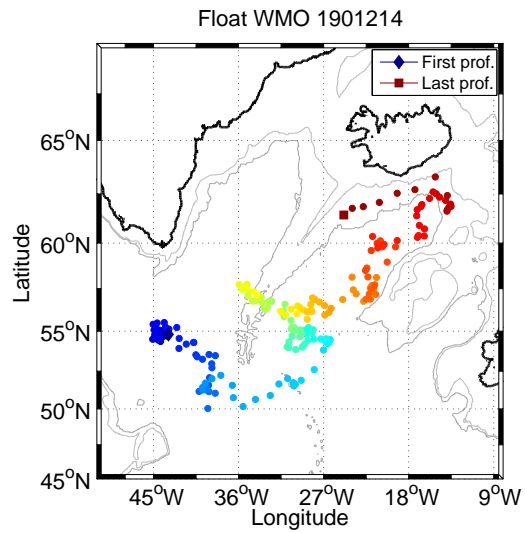


Figure 1: Profiles position and relationship between cycle number, date and color.

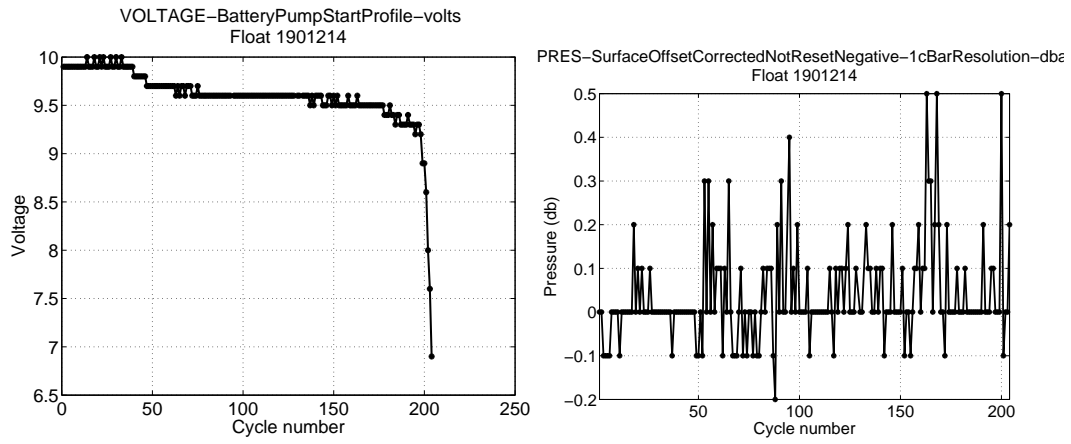


Figure 2: Battery Voltage and Surface Pressure

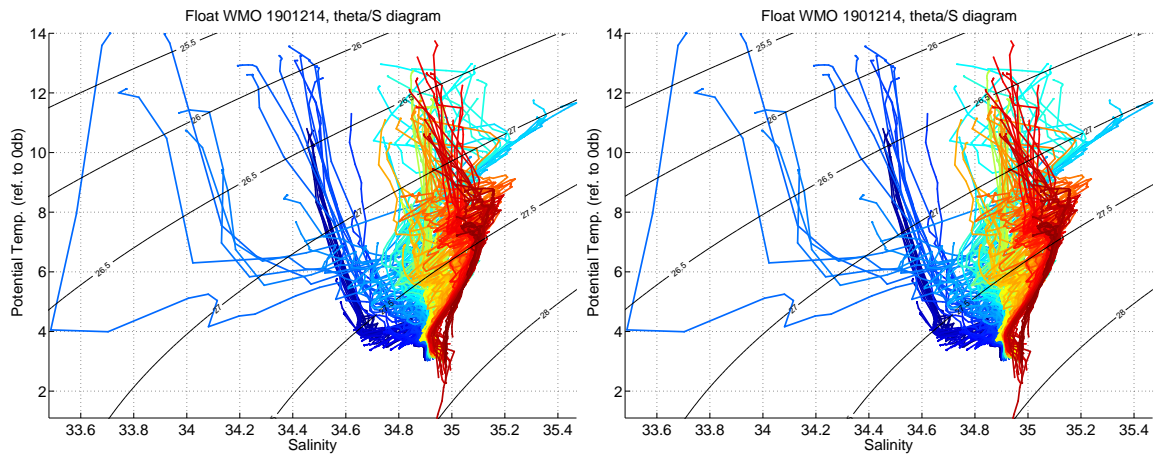


Figure 3:  $\theta/S$  diagrams. (Left panel) Flags are not taken into account. (Right panel) Quality flags are taken into account.

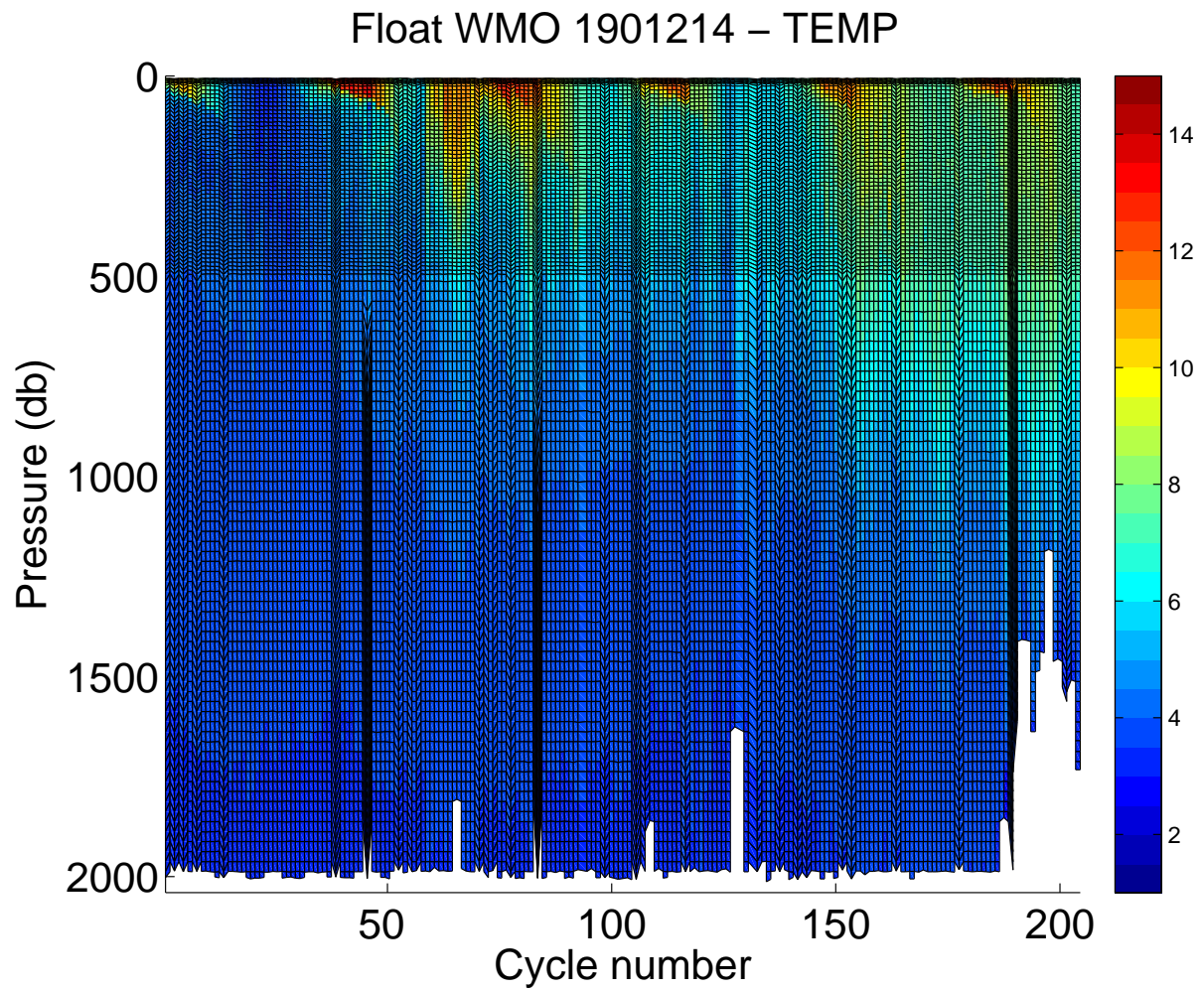


Figure 4: Temperature section along the float trajectory. Quality flags are not taken into account.

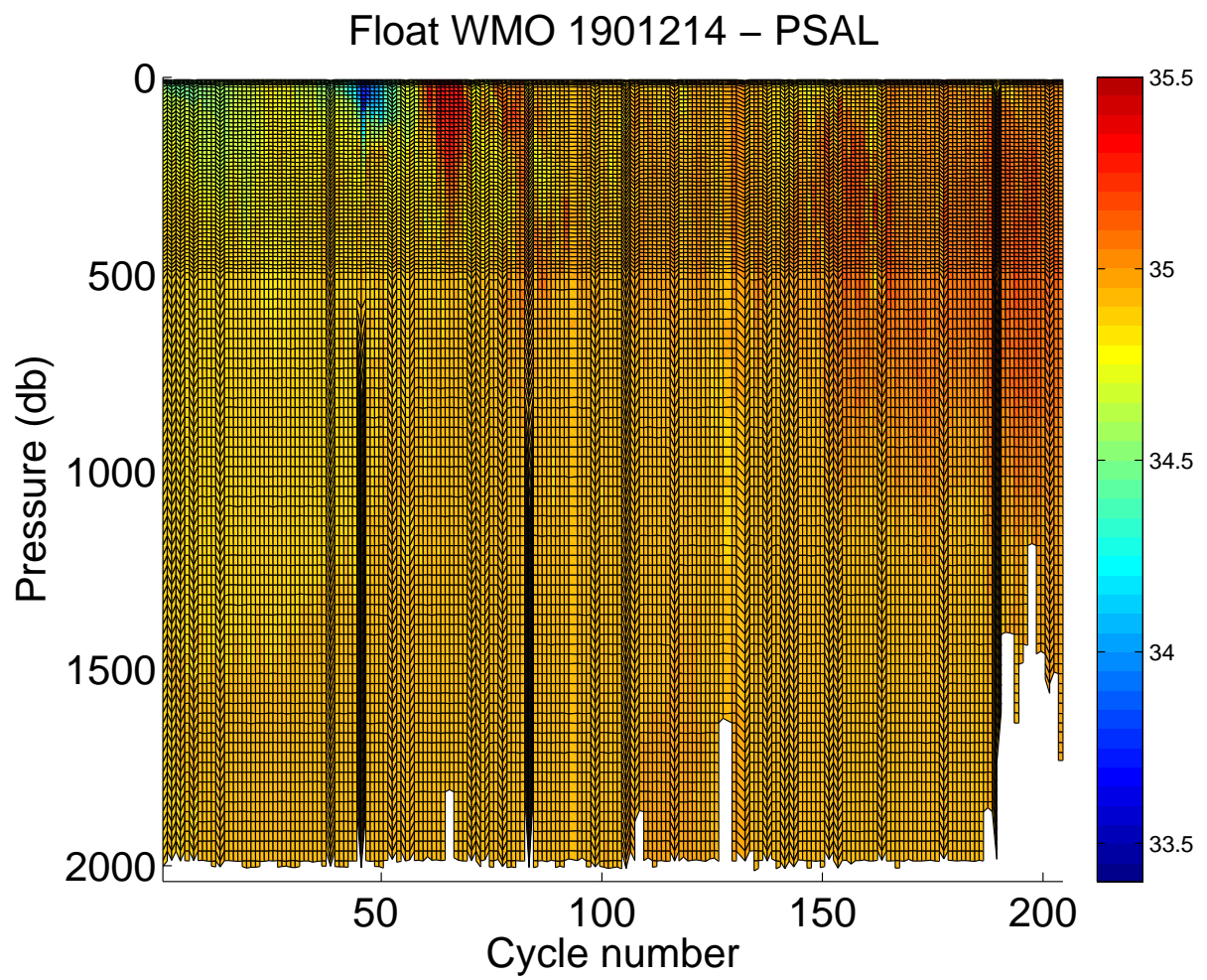


Figure 5: Salinity section along the float trajectory. Quality flags are not taken into account.



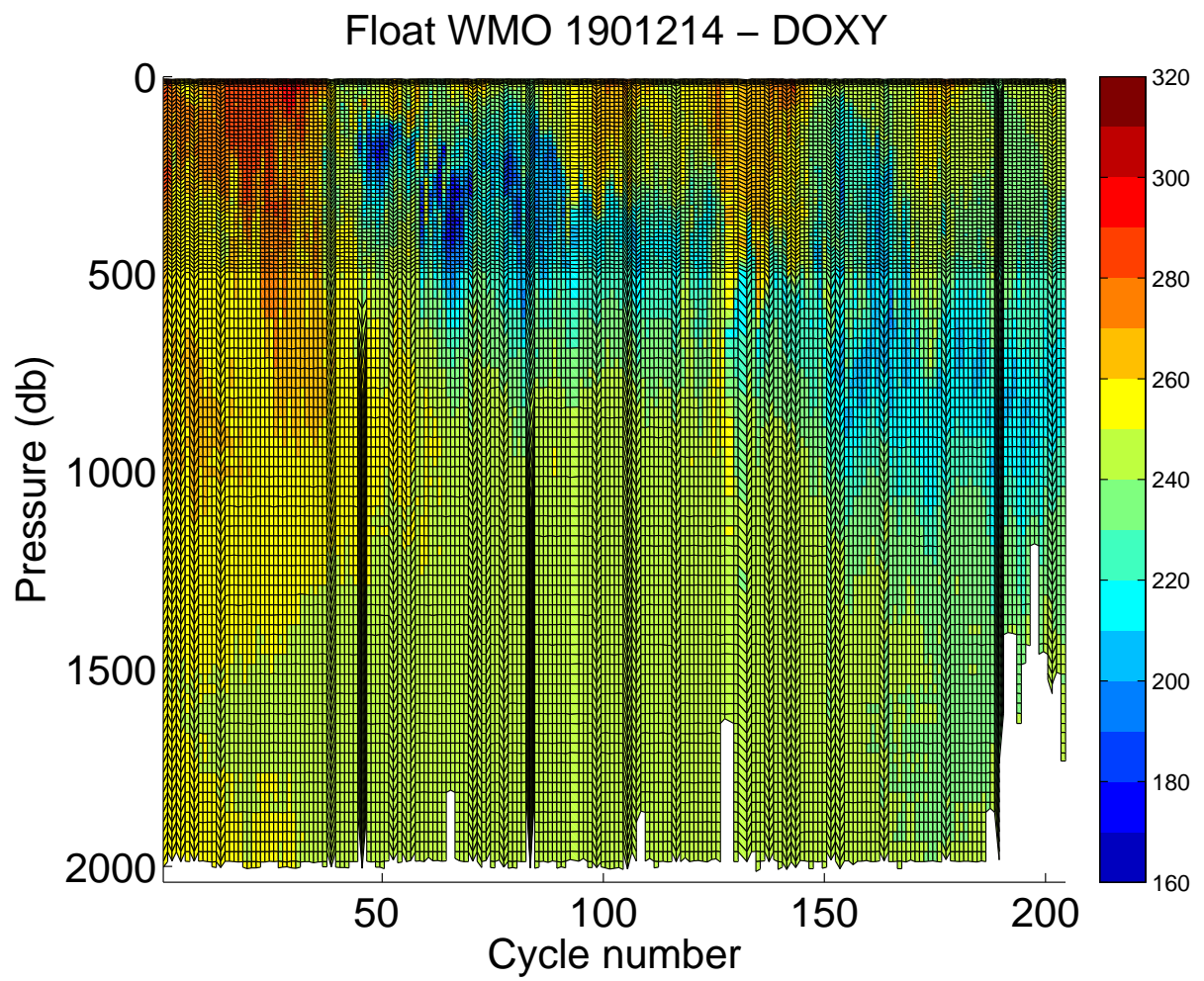


Figure 6: Oxygen section along the float trajectory. Quality flags are not taken into account.

Float WMO 1901214 – PRES

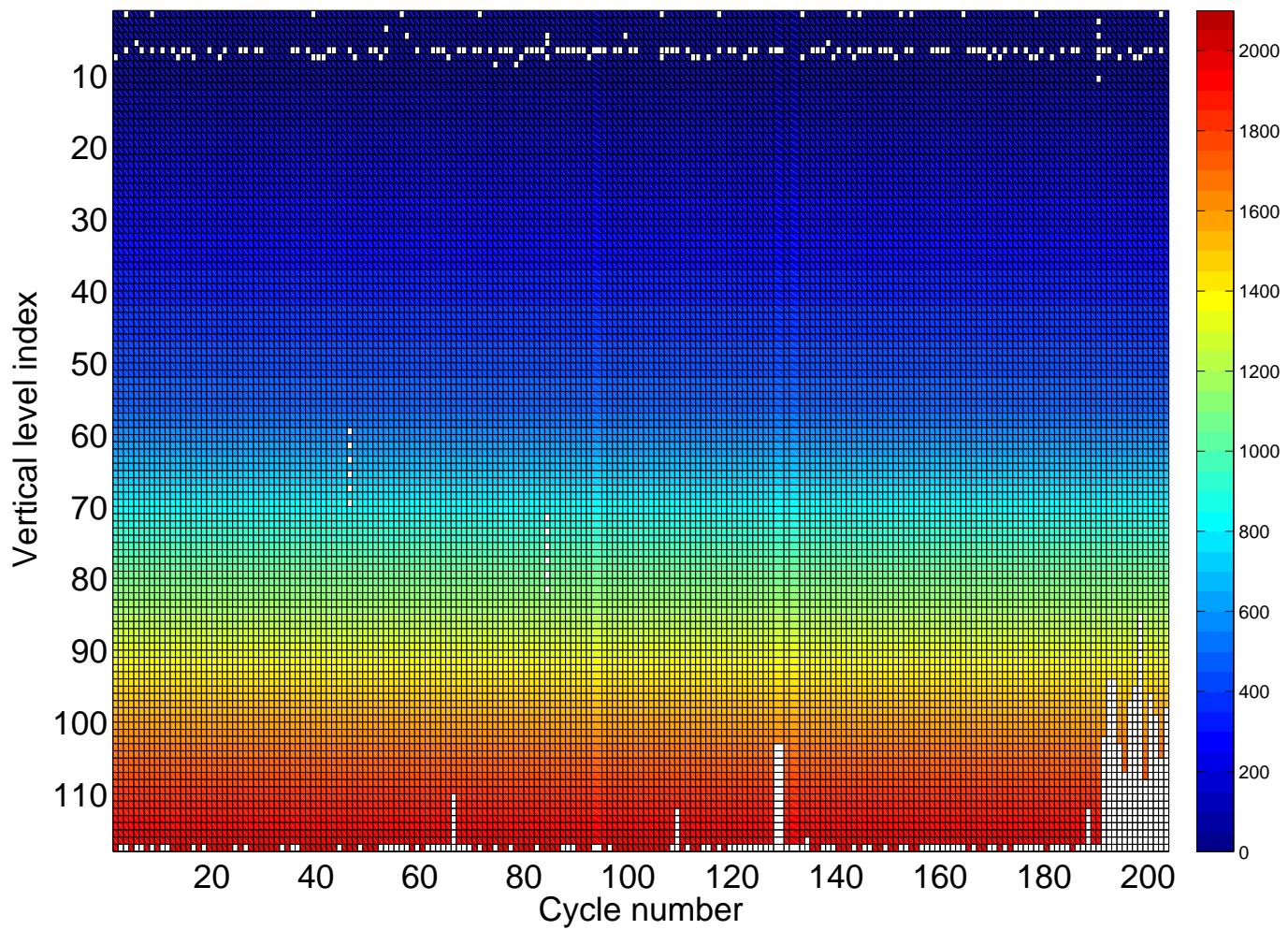


Figure 7: Pression as fonction of cycle number and vertical level index along the float trajectory. Quality flags are taken into account.

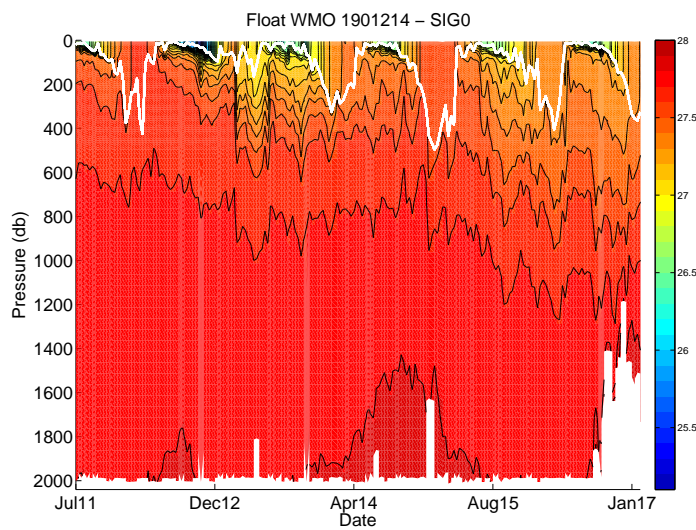
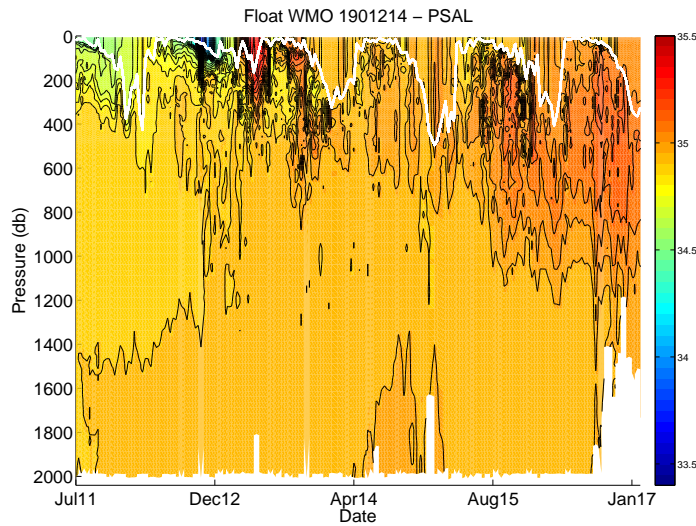
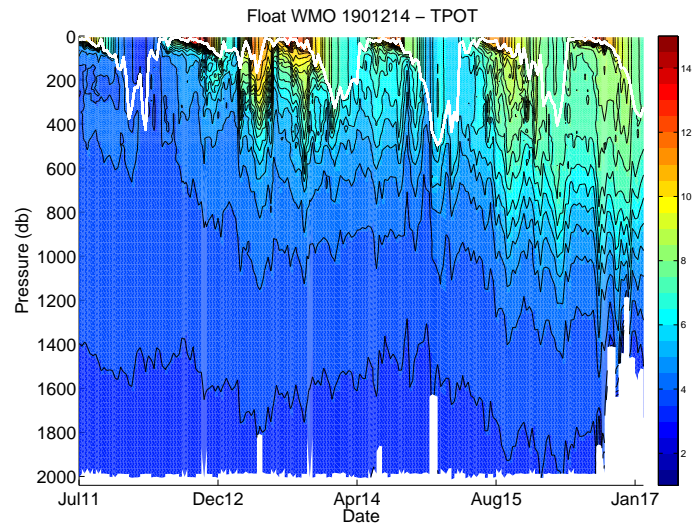


Figure 8: Potential temperature, salinity and potential density sections along the float trajectory (interpolated on standard levels). Quality flags are taken into account.



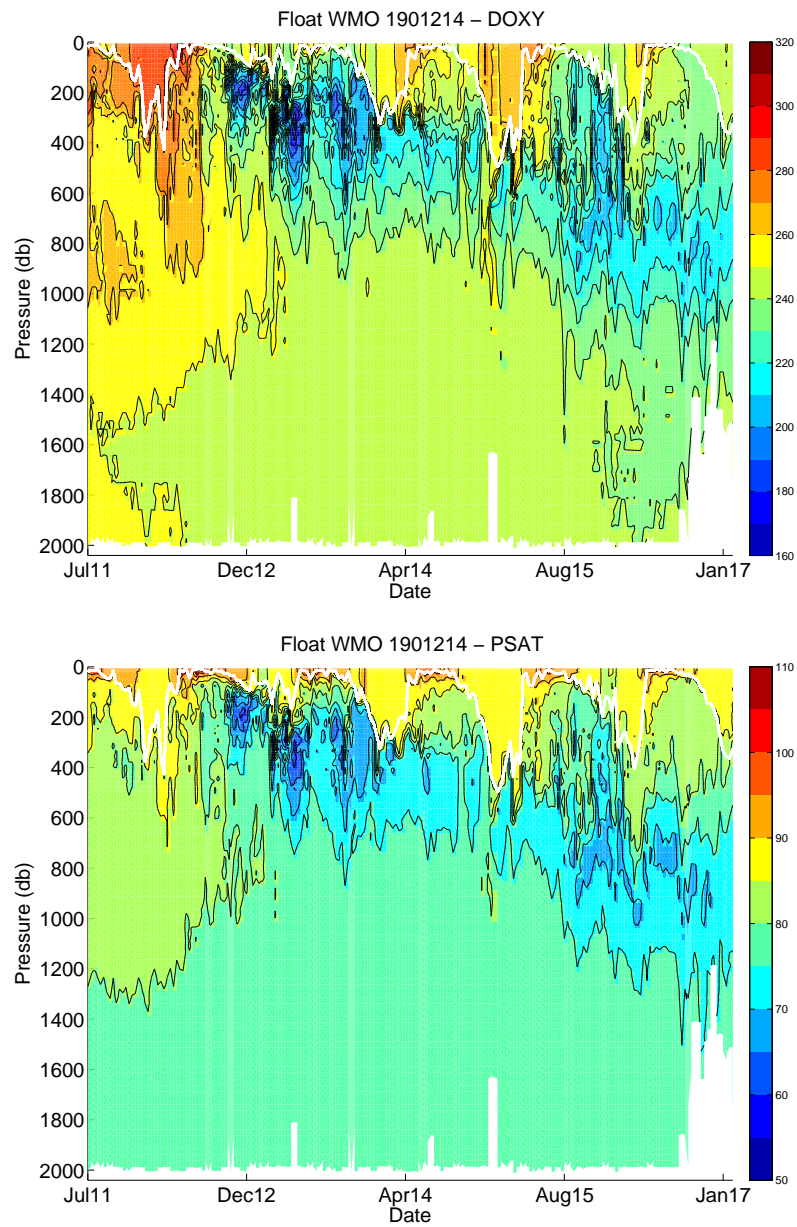


Figure 9: Oxygen and Saturation Oxygen sections along the float trajectory (interpolated on standard levels). Quality flags are taken into account.

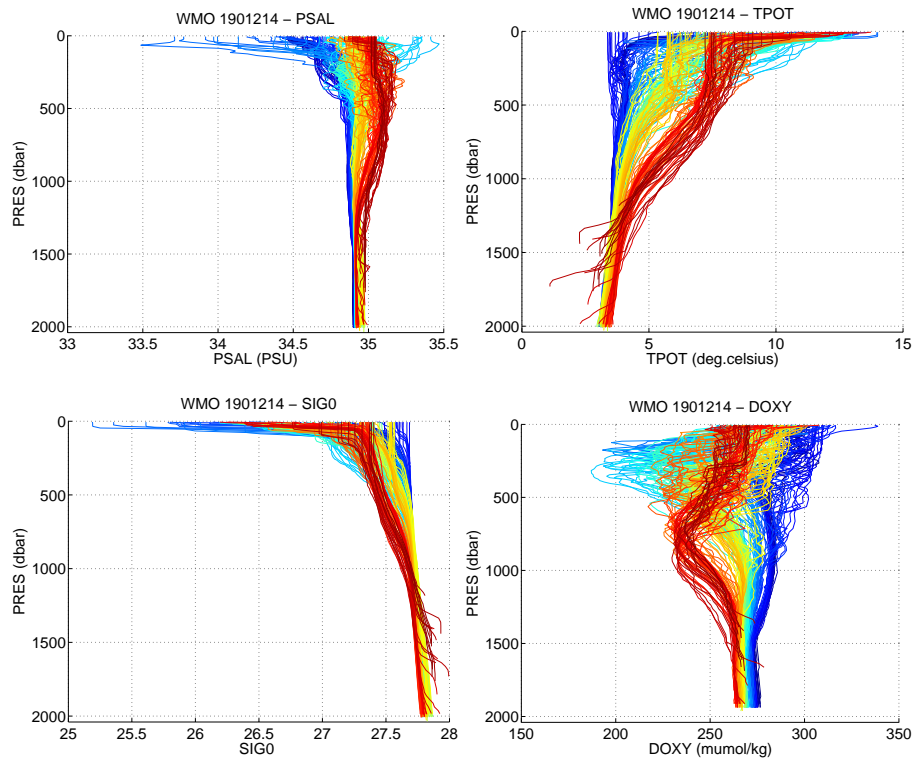


Figure 10: Salinity, Potential Temperature, Potential Density and Oxygen profiles. Quality flags are taken into account.

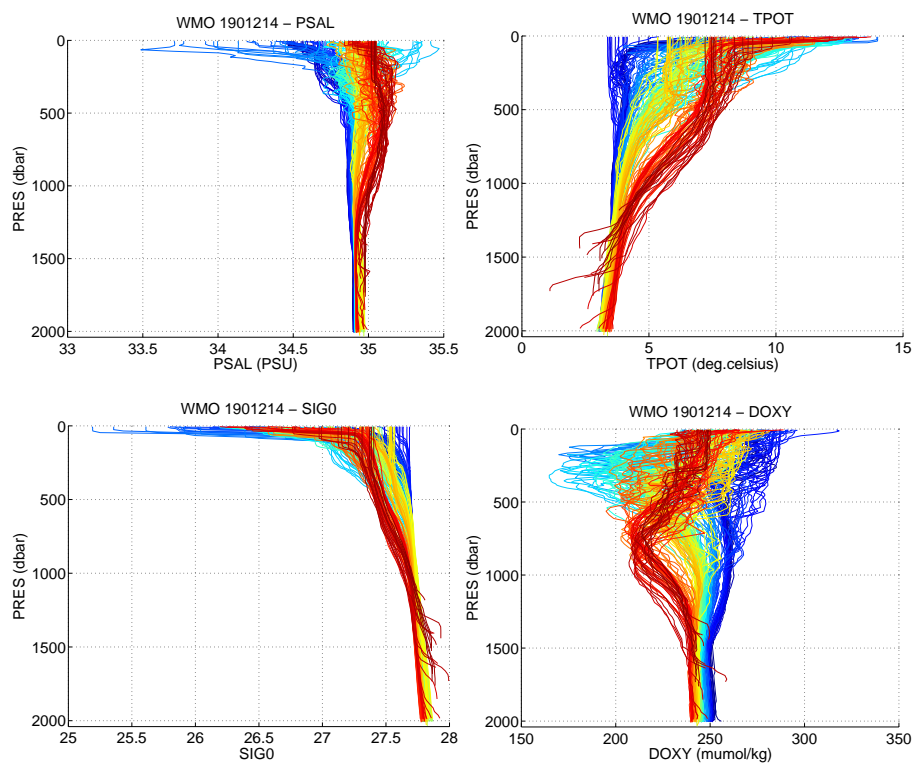


Figure 11: Salinity, Potential Temperature, Potential Density and Oxygen profiles. Quality flags are not taken into account.

### 3 Comparison cycle 1A to the OVIDE 2011 nearest CTD profile

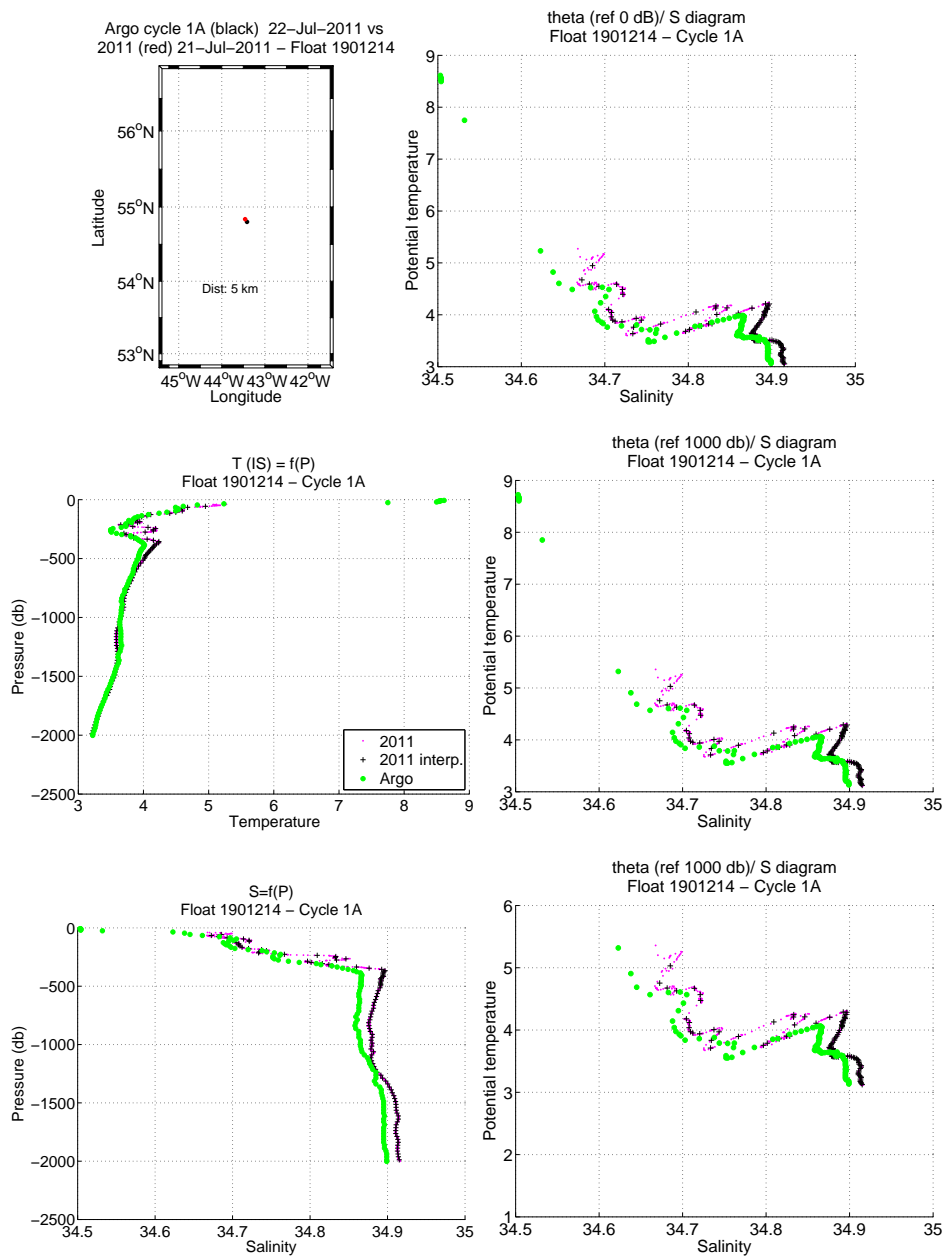


Figure 12: Comparison of the cycle 1A with the nearest CTD profile done after the float deployment.

## 4 Cycle 15 - Comparison to the nearest historical CTD profiles

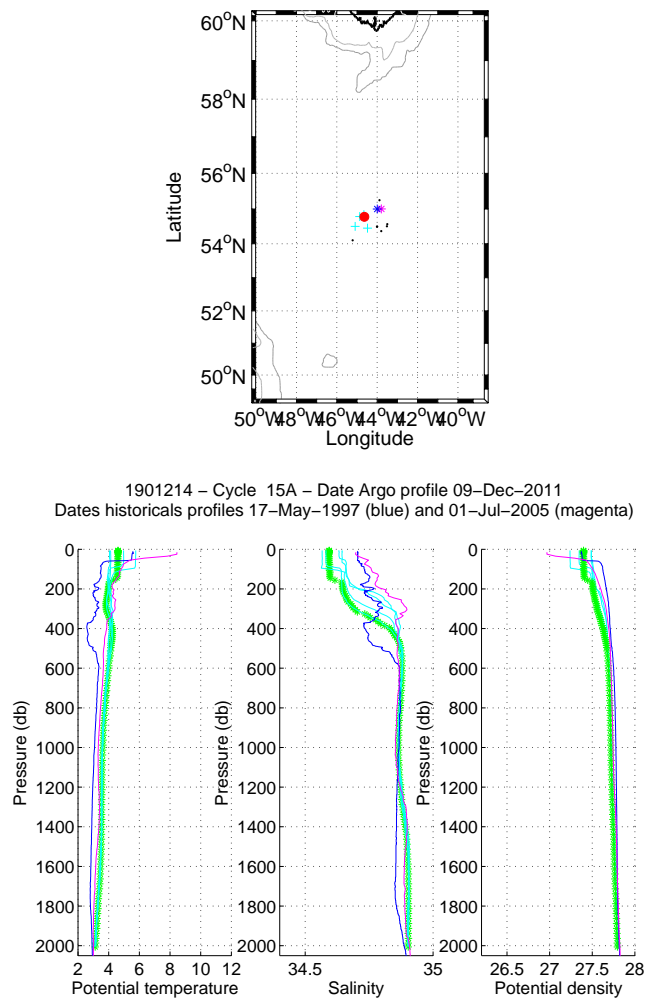


Figure 13: Flotteur 1901214, cycle 15A. Upper panel: Position of the analysed CTD profile (red) and of the nearest CTD profiles (black). The nearest CTD profile in time is in magenta while the nearest CTD profile in space is in blue. Lower panels: Temperature, salinity and potential density as function of pressure for the analysed CTD profile (stars) and for the nearest CTD profile in time (magenta line) and for the nearest CTD profile in space (blue line). The color of the analysed CTD profile represents the QC flag (green for a QC=1; blue for a QC=2; orange for a QC=3 and red for a QC=4).

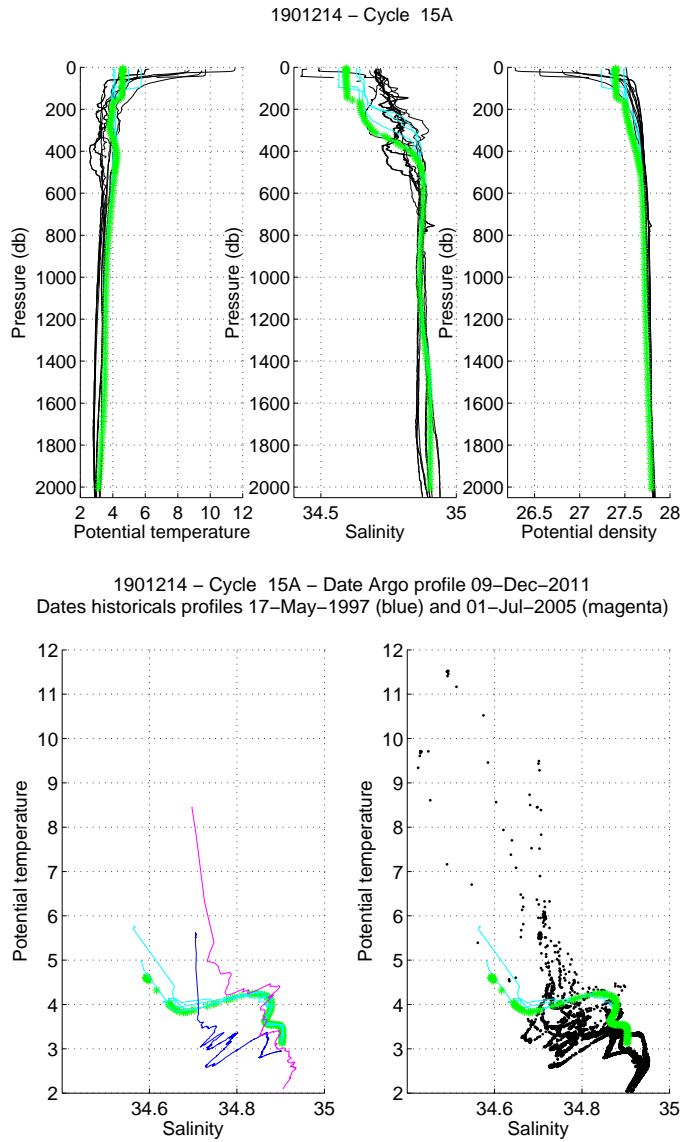


Figure 14: Float 1901214, cycle 15A. The analysed CTD profile (stars) is compared to the nearest CTD profiles (black line) and to two specific profiles: the nearest CTD profile in time (magenta) and the nearest CTD profile in space (blue). The color of the analysed CTD profile represents the QC flag (green for a QC=1; blue for a QC=2; orange for a QC=3 and red for a QC=4). (Upper panels) Temperature (left panel), salinity (middle panel) and potential density (right panel) as function of pressure. (Lower panels)  $\theta/S$  diagrams.

## 5 Cycle 15A - Comparison to the nearest ARGO profiles

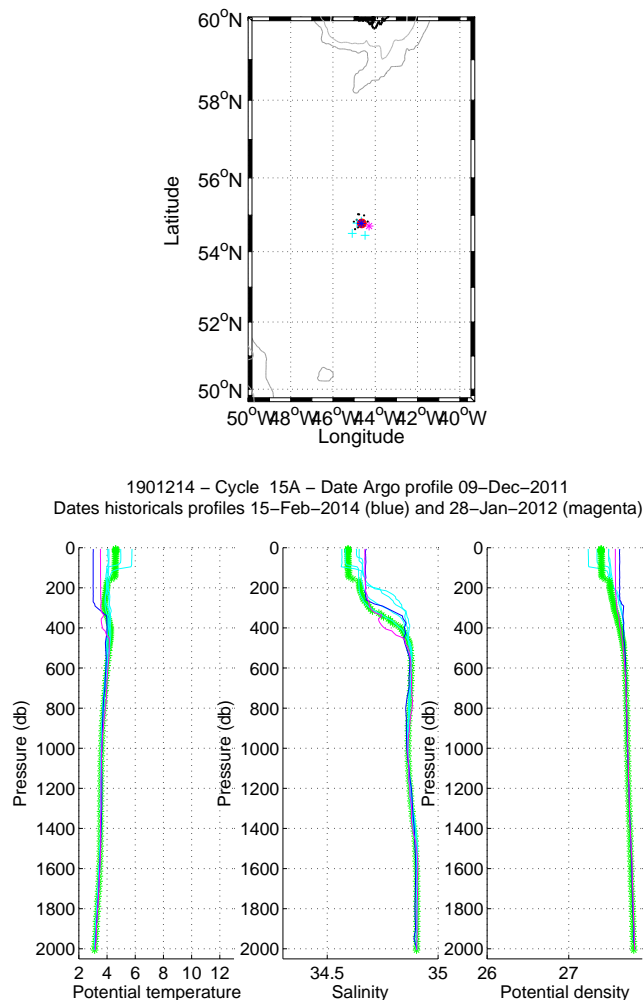


Figure 15: Flotteur 1901214, cycle 15A. Upper panel: Position of the analysed Argo profile (red) and of the nearest Argo profiles (black). The nearest Argo profile in time is in magenta while the nearest CTD profile in space is in blue. Lower panels: Temperature, salinity and potential density as function of pressure for the analysed Argo profile (stars) and for the nearest Argo profile in time (magenta line) and for the nearest Argo profile in space (blue line). The color of the analysed Argo profile represents the QC flag (green for a QC=1; blue for a QC=2; orange for a QC=3 and red for a QC=4).

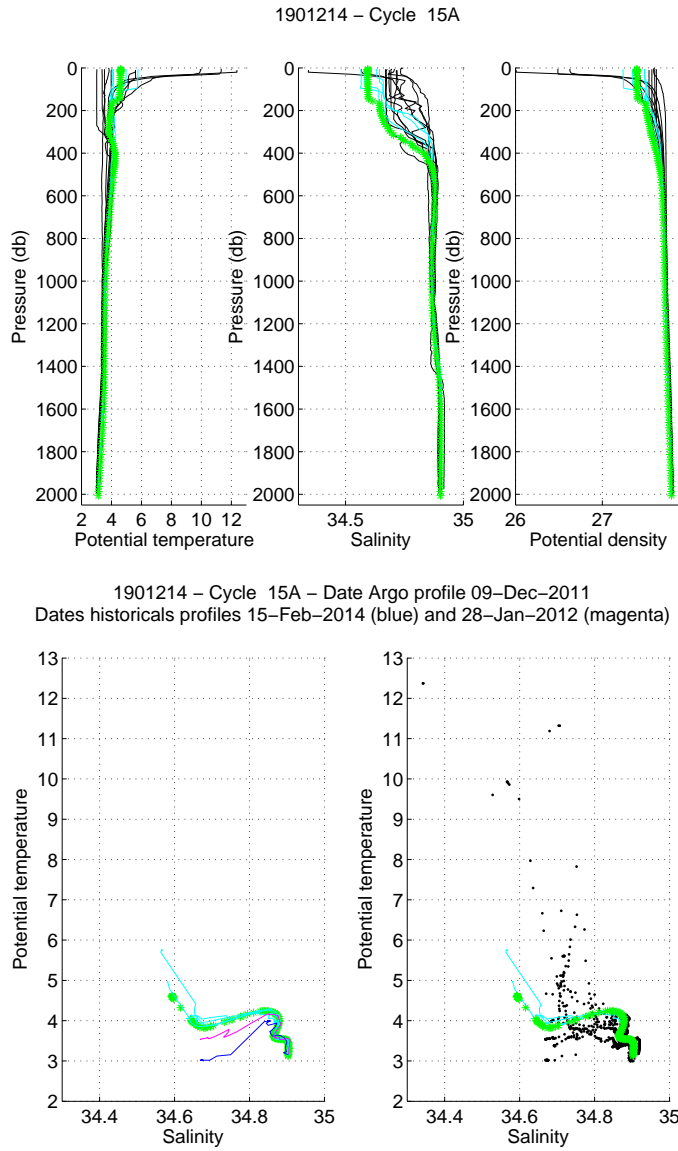


Figure 16: Float 1901214, cycle 15A. The analysed Argo profile (stars) is compared to the nearest Argo profiles (black line) and to two specific profiles: the nearest Argo profile in time (magenta) and the nearest Argo profile in space (blue). The color of the analysed Argo profile represents the QC flag (green for a QC=1; blue for a QC=2; orange for a QC=3 and red for a QC=4). (Upper panels) Temperature (left panel), salinity (middle panel) and potential density (right panel) as function of pressure. (Lower panels)  $\theta/S$  diagrams.



1901214 – Cycle 15A

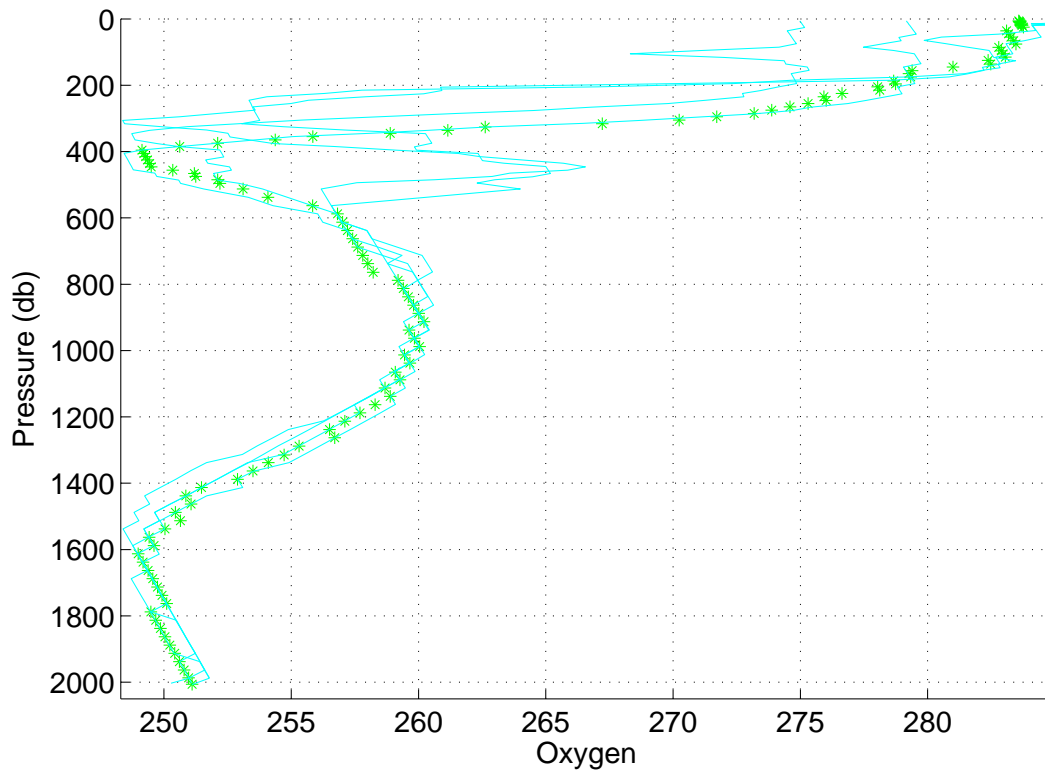


Figure 17: Float 1901214, cycle 15A. Oxygen data.

## 6 OW method, CONFIGURATION # 129

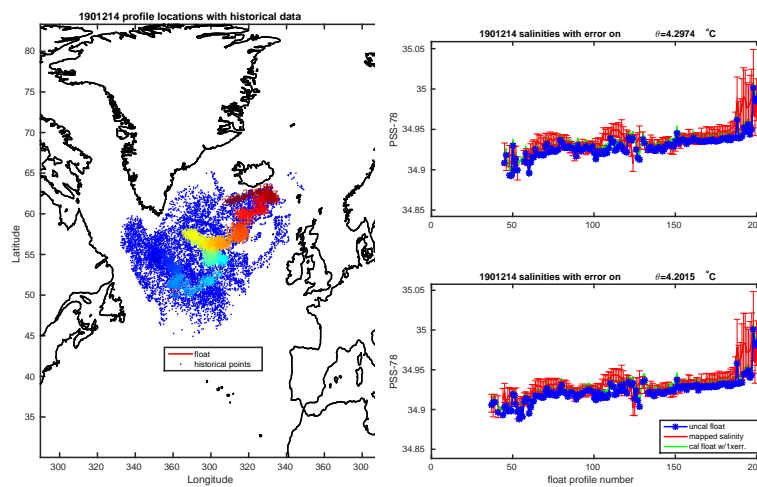


Figure 18: Figures from the OW method. (Left) Position of the historical and float data. (Right) Comparison, on various  $\theta$  levels, between the float data and the historical data interpolated at the float position.

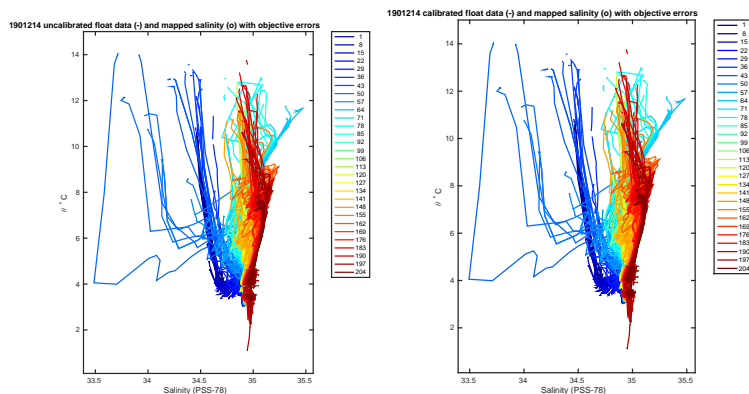


Figure 19: Figures from the OW method. Comparison of the  $\theta/S$  diagram of the float with the historical database. (left) raw data; (right) corrected data using the OW correction.

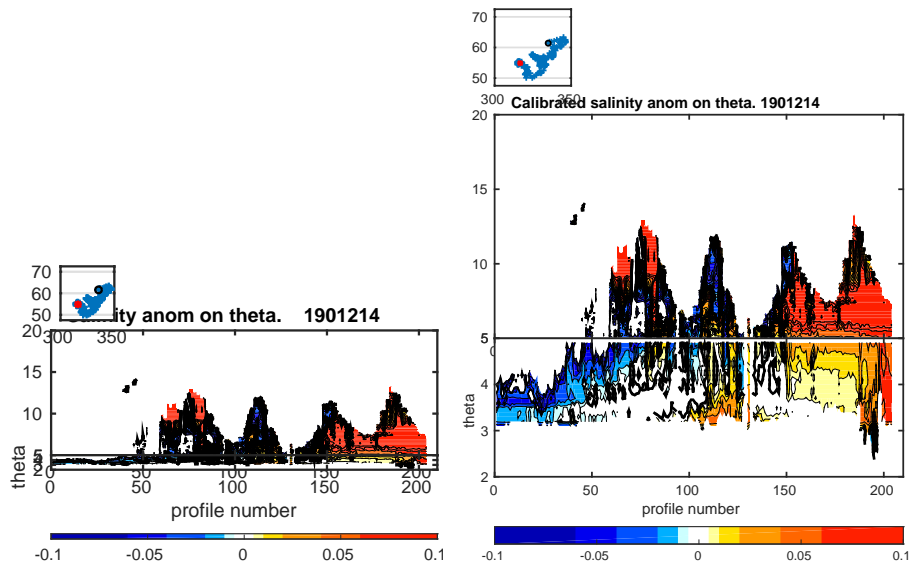


Figure 20: Figures from the OW method. Salinity anomaly:(left) raw data; (right) corrected data using the OW correction.

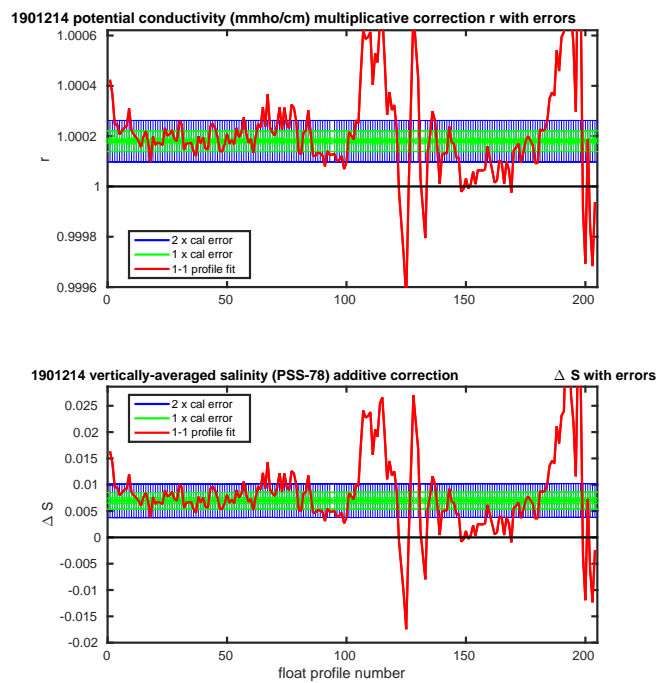


Figure 21: Correction proposed by the OW method.

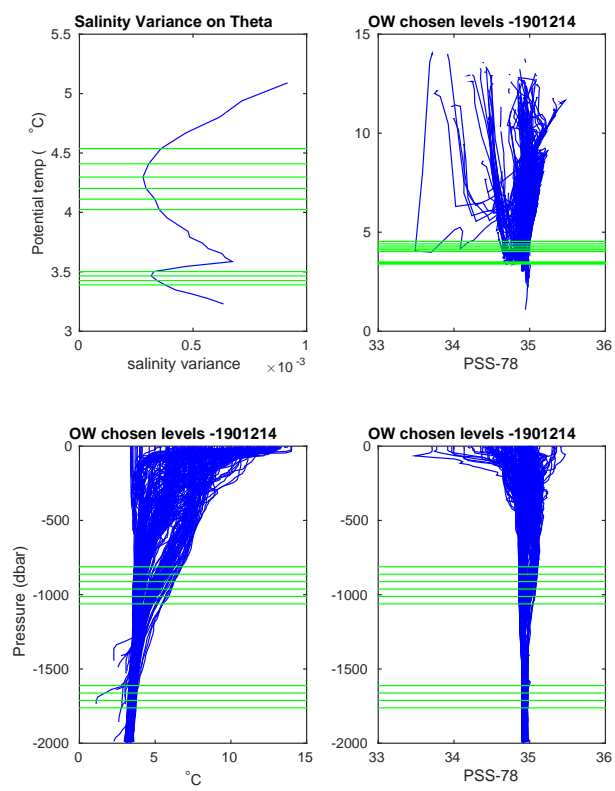


Figure 22: Chosed levels by the OW method.

# 1 Oxygen correction with LOCODOX

|  |                                   |                          |
|--|-----------------------------------|--------------------------|
| Number                                 | Deployment (cycle 1D)<br>cycle 1D | Last cycle<br>204A       |
| Provov<br>WMO 1901214                  | 21/07/2011<br>16h50               |                          |
| CTS3 DO                                | N 54.83655<br>W 34.4558           |                          |
| Date of oxygen control<br>October 2017 | Float status<br>DEAD              | Last cycle<br>01/02/2017 |
| Coriolis transmission                  |                                   | 10/10/2017               |

Table 1: Status of the float

This software is used to correct Oxygen data (parameter DOXY) contained in the files BR(real time) and/or BD(Delayed Mode) associated to files R (Real Time T/S) and/or D(Delayed Mode T/S).

**PI suggests :** The Oxygen corrections have been done only when Salinity and Temperature were available in Delayed Mode (D files). Theoretically, the corrections should be done from adjusted values (TEMP and PSAL). However, when there is a few bad values in salinity (of about few tens of PSU), and if there is no bias in salinity (OW method), PSAL data can be used instead of PSAL\_ADJUSTED, because the impact of those values on the oxygen correction is not significant.

To correct Oxygen data, LOCODOX software gives 3 choices to work :

- from a reference profile
- from WOA climatology
- from in air measurements

**The reference profile for this float is the station 6 of Ovide 2011 cruise (ov11me).**

LOPS options are :

|                              |          |
|------------------------------|----------|
| Options                      | Choice   |
| Unit DOXY                    | Mumol/kg |
| Suppress hooks               | YES      |
| Drift correction with        | PRES     |
| Vertical scale               | PRES     |
| Apply drift correction       | NO       |
| Correction using : PSAT/DOXY | PSAT     |
| kind of error                | RELATIVE |

Table 2: LOCODOX Options

## Applied DOXY correction

$PSAT=f(DOXY)$ ;  $PSAT\_ADJUSTED=A*PSAT+B$ ;  $DOXY\_ADJUSTED=f(PSAT\_ADJUSTED)$   
with  $A=0.972$ ;  $B=9.554$

Percent saturation corrected as a linear function of PSAT; Comparison to a single reference profile (isobaric match as in Takeshita et al. (2013)) on cycle 1; PSAT converted

from DOXY and DOXY\_ADJUSTED converted from PSAT\_ADJUSTED.

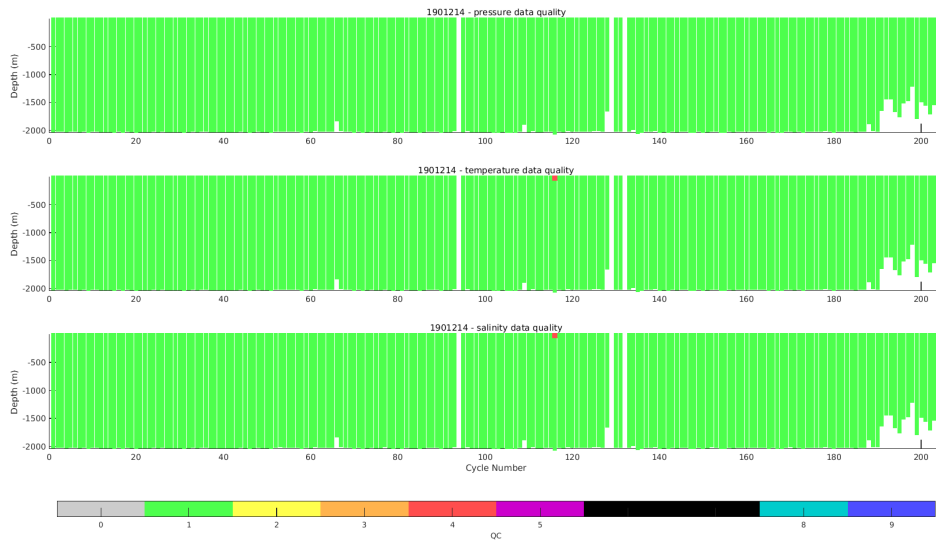


Figure 1: QC controls of Pressure, Temperature and Salinity. No bias in salinity for this float. Correction done with PSAL and TEMP and flags = 1 to 4.

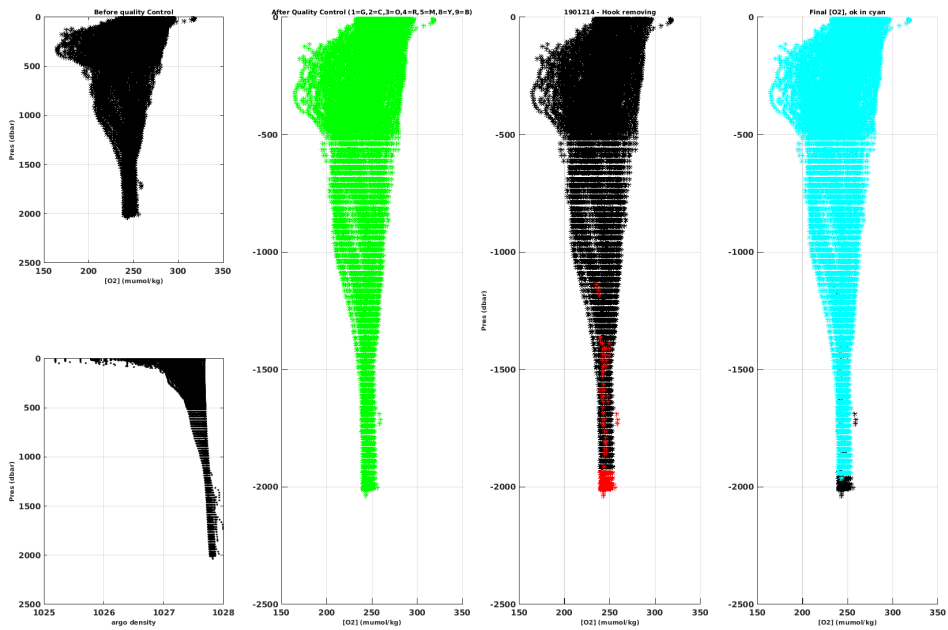


Figure 2: The first 50 meters from the bottom are suppressed because data are uncertain; Only data in cyan are taken for the correction.

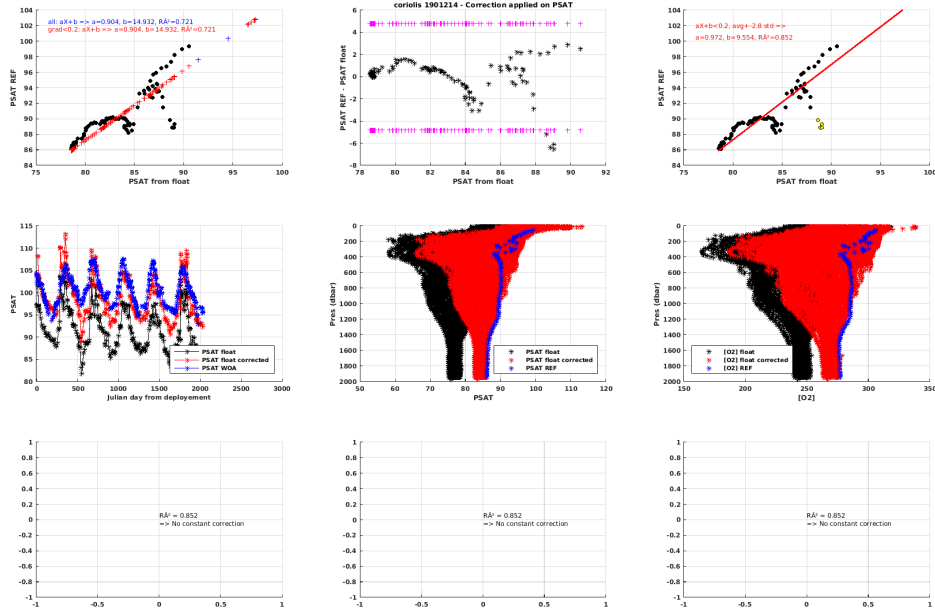


Figure 3: Plots produced by LOCODOX

Float 1901214 was corrected based on a comparison of the first ascending profile of the float with an in situ reference profile acquired at float deployment. The correction is done in considering the percentage of saturation (PSAT).

**Upper panels :** The three panels show the regression between the Argo profile and the reference profile.

**Middle left panels :** PSAT in the upper 10m from the raw data (black curve) and the corrected data (red curves). PSAT estimated from the World Ocean Atlas at the float position is also provided for comparison (blue curves).

**Middle center panel :** PSAT values from the raw data (black curves), the adjusted data (red curves) and the reference profile (blue curve).

**Middle right panel :** Same as the center panel but for dissolved oxygen concentration value (DOXY et DOXY\_ADJUSTED) in mumol/kg.

**Lower panels :** Same as the middle panels but when LOCODOX proposes a constant correction.



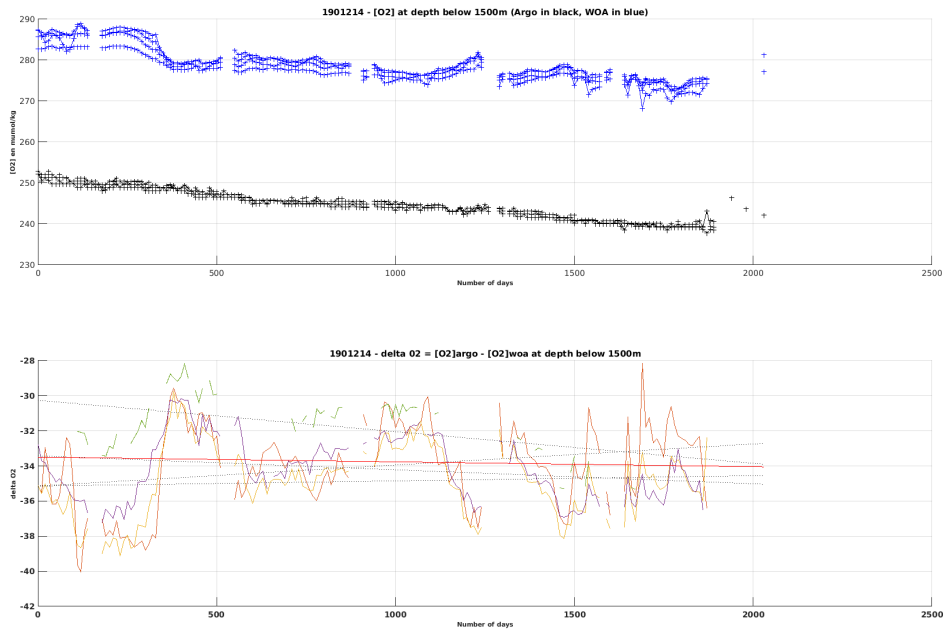


Figure 4: Comparison in the deeper levels (below 1500m) between the float data and WOA data interpolated at the float position (horizontal and vertical). The temporal evolution of the difference is used to estimate a possible sensor drift.

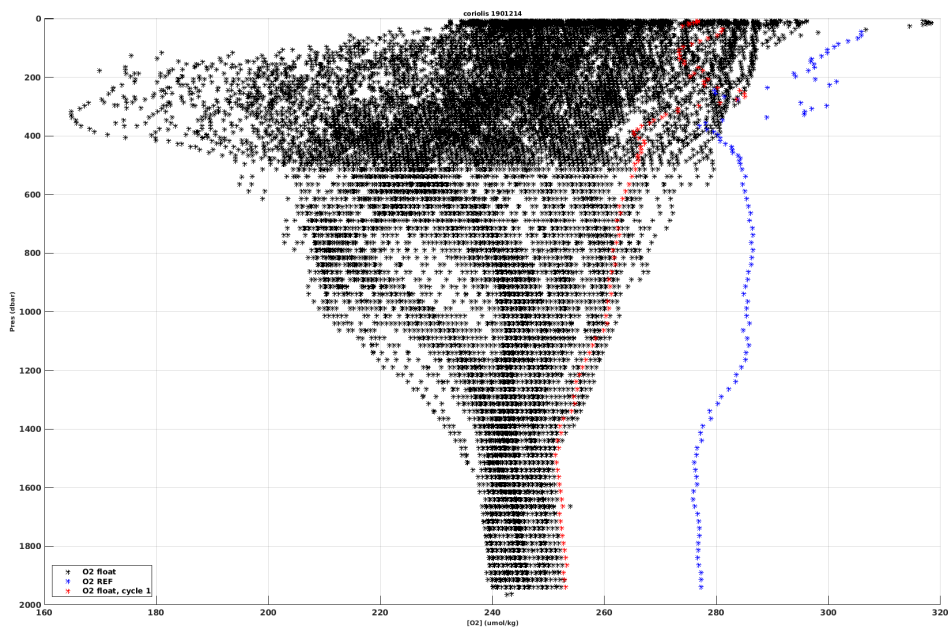


Figure 5: Profiles float 1901214 (black), O2 hydro reference (blue), O2 float cycle 1 (red)

## 1.1 Corrected data float

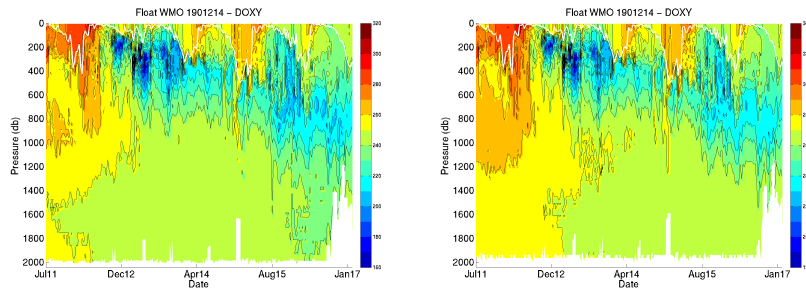


Figure 6: Oxygen section along the float trajectory (interpolated on standard levels). Quality flags are taken into account. Left plot: Raw data - Right plot : corrected data

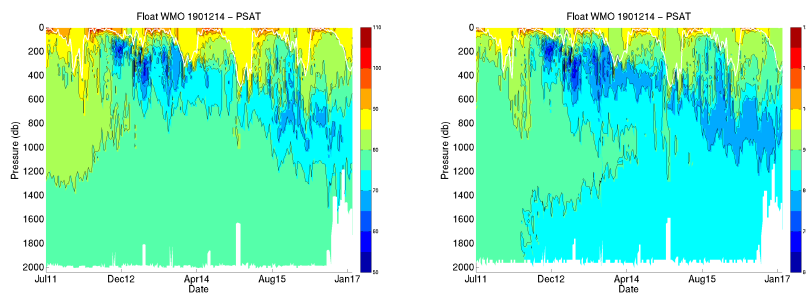


Figure 7: PSAT section along the float trajectory (interpolated on standard levels). Quality flags are taken into account. Left plot: Raw data - Right plot : corrected data

## 1.2 Examples of corrected profiles with LOCODOX

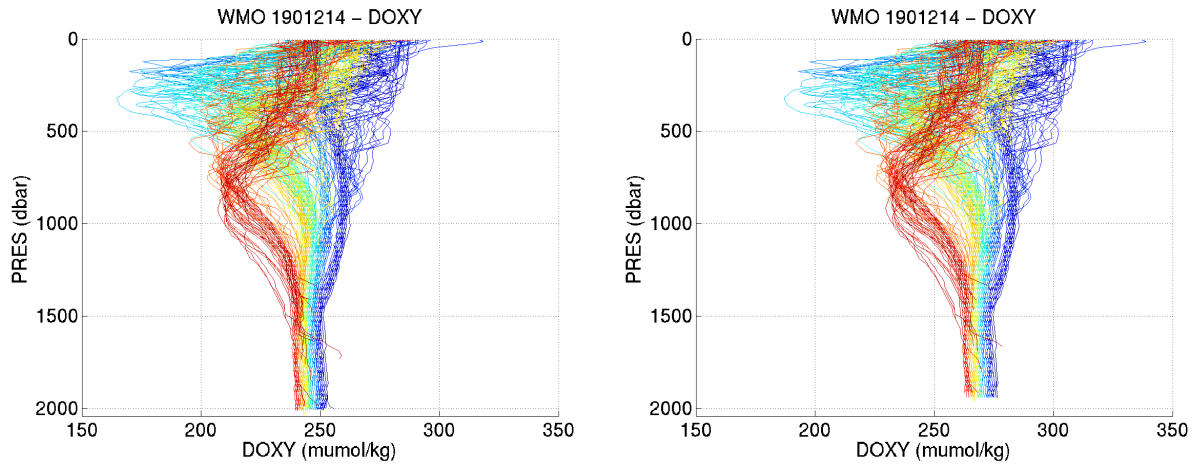


Figure 8: Oxygen profiles. Left plot: Raw data - Right plot : corrected data

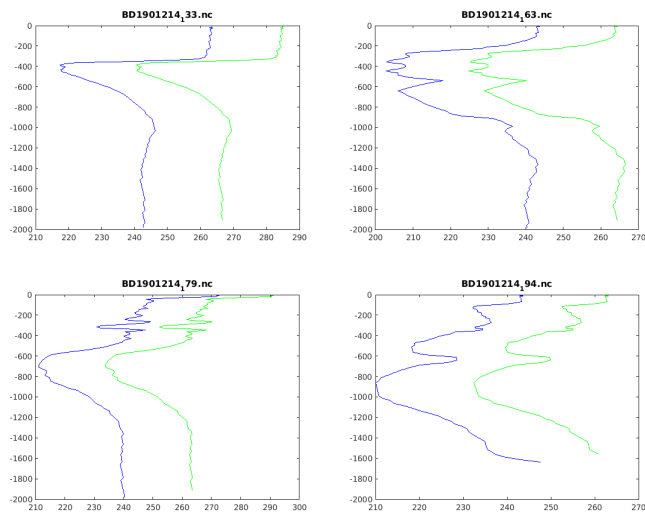


Figure 9: Float 1901214 : Corrected profiles in green.