
Argo Delayed Mode : Test of OW software against BS in North Atlantic

Delayed Mode

Action 26 – ADMT7

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1. Software and configuration

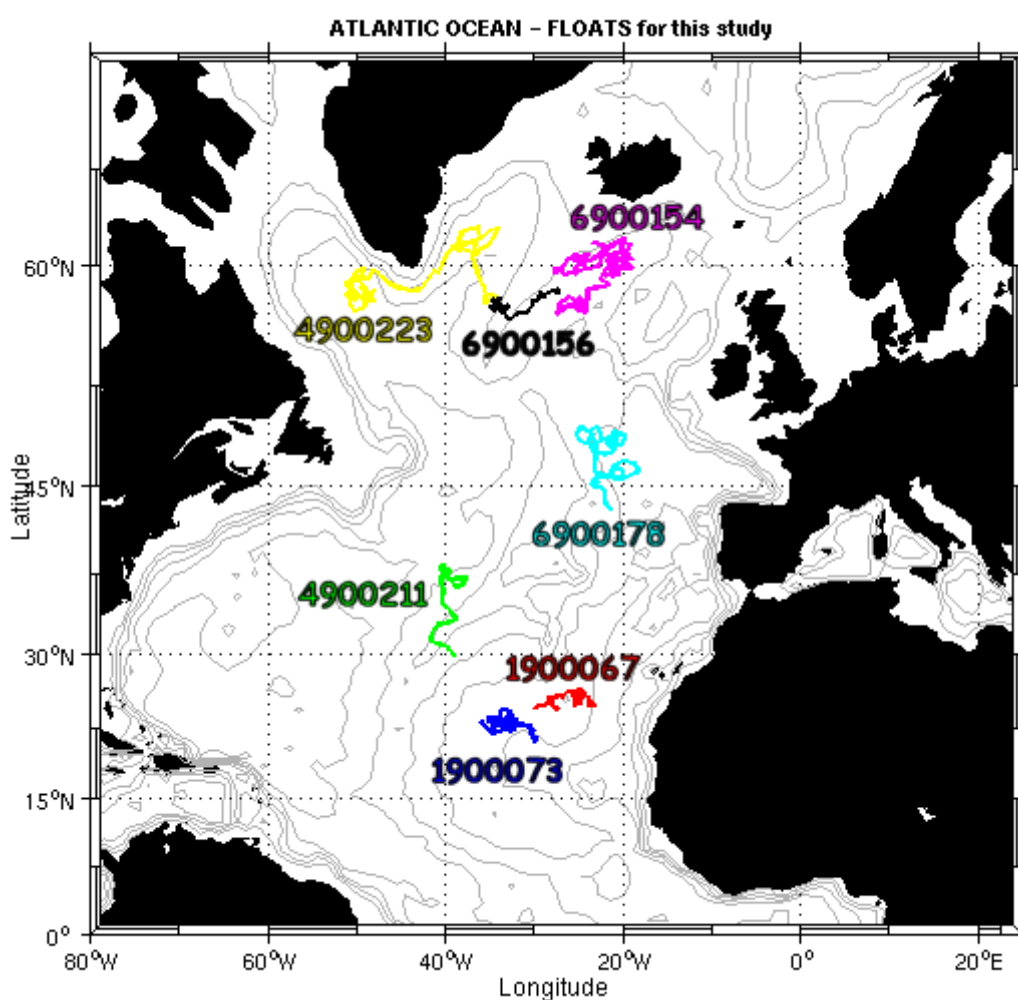
The OW software runs on PC (windows XP) with Matlab R2007a (7.4.0).

The BS software runs on PC (windows XP) with Matlab R2006b (7.3.0).

The float_source (OW' s method) has been updated on the 5th September, conversion has been done between ITS90 and ITS68 temperature. PV constraint is turned on in both softwares.

A first test has been done by Annie Wong on the float 3900161 in the Equatorial Pacific Ocean.

Tests have been done on the North Atlantic Ocean for 7 floats (1900067, 1900073, 4900211, 4900223, 6900154, 6900156, 6900178).

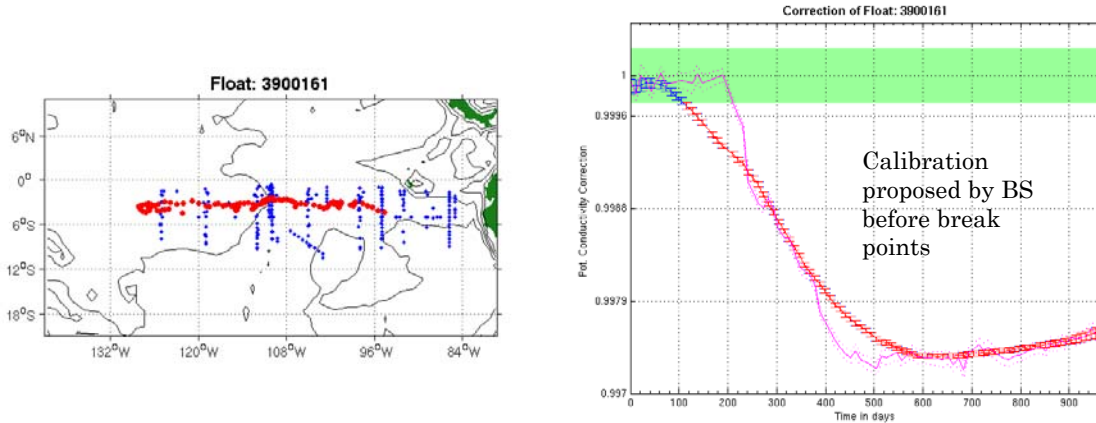


Location of the studied floats.

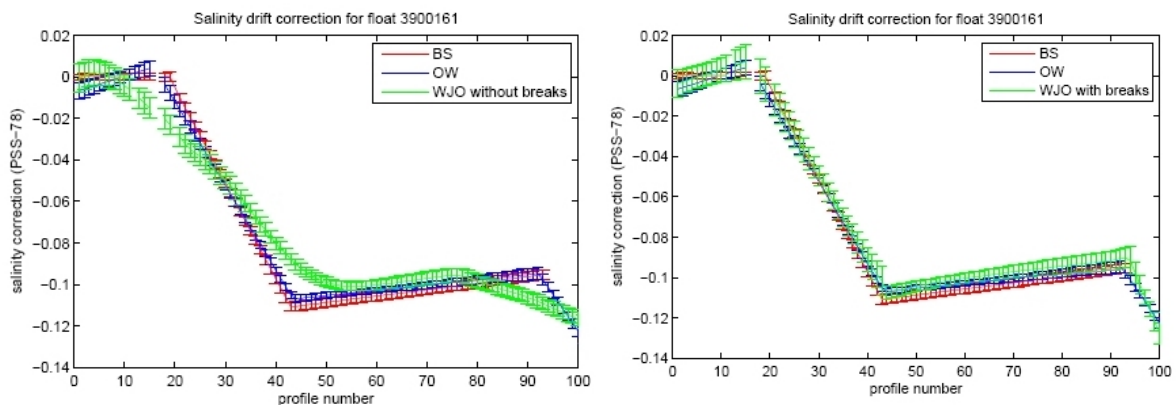
2. Results

2.1 Float 3900161

- Location of the stations : Pacific Equatorial Ocean



BS : Location of the stations (red) with historical CTD (blue) and calibration proposed before break points.



Comparison of salinity drift correction for float 3900161 recommended by OW, BS, and WJO. (results from Annie Wong)

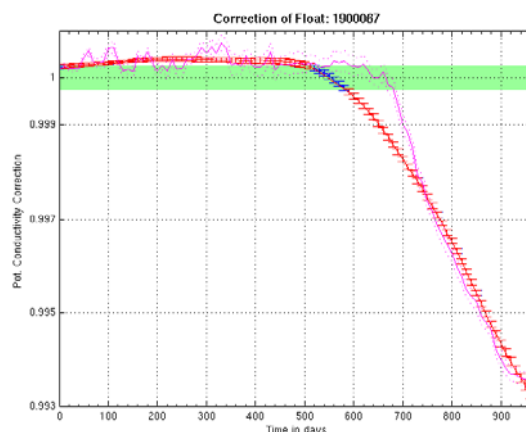
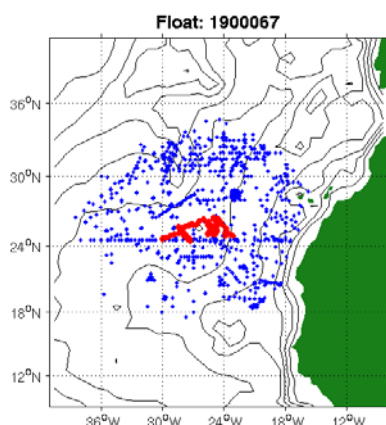
Comments of Annie Wong :

This float is in the equatorial Pacific, and developed salinity drift from about cycle 17 onward. The objective salinity estimates from OW (without PV constraint) and BS (with PV constraint) are similar in this part of the ocean, differing by less than 0.01 PSS-78. The recommended drift correction from OW and BS are also similar, with break points at similar cycles, and again with salinity corrections differing by less than 0.01 PSS-78.

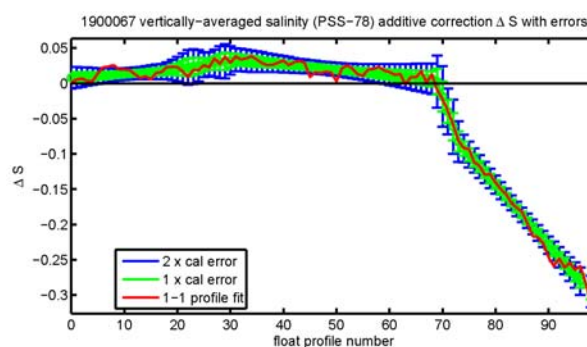
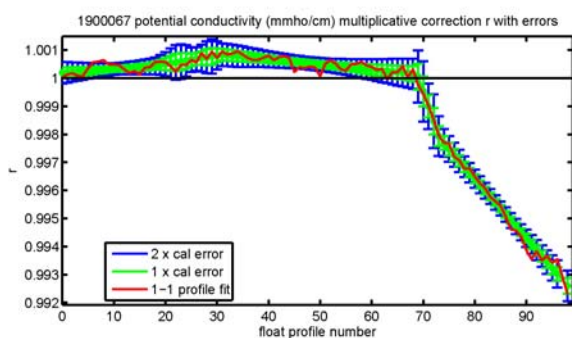
When WJO is run with no break points manually specified, WJO differs significantly from OW and BS at the cycles around where break points are present, ie. around cycles 43 and 92 (see left panel). This is to be expected since the WJO running window method is designed to smooth out such hard breaks. When break points are manually specified, WJO agrees with OW and BS.

2.2 Float 1900067

- Location of the stations : North-East Atlantic Ocean

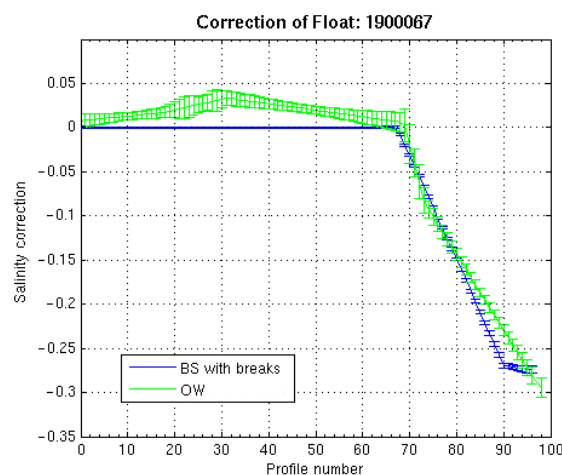
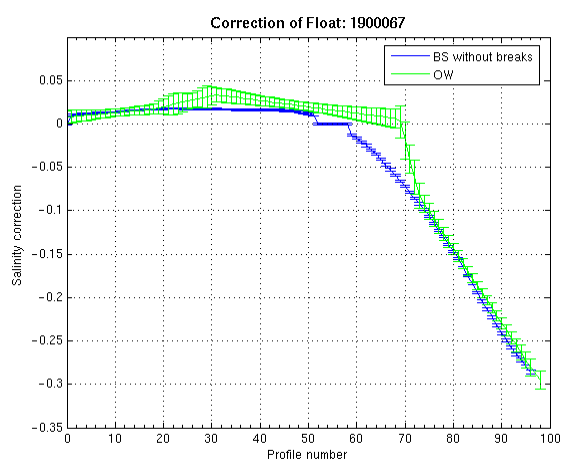


BS : Position of the cycles (red) with historical CTD (blue) , calibration without breaks.



OW calibration : potential conductivity and ΔS .

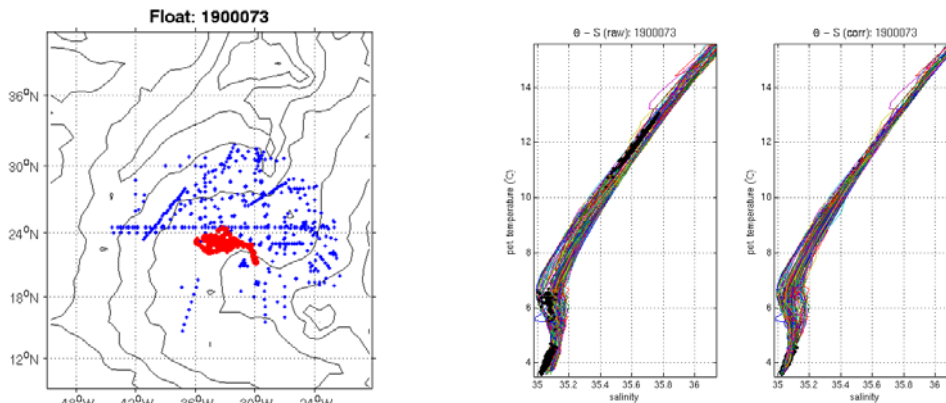
The float is in the North-East Atlantic ocean and developed salinity drift from about cycle 66 onward.



The objective salinity estimates from OW and BS are similar except for the choice of the break point in the area of the drift. When OW is run with no breaks points manually specified, the best model is found with 4 break points and differs slightly from BS at the cycles around where break points are present. Looking at the fit proposed without break (red and blue) from BS and individual corrections (magenta), the break point is not at the appropriate cycle. Without manual breaks for BS, the fit propose a correction before the break point at the cycle around 70 whereas with OW, the "correct" break is proposed. The piecewise linear fit appears to work very well with OW. For the last cycles, an other break points has been selected from BS but

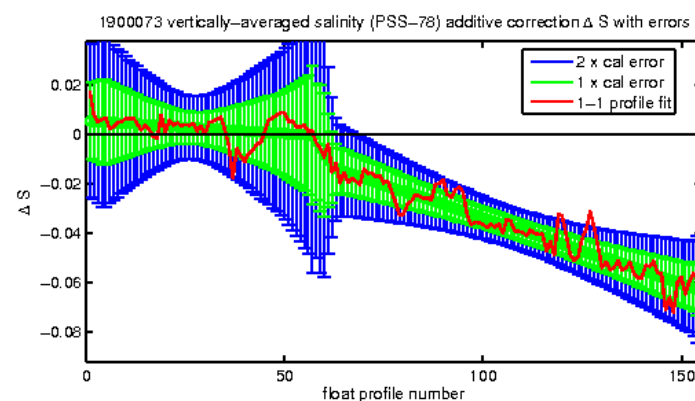
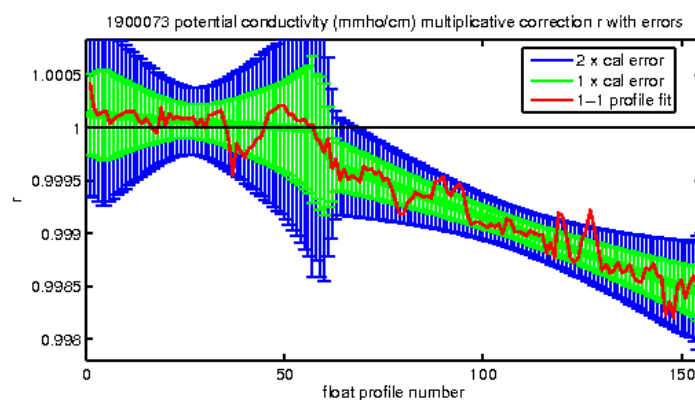
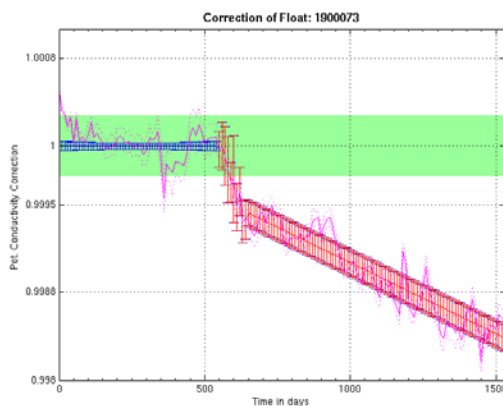
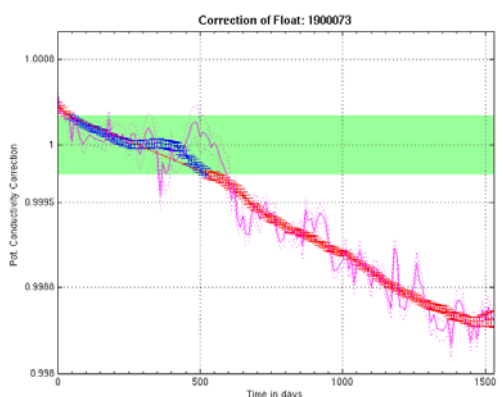
seems not to be very significant. For the first part of fit, it was decided to not take into account the correction with BS.

2.3 Float 1900073



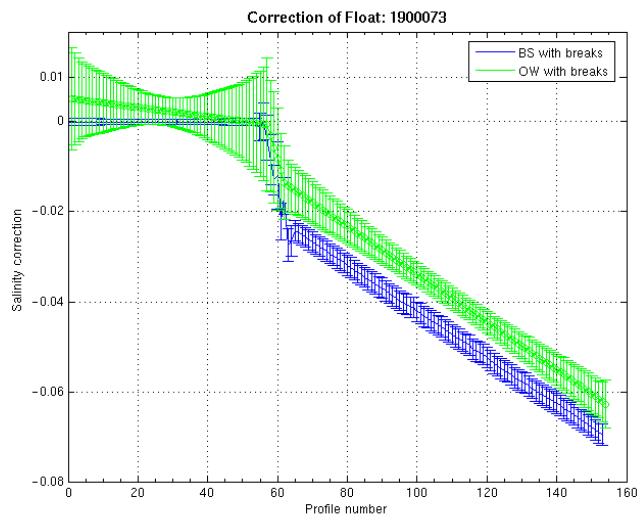
BS method : Position of the cycles (red) with historical CTD (blue) , TS diagrams with raw and corrected data. A drift is observed for salinity.

The float is in the North Atlantic ocean and developed salinity drift from about cycle 55 onward. The objective salinity estimates from OW and BS are similar. Both softwares set the same trend to fit the calibration on salinity : no real correction for the first part of cycles then a break point is observed around the cycle 55 with a negative drift. From the BS, the break point is visually selected. The piecewise linear fit from both softwares answer with same trends.



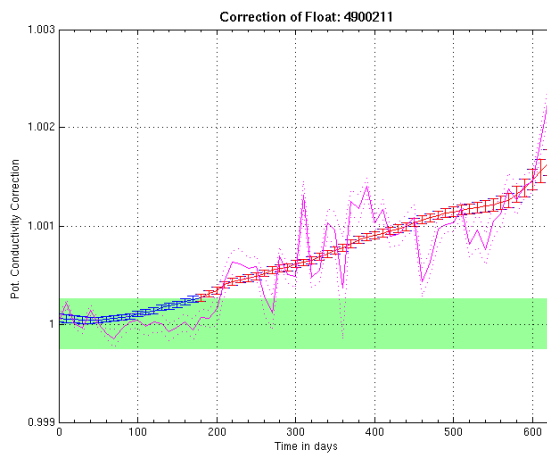
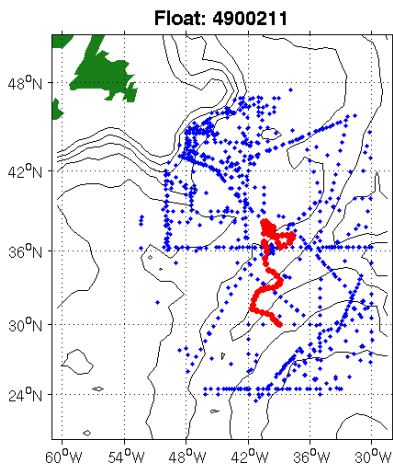
BS : (r cond) before and after splitting the time-serie OW : r cond and ΔS with breaks

Two break points have been selected from BS (55 and 65) whereas OW uses only different break points (55 and 60). Since the last break point is different, the slope of the fit shows a small gap not higher than 0.01 PSS-78.

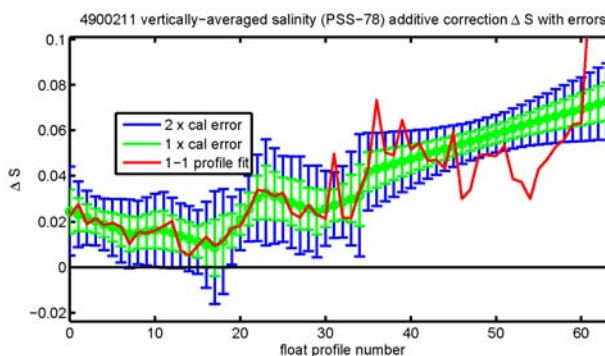
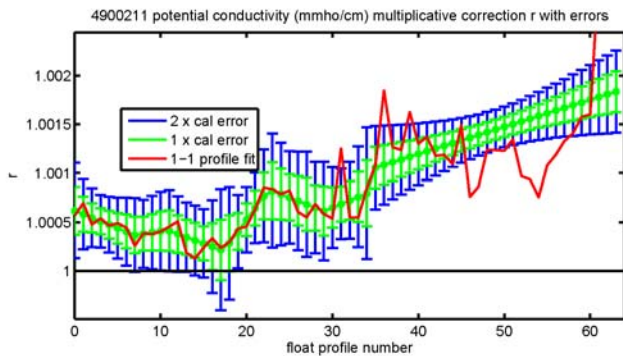


2.4 Float 4900211

Location of the stations : North Atlantic Ocean

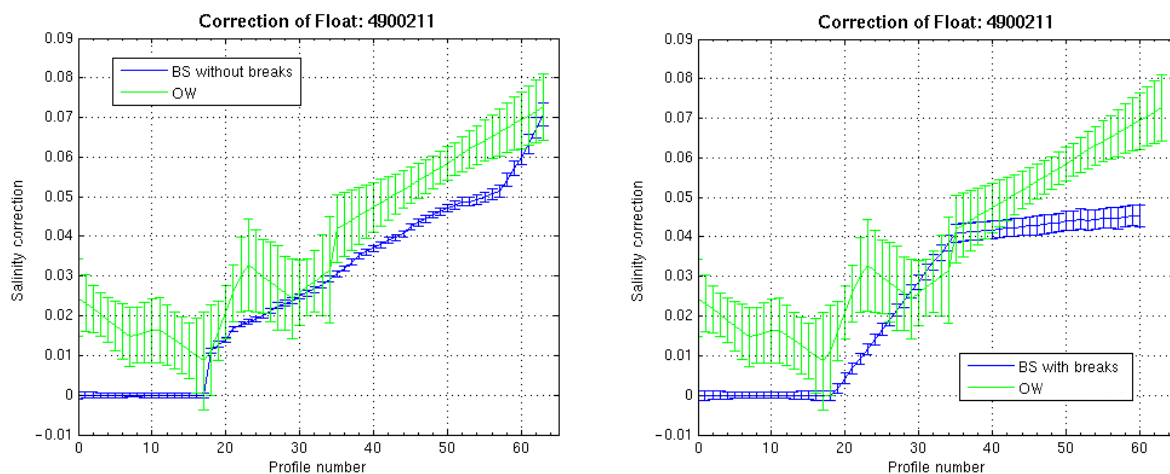


BS : Position of the cycles (red) with historical CTD (blue) , calibration without breaks.



OW calibration : potential conductivity and ΔS .

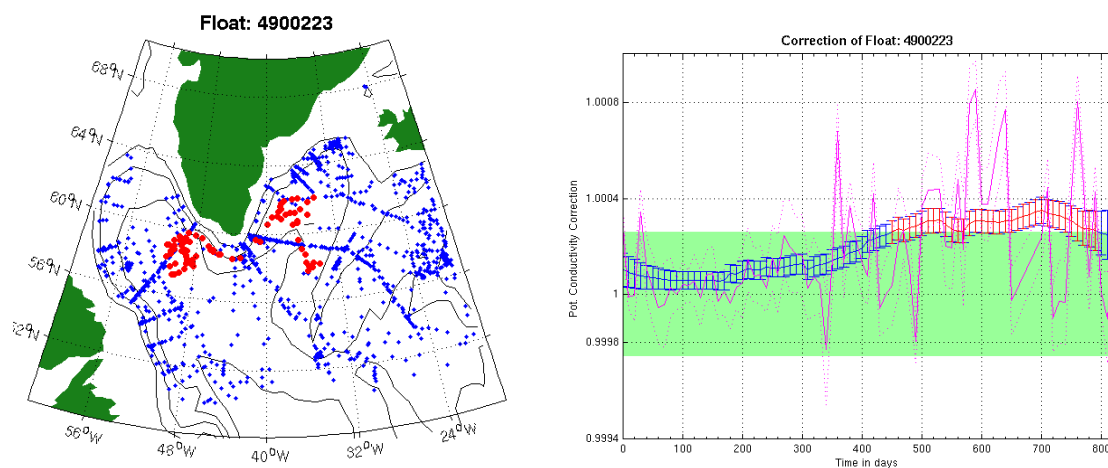
The objective salinity estimates from OW and BS show a slight difference, with a small gap, except for the last cycles where BS proposes a break point around the cycle 57 where a linear fit is proposed from the cycle 35 to the end with OW. For the first part of the cycles, no correction has been applied with BS.



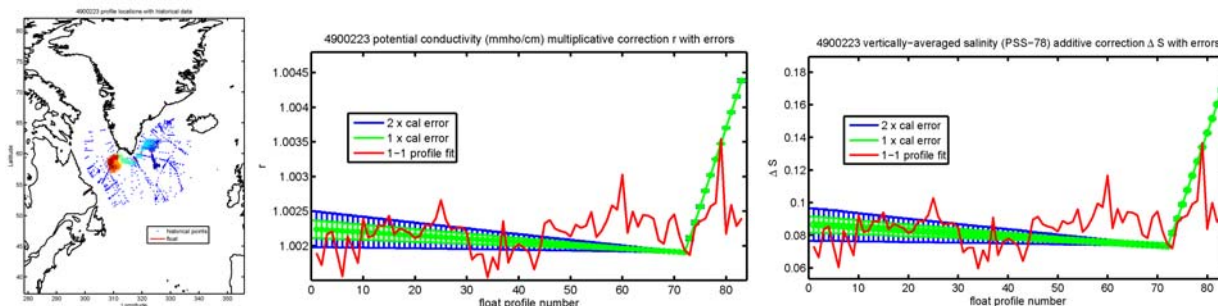
In the BS software, an offset can be included in the calculation. For the float 4900211, the offset calculated in tank is known and has been included for the run. This value of this offset is 0.007 and can explain the slight difference between OW and BS.

2.5 Float 4900223

Location of the stations : North-West Atlantic Ocean, close to the Labrador Sea.

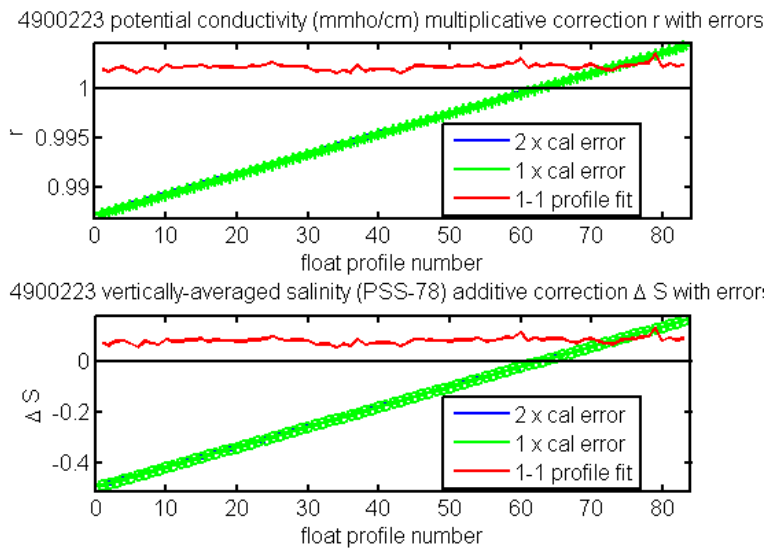


BS : Position of the cycles (red) with historical CTD (blue) , calibration without breaks.

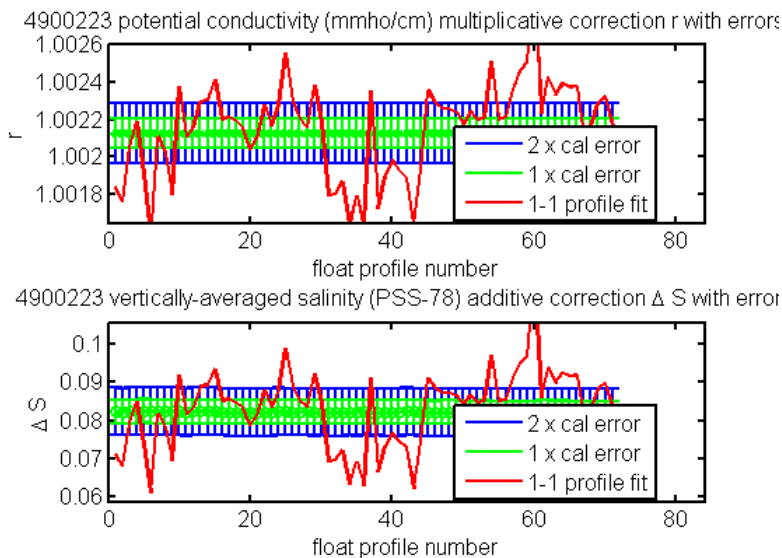


OW : map of the reference CTD and calibration (potential conductivity and ΔS).

The objective salinity estimates from OW and BS are not similar for the last part of cycles, after cycle 72. A linear fit is proposed for the first part but the spike observed around the cycle 80 leads to propose a correction of drift with OW. A first test has been done imposing no break, the results show a linear fit not correct. A second test has been done where the cycles 72 to 83 are manually excluded from all unique cal series.

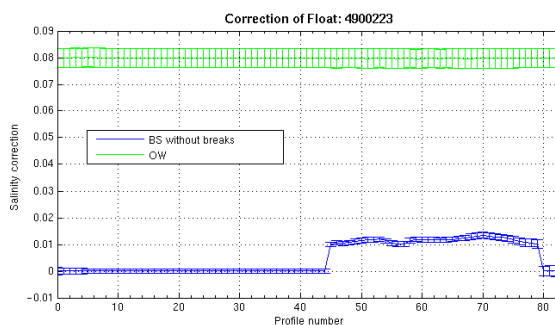


No break



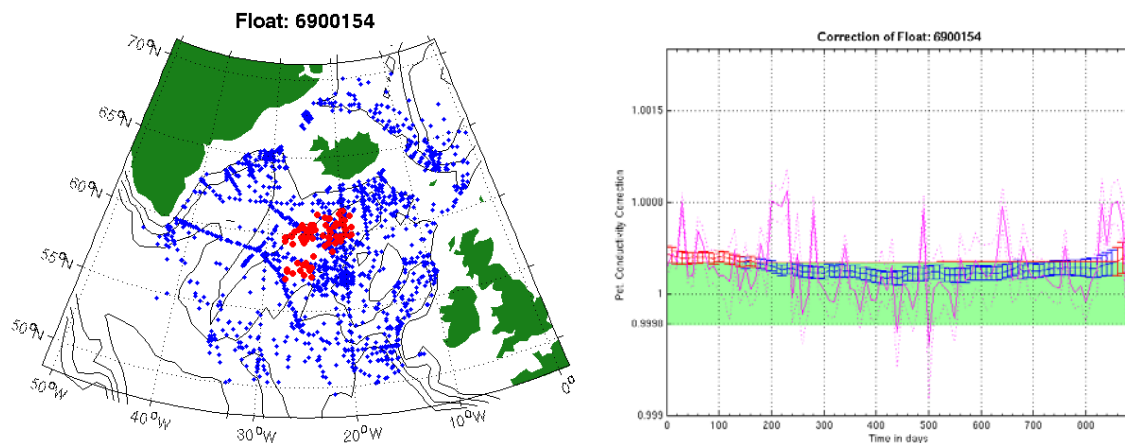
Cycles 72 to 83 are excluded.

From the second test, OW proposes a linear fit in more agreement with BS but with a consequent offset (around 0.08). For the float 4900223, the offset calculated in tank is known and has been included for the run. This value of this offset is -0.071 and explains the difference between OW and BS.

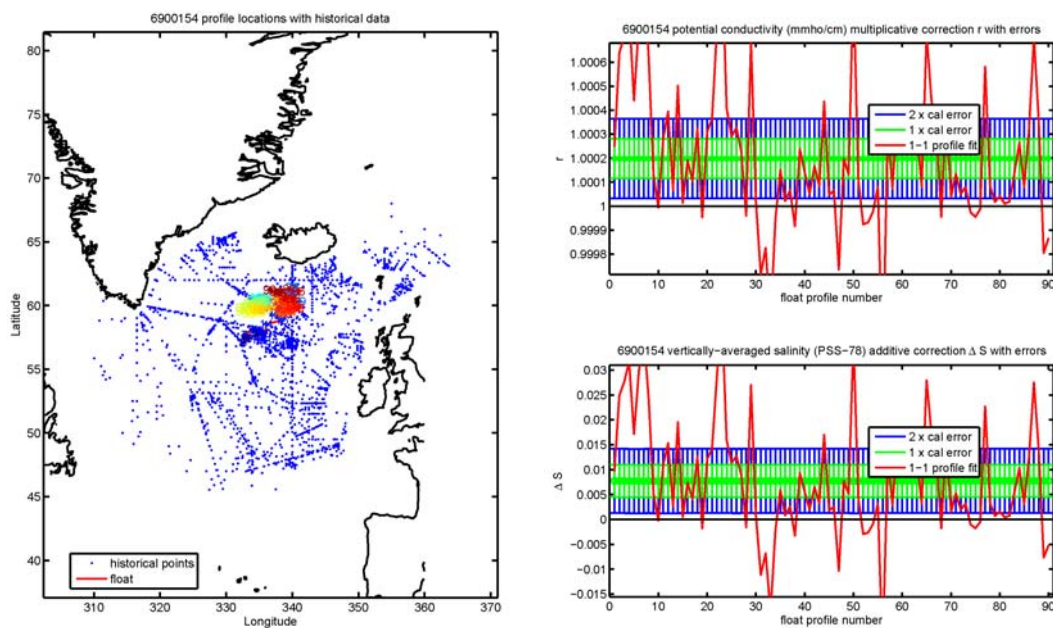


2.6 Float 6900154

Location of the stations : North Atlantic Ocean.



BS : Position of the cycles (red) with historical CTD (blue) , calibration without breaks.

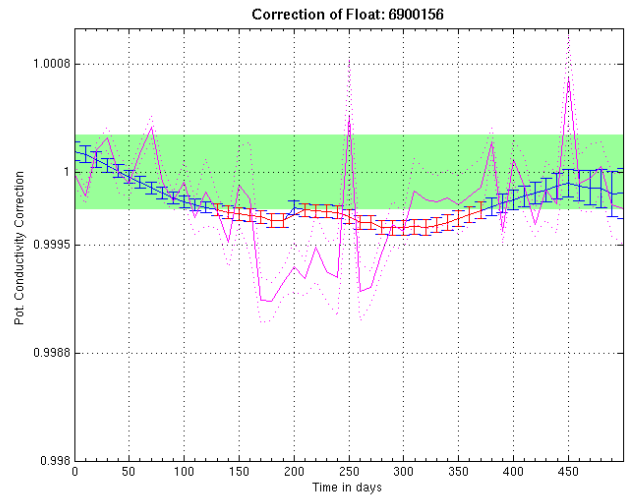
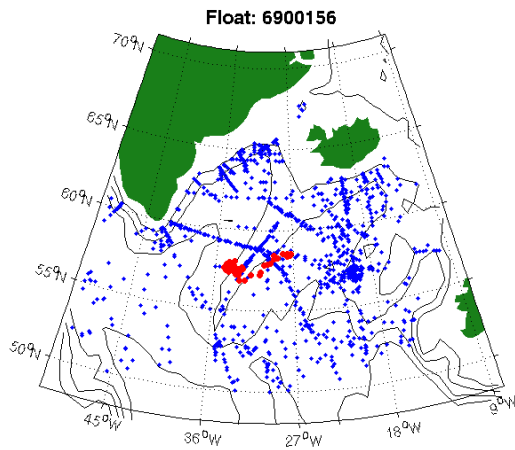


OW : map of the reference CTD and calibration (potential conductivity and ΔS).

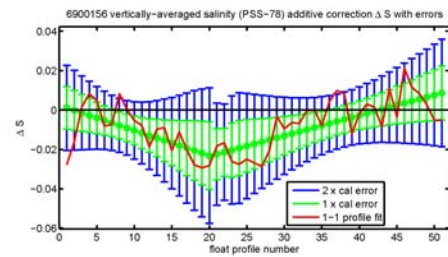
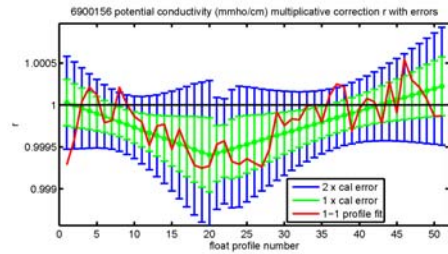
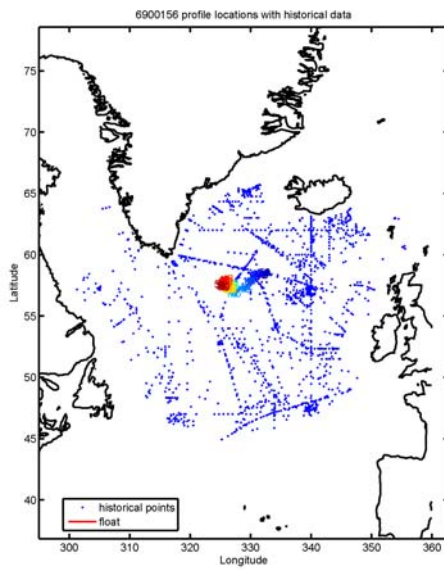
The objective salinity estimates from OW and BS are similar. A slight offset is proposed from both software. In this case, the results can almost be superposed.

2.7 Float 6900156

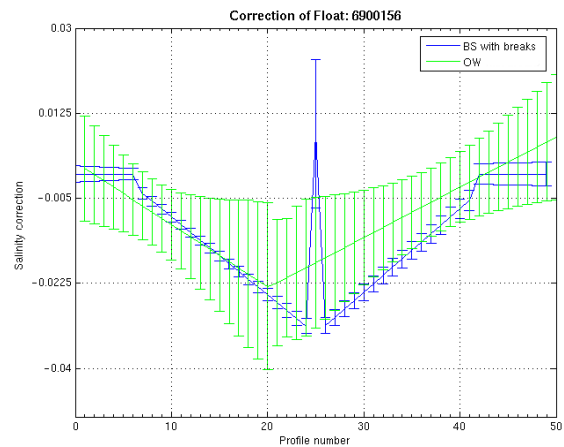
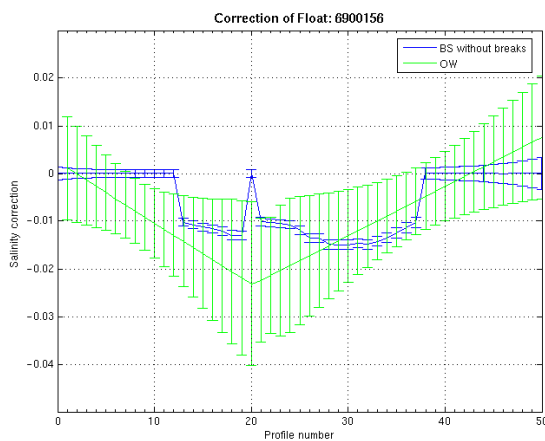
Location of the stations : North Atlantic Ocean.



BS : Position of the cycles (red) with historical CTD (blue) , calibration without breaks.



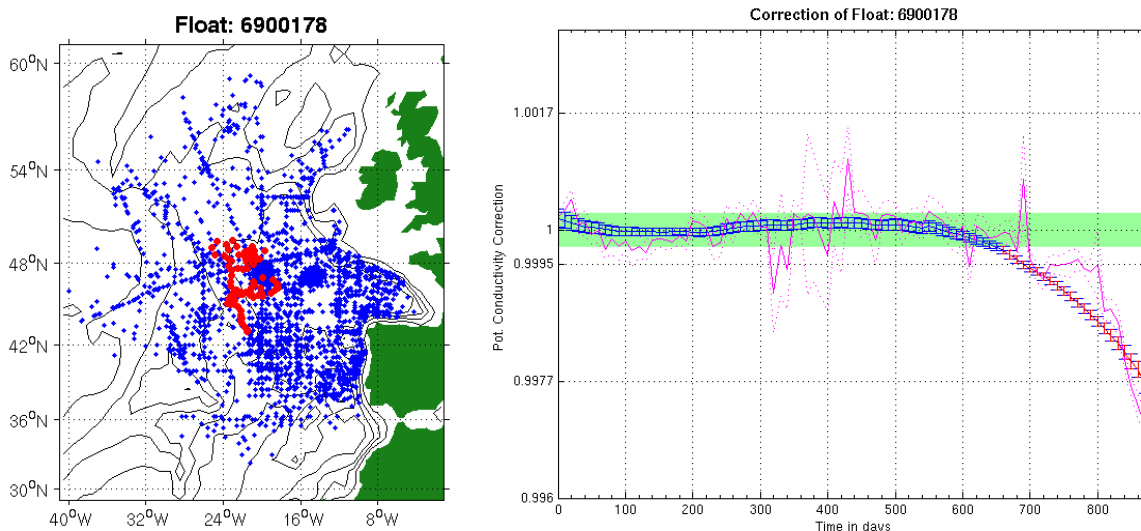
OW : map of the reference CTD and calibration (potential conductivity and ΔS).



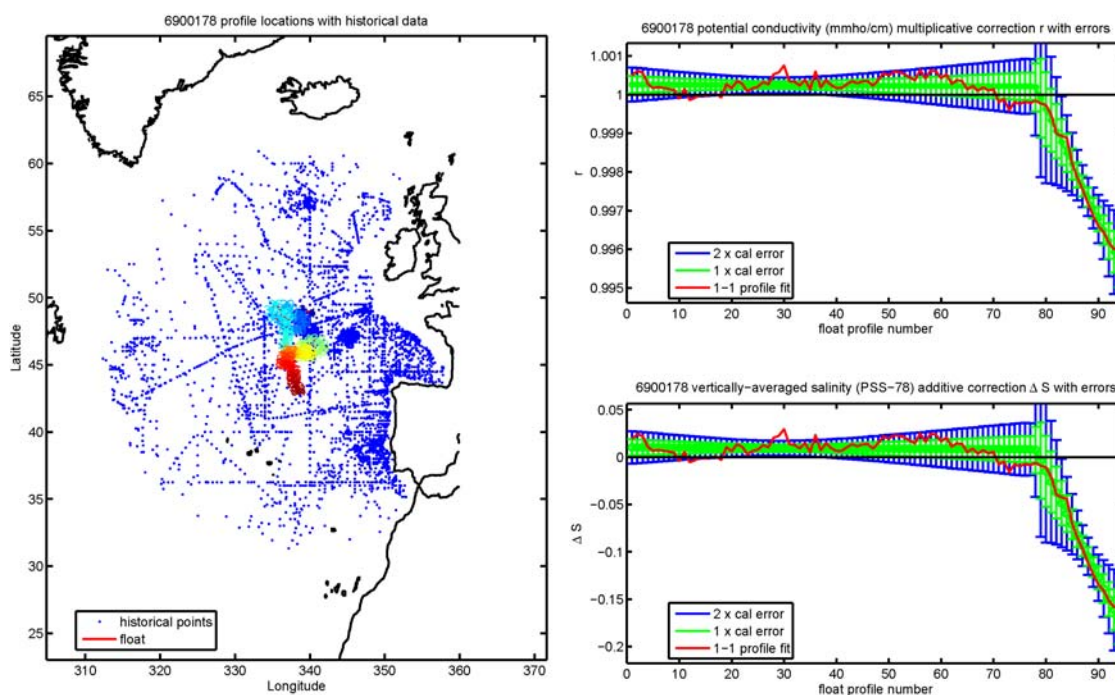
The break proposed by the OW method is agreed with the break observed with the BS method (without breaks imposed by an operator). The break which has been chosen by the operator could not be as good as the one from the automatic break point method. An individual correction is proposed by BS for the cycle 25, not observed with OW. The choice of the break points has been done with BS taking into account this cycle which may be would be removed from the correction.

2.8 Float 6900178

Location of the stations : North-East Atlantic Ocean.

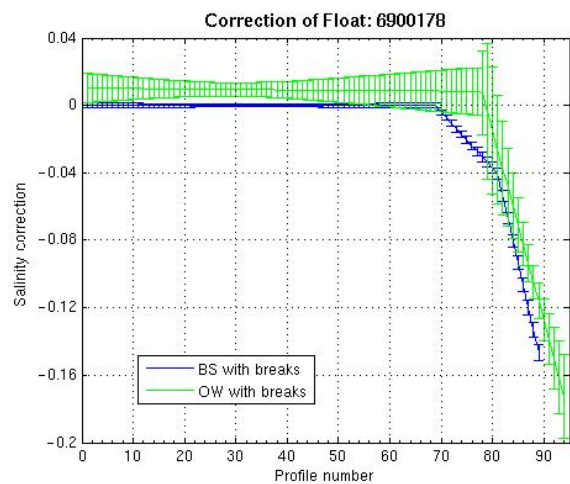
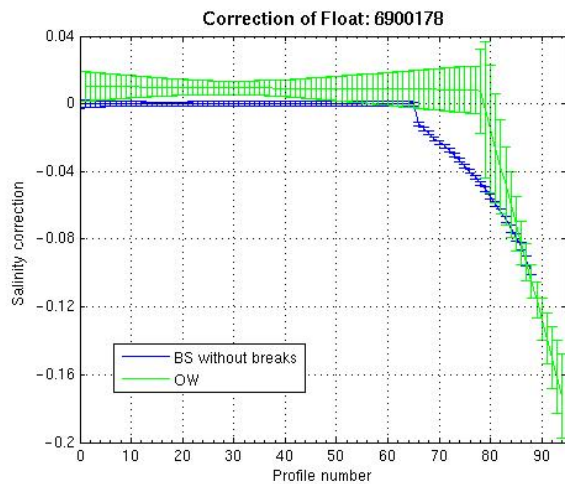


BS : Position of the cycles (red) with historical CTD (blue) , calibration without breaks.



OW : map of the reference CTD and calibration (potential conductivity and ΔS).

The float is in the North Atlantic ocean and developed salinity drift from about cycle 80 onward. The objective salinity estimates from OW and BS are similar. Both softwares set the same trend to fit the calibration on salinity : no real correction for the first part of cycles then a break point is observed around the cycle 80 with a negative drift. From the BS, two break point are visually selected but according to the OW results only one would be enough. The piecewise linear fit from both softwares answer with same trends.



A slight gap can be observed between both softwares. For the float 6900178, the offset calculated in tank is known and has been included for the run. This value of this offset is -0.012 and explains the slight difference between OW and BS.

3. Conclusion

Both softwares show similar results for the North Atlantic Ocean. The test done with one float in the Equatorial Pacific Ocean also shows good results. The objective salinity estimates from OW and BS are similar in those parts of the ocean, differing by less than 0.01 PSS-78.

The recommended drift correction are similar for OW and BS with break points at similar cycles. The PV constraint turned on in both softwares and piecewise linear fit lead to same results. In a few cases, a manual specification of the break points is needed. Those cases are mainly observed when the floats show a specific behavior.

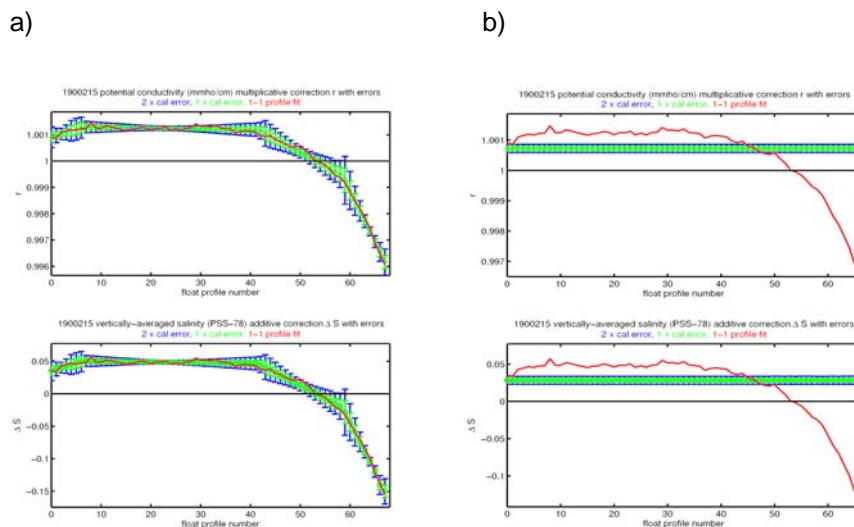
When differences are observed between both softwares for some floats, it is mainly due to a known offset on the salinity. This offset is known for some PROVOR floats from tests done in tanks and is included in the calculation with BS and not with OW.

4. Others comments

Some others tests have been done in the Equatorial Atlantic Ocean in spring 2007. A few problems occurred and exchanges with Annie Wong allowed to provide minor updates for a new version (available in June 2007).

- Sometimes failures occurred in the calculation and some cycles were missing in the final results. This problem could be related to a memory problem on computer. Matlab ran out of memory then the routine stopped before the last cycle.
- Some floats have two cycles 0 (ascending and descending profile). Since the PROFILE_NO in the float_source mat file has to be unique, a step needs to store cycle number to change the index which will be unique.
- In calseries_”float_name”.mat, the changes done to exclude some cycles give strange fit results.

Float 1900215 : a) First plots (without removing profiles), b) second plots (after excluding cycles 66 & 67, by setting 0 in the array "calseries" for these 2 profiles).



Float 1900215

It seems that excluding two cycles leads to different interpretation for the calibration. No break point has been found in the second case, that is strange. The Levenberg-Macquardt method to look for the break points seems to be very sensitive (as known).