direction de la technologie marine et des systèmes d'information
département informatique et données marines

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COATANOAN Christine

ARGO Real Time Standard test dataset

Real Time

Standard Test Dataset

This document aims to present the results of Argo real time quality control tests. This work has been done to check and make uniform the Argo quality control of each DAC.

This is the RTQC Procedure test — ADMT7 Action 23.

Summary

1. ARGO Real Time

1.1. Automatic Tests

A first action on the automatic tests has shown that the results were different in some cases according to the DACs. Some tests need to be more defined to put the right flag on the appropriate data.

The tests used for this action are the following tests :
(see the manual at http://www.coriolis.eu.org/cdc/argo/argo-quality-control-manual.pdf)

- **Deepest pressure** (test 19) :

This test requires that the profile has pressures that are not higher than DEEPEST_PRESSURE plus 10%. DEEPEST_PRESSURE value comes from the meta-data file of the float.
Action: If there is a region of incorrect pressures, all pressures and corresponding measurements should be flagged as bad data (flag '4'). All pressures flagged as bad data and all of the associated temperatures and salinities are removed from the TESAC distributed on the GTS.

- **Bad date** (test 2) :

The test requires that the observation date and time from the float be sensible.
· Year greater than 1997
· Month in range 1 to 12
· Day in range expected for month
· Hour in range 0 to 23
· Minute in range 0 to 59
Action: If any one of the conditions is failed, the date should be flagged as bad data and none of the data from the profile should be distributed on the GTS.

- **Impossible speed test** (test 5) :

Drift speeds for floats can be generated given the positions and times of the floats when they are at the surface and between profiles. In all cases we would not expect the drift speed to exceed 3 m/s. If it does, it means either a position or time is bad data, or a float is mislabeled. Using the multiple positions that are normally available for a float while at the surface, it is often possible to isolate the one position or time that is in error.
Action: If an acceptable position and time can be used from the available suite, then the data can be sent to the GTS. Otherwise, flag the position, the time, or both as bad data and no data should be sent.

- **Global range** (test 6) :

This test applies a gross filter on observed values for temperature and salinity. It needs to accommodate all of the expected extremes encountered in the oceans.
· Temperature in range -2.5 to 40.0 degrees C
· Salinity in range 0.0 to 41.0 PSU
Action: If a value fails, it should be flagged as bad data and only that value need be removed from distribution on the GTS. If temperature and salinity values at the same depth both fail, both values should be flagged as bad data and values for depth, temperature and salinity should be removed from the TESAC being distributed on the GTS.

- **Pressure increasing test** (test 8) :

This test requires that the profile has pressures that are monotonically increasing (assuming the pressures are ordered from smallest to largest).
Action: If there is a region of constant pressure, all but the first of a consecutive set of constant pressures should be flagged as bad data. If there is a region where pressure reverses, all of the pressures in the reversed part of the profile should be flagged as bad data. All pressures flagged as bad data and all of the associated temperatures and salinities are removed from the TESAC distributed on the GTS.

- **Spike test** (test 9) :

Difference between sequential measurements, where one measurement is quite different than adjacent ones, is a spike in both size and gradient. The test does not consider the differences in depth, but assumes a sampling that adequately reproduces the temperature and salinity changes with depth. The algorithm is used on both the temperature and salinity profiles.
Test value = | V2 - (V3 + V1)/2 | - | (V3 - V1) / 2 |
where V2 is the measurement being tested as a spike, and V1 and V3 are the values above and below.
Temperature: The V2 value is flagged when

· the test value exceeds 6.0 degree C. for pressures less than 500 db or
· the test value exceeds 2.0 degree C. for pressures greater than or equal to 500 db
Salinity: The V2 value is flagged when
· the test value exceeds 0.9 PSU for pressures less than 500 db or
· the test value exceeds 0.3 PSU for pressures greater than or equal to 500 db
Action: Values that fail the spike test should be flagged as bad data and are removed from the TESAC distributed on the GTS. If temperature and salinity values at the same depth both fail, they should be flagged as bad data and the values for depth, temperature and salinity should be removed from the TESAC being distributed on the GTS.

- **Gradient test** (test 11) :

This test is failed when the difference between vertically adjacent measurements is too steep. The test does not consider the differences in depth, but assumes a sampling that adequately reproduces the temperature and salinity changes with depth. The algorithm is used on both the temperature and salinity profiles.
Test value = | V2 - (V3 + V1)/2 |
where V2 is the measurement being tested as a spike, and V1 and V3 are the values above and below.
Temperature: The V2 value is flagged when
· the test value exceeds 9.0 degree C. for pressures less than 500 db or
· the test value exceeds 3.0 degree C. for pressures greater than or equal to 500 db
Salinity: The V2 value is flagged when
· the test value exceeds 1.5 PSU for pressures less than 500 db or
· the test value exceeds 0.5 PSU for pressures greater than or equal to 500 db
Action: Values that fail the test (i.e. value V2) should be flagged as bad data and are removed from the TESAC distributed on the GTS. If temperature and salinity values at the same depth both fail, both should be flagged as bad data and then values for depth, temperature and salinity should be removed from the TESAC being distributed on the GTS.

- **Density inversion** (test 14) :

This test uses values for temperature and salinity at the same pressure level and computes the density. The algorithm published in UNESCO Technical Papers in Marine Science #44, 1983 (referred to earlier) should be used. Densities are compared at consecutive levels in a profile, in both directions, i.e. from top to bottom profile, and from bottom to top.
Action: from top to bottom, if the density calculated at the greater pressure is less than that calculated at the lesser pressure, both the temperature and salinity values should be flagged as bad data. From bottom to top, if the density calculated at the lesser pressure is more than calculated at the greater pressure, both the temperature and salinity values should be flagged as bad data. Consequently, the values for depth, temperature and salinity at this pressure level should be removed from the TESAC distributed on the GTS.

- **Gross salinity or temperature sensor drift** (test 16):

This test is implemented to detect a sudden and important sensor drift. It calculates the average salinity on the last 100 dbar on a profile and the previous good profile. Only measurements with good QC are used.
Action: if the difference between the 2 average values is more than 0.5 psu then all measurements for this parameter are flagged as probably bad data (flag '3'). The same test is applied for temperature: if the difference between the 2 average values is more than 1 degree C then all measurements for this parameter are flagged as probably bad data (flag '3').

- **Frozen profile** (test 18):

This test can detect a float that reproduces the same profile (with very small deviations) over and over again. Typically the differences between 2 profiles are of the order of 0.001 for salinity and of
the order of 0.01 for temperature.
A. Derive temperature and salinity profiles by averaging the original profiles to get mean values for each profile in 50dbar slabs (Tprof, T_previous_prof and Sprof, S_previous_prof). This is necessary, because the floats do not sample at the same level for each profile.
B. Substract the two resulting profiles for temperature and salinity to get absolute difference profiles:
· deltaT=abs(Tprof-T_previous_prof)
· deltaS=abs(Sprof-S_previous_prof)
C. Derive the maximum, minimum and mean of the absolute differences for temperature and salinity:
· mean(deltaT), max(deltaT), min(deltaT)
· mean(deltaS), max(deltaS), min(deltaS)
D. To fail the test, require that:

· max(deltaT) < 0.3
· min(deltaT) < 0.001
· mean(deltaT) < 0.02
· max(deltaS) < 0.3
· min(deltaS) < 0.001
· mean(deltaS) < 0.004

Action: if the profile fails the test, all measurements for this parameter are flagged as bad data (flag '4'). If the float fails the test on 5 consecutive cycles, it is inserted in the greylist.

1.2. Reference Dataset

A set of data have been sent to each DAC on 11/22/2006.

The list of profiles is :

TEST	Name_TEST	FLOAT	CYCLE	FILENAME after TEST	FILENAME after all tests		
19	Deepest pressure	1900521	4	R1900521_004.nc	R1900521_004_all.nc		
2	Bad date	1900380	0	R1900380_000.nc	R1900380_000_all.nc		
5	Impossible speed test	1900074	124	D1900074_123.nc		needs cycle 123	
				D1900074_124.nc			
6	Global range	4900103	49	R4900103_049.nc	R4900103_049_all.nc		
8	Pressure increasing test	1900044	121	R1900044_121.nc			> test 19
				R3900259_057.nc		see flag on pressure (T & S all in flag 4 from the DAC)	add R1900144_066.nc
9	Spike test	4900103	49	R4900103_049_T9.nc	R4900103_049_all.nc		
11	Gradient test	6900119	117	R6900119_117_T11.nc	R690019_117_all.nc = R6900119_117.nc		
14	Density inversion	6900119	117	R6900119_117_T14.nc			
16	Gross salinity or temperature sensor drift	1900541	6	R1900541_006.nc		needs cycle 5	
				R1900541_005.nc			
18	Frozen profile	4900364	102	R4900364_102.nc			
		4900364	101	R4900364_101.nc		needs previous cycles - DAC can choose to put them in the grey list after more cycles and uses Flag 3	
		4900272	103	R4900272_103.nc			
		4900272	102	R4900272_102.nc			

This dataset has been created from the Coriolis "test" database to handle data without changing original netcdf files from the GDAC ftp site. For each profile, tests are passed one by one. Results are proposed accordingly to the appropriated test (FILENAME after TEST). For some cycles, results are also proposed after running all the automatic tests (FILENAME after all tests) because sometimes bad/doubtful data are flagged not with the right test but the following one.

If the results from Coriolis are different for those expected then a manual operation is done to put the right flag on measurements. See the results of Coriolis to know what profiles are in this case.

Some good profiles have been also provided to check the tests.

Good profile	Cycles	Area	Type	Filename	DAC
5900912	14	North Pacifique	PROVOR	R5900912_014.nc	CORIOLIS
2900410	4	Equatorial Pacifique	APEX	D2900410_004.nc	JMA
4900528	91	NE Atlantique	PROVOR	R4900528_091.nc	MEDS
6900367	84	Med-Atlantique	PROVOR	R6900367_084.nc	CORIOLIS
2900398	186	Indian	APEX	R2900398_186.nc	AOML
1900122	49	Indian	PROVOR	D1900122_049.nc	INCOIS
5900031	20	Indian	APEX	R5900031_020.nc	CSIRO

2. Synthesis of results and improvement

- For each test, comparisons have been done between the results of DACs and standard dataset, to point out the differences between DACs on the real time quality control. In the following tables, conclusions for each test and DAC is presented. To get details on the DAC results, go to the annex report.
- In some cases, wrong data can be detected from more than an individual test. Therefore, it is not impossible that a measurement, which should be detected by a first individual test, will be detected by the next test, aside from the way individual tests are applied by the DACs.
- It seems that some DACs were not able to run just a single test for this work, so it was not so easy, in some cases, to know if the QC on the measurement has been proposed by the right test. It is not excluded that there are differences in the way the tests are applied.
- It seems also that all the automatic tests do not find all anomalies on a float profile. There are some uncertainties on how to apply them. Some improvements need to be take into account to catch wrong or doubtful data. In this chapter, for each test, if necessary, improvement of the tests is provided, taking into account those results and propositions exchanged by emails the last months.
- As Claudia Schmid has notified : " Some DACs exclude data flagged by an earlier test from the next test, while others do not. For example, at some DACs, a value that failed the spike test is excluded before the gradient test is applied. Similarly, values that fail the spike or gradient test are excluded before the density inversion test is applied".

Proposal : Test application order
The automatic tests must be applied according to the specific order described in the QC manual. A value with a flag 4 must not be taken into account in the next tests.

For most of the tests, a figure is provided. This figure shows the value of TEMP and PSAL versus PRESSURE, and Flag on those measurements, by DACs which have sent data files with results. Results can be different since some DACs have run all the tests on each profile of the standard dataset. For INCOIS, only the difference with the Coriolis results is presented in the figure.

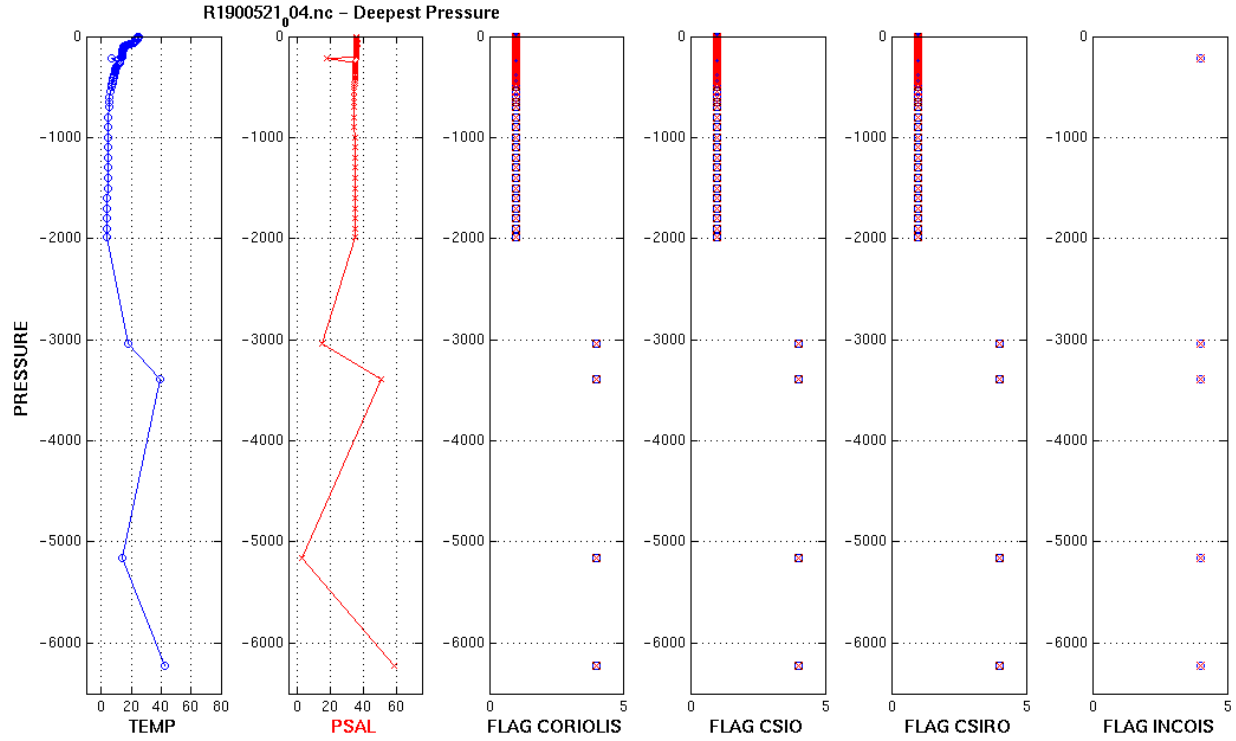
2.1. Deepest pressure

2.1.1. Synthesis of results – Test 19

The test has been done on the float 1900521, cycle 4. In the metadata file, DEEPEST_PRESSURE = 2000. The flag of the last 4 levels of pressure and, associated temperature and salinity, are set to 4 with the automatic test.

Results by DAC for this test :

	AOML	BODC	CLS	CSIO	CSIRO	CORIOLIS	INCOIS	JMA	KMA	MEDS
TEST 19	Implement	OK	OK	OK	OK	OK	OK	Not operationally applied	?	OK



Remarks :

Sometimes the bad measurement can be detected from another appropriate test if the first one is not failed. This is the case for instance for the last temperature measurement (42.183°C) of the profile which can be also detected with the test 6 (global range) if the test 19 (deepest pressure) is not failed.

For CSIO, the last 4 pressure measurements failed the deepest pressure test but it is not clear if the Flag on TEMP and PSAL have been set to 4 from this test or from all the automatic tests.
Other flag is proposed by INCOIS for the level 219, due to the spike test. No Flag 4 on pressure below 2000m for INCOIS ?

2.1.2. Improvement

Depending on DACs, if the flag on the pressure is set to 4, either the flags on TEMP and PSAL are also set to 4 or initial flag is kept for those parameters.
PRES_QC = FLAG 4 => T and S with FLAG 4 ??? KEEP INITIAL FLAG FOR TEMP & PSAL ?
The pressure can be bad but the associated values of TEMP and PSAL could be good with the right pressure, so if the pressure is corrected, the values of TEMP and PSAL could be good data.

Proposition : Only Flag pressures in tests 8 and 19.

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Test 19. Deepest pressure test
(ELIMINATED FLAG 4 FOR T AND S TO MAKE THIS TEST CONSISTENT WITH TEST 8)

Action: If there is a region of incorrect pressures, all pressures should be flagged as bad data (flag 4). All pressures flagged as bad data and all of the associated temperatures and salinities are removed from the TESAC distributed on the GTS.

3 REASONS TO ONLY FLAG THE PRESSURE IN TESTS 8 AND 19:
- TO HAVE A CONSISTENT WAY OF FLAGGING BETWEEN THE PRESSURE TESTS 8 AND 19,
- IF THE PRESSURE FLAG IS 4, THE TEMPERATURE AND SALINITY DATA DO NOT GO TO GTS AND ANY USER OF NETCDF FILES CAN DECIDE TO EXCLUDE ALL LEVELS WHERE THE PRESSURE FLAG IS 4.

- IT MAKES IT EASIER TO USE TEMPERATURE AND SALINITY DATA THAT PASSED ALL TESTS AND WERE ONLY FLAGGED AS BAD DUE TO PRESSURE PROBLEMS.
****

Proposal : As the TEMP & PSAL are doubtful but a correction may be applied in delayed mode when PRES is flagged to 4, T and S should be flagged to 3.

2.2. Bad date

2.2.1. Synthesis of results

The test has been done on the float 1900380, cycle 0. The flag on the JULD_QC must be 4.

	AOML	BODC	CLS	CSIO	CSIRO	CORIOLIS	INCOIS	JMA	KMA	MEDS
TEST 2	OK	Invalid date : argos message not processed	OK	OK	OK	OK	"Missing" date field in the profile, processing stops proceeding further	JULD and JULD_LOCATION tested flag 4 written in JULD_QC and POSITION_QC	?	OK

2.2.2. Improvement of the test

No improvement needed.

2.3. Impossible speed test

2.3.1. Synthesis of results

The test has been done on the float 1900074, cycle 124. For cycle 124, POSITION_QC = "4".
For other cases, the time could be the parameter in error.

	AOML	BODC	CLS	CSIO	CSIRO	CORIOLIS	INCOIS	JMA	KMA	MEDS
TEST 5	OK	Bad position found but flags not yet applied	No reproducible	Ok Overall flags for T and S are '4'	OK	OK	OK Identified using VQC (Visual Quality Control)	Use trajectory data	?	OK

2.3.2. Improvement of the test

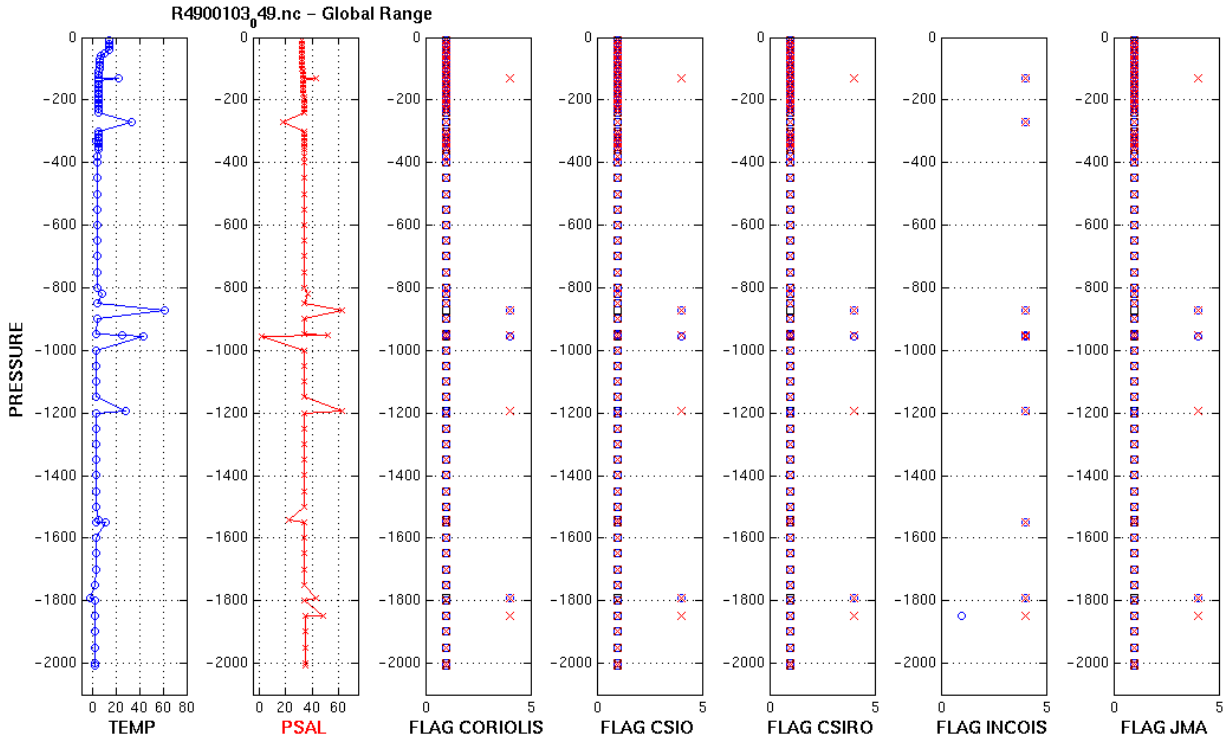
Do we need to set the flag to 4 on all profile measurements ? some DACs do it. If the position is bad, it may be corrected in delayed mode, then the data need to be kept with the good or doubtful QC ?

Proposal : As the TEMP & PSAL are doubtful due to bad position but correction may be applied in delayed mode when PRES is flagged to 4, T and S should be flagged to 3 at the most.

2.4. Global range

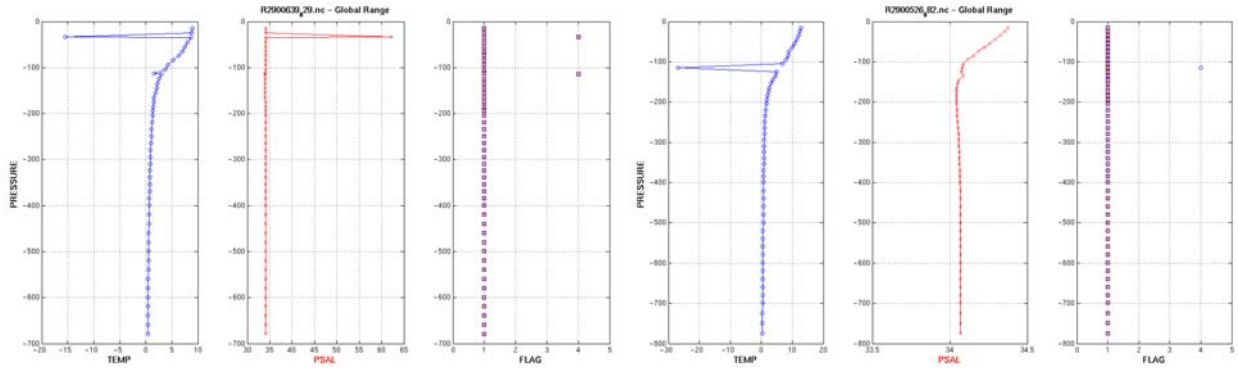
2.4.1. Synthesis of the results

The test has been done on the float 4900103, cycle 49. The temperature must be in the range –2.5 and 40°C and salinity in range 0 to 41 psu.



	AOML	BODC	CLS	CSIO	CSIRO	CORIOLIS	INCOIS	JMA	KMA	MEDS
TEST 6	OK	OK More strict than the QC manual	OK	OK	OK	OK	OK	OK	OK	OK

KMA has done this test in two other profiles (2900639_029 and 2900526_082) :



Remarks :

The results are the same for CORIOLIS, CSIO, CSIRO and JMA (figure). For INCOIS, some differences are found on levels 272.4 & 1549.6 (Flag 4 for TEMP and PSAL), 951.6 & 1194 (Flag 4 on TEMP). Those differences come from the other tests (spike,..).

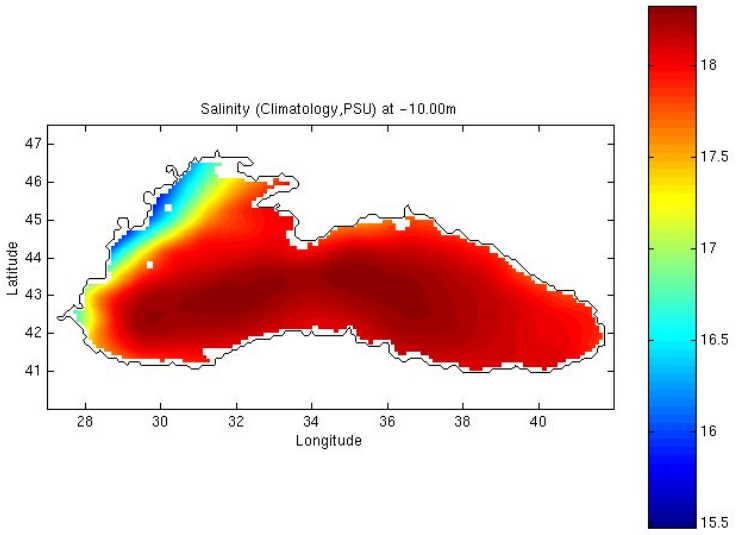
The BODC is more strict than the Argo QC manual, specially for salinity. In this example, the salinity measurements get flag 4 for value lower than 23 psu. But an example can be given for the Black Sea where salinity measurement can be lower than 18 psu. (Float 4900489).

For the second example of KMA, only TEMP gets a flag 4 on the bad value but the flag of the salinity needs also to be set up to 4, since temperature is used to calculate salinity.

2.4.2. Improvement of the test

The range of salinity could be reduced, especially for the lower measurement.

In the Argo dataset, the lower value on salinity has been found on data in the Black Sea area, with a value around 15.8 psu (Float : 1900134). According to the climatology done for the Medar/medatlas project, the salinity field for this area shows value not lower than 15 psu then this value can be kept as threshold for the minimum range.



From Michel Rixen (http://modb.oce.ulg.ac.be/medar/medar.html)

About the regional test (Red Sea & Mediterranean Sea), all the DACs do not run this test in the real time procedure. Do we implement this test as necessary test ?

Proposal : The salinity lower value should be changed to 10 PSU. The DAC who have specific regional requirement should set up the regional test (i.e. Mediterranean Sea and Black Sea, may be Polar seas).

2.5. Pressure increasing test

2.5.1. Synthesis of results

At the time of the creation of the reference files, Coriolis sorted the pressure on profiles in the database, then Coriolis was not able to provide a QC for this test. Therefore, test has been done on file : 1900044_121.nc, directly extracted from the ftp site with AOML QC. An other example, the float 3900259 (cycle 057), has been also sent to point out the results according to DACs.

The results seem very different from a DAC to an other one, but since the results are proposed from all tests from a lot of them, it is not easy to understand exactly from each test the flag has been changed.

	AOML	BODC	CLS	CSIO	CSIRO	CORIOLIS	INCOIS	JMA	KMA	MEDS
TEST 8	OK	To investigate why test failed only for some levels	OK	OK	Pressure with FLAG 4, due to this test ?	To be implemented	Test to be rectified	OK but results different from other DACs	OK but different profile	Not in the results, test does not exist ?

Remarks :

Example for Float 3900259 cycle 057. Results can be different from DACs (from files sent with results).

PRES =
4.4, 9.2, 19.1, 4930.2, 4899.6, 49.5, 878.9, 69.1, 79.0, 88.9, _, _, _, _, _, _, 0.0, 169.4, 3455.9, 189.5, 199.4, 209.0, 219.2, 226.2, 239.2, 249.3, 258.9, 269.3, 279.3, 288.8, 299.0, 308.9, 319.3, 329.6, 339.3, 349.4, 359.3, 379.5, 399.3, 449.2, 498.9, 549.1, 599.2, 648.9, 698.8, 749.0, 799.5, 849.4, 899.3, 949.3, 999.1, 1049.2, 1099.6, 1149.4, 1198.9, _, _, _, _, _, 0.0, 1549.5, 1599.1, 1649.1, 1699.3, 1749.0, 1799.3, 1849.3, 1898.9, 1948.6 ;

- Results sent by Coriolis (from aoml, after all tests)

PRES_QC =
"1114444411199999914411111111111111111111111111111111111199999111111111" ;

- JMA results (after all tests)

PRES_QC =
"1114411411444444414111111111111111111111111111111111144444111111111" ;

- CSIO results

CSIO does not have the missing data in their presented results.

PRES_QC =
"1114444411??????414411111111111111111111111111111111?????4111111111" ;

- CSIRO results (after all tests)

PRES_QC =
"1444444444999999144444444444444444444444444444444499999444444444" ;

- BODC results

A lot of flag is set to 4 on the PRES_QC.

- KMA results (on other profile 2900639_029) :

PRES =
14.4, 24.2, 33.7, 34.1, 44.2, 54.5, 64.4, 74.1, 83.9, 94.4, 104.1, 113.1, 114.0, 123.9, 134.4, 143.9, 154.1, 164.3, 174.3, 184.2, 194.2, 204.2, 219.2, 234.4, 249.3, 264.5, 279.4, 294.0, 309.2, 323.9, 339.2, 354.4, 369.2, 384.4, 399.5, 419.5, 439.2, 459.3, 479.3, 499.3, 519.0, 539.1, 559.3, 579.0, 599.3, 618.8, 639.1, 659.1, 678.8 ;

PRES_QC =
"114111111111411111111111111111111111111111111111" ;

2.5.3. Improvement of the test

A new test is proposed (from Claudia Schmid).

From a very bad profile, the results are :

Level	P	New test	Current test
1	2096	1	1
2	2040	1	4
3	888	1	4
4	890	1	1
5	883	4	4
6	934	1	1
7	983	1	1
8	1149	1	1
9	1225	1	1
10	1282	1	1
11	1336	1	1
12	1373	1	1
13	1427	1	1
14	1752	1	1
15	1787	1	1
16	1524	4	4
17	2042	1	1
18	2042	1	4
19	463	1	4
20	462	4	4
21	461	4	4
22	457	4	4
23	455	4	4
24	2043	4	1
25	486	1	4

The new test can not catch the first two values (the current test rejects values at levels 2 and 3, i.e. doesn't work well either). In addition the new test misses the constant pressure case at level 18 and the bad value at level 25. The new test works better than the current one for level 24. (Of course one could say all pressures are likely wrong, but there can be similar cases to this one where such a statement would be too strict).

Proposition to consider applying 4 steps in the pressure increasing test:

```
1) V2 is bad if
   a) abs(V2-(V3+V1)/2) - (V3-V1)/2 > 0
   and
   b) V3-V1 > 0
   Same as Takashi's proposal,
   except for removing the abs() in abs((V3-V1)/2) of (a) since
   (V3-V1)/2 can not be negative due to (b).
```

2) If the pressure decreases in the first N layers then V(1, ..., N-1) is bad. In the example N would be 3.
Note: ignore any flags assigned during step 1.
3) If the pressure increases in the last N layers then V(L-N+1, ..., L) is bad. In the example N would be 2 and L 25 (number of levels).
Note: ignore any flags assigned during step 1.
4) V2 is bad if it is the same as V1 (part of the current test).
Note: ignore any flags assigned during steps 1, 2 or 3.

These four steps together can detect the bad pressures in the example except for the one at level 19. The current test works better for level 19 but doesn't work for levels 1, 3 and 24. Level 17 passes the new and the current test (and could potentially be good) :

level	P	New test	Current test
1	2096	4	1
2	2040	4	4
3	888	1	4
4	890	1	1
5	883	4	4
6	934	1	1
7	983	1	1
8	1149	1	1
9	1225	1	1
10	1282	1	1
11	1336	1	1
12	1373	1	1
13	1427	1	1
14	1752	1	1
15	1787	1	1
16	1524	4	4
17	2042	1	1
18	2042	4	4
19	463	1	4
20	462	4	4
21	461	4	4
22	457	4	4
23	455	4	4
24	2043	4	1
25	486	4	4

Proposal : 8. Pressure increasing test (ADDED A SENTENCE TO FIRST PRAGRAPH)
This test requires that the profile has pressures that are monotonically increasing (assuming the pressures are ordered from smallest to largest). This test needs to be repeated in an iterative way until no more pressure inversions are found.

2.6. Spike test

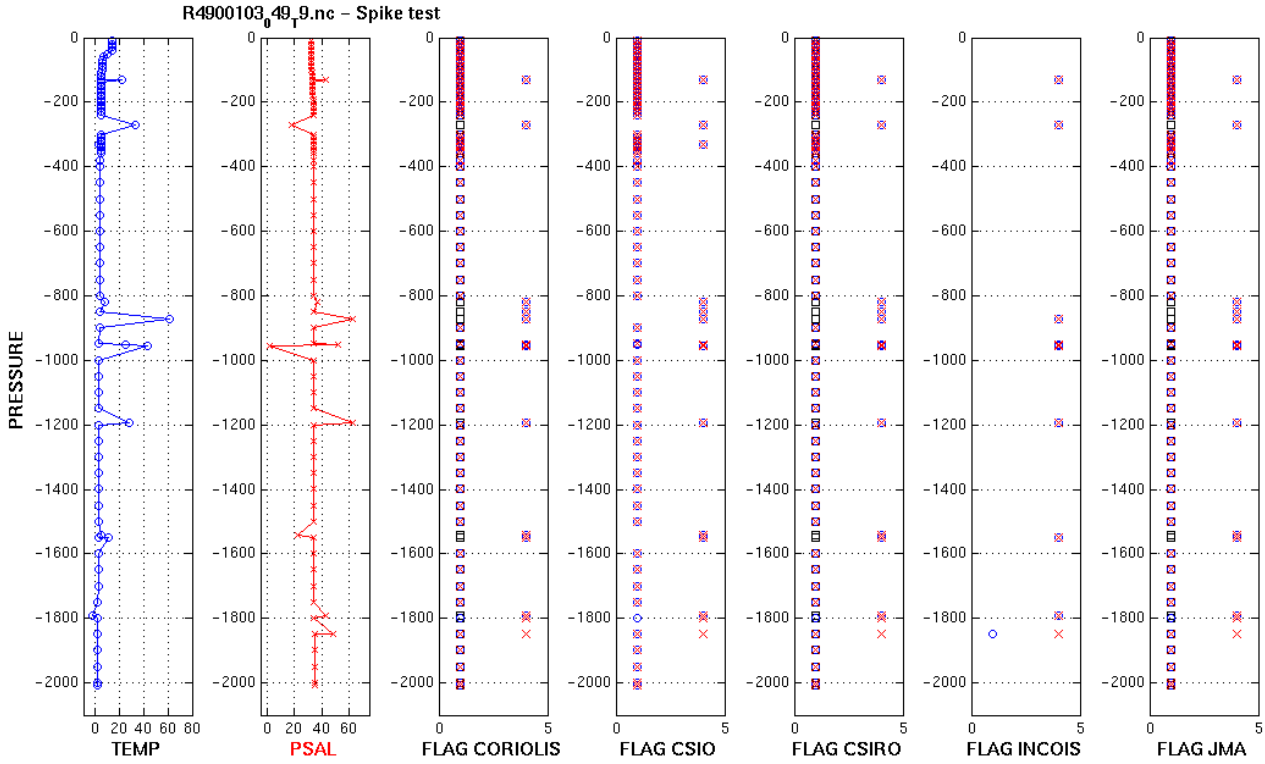
2.6.1. Synthesis of the results

The test has been done on the float 4900103, cycle 49.

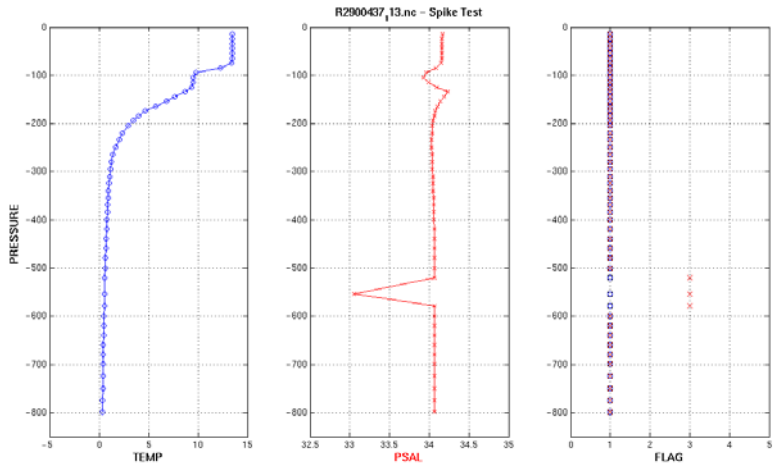
	AOML	BODC	CLS	CSIO	CSIRO	CORIOLIS	INCOIS	JMA	KMA	MEDS
TEST 9	OK	OK	OK	OK	OK	OK	OK, Visual QC help to change flag above and below wrong data	OK	OK	Ok, but differences with reference file

Remarks :

Generally the spike is found by the test but some differences between DACs can be observed above and below the wrong measurement.



KMA has done this test in an other profile (2900437_113) :



2.6.2. Improvement of the test 9

Proposal : Spike test (ADDED A SENTENCE TO FIRST PRAGRAPH)
Difference between sequential measurements, where one measurement is quite different than adjacent ones, is a spike in both size and gradient. The test does not consider the differences in depth, but assumes a sampling that adequately reproduces the temperature and salinity changes with depth. The algorithm is used on both the temperature and salinity profiles. This test needs to be repeated in an iterative way until no more spikes are found.

2.7. Gradient test

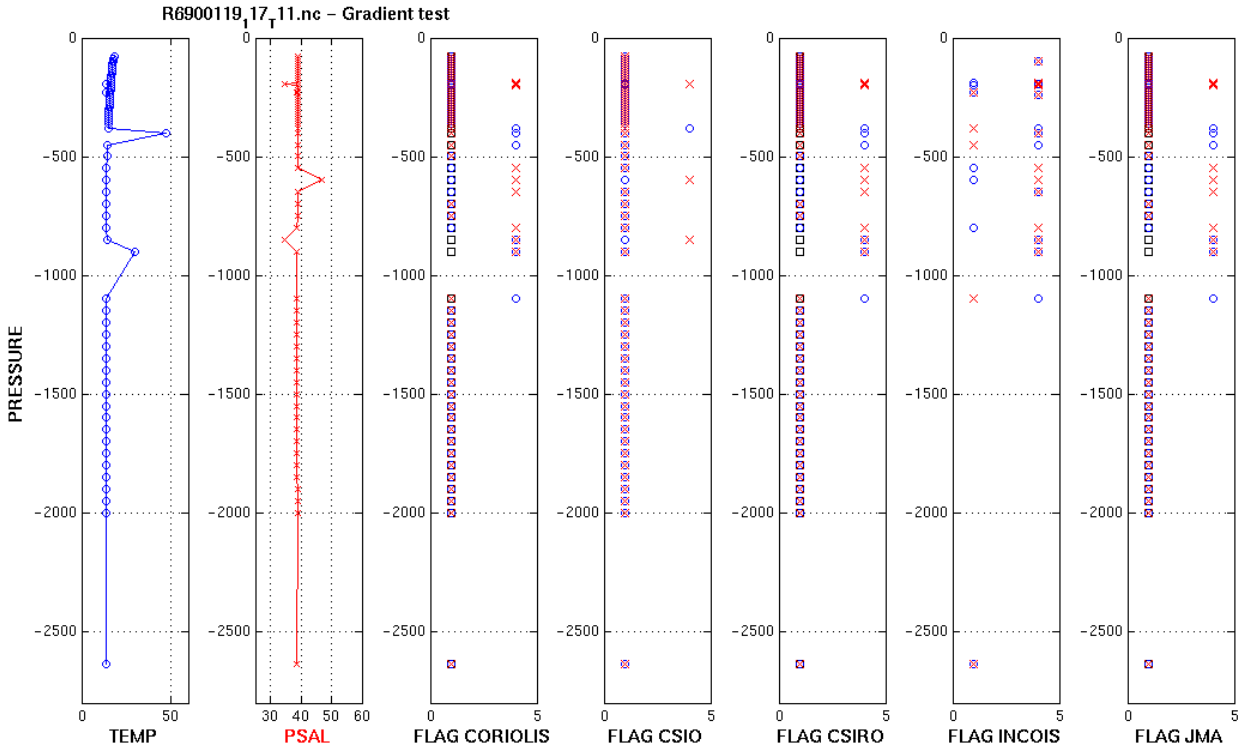
2.7.1. Synthesis of results

The test has been done on the float 6900119, cycle 117.

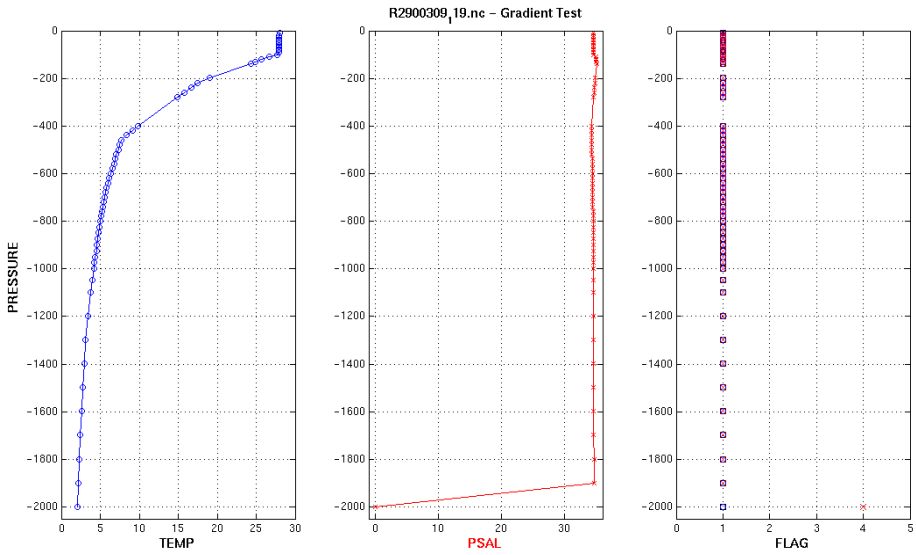
	AOML	BODC	CLS	CSIO	CSIRO	CORIOLIS	INCOIS	JMA	KMA	MEDS
TEST 11	OK	Need to be improved	OK	OK	OK but different results ?	OK data up and down bad data are also with flag 4	OK but no gradient detected at some levels	Different results	OK	OK but different results ?

Remarks :

Not exactly same results between DACs. Since some DACs have no run the test independently, it is not easy to understand from what test come the flags.



KMA has done this test in an other profile (2900309_119) :



2.7.2. Improvement of the test

Proposal : 11. Gradient test (ADDED A SENTENCE TO FIRST PRAGRAPH)
This test is failed when the difference between vertically adjacent measurements is too steep. The test does not consider the differences in depth, but assumes a sampling that adequately reproduces the temperature and salinity changes with depth. The algorithm is used on both the temperature and salinity profiles. This test needs to be repeated in an iterative way until no more gradient problems are found.

2.8. Density inversion

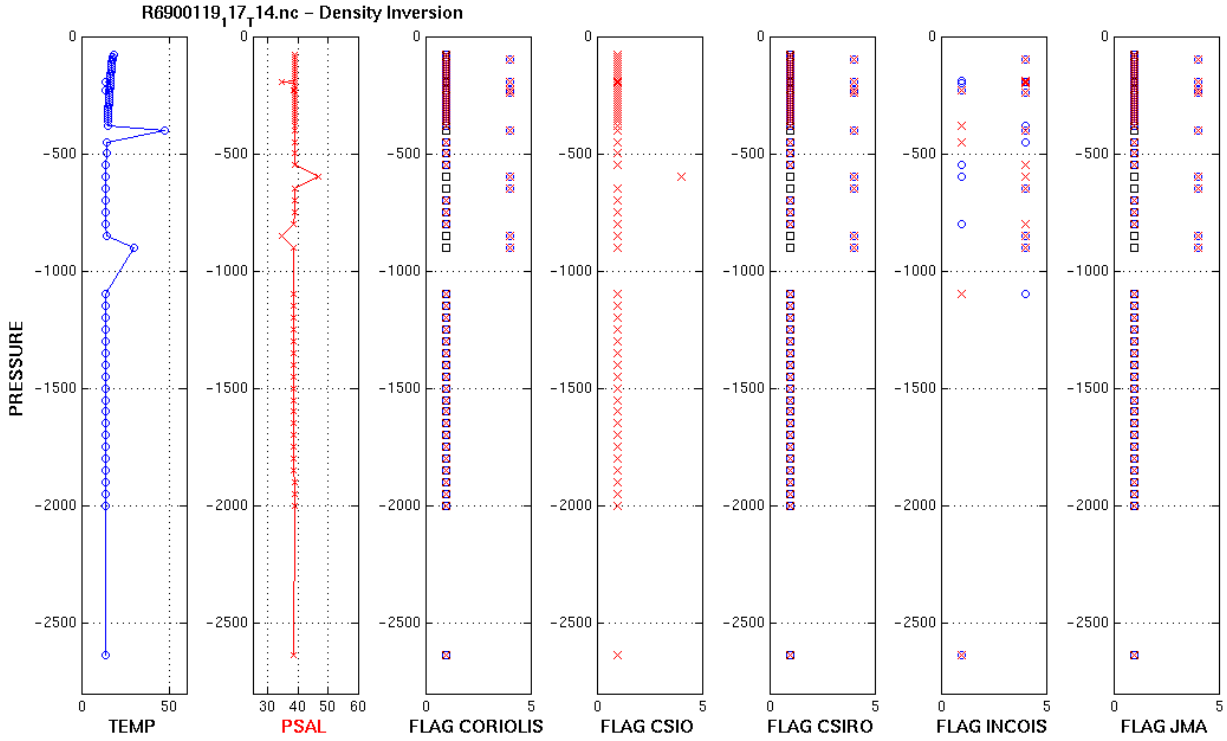
2.8.1. Synthesis of results

The test has been done on the float 6900119, cycle 117.

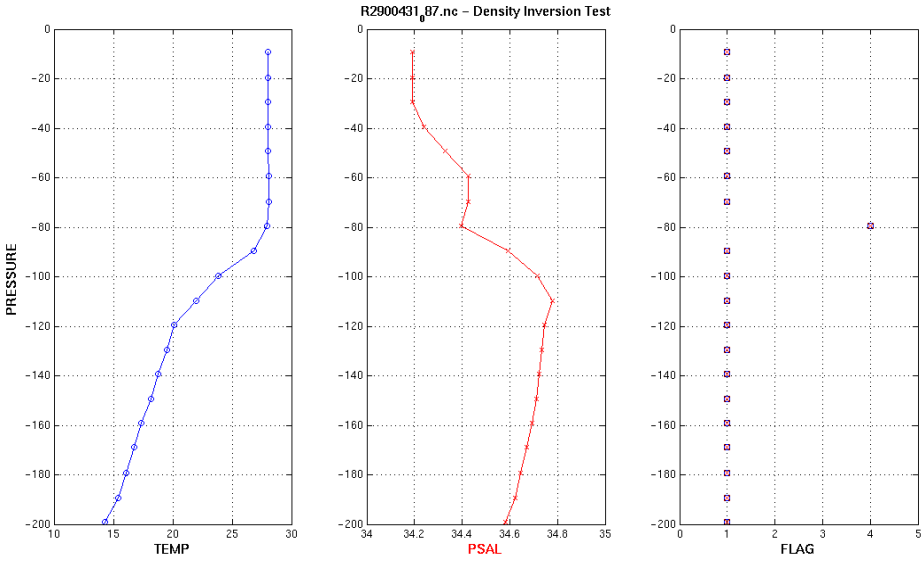
	AOML	BODC	CLS	CSIO	CSIRO	CORIOLIS	INCOIS	JMA	KMA	MEDS
TEST 14	OK	Need to be improved	OK	OK	OK but different results ?	Up and down implementation in progress	OK but different results ?	Different results	OK	OK but different results ?

Remarks :

Not exactly same results between DACs. Since some DACs have no run the test independently, it is not easy to understand from what test come the flags.



KMA has done this test in an other profile (2900431_087), zoom on the range 0-200 m :



2.8.2. Improvement of the test

Proposal : 14. Density inversion (LOTS OF CHANGES)
This test uses values for temperature and salinity at the same pressure level and computes sigma-0. The algorithm published in UNESCO Technical Papers in Marine Science #44, 1983 (referred to earlier) should be used. Sigma-0 values are compared at consecutive levels in a profile, in both directions, i.e. from top to bottom profile, and from bottom to top. This test needs to be repeated in an iterative way until no more density problems are found.

Test value V2-V1 where V2 is at a higher pressure than V1.

The test value may not be smaller than -0.05 (Small inversions can be considered good data).

Action: for test values that fail the test, the temperature and salinity used to derive the value V2 should be flagged as bad. Consequently, the values for depth, temperature and salinity at this pressure level should be removed from the TESAC distributed on the GTS.

- Difference between density and sigma 0 :

SIGMA-0 VERSUS DENSITY:
Feedback from 3 DACS : one uses density, the others use sigma 0. Of those that use sigma 0, one uses 0.05 and one uses 0.01 as the threshold to allow small inversions. AOML chooses sigma 0 (to eliminate the pressure dependence) and 0.05 as the threshold.

- If iterative test, no need both ways (top-bottom and bottom-top) ? :

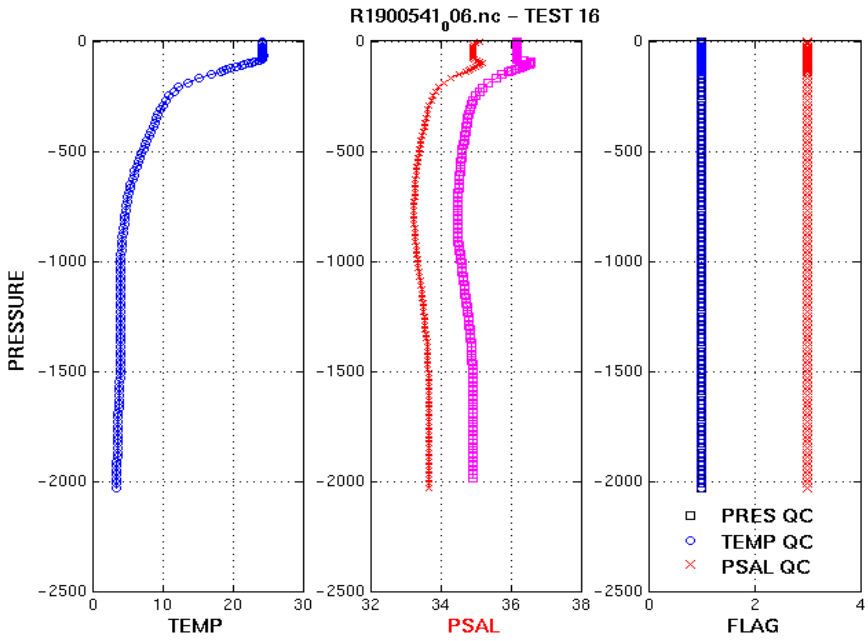
Justification for eliminating TOP-BOTTOM and BOTTOM-TOP:
If the test is done iteratively then it seems unnecessary to do it in both directions. With the action, the problem is which level is the bad one. The one used to derive V1 or the one used to derive V2 (or both) ?

Proposal :
The density inversion must be calculated from sigma-0 instead of from the density.
The threshold must be 0.05.
The flag 4 must be on the TEMP and PSAL value :
- For level V2 if V2-V1 < -0.05 and V3-V1 > -0.05
- For level V1 if V2-V1 < -0.05 and V3-V1 < -0.05

2.9. Gross salinity or temperature sensor drift

2.9.1. Synthesis of results

The test has been done on the float 1900541, cycle 6. In the figure, the previous cycle (5) is in magenta for salinity.



	AOML	BODC	CLS	CSIO	CSIRO	CORIOLIS	INCOIS	JMA	KMA	MEDS
TEST 16	Implement	Drift not detected. Tolerance on the average T:1 ; S:0.5	Test not available	OK	OK	OK	Test to be implemented. Flag 3 set from Visual QC by comparing with previous cycle	OK	?	OK

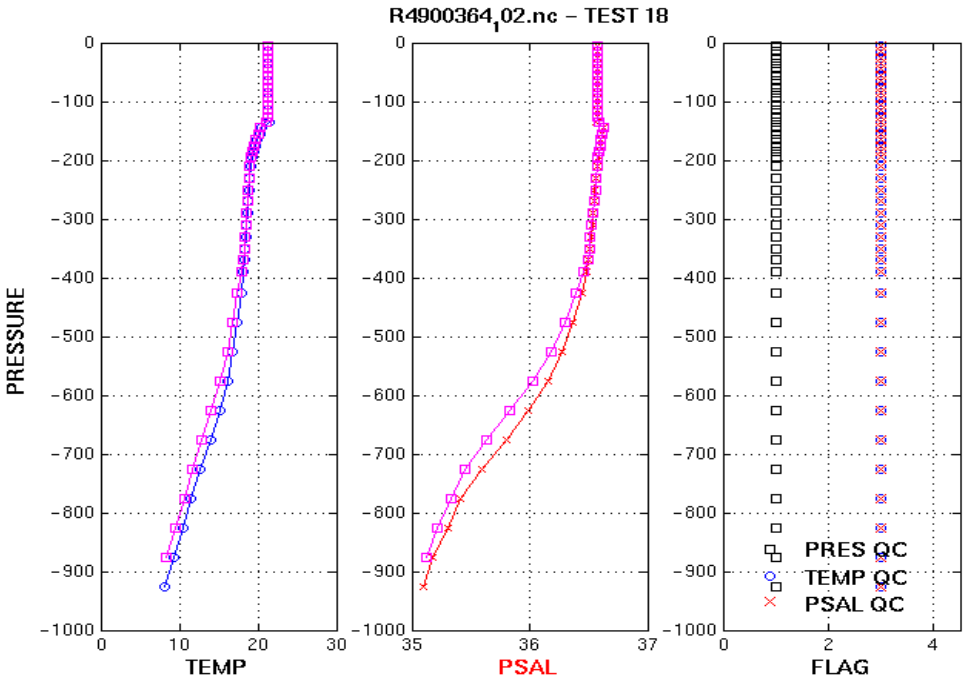
2.9.2. Improvement of the test

No need.

2.10. Frozen profile

2.10.1. Synthesis of results

The test has been done on the floats 4900364, cycle 102, and 4900272, cycle 103. All the profiles of temperature and salinity must have flag 3.



	AOML	BODC	CLS	CSIO	CSIRO	CORIOLIS	INCOIS	JMA	KMA	MEDS
TEST 18	OK	Not detected. Tolerance values used slightly different from those in QC manual	Test not available	OK	Test not failed	Need to be more implemented	Test not implemented	Not operationally applied	?	No answer for 4900272 ; 4900364 failed gross salinity instead of frozen profile

2.10.2. Improvement of the test

No change needed. This test needs to be more implemented in some DACs.

2.11. Grey List – Improvement of the test

The DACs should submit their modified DAC Grey List according to the following proposal made by Thierry Carval :
****
Here is a proposal for an automated collect :

1. Query xxx_greylist.csv file in each DAC submit directory; xxx must be identical to the DAC (eg : aoml, coriolis); otherwise the file is rejected.

2. Check the format of xxx_greylist.csv . The whole file is rejected is the format check fails.
Floatid : valid Argo float id; the corresponding meta-data file must exist Parameter : PSAL, TEMP, PRES or DOXY Start date : YYYYMMDD valid, mandatory End date : YYYYMMDD valid, fill value : ',,'
Flag : valid argo flag
Comment : free
DAC : valid DAC, mandatory

3. Remove all the floats of the DAC from the GDAC grey list and add the content of the submitted xxx_greylist.csv file

2.12. Test application order – Others comments

The tests have been implemented according to a list. It seems that some values can be excluded differently depending on whether the gradient test is applied before the spike or density inversion tests. It is important to specify which test must be applied before an other one to be sure to not exclude too much data.

If TEMP is with FLAG 4 then FLAG on PSAL must be set to 4.

Proposal :
Check when flag of TEMP is set to 3 or 4 then flag of PSAL must be, according to the flag on TEMP, set to 3 or 4.

2.13. Good profiles

All the profiles have gone through the automatic tests without needing correction in output (only good flags) for all the DACs.