# North Atlantic Regional Centre



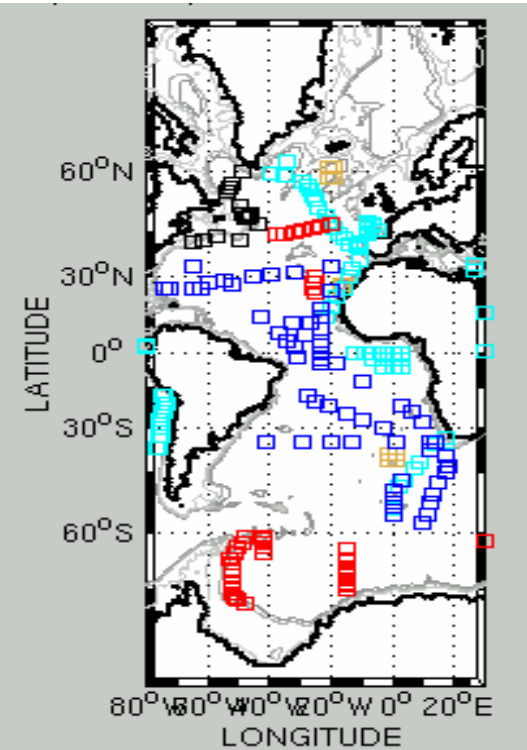
- S Pouliquen , V Thierry, C Coatanoan, F Gaillard, PM Poulain & al.

# Main activities

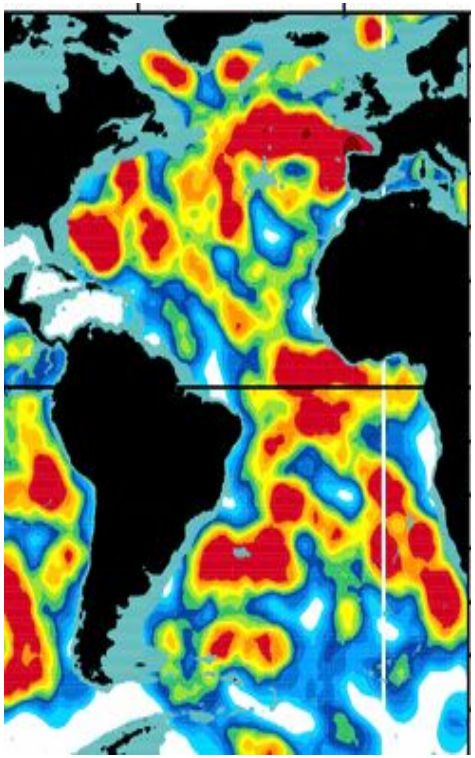
- Coordination of Float Deployments in the Atlantic
- Delayed Mode QC:
  - Networking on the methodology : mainly between France and Germany
  - Improve reference database in the North Atlantic
  - Data sharing among the RDAC partners
- Improve climatology in the North Atlantic
- Data consistency at Basin level
  - Warning: The method is still in development
  - The goal is to point out suspicious profiles, not to propose and apply a new correction. Floats remain under the responsibility of the operator and the PI it “belongs” to.
- Mediterranean Sea Activities

# Float deployment coordination

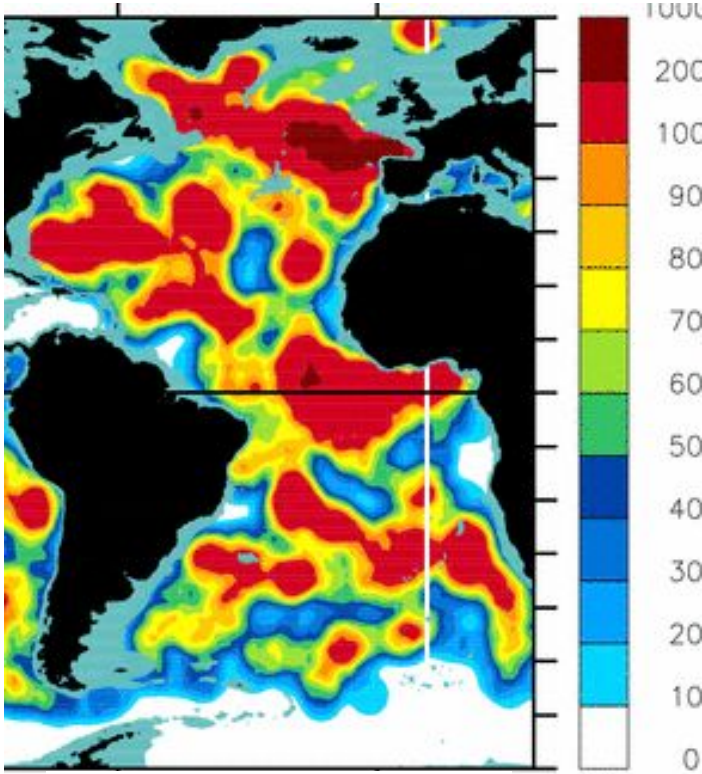
- NARDAC performs a regular monitoring for deployment coordination
  The goal is to achieve a regular density of one float per 3*3 degree
  **Red** : the float density is correct




planned deployements



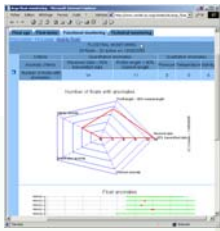
January 2006




September 2006

# Network monitoring

- NARDAC performs a regular monitoring for all deployed floats



oats monitoring

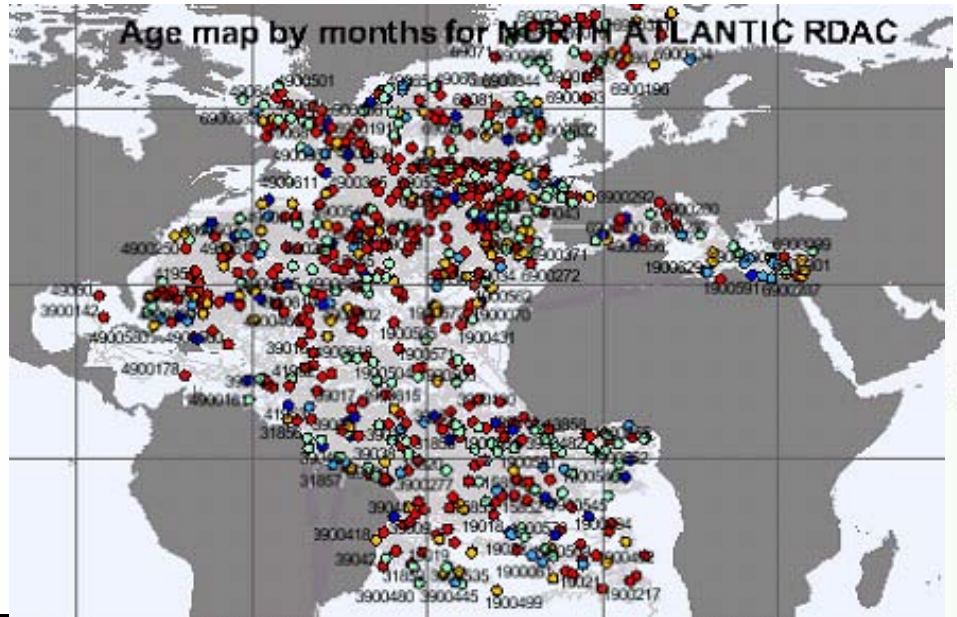
Float age | Float status | Functional monitoring | Technical monitoring

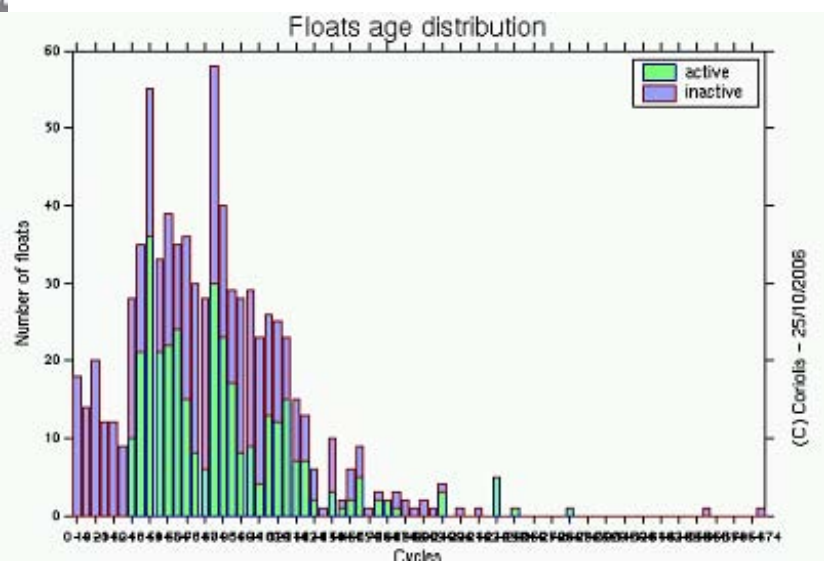
Print bulletin Print page display floats

NORTH ATLANTIC RDAC

777 floats - 336 active on 25/10/2006

| All Floats | | | Active | | Inactive | | |
|---|---|---|---|---|---|---|---|
| Deployed | Active (%) | Number of performed profiles | Maximum number of performed cycles | Average number of cycles | Maximum number of performed cycles | Less than 5 cycles performed (%) | Average number of cycles |
| 777 | 43.24 | 59411 | 274 | 80.2 | 379 | 4.08 | 71.29 |



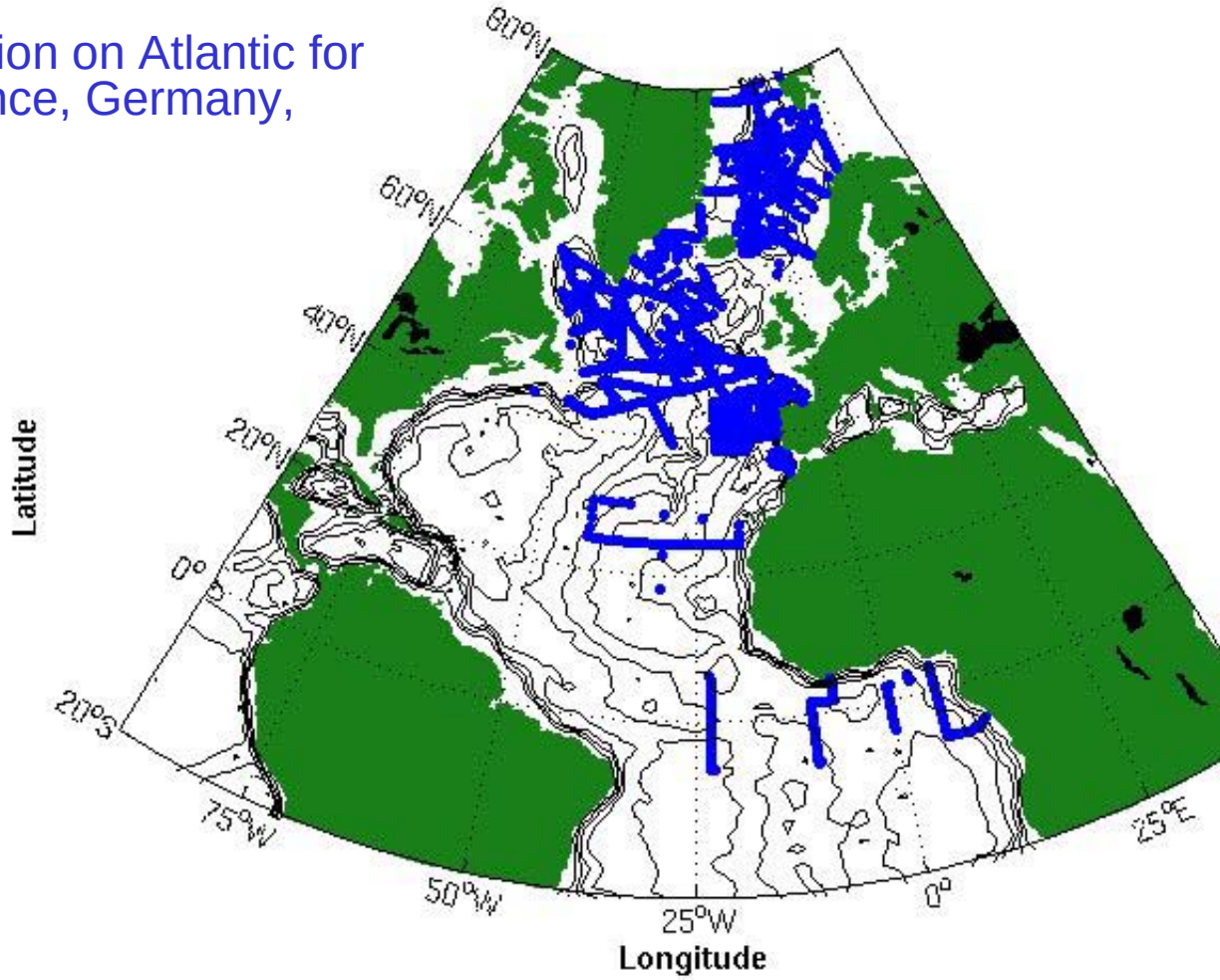
# 2007-2008 deployments forecast

- Netherlands 4-8 in 2007
- France 40-50 in 2007 & 2008
- Germany : ??? 2007  30-50/year starting 2008
- UK: 6 in 2007 ?
- Italy 0 2007 ?? 2008
- Spain ???
- Ireland ???
- Norway ???

- EURO-Argo: a proposal is under construction to get funds for a European contribution to ARGO of about 250/year. Should be a trial year  in 2008-2009

# Delayed Mode Activities

- Close collaboration between France and Germany on delayed mode processing methods
- Starts of CTD collection on Atlantic for RDAC partners (France, Germany, Canada)



# Data consistency over North Atlantic



P. Galaup, V. Thierry, C. Coatanoan, E. Autret, F. Gaillard,

Sismer and Laboratoire de Physique des Océans Brest, France

# Dataset

Coriolis dataset:

ARGO profilers, CTD/XBT, buoys and moorings

Good and probably good data are fed as input to the analysis system

0 < QC < 3

1 analysis /week from January 2001 to December 2005 with a temporal window of +/- 21 days

CORA-RT : analysis with only real-time data

CORA-DM : ARGO real-time profiles are replaced by delayed-mode profiles when available

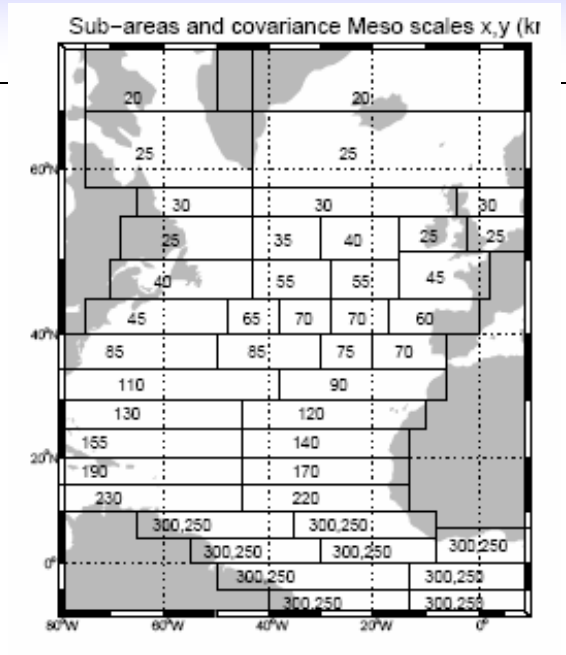
# Configuration

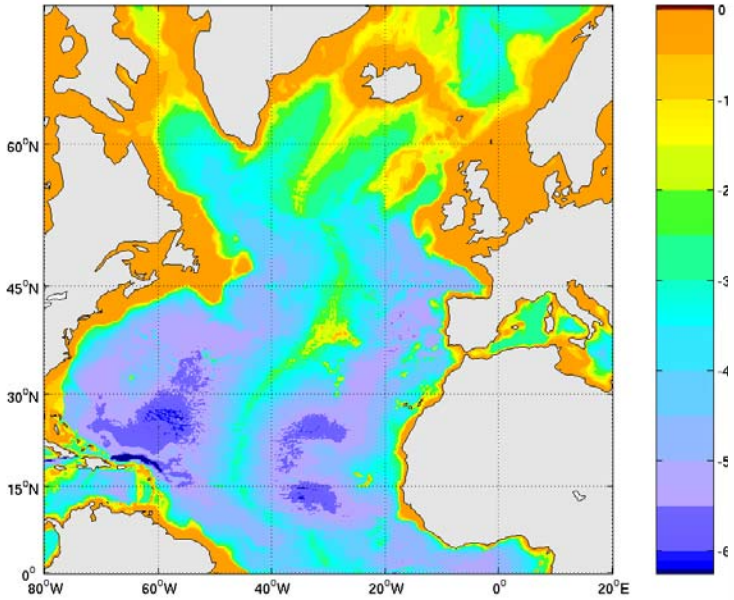


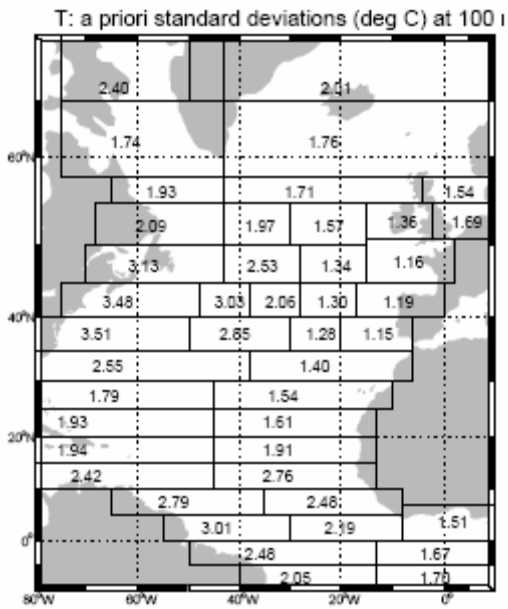
- Reference: Levitus 98 adapted by MERCATOR
- Horizontal grid: 1/2°
- 59 levels (5 to 2000 m)
- gaussian covariances C(dx, dy, dt)

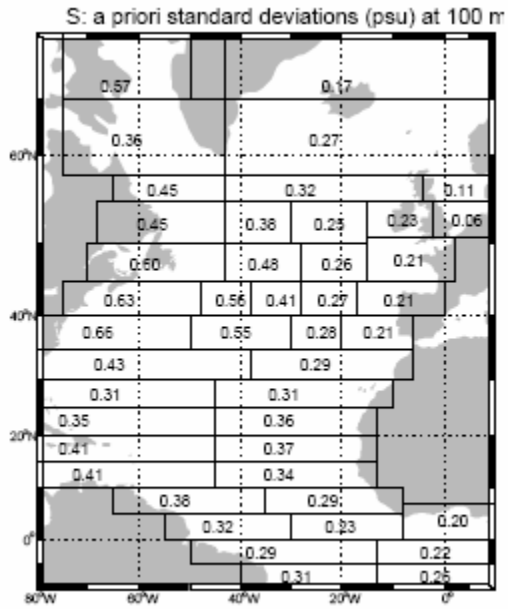
$$\sigma^2_{tot} = \sigma^2_{LS} + \sigma^2_{MS} + \sigma^2_{UR} + \sigma^2_{ME}$$

- LS = 300 km, MS ~ Rossby Radius



# ARGO Dataset consistency



## Comparison of CORA-RT and CORA-DM

As in real-time and operational mode, residuals from the analysis are used to detect suspicious profiles / profilers

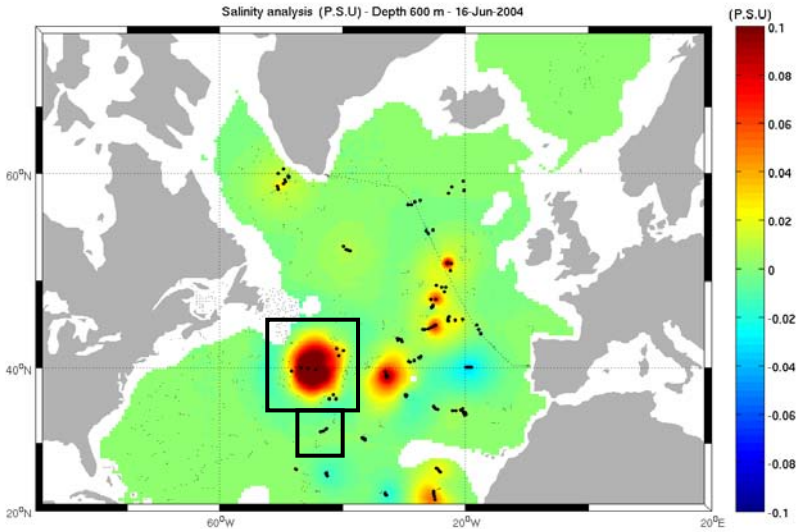
The method has been tested on the North-Atlantic : 20°N-70°N, 80°W-10E

Two analyses have been performed:

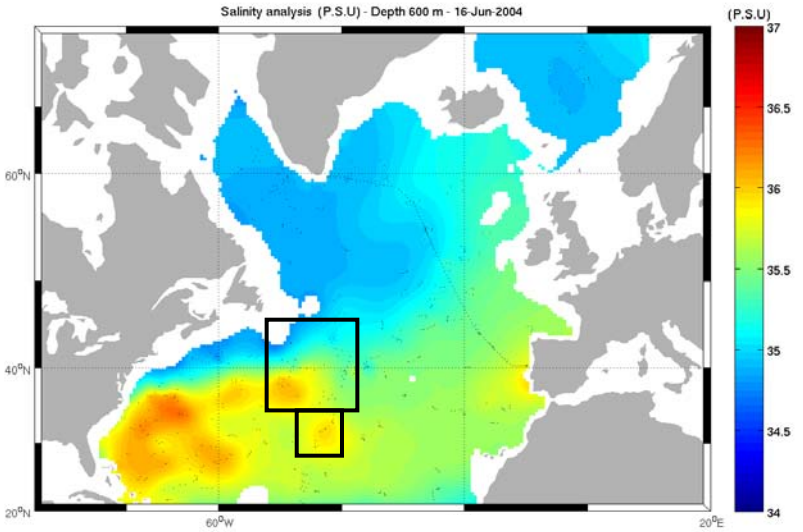
1. using 77 DM floats from the DAC Coriolis
2. using 149 DM floats from various DACs

# Local differences between CORA-RT and CORA-DM

## Salinity field at 600m depth on the 16th of June 2004




Cora-DM- Cora-RT




Cora-DM

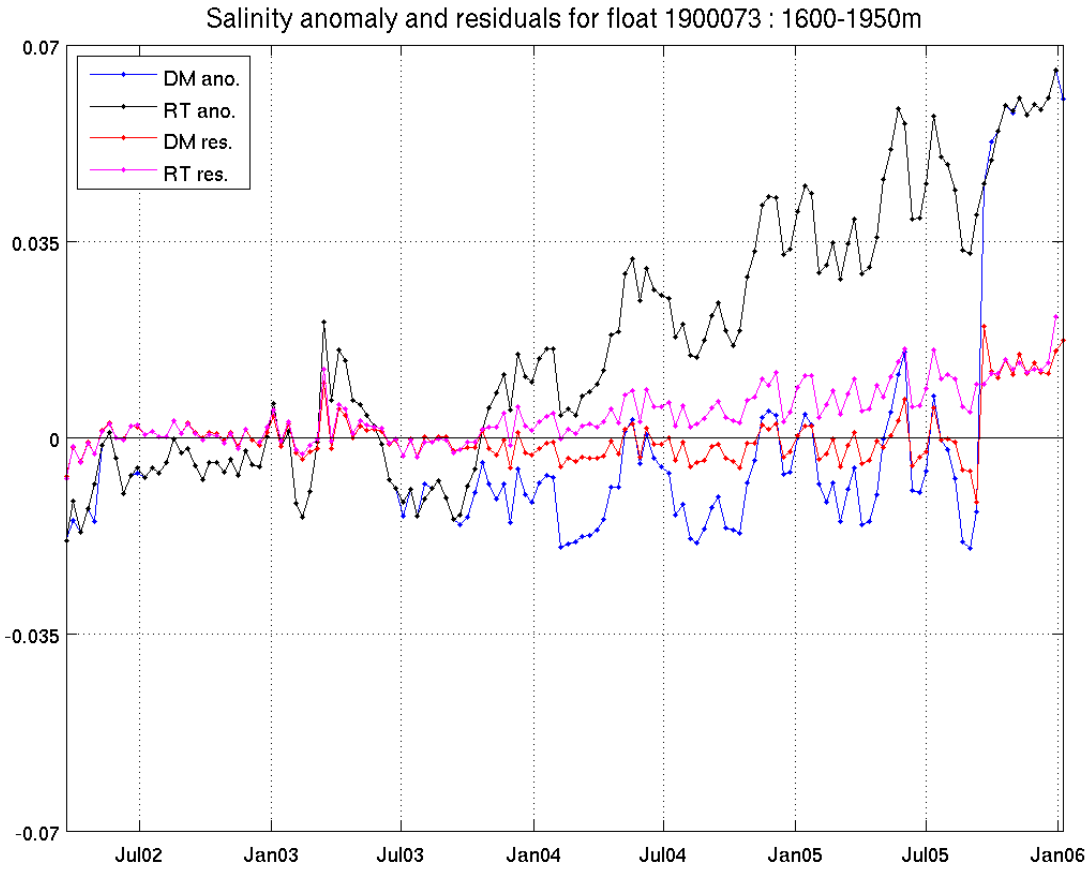
Impact of the DM data :

- new information consistent with RT data
- new information in a frontal zone induces large differences

# Residuals analysis

2006

## 1900073 (1600 -1950 m)




RT data - climatology

DM data - climatology

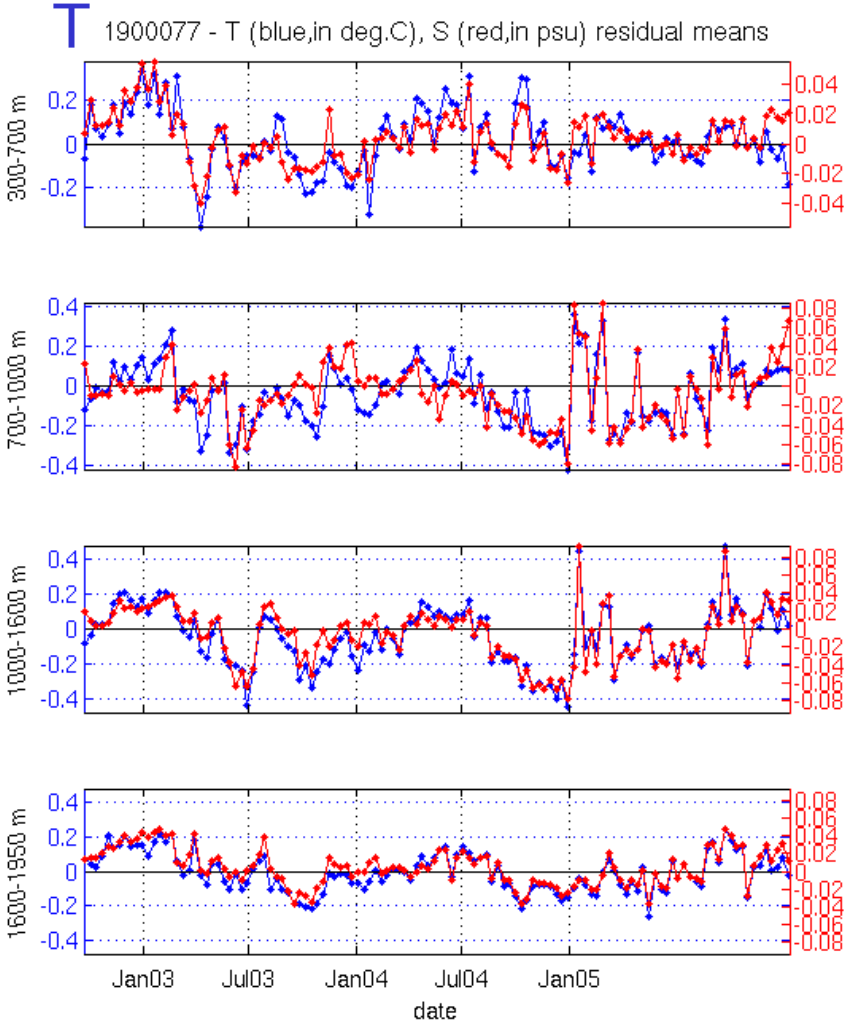
CORA-RT residuals

CORA-DM residuals

# Residuals analysis

## 1900077

T

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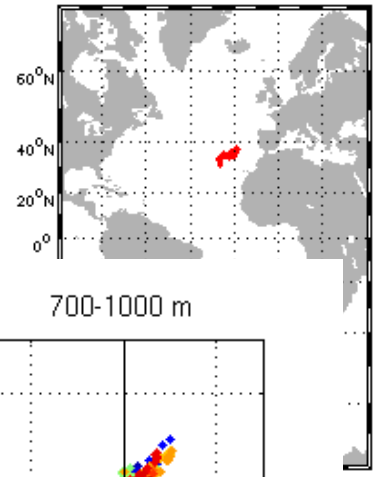
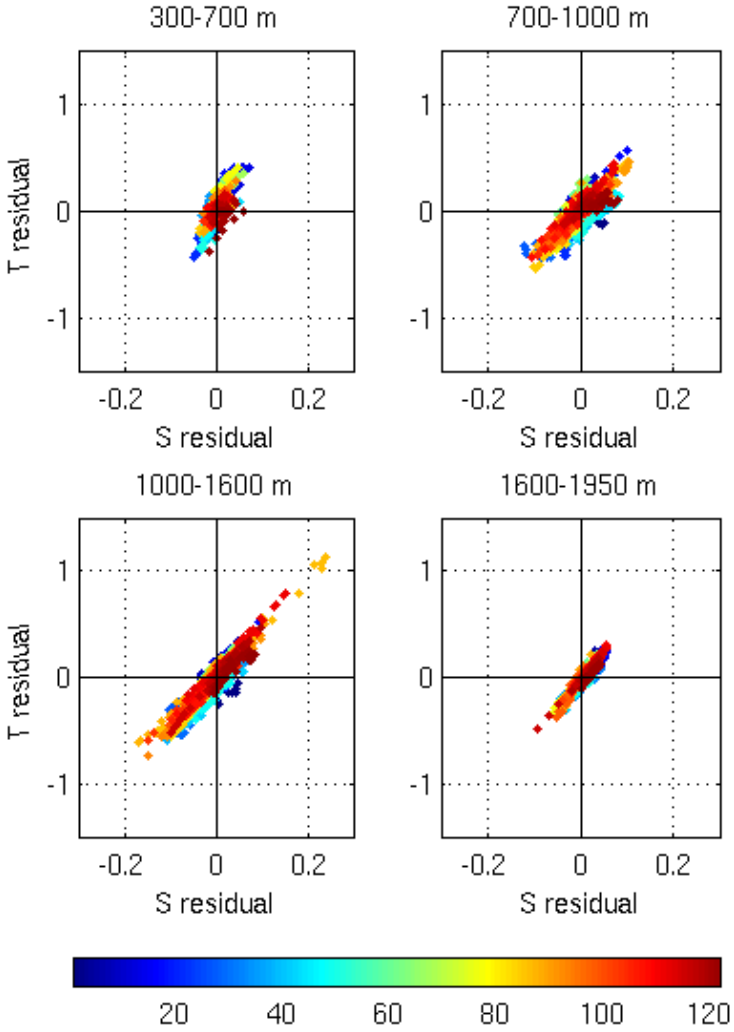
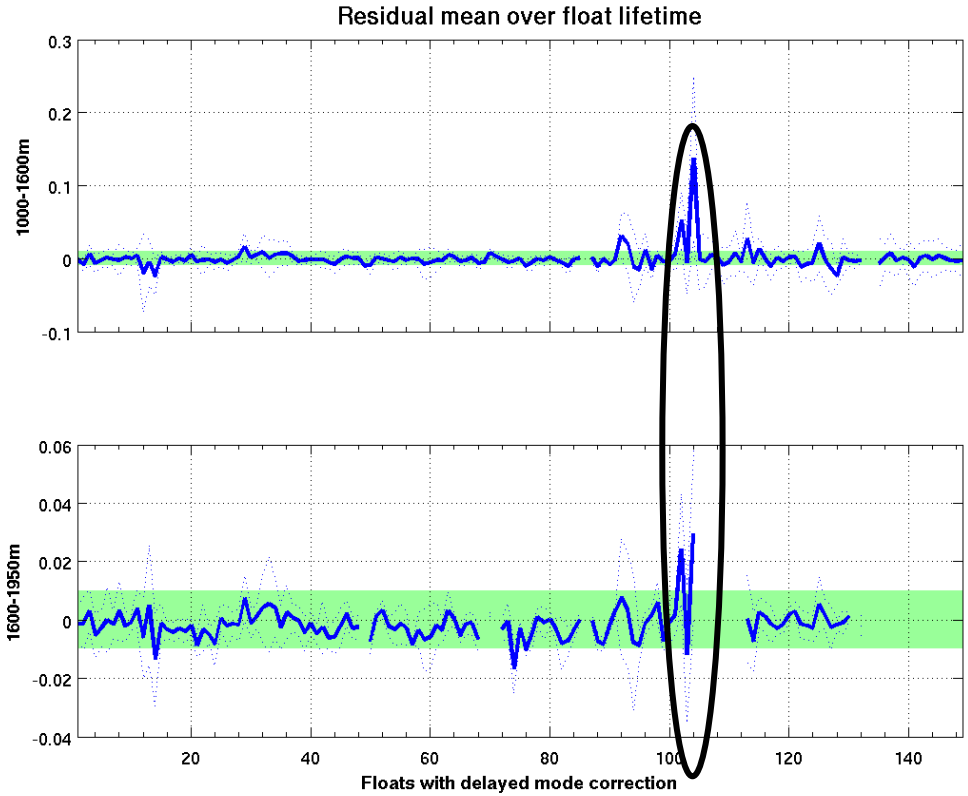


# Identification of suspicious profiles / profilers



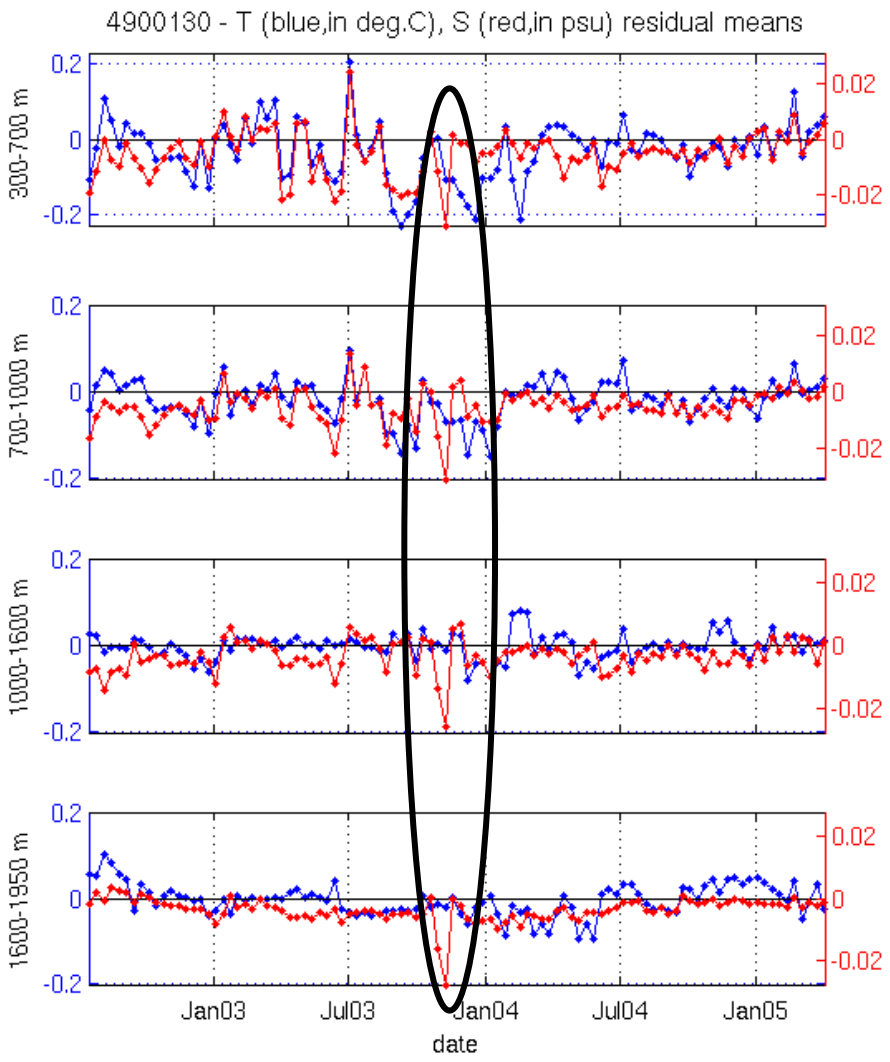
- Screening residuals time-series
- Greater attention to floats with
  - delayed-mode data with a QC=2
  - large mean residuals over their life time

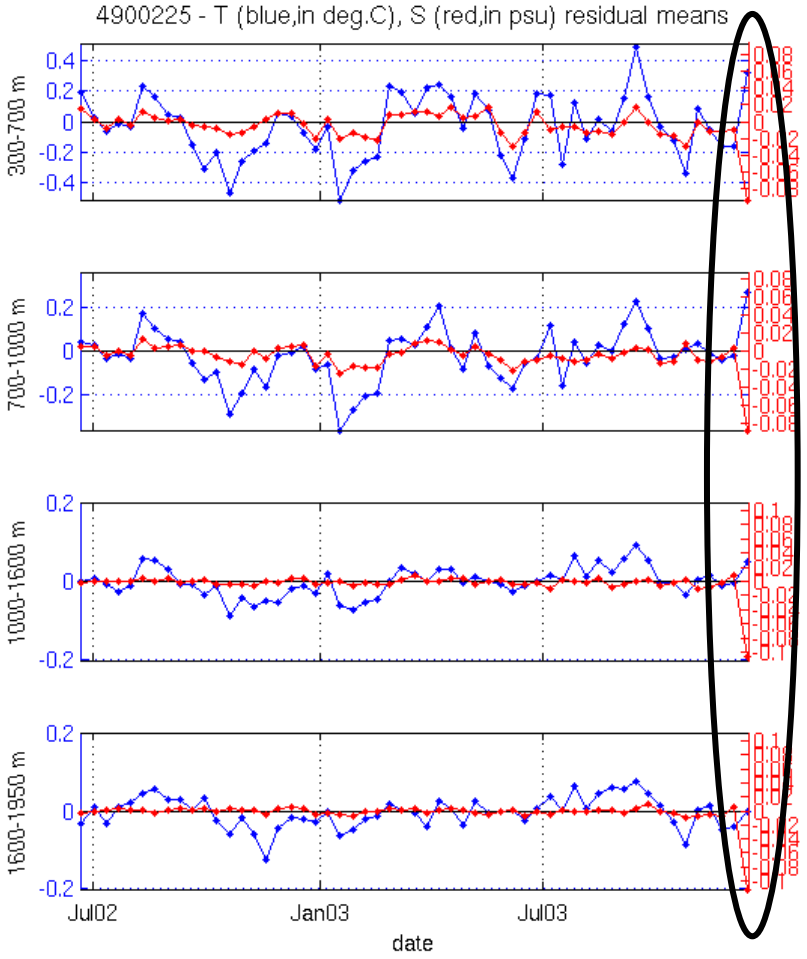



Few floats have mean residuals greater than 0.01 PSU.

None of them are problematic : short life time, salinity and temperature anomaly correlated, Med water influence, etc..

# Case 1: suspicious profiles

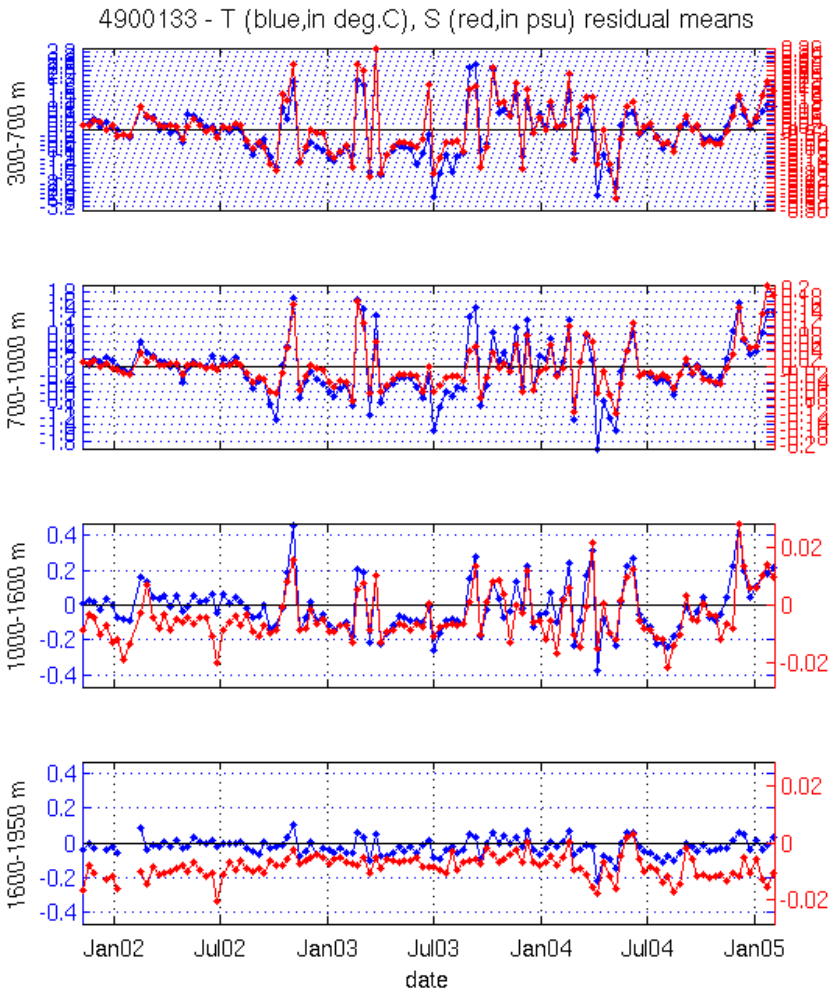


# Case 1: Suspicious profiles

- Among the 11500 delayed mode profiles that enter the analysis system, less than 5 were bad
  - ➢ the DMQC processing is rather good
- However, for the overall quality of the ARGO data set, it is worth being able to detect them
- The analysis system allows to do it in a rather efficient way

# Case 2: suspicious offset

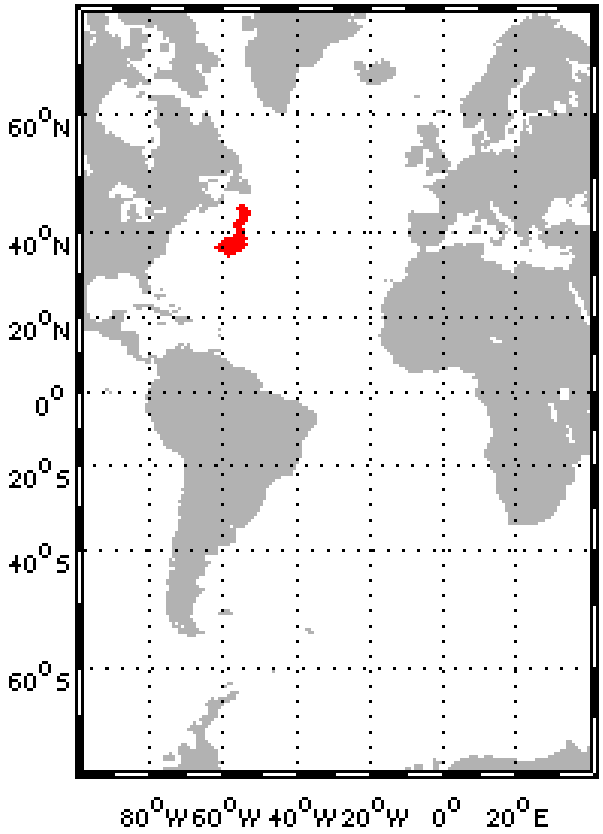



- Few profilers exhibits a negative ‘suspicious’ offset :

- 4900133 (corrected)
- 4900135 (not corrected)
- 4900136 ( “ )
- 4900227 ( “ )
- 4900497 ( “ )

# Case 2 : suspicious offset

- They all are located in the same area

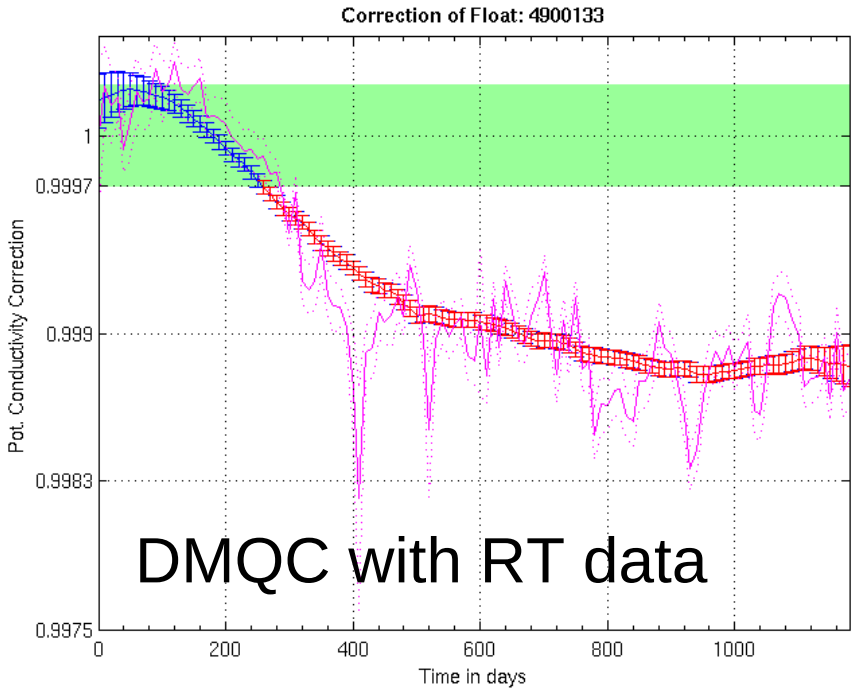


# Case 2 : suspicious offset

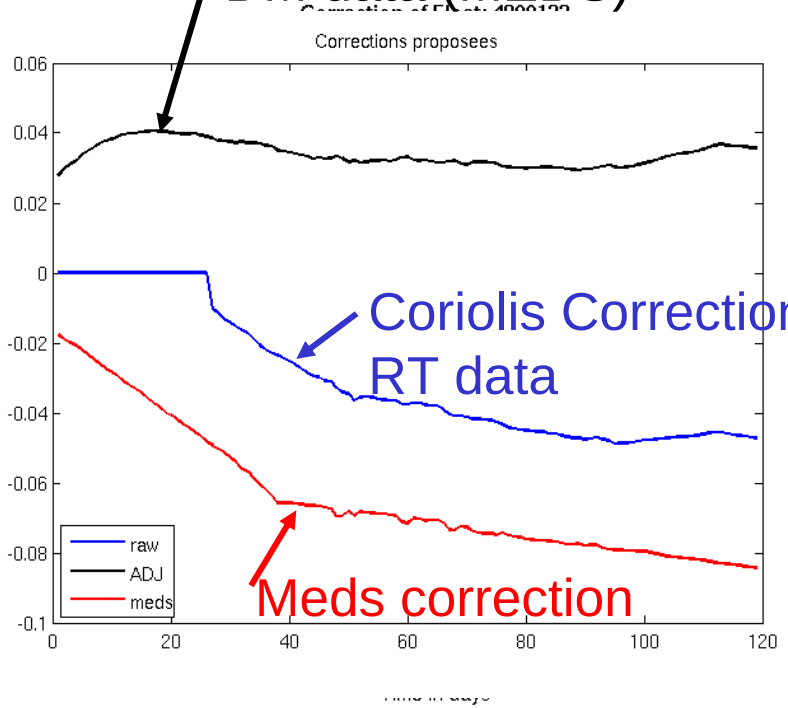
2006

4900133

Coriolis Correction on DM data (MEDS)




DMQC with RT data




Coriolis Correction on RT data

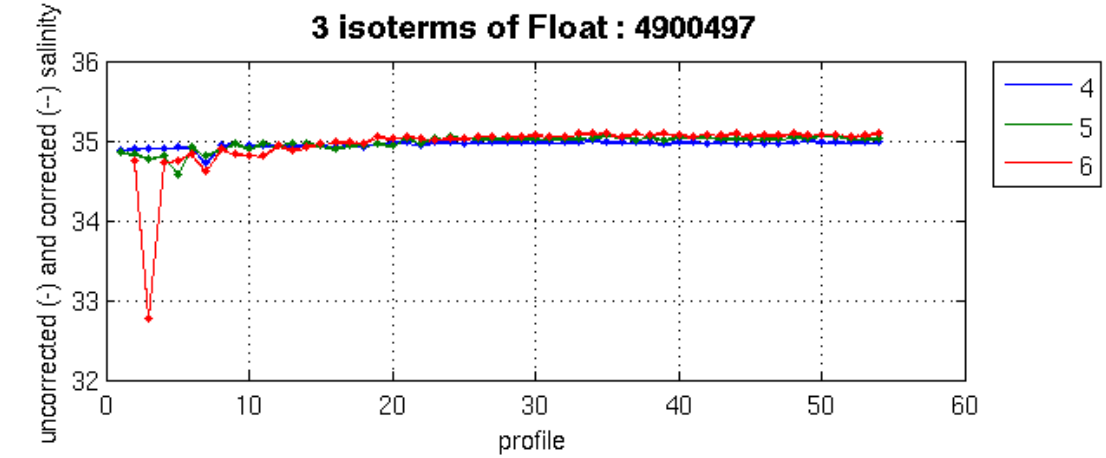
Meds correction

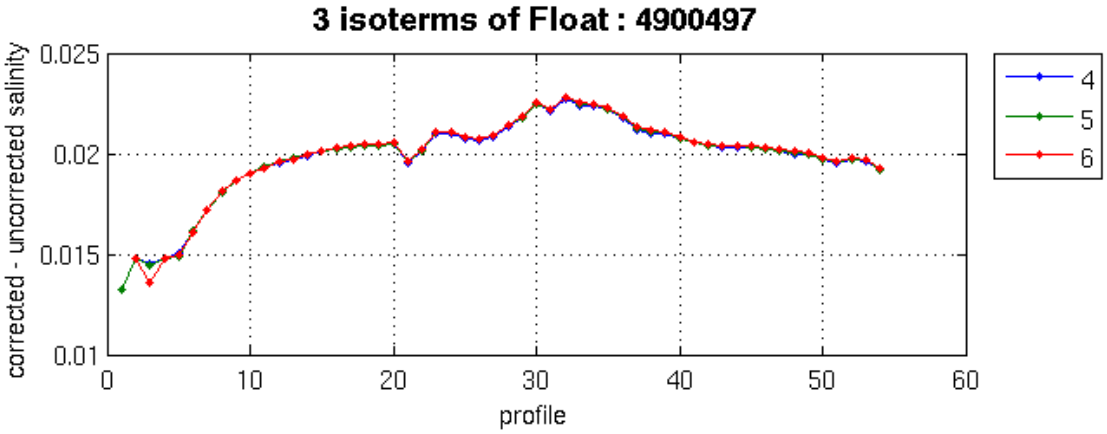
S)

This float has been corrected (red curve), but the Boehme&Send (2005) method proposes a different correction (blue or black curves), consistent with the residuals deduced from the objective analysis.

# Case 2 : suspicious offset

2006




In all cases, the Boehme&Send method suggest a correction of order 0.02 psu or more.

# Case 2 : suspicious profilers

- Given the fact that 5 or 6 profilers show the same offset of order 0.02 psu, it is likely that the measurements are true.
- Those floats are from MEDS and we don't know yet how MEDS corrected these floats. Hypothesis are :
  - they may have used neighboring ARGO floats and data from the Bedford cruises in the reference database, they also use Wong et al.'s software
  - both the reference database and the software are different at Coriolis
- So, knowing the current conditions near Newfoundland, we are able not to correct good profiles but we are not able to correct profiles that need a correction….

# Conclusions On ARGO Dataset consistency

- We were among the first users of the delayed mode data: some problems in the D files have been identified and resolved
- From those first analyses, general statistics show that the delayed mode dataset in the North-Atlantic is rather good
- Few “bad” profiles with a 0<QC<3 have been found
  - very low percentage of the delayed-mode profiles
  - the analysis system allow to detect them in a rather efficient way
- The analysis is able to detect “suspicious” profilers. They will be “reconsidered” by they PI and operator. DM data with a QC=2 will be consider with greater attention.
- This study reveals the importance of the reference database (and of the software ?) to propose the adequate correction.

# Perspectives On ARGO Dataset consistency



## More work is necessary

- to fully understand and exploit the results of the analyses
- to adapt the analysis system to the consistency problem in
  - improving the initial climatology to eliminate bias due to the age of the climatology
  - increasing the number of neighboring floats in each analysis to reduce the weight of 1 float compared to the other
- to transfer/adapt the method for an operational use

# Improved Climatology for North Atlantic (E Autret and F Gaillard)



- Take advantage of a dataset (Coriolis FTP files):
  - homogeneous (format and QC)
  - Extended (ARGO profilers, CTD/XBT, buoys and moorings)
- Use an operational tool (Coriolis Analysis System)
  - Codes adapted to Coriolis datasets
  - Configuration (grid, statistics, reference climatology)
  - Tunable parameters
- To Perform the re-analysis of the ARGO period (2000-2005)

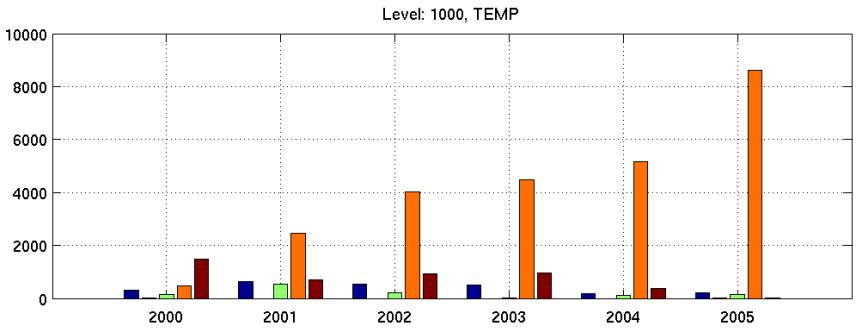
# Dataset 2000-2005

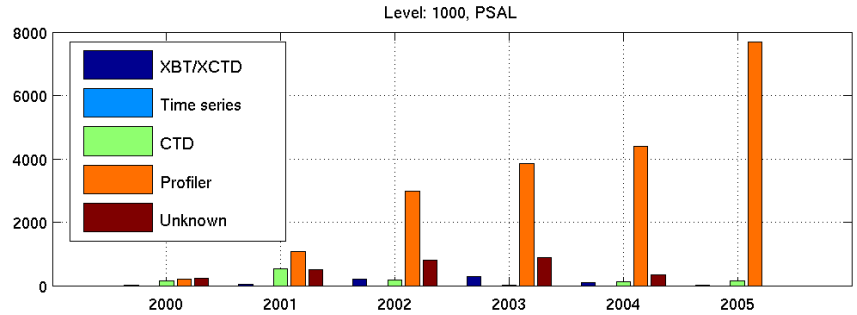
- Download of Coriolis data base: 23/01/2006
- Use 0<QC <3
- High frequency data averaged (over 1 day)

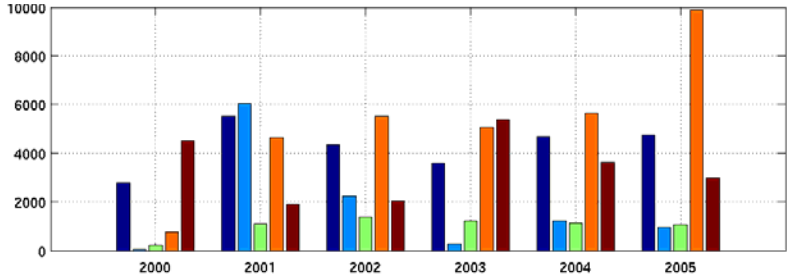
The ARGO array has been gradually setting up:

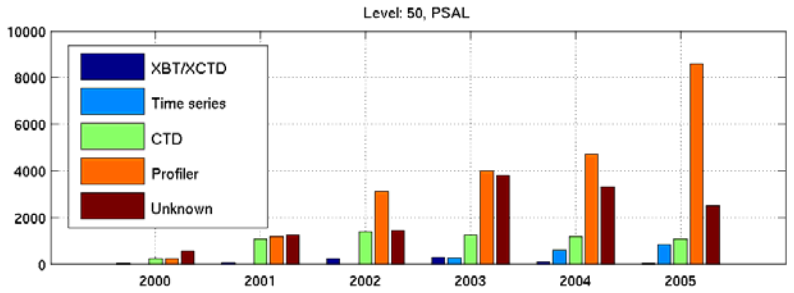
- Very poor in 2000
- Temperature improved in 2001
- Salinity in late 2002
- Nearly nominal since mid 2003

Most data are now provided by ARGO



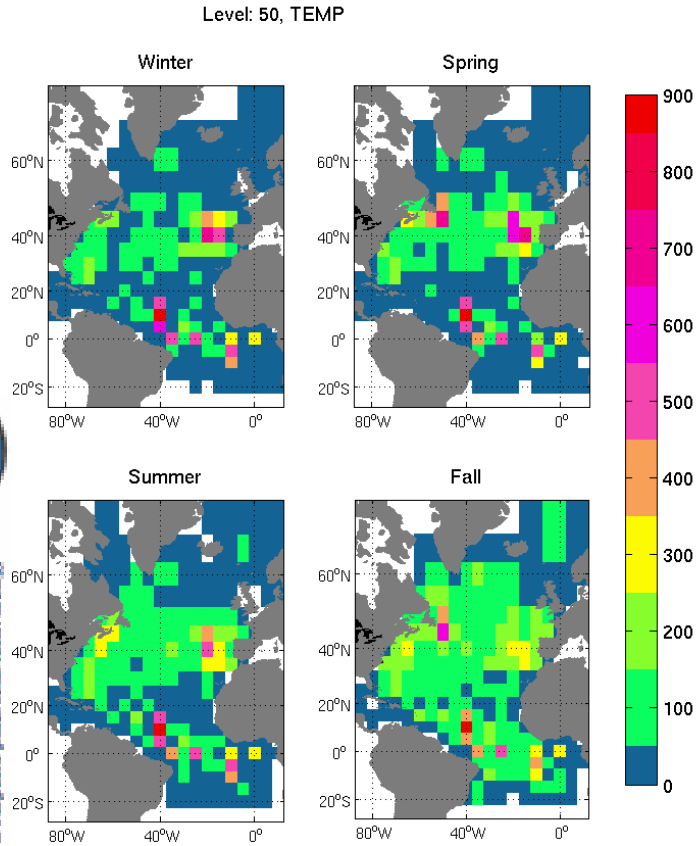



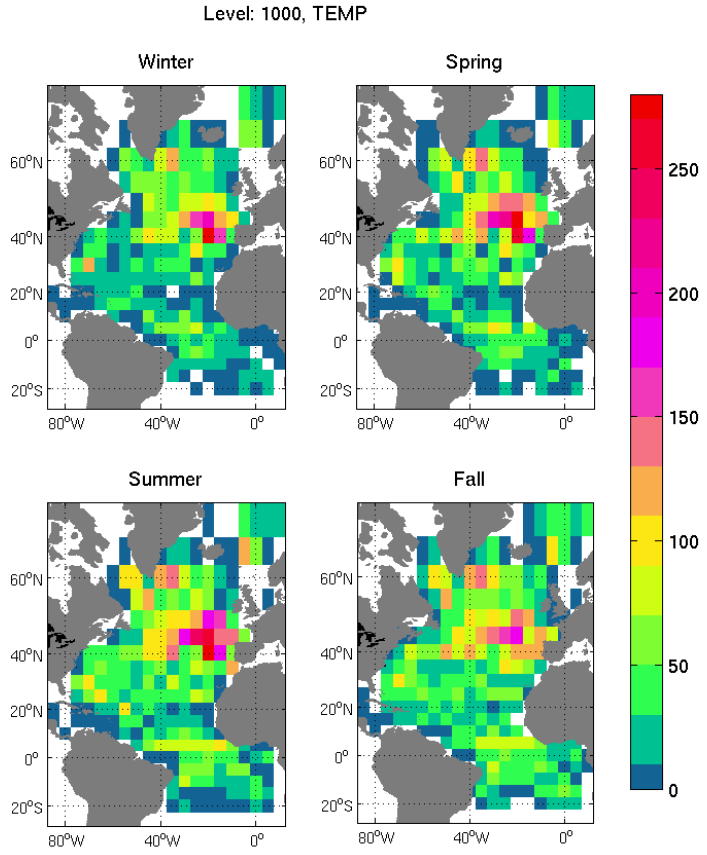



# Data distribution over space

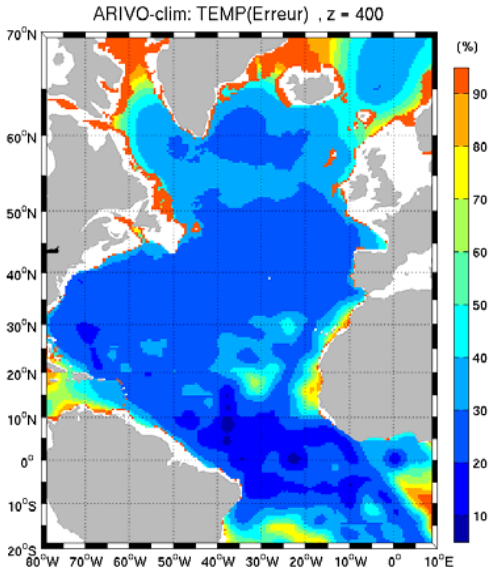
- The Atlantic from 20S to 70N is not evenly sampled : The 20N and 20S bands and latitudes > 65N are less observed (except for Norwegian sea)
- The seasonal bias is moderate
- North-East Atlantic is the best sampled area

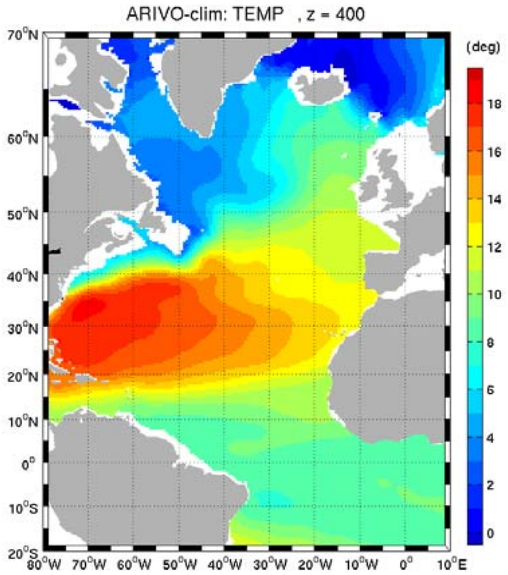


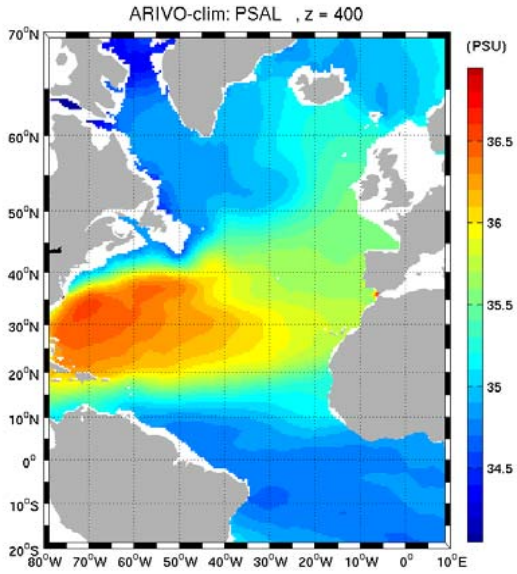



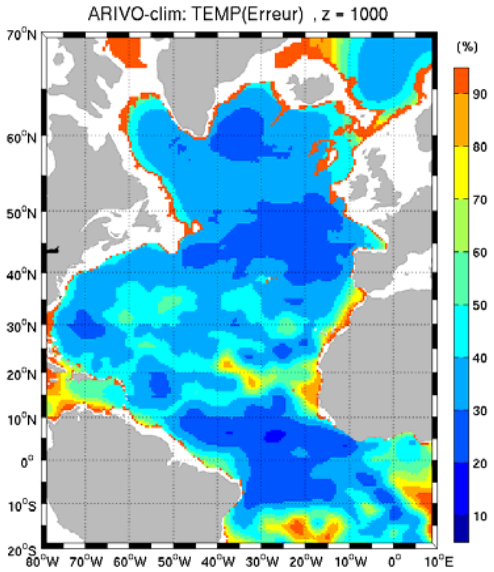
# The annual mean

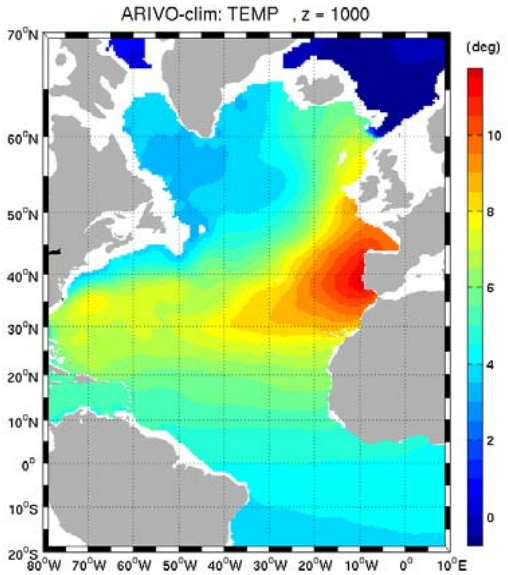


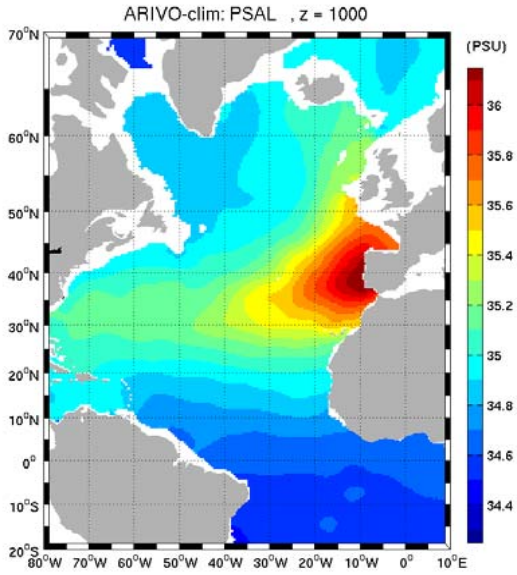


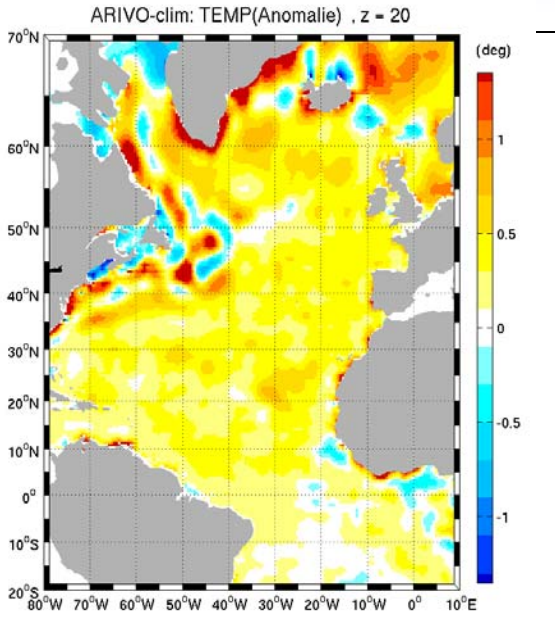



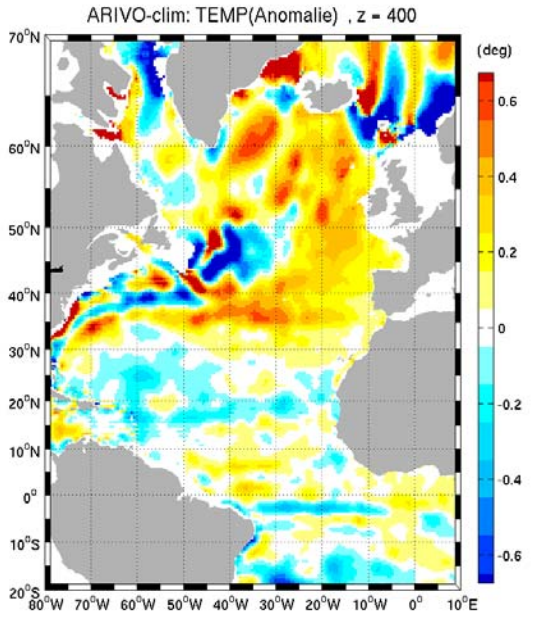



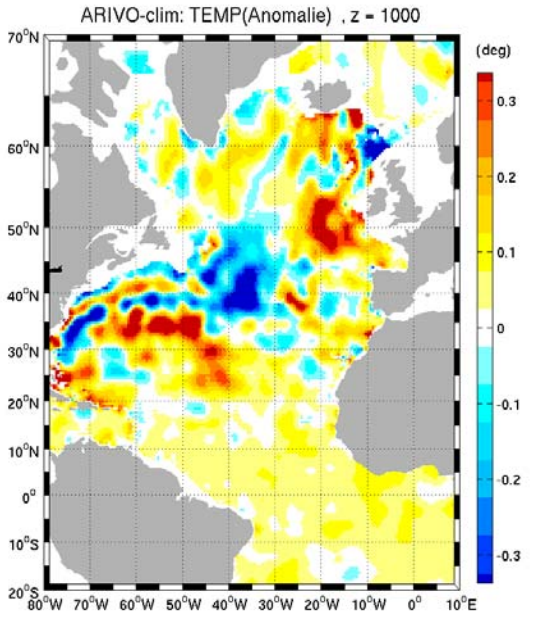



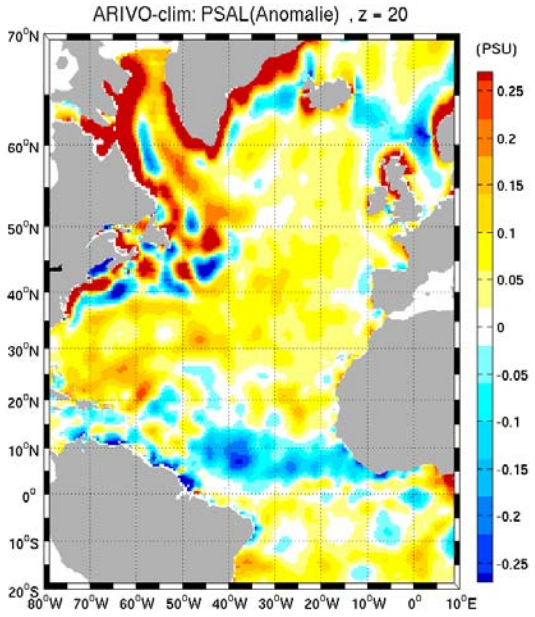



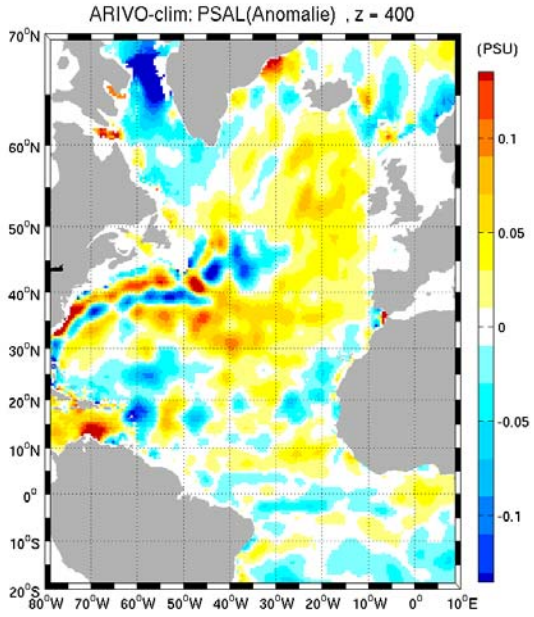
# Anomalies/WOA01-V2 (1/4°)

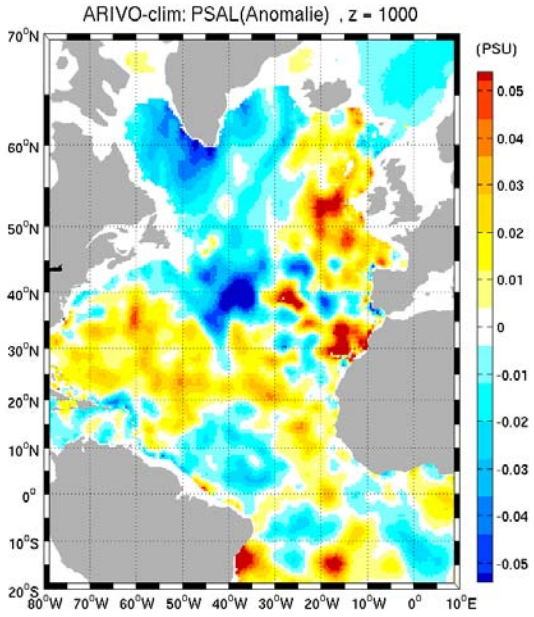


# Conclusion on Climatology activity



- Coriolis dataset
  - Since 2003 the full 0-2000m layer is well covered for T and S by ARGO profilers
  - High latitude and shelves remain problematic
- Mean 2000-2005 /WOA01-v2
  - Surface : water is warmer and saltier (except 10°N fresher)
  - At 400 m : Gulf Stream and North Atlantic Current are cooler and fresher (at least in the western basin). Labrador sea is fresher. NE Atlantic is warmer and saltier.
  - At 1000/1400 m: Labrador sea is warmer and fresher. Eastern basin is Warmer and saltier. Central (40N-40W) basin is colder and fresher. Tropics are warmer and mostly fresher
- 2000-2005 inter-annual variability at basin scale can be accessed with this dataset