Delivering data to users

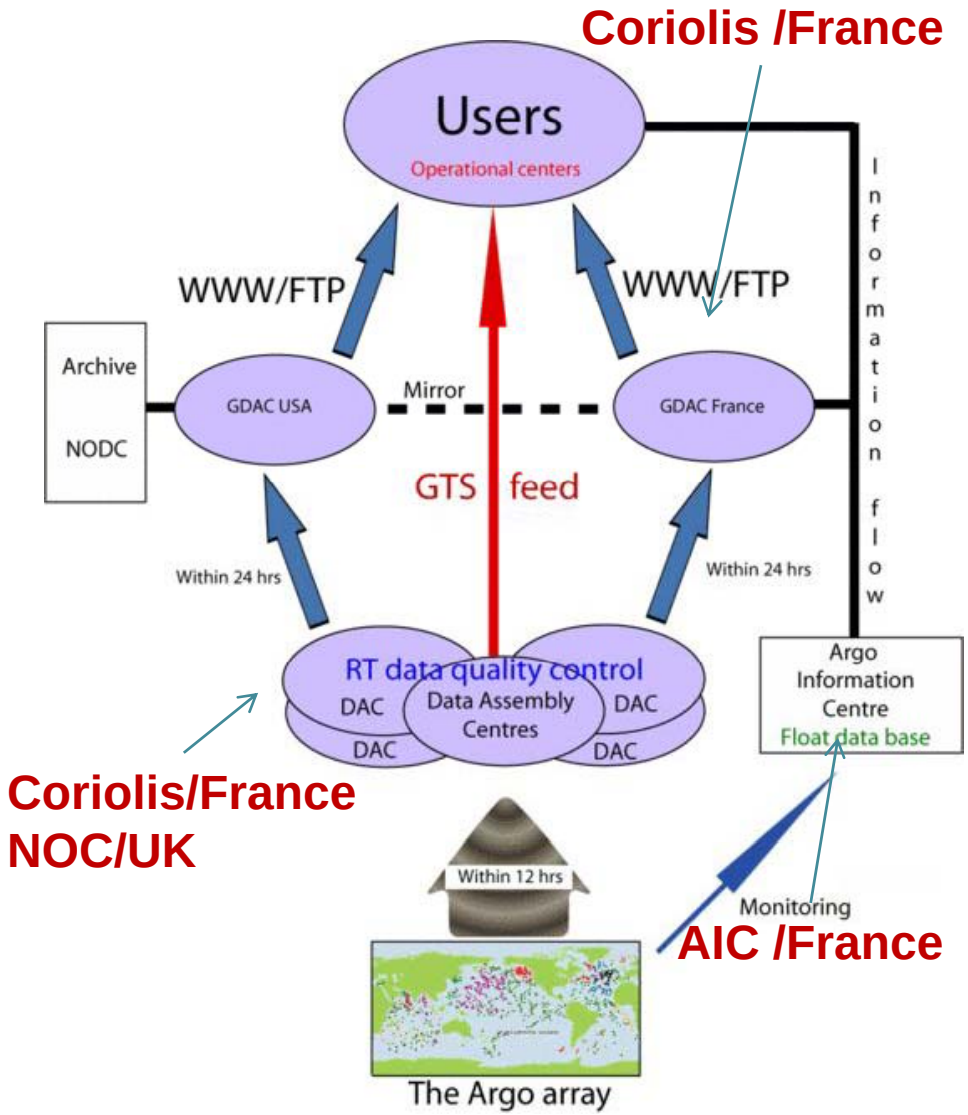
Euro-Argo: A new European Research Infrastructure

S Pouliquen /Ifremer

2007 - 2013

Designed for real-time

- Real-Time processing and delivery of Argo data for operational use ⇒National Data Centers (DAC)
- Easy access for Users ⇒ Global Data Centers(GDAC)
- Real-Time monitoring of the network ⇒ Argo Information Center (AIC)
- Archive for Future ⇒ NODC



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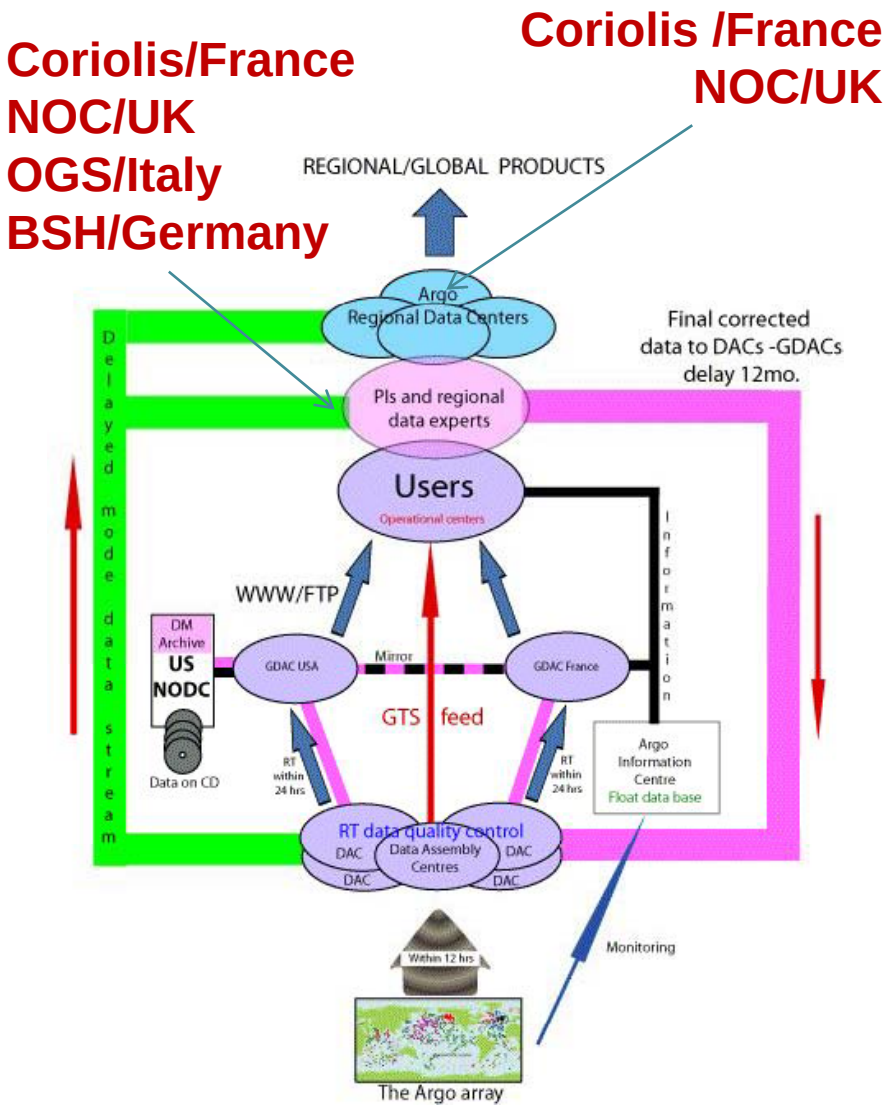
Enhanced for Delayed mode

- Common Delayed Mode methods ⇒ Wong & al
- Applied by skilled scientists ⇒ Delayed—Mode Operators
- More difficult to deploy on all oceans than planned
- Necessity to have access to recent CTDs as reference



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Detect anomalies before the users

- Some bad experiences : pressure problem on Solo FSI floats, Pressure drift on Apex floats, micro-leak on Seabird pressure sensor,…
- Such problems are difficult to detect on a float time serie alone as it induces small drifts

⇒it led to creation of Argo regional centers in charge of
  - Checking the consistency of Argo dataset at basin scale
  - Building products from Argo data

What works well in Argo Data System

- Integrated data access from central place
- Real Time processing within operational user constrains (24h to 48h from acquisition)
- Distributed data processing using same methods
- Partnership between Data Management team and Scientific team

What is perfectible in the Argo Data System

- Users don't read the documents , don't use flags, use real-time data for climate applications without enough cautions
- The man power is stable when the dataset has increased exponentially in past ten years
- Delayed mode processing can still be biased by subjectivity despite good collaboration between Delayed Mode operators
- Need for Recent CTD that are not provided by scientist rapidly enough

What Euro-Argo developed for Argo Data System

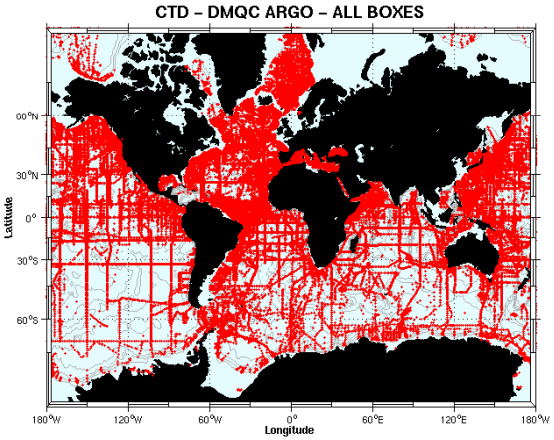
- Enhanced Argo regional activities for Nordic sea and Med Sea
- Developed news tools to monitor the float at sea behavior and to plan float deployment
- Developed Real time QC on biogeochemical Data
- Improved methods for assessing the consistency of the Argo dataset

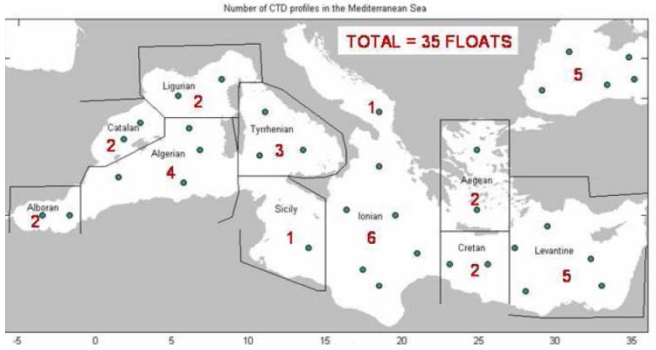
Enhanced Regional Activities

- Improved the CTD reference database in North Atlantic and Med sea .

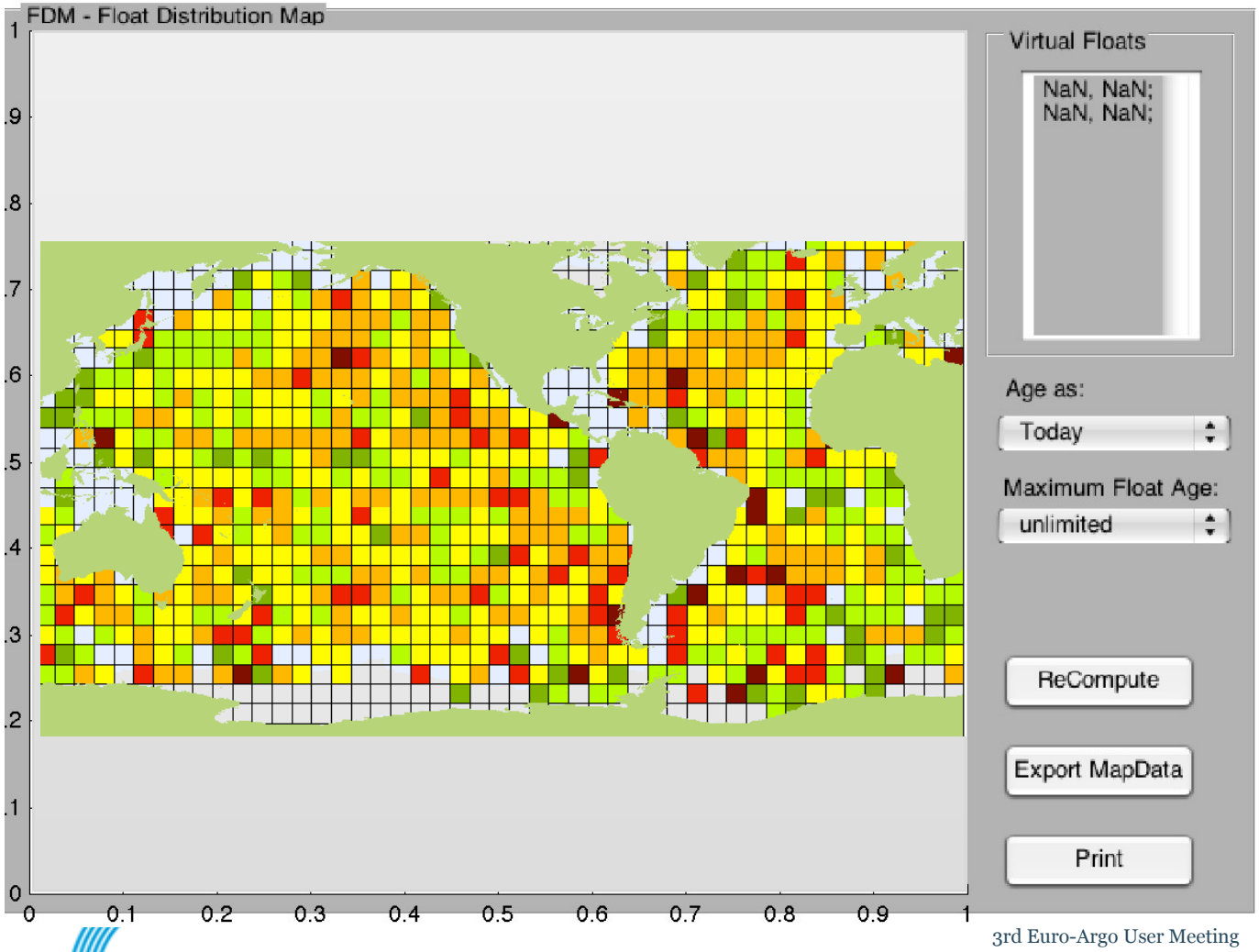
- Delayed mode QC of Med and Nordic seas floats were performed using recommended Argo procedures

- Recommended deployment strategy for regional seas (numbers, location, mission characteristics)





New tool to facilitate Float Deployment plan elaboration



- Virtual floats can be added and impact analyzed
- Age of distribution as of today or in the future displayable
- Death Age for floats can be set, thus they don't show in distribution
- Data of final map can be exported

Improve at sea monitoring

- Objectives
  - Detect malfunctions earlier than DMQC
  - Provide summary information of the Argo fleet behavior in term of lifetime, transmission efficiency, grounding , …
  - Compute statistics that are useful to engineers and manufacturer to analyze at sea behavior and do the in depth analysis on individual float data

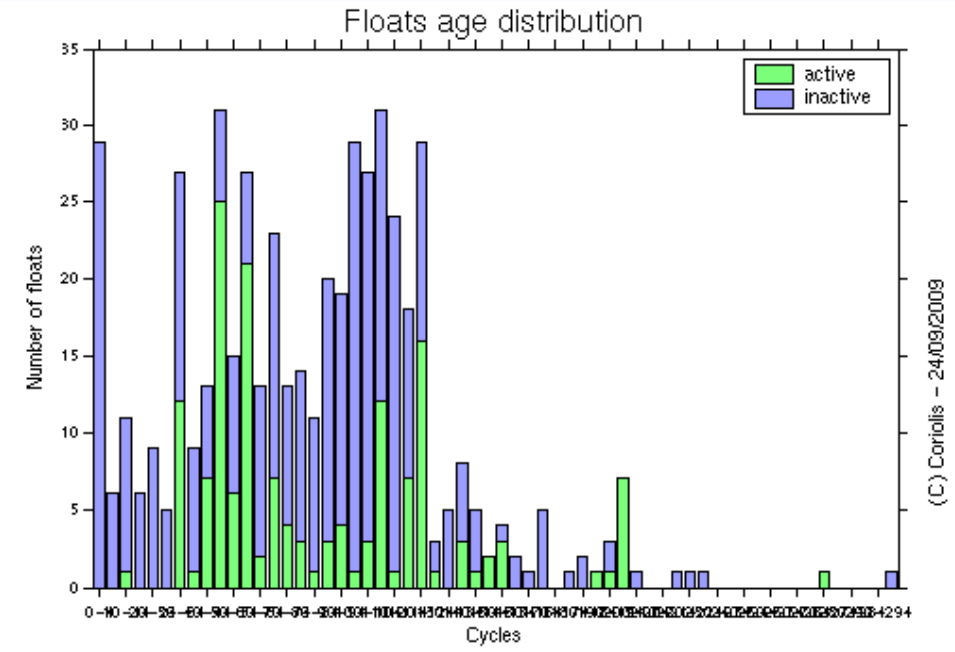
- Ifremer developed a first version of the Provor fleet monitoring and tested it of French fleet. It can be executed on a selected fleet of floats. Some basic tests are made on APEX

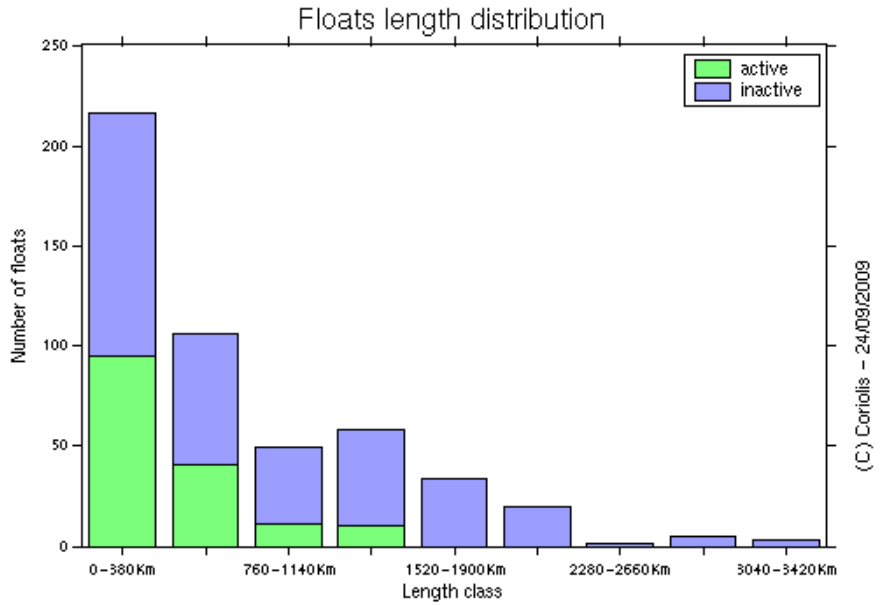
First results of French Fleet

Float age | Float status | Functional monitoring | Technical monitoring

Statistical information of the fleet as a whole

More detailed statistics that allow to study fleet and individual float behavior with direct link to the Coriolis WWW site





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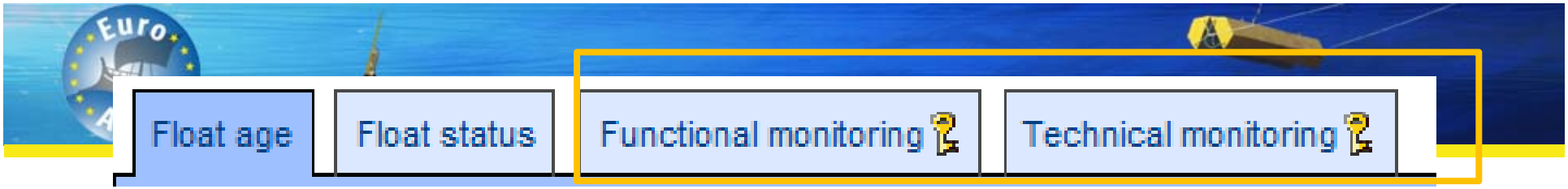


Float age | Float status | Functional monitoring | Technical monitoring

Full report | WMO Correspondance | Print page

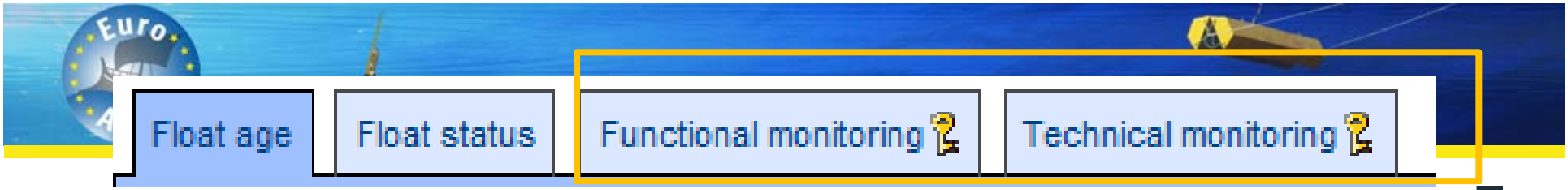
Active Floats | Dead Floats

157 active floats at 24/09/2009
0 deployed floats, 0 new dead floats since last monthly bulletin at 11/06/2009

PROVOR_LOT_V4 (104) + 0 - 3 | APEX_LOT_V10 (8) + 0 - 0 | APEX_LOT_V20 (24) + 0 - 2

104 active floats at 24/09/2009
0 deployed floats, 0 new dead floats since last monthly bulletin at 11/06/2009

Floats	Program	Deployment data	Lastest cycle	T/S Profiles		Drift	Data Transmission			Battery Voltage	Kms			Excel File
			Missing cycles	Quality	Length	Cycles with anomaly	Cycle	Missing Frames	Missing Measurements		Kms done	kms done / previous month	Expected Kms/ previous month	
6900700	PROSAT	19/02/2009	15/09/2009 #41	OK	Grounded	Grounded	NOK			10.0	67.8	32.7	31.5	Cycles
6900699	PROSAT	03/04/2009	23/09/2009 #34	27 14 6 2	Grounded Grounded Cycles 9 10 15 Too short cycles 0	Grounded	NOK 15 22 23 29	 1/15 2/14 1/14 1/14	 6.2% 14.1% 7.6% 7.5%	10.0	53.3	32.8	33.6	Cycles
6900695	CORIOLIS	24/11/2008	23/09/2009 #30	21	OK	OK	NOK			10.0	59.5	21.9	21.0	Cycles



Float age | Float status | Functional monitoring | Technical monitoring

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Active Floats | Dead Floats

357 dead floats at 24/09/2009
0 new dead floats since last monthly bulletin at 11/06/2009

PROVOR_LOT_V2 (17) + 0 | PROVOR_LOT_V3 (81) + 0 | PROVOR_LOT_V4 (39) + 3 | PROVOR_LOT_V5 (2) + 0 | APEX_LOT_V1 (20) + 0 | APEX_LOT_V10 (9) + 0 | APEX_LOT_V20 (5) + 2

17 dead floats at 24/09/2009
0 new dead floats since last monthly bulletin at 11/06/2009

Floats	Program	Deployment data	Lastest cycle	T/S Profiles: Quality		T/S Profiles: Length		Drift	Data Transmission			Battery Voltage	Kms		Excel File
			Missing cycles	Cycles with anomalies	Grey list	Grounded Cycles	Too short Cycles	Cycles with anomaly	Cycle	Missing Frames	Missing Measurements		Kms done	expexted kms	
69041	POMME	26/09/2000	01/09/2001 #34	0	No	0	53	33	5			-	44.9	67.9	Cycles
69040	POMME	26/09/2000	21/10/2003 #112	0	No	0	113	109	14			-	214.7	224.0	Cycles
							1 2 3 4	Unstable	2	1/9	2.2%				
							5 6 7 8	Cycles	27	2/9	25.5%				
							9 10 11	1 2 3 4 5	34	1/9	11.2%				
							12 13	6 7 8 9	35	2/9	22.9%				
							14 15	10 11 12	55	1/8	14.0%				
							16 17	13 14 15	60	1/8	13.3%				
							18 19	16 17 18	75	1/8	12.4%				
							20 21	19 20 21	78	1/7	16.0%				
							22 23	22 23 24	81	2/8	28.4%				
							24 25	25 26 27	84	2/8	16.3%				
							26 27	28 29 30	91	1/8	13.8%				
							27 28	31 32 33	92	1/8	12.8%				

Defined RTQC for Chlorophyll

Test 1. Platform Identification
Test 2. Impossible date test
Test 3. Impossible location test
Test 4. Position on land test
Test 5. Impossible speed test
Test 8. Pressure increasing test
Test 13. Stuck value test
Test 15. Grey List
Test 17. Visual QC
Test 19. Deepest pressure test

Not modified Tests

Test 7. Regional Test.
Test 12. Digit Rollover test.
Test 14. Density inversion.
Test 16. Gross Salinity or Temperature sensor drift.

Not applicable Tests

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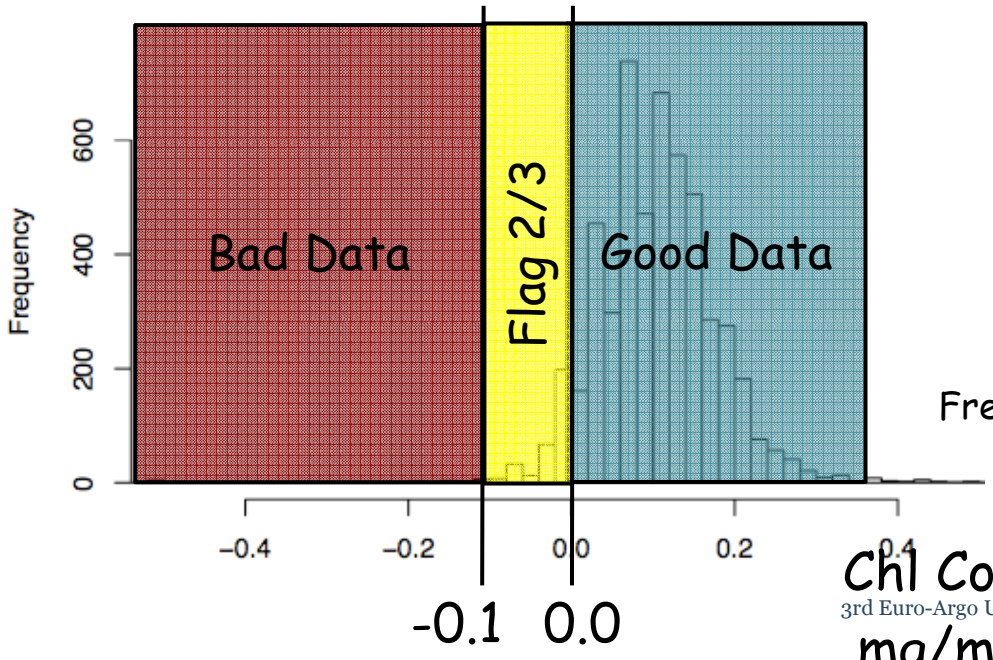
Test 6. Global range

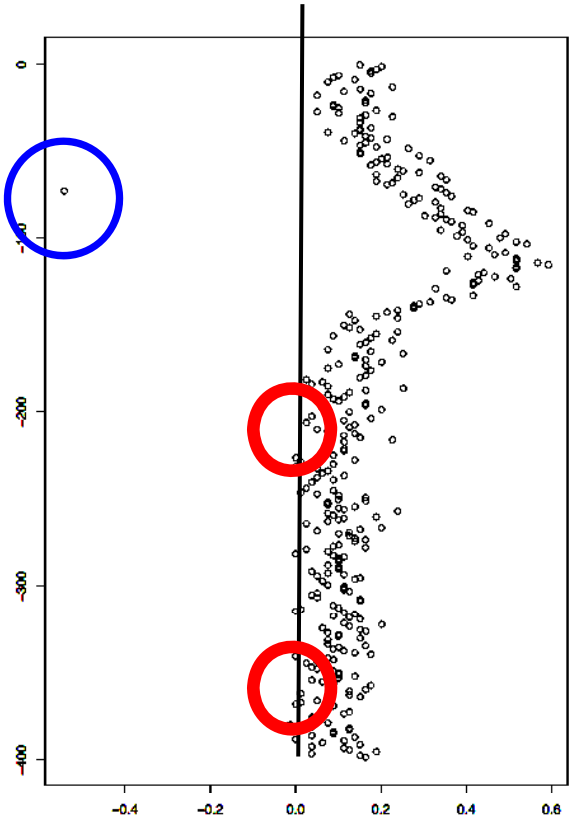
NEGATIVES VALUES

Two types of negatives values:

1. Values close to zero, principally observed at depth

2. Negative values, randomly distributed all along the profile

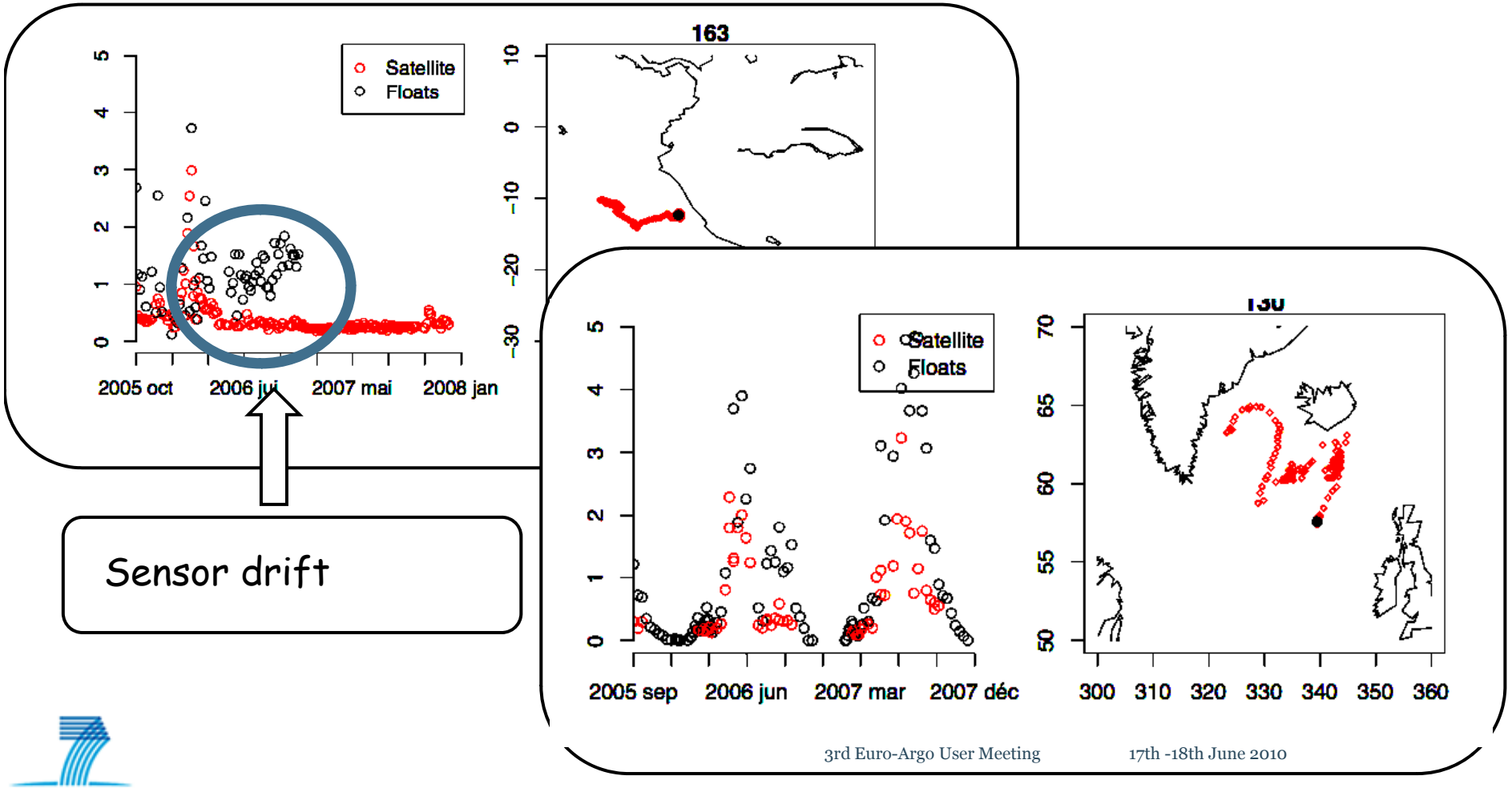




Frequency distribution of chl values for a specific float

Hypothesis for delayed mode

- Utilization of ocean color data to check long term stability of the sensor (Delayed Mode and Adjusted Mode, «like » Guinehut et al. JAOT, 2009 »)



Sensor drift

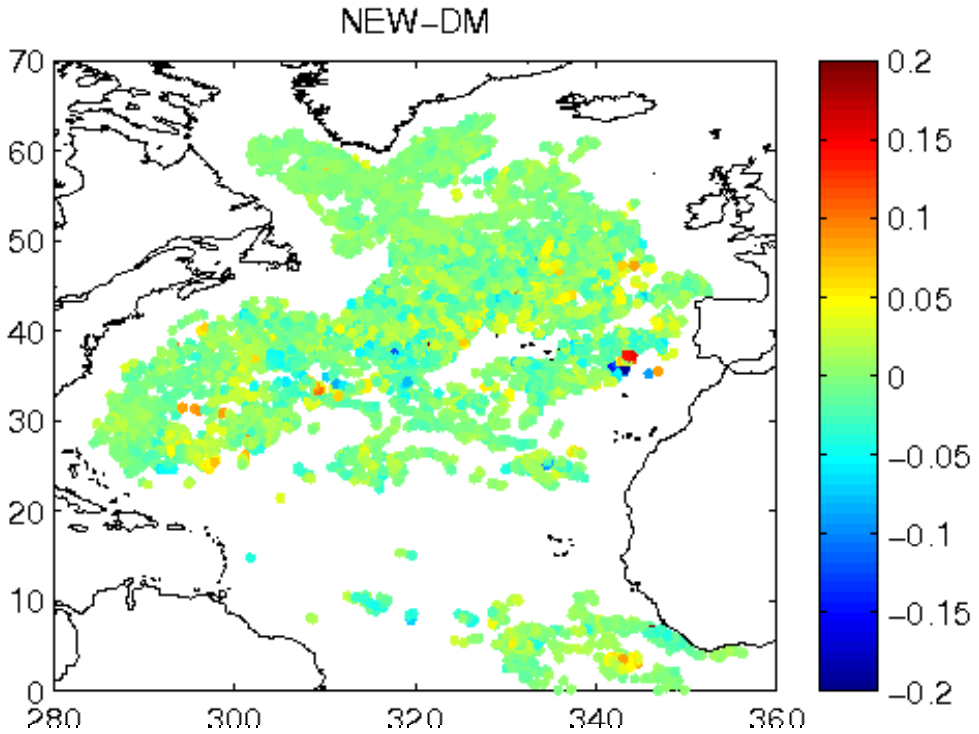
Enhance Consistency methods

- Comparison of float salinity measurements with measurements from neighbouring floats (Adjusted field if exist, RT (flag=1) if not).
  - inspired from OW method used for DMQC (*Owen and Wong, 2003 & 2009)*

- For one float:
  - For each profile, neighbouring measurements are interpolated at the profile position by optimal mapping:
    - neighbouring measurements: profiles included in a 6° latitude and 12° longitude ellipse and a 3 months temporal range around the examined profile.
    - mapping correlation scales: latitude=2°, longitude=4° and time=1 month
  - A depth-independent ΔS between measured and mapped salinities is then estimated, from data at 10 minimum variance levels weighted by the mapping error.

Enhance Consistency methods

Comparison of float salinity measurements with measurements from neighbouring floats (Adjusted field if exist, RT (flag=1) if not). inspired from OW method used for DMQC (*Owen and Wong, 2003 & 2009*

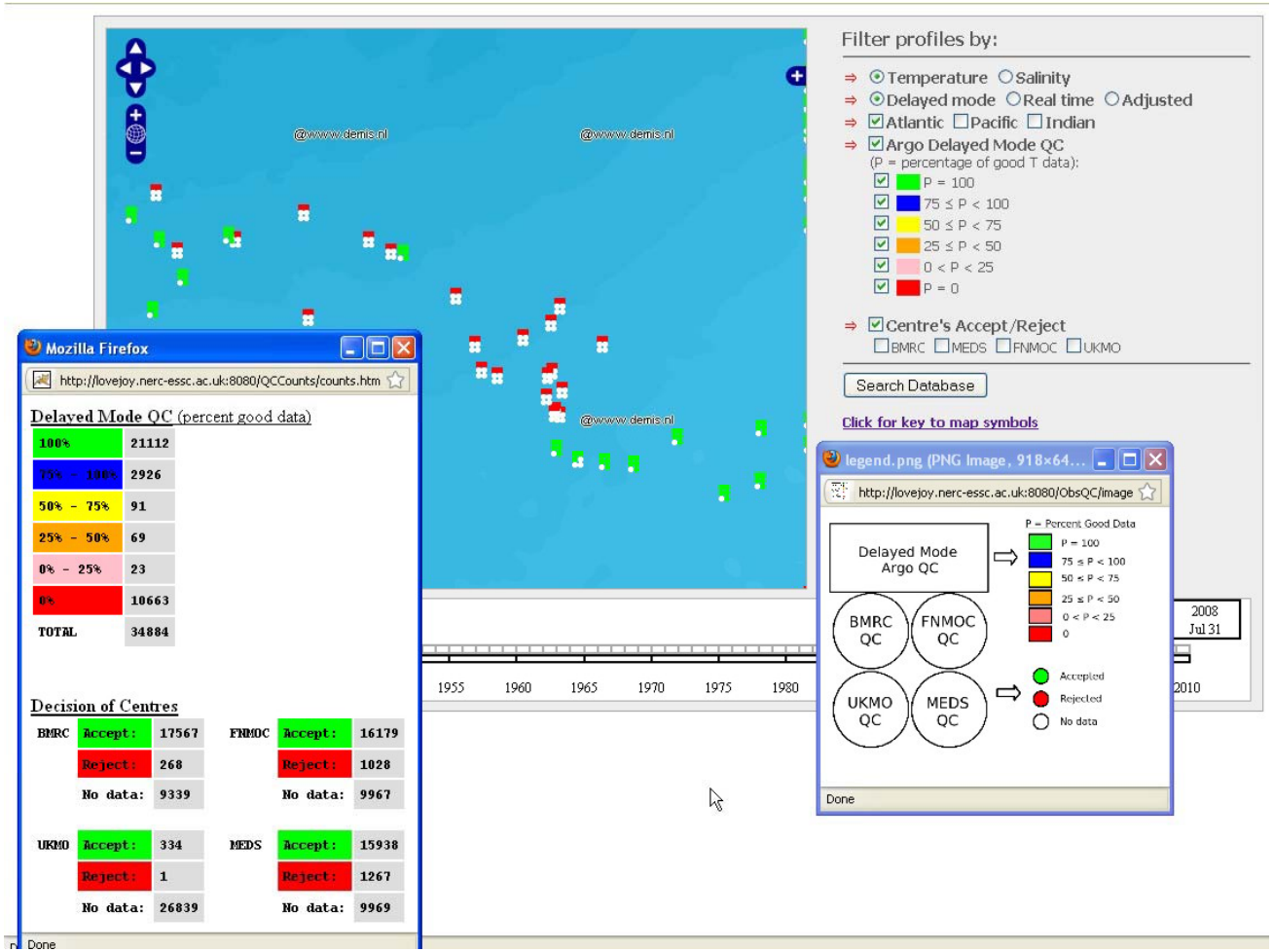


The method has been run on 200 floats already in Delayed Mode in the North Atlantic (~10000 profiles), for test.

Results are globally coherent with DM adjusted fields The method allows detection of some suspicious DM profiles, to be analysed more in details

Enhance Consistency methods by comparing Model QC to Argo Qc

- Within Godae a database has been set up allowing a comparison of Argo QC results and operational centre data assimilations (Met agencies) QC.
- The database currently contains 2 years data and it is hoped to include the full Argo dataset and other instruments such as XBT data in future.



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Enhance Consistency methods by comparing Model QC to Argo Qc

- BODC will go further in this analysis and plan to turn the developed tools into operation within MyOcean.
- The aim is to use the UK database (and portal) to compare the rejected and accepted floats from the operational centre QC systems with those from the Argo project QC.
- If significant discrepancies are identified it is hoped we can:
  - Determine the reasons
  - Investigate if the Argo QC can be improved
  - Present these finding to the Argo data management team and the operational centres with the aim of developing our QC methods or improving the operational systems

What could be improved Argo Data System

- Dedicate the man power necessary to Delayed mode and assessment activities
- Enhanced scientific assessment in regional centers
- Register the Argo users to better inform them
- Enhanced at sea monitoring of the Argo Fleet