



Overview of Euro-Argo and its Preparatory Phase activities

Trieste, June 18

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Euro-Argo: A new European Research Infrastructure





Outline

Why do we need Argo and Euro-Argo ?

The Euro-Argo infrastructure

The Euro-Argo preparatory phase

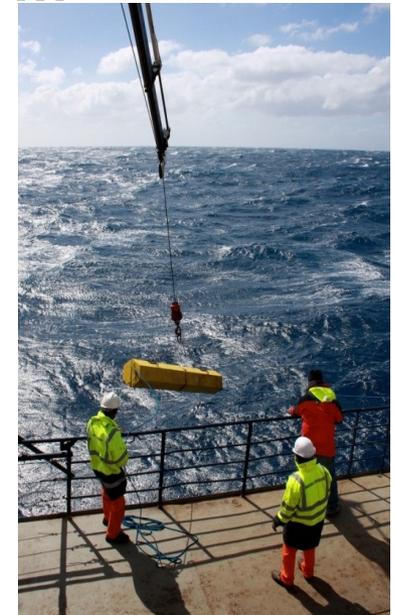
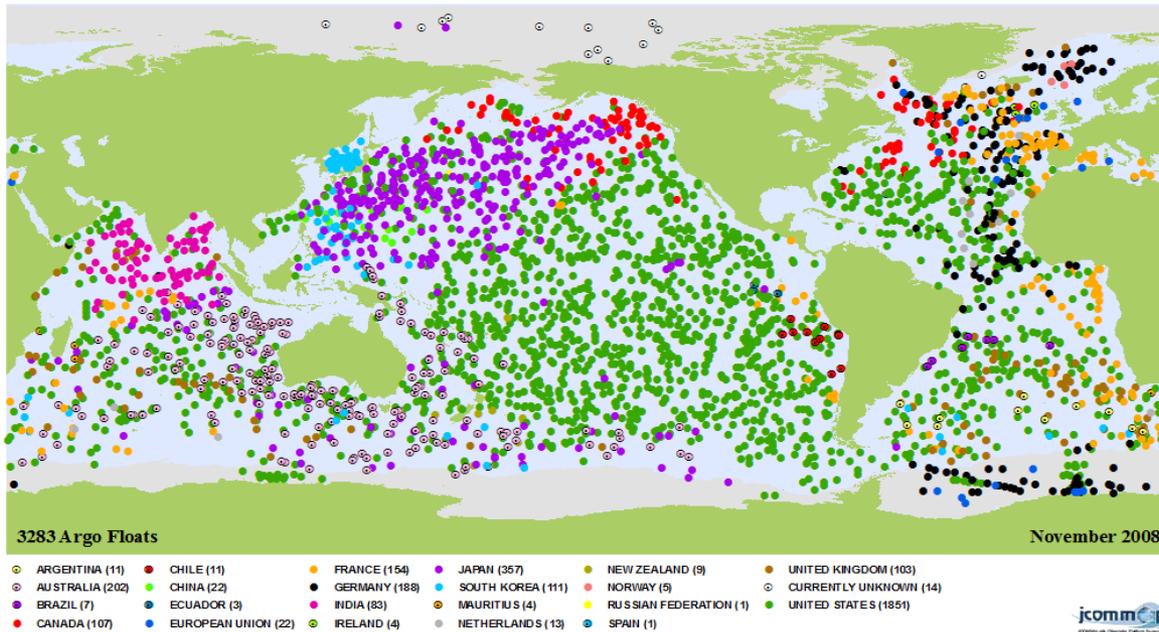
Funding issues

Future organisation of Euro Argo



Argo: the first global in-situ ocean observing system

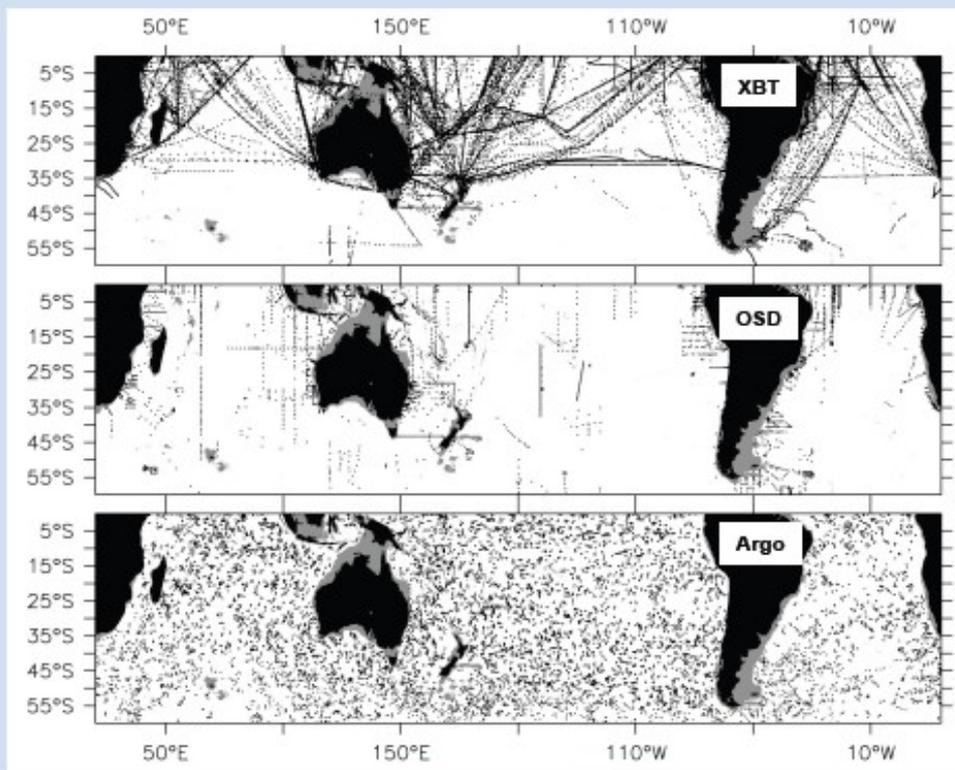
3000 robotic floats worldwide measuring the temperature and salinity to a depth of 2000 m



Maintaining the array's size in the coming decades is the next challenge for Argo. This is essential for climate and operational oceanography applications (GMES MCS)



Status: What has been achieved?



Through 2000: All August XBT profiles (> 300 m; source WOD).

1951 – 2000: All August hydrographic (T,S) stations (> 1000 m; source WOD).

2004 – 2008: August Argo T,S profiles.

Argo is revolutionizing global oceanography, and its impact will be greatest in the southern hemisphere where (i) there are large climate signals and (ii) there is little historical data.





The science case : Climate change and global warming

The oceans have a **fundamental influence on our climate and weather**, both of which are affected by changes in the currents and heat content of the ocean.

Argo is a unique system to monitor heat and salt transport and storage, ocean circulation and global overturning changes and to understand the ability of the ocean to absorb excess CO_2 from the atmosphere.

Over the past 50 years, the oceans have absorbed more than 80% of the Earth warming due to the anthropogenic increase of greenhouse gas concentration

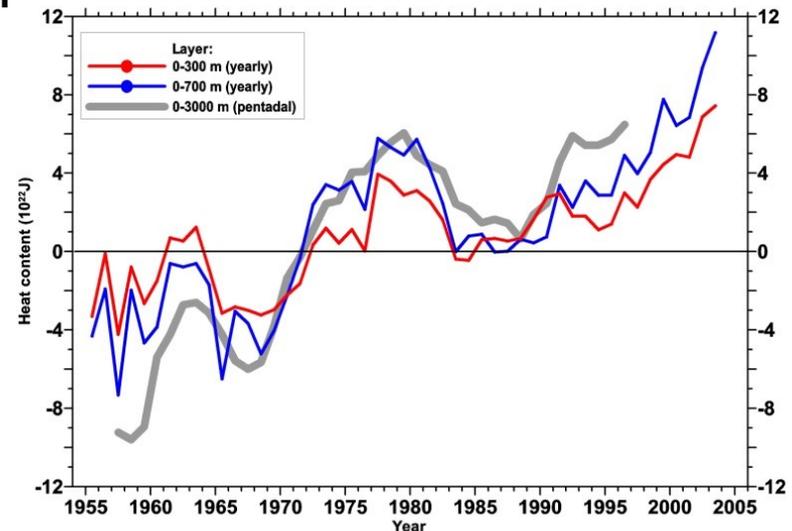
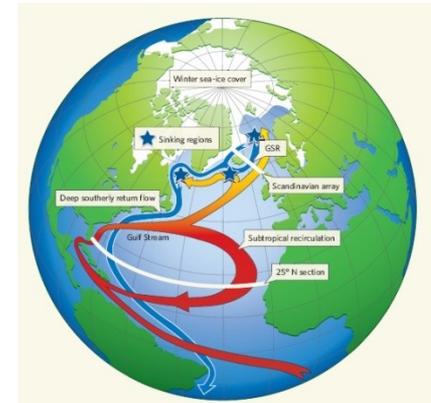
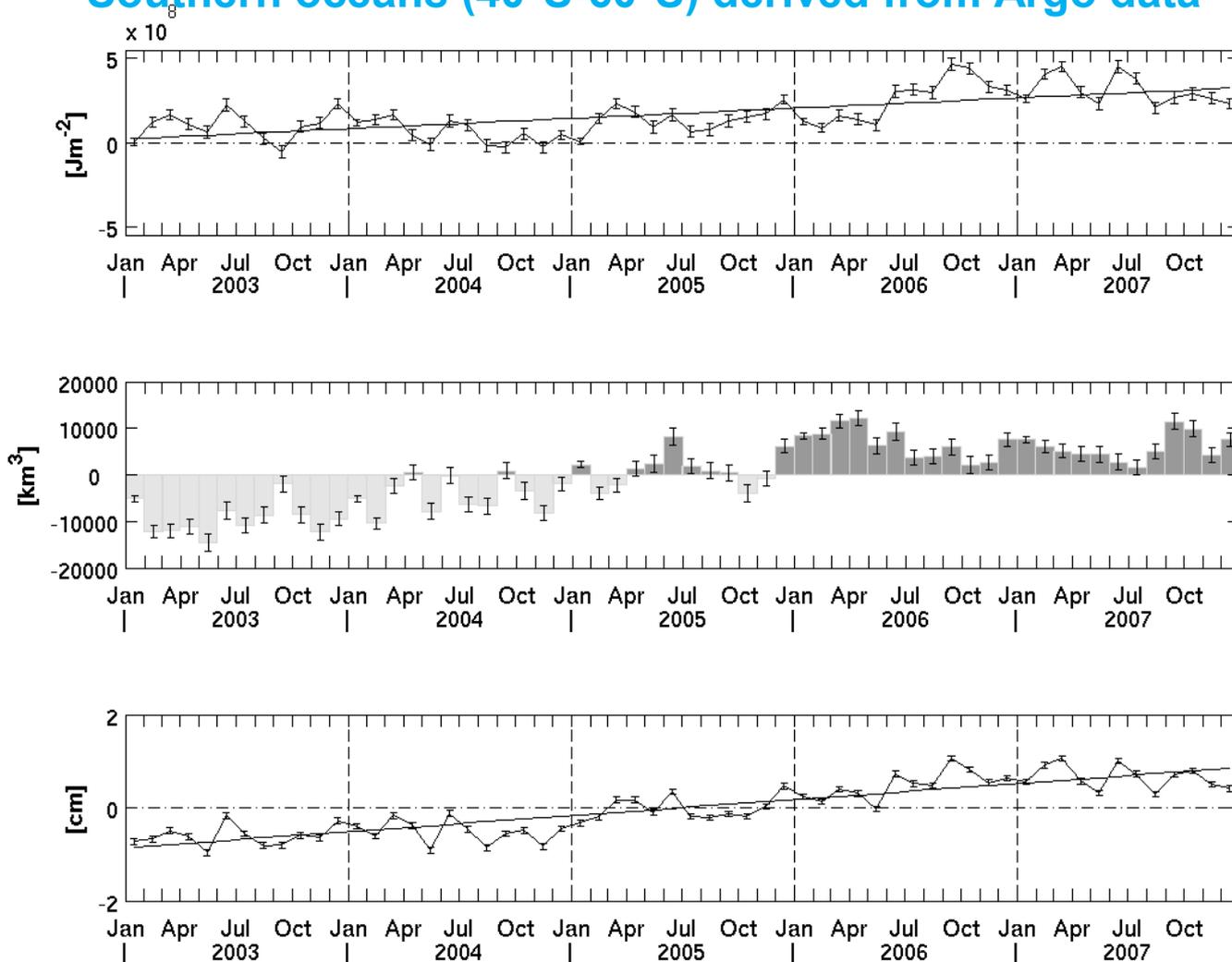


Figure 1. Time series of yearly ocean heat content (10^{22}J) for the 0-300 and 0-700 m layers and pentadal (5-year running composites for 1955-59 through 1994-98) ocean heat content (10^{22}J) for the 0-3000 m layer. Each yearly estimate is plotted at the midpoint of the year, each pentadal estimate is plotted at the midpoint of the 5-year period.



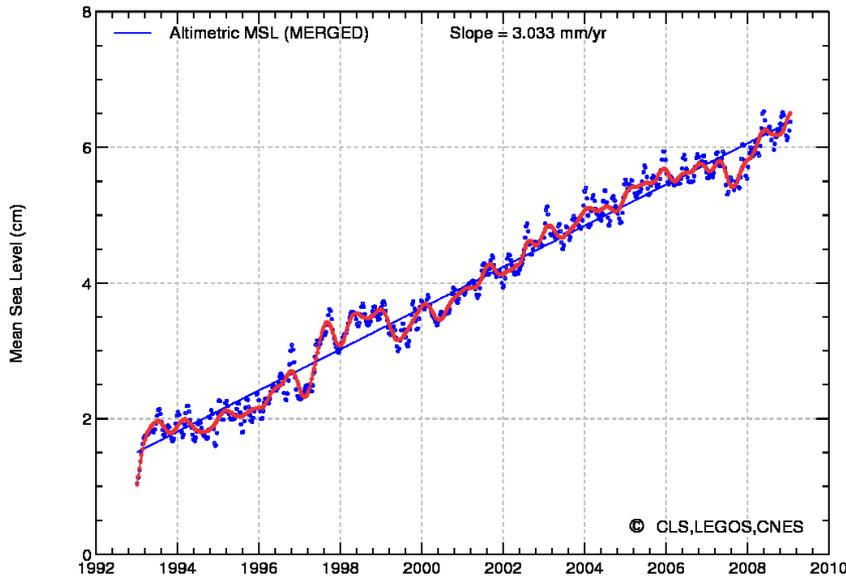
Warming, freshening and steric sea level rise (thermal expansion) of the Southern oceans (40°S-60°S) derived from Argo data



Von Schuckmann et al. (2009)

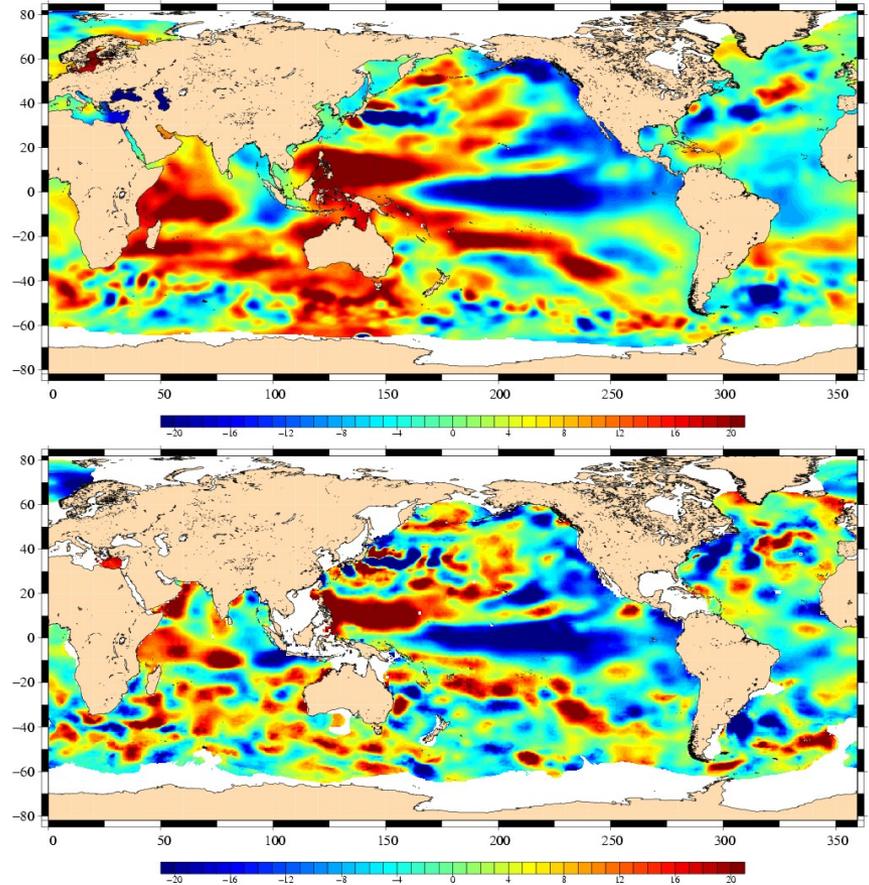


Mean sea level rise: a major concern for the 21st century



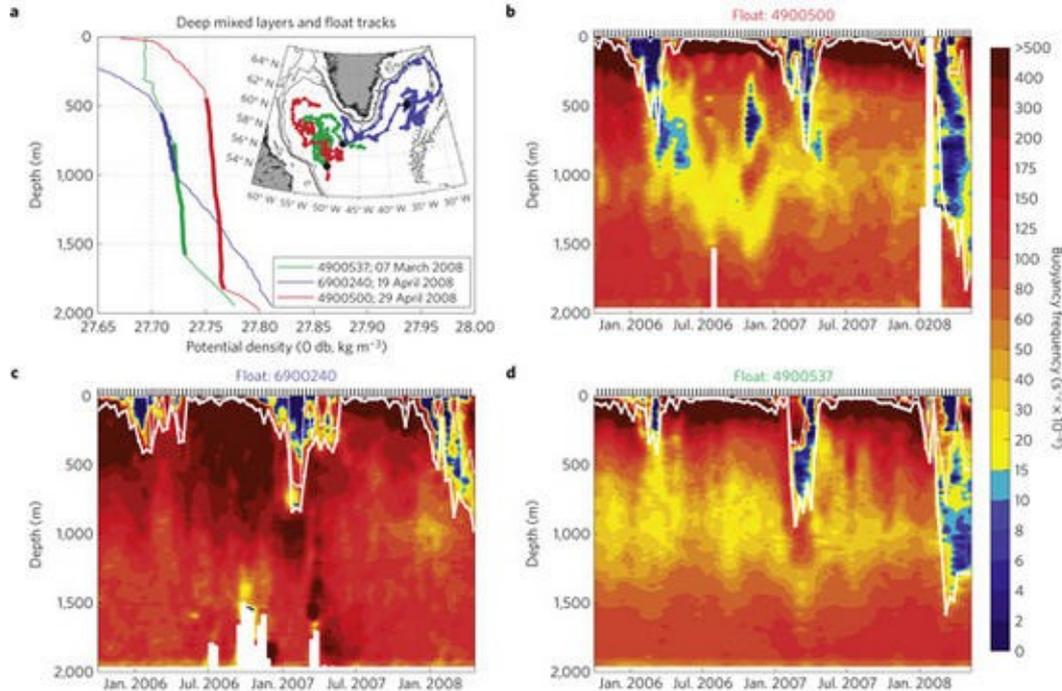
MSL trend for the last 15 years from satellite altimetry

Without Argo, large uncertainties on the effect of ocean warming. Crucial to predict long term evolution of MSL.



Spatial distribution of the sea level trend from satellite altimeter (top) and steric sea level from Argo floats (bottom) for the 2004-2007 periods (in mm/year) (CLS, LEGOS)

Deep convection in the North Atlantic Ocean



Argo floats represent a unique opportunity for observing deep convection which occurs in place and time of especially strong sea conditions. Deep convection affects the Meridional Overturning Circulation and its associated northward heat flux



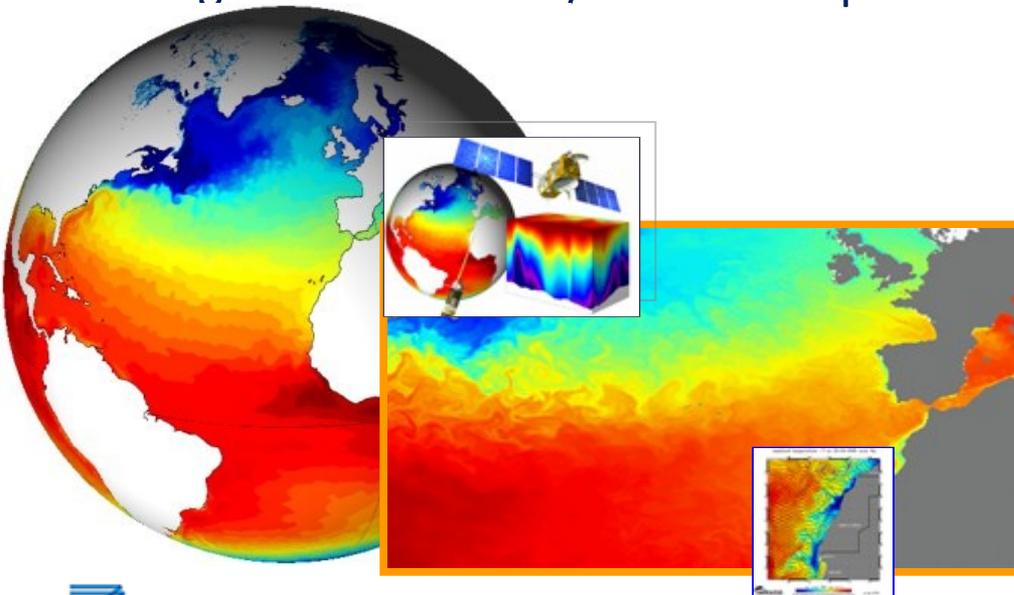
Operational monitoring systems

GMES Marine Core Service (MCS)



Combining in situ and satellite data, with models to deliver regular and systematic reference information on the state of the oceans and regional seas.

Argo is an essential/critical component of GMES MCS. Strong links



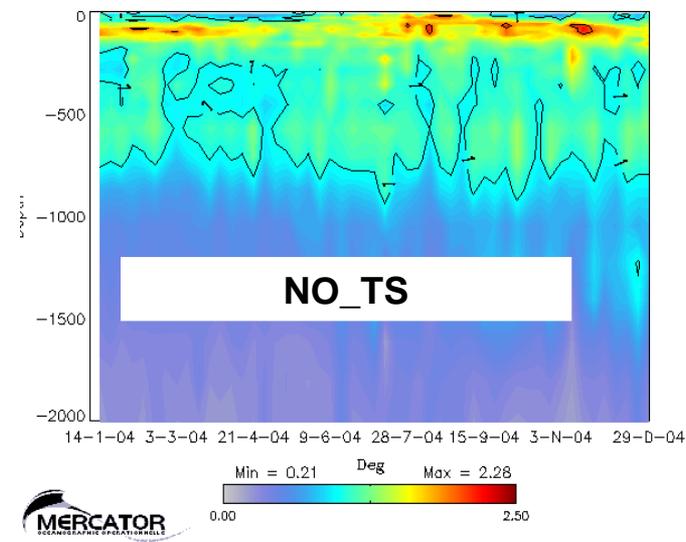
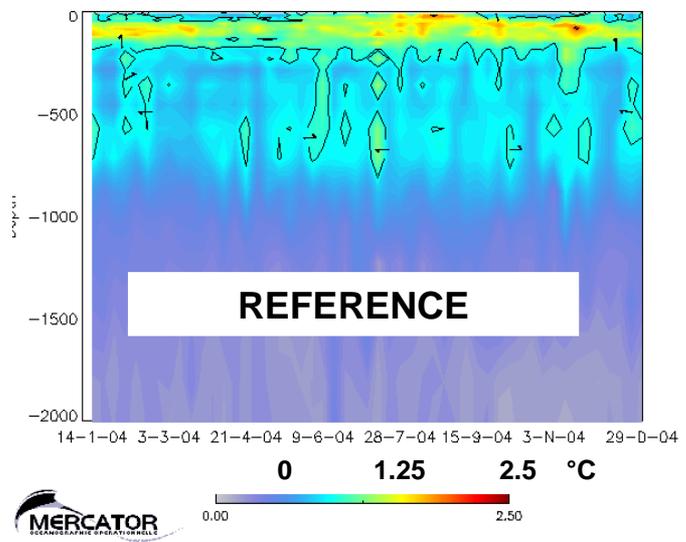
- Physical state of the ocean, and primary ecosystem
- For global ocean, and main European basins and seas
- Large and basin scale ; mesoscale physics
- Hindcast, Nowcast, Forecast
- Data, Assimilation and Models



Impact of Argo data on the Mercator system

- **REFERENCE** run assimilated all obs (SLA, SST, T/S from Argo)
- **NO_TS** run assimilated only (SLA, SST)

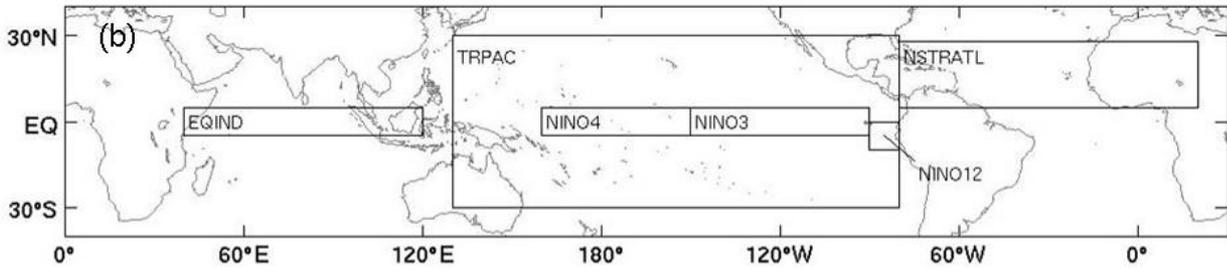
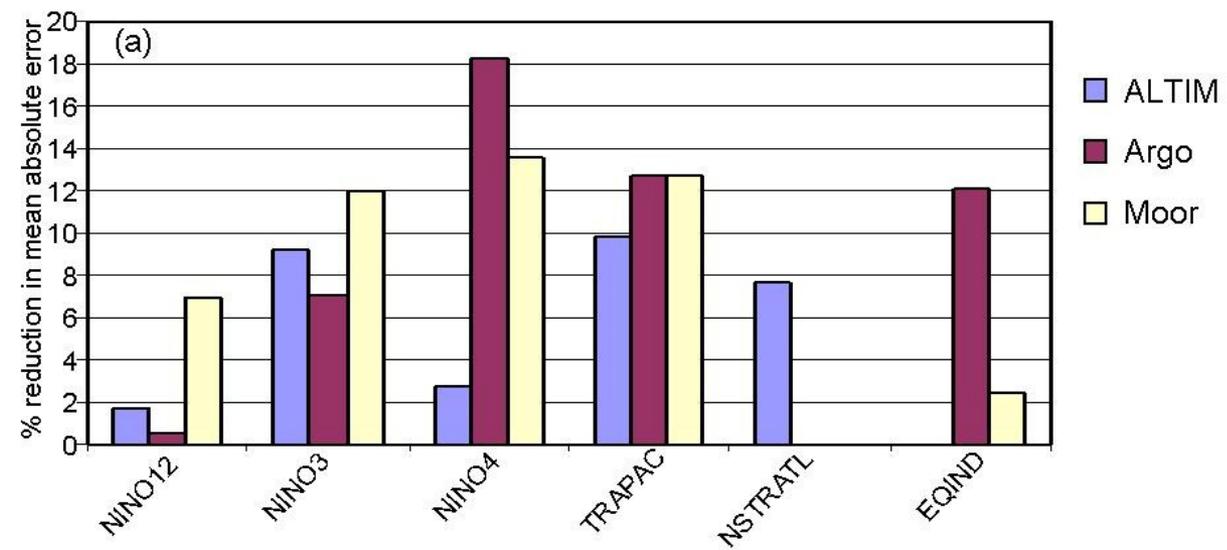
Temperature : Rms of the differences between the in-situ profiles and the model 7-days forecast



- Instantaneous development of large biases (0.3 °C) in the 300-700 m layer
- Over time, at deeper depths, the model drifts from the climatology
- SST data still constraint the surface layer



Impact of Argo data for seasonal prediction (ECMWF)



All contribute different information.

Argo is particularly important for seasonal prediction.

Balmaseda, M. A., and D. Anderson (2008) Impact on initialization strategies and observations on seasonal forecast skill. *Geophys. Res. Letters*



The Euro-Argo infrastructure



Euro-Argo : A new European research infrastructure

European contribution to a global ocean observatory

- A significant component of the global Argo array of 3.000 floats in operations
- Requires strong international and European cooperation
- Proposal : Europe establishes an infrastructure for $\frac{1}{4}$ of the global array
 - Requirement : 250 floats per year including regional enhancements (Nordic seas, Mediterranean&Black seas) (about 50 floats per year for regional enhancements)

Dual use : research and environmental monitoring (GMES)

Concept case (1)

Proven concept

The array must transition from research to sustained operational mode

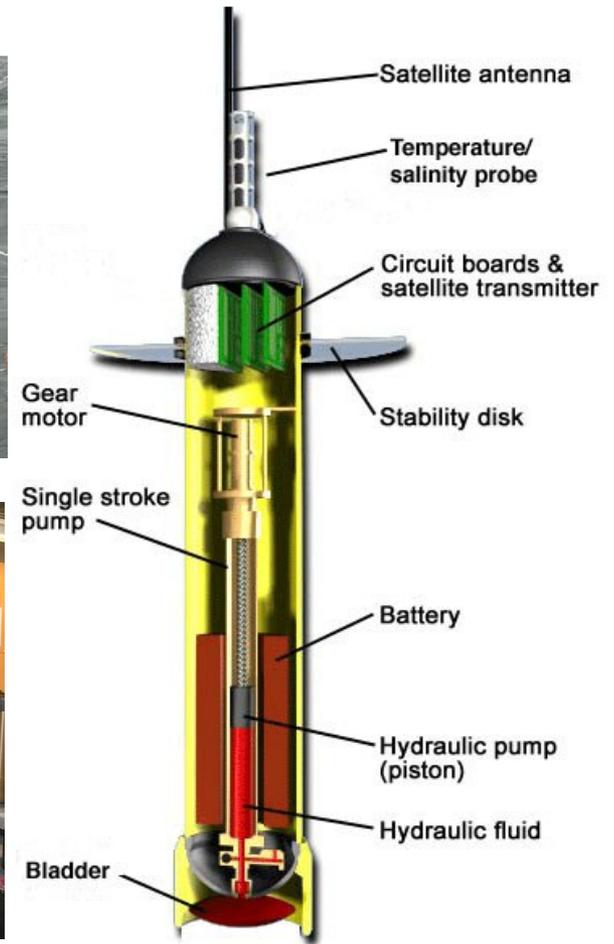
Will evolve over time

Extending core mission (e.g. under ice, marginal seas, sampling)

Evolution of instrumentation (data transmission, hardware improvements)

Towards biogeochemistry

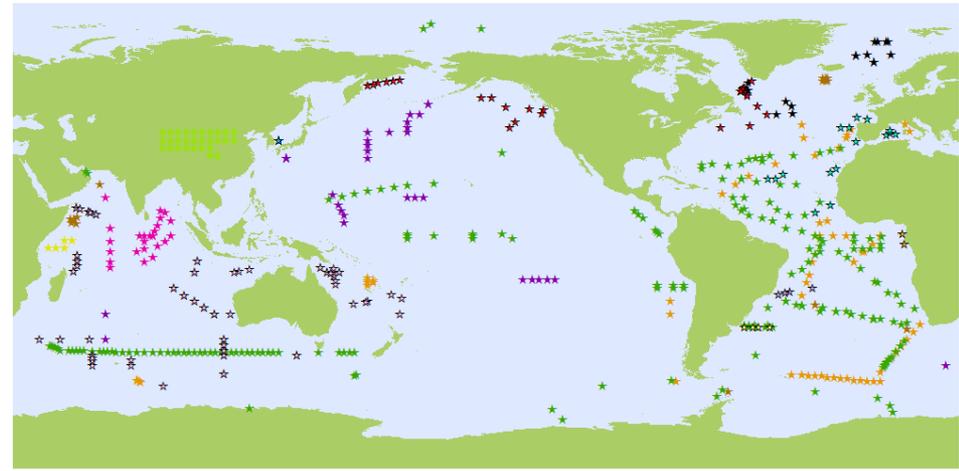
- O₂, Carbon cycle, ecosystems





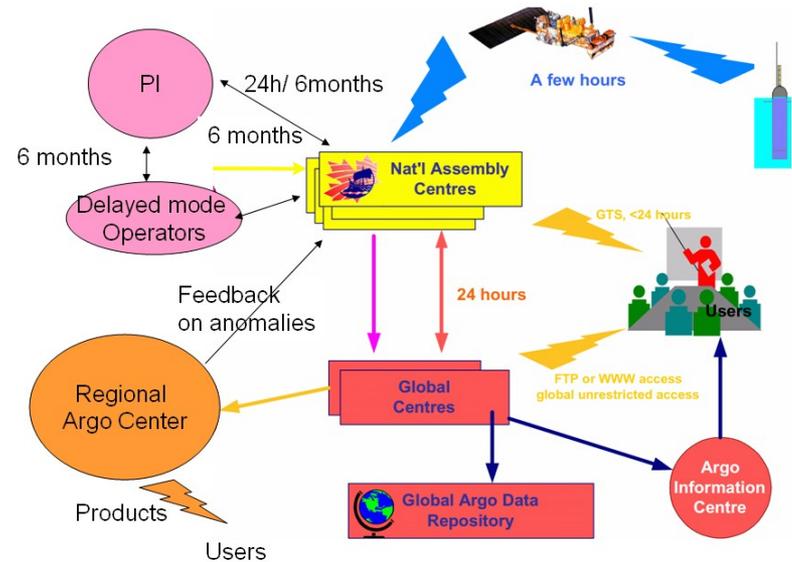
Concept case (2)

- Operations, logistics are a challenge
 - Preparing the equipment
 - Conducting operations at sea
 - Array monitoring
- Data management
 - Efficient structure in place for information management and quality control
 - Regional Data Centres (incl. UK, France), Global Data Centres (USA and France)
 - Data freely and easily accessible for science and other users



Planning (533) April 2009

★ ARGENTINA (4)	★ CANADA (26)	★ GABON (2)	★ JAPAN (33)	★ SPAIN (16)
★ AUSTRALIA (77)	★ CHINA (29)	★ GERMANY (17)	★ KENYA (5)	★ UNITED KINGDOM (17)
★ BRAZIL (4)	★ FRANCE (67)	★ INDIA (25)	★ KOREA (REPUBLIC OF) (5)	★ UNITED STATES (206)





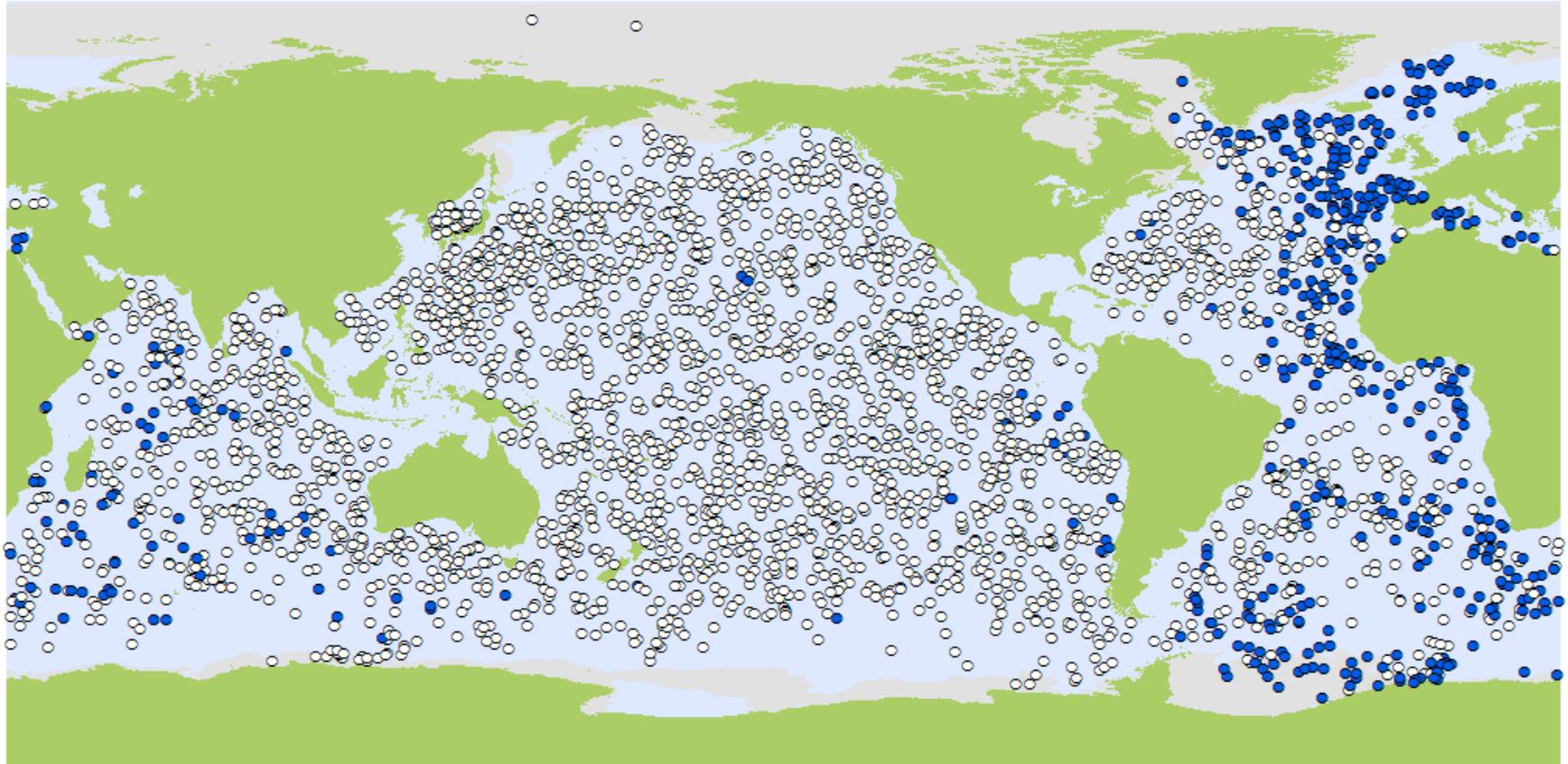
Why a European Research Infrastructure ?

- Maintenance and evolution of the system requires high level of cooperation between European partners
- Efficiency in all aspects of implementation:
 - Operations at sea
 - Array monitoring and evolution
 - Sharing expertise on all scientific/technological developments
 - Facilitate data access for research
 - Interfaces/links with the GMES Marine Core Service
 - Coordinate the European contribution to the international management of the Argo programme

A well organized European research infrastructure will be highly beneficial for GMES and will strengthen European excellence and expertise in climate research



European contribution to the global array (from Argo Information Center) (15% - January 2009)



3291 Argo Floats
501 Euro Argo

*Bulgaria - France - Germany - Greece - Ireland - Italy
Netherlands - Norway - Poland - Portugal - Spain - United Kingdom*

January 2009

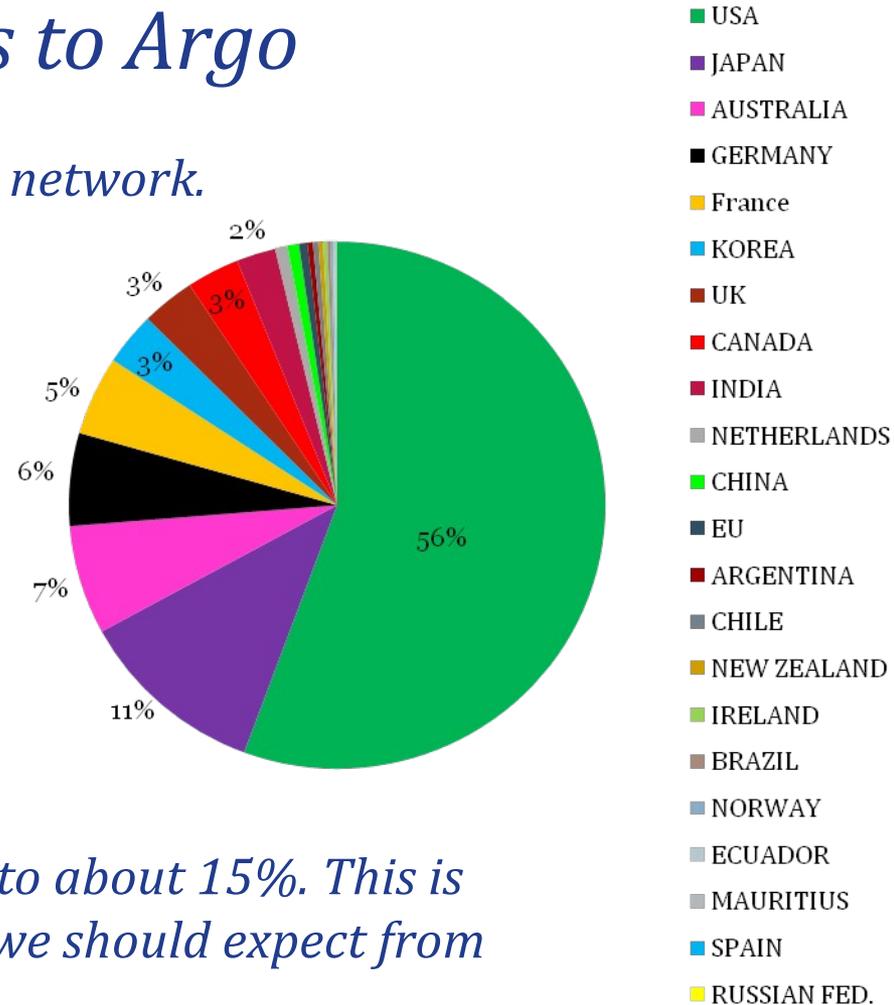


International contributions to Argo

A dozen countries are sustaining the global network.

Another dozen takes care of regional gaps.

Many others are supporting Argo.



Status as in January 2009. EU contributes to about 15%. This is well below the USA contribution and what we should expect from





Euro-Argo Preparatory Phase



Euro Argo Preparatory Phase (2008-2010)

FP7 project. New European research infrastructure (ESFRI roadmap)



Objectives :

- Undertake the work needed to ensure that by 2010 Europe will be able to:
 - Deploy, maintain and operate an array of 800 floats. This will require Europe to deploy 250 floats per annum worldwide.
 - Provide a world-class service to the research (climate) and environment monitoring (GMES) communities.

Main expected outcomes :

- Agreement for long term (10-20 years) operation of Euro-Argo (financial, governance, organisation, technical). Member States and GMES.



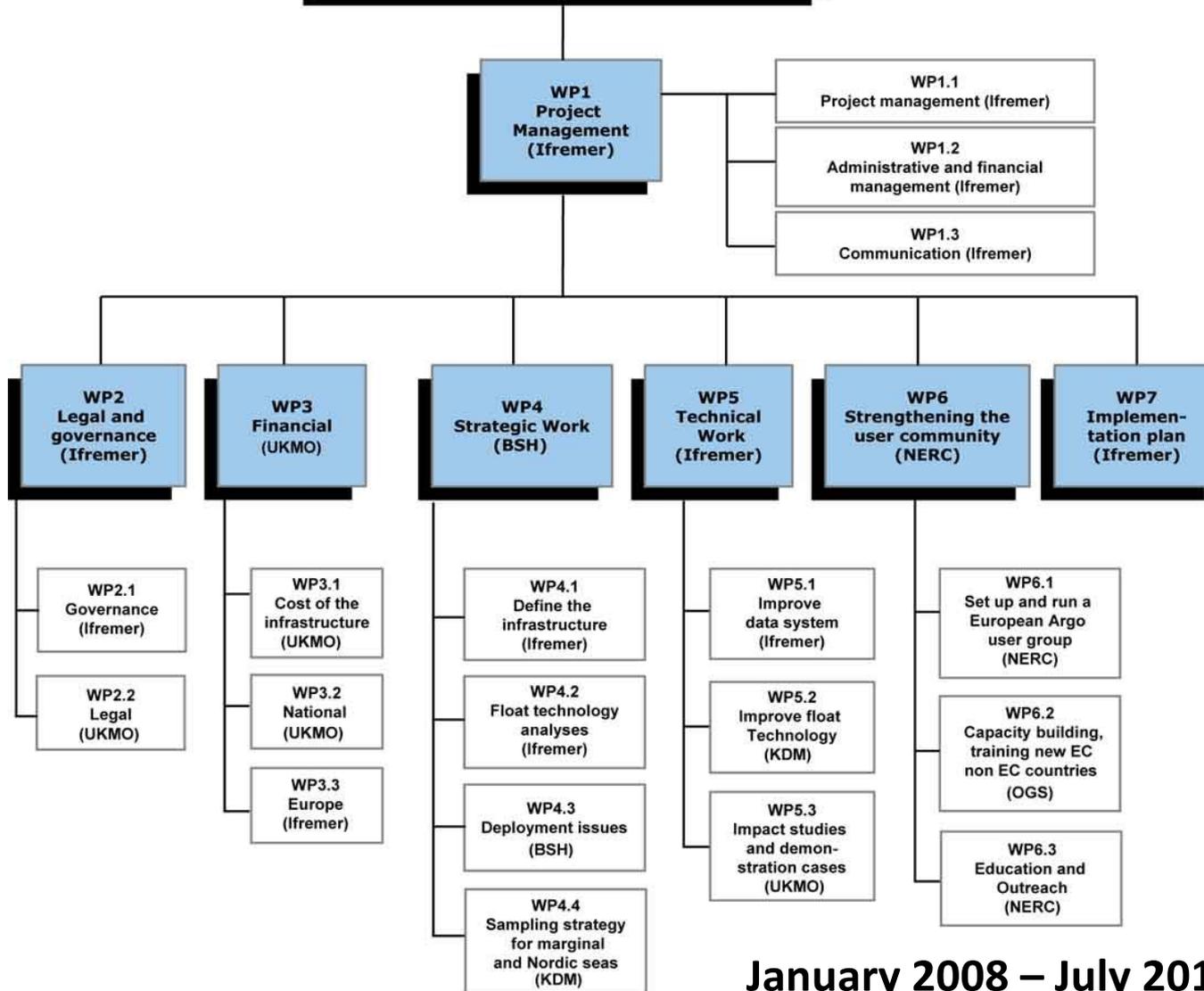
Euro Argo Preparatory Phase partnership

12 countries, 15 partners

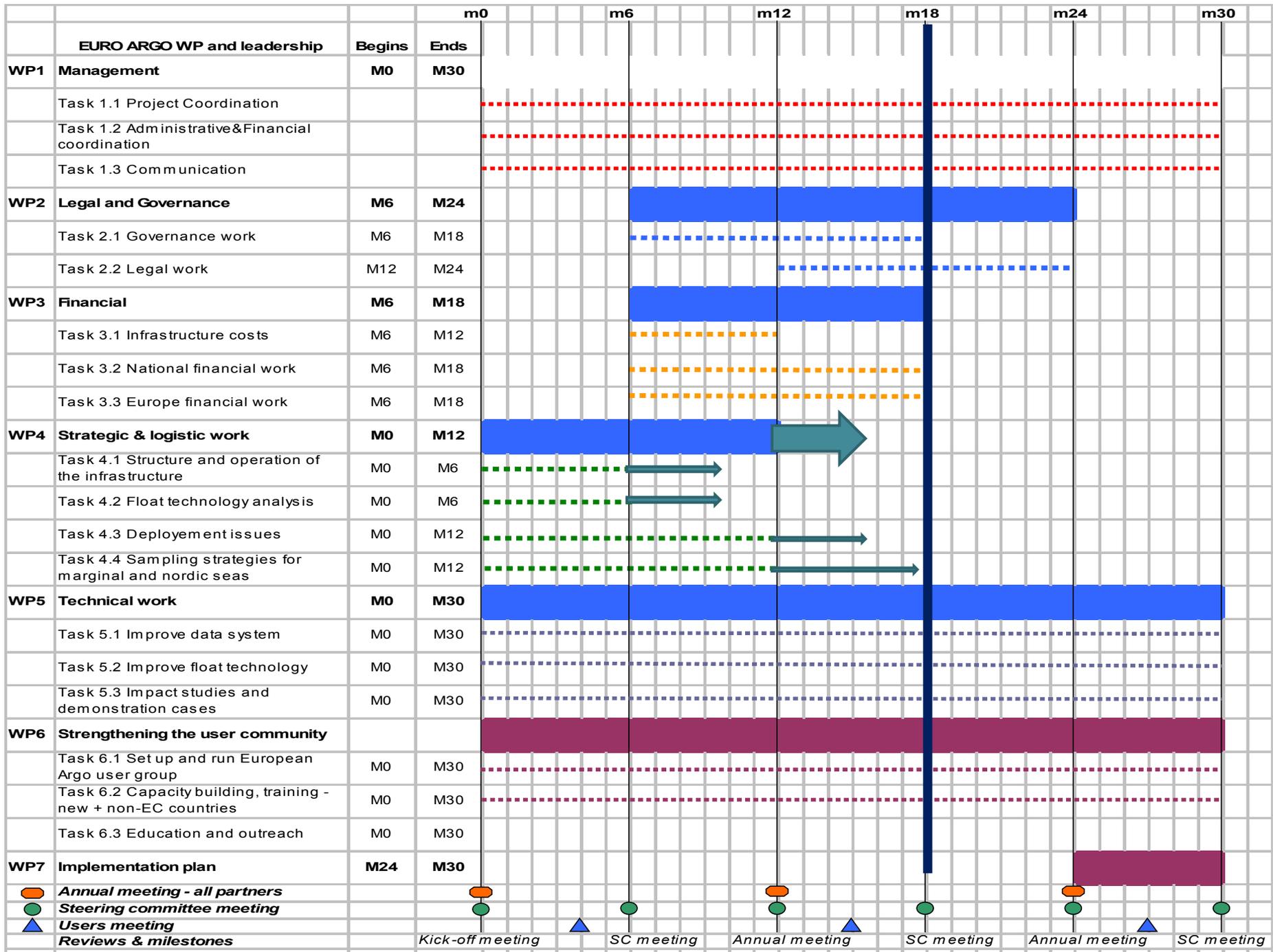
- France: IFREMER (representing the multi-agency Coriolis project) + SHOM
- Germany: BSH + Konsortium Deutsche Meeresforschung (KDM)
- UK: Met Office and NERC.
- Netherlands: KNMI
- Spain: IEO
- Italy: OGS
- Ireland: Marine Institute
- Norway: IMR
- Portugal: FCCUL
- Greece: HCMR
- Bulgaria: USOF
- Poland: IOPAS



EURO-ARGO PREPARATORY PHASE



January 2008 – July 2010





Euro-Argo progress

- Develop/consolidate long term national plans for Euro-Argo and attract new countries
- Several reports on infrastructure description, costs, float technology, deployment issues, data processing issues and improvements, impact of Argo data
- Float technology tests : Arvor-Iridium, Argos3, Sea Ice and O2 sensors
- Strengthening the user community in Europe (this meeting !)
- Links with GMES Marine Core Service – MyOcean project
- Develop long-term EC funding
- Definition and agreement on the future governance and legal structure





Long -term plan from Euro-Argo partners

- France - 60 floats. Yearly budgets but stable.
- Germany - 50 floats (5-year) - operational line + 10 research mode
- United Kingdom - 30 floats (aspiration 45 floats).
- Spain. Long term plans 5/10 floats under discussion.
- Netherlands : plans for 8 floats/years
- Greece : 2 floats in 2009/2010. Plan for 4-5 floats/year
- Italy : 3 floats in 2009. Initial plan of 30 floats/year not accepted.
- Poland : 2 floats in 2009. Plan for 2/3 floats/year
- Portugal : setting up of a consortium (proposal). Good prospects.
- Ireland, Norway : no long term commitments (yet).
- Bulgaria : 1 or 2 floats (goal) – Black Sea.
- Finland ? (expression of interest)

A target of 150 floats/y is realistic. EC funding needed to reach 250 floats/y





Funding issues

Estimation of Euro Argo cost is about 8.2 Meuros/year (250 floats+ 35 FTE/y). Based on planned Member States contributions (4-5 Meuros/year), a direct EC funding (through GMES and DG Research) of about **3.3 Meuros/year focused on activities of European relevance** will be needed (see below) from 2010.

Category	Member States	EC	TOTAL
Float procurement			
Global	1400	1400	2800
Regional	850		850
Operations			
Telecommunications	160	160	320
Personnel for management/coordination	500		500
Personnel for technical/logistic support	600		600
Misc (e.g. freighting)	50		50
Equipment and consumables	50		50
Dedicated ship time		300	300
Data management (part of GMES Marine Core Service)			
Personnel	950	950	1900
Equipment, other	50	50	100
Euro-Argo central infrastructure (CI)			
Personnel for management/coordination	200		200
Personnel for technical/logistic support		300	300
Missions (users workshops, board, council), equipment, etc	50	50	100
International infrastructure support			
Support to Argo Information Centre		40	40
Support for Argo Project Office/Director		30	30
Total without MCS	3850	2280	6140
Total with MCS	4860	3280	8140



Future organisation of Euro-Argo

Governance and legal issues



Purpose of Euro-Argo infrastructure

- Manage and supervise operation of the RI,
- Organize float procurement,
- Coordinate float deployments in the world ocean,
- Monitor array performance and operations,
- Decide on evolutions (array design, technology, data systems),
- Facilitate access to users, develop new data sets and products
- Interfaces with users and user requirements (research, GMES)
- Link with, and integrate into, international structure.



Organisation of the Euro-Argo RI

The RI will comprise :

- ❑ A central facility (Central RI)
- ❑ Distributed national facilities (as of today but with coordination via the C-RI)
- ❑ Floats will be procured through the C-RI and through national facilities

The Central RI (4-5 people) – Need a legal entity

Plays the coordination role and participates actively in the programme :

- ✓ Float procurement, deployments
- ✓ Expertise on all aspects of the programme

It hosts the

- ✓ Programme Manager
- ✓ the RI Office
- ✓ Logistics coordinator and facilities : technical support, storage, testing, shipping, etc





Governance

- ❑ A Council (high level)
 - ✓ Establishes the infrastructure and takes major strategic decisions
- ❑ A Management Board
 - ✓ Supervises operation of the infrastructure; decisions on implementation of annual work plan
- ❑ Programme Manager
 - ✓ Executes, organizes, coordinates, manages day to day operations
 - ✓ Representation to other international bodies
 - ✓ The Programme Office
- ❑ Scientific and Technical Advisory Group
 - ✓ Advises, recommends to the PM and to the MB.
- ❑ Users Group : forum for all users of the EuroArgo -RI



Legal entity for the C-RI

Some key requirements have been identified: the entity must be able to:

- ✓ receive and manage funds from members, grants, ..
- ✓ purchase floats
- ✓ provide funding for the Argo Information Centre, ship time, data processing, etc ..
- ✓ hire staff
- ✓ host scientists
- ✓ invest in property (equipment)
- ✓ own intellectual property rights
- ✓ retain liability for claims and losses

Large range of options analyzed (european, national). ERI is the preferred choice (new european legal framework for RI)





EURO ARGO PP in 2008/2009

- Kick Off 14/15 January, Ifremer, Brest
- First European Argo User Group meeting (June, 2008 Southampton)
- National discussions (ministerial level)
- Define infrastructure and overall cost (almost done)
- Interactions with GMES bureau (2 meetings)
- Interactions with ESFRI (update of roadmap published in 2008)
- Meetings and conferences (Eurogoos, GMES forum, GODAE, ESFRI)
- Legal and organization structure (to be decided mid 2009)
- Links with international structure (Argo, Jcomm)
- First annual meeting (Hamburg) (20-22 January)
- Joint discussion with GMES, DG Research and DG Mare (April 24, 2009)
- Second European Argo User Group meeting (Trieste, June 15-18, 2009)
- *Decision on legal and governance structure (October 2009)*
- *Decision/commitments on long term funding (EC, Member States) (end of 2009).*

[see http://www.euro-argo.eu/](http://www.euro-argo.eu/)

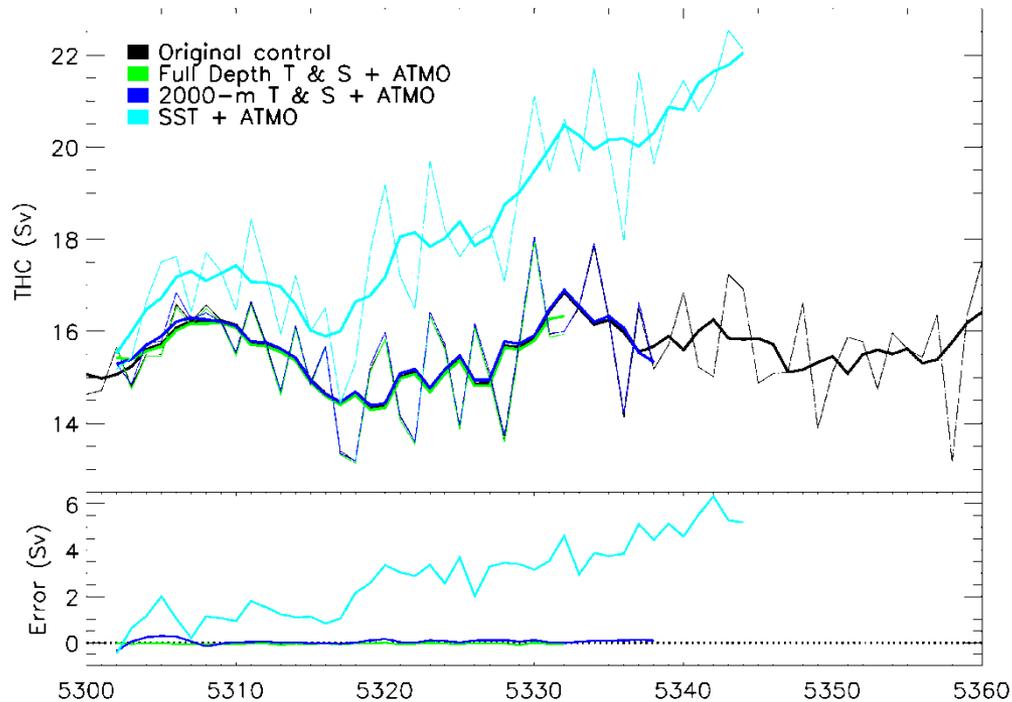


The role of Euro-Argo user group

- Need to set up a strong European user group to:
 - Advise on the evolution of the infrastructure (data&products, QC, sampling, new sensors, etc)
 - Develop the use of Argo in Europe (research, climate, GMES)
 - Promote and disseminate results on Argo achievements
- Critical to sustain Euro-Argo
- Need your feedback/ideas on the best way to organize a Euro-Argo user group on the longer run



Using Argo data to initialise decadal climate prediction models (Hadley Centre, UK)



A set of idealised experiments designed to test the potential skill of decadal forecasts when initialised with 2000-m Argo T & S data. Preliminary results are presented.

- When predicting the variability in the MOC, assimilating 2000-m data compares favourably with full-depth assimilation over 15 year forecasts



Towards a long term Euro-Argo Research Infrastructure (RI)

- Objectives of the RI
 - Better, more efficient coordination and cooperation
 - Significant increase of European Argo contribution
 - Secure sound funding base (national and EC)
 - Interfaces with GMES Marine Core Service
 - Improve the links with the international structure
- A central facility (Central RI) & Distributed national facilities
- Gouvernance model defined (council, board, scientific and technical AG, user group).
 - Coordination of European contribution to Argo (floats procured at national and through a central facility). All aspects of the programme.
- Need a legal structure for the central RI
 - To receive EC and national (member states) funding
 - To procure floats (includes logitics and test facilities).
 - To provide funding to the international structure
- The centralized structure
 - 2 to 4-5 people funded by Euro-Argo members and by the EC

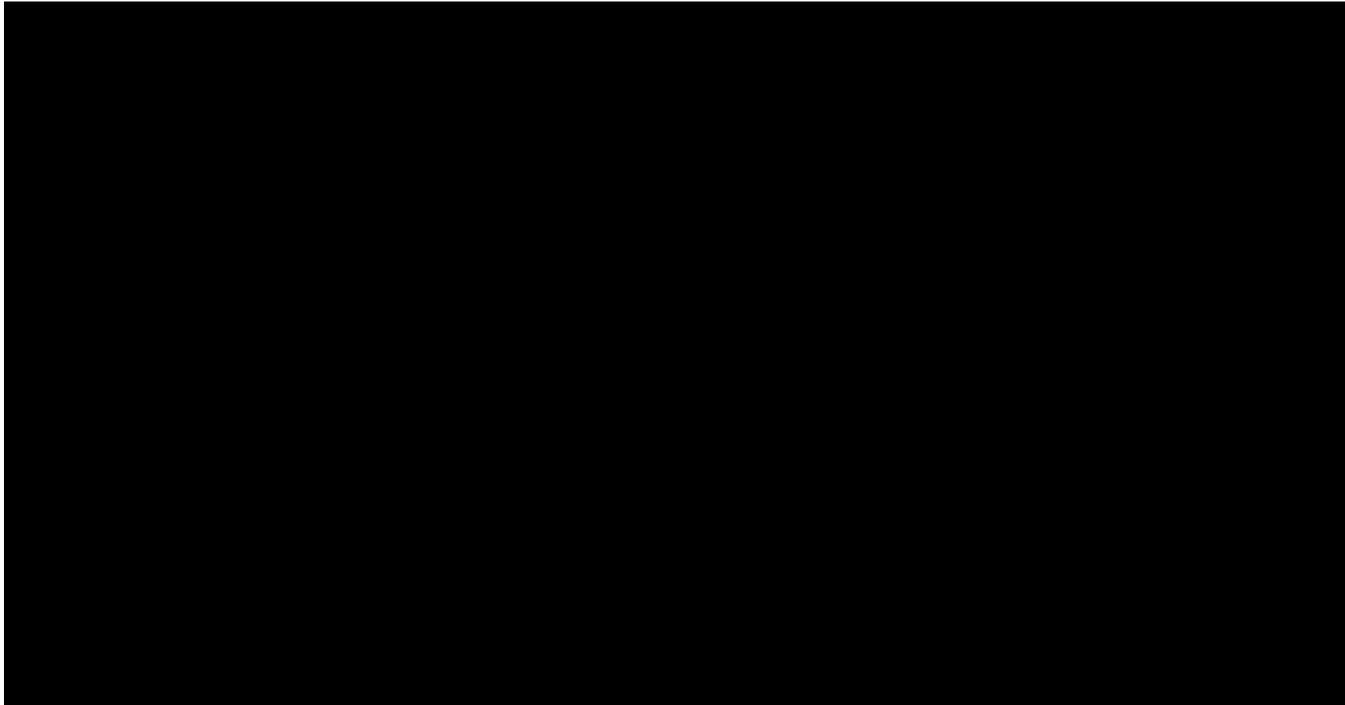


Socio-economic impact

- Climate change: a major challenge and concern
- Improved weather (incl extreme events), seasonal and decadal forecasts
- GMES : Marine Core Services, in support of
 - Environment monitoring, coastal systems, marine safety, maritime operations: offshore, shipping, fisheries and fishery management
- Support to policy and reporting
 - EEA, ICES, conventions (UNFCCC, OSPAR, UNEP/MAP)
 - Marine Strategy Directive
- Public interest in global environment, education, informed citizen
- Industry: instruments, sensors, downstream services



Deployed European floats (from Argo Information Center)



Not at the required or expected (e.g. GNP) level

Use the PP to consolidate national long-term plans

New EU countries needed. Need a direct EC contribution



Euro-Argo refined estimation of costs/year (detailed in Euro-Argo deliverables)

Category	Unit cost (k€)	Number	Cost (k€)
Float procurement			
Global (assumes standard Argo float)	14	200	2800
Regional (assumes enhanced floats)	17	50	850
Operations			
Telecommunications	0.4	800	320
Personnel () for management/coordination	100	5	500
Personnel () for technical/logistic support	100	6	600
Misc (e.g. freighting)	0.2	250	50
Equipment and consumables			50
Dedicated ship time			300
Data management			
Personnel ()	100	19	1900
Equipment, other			100
Euro-Argo central infrastructure (CI)			
Personnel () for management/coordination	100	2	200
Personnel () for technical/logistic support	100	3	300
Missions (users workshops, board, council), equipment, etc.			100
International infrastructure support			
Support to Argo Information Centre			40
Support for Argo Project Office/Director			30
Total			8140

****Includes extra staff for processing, operation and coordination***