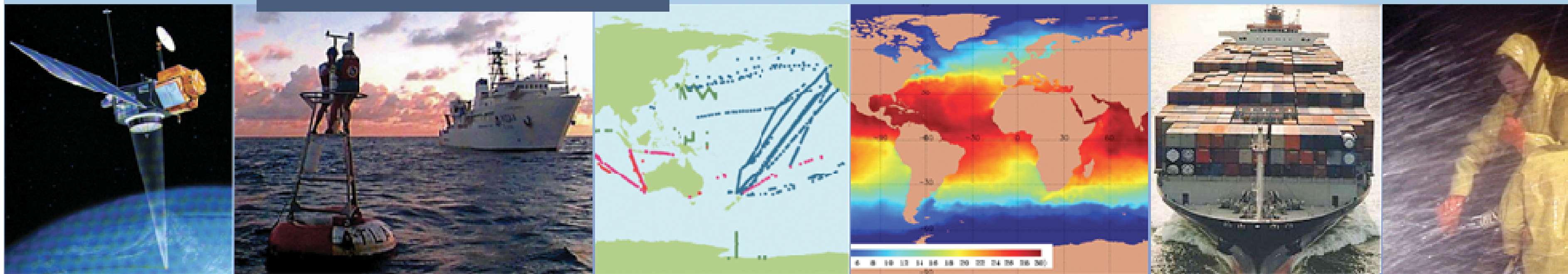
GOOS

IODE

jcomm
OCEANOGRAPHY & MARINE METEOROLOGY




Keith Alverson

Ocean Observations and Services

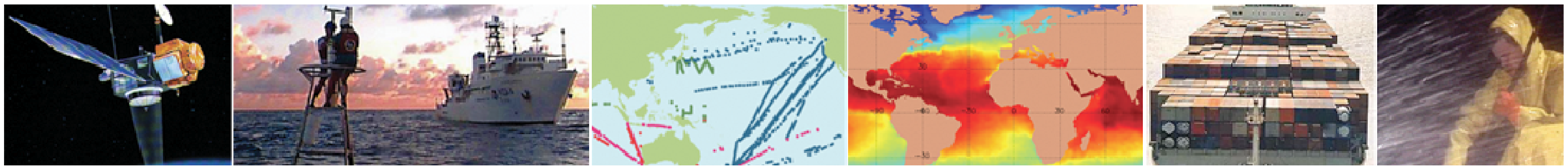
Intergovernmental Oceanographic Commission of UNESCO


IOC / UNESCO WMO UNEP ICSU

# Major Accomplishments 2005-2010: Global Ocean Climate Observations

- The ocean observing system for climate is 60% complete.
- Reporting to UNFCCC ensures high visibility and national engagement.
- Understanding of global climate change – particularly detection and attribution - has been substantially enhanced.
- Development of a Global Framework for Climate Services is being enabled.

EUROPE: is **directly** affected by regional impacts of global climate variability and change and **indirectly** affected through socio-economic impacts such as human migration, calls for adaptation funding, etc.

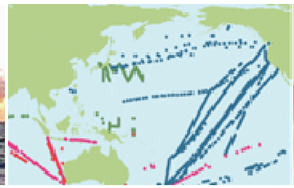
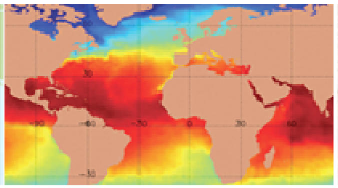


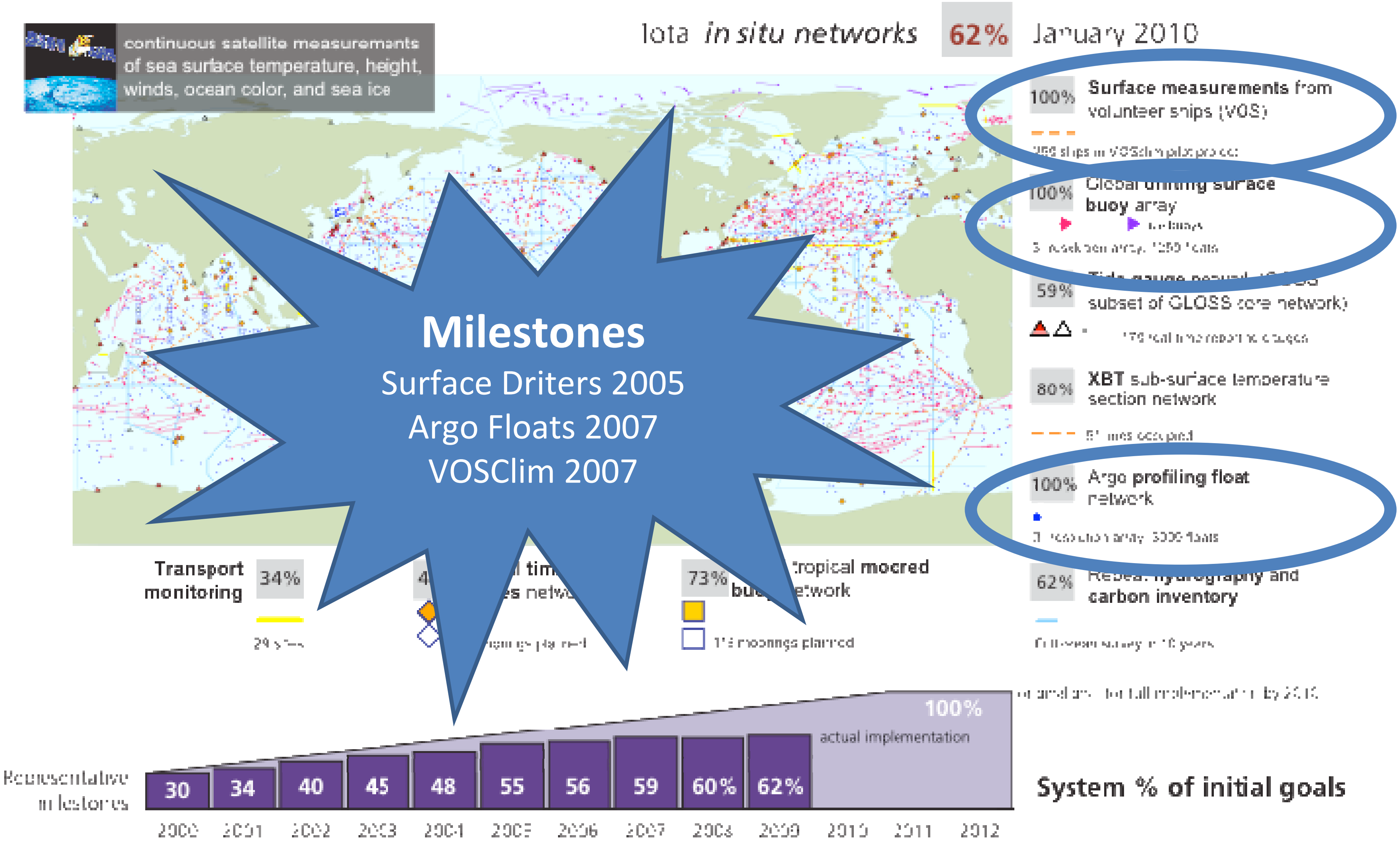
# Major Accomplishments 2005-2010:
# Regional Observations for Societal Benefit

- Relevant regional components of the GOOS are increasingly available in real time, enabling coastal hazard warnings and mitigation (eg. oil spills, storm surges, tsunami, cholera …).
- Seasonal products derived from ocean observations are also starting to become possible (eg ENSO, Monsoon, drought, flooding and fire regime forecasts).
- Quotidian services are being delivered (eg. Shipping and Port traffic optimization, offshore wind and drilling operations supported …)

EUROPE: provides a stellar example of a strong and effective GOOS regional alliance (I-OOS in the US and IMOS in Australia are single-nation systems).





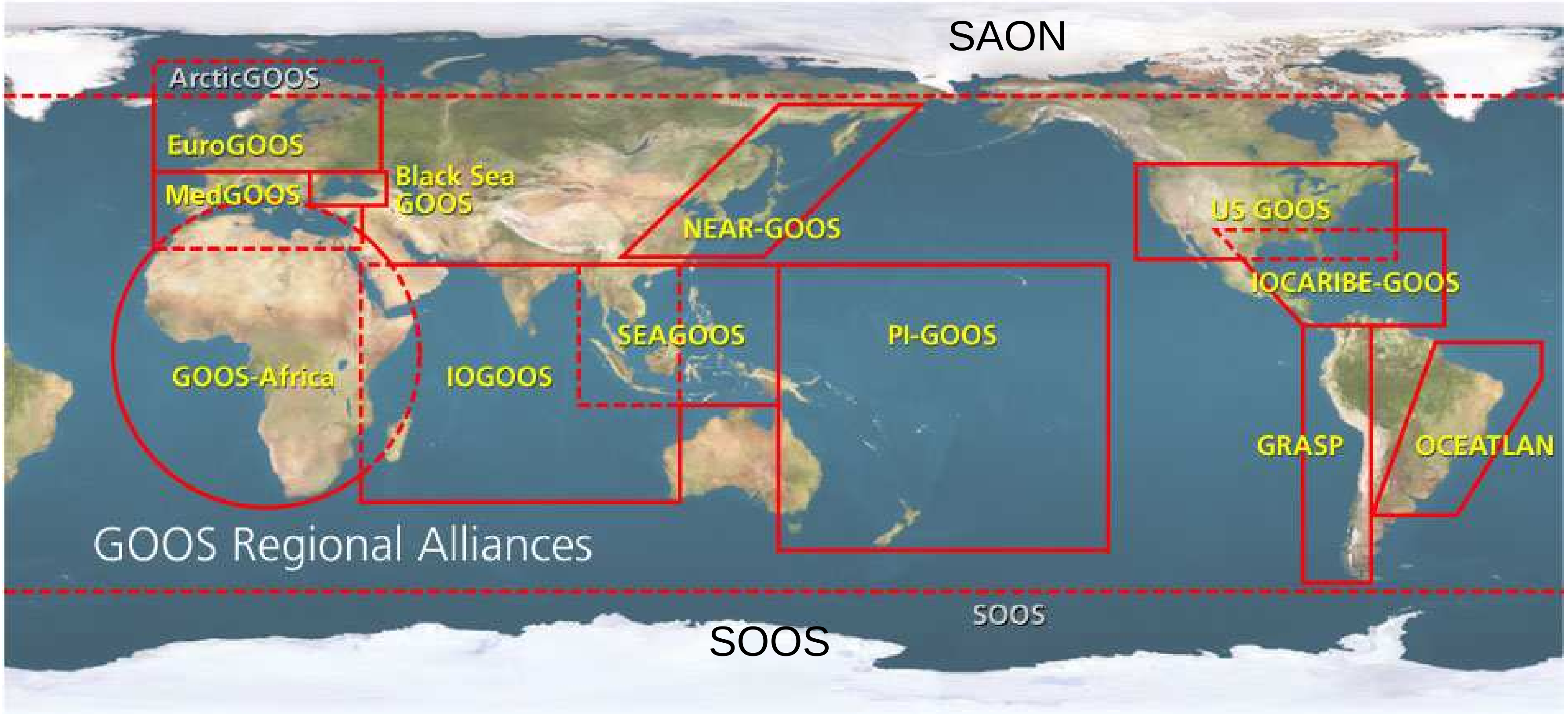

IOC / UNESCO

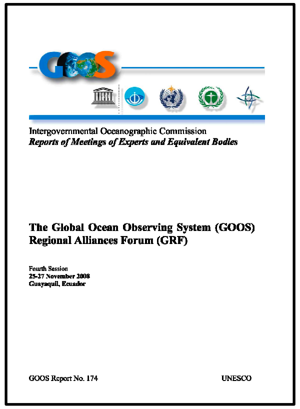
WMO

UNEP

ICSU

# Implementing Coastal and Regional GOOS





GOOS

Intergovernmental Oceanographic Commission
*Reports of Meetings of Experts and Equivalent Bodies*

**The Global Ocean Observing System (GOOS) Regional Alliances Forum (GRF)**

Fourth Session
25-27 November 2008
Guayaquil, Ecuador

GOOS Report No. 174 UNESCO

**1st GOOS Regional Forum, Athens, Greece, 2002**

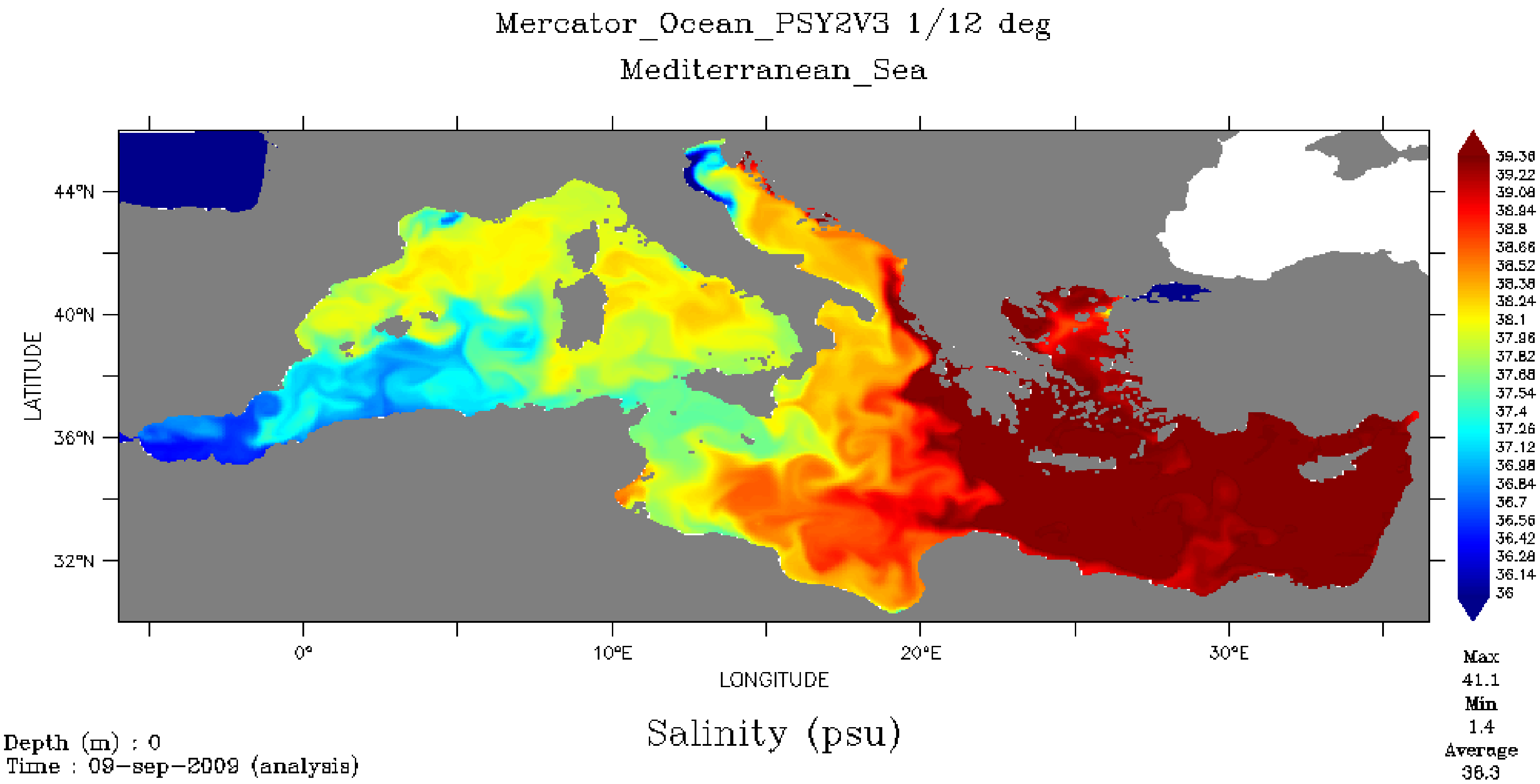
2nd GRA Forum, Nadi, Fiji, 2004

3rd GRA Forum, Cape Town, S. Africa, 2006

4th GRA Forum, Guayaquil, Ecuador, 2008

**5th GRA Forum and 1st Regional Council, Sopot,**

# Regional Products




Near real time ocean conditions (t, s, and currents) are now freely available on the web, and widely used. These products depend on data streams from the observing system (eg. www.mercator-ocean.fr)

IMOS Integrated Marine Observing System

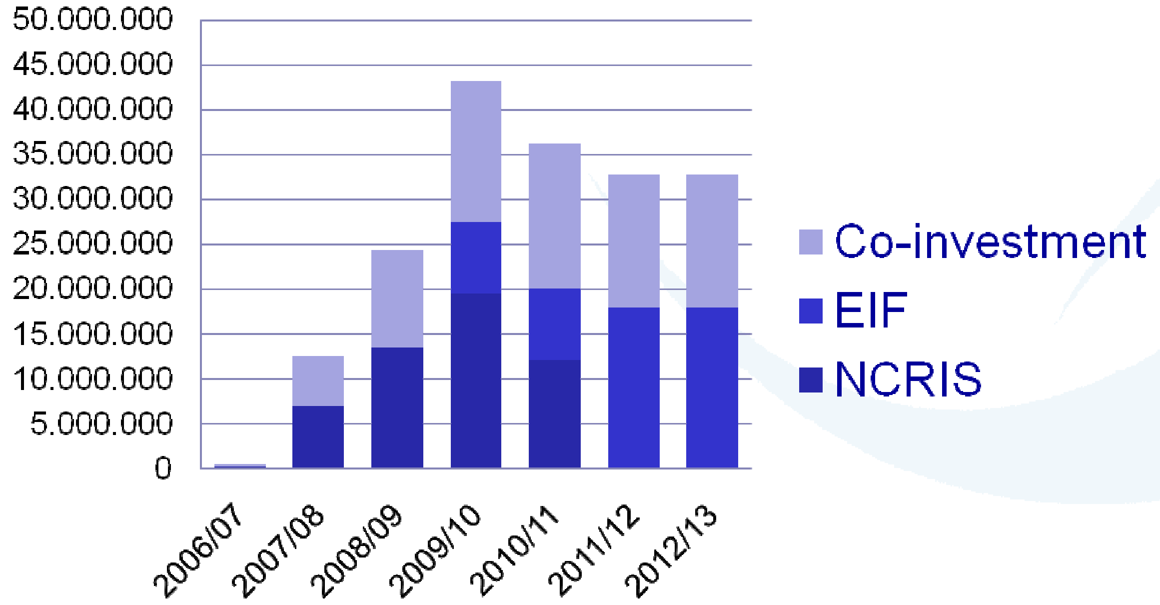
# An Example of a National System:

The Australian
Integrated Marine Observing System
(www.imos.org.au)

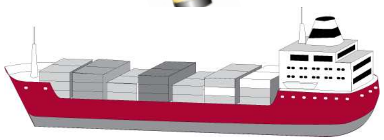
Thanks:
Nick D’Adamo, Director, IOC Perth Regional Office (N.D'Adamo@bom.gov.au)
Katy Hill, IMOS Scientific Officer (Katy.Hill@imos.org.au)

# The bottom line

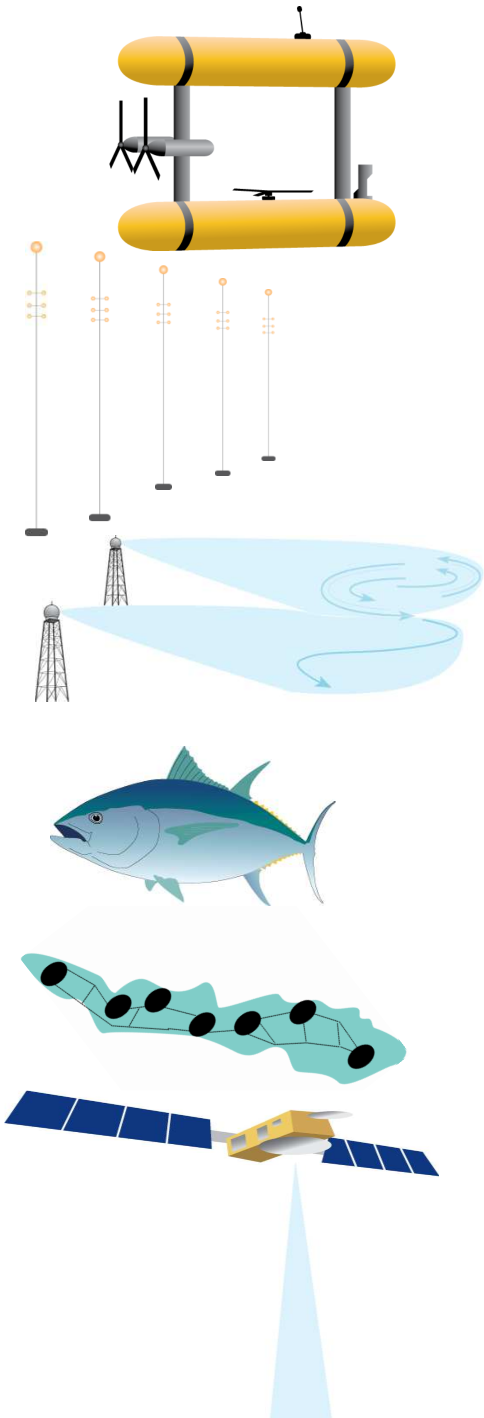
- Core funding from the Australian Government
  - $102M over ~six years ($50M ‘NCRIS’ and $52M ‘EIF’)
- Co-investment by Partners
  - Operators, other Australian Govt. Programs, State Govt’s
  - ~$78M cash and in-kind (40+%)
- Ramp up to 2009-10, then levelling out at ~$35M pa



# IMOS Facilities (there are 11)

1. Argo Floats
   – autonomous profiling floats
2. Ships of Opportunity
   – repeat underway observing on volunteer ships
   – physical, chemical and biological observations
3. Deepwater Moorings
   – existing: Southern Ocean Time Series ($47^0$S)
   – planned: Antarctic Coast (Adelie), Indonesian Through Flow, East Australian Current ($26^0$S)
4. Ocean Gliders
   – coastal and open ocean

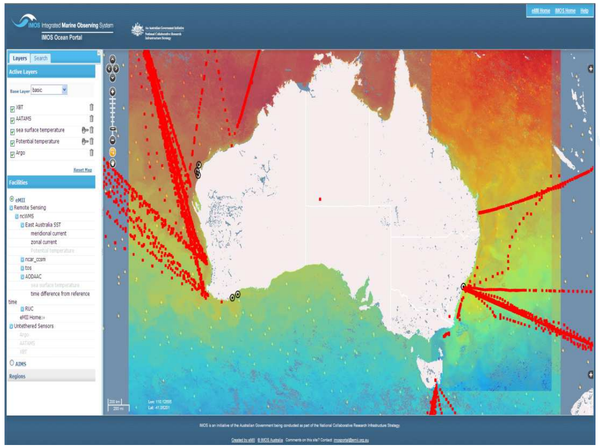


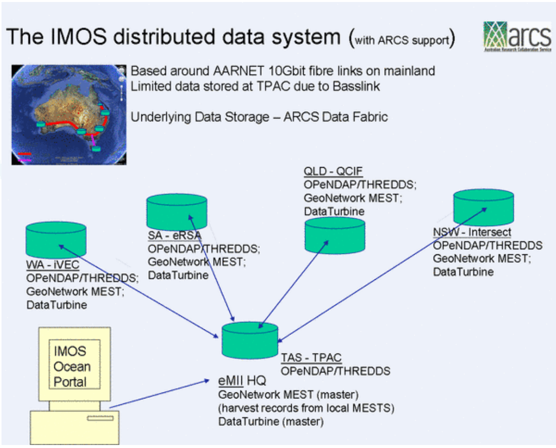
5. Autonomous Underwater Vehicle
    - benthic surveys
6. National Moorings Network
    - National Reference Stations (nine)
    - shelf moorings and arrays
7. Coastal Radar Network
    - phased array and direction finding
8. Tagging Marine Creatures
    - Acoustic curtains and satellite tags
9. Sensor Networks
    - southern Great Barrier Reef
10. Satellite Remote Sensing
    - SST, altimetry (planned), and ocean colour

IMOS

# 11. electronic Marine Information Infrastructure (eMII)

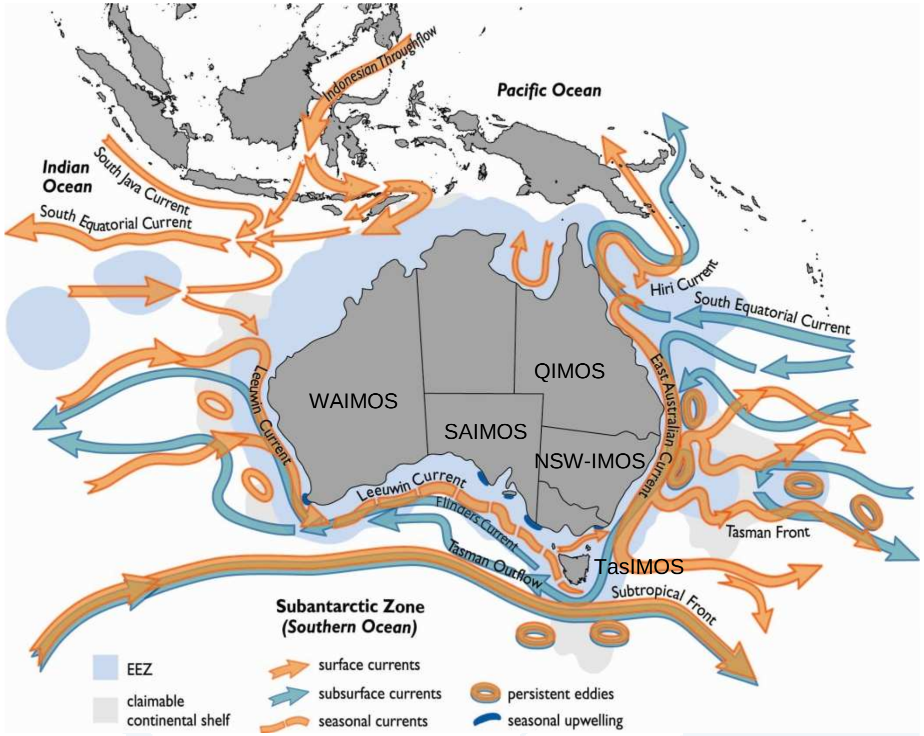
- Facility responsible for creating and developing the information infrastructure
  - to make all data discoverable and accessible
  - via the IMOS Ocean Portal http://imos.aodn.org.au/webportal/
- ~10% of core funding invested in this activity
- Opportunity to use this infrastructure to create a larger Australian Ocean Data Network (AODN)
  - providing access to IMOS and non-IMOS data
    - ‘*publicly-funded data, publicly available*’



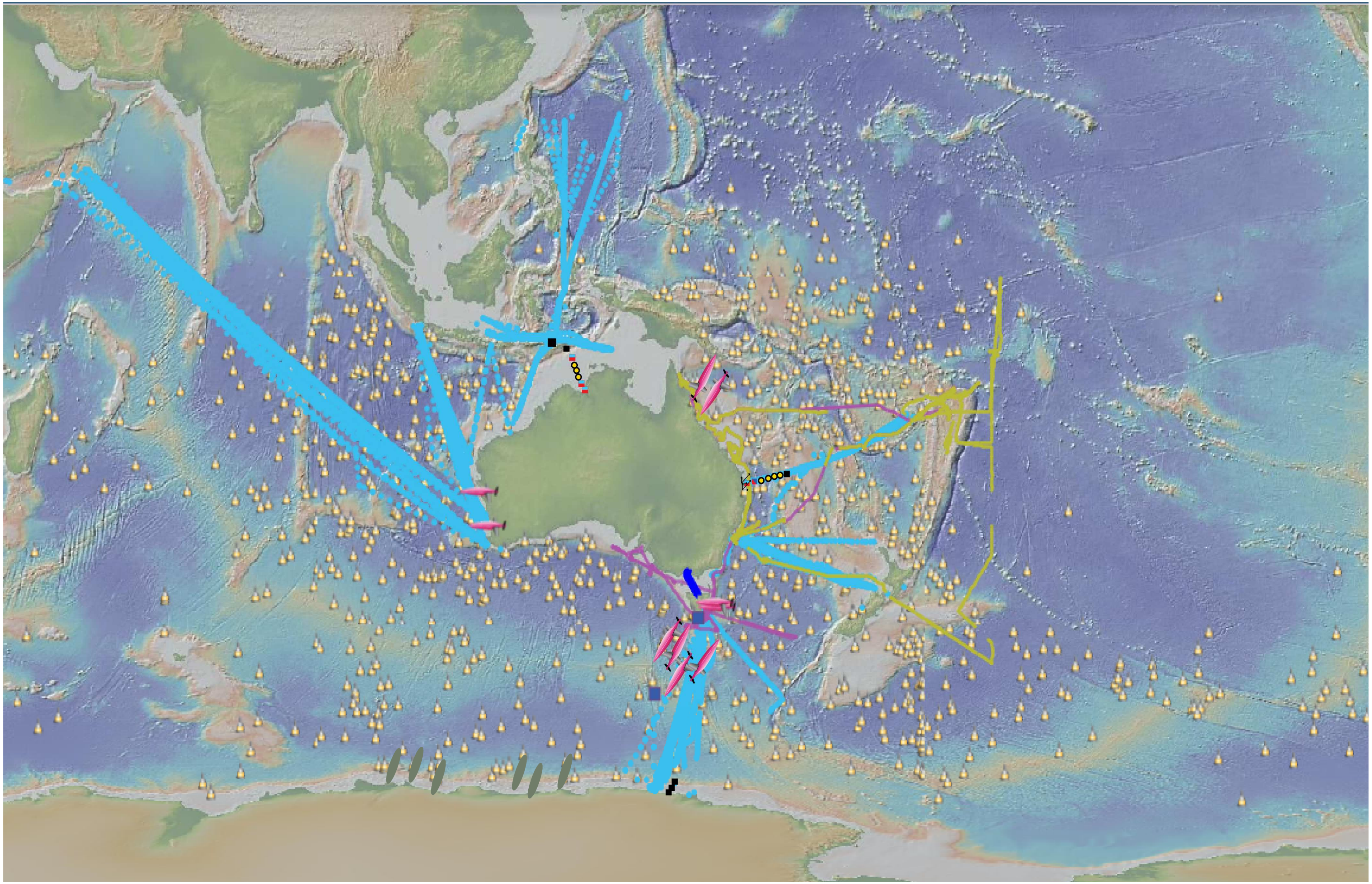


# Six IMOS Nodes

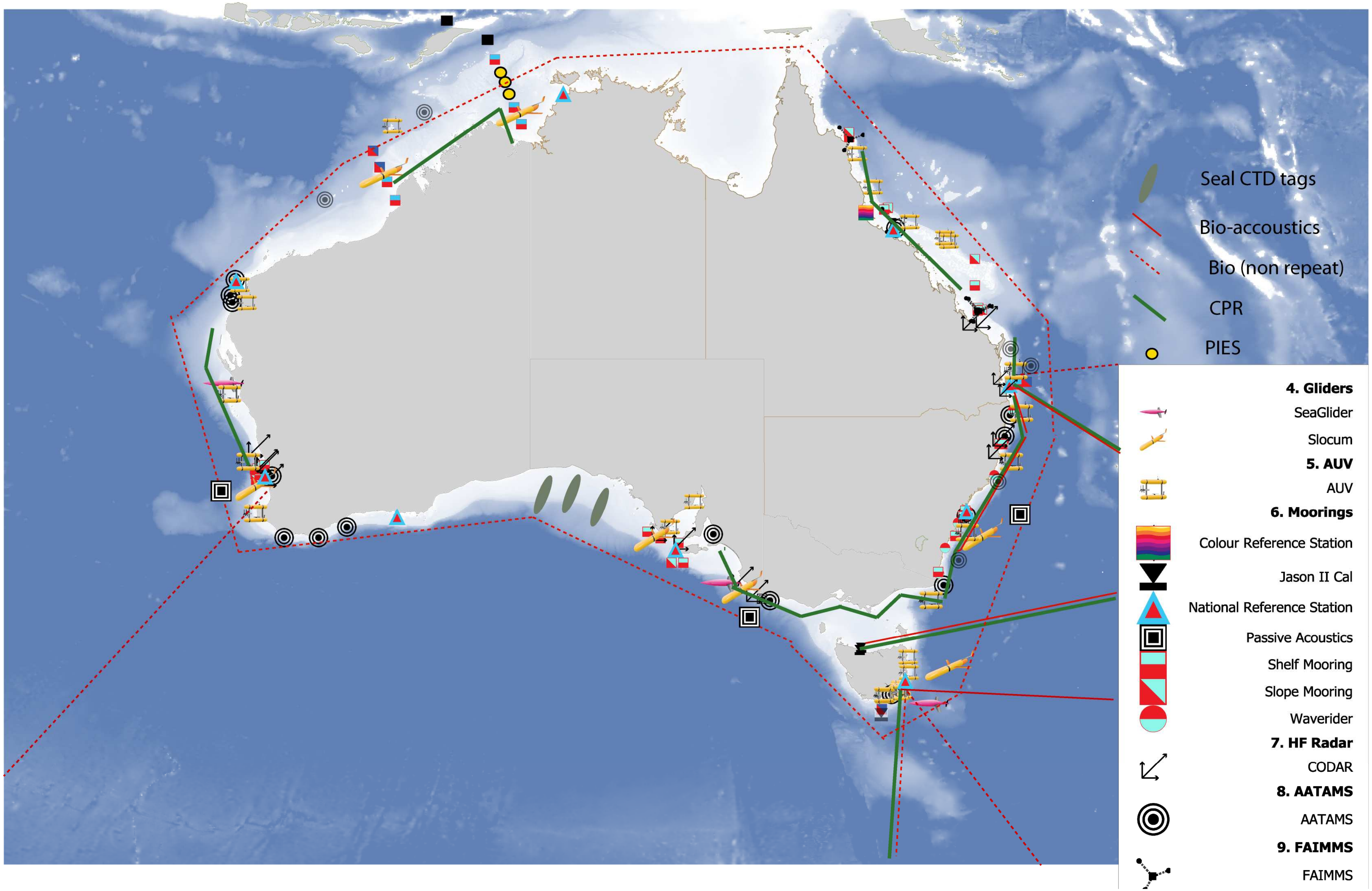
- ***Bluewater and Climate*** Node
  - open ocean focus
- Five Regional Nodes
  - continental shelf
    and coastal focus
    - ***Western Australia***
    - ***Queensland***
    - ***New South Wales***
    - ***Southern Australia***
    - ***Tasmania (planned)***



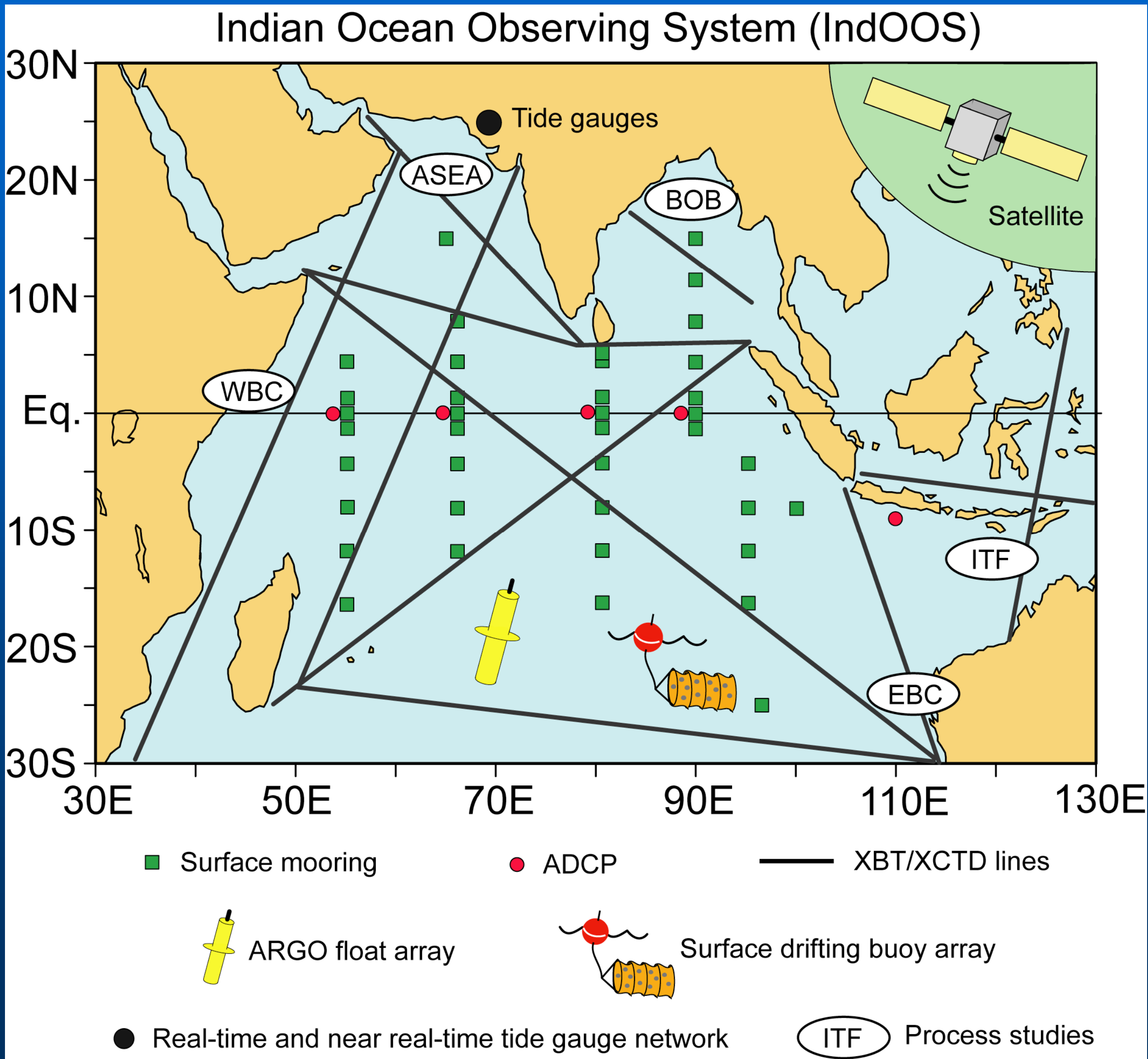
# IMOS – Bluewater Observations



# IMOS – Shelf Observations



# IMOS contributes to regional systems such as the Indian Ocean Observing System (IndOOS)



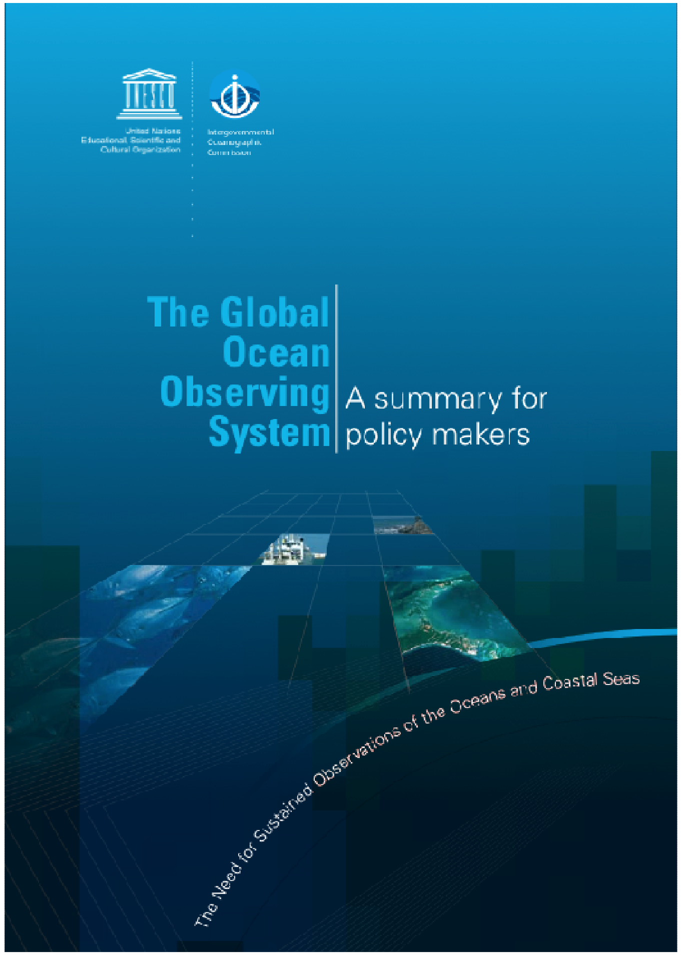
# Sustaining the GOOS

The Marine Economic Sector comprises approximately 5% of Global GDP (2.7 Trillion Dollars).

At present, investment in the observing system underpinning this economic sector is approximately $1 billion/year, of which about $500,000/year is for global coordination.

The estimated required investment for adequately sustaining the system, as designed, is $2 billion/year of which $2 million/year is for global coordination

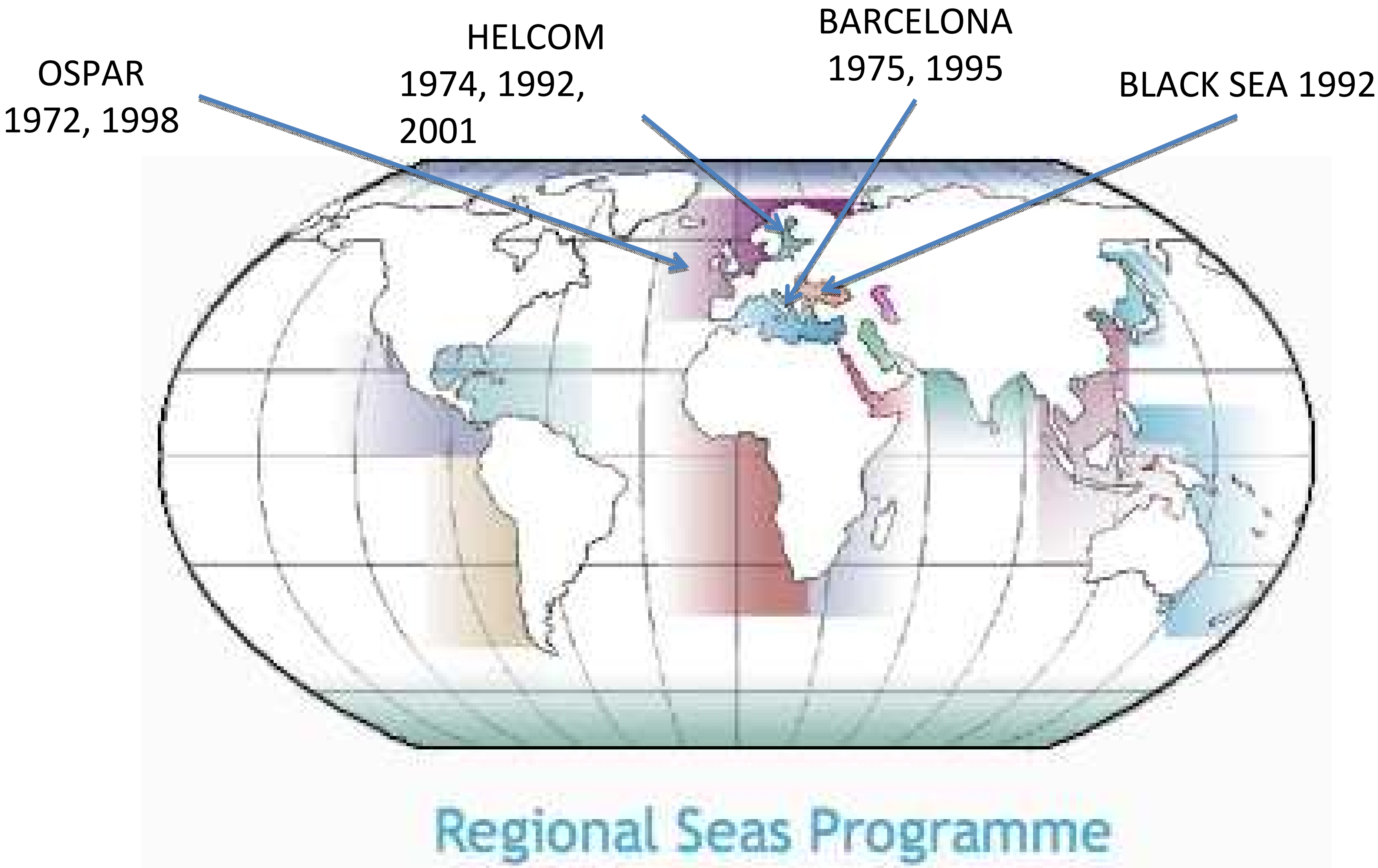
***The glass is about ½ full…***



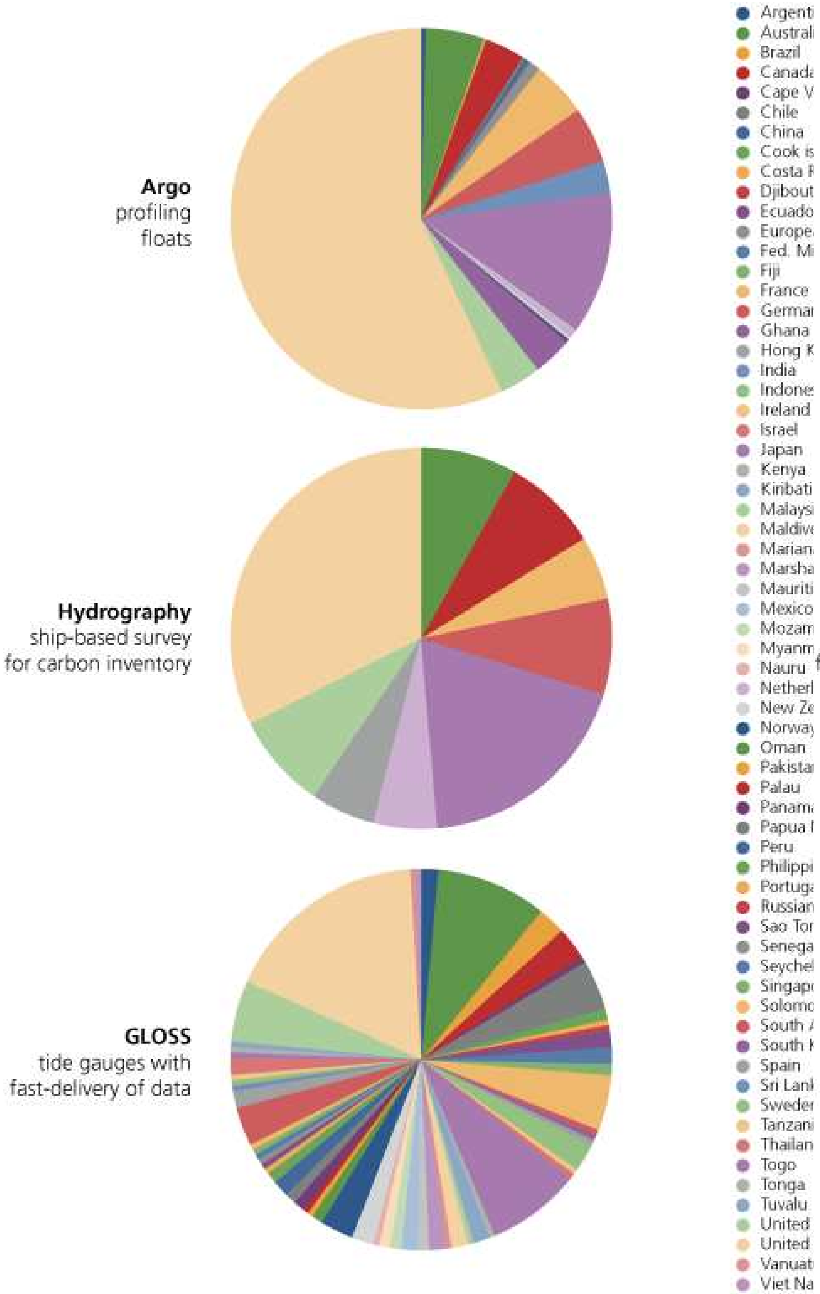

GOOS Summary for Policy Makers, “Cost and Benefits of coordinated ocean observations” 10-12, 2009

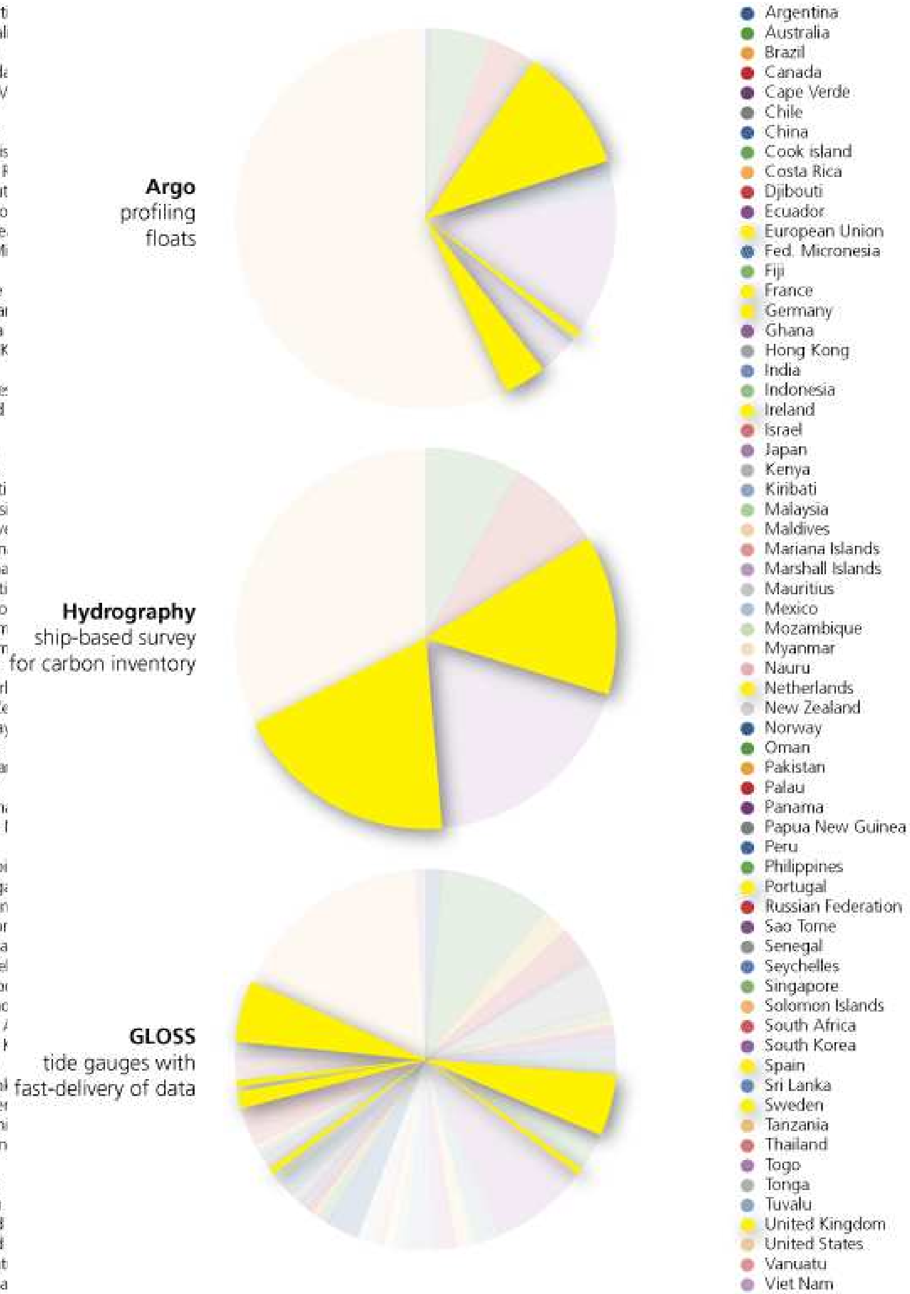
# Regional Seas Conventions

Can they play an analogous role for *regional GOOS* to the one that the UNFCCC has played in developing the global climate module of GOOS?

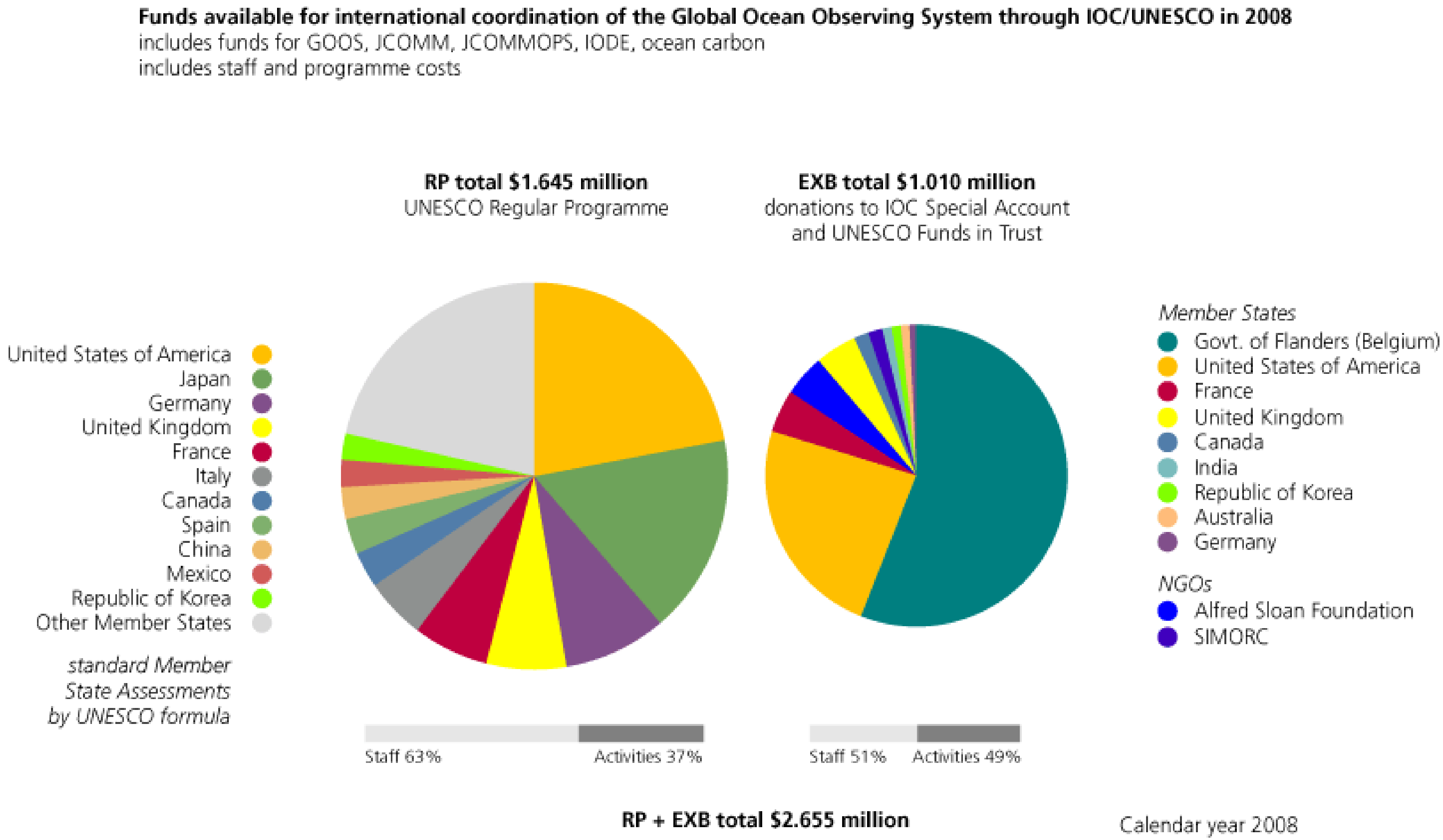


# European Contributions to the Global System



# European Contributions to Global Coordination




GOOS Summary for Policy Makers, "Cost and Benefits of coordinated ocean observations"12, 2009

# Sustaining the system

Governmental engagement and willingness to commit resources for both implementation and coordination remains weak.

Demonstrating clear societal benefits to catalyze 'user pull' requires better **advocacy**

The observing system – especially the coastal module – needs redesigning to serve adaptation needs.

EDITORIAL

Keith Alverson is director of the Global Ocean Observing System and head of Ocean Observations and Services at the IOC of UNESCO, 1 rue Miollis, 75732 Paris, Cedex 15, France. E-mail: k.alverson@unesco.org.

D. James Baker is a former undersecretary for Oceans and Atmosphere and administrator of the National Oceanic and Atmospheric Administration and is currently a consultant at the IOC of UNESCO. E-mail: djamesbaker@comcast.net

## Taking the Pulse of the Oceans

UNDERSTANDING HUMAN IMPACT ON THE GLOBAL ENVIRONMENT REQUIRES ACCURATE AND integrated observations of all of its interconnected systems. Increasingly complex models, running on ever more powerful computers, are being used to elucidate dynamic links among the atmosphere, ocean, earth, cryosphere, and biosphere. But the real requirement for integrated Earth system science is a systematic, sustained record of observations, starting from as early as we can get quantitative information and extending reliably into the future. In particular, the ocean is critically undersampled both in space and time, and national and intergovernmental observational commitments are essential for progress.

Ocean basins cover most of the planet and are filled with circulating turbulent fluid whose behavior can be modeled only by approximation. For instance, we talk of a "conveyor belt," but this is an unrealistic cartoon of actual turbulent circulation, which by transporting heat and fresh water affects the planet's climate. Knowledge about the true variability of the circulation remains elusive because long-term systematic observations are lacking.

Any seafarer knows that although one can look up from the deck of a ship and see the Moon clearly through 100 km of atmosphere, one cannot look down and see further than 1 m. Because the ocean is opaque to all wavelengths of electromagnetic radiation, Earth-observing satellites can't see below the surface either. Thus, much of the ocean must be observed from a patchwork of drifting and moored buoys, neutrally buoyant floats, coastal installations, and ship-based measurements.

Great recent progress has been made with each of these individual observing-system components. The launch of the 1250th drifting surface buoy in Halifax Harbor last year completed a network that is vital for tropical storm track prediction. The rapidly expanding international network of Argo floats has rewritten our knowledge of the temperature and salinity of the upper oceans. Moored buoy arrays in the tropics have made seasonal climate and El Niño prediction a real possibility. With tide gauges reporting in real time, not only can we predict coastal inundation hazards, but we can also disentangle the myriad processes involved in changing global sea level. Although observing the ocean is challenging, in particular cases it can be done well.

For 15 years, a global ocean-observing system under the auspices of the Intergovernmental Oceanographic Commission (IOC) of the United Nations' Educational, Scientific, and Cultural Organization (UNESCO) has been meeting important needs of global society. However, surprisingly little progress has been made toward a truly global system with long-term funding commitments. Lacking such a system and commitments, critical scientific hypotheses will remain untested.

The IOC is now working with the Global Earth Observation System of Systems (GEOSS) to identify national focal points for ocean observation efforts and to integrate these efforts into a truly global system. Unfortunately, there is still no plan for sustaining individual measurement programs, for integrating them into a coherent observing system, or for supporting them with stable funding. With a few notable exceptions, substantial multilateral government support for coordination and integration remains elusive.

To address this flaw, we propose the development of a UNESCO convention that commits nations to sustaining an integrated ocean-observing system that will lead to better understanding of the ocean and at the same time enable the provision of hazard warnings, monitoring of climate change, and management of marine and coastal resources. UNESCO's IOC stands ready to broker the development of such a convention. Preliminary discussions, including completion of the initial GEOSS tasks in ocean observation, begin at the next meeting of the Intergovernmental Committee for the Global Ocean Observing System in June 2007 in Paris. Will your nation be at the table?

– **Keith Alverson and D. James Baker**

10.1126/science.1135358







Alverson and Baker, *Science*, 2006

# A **multi-user, multi purpose** system delivering societal benefits beyond climate

commentary

Will we be ready for the next one? Storm-surge waves, such as this one from Hurricane I


## Watching over the w

A quick technological fix is not the best response to the December tsunami.

**Keith Alverson**

In the mid-nineteenth century, the HMS Beagle docked in Conception, Chile, giving

years is likely to be falling apart by the time it is called to use.

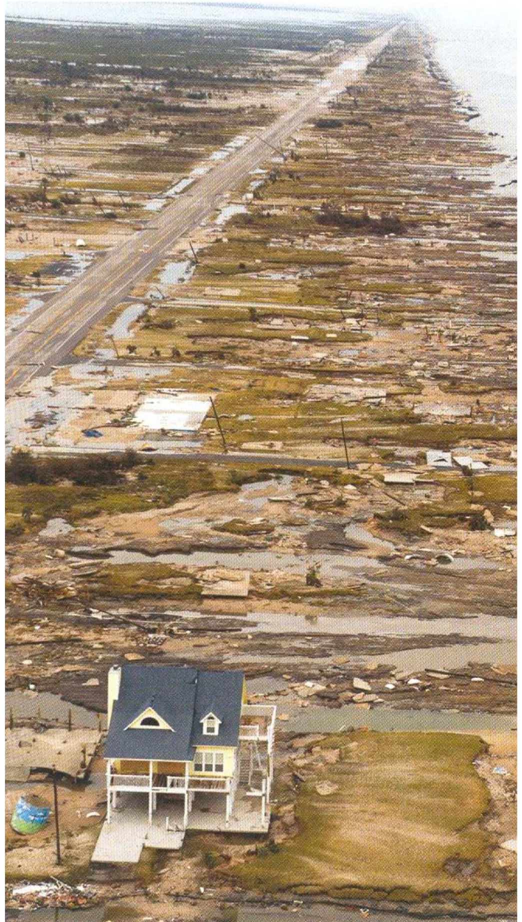
This is not a wholly pessimistic view —

the same rapidity as tsunamis, but occur much more frequently. For unprepared and unwarned populations, they can be equally

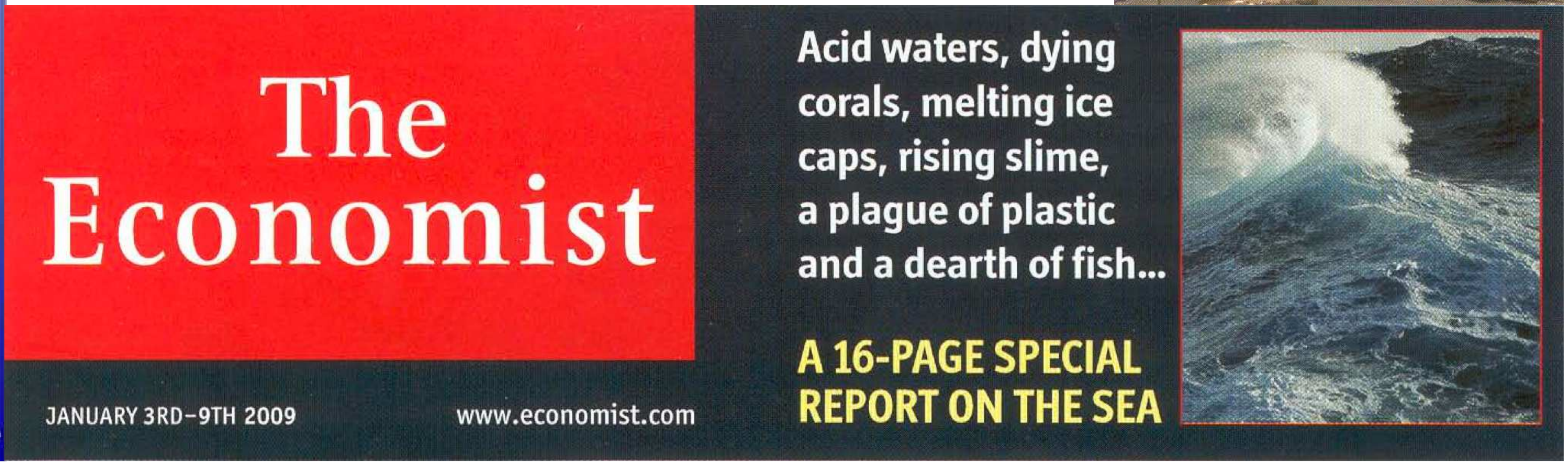
Alverson, *Nature*, 2005 The Economist, May 21, 2009

# Advocacy and Outreach depends on high profile public interest stories

- 2004 Indian Ocean Tsunami
- Storm Surges (Katrina 2005 in New Orleans, Nargis 2008 in Myanmar…)
- Global Climate (Sealevel, ENSO, etc)
- Toxic Algal Blooms
- Pacific Garbage Gyres
- Ocean Acidification
- Fisheries Collapses – (Tunafish 2010)
- Opening of the Arctic to development



not to mention …




IOC UNESCO

# Bridge the research-operational divide

"A comprehensive ocean observing system simply cannot exist without the full engagement of the oceanographic research community"

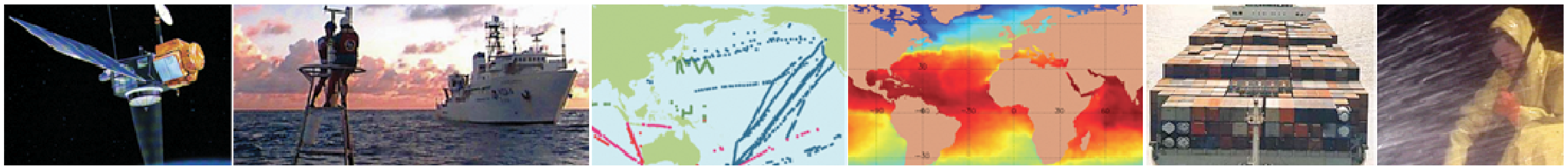
- improve deployment opportunities for autonomous platforms (eg. Argo, drifters)
- facilitate data availability, archiving
- Ensure high quality 'research' data contributes to the sustained data flow of GOOS


Alverson, IOC Annual Report, 38-39, 2005

# Major Challenges 2010-2015:
# Global Ocean Climate Module

Europe and its Member States have built strong national and regional infrastructures and services. But, just as oceans and climate change know no political boundaries, Europe must also play an leading role at the international level by actively supporting global efforts.

- European Member States, and the European Commission, should support increase their support for the global ocean climate observing system.
- The European Commission has strongly supported satellite observations (eg through GMES). Because the oceans are opaque satellite data can only scratch the surface of the ocean. Engagement by the commission in sustaining the in-situ oceanographic observing system for climate is a top priority.

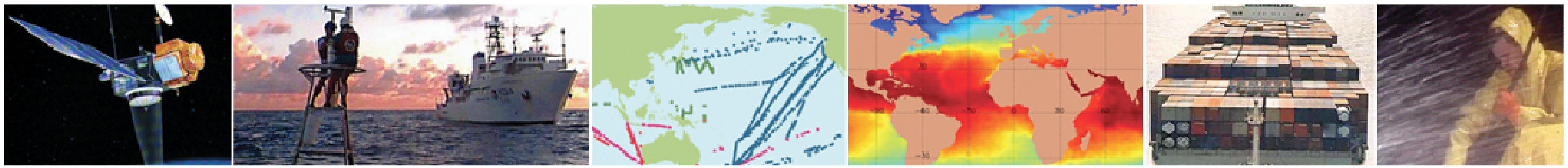


IOC
UNESCO

# Major Challenges 2010-2015:
# European Regional Observing System

GOOS' contribution, through its global climate module, to detection and attribution of anthropogenic impacts on global climate has been a substantial assistance to governments. A major challenge for the future comes with recognizing that adaptation to climate change occurs on a regional level and requires regional observing systems. There is an urgent imperative to ensure that GOOS can provide relevant, timely and useful data that will be required to underpin the development of the global framework for climate services that is being developed in the context of adaptation and mitigation.

- Europe lead by example. Show a regional alliance can work.
- Europe must provide leadership to the global council of regional alliances, thereby facilitating sharing of best practices, adoption of common standards, etc…



GOOS
IOC
WMO
UNEP
ICSU
glynnAgorick.co.uk
GLOBAL OCEAN OBSERVING SYSTEM
www.ioc-goos.org
The oceans are the basis of the life support system. GOOS measures ocean warming and provides an opportunity for the human system to respond.