NOAA Climate Observations Division

Bob Weller – Climate Observing System Council (COSC)

David Legler – NOAA, Division Lead

Outline

- Introduction/Overview of the Climate Observations Division
- Status of the efforts, successes
- The context for and constraints on sustained ocean observing
- Challenges/Opportunities during sustained operation and during evolution
- Asking for CWG input and assistance

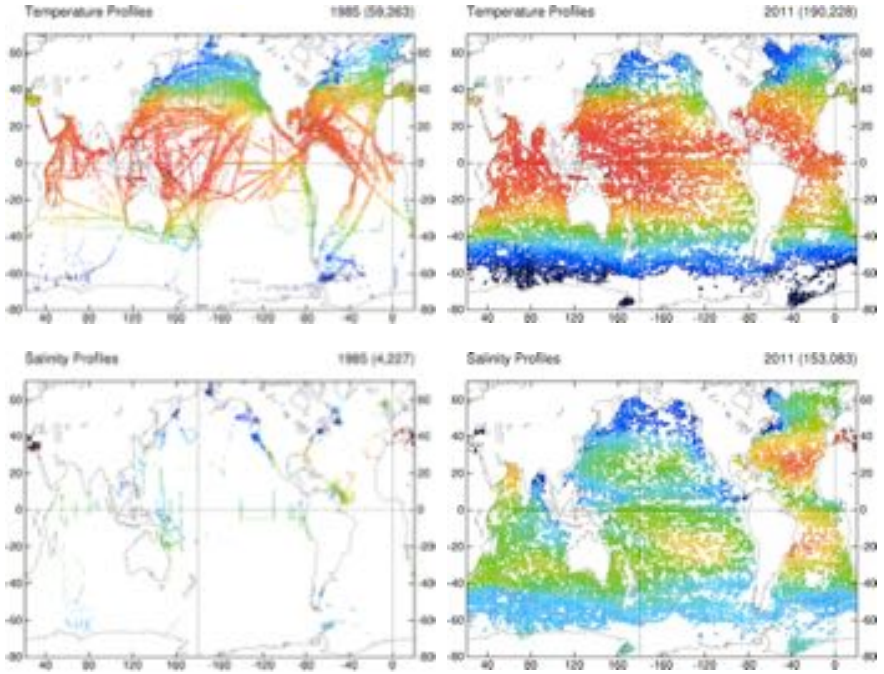
Overview

- Climate Observation Division
  - The majority of the investment is in ocean observations
  - COD appreciates the support of the CPO in prioritizing observation funding in FY12
  - COD has gone forward within its portfolio honoring that approach, working to sustain the observing efforts

Overview

- Climate Observation Division
  - Tide Gauge Stations
  - Argo Profiling Floats
  - Drifting Buoys
  - Tropical Moored Buoys
  - Ships of Opportunity
  - Ocean Reference Stations
  - Ocean Carbon Networks
  - Arctic Observing System
  - Dedicated Ship Time
  - System Integration and Monitoring
  - CLS Argos Data Processing
  - Data Assimilation and Ocean Analysis
  - Institutional Infrastructure
  - CPO Sea Level Initiative

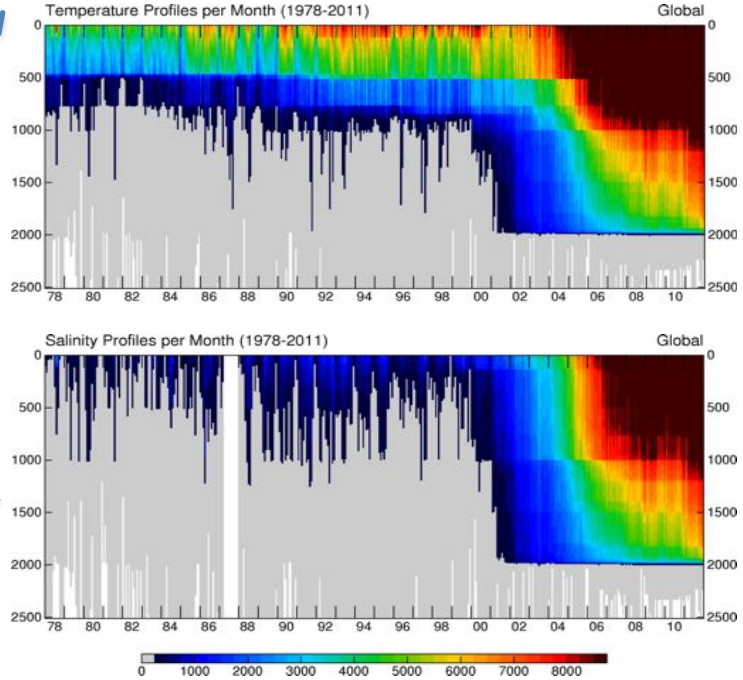
Successes – establishing global coverage



1985 2011

Temperature

Vertical Distribution of Global Profile Observations per Month 1978-2011



Salinity

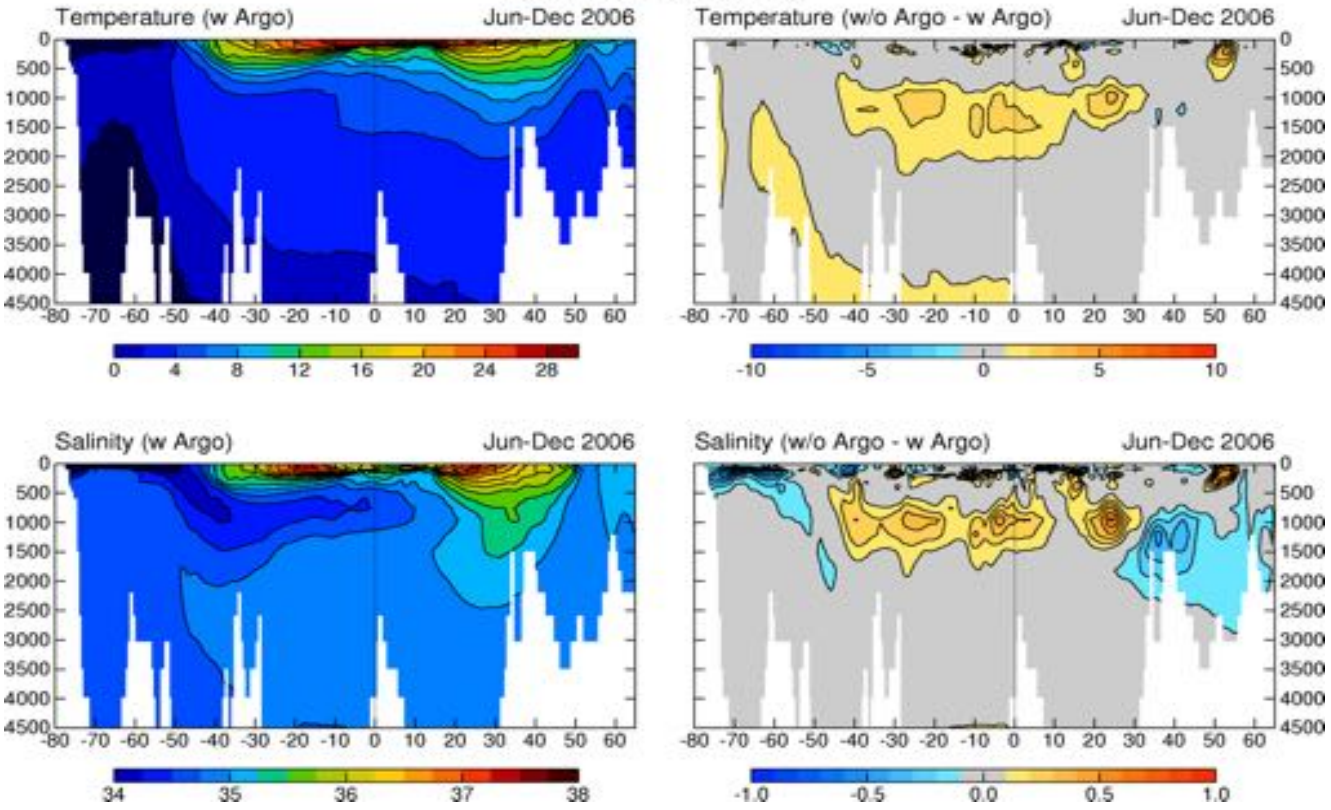
Behringer NOAA/NCEP

Successes- impacts of improved coverage

Atlantic 30°W Section Jun-Dec 2006

Temperature

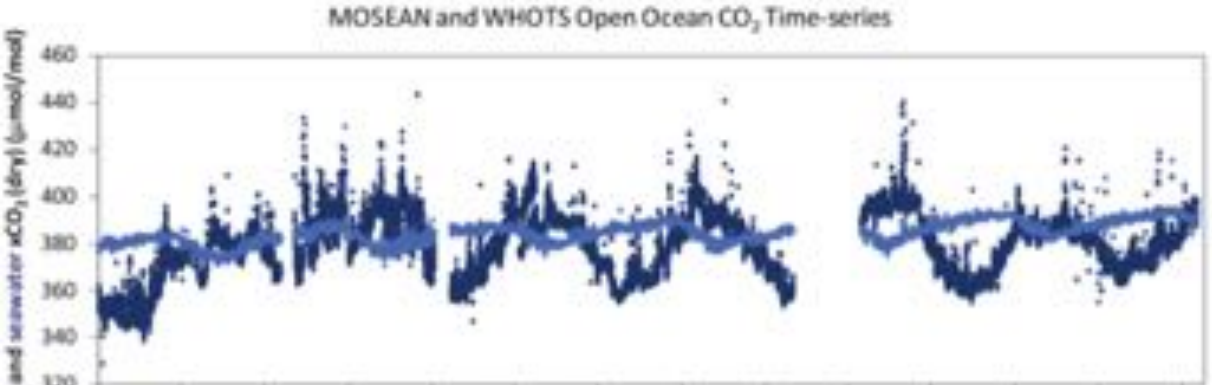
Salinity



GODAS
w. Argo
w. bias corr.

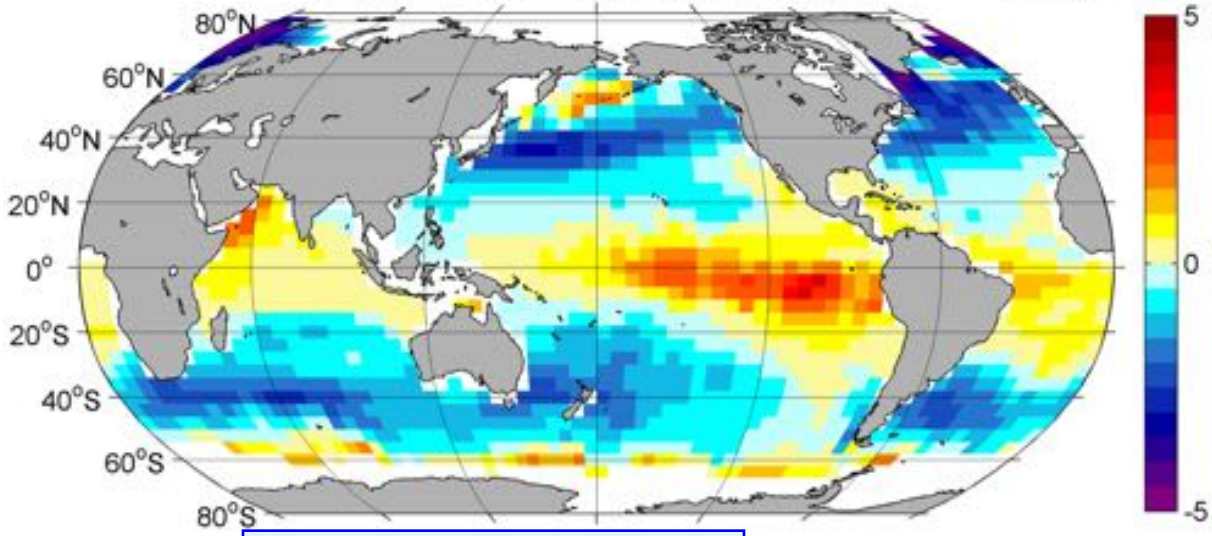
GODAS
(w/o Argo - w. Argo)

Successes- ocean carbon, Ocean Reference Stations



The 7 year time series at the MOSEAN H-A/WHOTS Ocean Reference Station shows an increasing trend in ocean and atmosphere CO_2.

RECCAP (REgional Carbon Cycle Assessment and Processes)



Climatological global net sea-air CO_2 flux

+ CO_2 release

− CO_2 uptake

-1.19 Pg (10^{15}) C yr^{-1}

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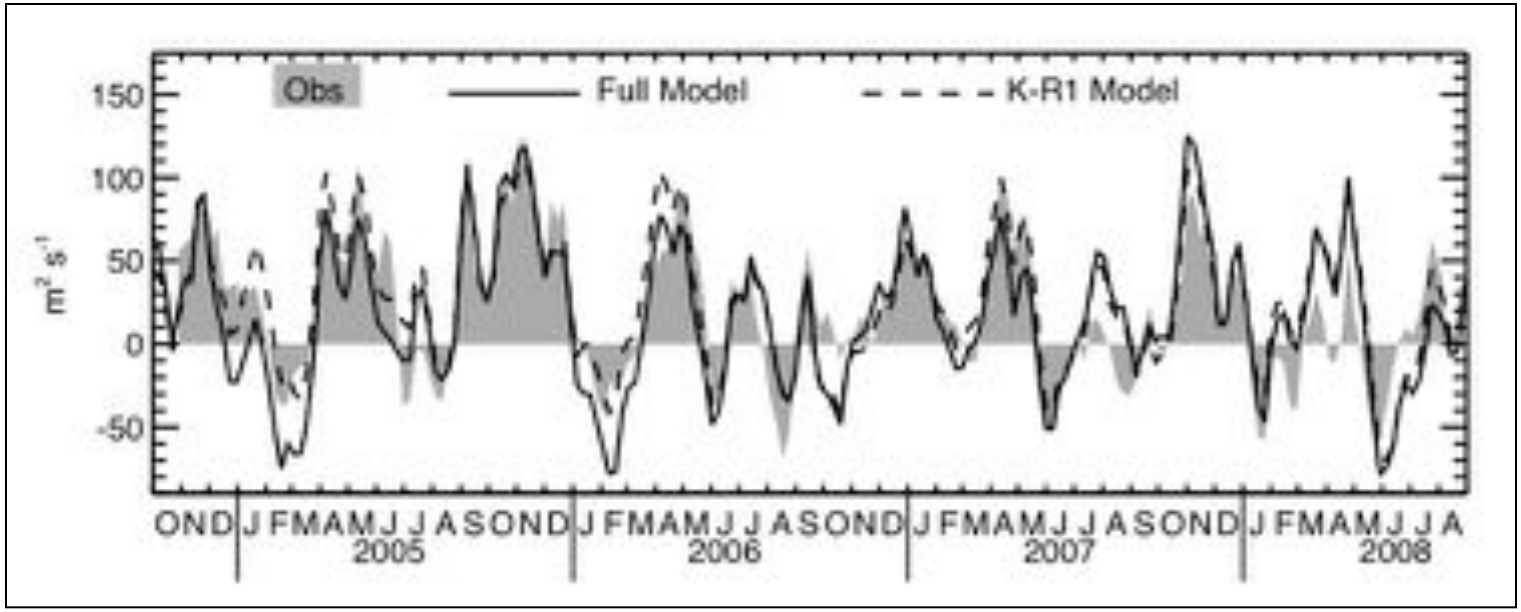
Successes- building an observing network in the equatorial Indian Ocean

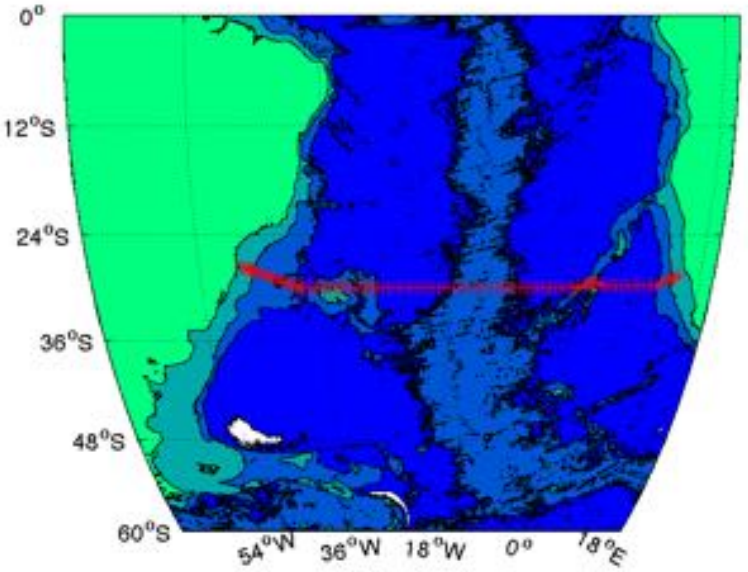


Solutions near the equator are dominated by the the Kelvin + 1st meridional mode Rossby wave of the two gravest vertical modes

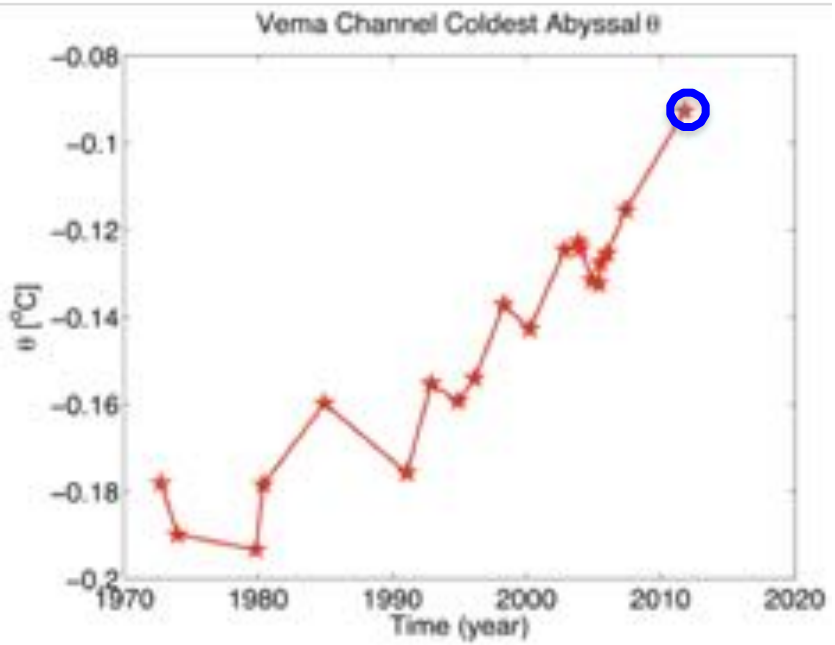
K-R1 Model is based on just the Kelvin wave and first meridional mode Rossby wave of the first and second baroclinic modes.

Nagura and McPhaden, 2010, J. Geophys. Res.

Successes- a number of sites have decadal and longer records. Example: AABW trends



Repeat Sections document large, persistent changes in Southern MOC



- AABW flows north through the
- Vema Channel as part of the MOC
- The 2011 reoccupation of A10
- crossed the Vema Channel
- Zenk and Morozov (2007, GRL)
- showed AABW warming in the Vema Channel by about 0.03 ºC per year since the 1980s
- An update including the 2011 data shows the coldest AABW in the Vema Channel has warmed by ***0.1 ºC*** since the 1970s. Part of a global contraction of AABW over that last few decades.

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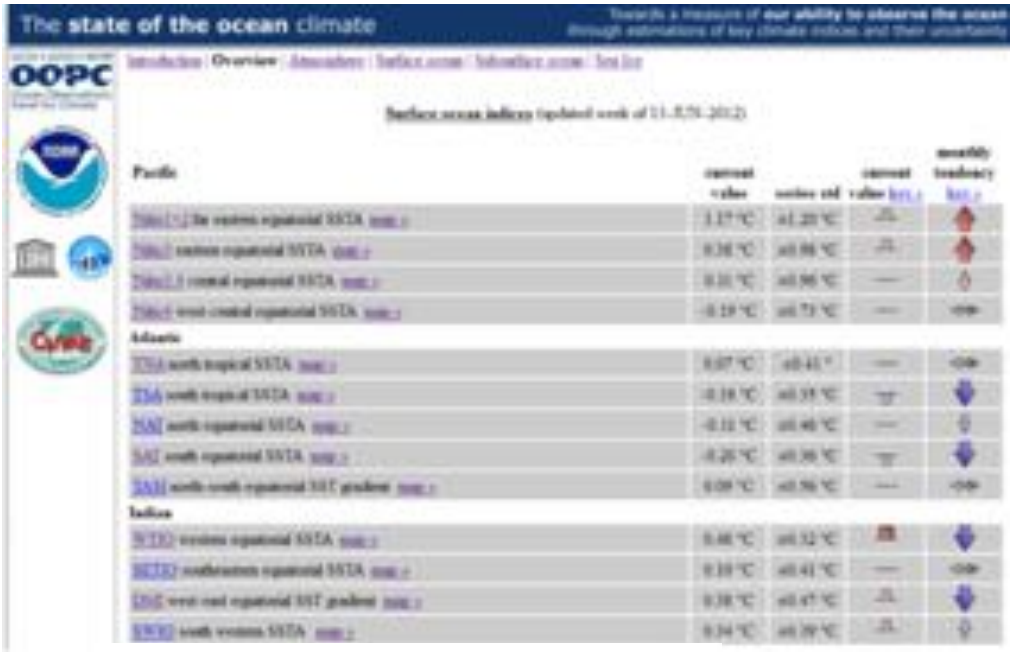
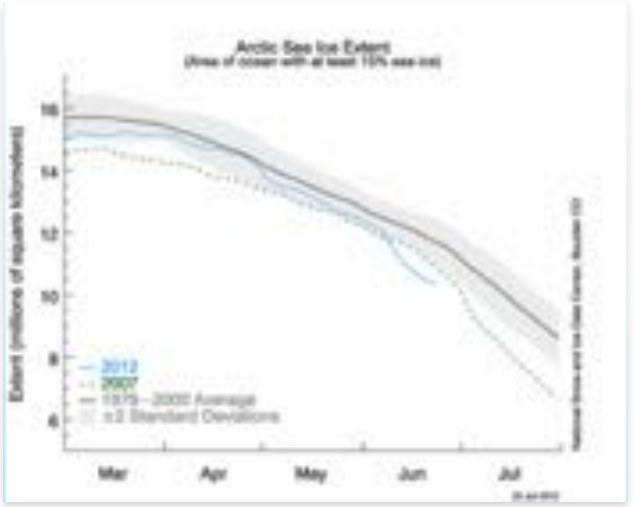
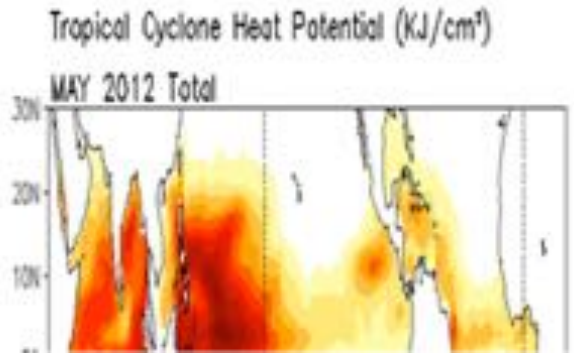
Successes- increased public access to information and products



Quick easy to use Indices and trends for Ocean Surface and Subsurface, Ocean-Atmosphere, and Sea Ice





NOAA NCEP GODAS Analyses

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Successes - increased public access to information and products

Going forward – continuing effort and more progress needed

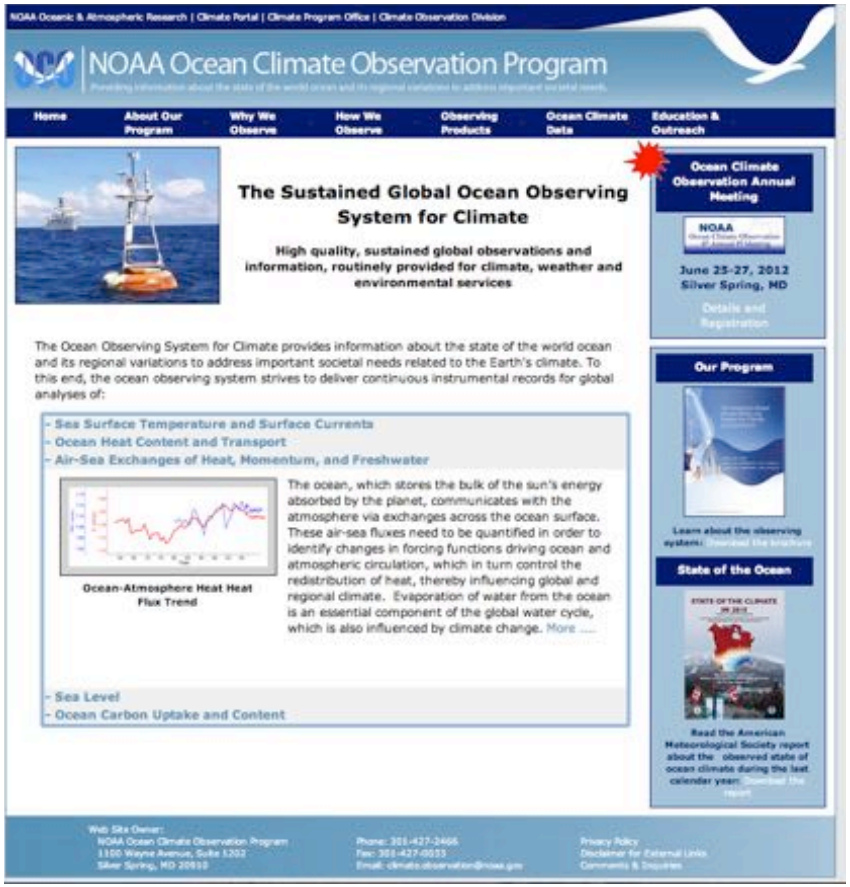
New website

Public, but not announced

Announce publicly in September.

Contents include:

- About our Program
- Why We Observe
- How We Observe
- Observing Products
- Ocean Climate Data
- Education and Outreach



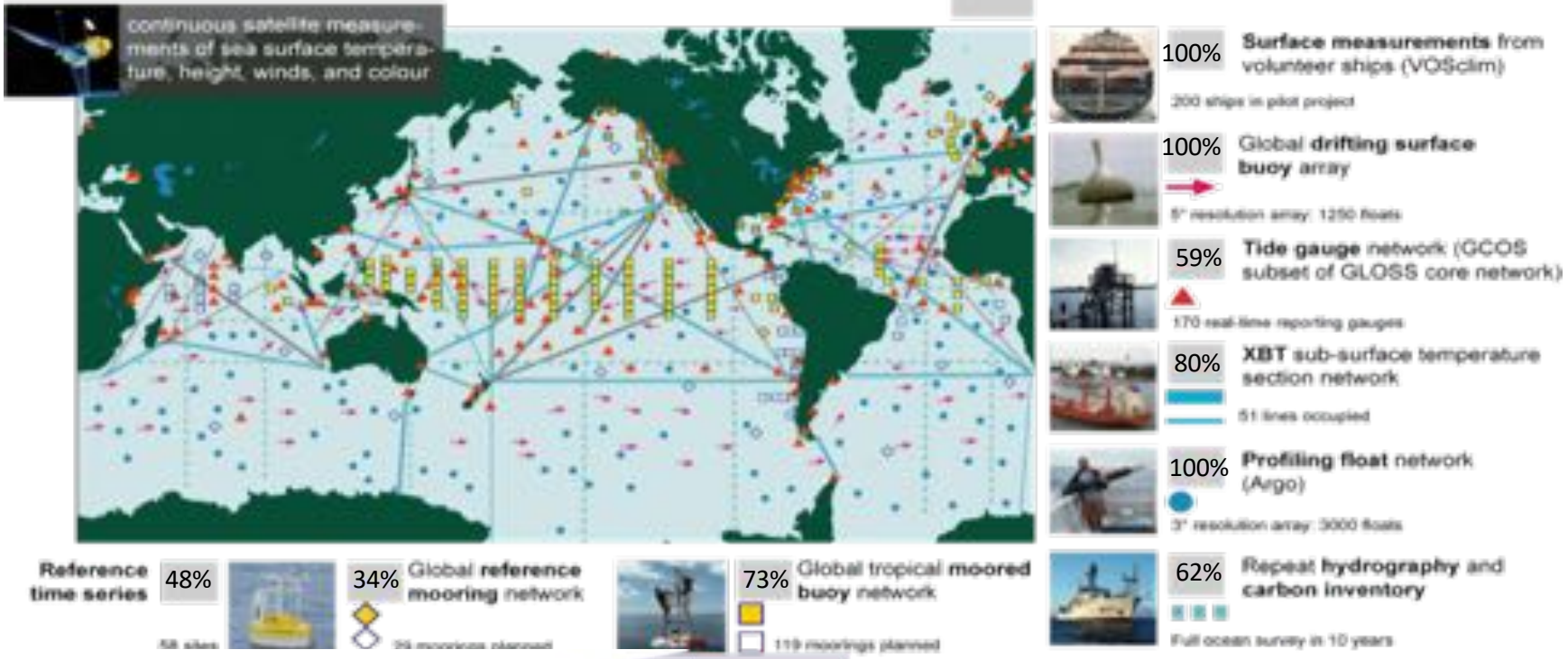
Feedback Welcome!

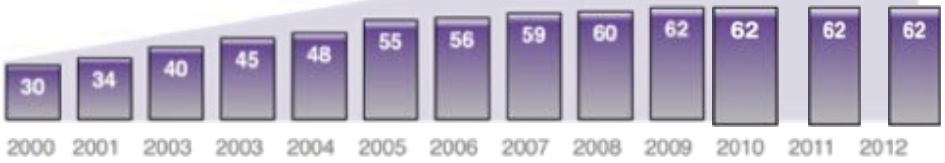
www.oco.noaa.gov

David Legler

Climate Observations Division: both embedded in and key to the international framework

Total *in situ* networks **62%**

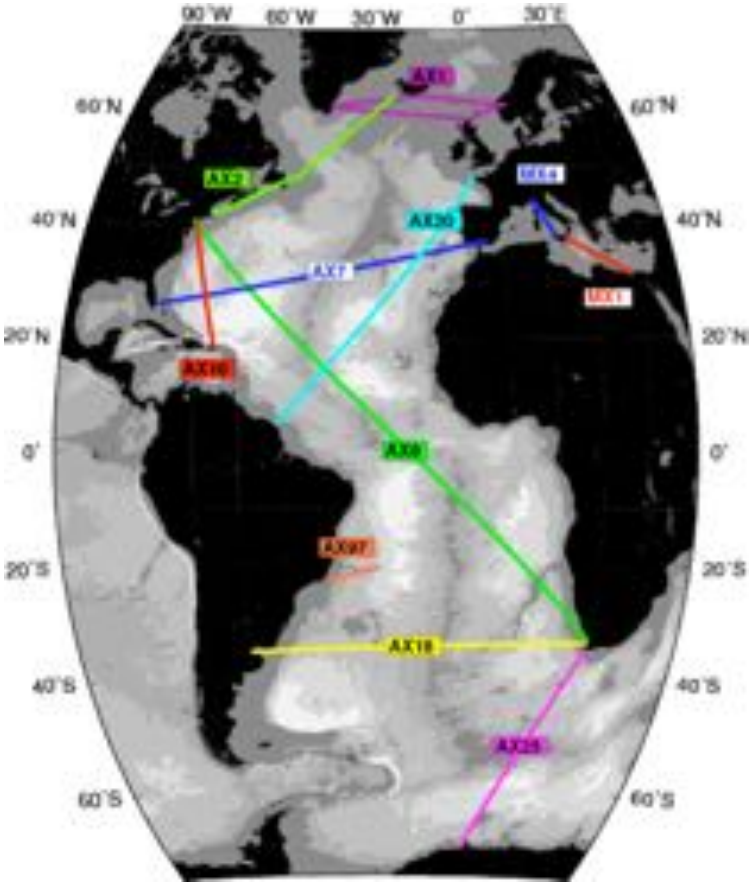




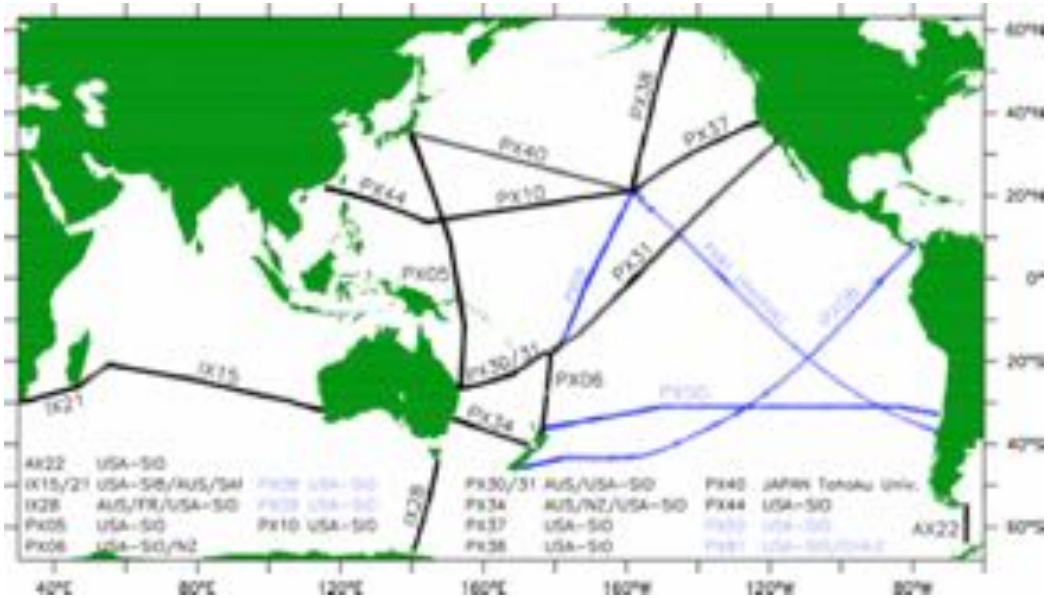
A heritage summary slide – now looking at new system goals and ways to convey the benefits of the system

Climate Obs Division: Staff in key international roles (e.g., JCOMM-OPS) and essential support to many international networks

AOML



SIO



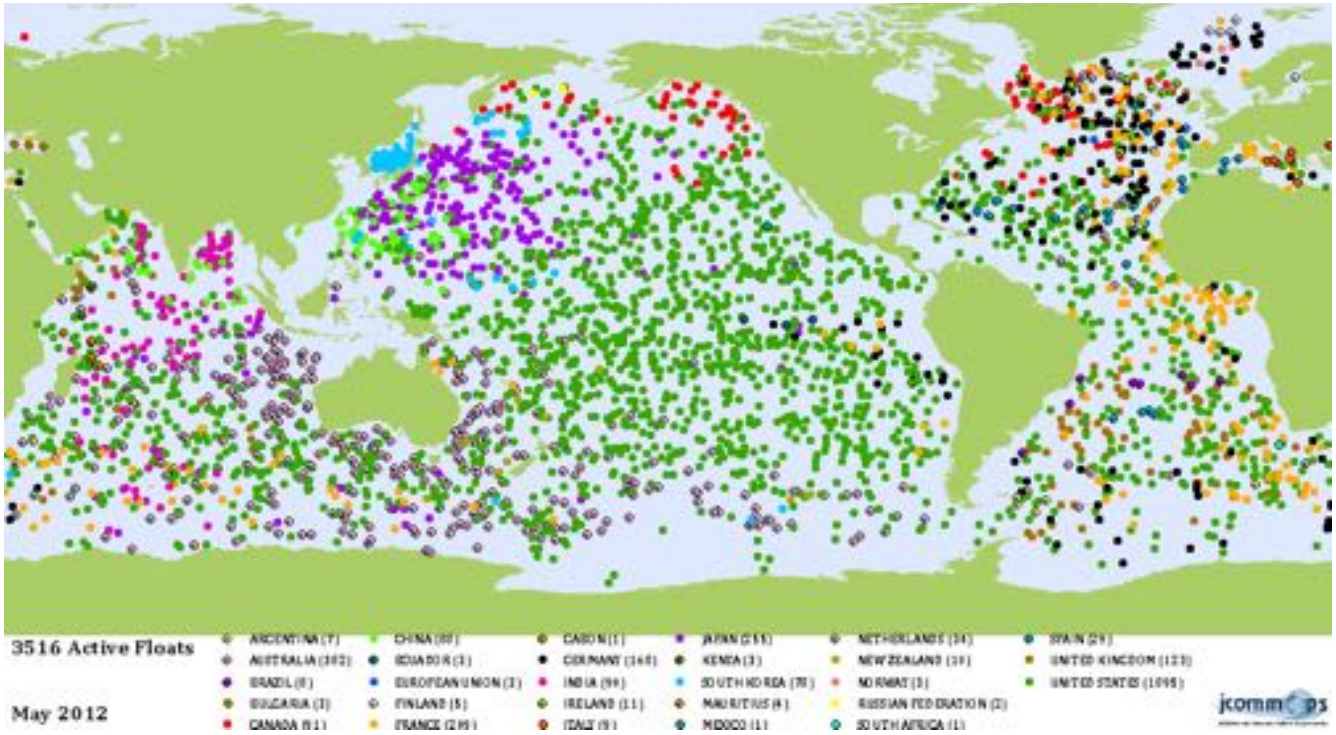
NOAA funds approximately 60% of XBTs, while international partners aid in the actual deployments

E.g. of the 11 HD transects done by AOML, international partners deploy XBTs on 9 lines.

Climate Obs Division: Staff in key international roles (e.g., JCOMM-OPS) and essential support to many international networks

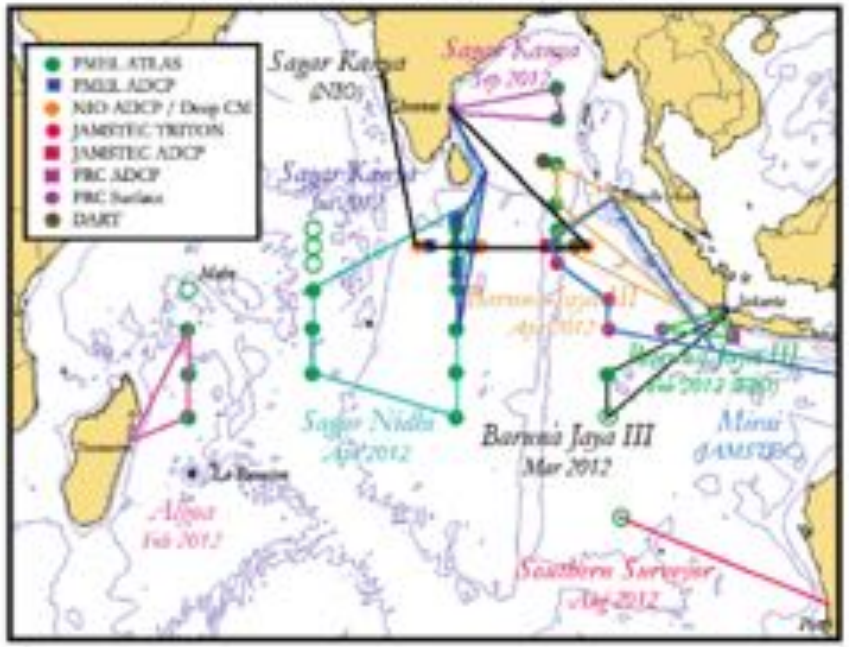
All observing activities supported by the Climate Observation Division are in partnership with other countries, including:

- Argo: 34 countries
- Arctic : 13 countries
- Global Sea-Level System: 57 countries
- Surface Drifters: 14 countries
- Tropical Moored Buoy Arrays: RAMA (15) and PIRATA (3)



Climate Obs Division: the forward trajectory not only benefits from but needs the international context

Cruises Oct 2011-Oct 2012



- 10 Cruises
  6 ships
  5 nations
- 227 sea days
- Maintain 30 existing sites
- Add 1 new site (25°S, 97°E)

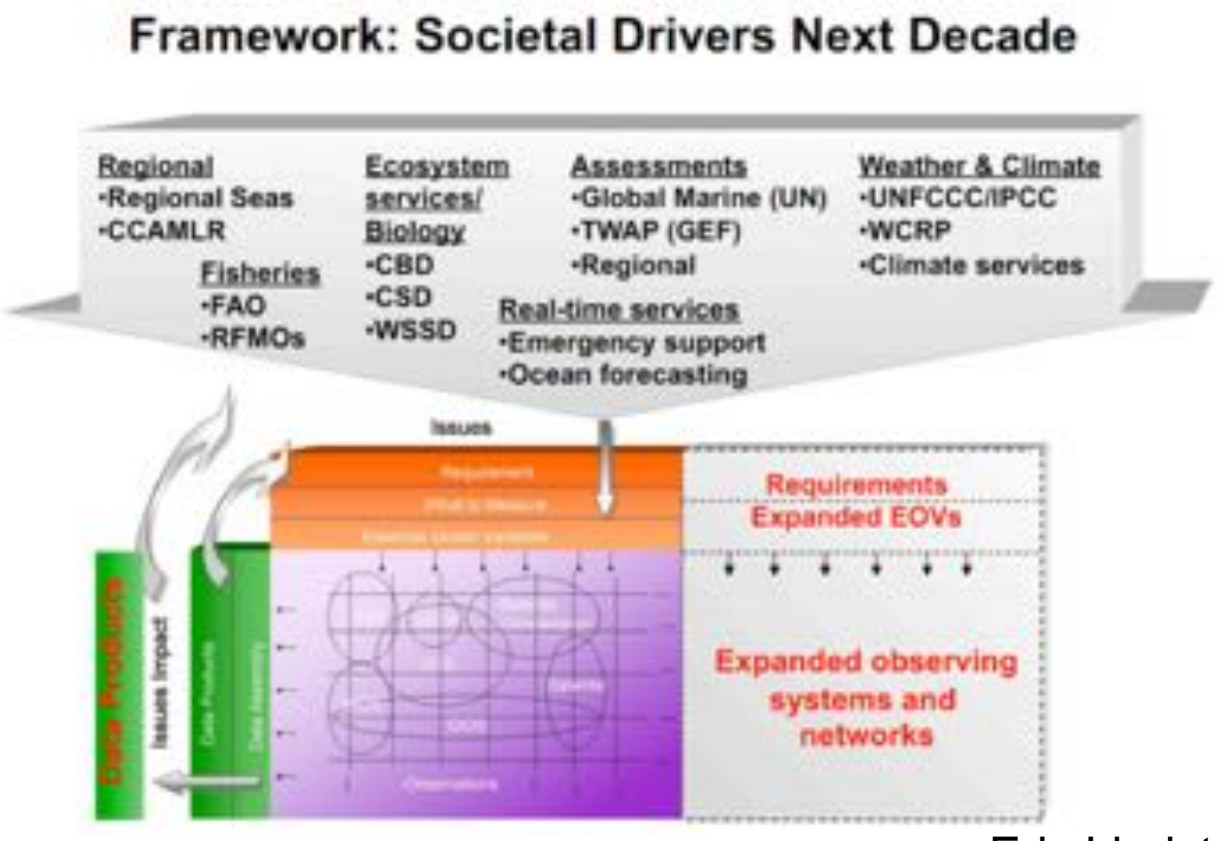
RV Southern Surveyor

PI: Nathan Bindoff, CSIRO/UTAS
Co-PIs: Helen Phillips, UTAS; Ming Feng, CSIRO; Eric Schultz, BOM

OO'09: Framework for Ocean Observing

Note: the framework plans to go forward with multidisciplinary observing guided by panels for:

- Physical
- Biogeochemical
- Bio-Ecological



Eric Lindstrom

GCOS GOOS WCRP jcomm

Challenges/Opportunities: Guiding the Evolution – system evaluation and technology

- Observing system evaluation in the context of models, forecast systems, and wider research enterprise as well as in the international context is recognized as a challenge.
  - Evidence so far supports current strategies and designs (we are exploring what more could be supported with available resources…)
- Technology is playing a big role in making some systems (e.g. Argo) more efficient. Other new technologies under development, too early to know impacts.
  - How to nurture technology development

Challenges/Opportunities: Guiding the Evolution – NOAA context

- CPO – place a high priority on observing
  - What are the impacts of:
    - Level or declining funding
    - Reductions to data assimilation, analyses
    - Less investment in synergistic research, process studies
- NOAA-wide
  - Is the management and guidance of sustained, in-situ observing a core mission and/or capability
    - Does NOAA recognize and value sustained in-situ observing networks, especially those in the research enterprise?
    - If so, why is there not sufficient ship time
  - Can NOAA measures of performance and success for a sustained observing system be developed with community resonance
  - Is there coherence across NOAA that works to coordinate efforts and, for example, ensure continuity of synergistic missions (e.g altimetry/JASON)

Challenges/Opportunities: Guiding the Evolution – NOAA context

- Serving multiple missions -
  - Elements of the Ocean Climate Observing System serve more than just climate
    - Example: Barometric pressure sensors on Southern Ocean surface drifters
  - Increasingly, new requirements are proposed, which in some ways fit the global capabilities of the system
    - Adding sensors: ocean carbon, biogeochemistry, oxygen, deep ocean
    - Taking on Arctic observing
    - Cal/val: calibration and validation of new satellite sensors
  - New taskings, added functionality, usually not accompanied by new funds
    - COD responded to international requests not to remove barometric pressure sensors from Southern Hemisphere drifters, but those users are not a source of funds
- Opportunities –
  - Partnering with additional International sponsors
  - Partnering with other Line Offices
  - Partnering with other U.S. agencies

Challenges/Opportunities: Guiding the Evolution – international context

- CPO – dependencies of international partners
  - Ship time (e.g., RAMA)
  - COD evolution impacts and has implications at international level (e.g., barometric pressure sensors)
  - Resource management challenge at an international level
- NOAA-wide
  - Does NOAA espouse the International Framework for Ocean Obs
    - Societal drivers, Essential Ocean Variables, multidisciplinarity
  - Provide a high level forum for ocean international ocean observing commitments and resource sharing
    - Ship time

Seeking input from and guidance of CWG

- Solidifying the larger context for sustained ocean observing
  - As a NOAA core mission and capability
  - With international resource sharing and management
  - Engaged in the International Framework
  - Fostering the utilization of ocean observations to meet diverse needs: forecasting, climate, ecosystems, research, cal/val

- The need for ship time to support the Climate Goal is critical
  - What is NOAA OMAO strategy to address climate requirements… priority of an ocean climate observing system?
  - What is strategy to provide ship time for TAO in FY13 in order to maintain historical reporting levels?
  - Chartering draws down COD program funds
  - Availability of global class vessels is uncertain (short-term and long-term)