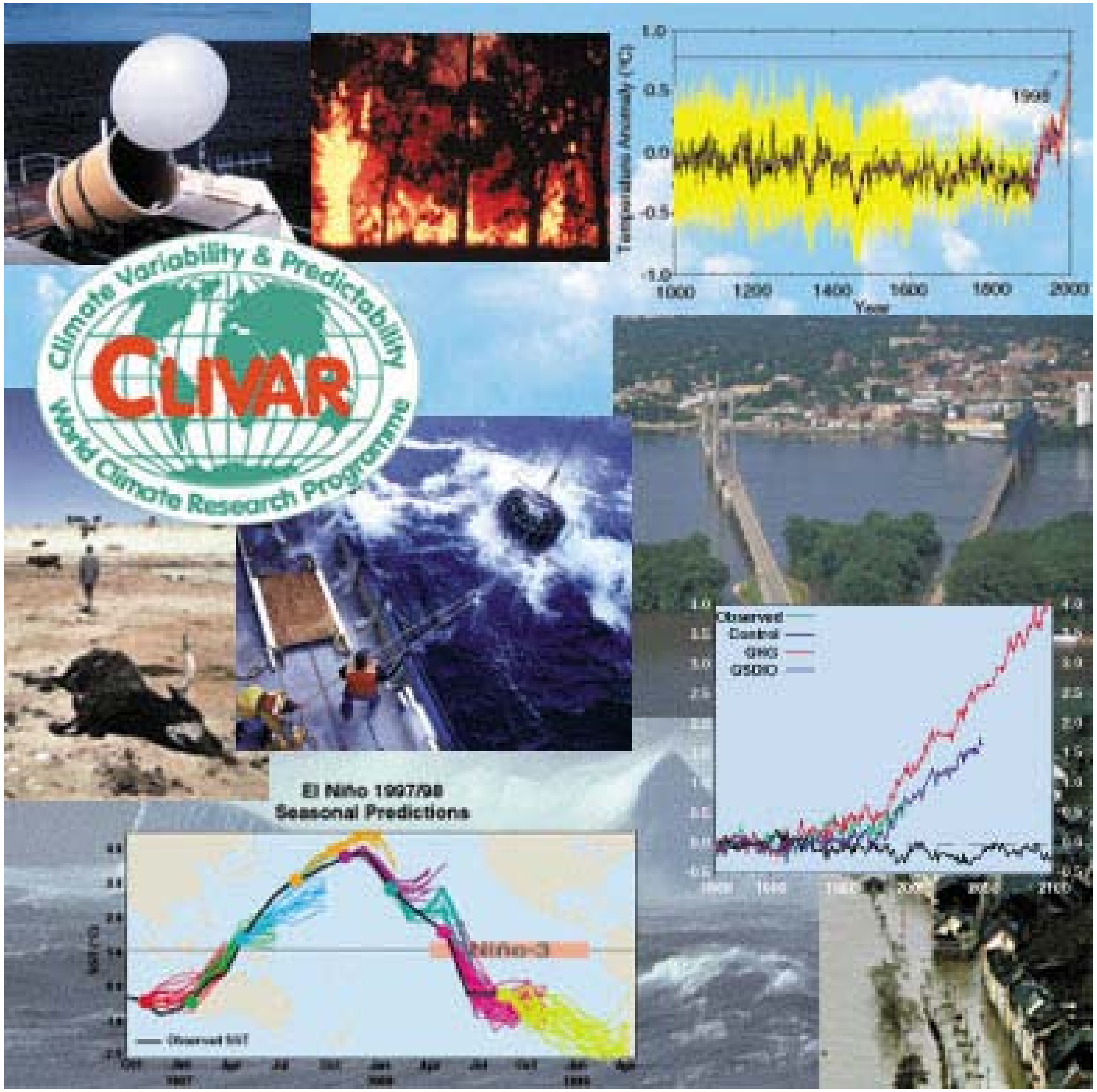
CLIVAR (Climate Variability and Predictability)

Mission

To facilitate observation, analysis and prediction of changes in the earth's climate system with a focus on ocean-atmosphere interactions, enabling better understanding of climate variability, predictability and change, to the benefit of society and the environment in which we live.



CLIVAR Research Imperatives

1. Anthropogenic Climate Change
2. Decadal Variability, Predictability and Prediction
3. Intraseasonal and Interannual Predictability and Prediction
4. Improved Atmosphere and Ocean Components of Earth System Models
5. Data Synthesis and Analysis
6. Ocean Observing System
7. Capacity Building

1. Anthropogenic climate change: Undertake the predictive science that aims to develop the adaptation decisions that must be made in response to human activity

Prepared by: Gerald Meehl, Sandrine Bony, Francis Zwiers and Wenju Cai

Proposed activities based on CMIP5 modeling structure of 2 time-scales (1) short term to 2035 using high resolution models concentrating on decadal prediction and (2) long term to 2100 using AOGCMs and ESMs addressing mitigation

1) Short-term experiments: how best to initialize the ocean, 2 hindcast models and one forecast model
2) Long-term experiments: 4 models with different mitigation scenarios to study how feedbacks contribute to climate change
3) Additional experiments to understand inter-model differences in climate change projections and to better interpret origin of differences in cloud simulations

CLIVAR/WCRP Working Group on Coupled Modelling (WGCM)

Major future plans/activities

Focus & priorities over the next 5+ years:

Near term (next 30 years) :

- Decadal prediction
- initialisation of coupled models
- factors that provide decadal predictability
- Regional information & extremes
- high resolution models (~ 50 km)
- short-lived species (aerosols, chemistry..)

Longer term (mid-century to 2100+)

- Climate sensitivity
  - radiative forcing
  - physical feedbacks (e.g. clouds)
- Carbon-climate feedbacks
- 1st generation of Earth System Models
- interactive carbon cycle and vegetation
- intermediate resolution (~ 200 km)

Evaluation & Understanding:

- Evaluation of OAGCMs
  - better definition of model outputs
  - bridge to observations and processes
- Narrowing of the gap between modeling and understanding
- hierarchy of model experiments
- sensitivity & idealized experiments

2. Decadal Variability, Predictability and Prediction

Identify and understand phenomena that offer some degree of decadal predictability and to skilfully predict these climate fluctuations and trends

Prepared by S. Griffies, G. Danabasoglu, H. Drange, W. Hazeleger, B. Kirtman, A. Timmermann

Proposed activities

1) Analyze results of CMIP5 decadal experiments and sponsor workshops addressing results

2) Analyze model biases and develop corrections

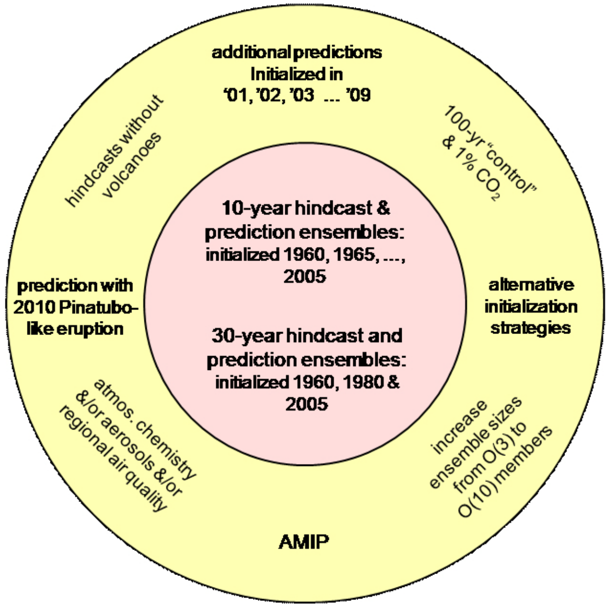
3) Foster decadal prediction experimental design studies

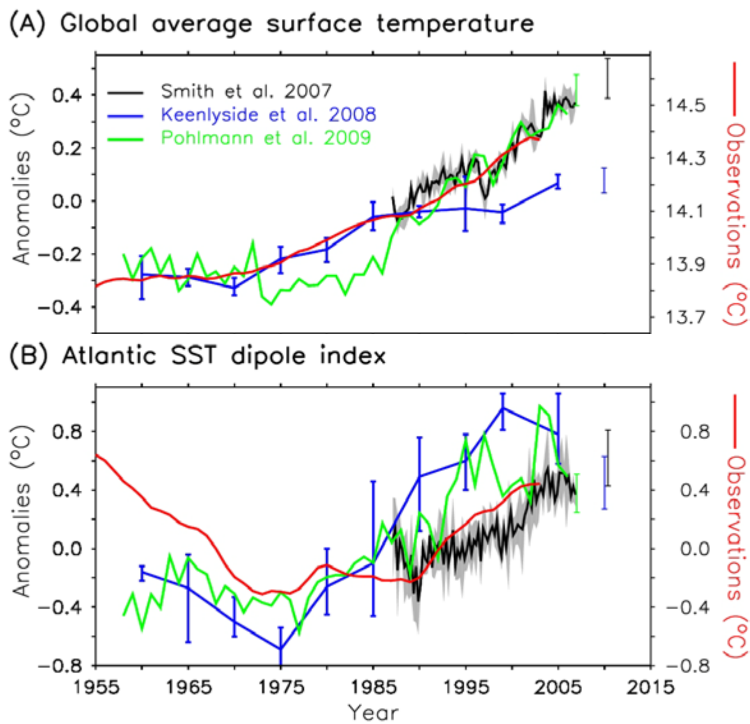
4) Establish links with other groups to address multi-disciplinary aspects of decadal prediction problem

Progress with imperatives

Decadal variability & predictability

- First attempts already underway
- Decadal prediction part of CMIP5 protocol
- Joint design by WCRP/WGCM/WGSIP/ CLIVAR sub group
- Opportunities for diagnostic sub-projects
- CLIVAR Workshops
  - AIP/GSOP Earth System Initialization for Decadal Predictions Workshop (4 – 6 Nov 2009) – KNMI, Utrecht, The Netherlands
  - *Planned: WGOMD/GSOP Workshop on Decadal Variability, Predictability and Predictions: Understanding the Role of the Ocean - 20-23 Sep 2010, NCAR, Colorado, USA*
- Atlantic Panel coordination of activities to monitor the Atlantic MOC





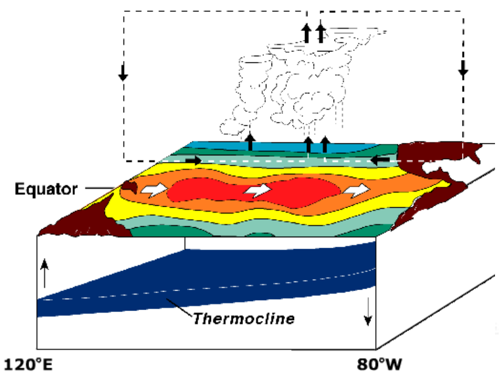
3.0 Intra-seasonal and inter-annual predictability and prediction

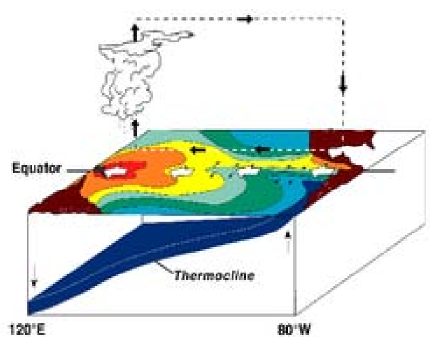
Identify and understand phenomena that offer some degree of intra-seasonal to inter-annual predictability, to skilfully predict these climate fluctuations and trends and to increase interactions between scientists, operational forecasters and decision makers

Prepared by Ben Kirtman, H Hendon, E H Berbery, K R Sperber

Seasonal to Interannual Prediction
Climate System Historical Forecast Project

- Until now, seasonal prediction has largely focused on tropical ocean-global atmosphere interactions, in particular the El Nino/La Nina cycle in the tropical Pacific





CHFP aims at exploring the hypothesis that:

There is currently untapped seasonal predictability due to interactions (and memory) among all the elements of the climate system (Atmosphere-Ocean-Land-Ice)

- 12 groups participating in a set of designed experiments
- Distributed archive and opportunities for diagnostic subprojects provide further opportunities for involvement

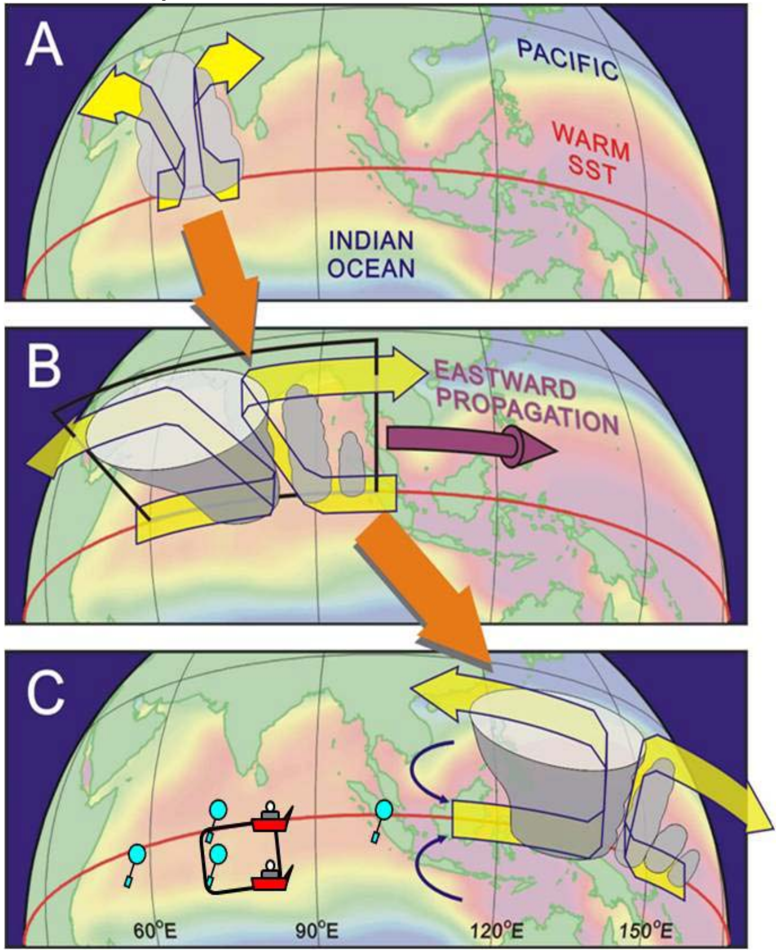
Proposed activities

1) Complete CHFP with extension to intraseasonal prediction
2) Focus on simulation and prediction of intraseasonal variability including coupled tropical modes (e.g., MJO) and extratropical annular modes
3) Increase research on coupled climate system data assimilation
4) Increase model improvement efforts through observationalists, process modellers and large scale modellers interactions
5) Encourage seamless (weather through climate) research

CINDY2011 (Cooperative Indian Ocean experiment on ISV in Year 2011) and DYNAMO (Dynamics of the MJO) *

Kunio Yoneyama

Purpose :
The goal of CINDY2011/DYNAMO is to collect in-situ observations to advance our understanding of MJO initiation process and to improve MJO prediction and simulation.



Period :
October 2011 – January 2012

Main Location :
In and around central equatorial Indian Ocean

Expected Participants :
Japan (JAMSTEC, and many universities)
USA (U. Miami, CSU, OSU, UW, NOAA, DOE, ONR, etc.)
India (NIO, IITM, etc.)
France (LMD, LOCEAN, etc.)
UK (U. East Anglia, U. Sussex)
Seychelles (National Weather Services)
China (SCSIO)
Australia (CAWCR) and others

* DYNAMO is a US program and its field campaign is US component of CINDY.

4. Improved atmosphere and ocean component models of Earth System Models

Reduce the negative impact of biases in model representations of atmospheric and oceanic processes

Prepared by: Sandrine Bony, Stephen Griffies, Tim Stockdale.

WCRP Climate-system Historical Forecast Project (CHFP)

•Initialization of all the components of physical climate system

•Experimental protocol is flexible to be inclusive as long as basic principle of no future information as the forecast evolves is not violated

- Atmospheric initial states to be taken from NCEP (ECMWF, or other analysis products) reanalysis each February, May, August and November each year from 1979-present. Each ensemble member should be run for at least seven months. Additional ensemble members and longer leads are encouraged.
- Oceanic initial states: can be taken from most appropriate ocean data assimilation system.
- Sea Ice initial states: can be taken from best available observational data.
- Land initial states: can to be taken from most appropriate land data assimilation system or consistent offline analyses driven by observed meteorology (i.e., GLACE2;)
- Soil wetness: predicted (i.e., interactive Land Model)
- Snow cover and depth predicted (i.e., interactive Land Model)
- Chemical Composition (carbon dioxide, ozone …) prescribed and varying.

Multi-model and multi-institutional experimental framework for sub-seasonal to decadal complete physical climate system prediction to:

- Provide a baseline assessment of our seasonal prediction capabilities using the best available models of the climate system and data for initialisation.
- Provide a framework for assessing of current and planned observing systems, and a test bed for integrating process studies and field campaigns into model improvements
- Provide an experimental framework for focused research on how various components of the climate system interact and affect one another
- Provide a test bed for evaluating IPCC class models in seasonal prediction mode

The CHFP dataset also provides a framework for exploring seasonal to interannual predictability for climate-sensitive applications research, for example on topics related to health, crop and hydrological modelling

Proposed activities

1) Use CMIP5 and CHFP results to identify and set priorities for most critical model improvements (e.g., model biases)

2) Develop tools to facilitate model-observations comparisons

3) Archive appropriate model data needed to address questions in model-measurement comparisons about model parameterizations and how they affect simulations

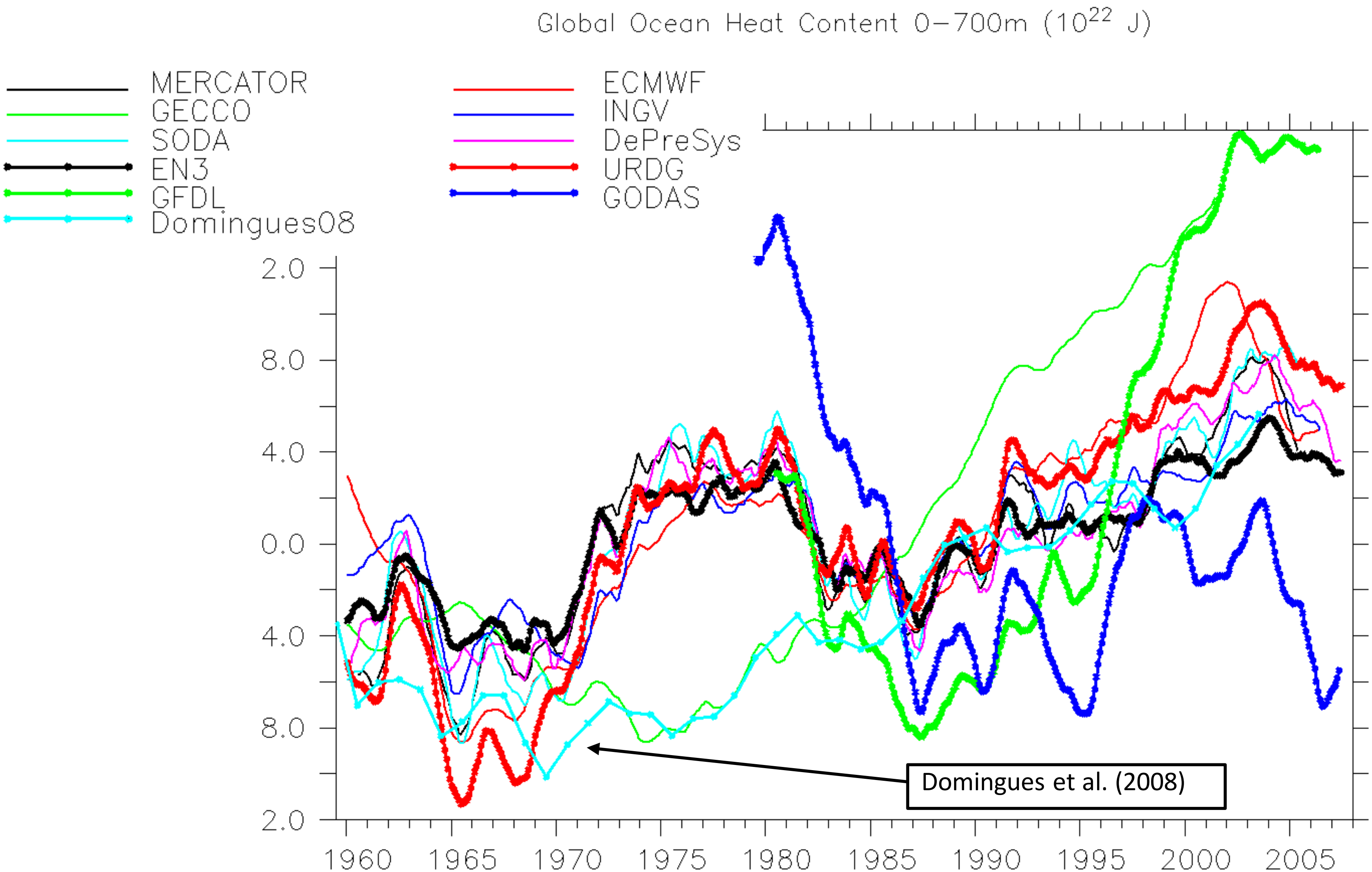
4) Establish Climate Process Teams to address deficiencies once identified

5. Data synthesis, analysis, reanalysis and uncertainty

Provide credibility to climate projections by understanding the past and present state of the ocean

Prepared by: D. Stammer, T. Palmer, K. Trenberth

Ocean synthesis intercomparison activity



Proposed Activities

1) Perform corrections of ocean data prior to use in syntheses

2) Use models and corrected data to generate syntheses

3) Develop fully-coupled data assimilation schemes using covariance's between ocean and atmospheric variables

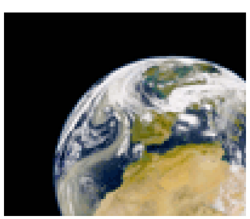
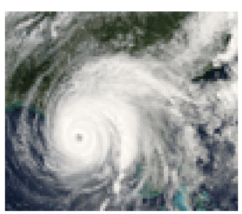
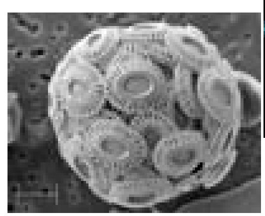
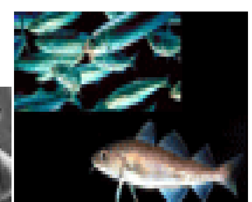
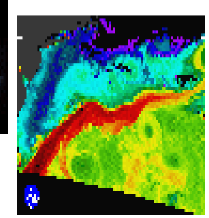
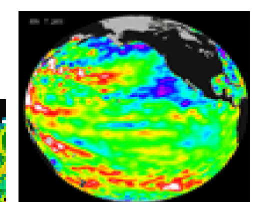
4) Improve coupled climate models to better represent and simulate present day climate

5) Estimate model and data uncertainties

6) Build links to carbon, biogeochemistry and ecosystem groups (e.g., to better understand observed ocean changes in carbon dioxide)

Priorities Over the Next 5+ years

- Develop and Strengthen Interactions with Ocean Biogeochemistry and Ecosystem Communities
  - ➢ Develop and strengthen existing links with IMBER, PICES, SIBER (INDIAN OCEAN), IOCCP
  - ➢ Joint targeted workshops
  - ➢ Develop ocean carbon aspects of ocean synthesis activities (WGCM with IGBP AIMES/WGOMD; GSOP
  - ➢ Strengthen SSG in this area

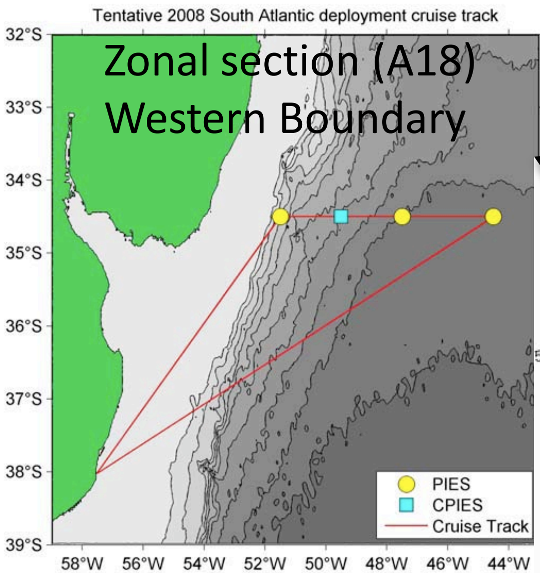







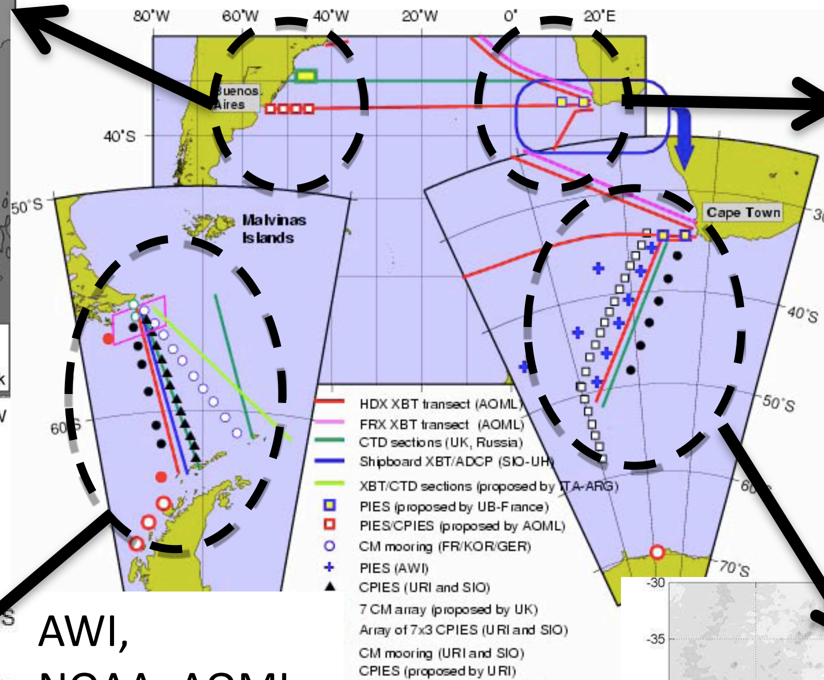
6. Ocean observing system

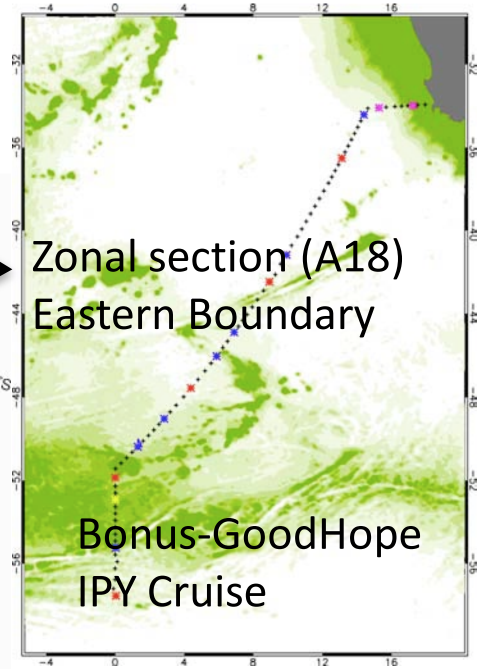
Maintain over many decades a sustained ocean observing system capable of detecting and documenting global climate change

Prepared by: Dean Roemmich, Bernadette Sloyan, Mike McPhaden Uwe Send, and Josh Willis

Atlantic Implementation Panel
Monitoring the South Atlantic







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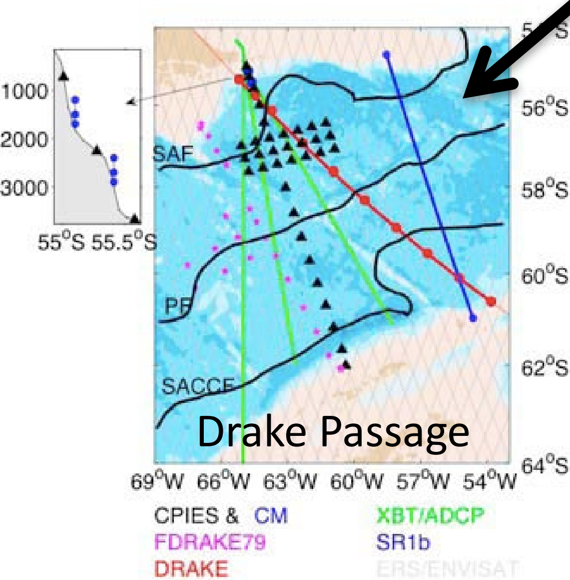

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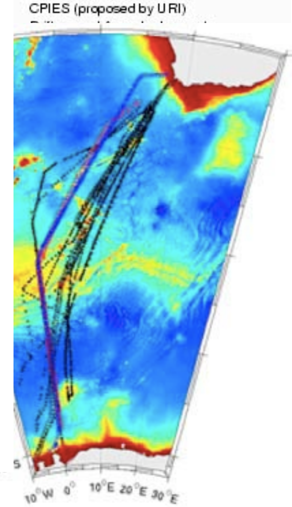

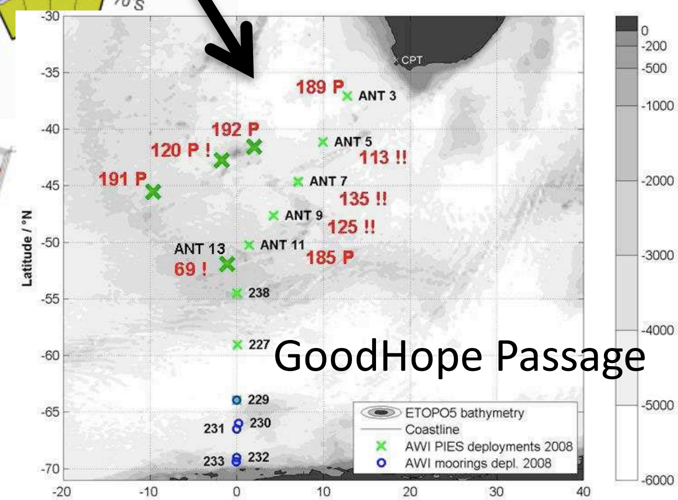

Proposed activities

1) Sustain observing system

2) Maintain free and open access to data

3) Maintain structures and agreements to allow data collection

4) Provide capacity building

5) Review status of all components of observing system on a regular including evaluating their adequacy in meeting user requirements

Capacity Building

Prepared by: V. Detemmerman, L. Goddard, F. Zwiers, H. Berbery

Proposed activities

1) Organize interdisciplinary workshops for graduate students and post-docs

2) Seek support to bring young scientists to CLIVAR meetings

3) Develop exchange programs for young scientists

4) Provide support for senior scientists to visit institutions in developing countries with goal of "train the trainer"

5) Provide scientific results in form understandable by non-scientists

6) Provide training for adaptation purposes

Thank you

www.clivar.org