Phenomena, Observations and Synthesis Panel (POS)

Developing a framework for CLIVAR

TOGA led to seasonal-to-interannual prediction systems

WOCE observed state of ocean and set up global ocean observing systems

CLIVAR should set up experimental decadal predictability systems

Pre-requisite is decadal predictability of slow components of climate system i.e. the ocean

Predictability ‘end-members’

Numerical Weather Pred

‘Moist’ fluid mechanics

Days

Seasonal inter-annual

Decadal

Centennial

IPCC climate projections

Forced

Decadal, basin/continental scale Interactions of modes of variability

Much effort has been placed in setting up prediction systems pushing out from NWP

It would be highly productive to attempt to also ‘push down’ from IPCC-class coupled models
Two huge investments make such an effort timely:

1. Construction of IPCC-class coupled climate models
2. Existence of global ocean observing/synthesis systems

POS panel objectives identified at last year’s summit can be usefully drawn in to the following three thrusts:

1. Ocean observations/synthesis and predictability
   Meeting at MIT in Feb.06 sponsored by NASA
2. Decadal predictability and variability of coupled system
   Meeting at GFDL in June.06 sponsored by NOAA
3. Weather and climate extremes
   Proposed working group on Drought (Schubert)

Note – these are closely related to one-another:

1. enables 2: 2 provides the context for 3.
Decadal predictability studies using global coupled models

- GFDL coupled model
  - Atlantic MOC – GFDL CM2.1 Model

NOAA-sponsored workshop on Atlantic decadal predictability; June 06

Workshop focused on Atlantic, but models are global.

Courtesy of Tom Delworth
Anomalies associated with interdecadal MOC fluctuations

- SST anomalies:
  - Maximum MOC: +1 °C, +2 °C
  - SST: +3 °C, -3 °C

- Air temperature anomalies:
  - Maximum MOC: +3 °C
  - Air temperature: +3 °C, +1 °C, 0 °C, -1 °C, -3 °C
Decadal predictions provide context for severe weather: drought, hurricanes

Need to de-convolve forced vs natural variability
Does, e.g., the MOC have any predictability?

perhaps

...or not? And why?

GFDL workshop on predictability organized by Delworth, Leetma, Marshall and Rosati

Implementation plan is being written

POS-PPAI: joint discussions

Ideas for next steps

Early warning system for abrupt MOC changes?
Ocean observations/synthesis and predictability

Strength of Atlantic MOC at 25N from ocean analysis compared to Bryden et al., 2005

Can assess the current state of the ocean, the status of the MOC, ice extent, sea-level etc etc, and provide initial conditions for decadal projections.

Requires combining the developing global ocean observing capability with ocean data assimilation systems.

Elements are in place, but a ‘push’ is needed to move beyond demonstration projects.

decadal prediction can provide a focus
Ocean observing system is in continual threat of being significantly reduced in scope. The backbone is provided by ARGO arrays, satellite altimeters and satellite wind measuring systems.

Assimilation of ARGO profiles dramatically improves the ability of MIT ocean model to simulate the MOC and its heat transport.

ARGO profiles
May 2002-Apr 2003
(+climatology south of 30N & below 2000m)

Gael Forget et al (b), to be submitted

NOTE
There is a strong link between marine ecosystems and ocean climate. Sophisticated fisheries and ecosystem models exist and significant progress in the area of assessing potential changes can be made once these are coupled to ocean models.

POS panel discussions:
Sarah Gillie: status of ARGO
Jim Carton: ocean synthesis
Terry Joyce: CO2 hydrography

POS-PSMI joint discussions
use of assimilative models to identify and fix systematic model errors

Salinity WG report: Jim Carton
Weather extremes

Drought has emerged as a CLIVAR focus

A physical understanding of the causes of long-term drought is emerging. Uncertainties remain about relative roles of:

- different ocean basins
- strength of the land-atmosphere feedbacks
- role of deep soil moisture
- nature of long term SST variability
- impact of global change
- fundamental issues about predictability of drought.

Dust Bowl Rainfall Patterns

[Maps showing observed and modeled rainfall patterns with labels: observed, modeled.]

Drought WG proposal: Schubert, Nigam

Proposed working group will help focus observational and modeling studies
What can we do?

Set up and study prototype decadal predictability systems based on IPCC-class coupled models.

What does one need?

- Coupled IPCC-class models
- Global data sets and assimilation methods particularly for the ocean
- Computational resources - ensembles
- Smart ideas on predictability of coupled system
  better understanding of the key components
- Research program on basic dynamics and analysis related to the prediction problem
- Links to the international community.

What would the products be?

- Projection of sea-level rise, sea-ice extent, MOC, trends for weather extremes, separation of natural and forced variability, applications to global biogeochemical cycles, fisheries, carbon cycle………

New – not being done now