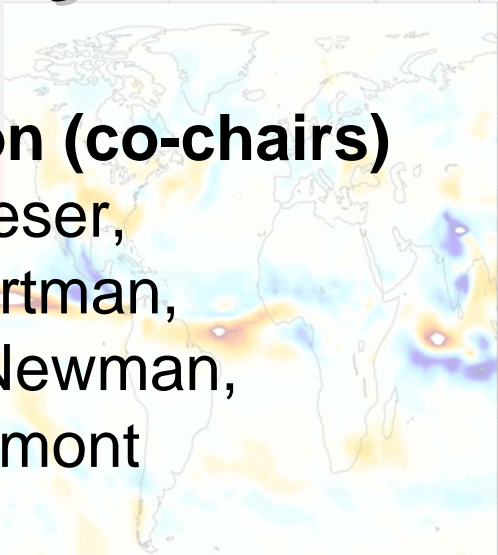
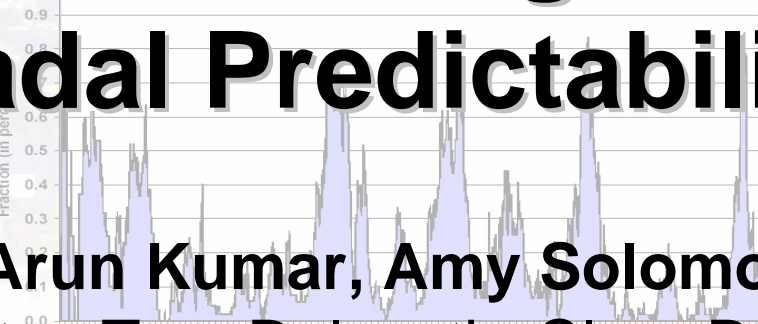
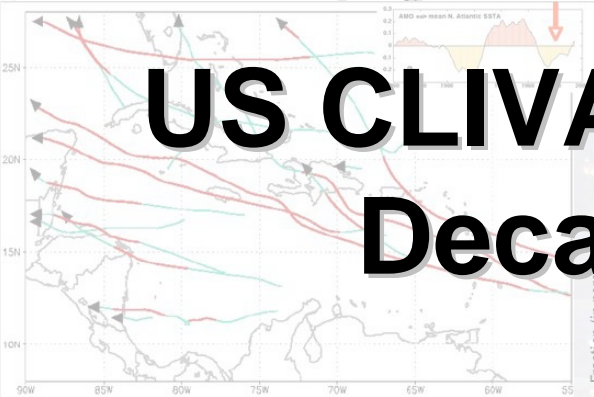


US CLIVAR Working Group on Decadal Predictability

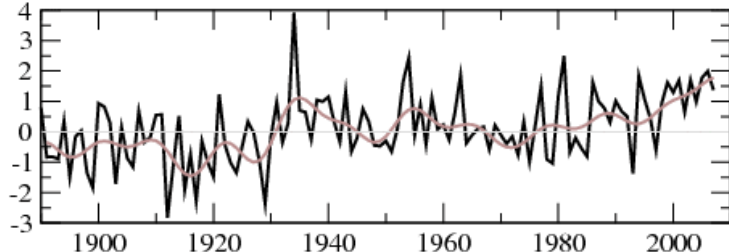


Lisa Goddard, Arun Kumar, Amy Solomon (co-chairs)
Jim Carton, Tom Delworth, Clara Deser,
Ichiro Fukomori, *Gabi Hegerl*, Ben Kirtman,
Yochanan Kushnir, *Jerry Meehl*, Matt Newman,
Doug Smith, Tim Stockdale, Dan Vimont

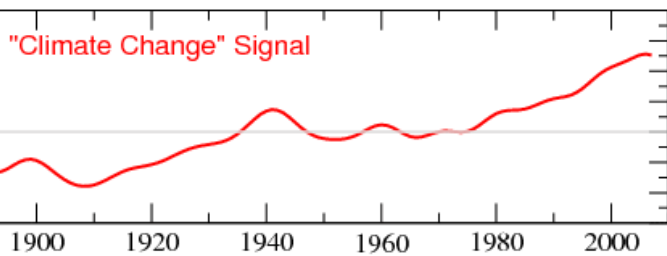
Climate Variability & Change in CO

T

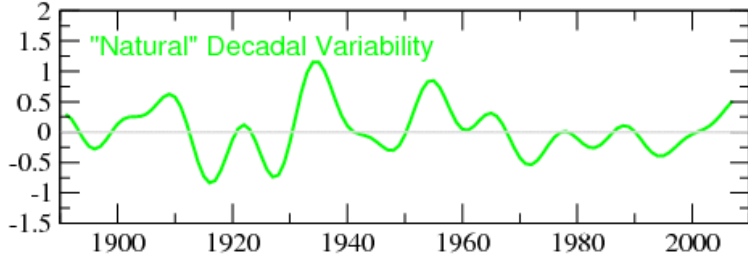
Annual-Mean Temperature Anomaly (deg. F)



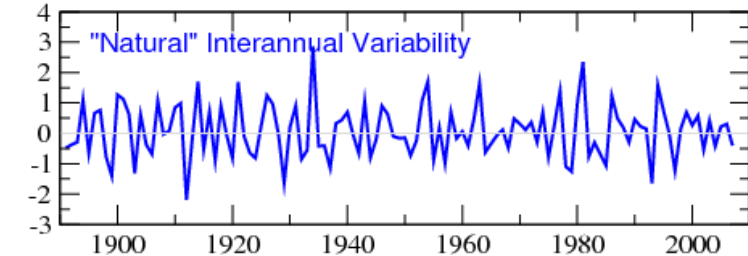
25%



13%

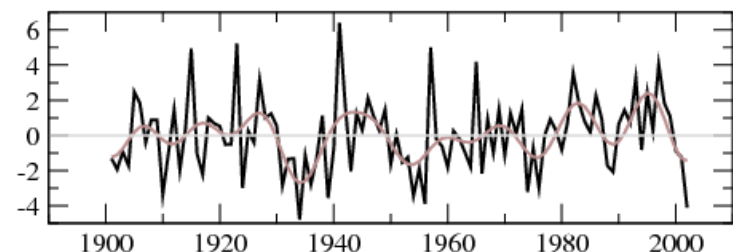


62%

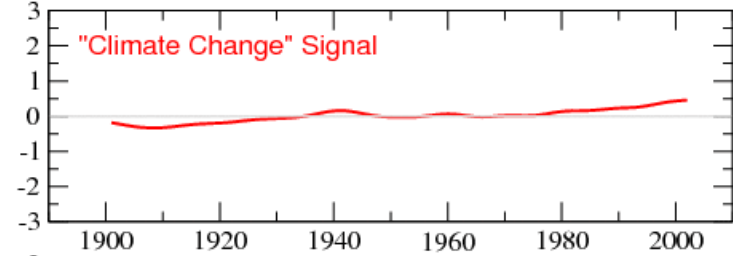


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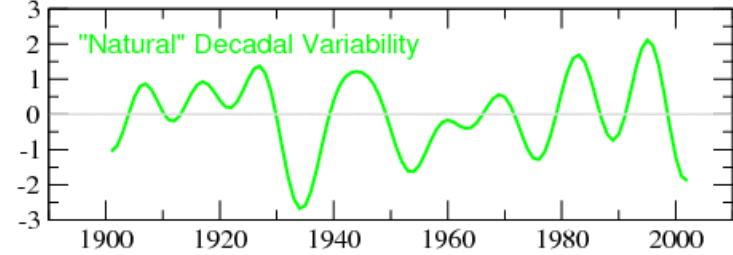
Annual-Mean Precipitation Anomaly (inches/year)



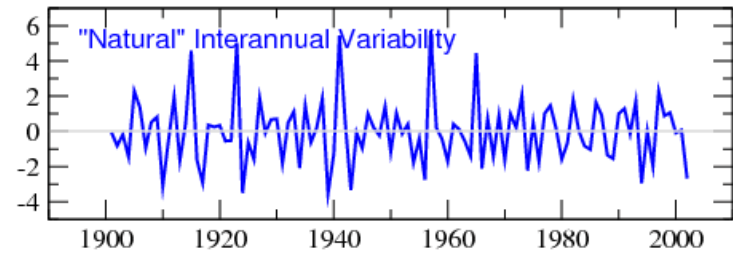
1%



25%

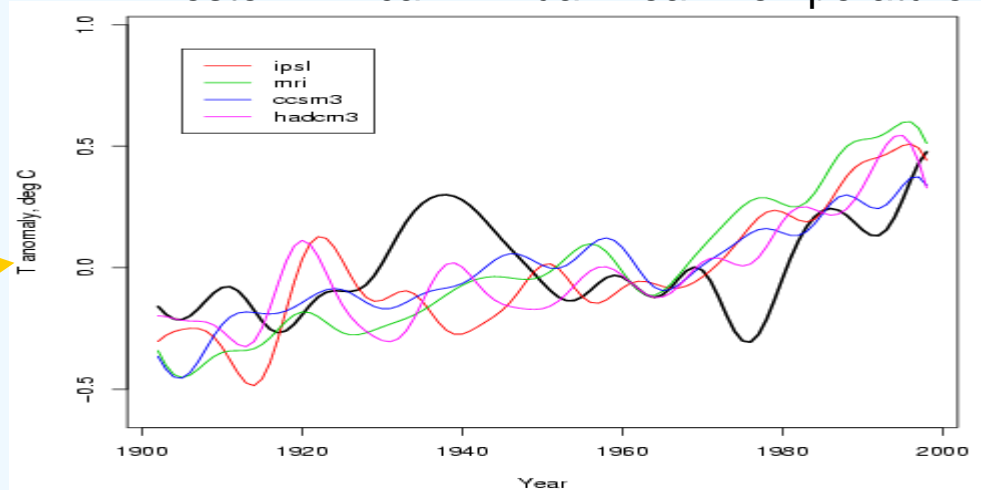


74%

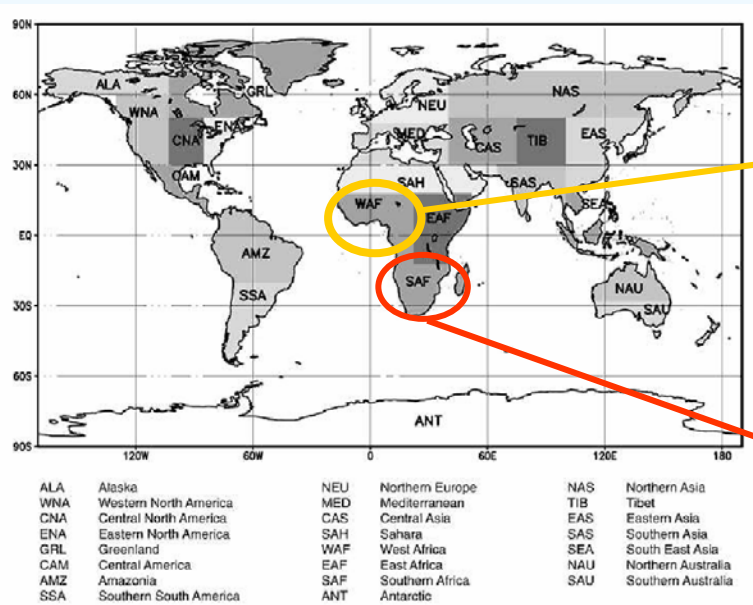
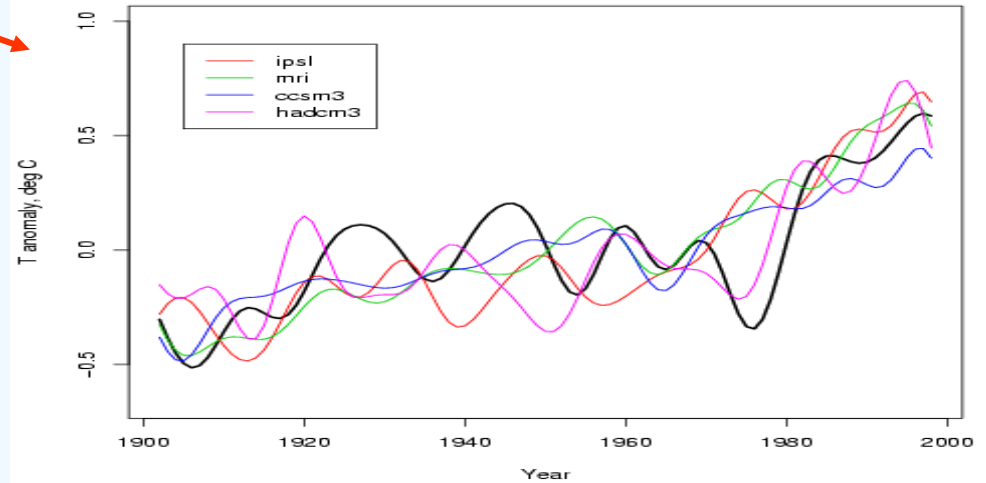


Climate Change Projections Cannot Deliver Predictions of Decadal Variability

Western Africa : Annual-Mean Temperature



Southern Africa : Annual-Mean Temperature

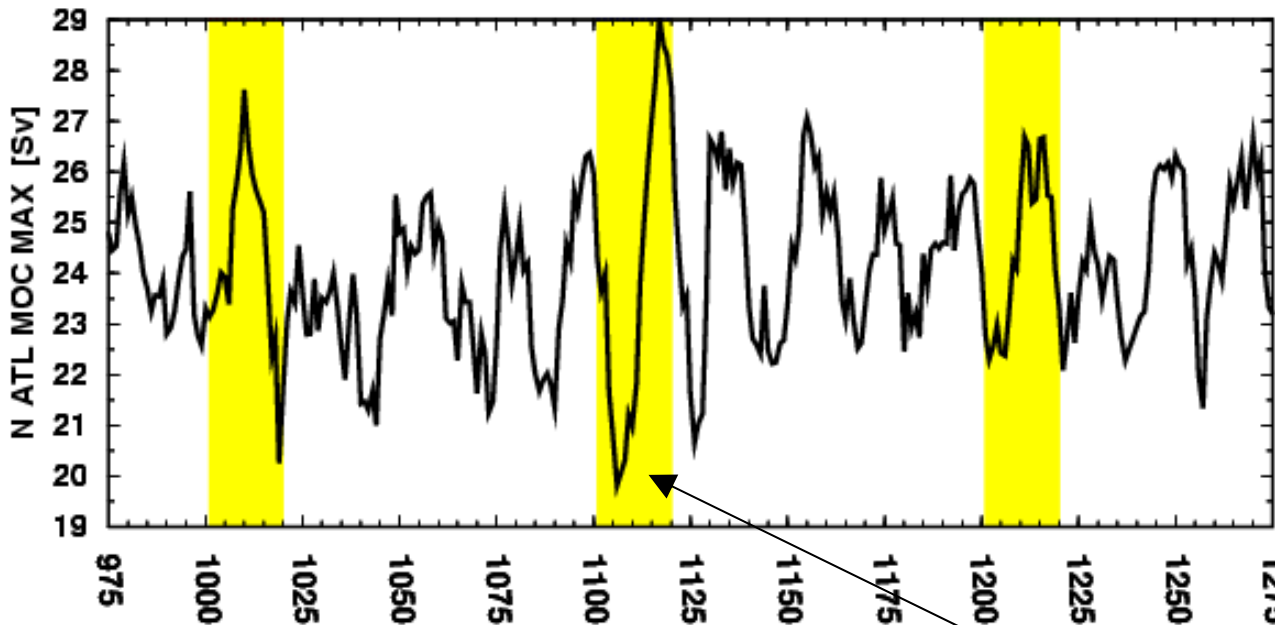


Scientific Basis for Decadal Prediction

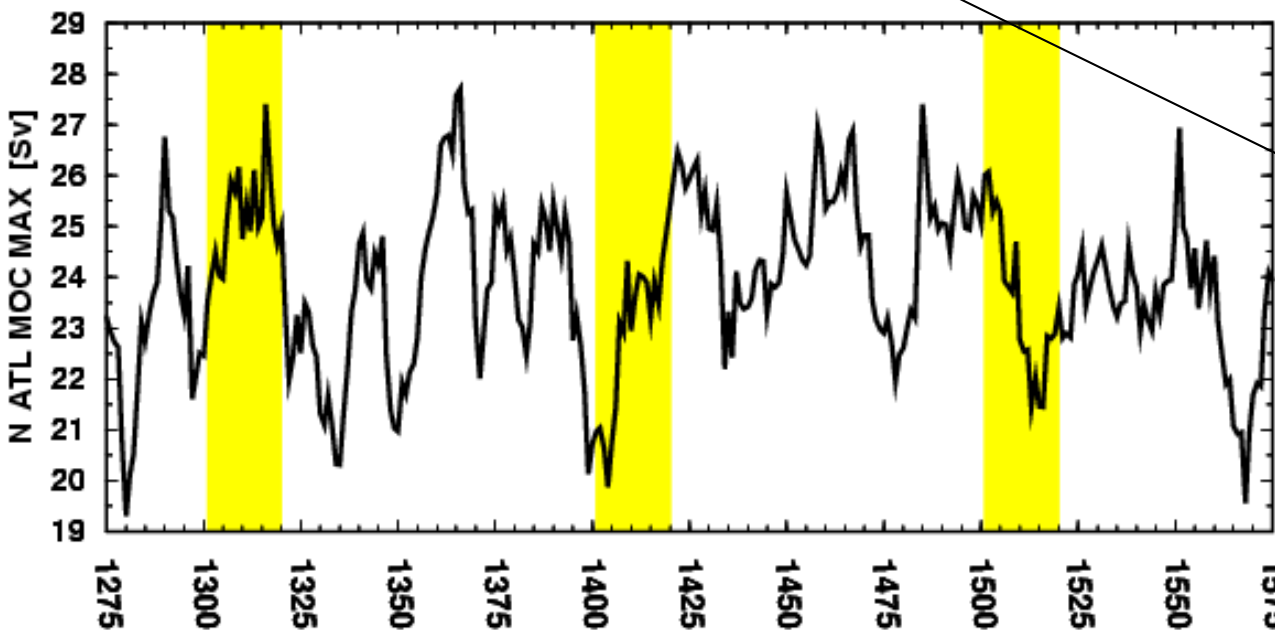
- Existence of decadal predictability needs to be proven
- Null hypothesis: decadal fluctuations in SST associated with the MOC (AMO) or PDO arise from low-pass filtering of unpredictable atmospheric noise by the slow components of the climate system such as the oceans
- But there is some tantalizing evidence from models:
 - ✓ PREDICATE → 60% of decadal variance in Europe/ North Atlantic climate potentially predictable
 - ✓ GFDL workshop → potential predictability of MOC

The N. Atl. MOC in the 1860 Control

CM2.1 1860 CONTROL

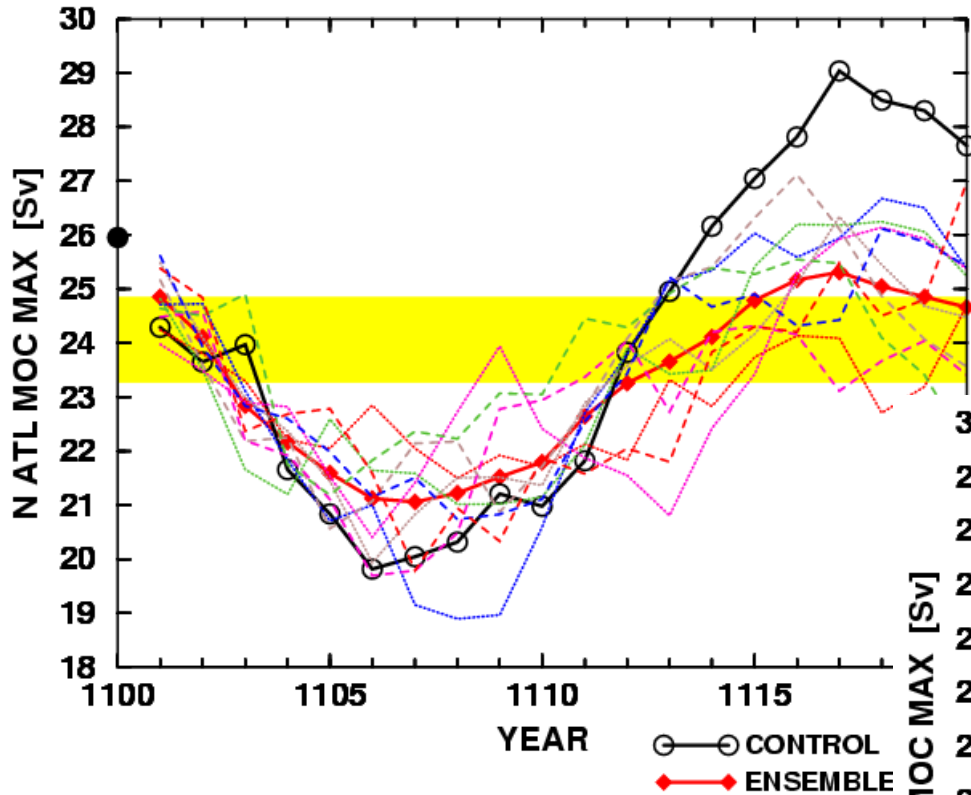


Strength of the Atl. MOC in a long control run of a CGCM. So CO2 is fixed, just looking at natural variability

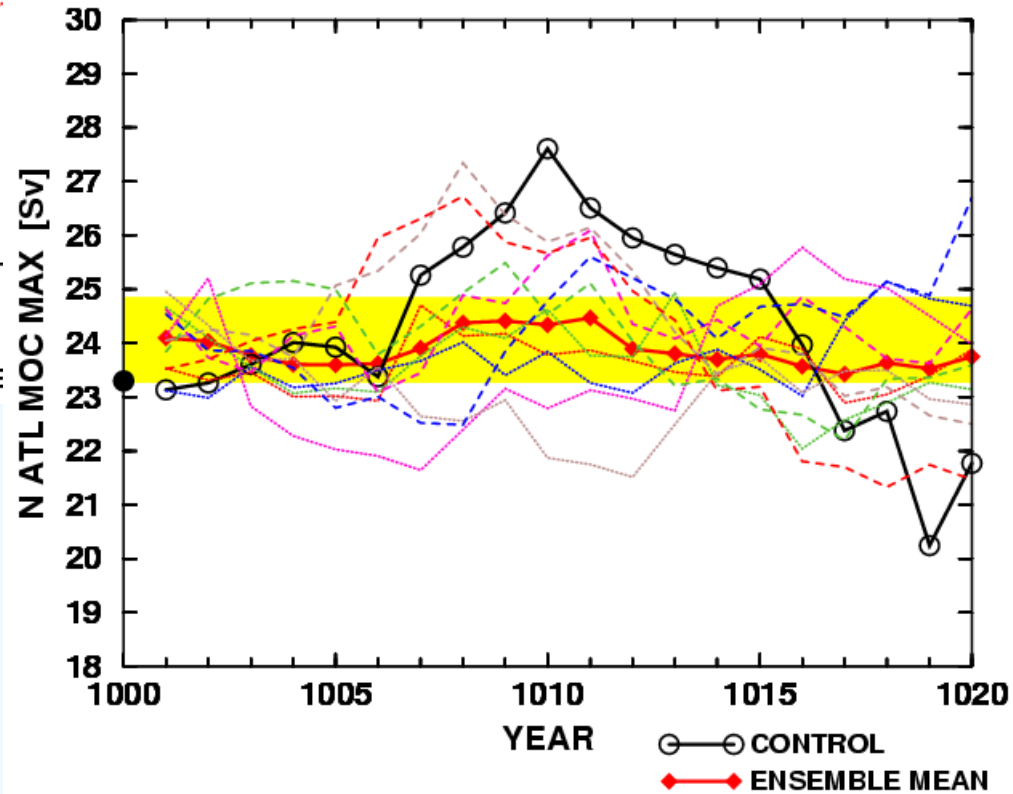


Experimental periods – See if model can predict itself...

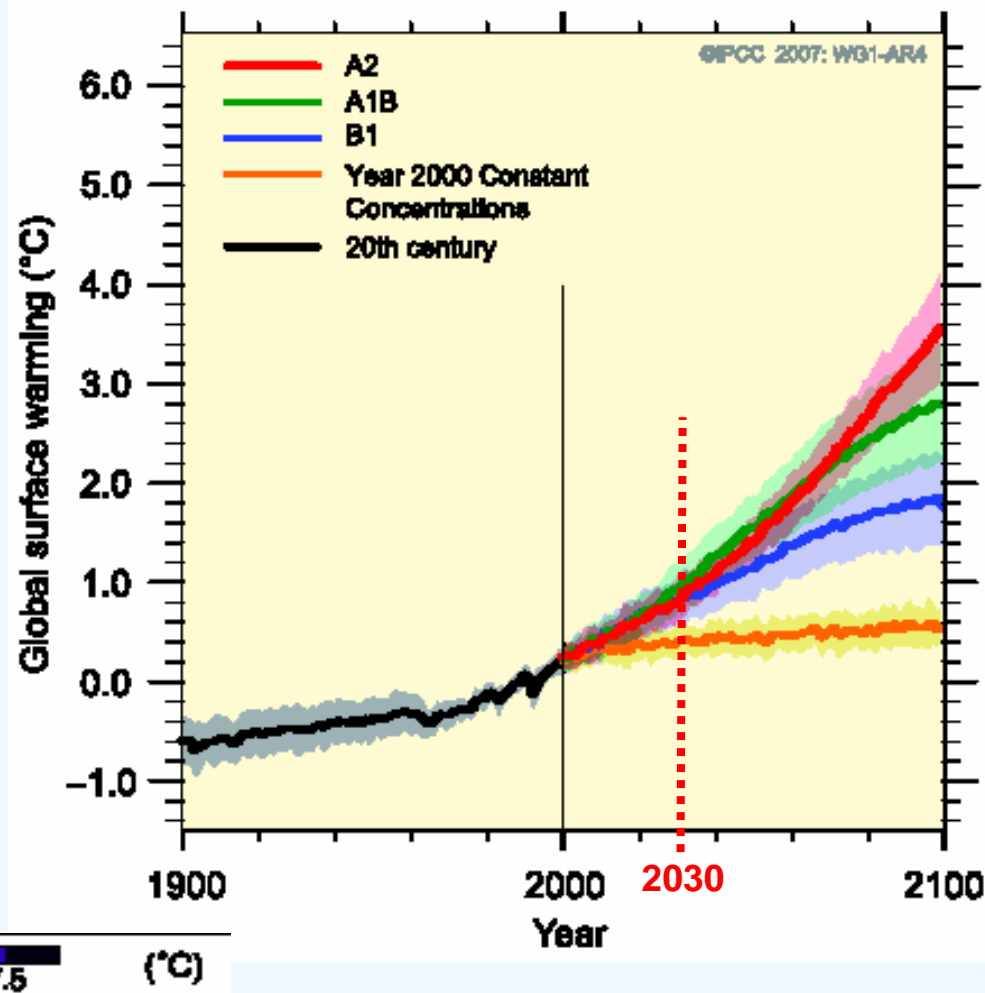
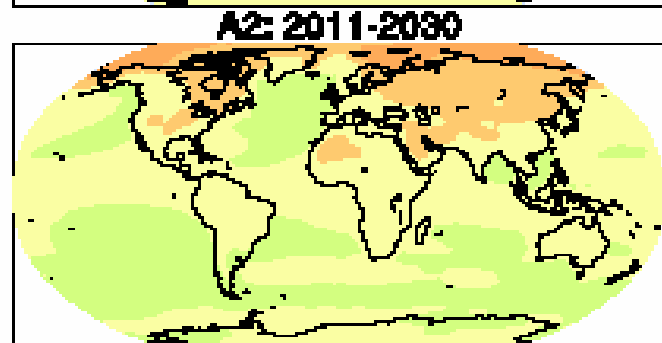
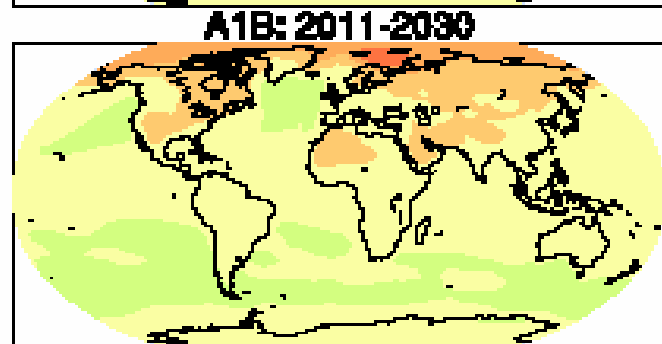
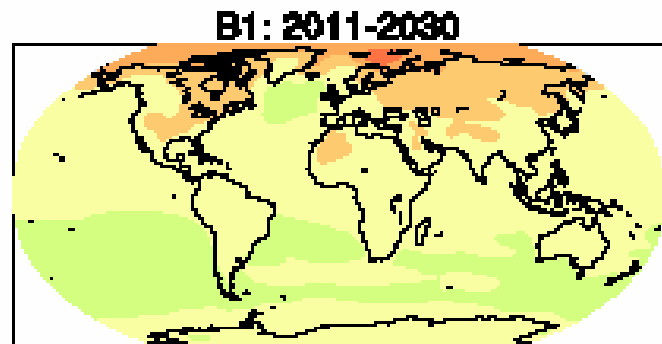
The set starting at Jan 1101



The set starting at Jan 1001



Global Climate Change Projections



Coordinated Decadal Prediction for AR5

Basic model runs:

- 1.1) **10 year integrations** with initial dates towards the end of 1960, 1965, 1970, 1975, 1980, 1985, 1990, 1995 and 2000 and 2005 (see below).
 - Ensemble size of 3, optionally increased to O(10)
 - Ocean initial conditions should be in some way representative of the observed anomalies or full fields for the start date.
 - Land, sea-ice and atmosphere initial conditions left to the discretion of each group.

- 1.2) **Extend integrations** with initial dates near the end of 1960, 1980 and 2005 to **30 yrs.**
 - Each start date to use a 3 member ensemble, optionally increased to O(10)
 - Ocean initial conditions represent the observed anomalies or full fields.

Experimental [Dynamical] Decadal Predictions

❖ Few Pioneers

1. Hadley Centre (Smith et al, 2007 - *Science*)
2. IFM-GEOMAR (Keenlyside et al, 2008 - *Nature*)
3. MPI/Hadley Centre (Pohlman et al, 2008 *submitted*)

❖ Uncertainty (how to present)

❖ Validation/verification

❖ Source(s) of predictability

Smith et al (2007)

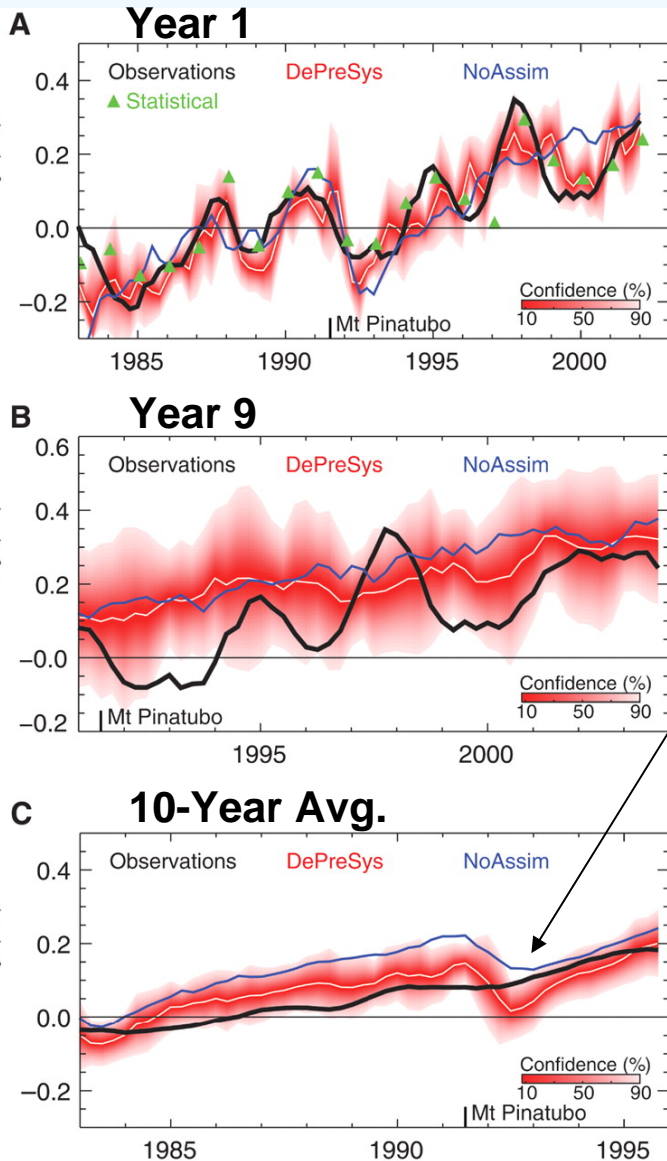


Figure 2

CONS

- Global average
- Little to no evidence of [predictable] LF climate *variability* at long lead

PROs:

- Improved projections relative to original system
- View of **change in uncertainty with time scale**
 - 1) Uncertainty in decadal-average
 - 2) Uncertainty through a decade due to interannual variability
 - 3) Realization of natural variability through decade

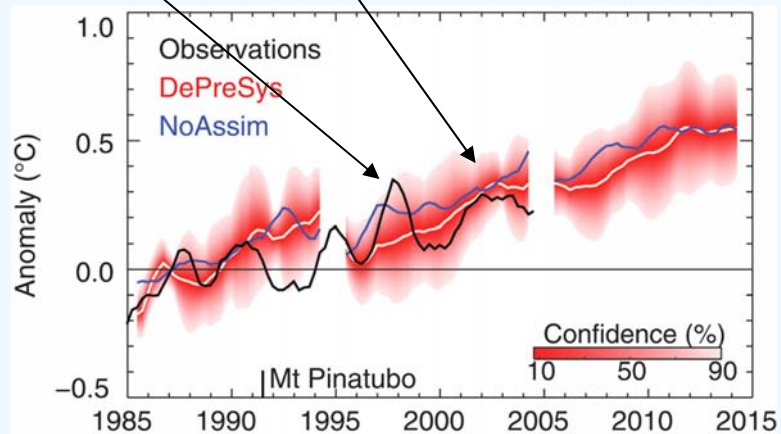


Figure 4

Smith et al (2007)

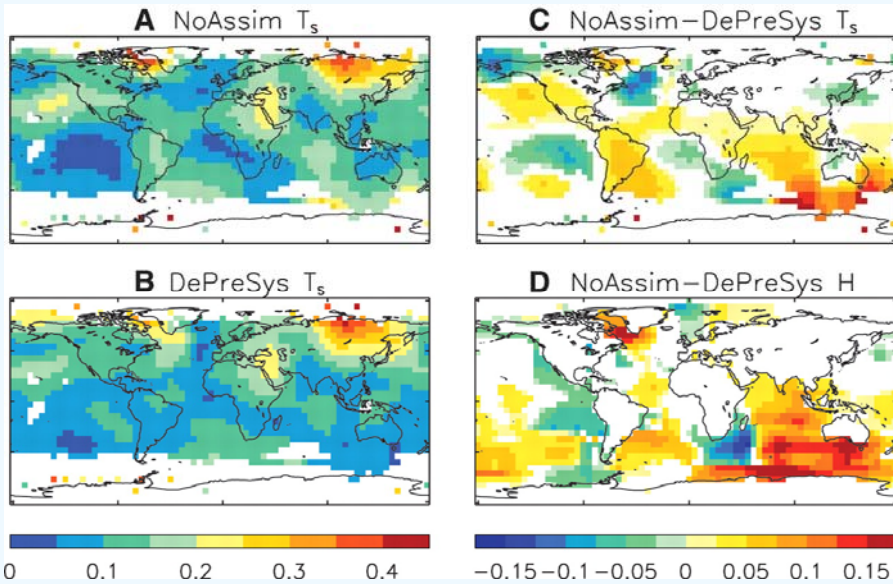


Figure 5

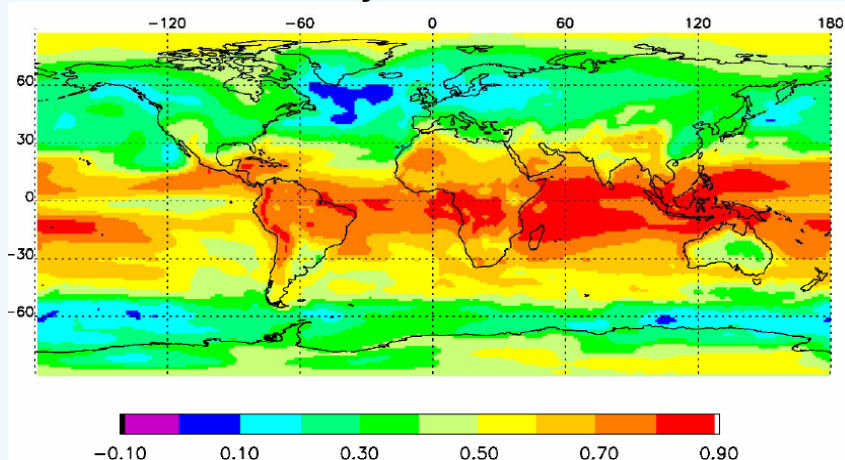
Regionality?

- T_s projections improved over many regions

Climate variability?

- T_s projection worse over N. Atlantic
- Much improvement in regional T is associated with improvement in regional H, which bears striking resemblance to regions where T is dominated by externally-forced signal.

Ratio of Externally-forced to Total Variance



(Courtesy: M. Ting et al, J.Climate, 2009)

US CLIVAR Working Group on Decadal Predictability

Objective 1: *Define a framework to distinguish natural decadal variability from anthropogenically forced variability and to quantify their relative magnitudes.*

Objective 2: *Work towards better understanding decadal variability and predictability through metrics that can be used as a strategy to assess and validate decadal climate predictions and simulations.*

Efforts DPWG Can Potentially Leverage

- ENSEMBLES
- US CLIVAR AMOC Team
- IPCC CMIP3 & CMIP5 (esp. initialized runs)
- THOR (ThermoHaline Overturning at Risk, EU)

Planning for Broad Community Participation in Analysis of Decadal Prediction Experiments

- CMEP (2004): Coupled Model Evaluation Project
 - 19 Funded Proposals (+ 2 lab funded)
 - 18 Papers published (at least)
- DRICOMP (2007): DRought In COupled Models Project
 - 16 Funded Proposals
 - Papers to Journal of Climate special issue on drought (together with results from US CLIVAR Drought WG)
- DECPREP ?? (2010): DECadal PREdictability Project

Prospects for Evaluations of CMIP5 runs?

Opportunity

- CMIP5 model results provide new opportunities...
- Scope of a model-evaluation-type program for AR5?
 - Decadal runs (US CLIVAR Decadal Predictability Working Group) (some interest by the UK)?
 - Value added in CMIP5 models (complexity, fidelity)?
 - Regional, high resolution “applications-focused” (ie links between IPCC WGI and WGII)
- US agency interest in supporting research proposals

**How can VAMOS encourage and coordinate
analyses of CMIP5 runs?**

DPWG Timeline

- January 2009 – finalize membership and prospectus
- February 2009 - first telecon to begin planning activities.
→ Quasi-Monthly telecons: progress on analysis, workshop planning, etc.
- June 2009 – 1st WG meeting, coincident with CCSM workshop
- September 2009 – submit white paper, summarizing key results from WG and May '09 workshop session on isolating natural decadal variability.
- Spring 2011 – Workshop on ‘Defining Metrics to Assess Decadal Predictions in Climate Models’ as part of DECPREP
- Summer 2011 – Write workshop report and WG wrap-up focused on decadal prediction metrics

Other Meetings of Interest:

- **The Eighth Workshop on Decadal Climate Variability: Decadal Climate Predictability and Prediction: Are We Ready?**
October, 2009 St. Michaels, Maryland
- **Predicting the climate of the coming decades**
January 11-15, 2010, RSMAS Miami, FL