US CLIVAR Activities Addressing Long-Term Drought

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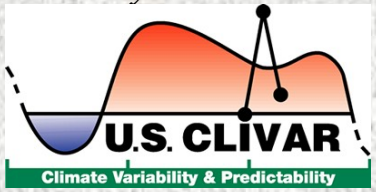
U.S. CLIVAR Office

U.S. Climate Variability and Predictability Program



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WCRP World Climate Research Programme

U.S. CLIVAR Program

Outline

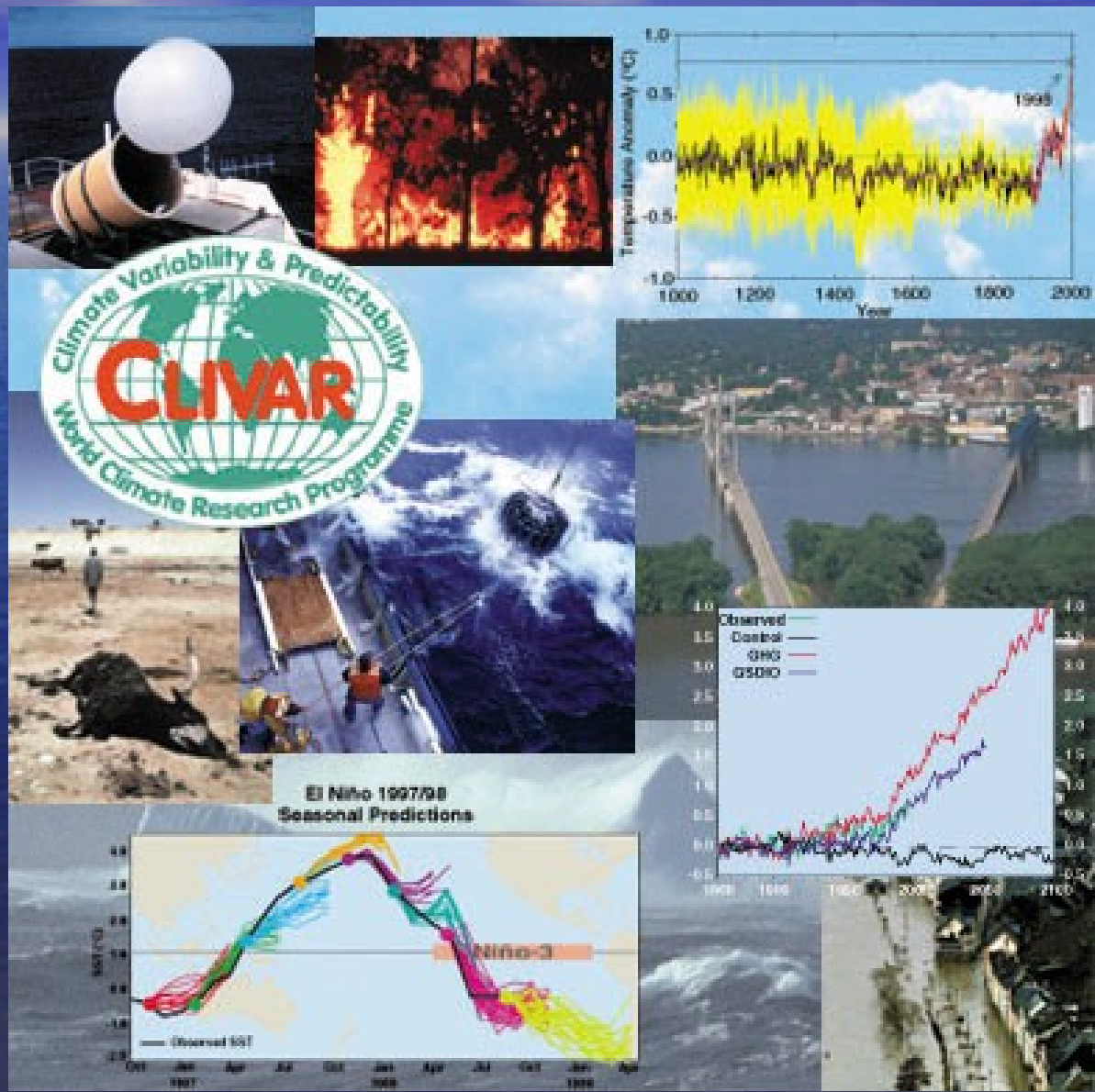
- Quick introduction to CLIVAR
- Motivation for drought research
- Activities Overview
  - DRICOMP
  - Drought Working Group
- Future Opportunities
  - Drought Workshop

CLIVAR (Climate Variability and Predictability)

CLIVAR is an multidisciplinary research effort within the World Climate Research Programme (WCRP) focusing on the variability and predictability of the slowly varying components of the climate system.

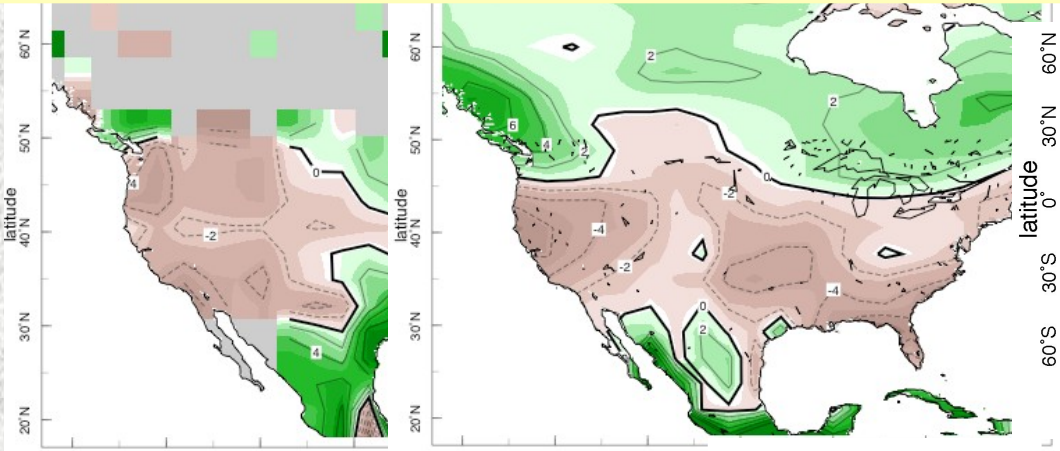
CLIVAR coordinates activities in support of its mission to observe, simulate and predict Earth's climate system, with focus on ocean-atmosphere interactions, enabling better understanding of climate variability, predictability and change, to the benefit of society and the environment in which we live.

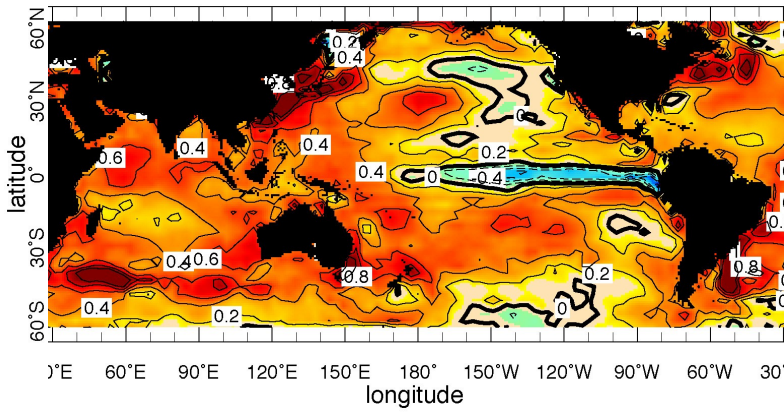
http://www.clivar.org



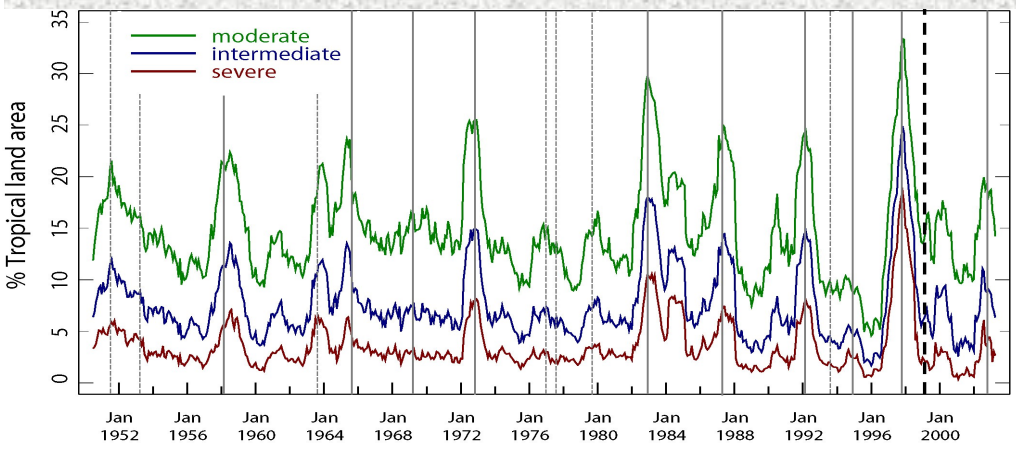
Improve provision of climate forecast information, particularly with respect to drought and other extreme events

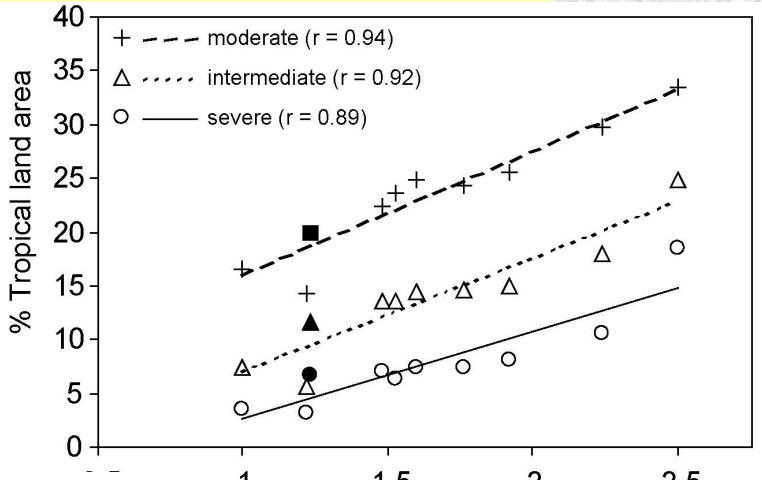
Regions of Mid-latitude Drought Related to La Niña





Spatial Extent of Tropical Drought Correlated with El Niño





Note: 5 month lag between max. Nino 3.4 SSTA a *(B. Lyon, 2004, GRL)*

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Two Major Opportunities Identified as major foci for US CLIVAR:

I Drought

II Decadal Variability/Predictions

Science Foci Are Increasingly Being Motivated by Interactions with Service and Decision Making Communities

Drought

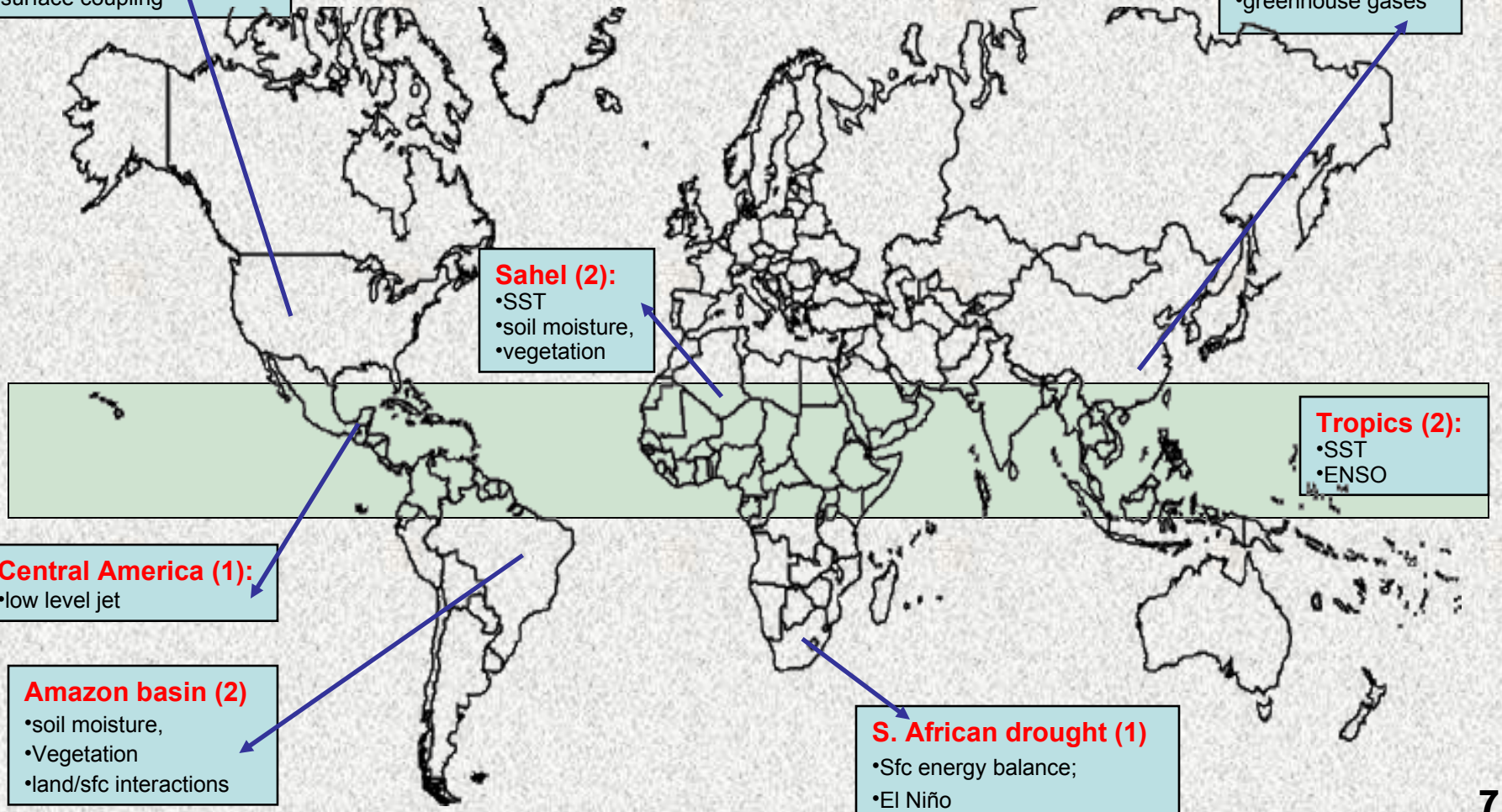
DRICOMP (DRought In COupled Models) Project

- Follow-on to CMEP (Coupled Model Evaluation Project) which was the kernel that lead to a large international workshop (Hawaii) and many papers that contributed to the IPCC FAR.
- DRICOMP: Evaluation of existing relevant model simulations
  - CMIP3, Paleo Models, NARCCAP, SMIP, C20C

Aims: Identify and characterize physical and dynamical mechanisms leading to drought and the mechanisms through which drought may change as climate changes. Diagnose simulation of drought in current models.

17 projects ($30K each) - supported by NOAA, NASA, NSF, and DOE

US DRICOMP (DRought In COupled Models) Project



N. American drought (12)
- SST forcing,
- ENSO,
- soil moisture,
- sfc energy balance,
- land-surface coupling

E. Asia (1):
- SST
- greenhouse gases

Sahel (2):
- SST
- soil moisture,
- vegetation

Tropics (2):
- SST
- ENSO

Central America (1):
- low level jet

Amazon basin (2)
- soil moisture,
- Vegetation
- land/sfc interactions

S. African drought (1)
- Sfc energy balance;
- El Niño

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Drought

The US CLIVAR Drought Working Group

- Coordinate and encourage the analysis of observational data sets to reveal antecedent linkages of multi-year drought
- Propose a working definition of drought & related model predictands
  Exploring use of land data assimilation products for operational monitoring, assessment and hydrological applications
- Executing model experiments to address outstanding uncertainties of multi-season droughts and potential role of ocean and land
- Coordinating key aspects of the (US) long-term drought research agenda outlined in the 2005 drought workshop recommendations
- Interact with the developing NIDIS program to communicate current drought prediction and attribution capabilities.
- Organize a community workshop in 2008 to present and discuss results

The US CLIVAR Drought Working Group

U.S. Membership

- Tom Delworth NOAA GFDL
- Rong Fu Georgia Institute of Technology
- **Dave Gutzler (co-chair)** University of New Mexico
- Wayne Higgins NOAA/CPC
- Marty Hoerling NOAA/CDC
- Randy Koster NASA/GSFC
- Arun Kumar NOAA/CPC
- Dennis Lettenmaier University of Washington
- Kingtse Mo NOAA CPC
- Sumant Nigam University of Maryland
- Roger Pulwarty NOAA- NIDIS Director
- David Rind NASA - GISS
- **Siegfried Schubert (co-chair)** NASA GSFC
- Richard Seager Columbia University/LDEO
- Mingfang Ting Columbia University/LDEO
- Ning Zeng University of Maryland

International Membership: Ex Officio

- Bradfield Lyon International Research Institute for Climate
- Victor O. Magana Mexico
- Tim Palmer ECMWF
- Ronald Stewart Canada
- Jozef Syktus Australia

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Drought Working Group WebPage

- http://www.usclivar.org/Organization/drought-wg.html
- Information on:
  - Drought WG prospectus
  - Relevant meetings
  - Summary of teleconferences (approximately monthly)
  - List of relevant model simulations
  - List of relevant observational data sets
- maintained by U.S. CLIVAR Project Office (Cathy Stephens)

Model Simulation Subgroup

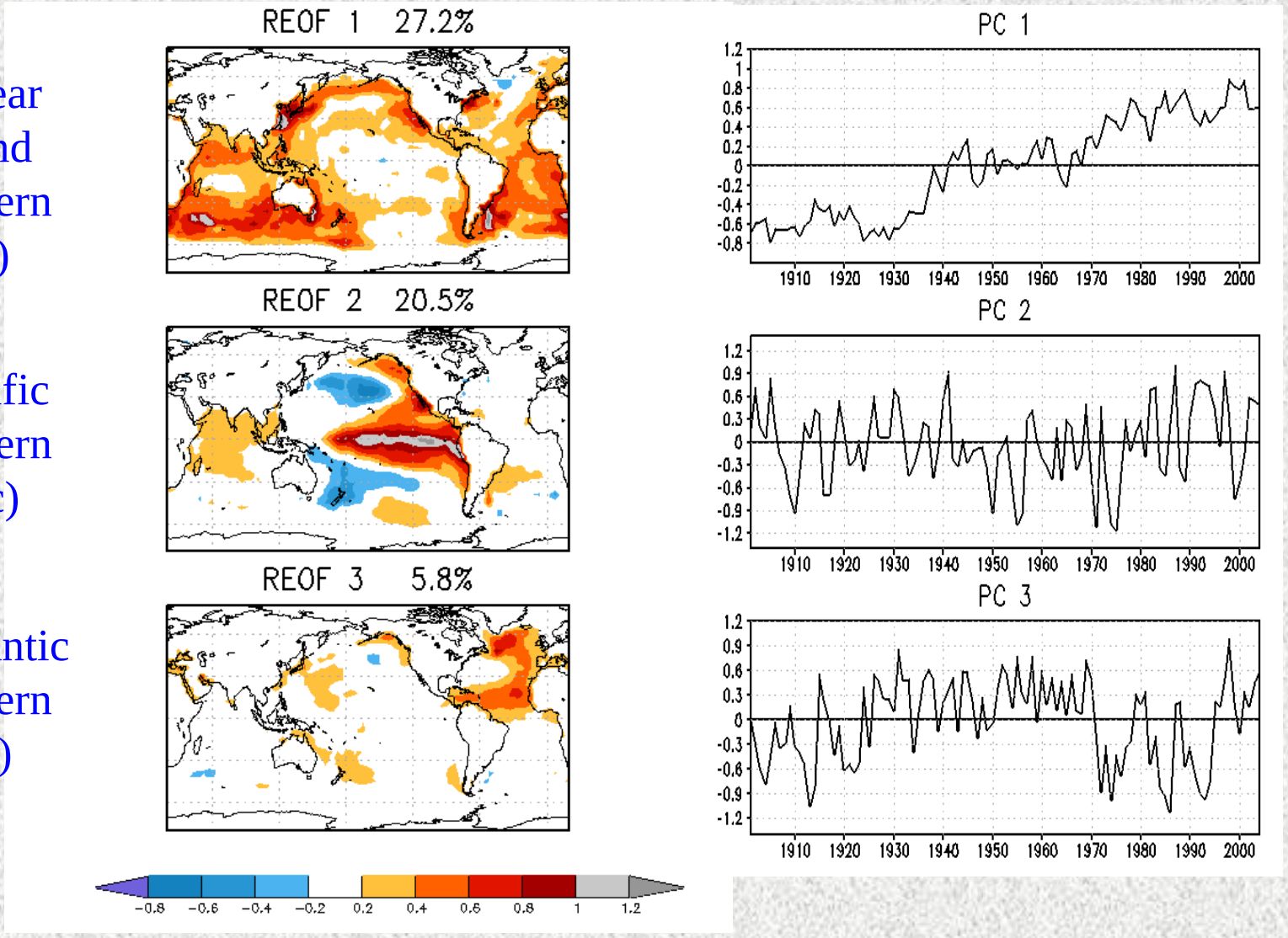
- Existing runs: Website has list of existing relevant model simulations
- New runs: The idea is for several modeling groups to do identical (somewhat idealized) experiments to address issues of model dependence on the response to SSTs (and the role of soil moisture), and to look in more detail at the physical mechanisms linking the SST changes to drought
- Strategy: Idealized SST *forcing* based on combinations of EOFs of Pacific and Atlantic SSTs, to assess role of Tropical Pacific, N. Atlantic, global SST trend, uniform warming case, plus soil moisture experiment. Each run should be at least 51 years.
- Analysis: Model results will be shared via a GDS. Analysis coordinated by Drought Working Group.

Leading EOFs and Time series (annual mean SST - 1901-2004)

Linear Trend Pattern (LT)

Pacific Pattern (Pac)

Atlantic Pattern (Atl)



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Participating models

NASA (NSIPP1 and GEOS-5) - Contact: S. Schubert
GFDL - Contact: Tom Delworth
NCEP - Kingtse Mo and Jae Schemm
CCM3 - Contact: Richard Seager
CAM3.5 - Contact: Aiguo Dai

Making these model runs available to others has yet to be determined.

Idealized Experiments

N. Atlantic

PacInd

	warm	neutral	cold
warm	ww	wn	cw
neutral	nw		nc
cold	wc	cn	cc

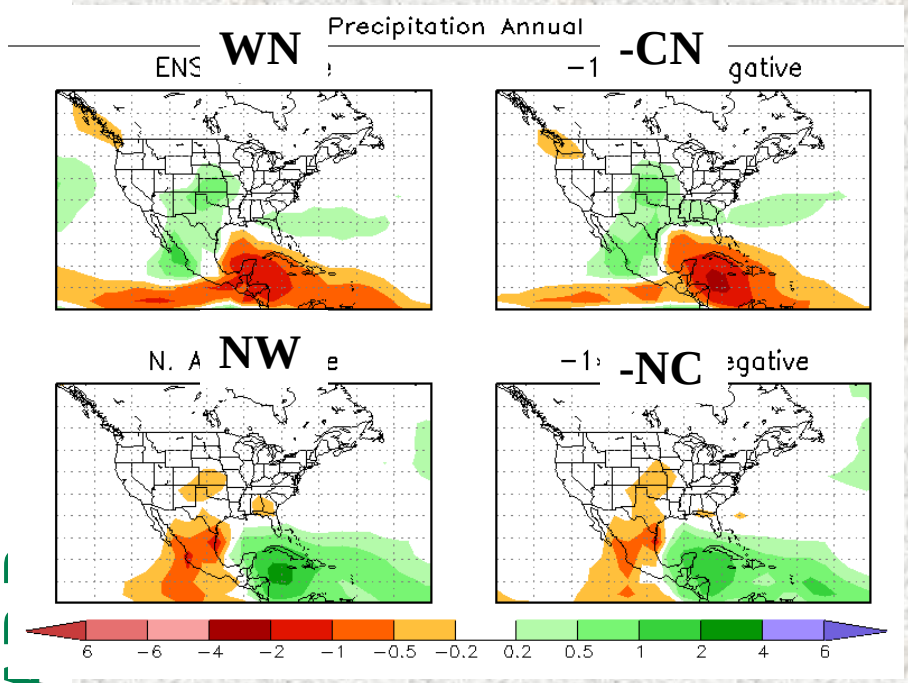
SST Forcing patterns
(warm phase)

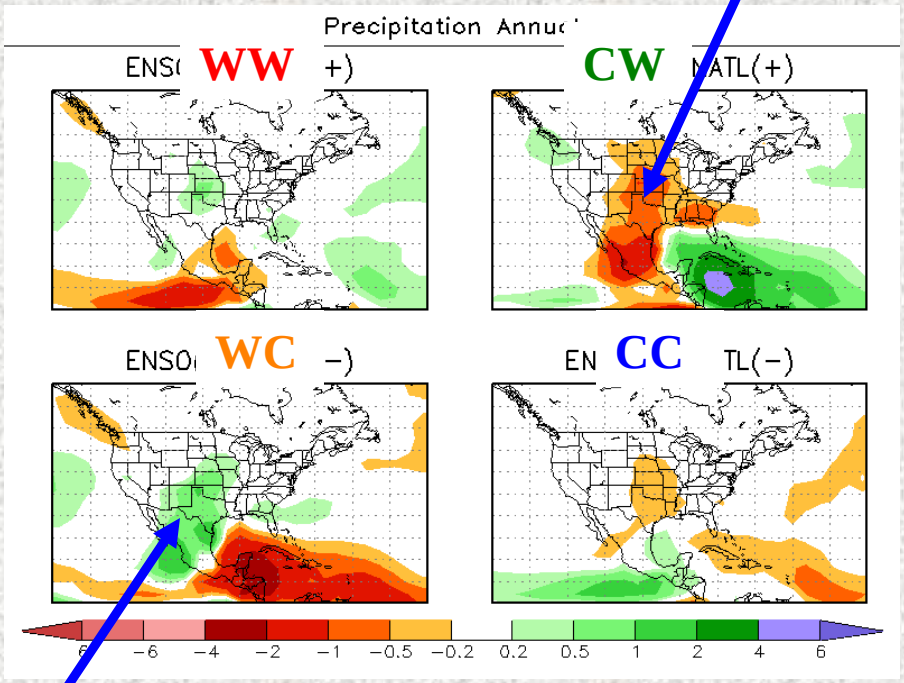
Impacts of Pacific and Atlantic Patterns

Some results with the NASA NSIPP-1 AGCM

Annual Mean Precipitation Responses

Major drought conditions



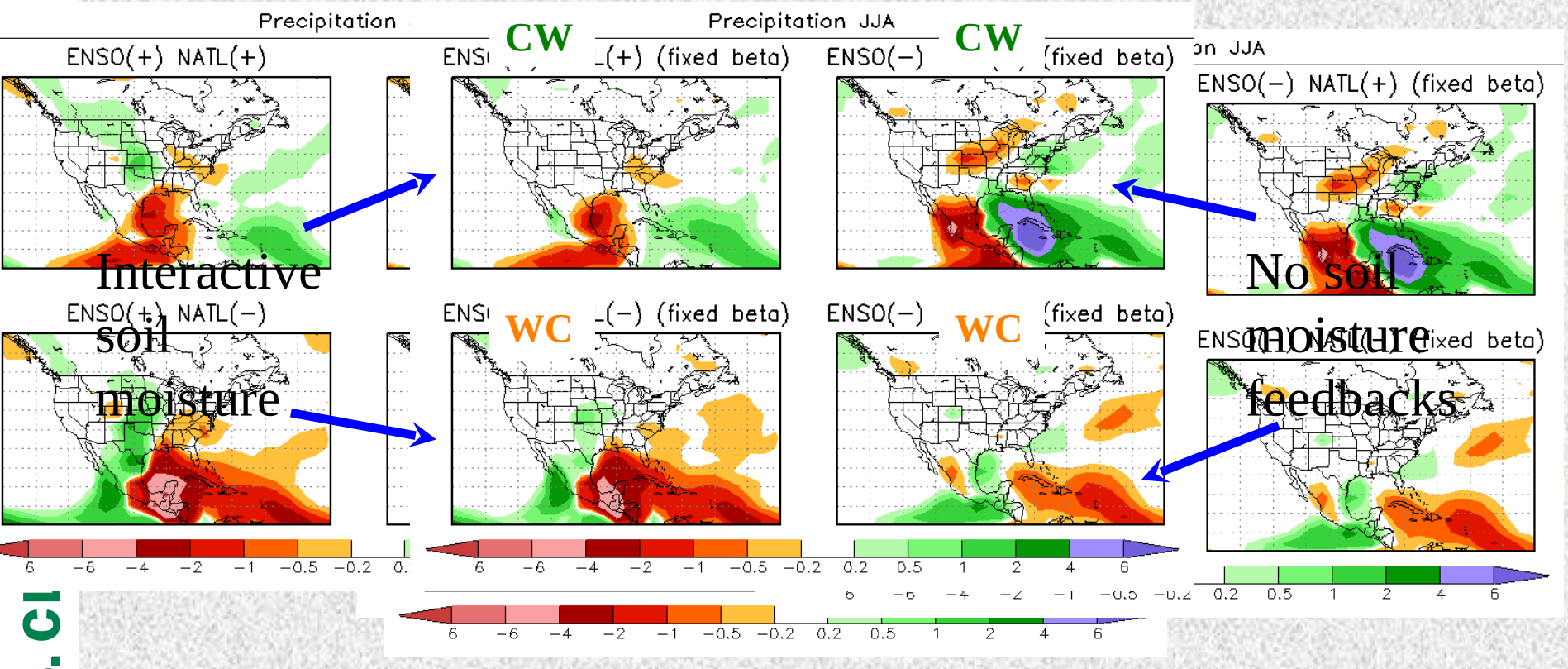


Responses to individual EOFs

Pluvial conditions

Responses to combined EOFs

Impact of Soil Moisture Feedbacks on JJA Precipitation



33rd Climate Diagnostics and Prediction Workshop

Jointly sponsored by NOAA and US CLIVAR (NSF, NASA, DOE)

October 20-24, 2008

Lincoln, NE

Major themes:

- improving climate predictions / predictability
- understanding and attribution of drought and its impacts
- incorporating climate predictions /projections in the development and delivery of drought products.

Meeting Highlights

- DRICOMP program results
- US CLIVAR Drought Working Group findings
- Town-Hall discussion on Drought

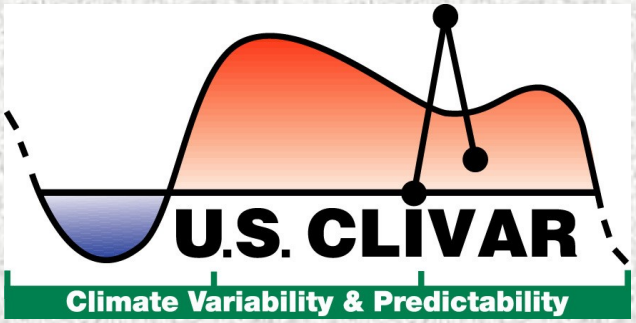
Science foci includes

- Drought across multiple time scales (weekly through centennial and longer)
- Droughts across the Americas and other continents (Africa, Asia, etc.).
- Assessments of the role of ocean, land, and seasonal cycle in multi-year droughts as evidenced in coupled models (especially from IPCC CMEP-3)
- Linkages between drought research and societal needs

http://www.cpc.ncep.noaa.gov/products/outreach/meetings.shtml

Summary

- US CLIVAR DRICOMP & Drought Working Group are focusing on long-term drought (causes, mechanisms, simulation) research questions & capabilities (keeping NIDIS in mind)
- Would like to engage similar international efforts such as DRI and encourage coordination of research investigations on droughts in other regions…
- Drought workshop (Oct 2008) will be a major opportunity to present initial conclusions of coordinated US drought research efforts… DRI should be present



Thank you

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US CLIVAR Working Groups

- Limited lifetime (2 yrs)
- Very focused… measurable outcomes
- Compelling subject areas…CLIVAR +
- Leveraging existing research resources
- Entraining wider community
- Limited funds (teleconferences, a meeting, workshop)
- Yearly call within US CLIVAR Panels for WG proposals

US CLIVAR Working Groups - incredibly energetic; successful in catalyzing and advancing research in focused areas

The US CLIVAR Drought Working Group

Other interested participants

- Lisa Goddard <goddard@iri.columbia.edu>
- Alex Hall <alexhall@atmos.ucla.edu>
- Jerry Meehl meehl@ucar.edu
- Jin Huang Jin.Huang@noaa.gov
- John Marshall <jmarsh@MIT.EDU>
- Adam Sobel <ahs129@columbia.edu>
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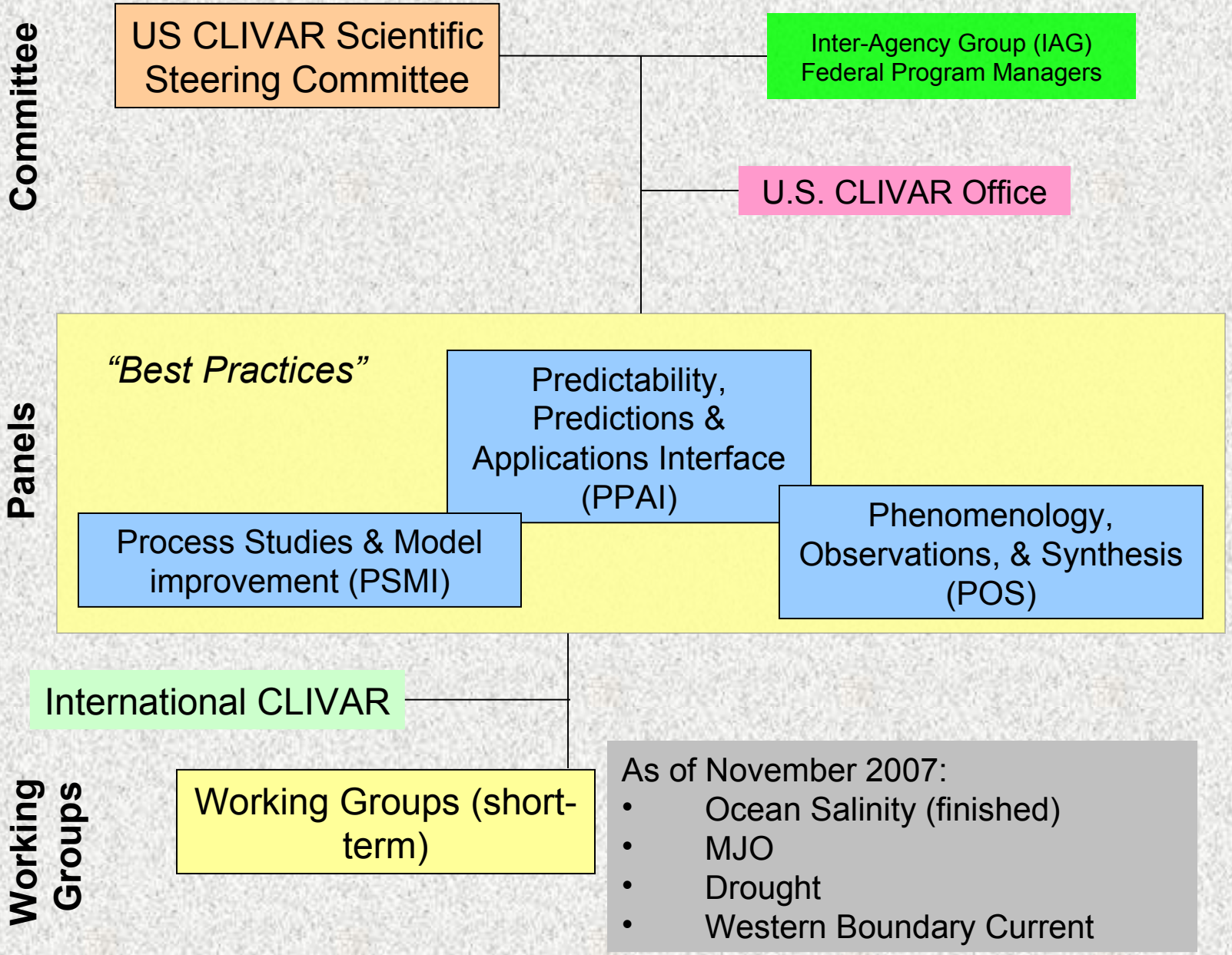
- Aiguo Dai adai@ucar.edu
- Alfredo Ruiz-Barradas <alfredo@atmos.umd.edu>
- Jae Kyung E Schemm <Jae.Schemm@noaa.gov>

Aims of US CLIVAR

- Coordination and leadership of scientific community addressing CLIVAR objectives
  - Develop tactical and strategic “guidance” for the community and the research agencies
  - Develop “best practices”
  - Coordinate and assess progress of key activities…
- Coordination of programmatic community - inter and intra-agency programs
  - Develop, coordinate, and promote programs across the agencies
- Coordinate US and Int’l CLIVAR activities

U.S. CLIVAR Organization



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