International CLIVAR Modeling

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International CLIVAR Modeling

- WGSIP Centric View of CLIVAR Modeling
  - Initial Phase:
    - Emphasized Seasonal Time Scales
    - Potential Predictability – Perfect BCs
    - Assessment of Coupled Model Simulations
  - Current Phase:
    - Time Scales to include Sub-seasonal and Decadal
    - Real Prediction and Realizable Predictability
    - Emphasis on Probabilistic Prediction and Multi-Model Ensembles
- GLACE: CLIVAR-GEWEX Collaborative Project
- Impact of Amazon Deforestation on Coupled Variability
- Regional Modeling
- Climate Observation and Prediction Experiment (COPE)
  - Task Force for Seasonal Prediction (TFSP)-WGSIP Collaboration/Workshop
  - Evaluation of Current Seasonal Prediction Capability and Skill in the Americas
Annual mean 2N–2S SST – without flux correction

No Flux Correction

Annual mean 2N–2S SST – flux corrected

Flux Corrected

STOIC Project
NINO3 Skill Score Comparison
(Systematic Error Removed)

Multi-Model Ensemble

- SIO-180 Cases
- U0X-312 Cases
- LDEO1-288 Cases
- NCEP-192 Cases
- COLA-180 Cases
- LIM-323 Cases
Effect of Increasing Ensemble Size

Precipitation, RPSS over Tropics
Forecast start month and years: May / 1987-1999
Average over 2-4 months FC (JJA)

Multi-Model
Single-Model

From DEMETER (ECMWF)
Global Land-Atmosphere Coupling Experiment

An intercomparison of land-atmosphere coupling strength across a range of atmospheric general circulation models

GEWEX – CLIVAR Collaboration
Amazon Deforestation on Enhances Coupled Variability: Impacts on Predictability?
High Resolution Regional Modeling of South American Interannual Variability

Low Level Jet Variability - Impact on Precipitation Variability?
SMIP (Seasonal prediction Model Intercomparison Project)

- **Organized by**: World Climate Research Programme
  Climate Variability and Predictability Programme (CLIVAR)
  Working Group on Seasonal to Interannual Prediction (WGSIP)
- **Coordinators**: G. Boer (CCCma), M. Davey (UKMO), I.-S. Kang (SNU), and K. R. Sperber (PCMDI)

### Purpose

Investigate 1 or 2 season potential predictability based on the initial condition and observed boundary condition

### SMIP Experimental Design

- Model Integration: 7 month x 4 season x 22 year (1979-2000), 6 or more ensembles
- 4 institute 5 models have been participated.

: NCEP (USA), CCCma (Canada), SNU/KMA (Korea), MRI/JMA (Japan)

### Models used

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<tr>
<th>Institute</th>
<th>Resolution</th>
<th>Experiment Type</th>
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<td>NCEP</td>
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Climate System Observations and Prediction Experiment (COPE)

Task Force for Seasonal Prediction (TFSP)

Hawaii Workshop November 2003
Scientific Direction and Structure of WCRP

- Determine to What Extent Climate can be Predicted
- Determine the Extent of Man’s Influence on Climate

- WCRP Activities will Lead to the Prediction of the Total Physical Climate System Including an Assessment of What is and What is not Predictable
• Four Major Programs
  – CLIVAR: Climate Variability
  – GEWEX: Water Cycle and Energy
  – CliC: Cyrosphere in Climate
  – SPARC: Stratosphere in Climate

• Two Major Modeling Activities
  – WGNE: Working Group on Numerical Experimentation
  – WGCM: Working Group on Coupled Modeling
Climate System Observations and Prediction Experiment (COPE)

• Seamless Prediction of the Total Physical Climate System from Weeks Through Decades
• Synthesizes Ongoing Observational and Modeling Activities of the all Relevant WCRP Components

• Three Central Themes:
  – Describe Structure and Variability of the Total Climate System Through Modeling and Observational Studies
  – Assess the Predictability of the Total Climate System by Making Predictions
  – Understand Mechanisms and Uncertainty of Regional Climate Change Prediction
Task Force for Seasonal Prediction: Hypothesis

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

• Seasonal Predictability Needs to be Assessed with Respect to a Changing Climate
  – Use IPCC Class Models
  – Climate Change is More than just Global Warming
    • Example: Land Use Change
Interactive Atmosphere-Ocean-Land-Ice Prediction Experiment

• Best Possible Observationally Based Initialization of all the Components of Climate System
• Six Month Lead Ensemble (10 member) Fully Interactive Predictions of the Climate System
  – Predictions Initialized Each Month of Each Year 1979-Present
• Interactive Model:
  – Ocean – Open but interactive (e.g., slab mixed layer or GCM)
  – Atmosphere – Open but interactive, most likely a GCM
  – Land – Open but interactive, e.g. SSiB, Mosaic, BATS, CLM, Bucket …
  – Ice – Open but interactive (e.g., thermodynamic or dynamic)
Interactive Atmosphere-Ocean-Land-Ice Prediction Experiment

- **ENSO Mechanism Diagnostic (Example)**
  - Recharge Oscillator vs. Delayed Oscillator
  - Role of Westerly Wind Bursts/Stochastic Forcing

- **Impact of AO on Seasonal Predictability**

- **Regional Predictability**
  - Monsoons
  - Diurnal Cycle/Low Level Jets
  - South American Climate

- **Coupled Feedbacks**
  - Intraseasonal Variability
  - Warm Ocean Processes (i.e., Indian and West Pacific)
  - Remote Impact of Deforestation on Predictability
COPE-TFSP Implementation

- Evaluation of Current Seasonal Prediction Capability and Skill
  - WGSIP and Regional Panel Driven Science
    - What Fields to Verify?
    - What Data Sets to Use?
    - For Example: Collaborative Effort Between VAMOS and WGSIP to Evaluate Current Seasonal Forecast Skill over the Americas

- TFSP Experiments: VAMOS-WGSIP Collaboration
  - How to Initialize and Verify
  - Science Questions/Problems
  - How to Solidify Collaboration