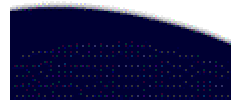


VPM-7

International CLIVAR Modeling

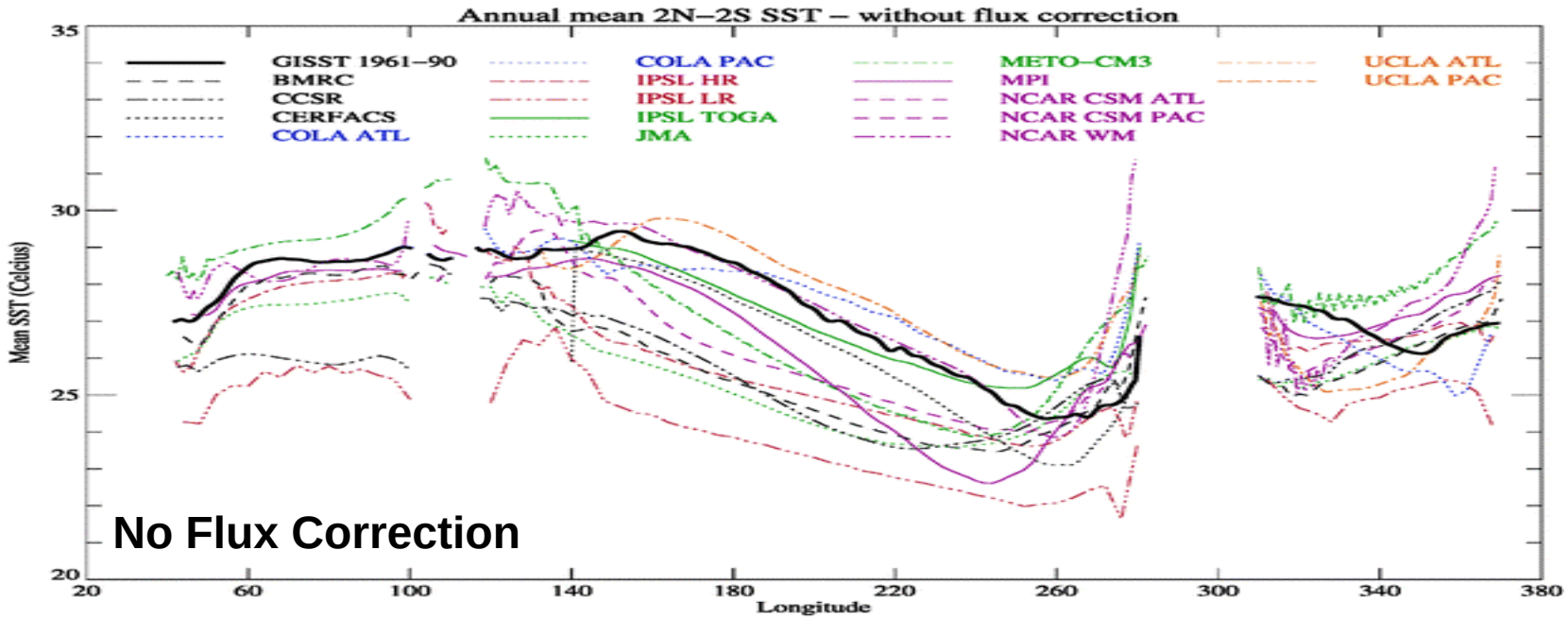
Ben Kirtman

George Mason University

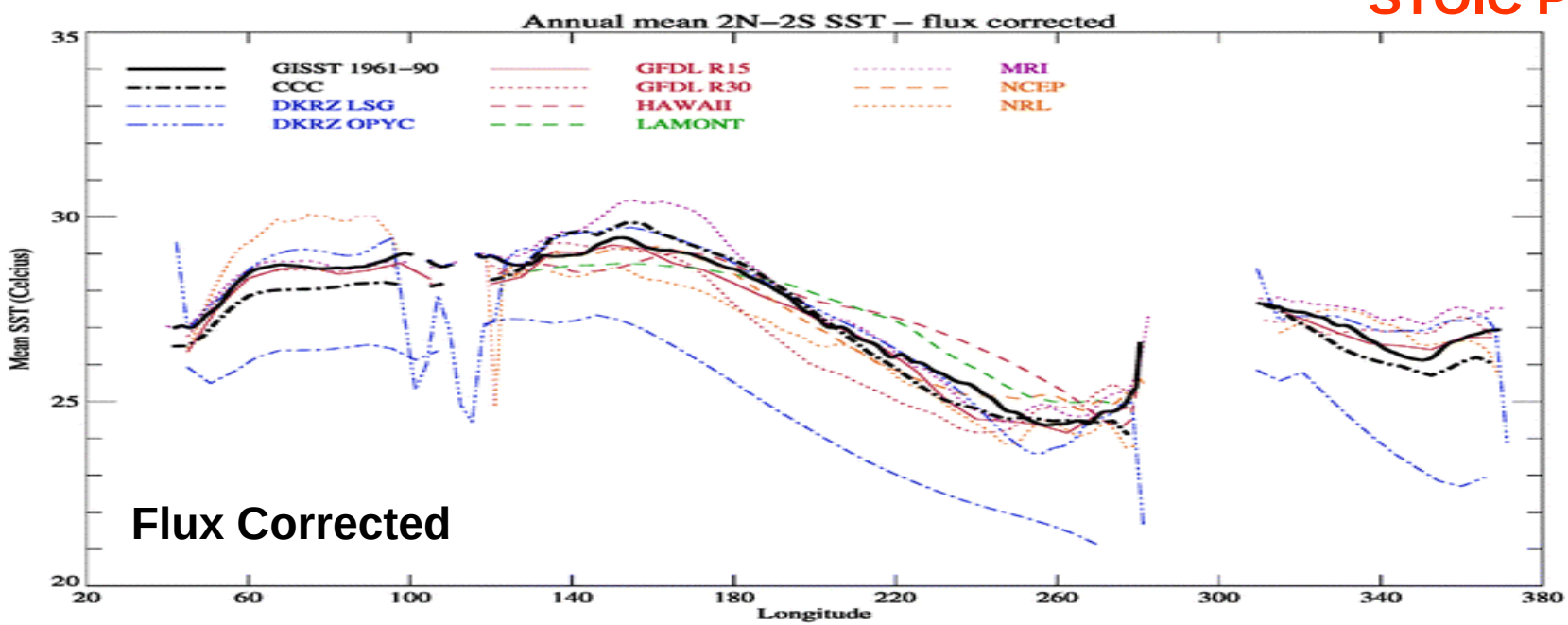
Center for Ocean-Land-Atmosphere Studies

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



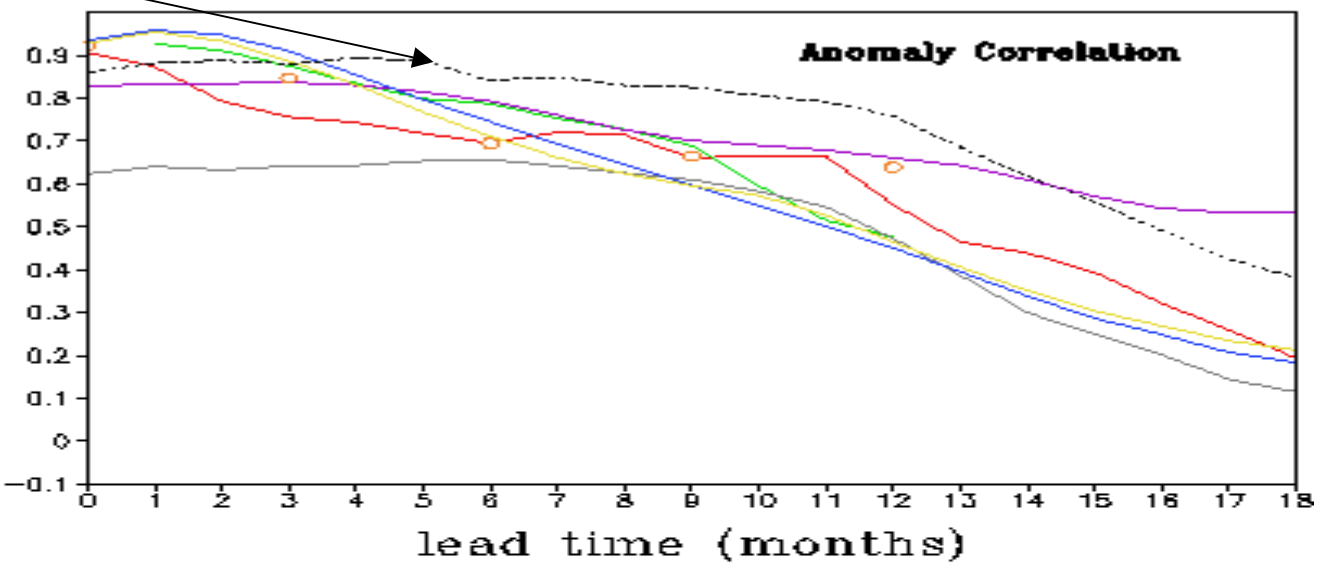
STOIC Project

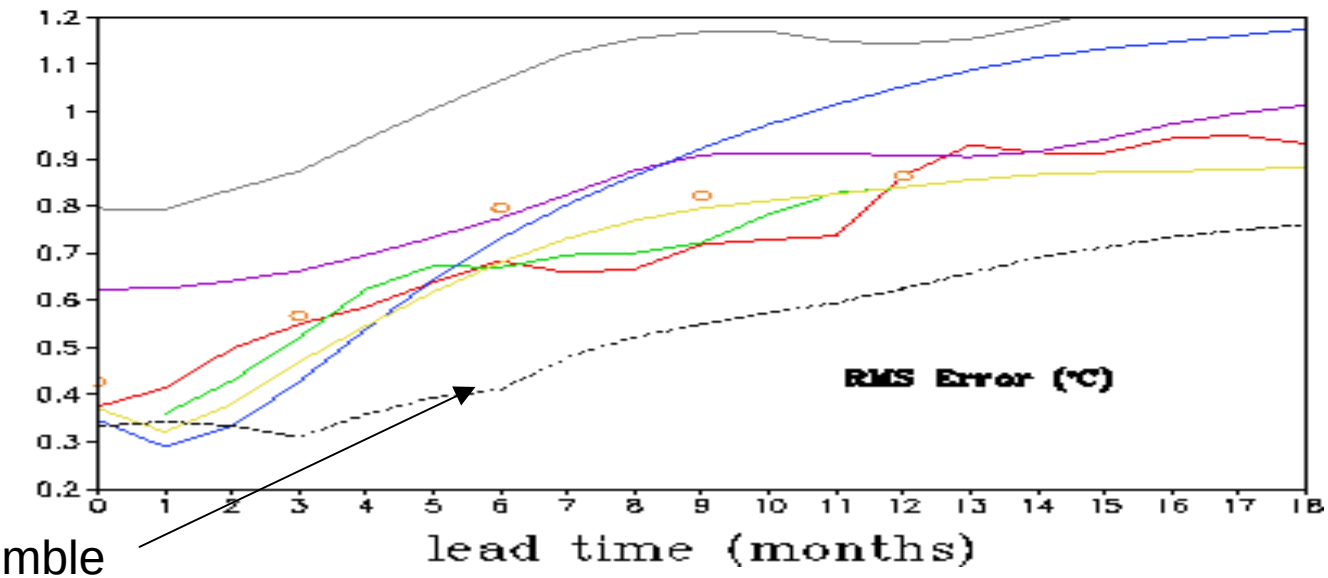


NINO3 Skill Score Comparison (Systematic Error Removed)

Multi-Model Ensemble

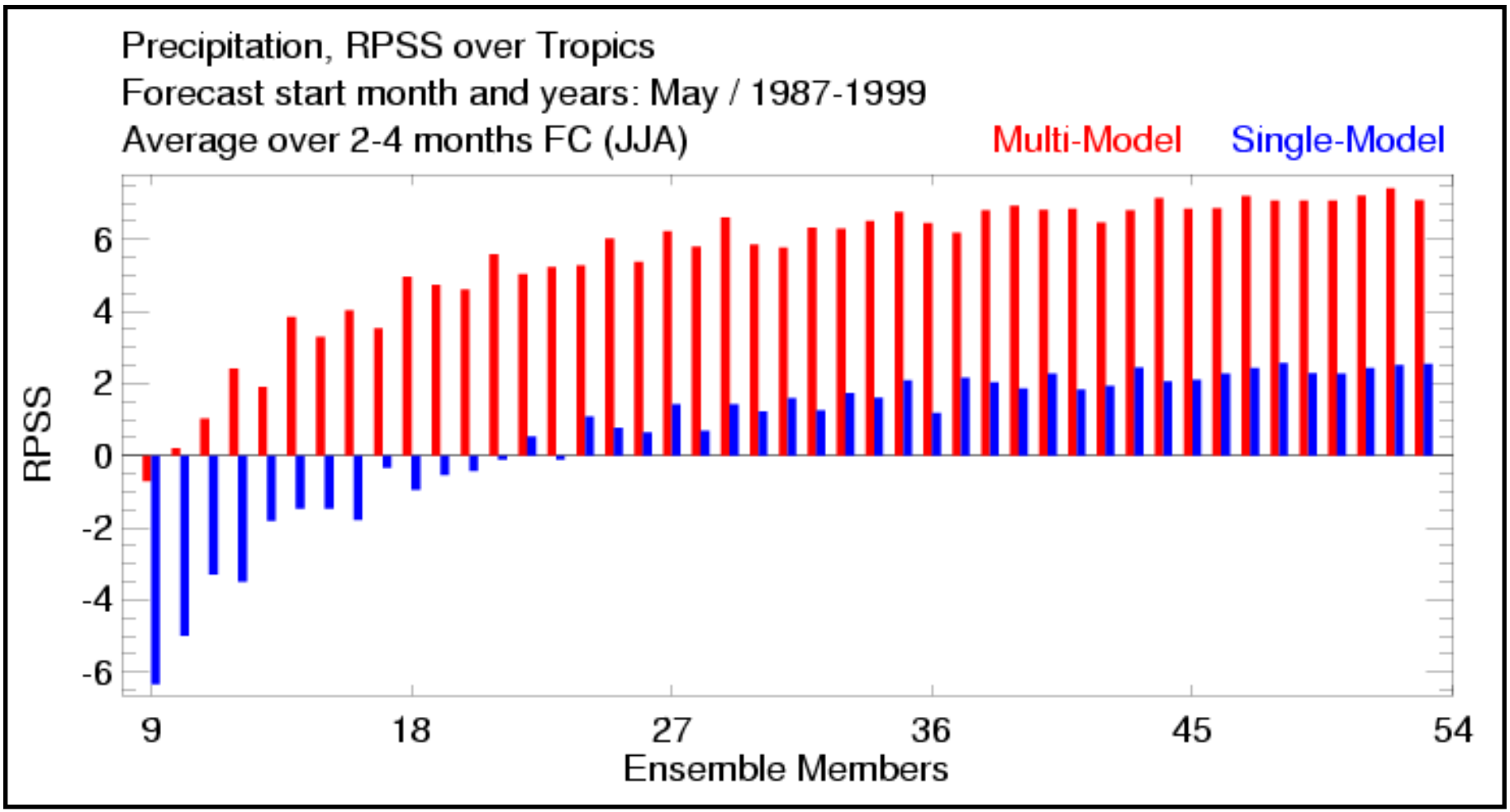
SIO–160 Cases
UOX–312 Cases
LDEO1–288 Cases
LDEO2–288 Cases
NCEP–192 Cases
COLA–180 Cases
LIM–323 Cases





Multi-Model Ensemble

Effect of Increasing Ensemble Size



From DEMETER (ECMWF)

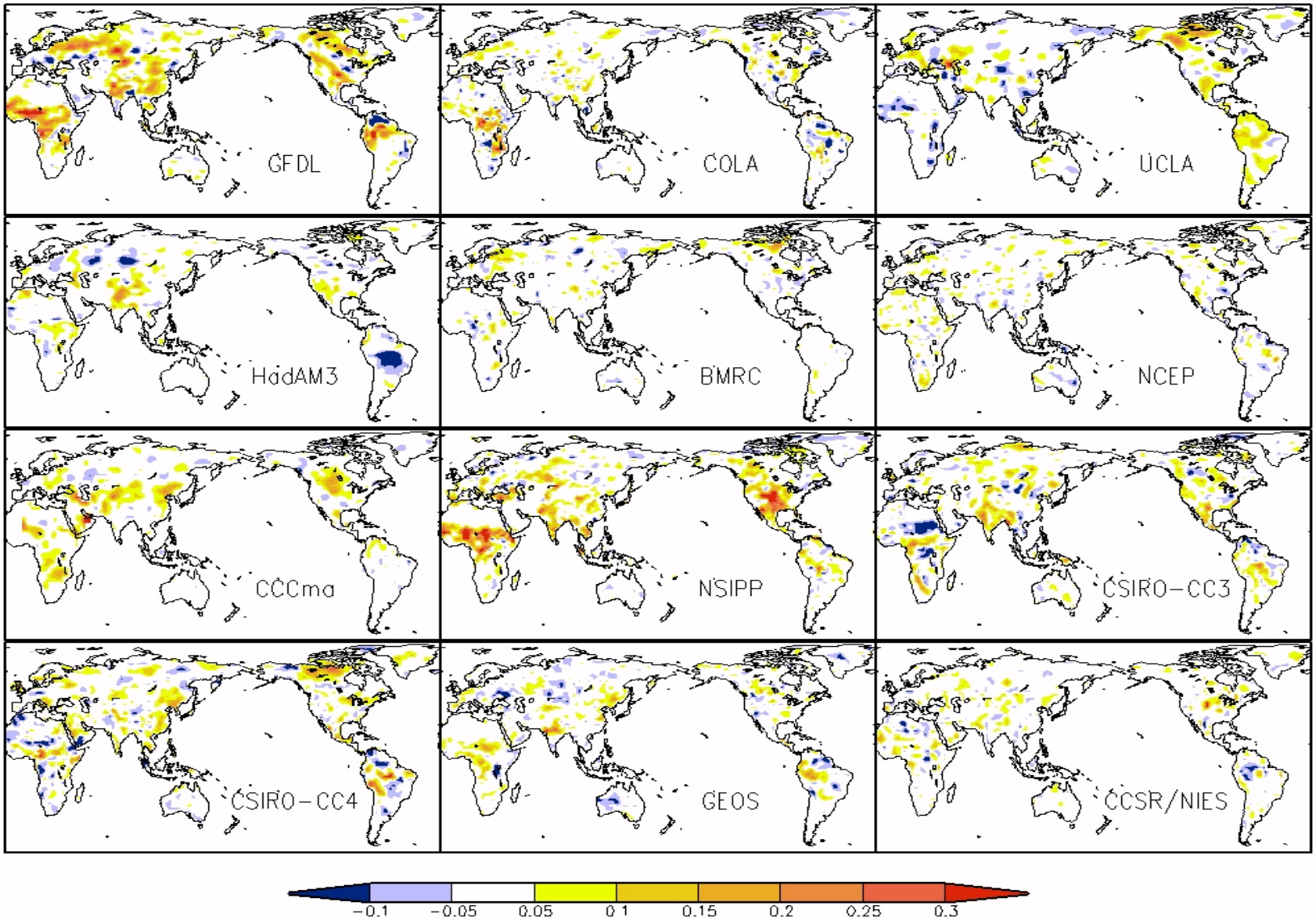
GLACE

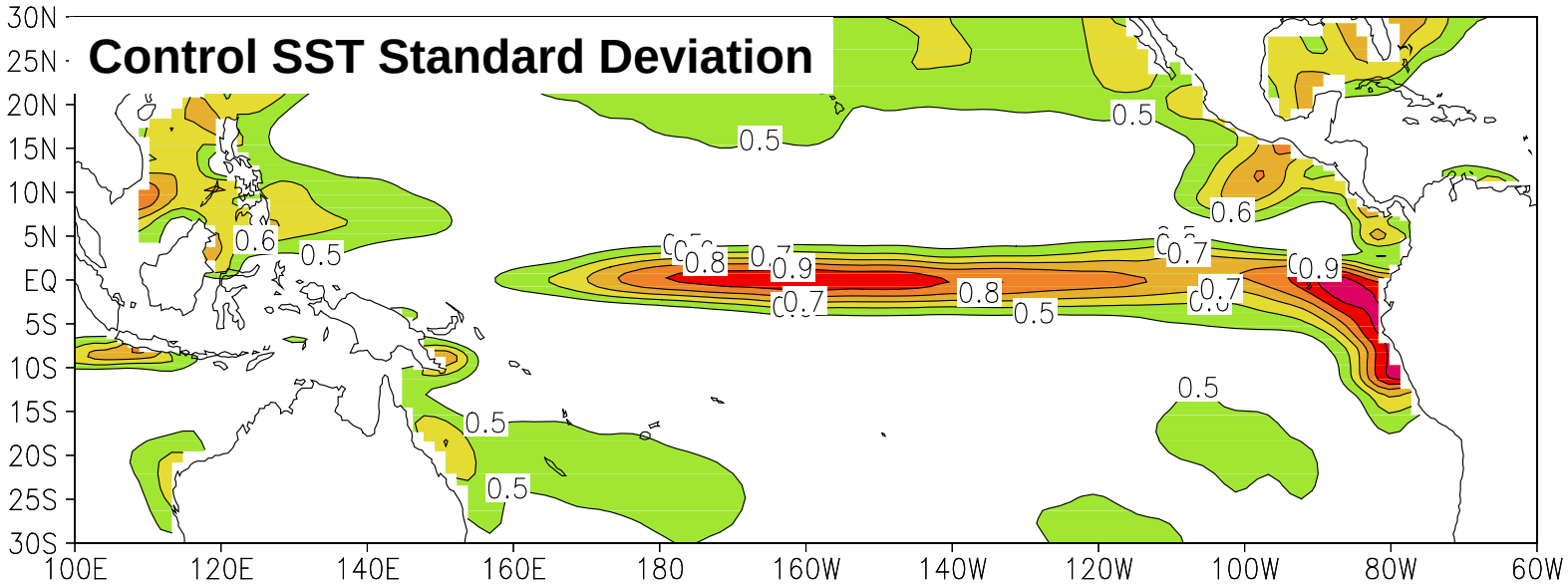
Global Land-Atmosphere Coupling Experiment

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

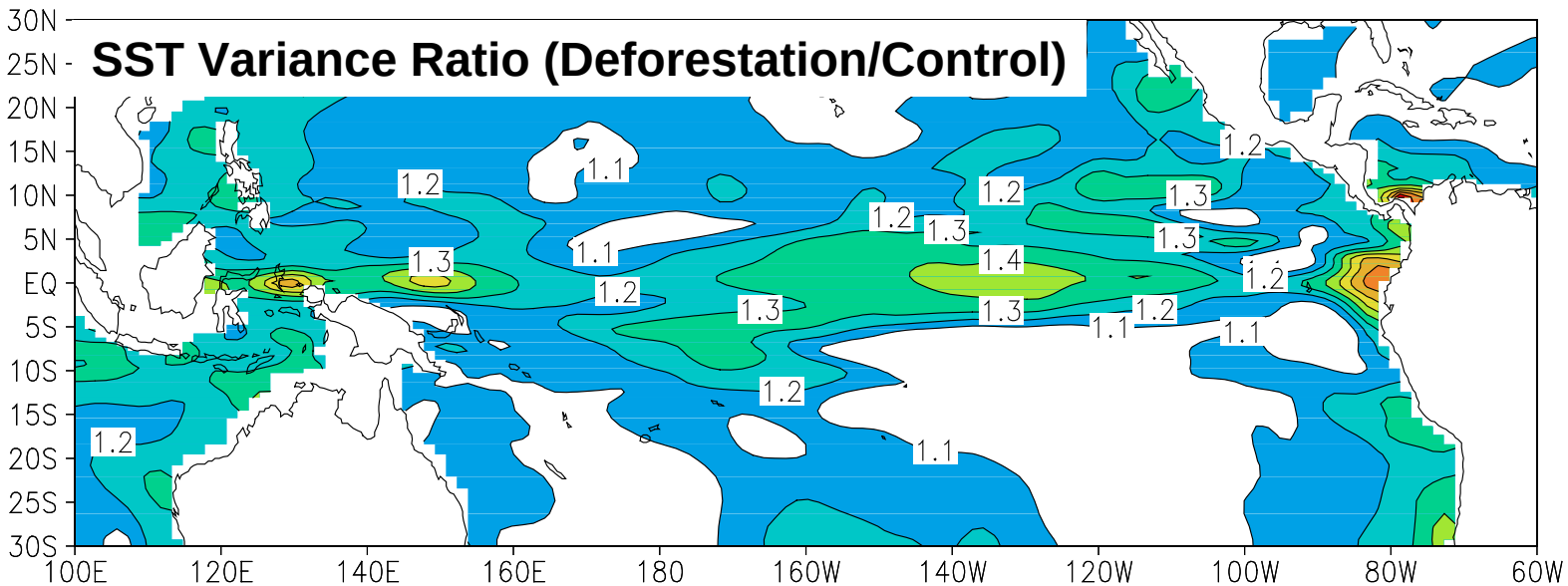
GEWEX – CLIVAR Collaboration

Omega (S−W) of Precipitation

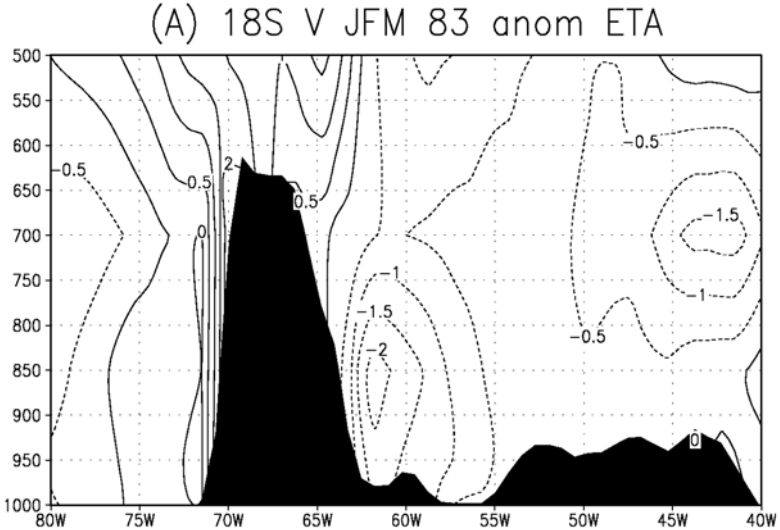


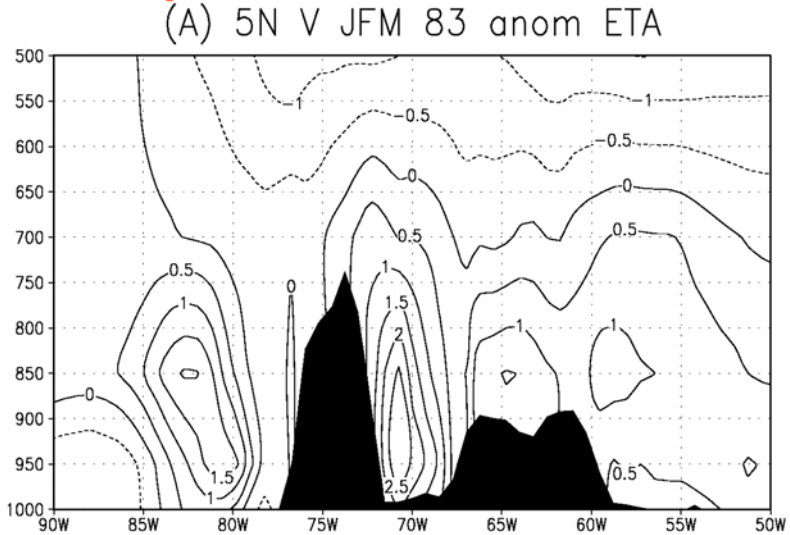


Amazon Deforestation on Enhances Coupled Variability: Impacts on Predictability?

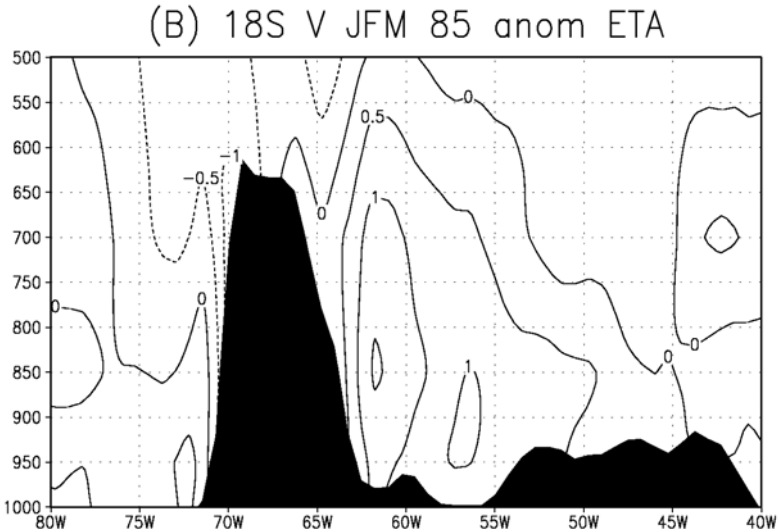


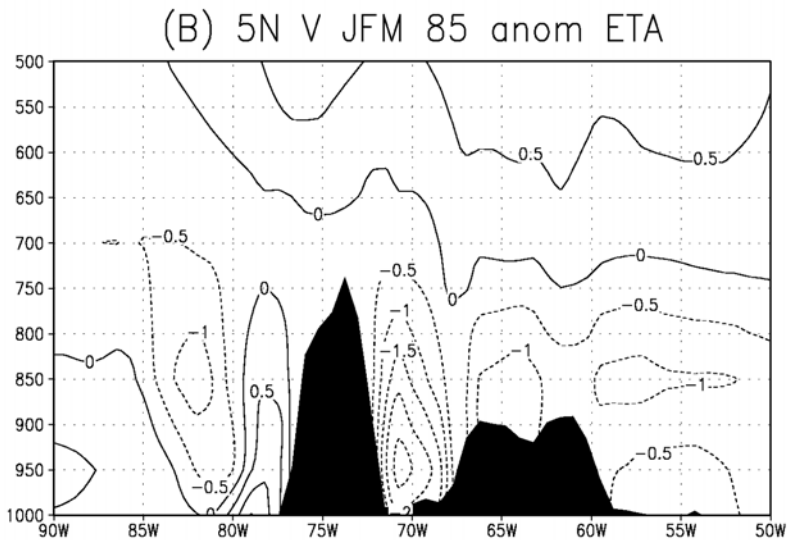
High Resolution Regional Modeling of South American Interannual Variability





Meridional Wind





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

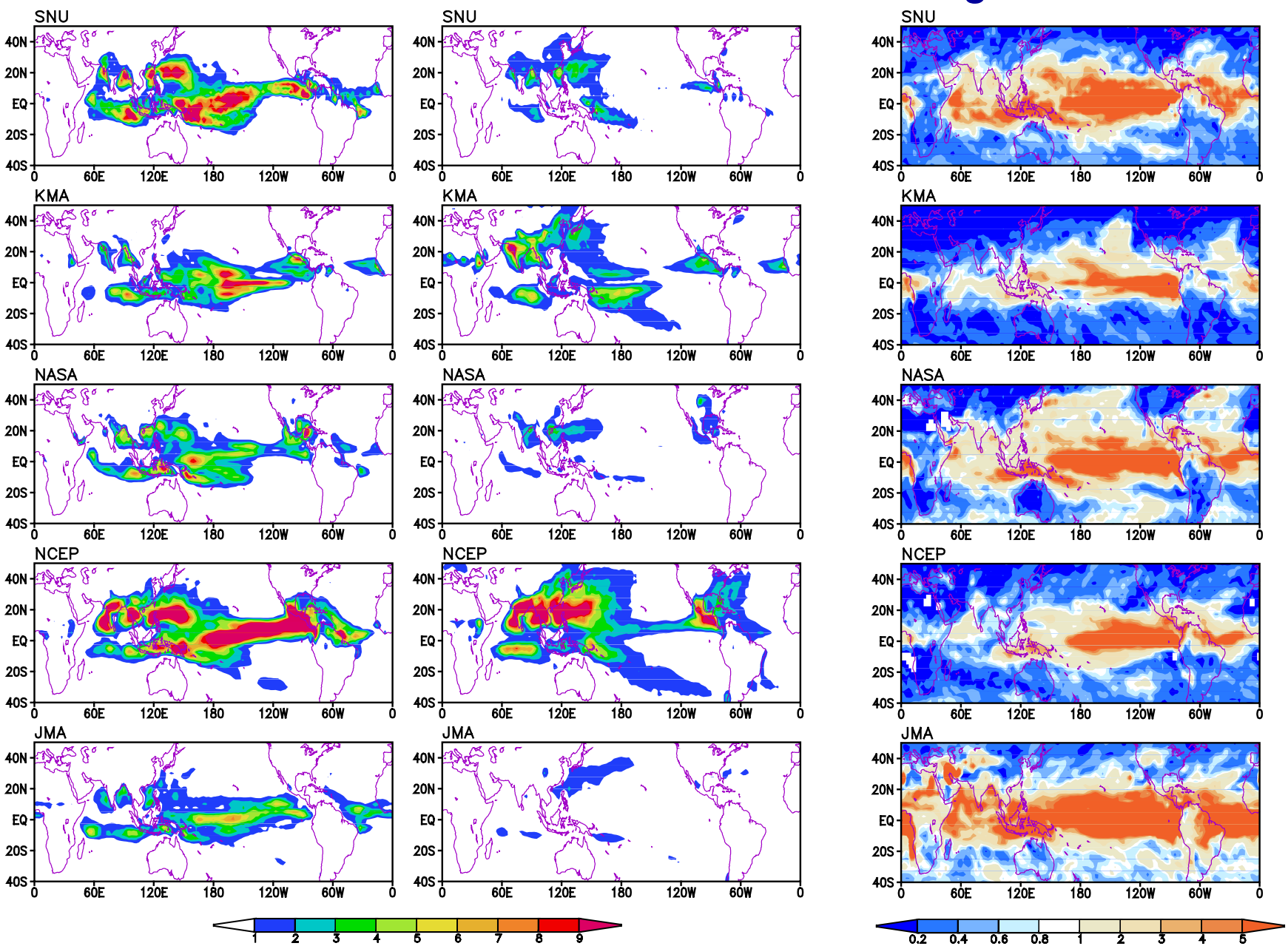
- **SMIP** Experimental Design

- 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

	Institute	Resolution	Experiment Type
NCEP	**NCEP**	**T62L28**	**SMIP (10 member)**
GDAPS	**KMA**	**T106L21**	**SMIP (10 member)**
GCPS	**SNU/KMA**	**T63L21**	**SMIP (10 member)**
NSIPP	**NASA**	**2°x2.5° L43**	**AMIP (9 member)**
JMA	**JAPAN**	**T63L40**	**SMIP (10 member)**

Seasonal Model Inter-comparison Project (SMIP): JJA Rainfall Variance



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