Review of AMY modeling study

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6th AMY Workshop

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Kun Ming, China

AMY Organization

Scientific Steering Committee:

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Working groups:

Observation : MD Yamanaka, DX Wang

Data management: K Masuda, GQ Zhou

Modeling and prediction: HH Hendon, T. Satomura

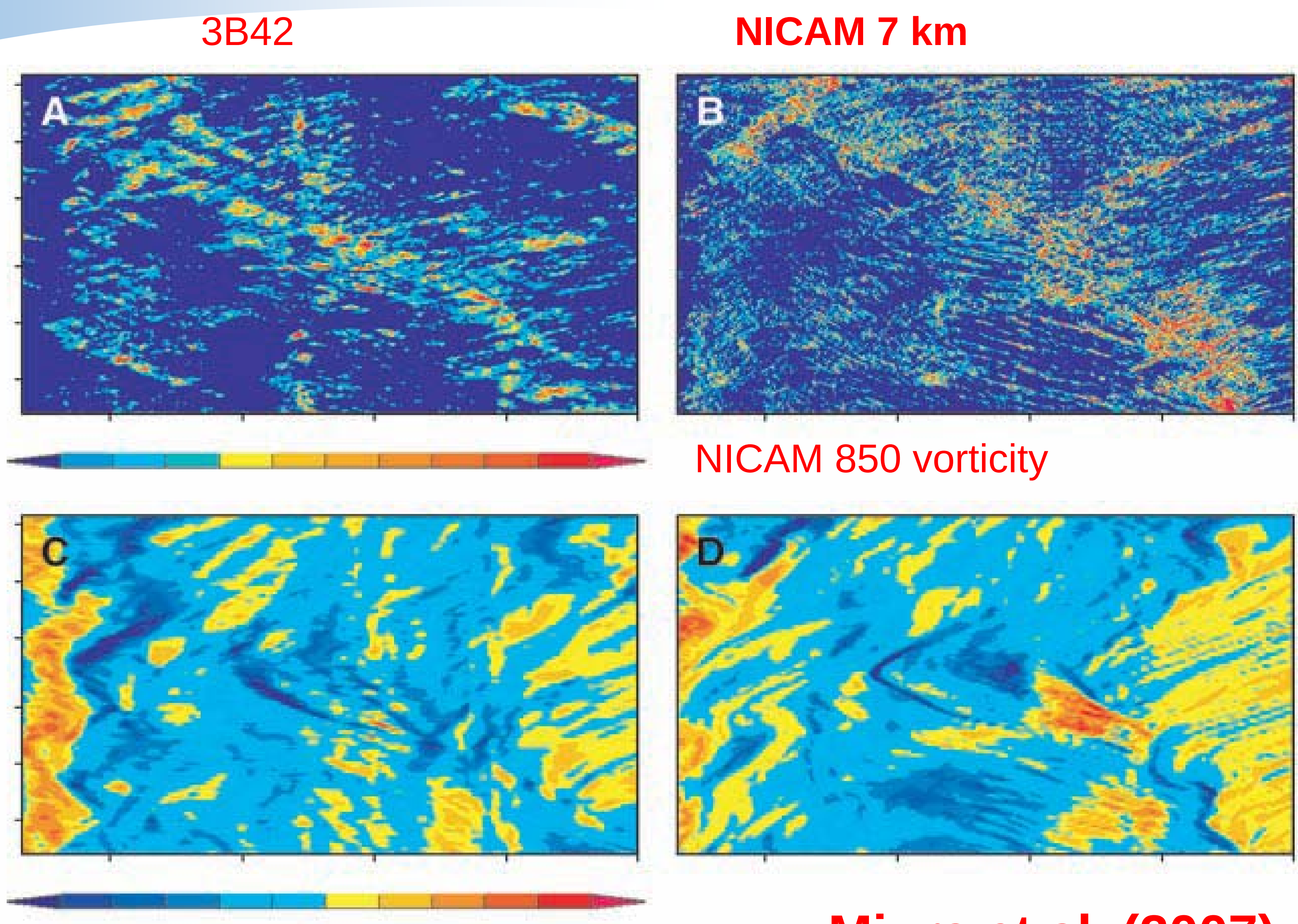
Specific Objectives

- Better understand the ocean-atmosphere-land-biosphere interactions, the multi-scale interactions, and the aerosol-cloud-water cycle interactions in the Asian monsoon system; Improve the physical representations of these interactions in coupled climate models;
- Determine the predictability of the Asian monsoon on intraseasonal and seasonal time scales, and the roles of land initialization in continental seasonal rainfall prediction;
- Develop data assimilation of the ocean-atmosphere-land system in the Asian monsoon region; and develop a high-resolution hydro-meteorological prediction system (with lead time up to a season) for the SEASM;
- Better understand Future climate change of Asian monsoon and how human activities in the monsoon Asia region interact with climate and environment.

Expectations

- Reveal new sources of monsoon predictability, improve capability to model and predict short-term climate variations, and to enhance the overall performance of disaster prevention and mitigation activities.
- AMY to become a key component in the WCRP's International Monsoon Study (IMS) 2008-2012.
- Enhance the international collaboration between it's own activities and other international programs or projects.
- Develop our understanding of how and why monsoon systems will change in a global warming environment, in particular, the effect of human influences (i.e., aerosols, land-use change, and greenhouse-gas increase) on hydro-meteorological variations in Asian monsoon regions.

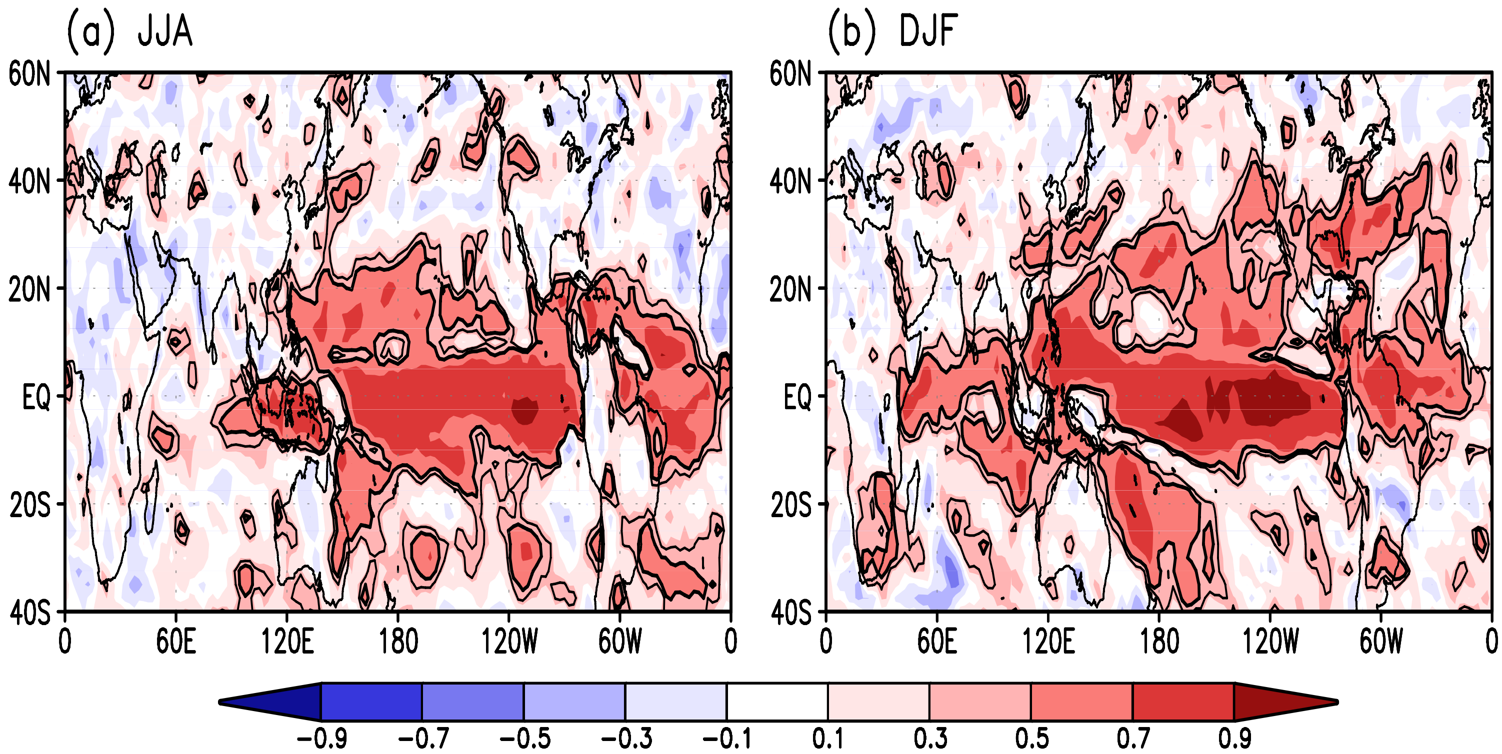
MJO simulated by NICAM



Miura et al. (2007).

APCC/CliPAS MME skill (1981-2003)

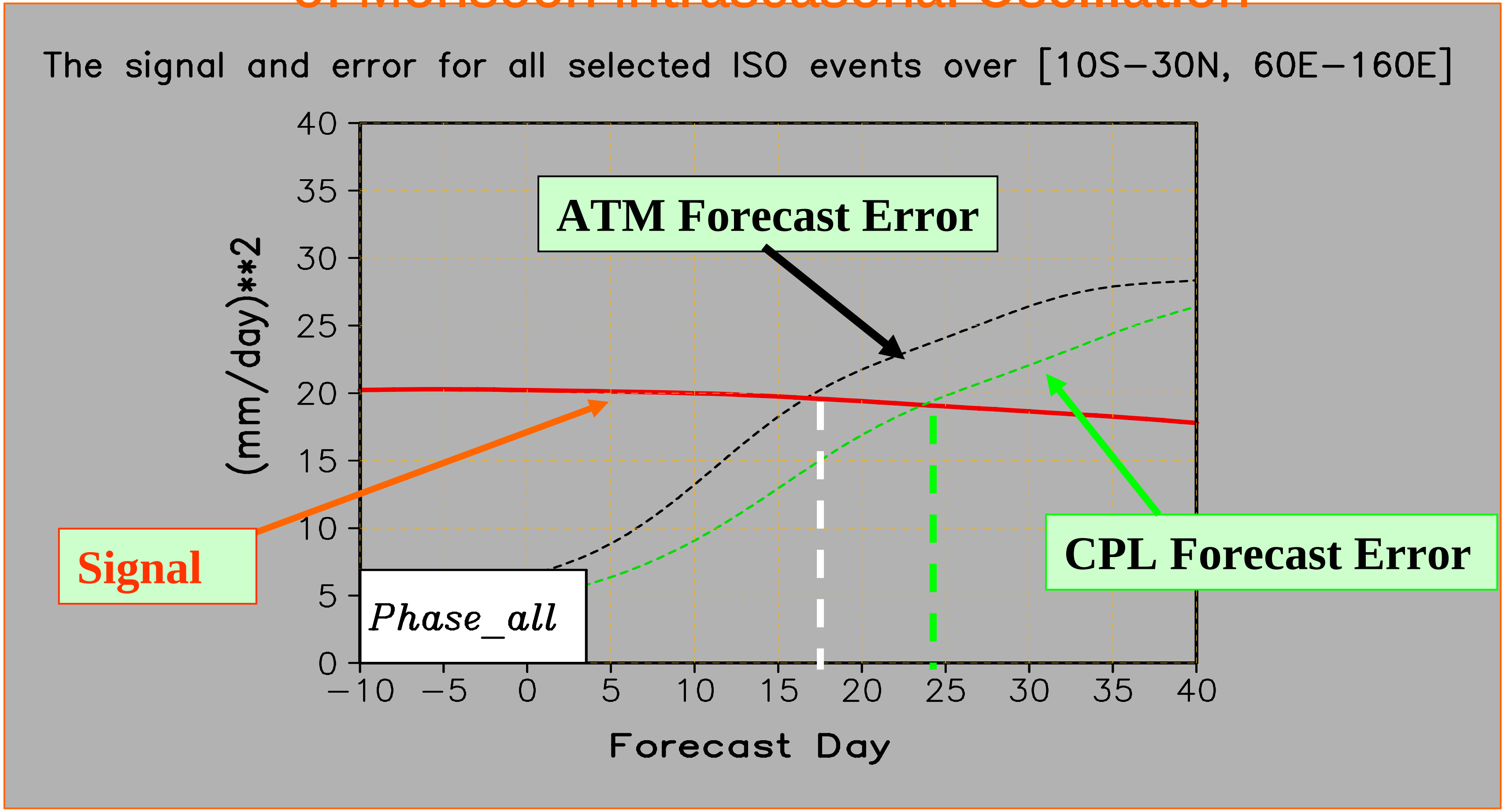
Precipitation



Wang et al.(2008)

Intraseasonal Predictability

Air-Sea Coupling Extends the Predictability of Monsoon Intraseasonal Oscillation



ATM: 17 days, CPL: 24 days

Fu et al. 2007

Hindcast Experiment for Intraseasonal Oscillation

Ad hoc organizing committee:

Bin Wang (lead), Harry Hendon, In-Sik Kang, Ken Sperber, and Duane Waliser

A joint effort by
CLIVAR/AAMP, APCC, YOTC and AMY

AMY 5th workshop Kun Ming China Nov 30-December 1

Importance

The Madden-Julian Oscillation (MJO)

interacts with, and influences, a wide range of weather and climate phenomena (e.g., monsoons, ENSO, IOD, ITF, NAO, Angular momentum, tropical storms and other extreme events, mid-latitude weather), and

represents an important, and as yet unexploited, source of predictability at the subseasonal time scale.

The Monsoon Intraseasonal Oscillation (MISO)

One of the dominant short-term climate variability in global monsoon system

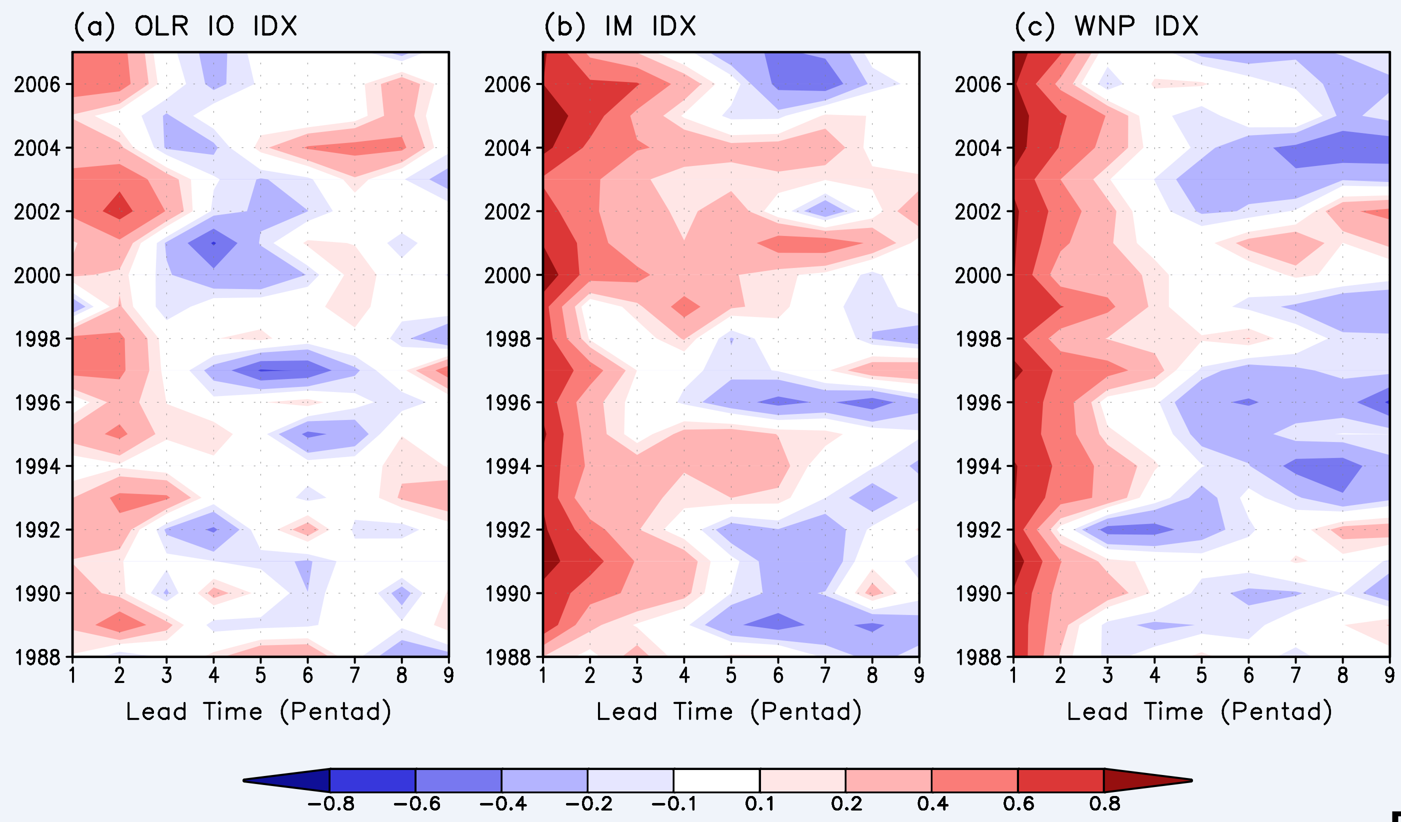
The wet and dry spells of the MISV strongly influence extreme hydro-meteorological events, which composed of about 80% of natural disaster, thus the socio-economic activities in the World's most populous monsoon region.

Need for Coordinated ISO Hindcast Experiment

There are still **great uncertainties regarding the level of predictability that can be ascribed to the MJO/MISO.** The development and analysis of a multi-model hindcast experiment is needed to address the above questions and challenges.

The development of an MME is **the intrinsic need for lead-dependent model climatology (i.e. multi-decade hindcast datasets) to properly quantify and combine the independent skill of each model as a function of lead-time and season.**

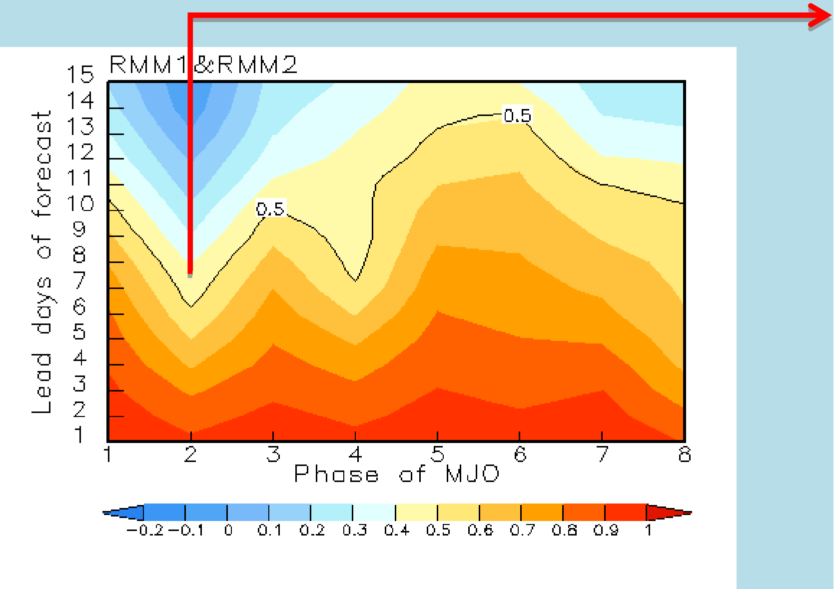
Current status: Temporal Correlation Skill for Monsoon Index in hybrid coupled ECHAM model



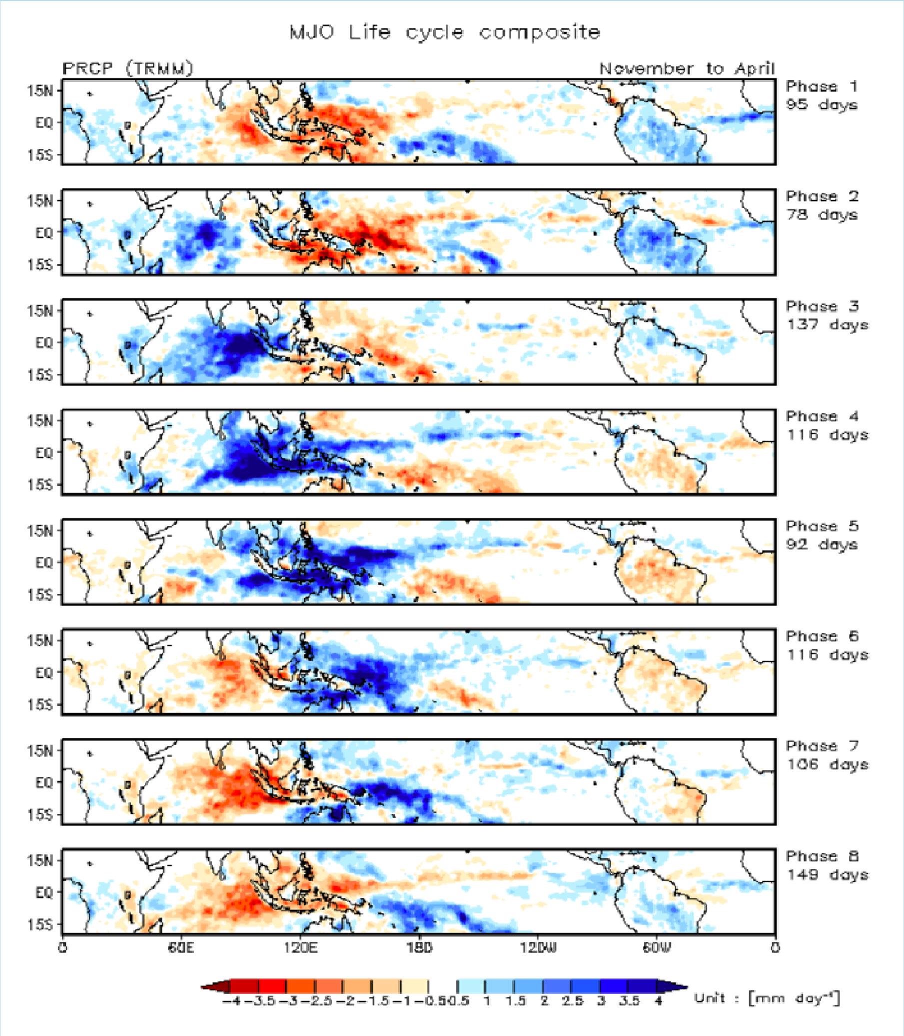
Fu et al.

OLR IO (Indian Ocean) Index : OLR(80-100E, 5S-5N)
IM (Indian Monsoon) Index: U850(40-80E, 5-15N) – U850(60-90E, 20-30N)
WNP (Western North Pacific) Index: U850(90-130E, 5-15N) – U850 (110-140E, 22.5-32.5N)

Limited intraseasonal prediction skill (< 15 days) – particularly low during the initiation of the MJO in the Indian Ocean and during the passage of the MJO over the Maritime Continent.



Correlation between predicted (by CFS) and observed MJO indices (Courtesy of Jon Gottschalck and Qin Zhang)



Objectives

◆ Better understanding of the physical basis for intraseasonal prediction. Determine potential and practical predictability of ISO in a multi-model frame work.

◆ Developing optimal strategies for multi-model ensemble (MME) ISO prediction system, including effective initialization schemes and quantification of the MME's ISO prediction skills with forecast metrics under operational conditions.

◆Revealing new physical mechanisms associated with intraseasonal variability that cannot be obtained from analyses of a single model.

◆Identifying model deficiencies in predicting ISO and finding ways to improve models' convective and other physical parameterizations relevant to the ISO through development of model process diagnostics.

◆Help to determine ISO's modulation of extreme hydrological events (e.g., midlatitude weather, monsoon depressions, and tropical cyclones) and its contribution to seasonal and interannual climate variation.

Experimental Design

There is no restriction as to the types of General Circulation Models (GCMs), although Coupled Atmosphere-Ocean GCMs (AOGCMs) are preferable.

AMIP-type Atmospheric GCM (AGCM) experiments are also acceptable – however SSTs CANNOT be specified from observations for the forecast periods.

Experimental Design

EXP1: Control Experiment

A long simulation allows us to
(a)Identify model common deficiencies;
(b)better understand the dependence of the prediction on initial conditions, and
(c)better define metrics that measure the "drift" of the model toward their intrinsic MJO/MISV modes.

A free run (without impacts of initial conditions) will serve as a control experiment. Free coupled runs with AOGCMs or AGCM simulation with specified boundary forcing (e.g., observed SST and SI distribution) are requested for at least 20 years. The period for the forced AGCM run should be consistent with the hindcast period (see below).

Experimental Design

EXP2: The 21-year ISO Hindcast

Retrospective Forecast Period	21 years from Jan 1989 to October 2009 YOTC (May 1 2008-Ocotber 31st 2009)
Initialization dates	Every 10 days on 1st, 11th, and 21st of each calendar month
Length of Integration	At least 45 days
Ensemble Member	At least 5 members
Initial conditions	One day lag for 5 member or 12 hours lag for 10 member

The total integration time is 450 years if 5 ensemble members are planned.

Requested output data and information

a. Model description

A concise model description includes model name, characteristics (parameterization scheme etc.), references, horizontal and vertical resolution, initial conditions and initialization scheme, ensemble size and integration duration etc.

b. Output from control and hindcast experiments

The description of the output is given in terms of the following 2D and 3D groups of variables:

I. Atmospheric 2D fields: total precipitation rate (preferably, the convective and stratiform separately), OLR, surface (2m) air temperature, SST, mean sea level pressure, surface heat fluxes (latent, sensible, solar and longwave radiation), surface wind stress, and geopotential, horizontal wind fields (u and v) at three specific levels: 850, 500, and 200 mb.

Requested output data and information

II. Atmosphere 3-D fields at 17 standard pressure levels (1000, 950, 925, 900, 850, 800, 700, 600, 500, 400, 300, 250, 200, 150, 100, 70, and 50hPa): humidity, temperature, horizontal wind and vertical pressure velocity (Pa/s), and each of the components of the diabatic heating rates (e.g., shortwave, longwave, stratiform cloud, deep convective, shallow convection).

III. Upper Ocean 3D fields (for coupled models): temperature, salinity, ocean currents (U and V), and vertical motion from surface to 300m.

(1) Output requested from the control simulations: **6-hour** values of items I, II and III.

(2) Output from the hindcasts initiated from January 1989 up to May 2008: **Daily** mean values of items I and III.

(3) Output from the hindcasts initiated during the YOTC Period (1 May 2008 – October 2009): **6-hour values** of items I, II and III.

Deadlines, contact information

- We will be in a position to receive the data starting May 1 2009 and will start analyzing the model contributions that available in October 2009.
- We expect the results for the control run and the hindcasts from January 1989 to May 2008 to be turned in by December 2009 and the results contributing to YOTC period (May 2008 to October 2009) to be turned in by March 2010.
- Contact person and website: If you have any questions regarding the experiment design and data submission, please contact coordinator Dr. June-Yi Lee (jylee@soest.hawaii.edu). Detailed information will be posted on the website (http://iprc.soest.hawaii.edu/~jylee/clipas/iso.html)

Participating Groups

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- GFDL: W. Stern
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Thanks

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