Climate Prediction and its Association to Society

ISO Hindcast Experiment (1989-2009)

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and ISO Hindcast Team

APCC/CliPAS

MJO and MISO

- **MJO** influences, a wide range of weather and climate phenomena (monsoons, ENSO, tropical storms, mid-latitude weather), and represents an important, and as yet unexploited, source of predictability at the subseasonal time scale (Lau and Waliser, 2005).

- **The Monsoon Intraseasonal Oscillation** (**MISO**) is a dominant short-term climate variability in monsoon system (Webster et al. 1998). The wet and dry spells of the MISO 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.

Background

- Determination of ISO prediction skill and estimate ISO predictability in current AOGCMs is a pressing scientific need for developing 2-6 week subseasonal prediction.
- Forecast of MJO and MISO is one of the major concerns of APCC, YOTC, CLIVAR/AAMP and AMY(2007-2012). It is also a central theme for WCRP cross-cutting monsoon research.
- Launching a coordinated ISO hindcast experiment was recommended at the Nov 2007 CLIVAR MJO Workshop, endorsed and supported by APCC, CLIVAR/AAMP, and the SSC of AMY (2007-2011), and echoed by THORPEX.

Need for a Coordinated ISO Hindcast Exp.

Development of an MME is intrinsic need for lead-dependent model climatologies (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.

There are still great uncertainties regarding the level of predictability that can be ascribed to the MJO, other subseasonal phenomena and the weather/ climate components that they interact with and influence.

Objectives

- ***Better understand physical basis for intraseasonal prediction.***

- ***Estimate 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.

- ***Identify model deficiencies in predicting ISO and suggest ways to improve models' convective and other physical parameterizations*** relevant to the ISO through development of model process diagnostics.

- ***Revealing new physical mechanisms associated with ISV*** that cannot be obtained from analyses of a single model.

- ***Study 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

EXP1: Control Simulation

Free runs with coupled OGCMs or forced AGCM simulation with specified boundary conditions are requested for at least 20 years. The period for the forced AGCM run should be consistent with the hindcast period.

The long-term simulation allows us to better understand the dependence of the prediction on initial conditions and better define metrics that measure the "drift" of the model toward their intrinsic MJO/MISV modes

EXP2: 21-year (January1 1989-Oct 31 2009) ISO Hindcast

Re Forecast Period	20 years from 1989 to 2008
Initial Date	Every 10 days on 1st, 11th, and 21st of each calendar month
The Length of Integration	At least 45 days
Ensemble Member	At least 5 members
Initial condition	Initial conditions may use 12-hour lags

No uniform specification regarding model resolution and initialization procedures. (for AGCM experiments, the ERA, NCEP 2 were recommend for initial conditions)

No information from "future" is used , for AGCM experiments, SST must be forecasted.

Requested output data and information

The data requested permit a basic understanding of
(a)the models ability to spontaneously generate MJO's/MISO's in the control simulation,
(b)the model predictability and prediction skill of ISO and its seasonal, interannual and MJO life- cycle phase dependencies,
(c)the models' weakness and
(d)To reveal new physical mechanisms.

Requested data and information

Model description
Output from control and hindcast experiments
I. Atmospheric 2D fields:
II. Atmosphere 3-D fields at 17 standard pressure levels
III. Upper Ocean 3D fields (for coupled models) from surface to 300m.

Outputs for different experiments

(1) Control simulations: 6-hour values of items I, II and III.
(2) The 21-year hindcasts : Daily mean values of items I and III.
(3) The YOTC Period: 6-hour values of items I, II and III.

Contact Information

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 are posted on the website
(http://iprc.soest.hawaii.edu/~jylee/clipas/iso.html)

Current Participating Group

Institution	Participants
ABOM, Australia	Harry Hendon, Oscar Alves
BCC/CMA, China	Zhang Peigun, Chen Lijuan
CMCC/Italy	Tony Navarra, Annalisa Cherichi, Andrea Alessandri
COLA and GMU, USA	Emilia K. Jin, J. Kinter, J. Shukla
CWB, Taiwan	Mong-Ming Lu
ECMWF, EU	Franco Molteni, Frederic Vitart
GFDL, USA	Bill Stern
IAP/LASG, China	T. Zhou, B. Wang, Y. Q. Yu
IITM, India	A. K. Sahai
JAMSTEC/APL, Japan	T. Yamagata, J.-J. Luo
JMA, Japan	Kiyotoshi Takahashi
MRD/EC, Canada	Gilbert Brunet, Hai Lin
NASA/GMAO, USA	S. Schubert
NCEP/CPC	Arun Kumar, Jae-Kyung E. Schemm
NCMRWF, India	Ashwini Bohara
PNU, Korea	Kyung-Hwan Seo, Joong-Bae An
SNU, Korea	In-Sik Kang
UH/IPRC, USA	Bin Wang, Xiouhua Fu, June-Yi Lee
UM, USA	Ben Kirtman

Current Status of the Experimental reuslts

Institution	Participants	Model	Current Status	
ABOM	Harry Hendon	POAMA 1.5 CGCM	26-year integration initiated the first day of every month with 10 ensemble simulations (1980-2006)	Collected
CMCC	Tony Navarra A. Alessandri	CMCC CGCM	20-year integration initiated every 10 days (1989-2008)	Collected
CWB	Mong-Ming Lu	CWB AGCM	25-year integration initiated every 10 day (1981-2005)	Collected
ECMWF	F. Molteni, Frederic Vitart	ECMWF CGCM	20-year integration initiated the 15th of every month (1989-2008)	Collected
GFDL	W. Stern	CM2.1 CGCM	27-year integration initiated the first day of every month (1982-2008)	Collected
JMA	K. Takahashi	JMA AGCM	20-year integration initiated every month (1989-2008)	
NASA/ GMAO	S. Schubert P. Pegion	GMAO AGCM	20-year integration initiated every day (1989-2008)	
NCEP/ CPC	A. Kumar J.K.E. Schemm	CFS CGCM	26-year integration initiated every 10 days (1981-2008)	Collected
SNU	I.-S. Kang	SNU CGCM	21-year integration initiated every five days during NDJFM season (1981-2001)	Collected
UH/IPRC	X. Fu J.-Y. Lee	UH CGCM	20-year integration initiated every 5 day during MJJAS (1989-2008)	Collected
MRD/EC	Gilbert Brunet Hai Lin	MRD AGCM	24-year integration initiated every 10 days (1985-2008)	Collected

Description of Model and Experimental Design

One-Tier System

	Model	Control Run	ISO Hindcast		
			Period	Ens No	Initial Condition
ABOM	POAMA 1.5 (ACOM2+BAM3)	CMIP	1980-2006	10	The first day of every month
CMCC	INGV (ECHAM4+OPA8.1)	CMIP (20yrs)	1989-2008	10	Every 10 days
ECMWF	ECMWF (IFS+HOPE)	CMIP(11yrs)	1989-2008	15	The 15th day of every month
GFDL	CM2 (AM2/LM2+MOM4)	CMIP	1982-2008	10	The first day of every month
NCEP/CPC	CFS (GFS+MOM3)	CMIP (100yrs)	1981-2008	5	Every 10 days
SNU	SNU CM (SNUAGCM+MOM3)	CMIP (20yrs)	1981-2001	6	Every 10 days
UH/IPRC	UH HCM	CMIP	1989-2008	6	Every 10 days during MJJAS

Two-Tier System

	Model	Control Run	ISO Hindcast		
			Period	Ens No	Initial Condition
CWB	CWB AGCM	AMIP (25yrs)	1981-2005	10	Every 10 days
JMA (not collected)	JMA AGCM	AMIP	1989-2008	10	The first day of every month
MRD/EC	CCCma	AMIP (21yrs)	1985-2008	10	Every 10 days
NASA/GMAO (not collected)	NSIPP	AMIP	1989-2008	10	Every day

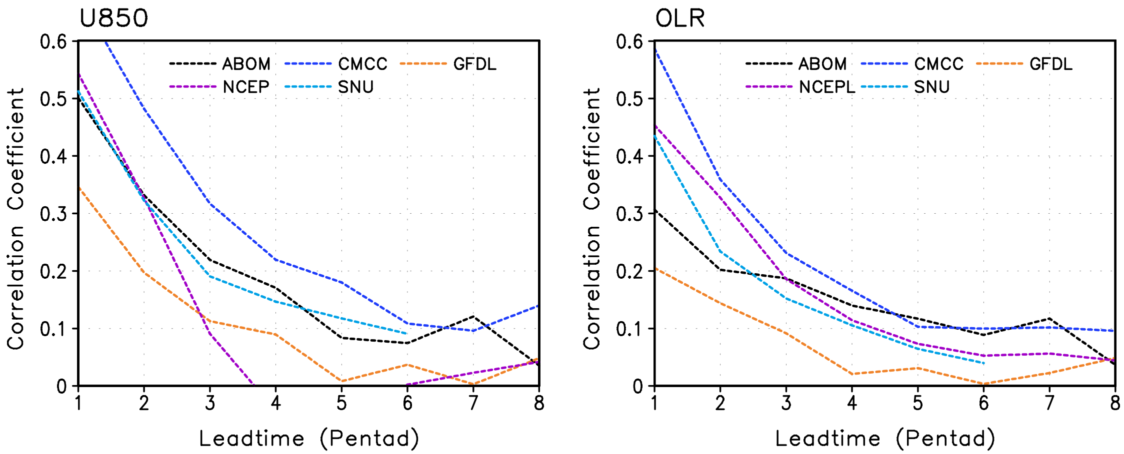
Data policy

- The experimental dataset will be immediately available to participating groups once the results are collected and passed quality check.
- Users should utilize the hindcast dataset for research purpose only and shall not distribute the hindcast datasets to any third parties.
- The source of the datasets shall be duly acknowledged in scientific or technical papers, publications, press releases, or any other communications regarding the datasets.
- For those users who used JMA dataset shall provide JMA with a copy of their scientific or technical papers, publications, press releases or any other communications regarding the JMA datasets.

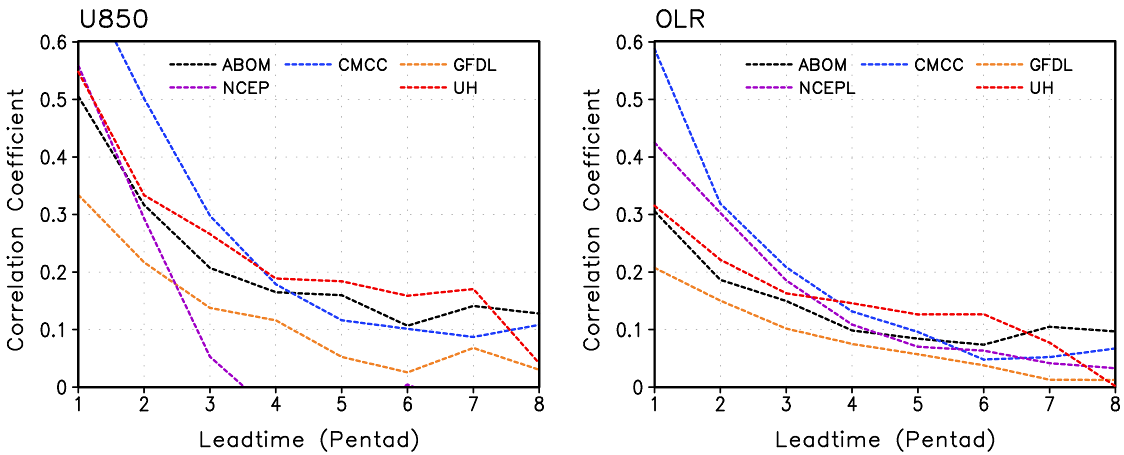
Forecast Skills of Coupled Models / Pentad Mean

Anomaly Pattern Correlation Coefficients (30ºS-30ºN, 40º-160ºE)

ONDJFM

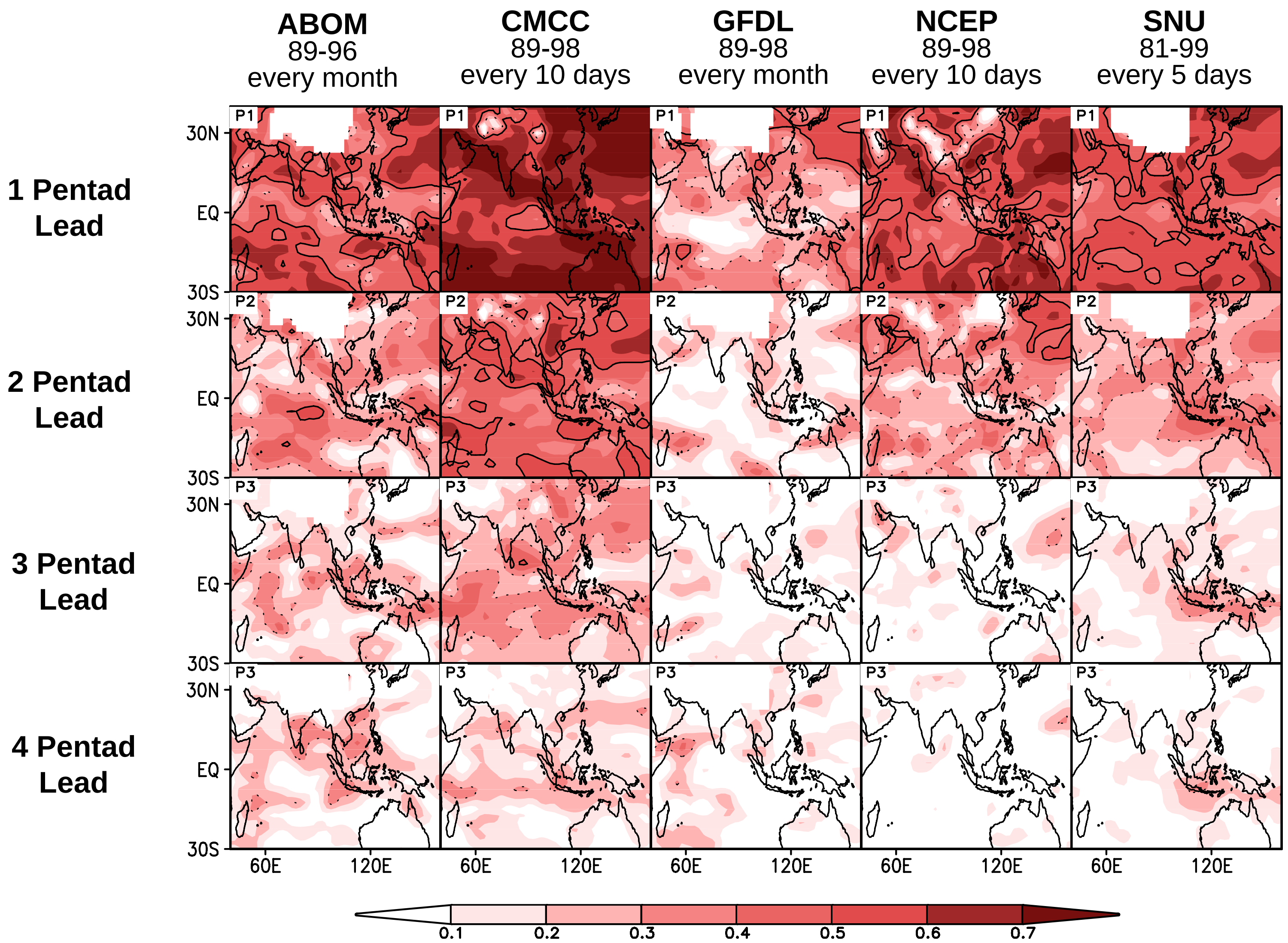


AMJJAS



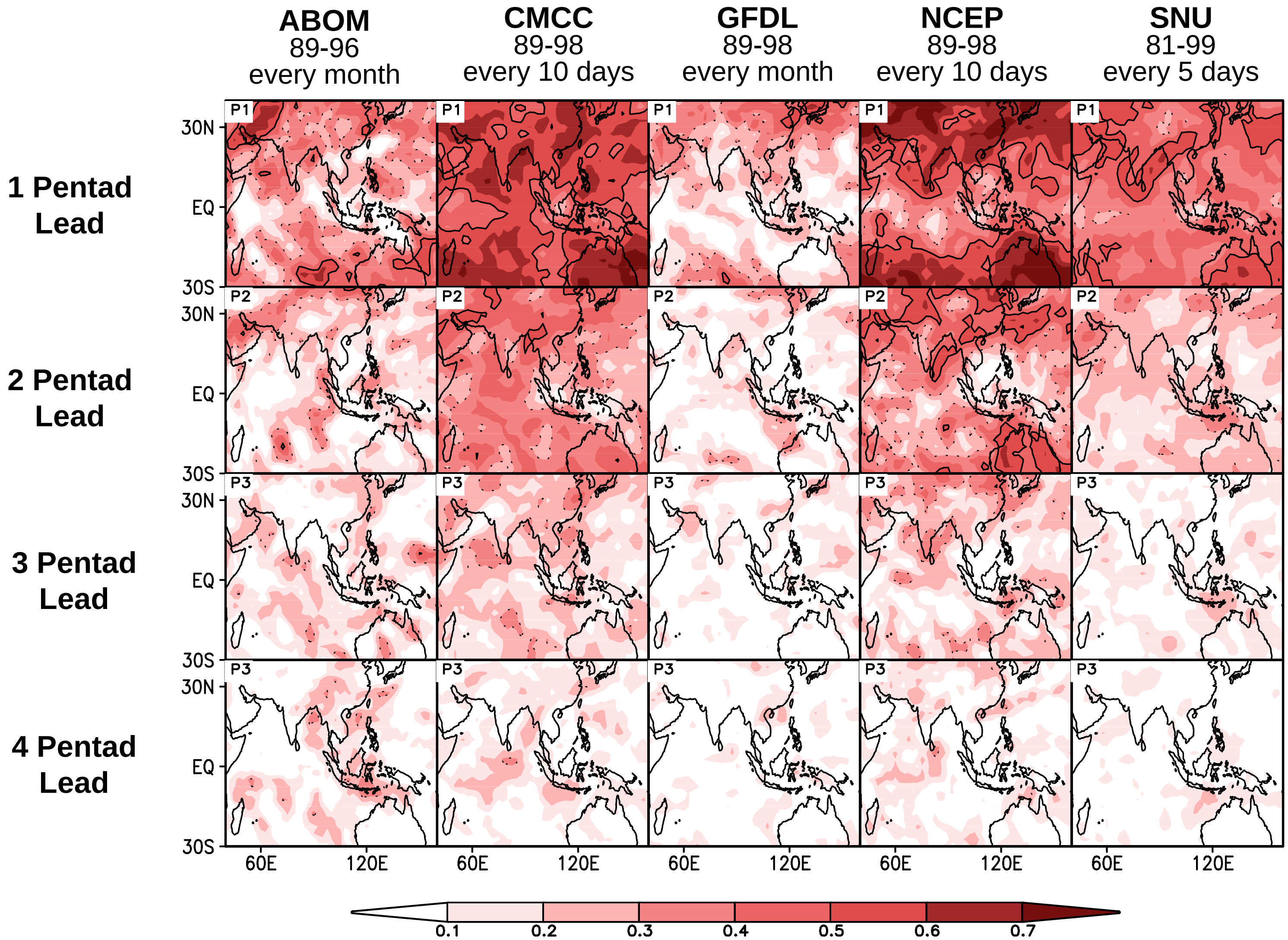
Forecast Skills of Coupled Models / ONDJFM

Temporal Correlation Coefficient Skill for U850



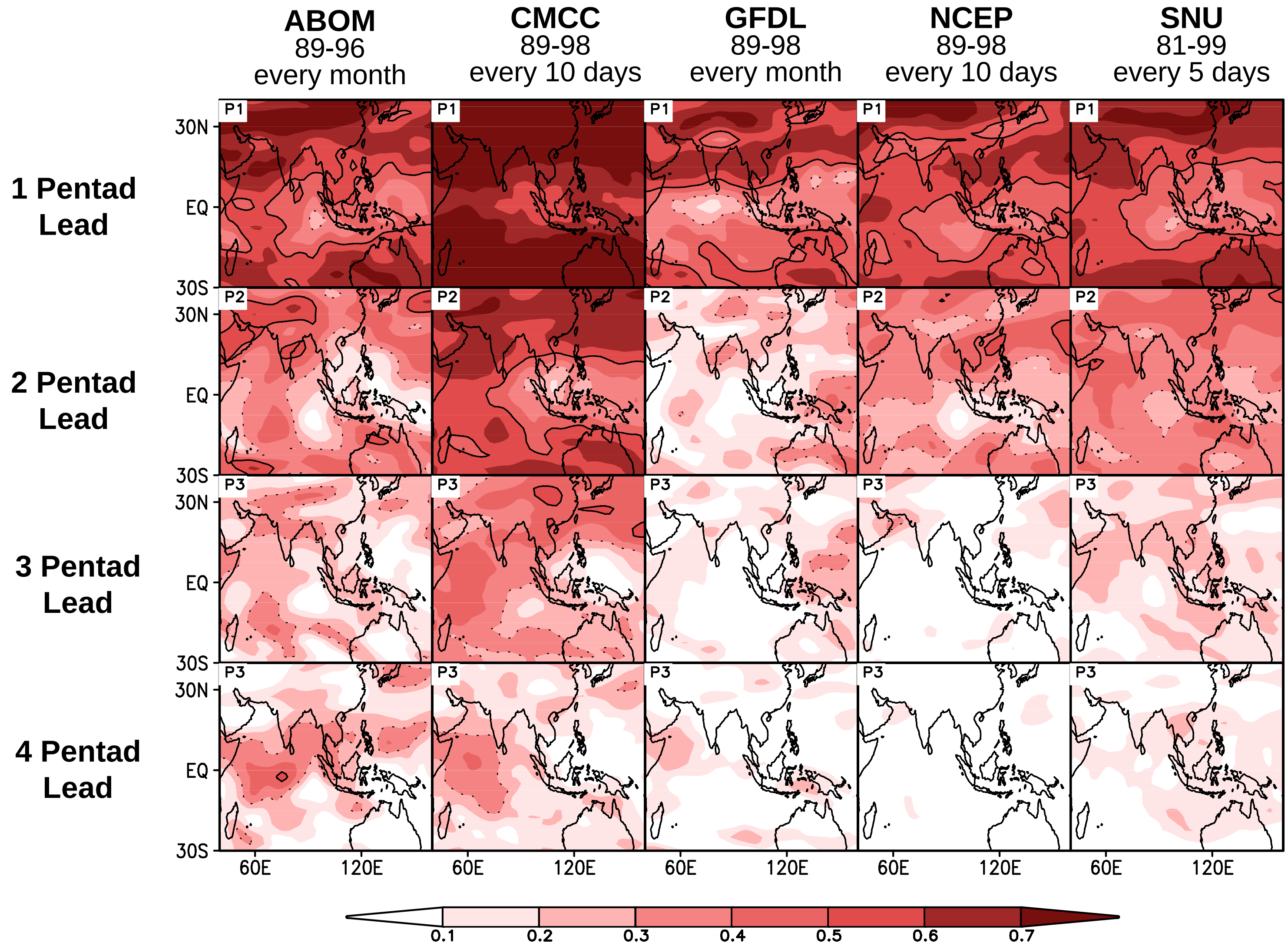
Forecast Skills of Coupled Models / ONDJFM

Temporal Correlation Coefficient Skill for OLR



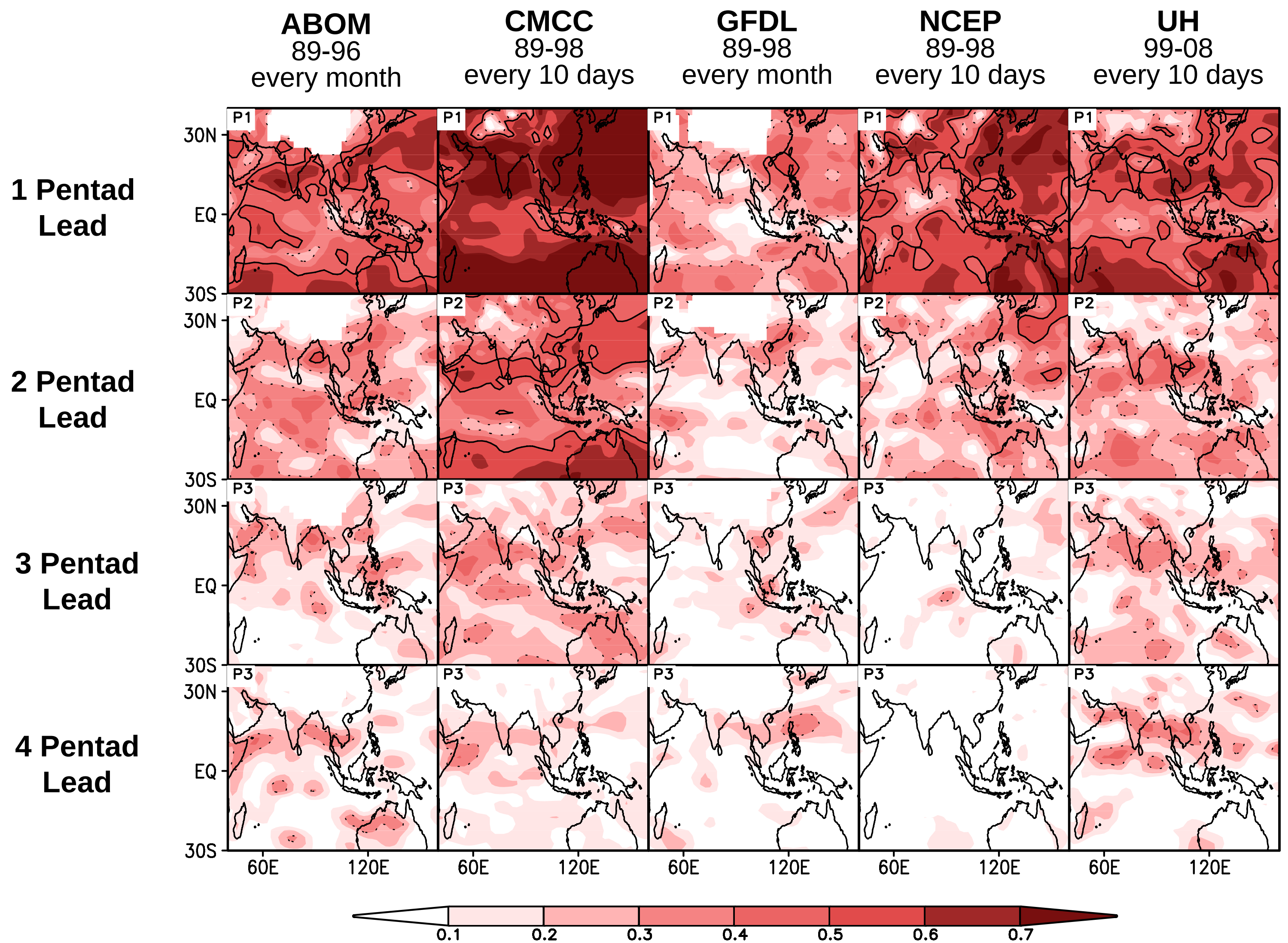
Forecast Skills of Coupled Models / ONDJFM

Temporal Correlation Coefficient Skill for U200



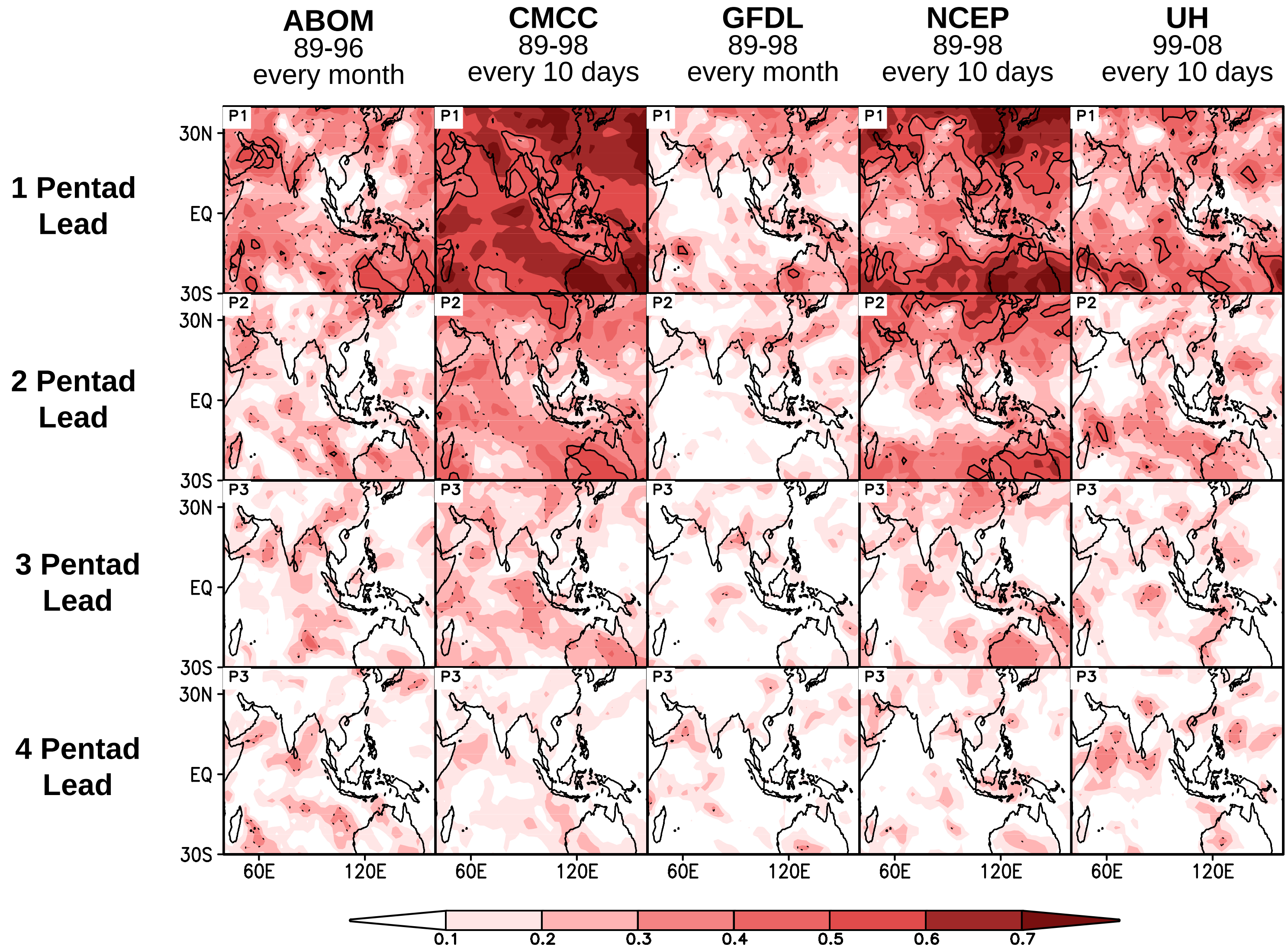
Forecast Skills of Coupled Models/ AMJJAS

Temporal Correlation Coefficient Skill for U850



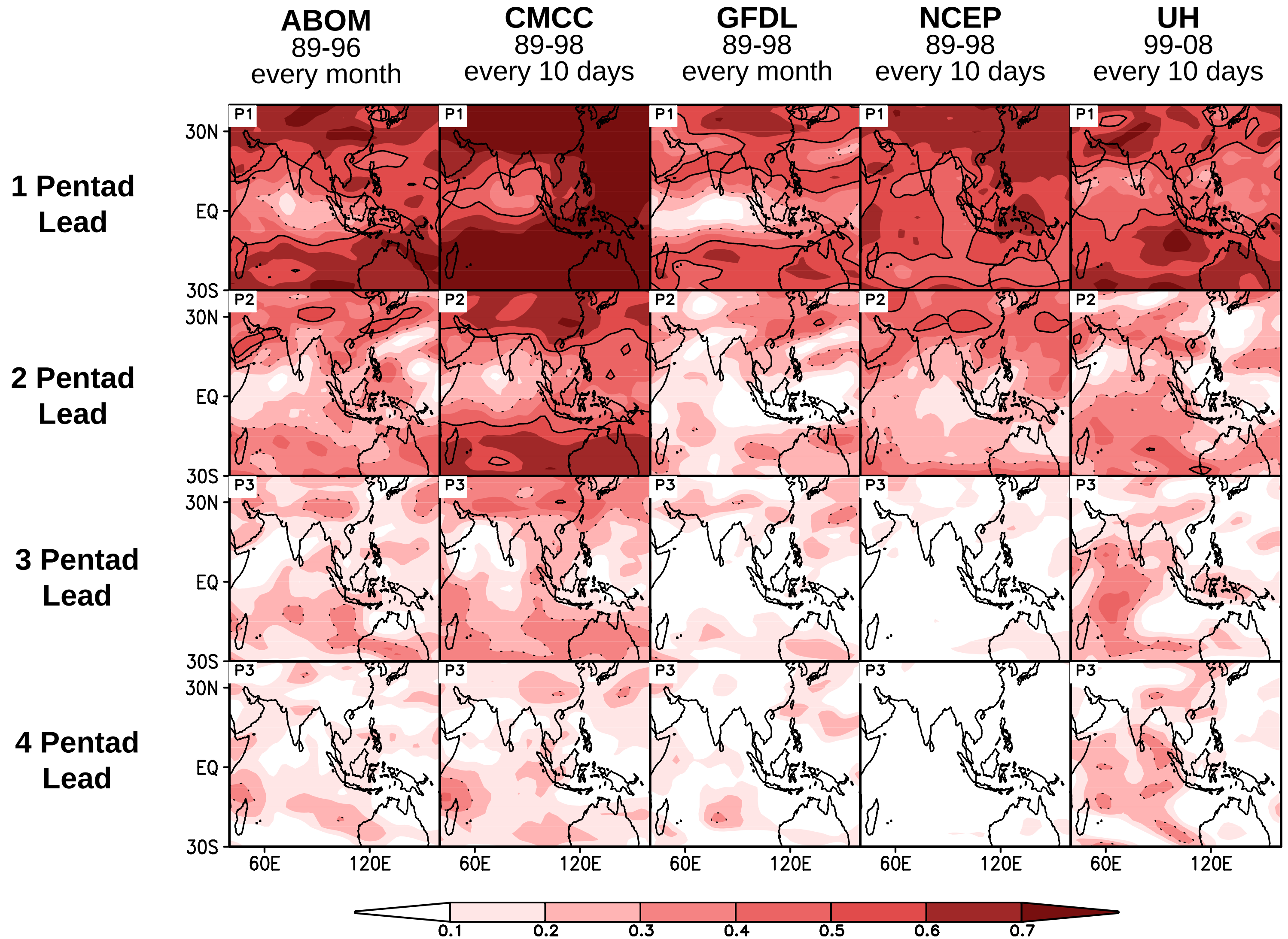
Forecast Skills of Coupled Models/ AMJJAS

Temporal Correlation Coefficient Skill for OLR



Forecast Skills of Coupled Models / AMJJAS

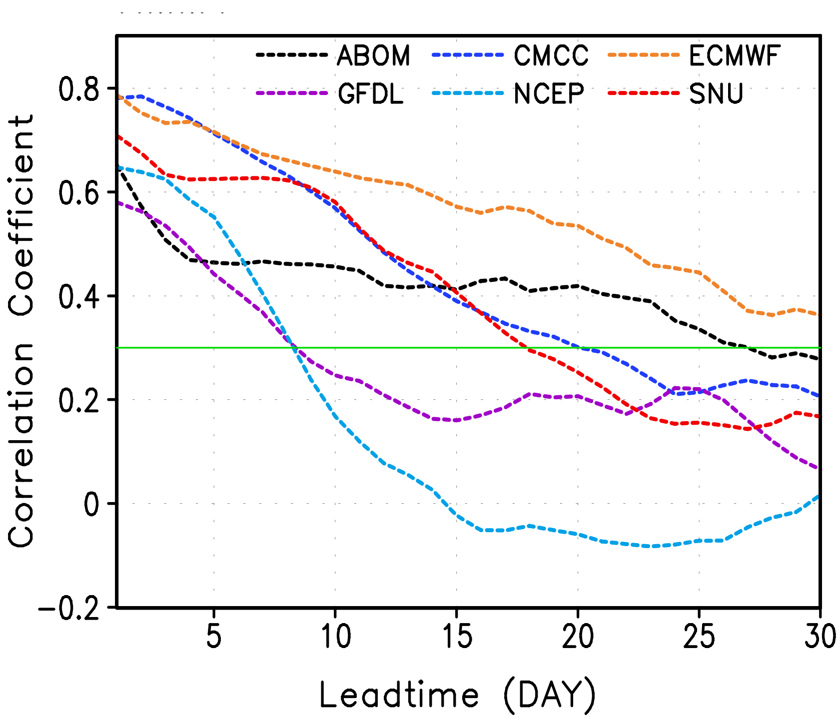
Temporal Correlation Coefficient Skill for U200



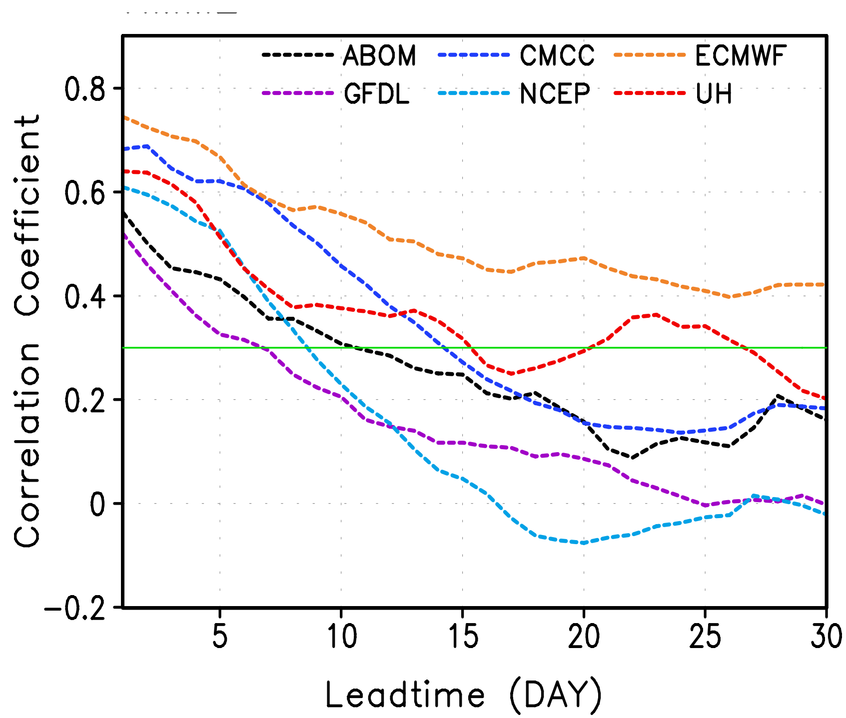
Forecast Skills for the RMM Index

The Bivariate Correlation Skill for the RMM Index

ONDJFM



AMJJAS

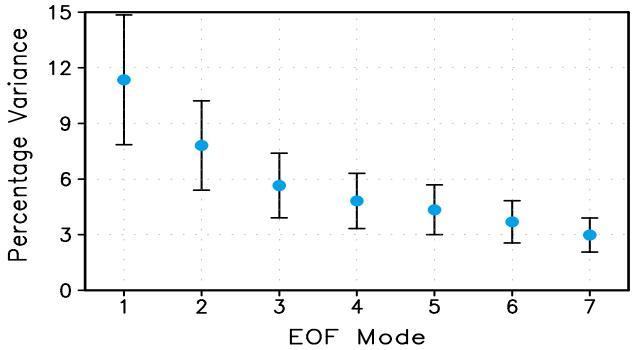


The bivariate correlation between the observed and forecasted RMM indices as described by Lin et al. (2008).

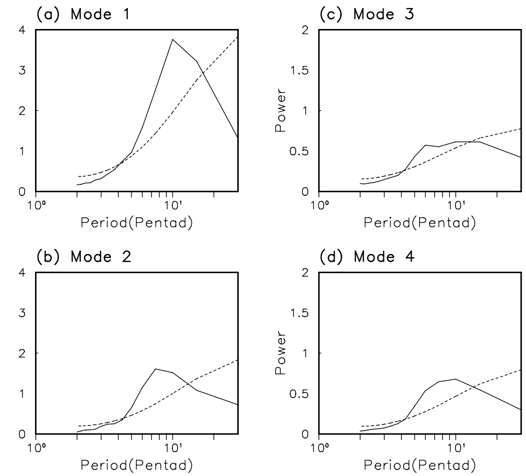
$$COR(\tau) = \frac{\sum_{t=1}^{N}\left[a_1(t)b_1(t,\tau) + a_2(t)b_2(t,\tau)\right]}{\sqrt{\sum_{i=1}^{N}\left[a_1^2(t) + a_2^2(t)\right]}\sqrt{\sum_{i=1}^{N}\left[b_1^2(t,\tau) + b_2^2(t,\tau)\right]}}$$

MISO Index:
The First Four PCs of ASM EOF of U850 and OLR

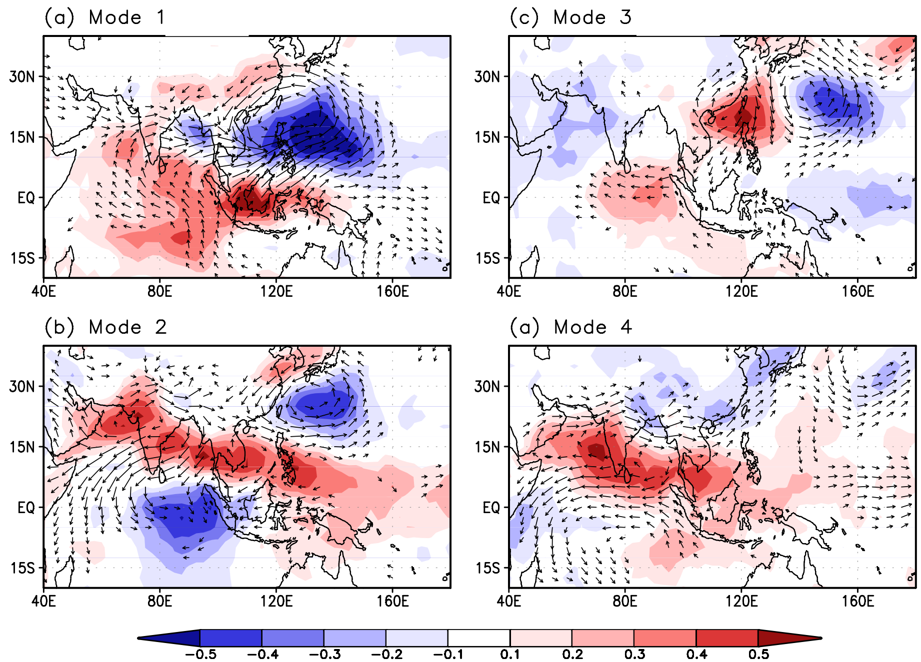
Eigen value for each mode with uncertainty



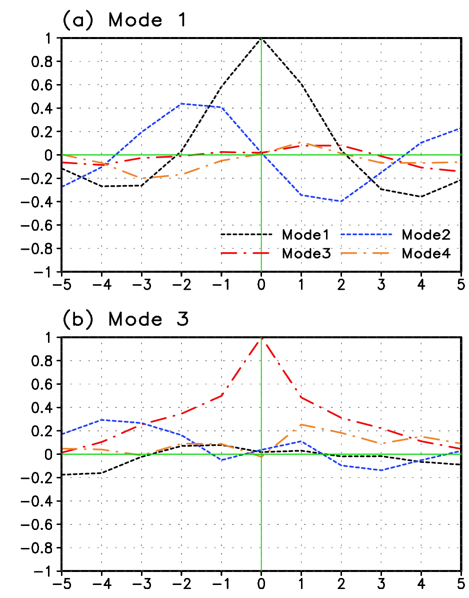
Power Spectra



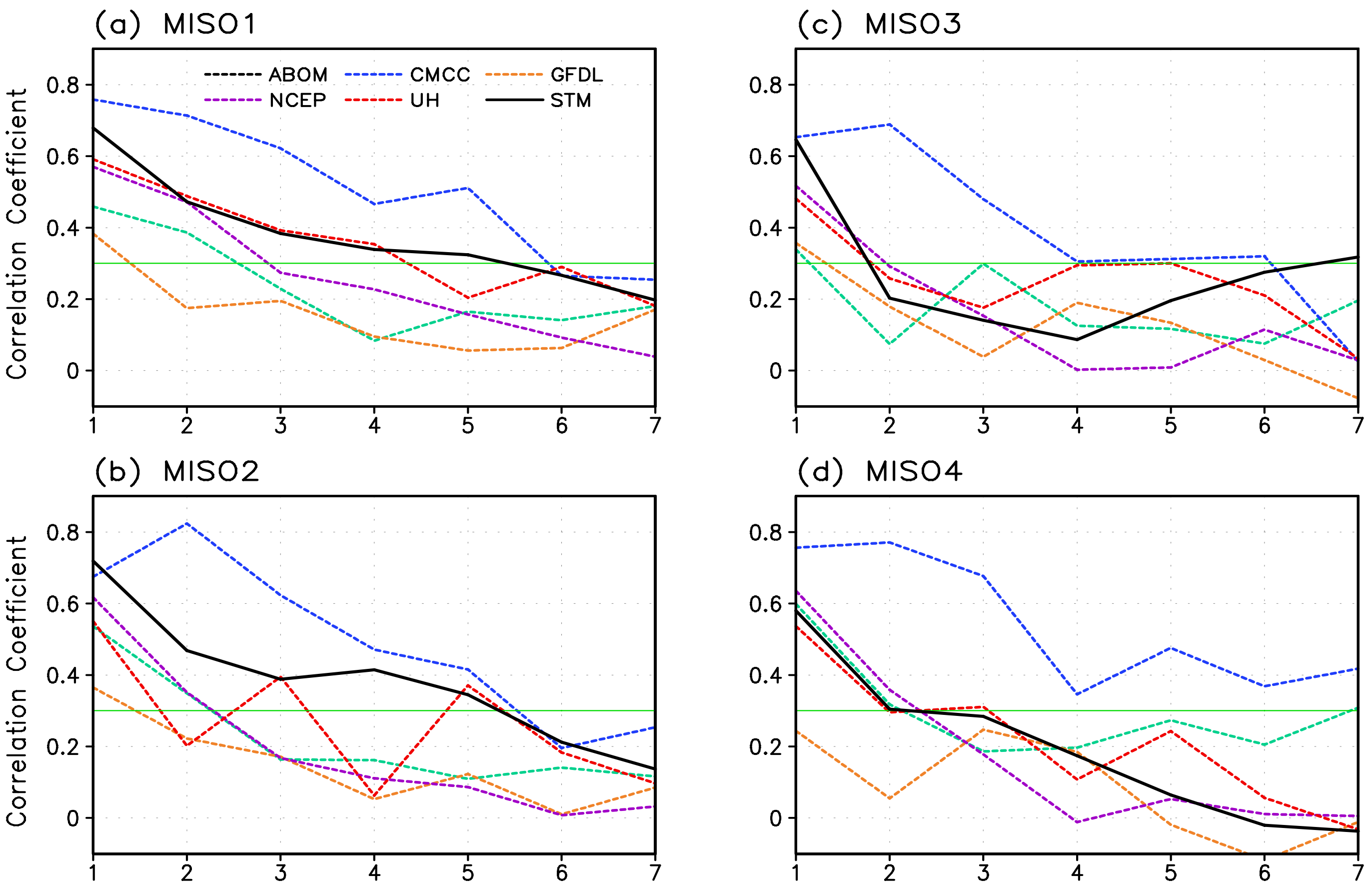
Correlation Coefficients against Each Mode



Lead-lag Correlation Between Modes

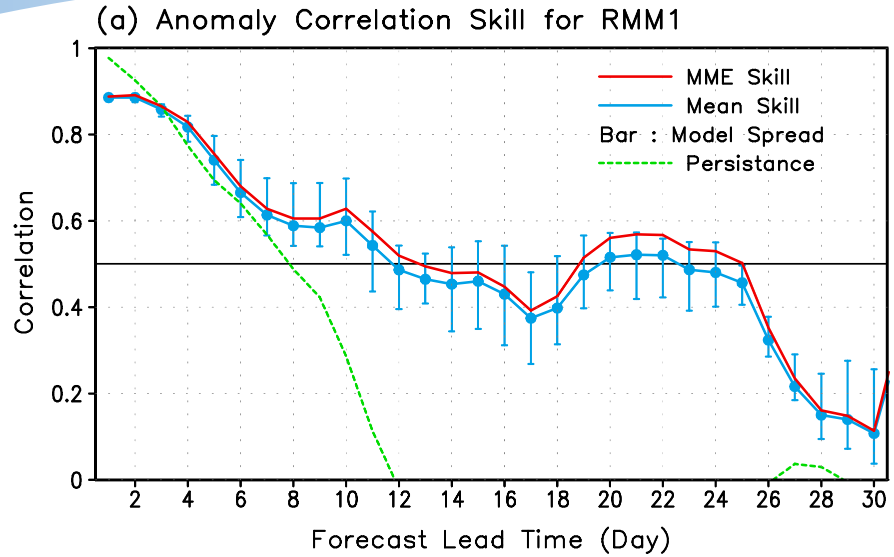


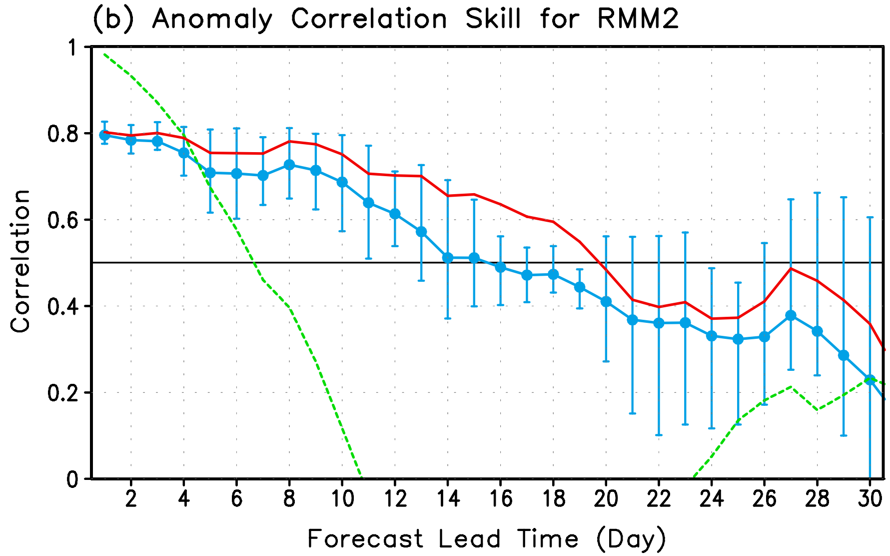
Forecast Skills for the MISO Index




Thank You !

Preliminary Results (will be modified)





* Anomaly temporal correlation skill for RMM1 and RMM2 for MJJAS