ISV Hindcast Experiment (ISVHE)

A Joint effort by APCC, AAMP, YOTC, and AMY

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Background

ISVHE

- Forecast of ISV (e.g. 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.
- Determination of ISV prediction skill and estimating ISV predictability in current AOGCMs is a pressing scientific need for developing 2-6 week subseasonal prediction.
- Launching a coordinated ISV 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.

Objectives

- Better understand physical basis for ISV prediction.
- Estimate potential and practical predictability of ISV with multi-model.
- Developing optimal strategies for MME ISV prediction.
- Identify model deficiencies in predicting ISV and suggest ways to improve models through development of model process diagnostics.
- Revealing new physical mechanisms associated with ISV and multi-scale interactions.
- Study ISV's modulation of extreme hydrological events and its contribution to S-I climate variation.

Experimental Design

ISVHE

EXP1: Control Simulation – intrinsic variability & multi-scale interactions

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.

EXP2: 21-year (January 1 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.

MODEL OUTPUT: a number of atmospheric 2D & 3D fields (17 press levs) and a few upper ocean (300m) 3D fields (for coupled models).

ISVHE Participations

ISVHE

Current Participating Groups

Institution	Participants
ABOM, Australia	Harry Hendon, Oscar Alves
CMCC, Italy	Antonio Navarra, Annalisa Cherichi, Andrea Alessandri
CWB, Taiwan	Mong-Ming Lu
ECMWF, EU	Franco Molteni, Frederic Vitart
GFDL, USA	Bill Stern
JAMSTEC, 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
PNU, Korea	Kyung-Hwan Seo
SNU, Korea	In-Sik Kang
UH/IPRC, USA	Bin Wang, Xiouhua Fu, June-Yi Lee

Description of Models and Experiments

ISVHE

One-Tier System

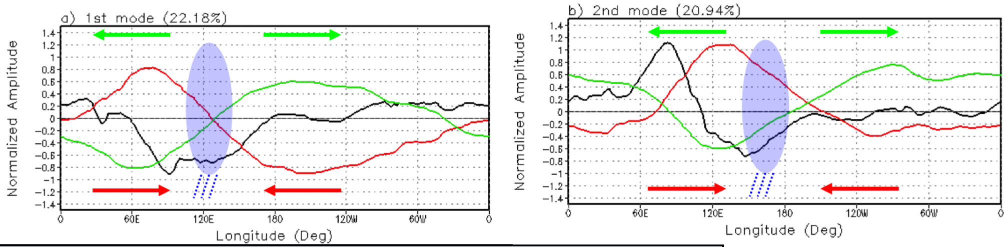
	Model	Control Run	ISO Hindcast		
			Period	Ens No	Initial Condition
ABOM	POAMA 1.5 & 2.4 (ACOM2+BAM3)	CMIP (100yrs)	1980-2008	10	The first day of every month
CMCC	CMCC (ECHAM5+OPA8.2)	CMIP (20yrs)	1989-2008	5	Every 10 days
ECMWF	ECMWF (IFS+HOPE)	CMIP(11yrs)	1989-2008	15	Every 15 days
GFDL	CM2 (AM2/LM2+MOM4)	CMIP (50yrs)	1982-2008	10	The first day of every month
JMA	JMA CGCM	CMIP (20yrs)	1989-2008	6	Every 15 days
JAMSTEC	SINTEX-F	CMIP (20yrs)	1989-2008	9	The first day of every month
NCEP/CPC	CFS v1 (GFS+MOM3) & v2	CMIP 100yrs	1981-2008	5	Every 10 days
PNU	CFS with RAS scheme	CMIP (13yrs)	1981-2008	3	The first day of each month
SNU	SNU CM (SNUAGCM+MOM3)	CMIP (20yrs)	1989-2008	1	Every 10 days
UH/IPRC	UH HCM	CMIP (20yrs)	1994-2008	6	Every 10 days

Two-Tier System

	Model	Control Run	ISO Hindcast		
			Period	Ens No	Initial Condition
CWB	CWB AGCM	AMIP (25yrs)	1981-2005	10	Every 10 days
MRD/EC	GEM	AMIP (21yrs)	1985-2008	10	Every 10 days

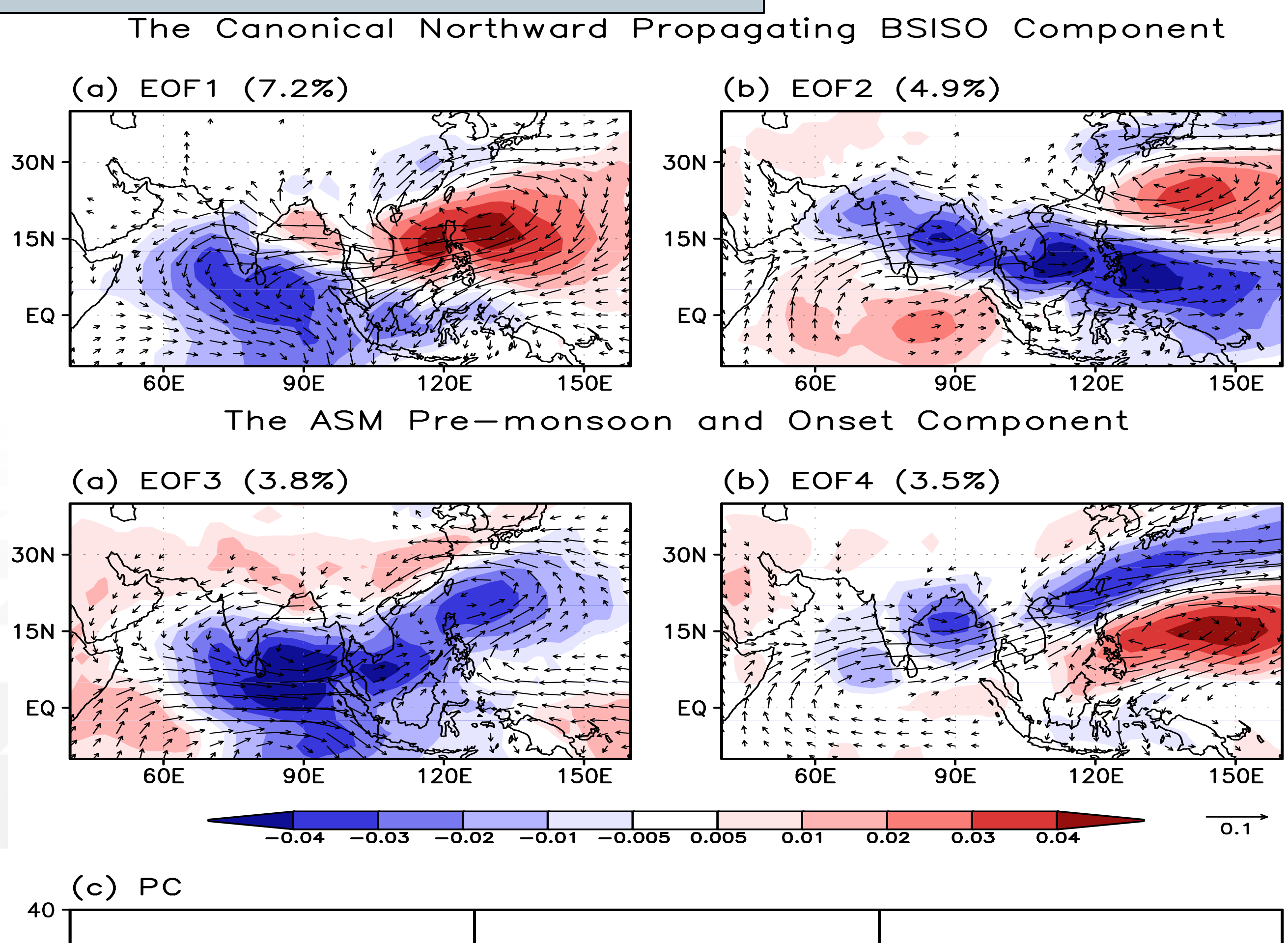
Modes for Analysis

- Boreal Winter – MJO – RMM1 & RMM2



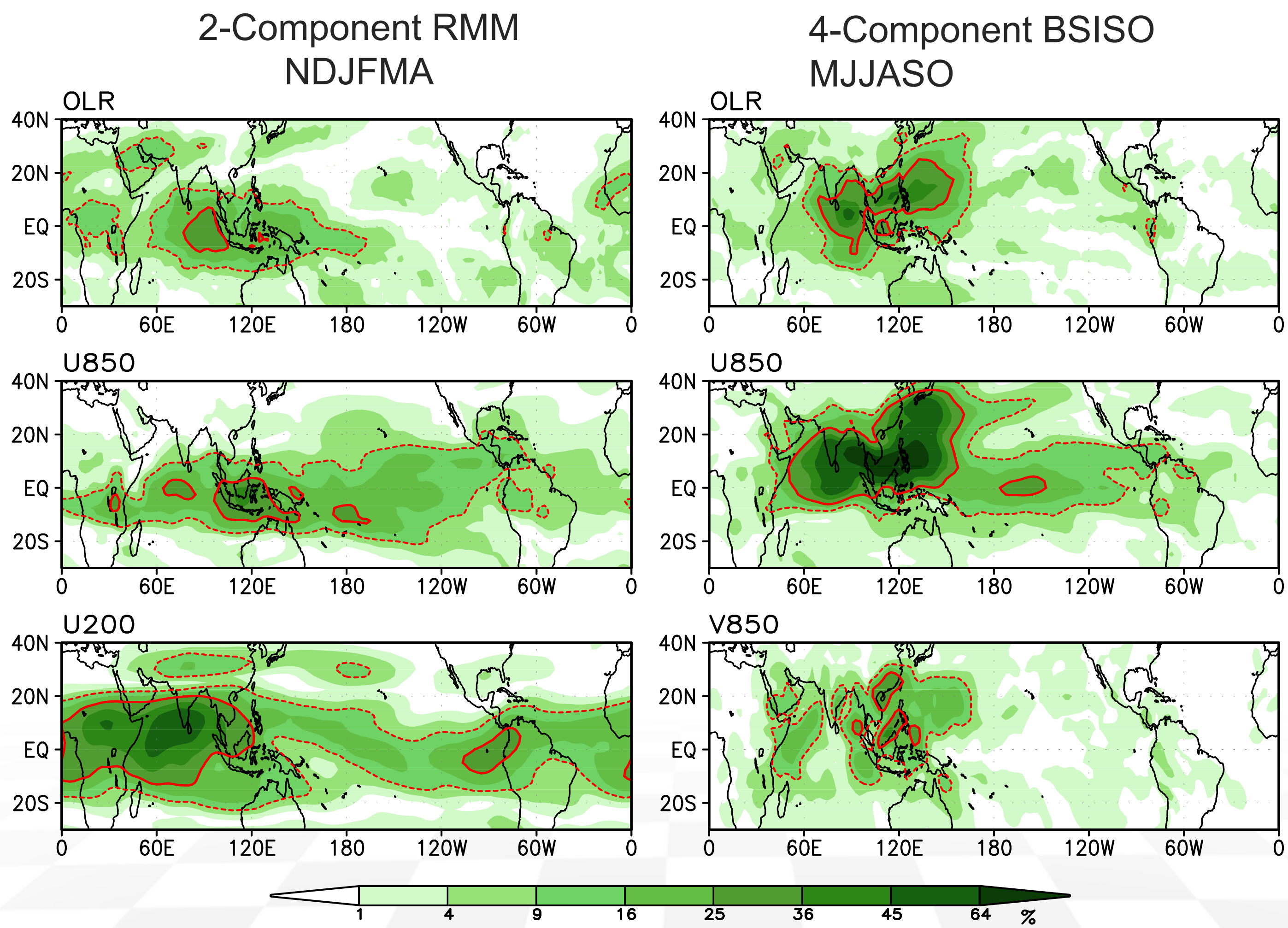
Wheeler and Hendon (2004)

- Boreal Summer – BSISO1 & BSISO2



Lee et al. (2013)

Fractional Variance by the RMM and BSISO Indices



Lee et al. (2013)

Fig. 3. Fractional variance (%) of 5-day mean of OLR, 850-hPa zonal wind (U850) and meridional wind (V850), and 200-hPa zonal wind (U200) anomalies accounted by the two-component RMM index from November to April (left) and by the four component BSISO index from May to October (right): Red dashed and solid lines indicate 9% and 25% level, respectively, those are corresponding to 0.3 and 0.5 correlation coefficient. Anomalies were obtained after removing climatological annual cycle and interannual variability.

Forecast Skill for MJO – Based on RMM Indices

Lee et al. (2013 – in prep)

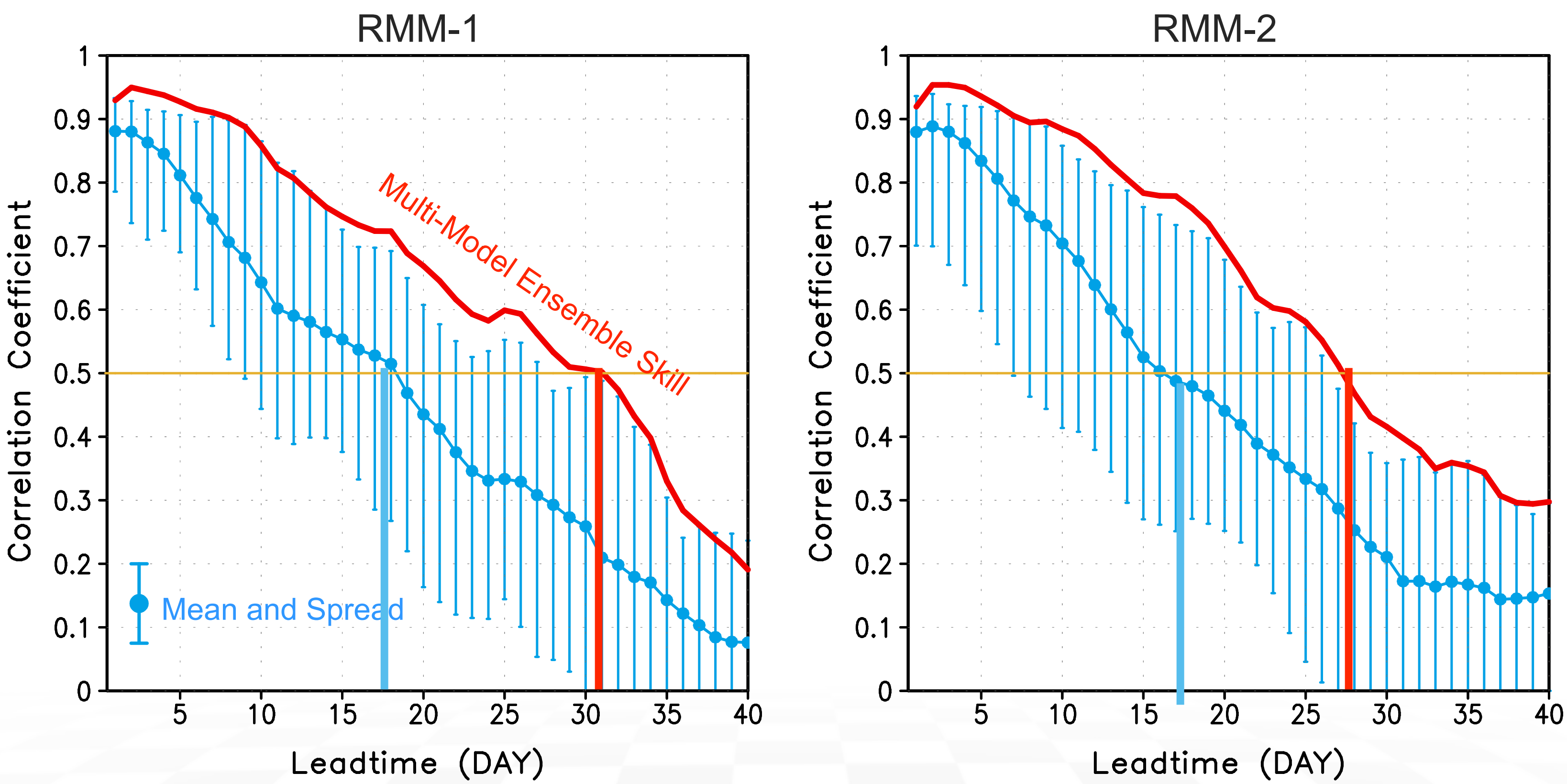


Fig. 4. The temporal correlation coefficient skill for the RMM-1(left) and RMM-2 (right) as a function of forecast leadtime: The mid-blue close dot and bar indicate the mean and spread, respectively, of individual model' correlation skills. The red solid line denotes the skill for the best three models' MME.

Forecast Skill for BSISO Indices

Lee et al. (2013 – in prep)

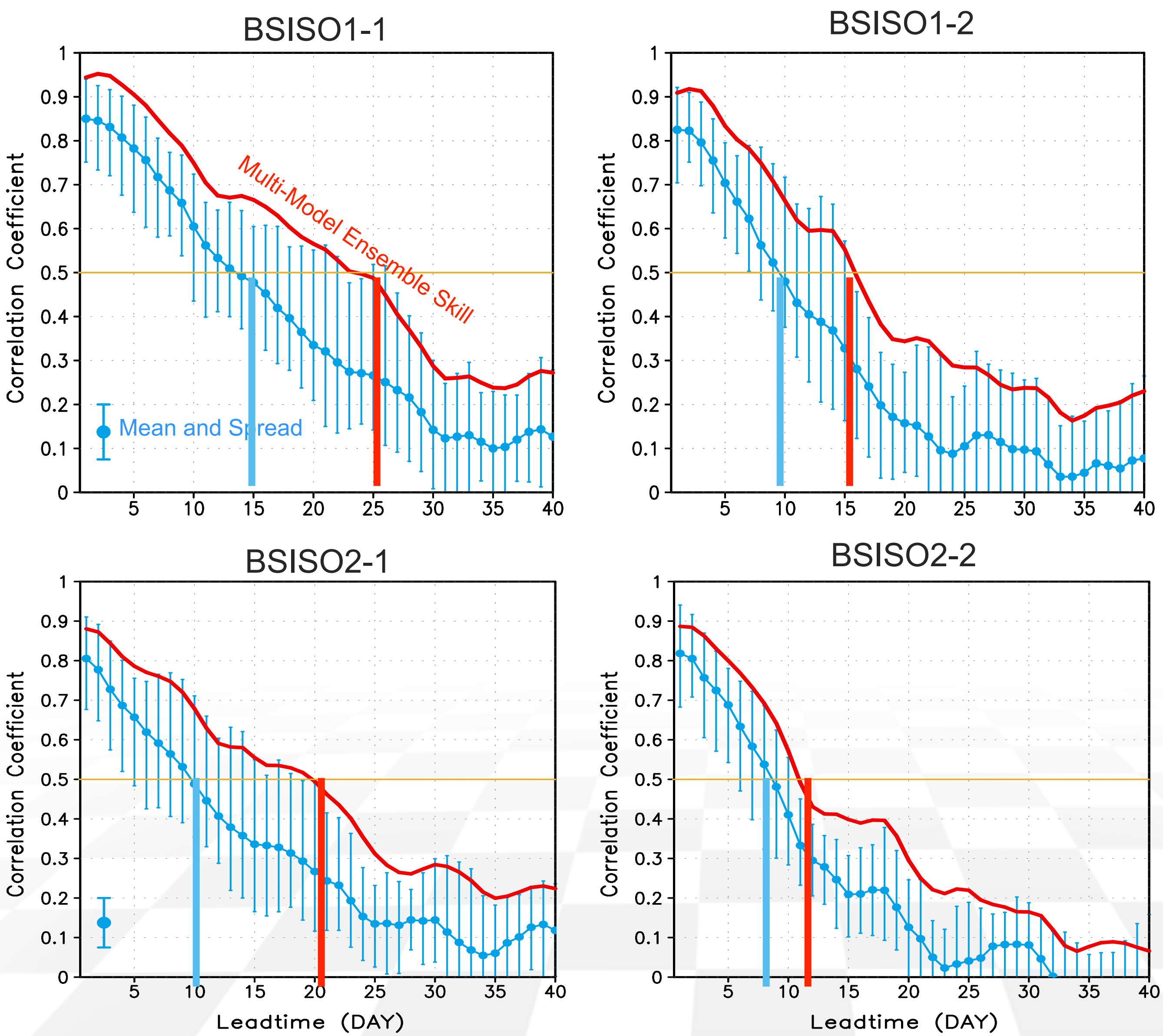
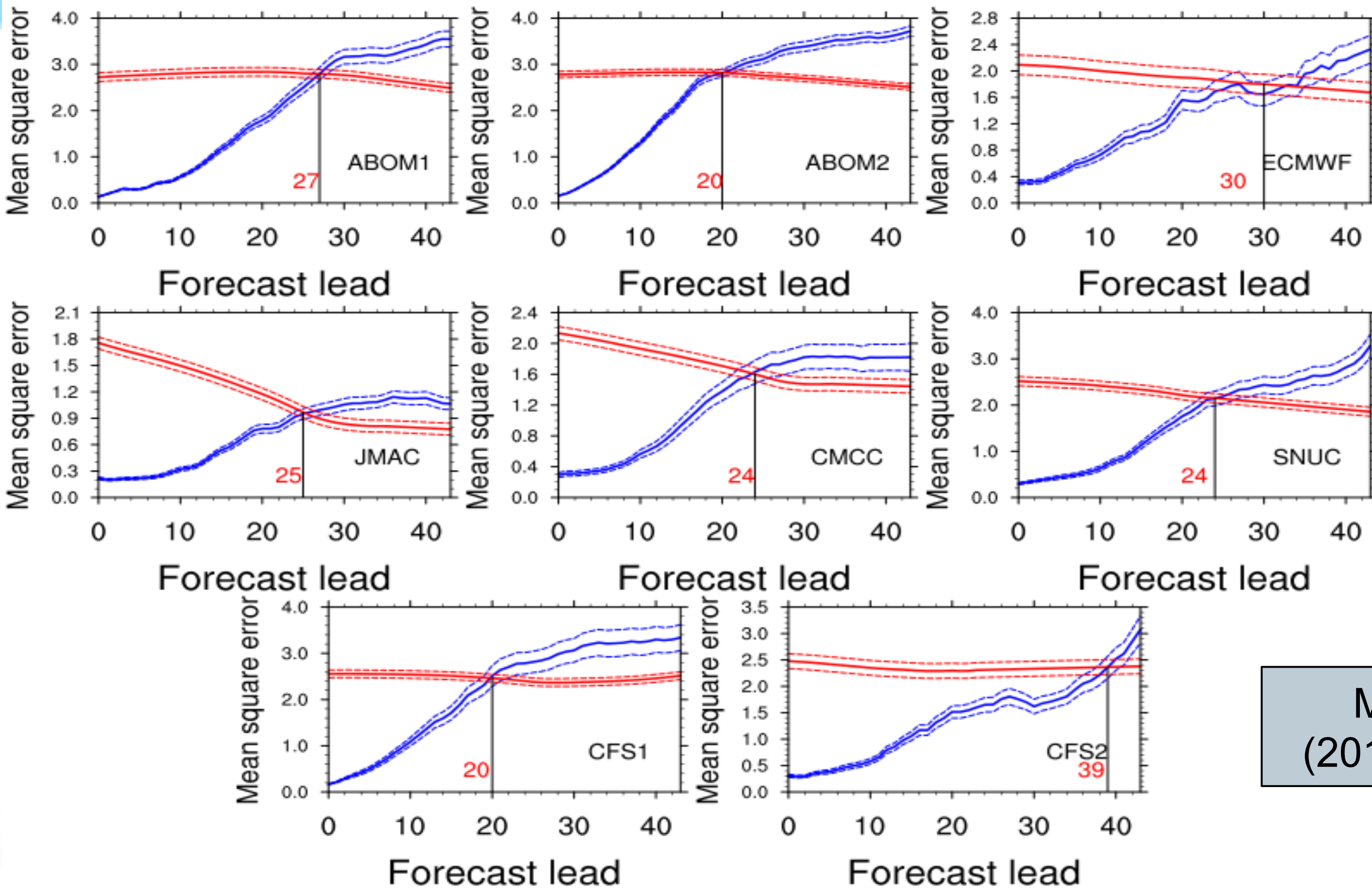


Fig. 5. Same as Fig. 4 except for the 4-component BSISO index.

MJO Predictability Estimates - Based on RMM Indices



Mani et al.
(2013 – in prep)

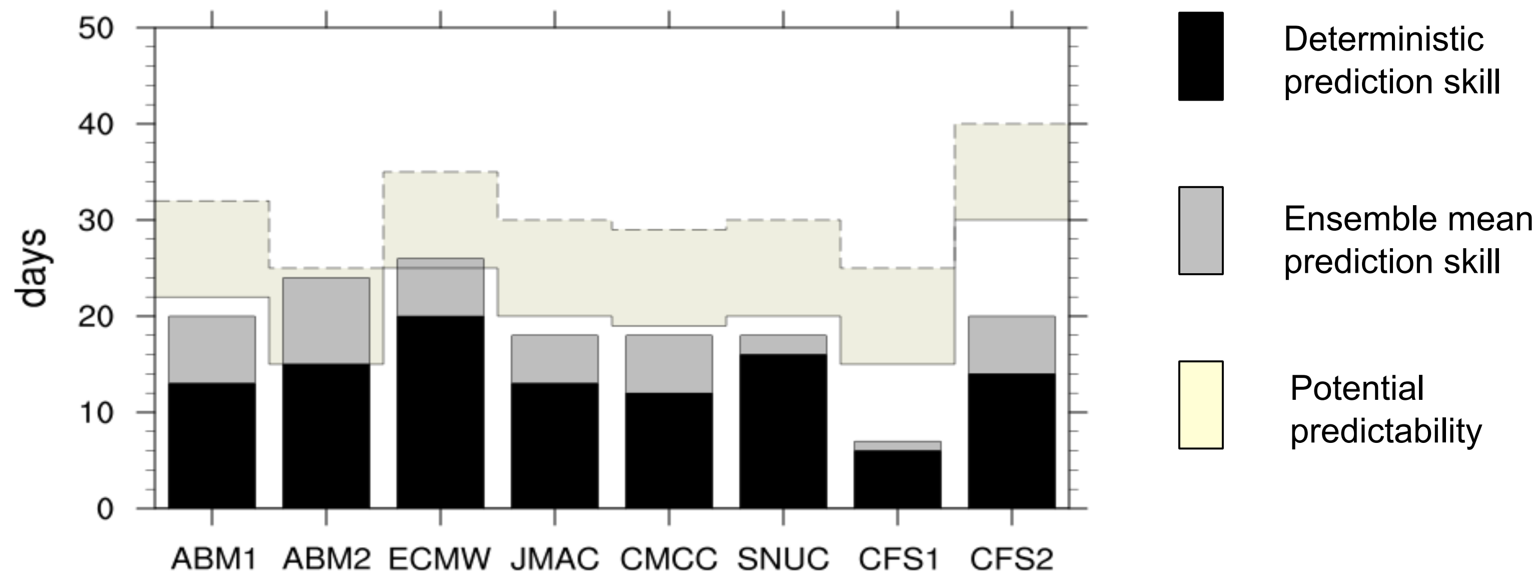
Blue curves --- Mean square estimate of the divergence of bivariate MJO amplitude in two ensemble members (shown along with 95% confidence estimates).

Red curve --- Mean square estimate of average MJO amplitude as a function of forecast leads (shown along with 95% confidence estimates).

The black lines indicate the upper limit of predictability of MJO based on each model's estimate.

MJO Predictability Estimates - Based on RMM Indices

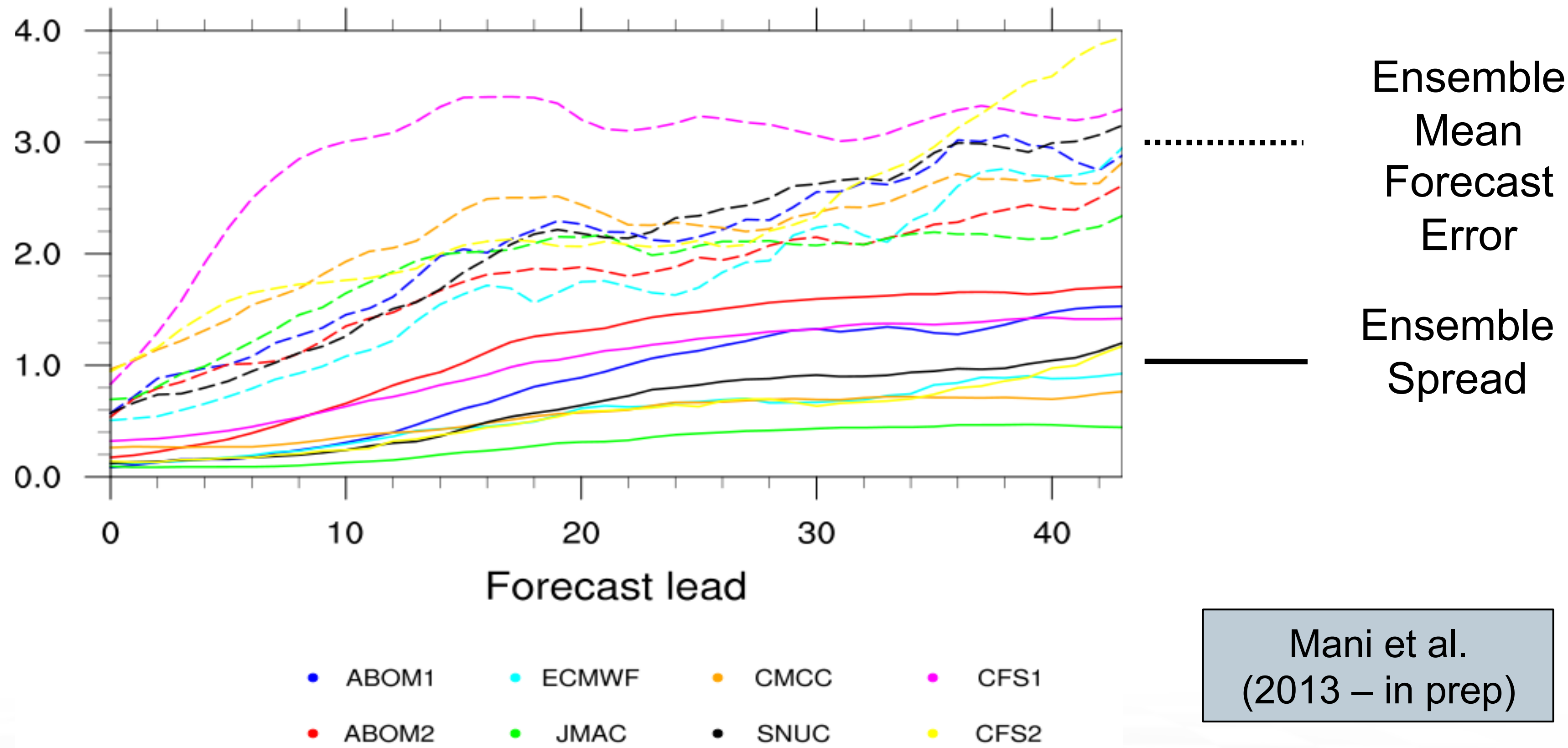
Gap between Prediction Skill and Predictability Estimate for Each Model



Most models can improve their MJO prediction skill by at least one week before reaching their associated potential predictability limit.

Mani et al. (2013 – in prep)

RMS Forecast Error & Ensemble Spread



Mani et al. (2013 – in prep)

- In a statistically consistent ensemble, the RMS forecast error of the ensemble mean (solid) should match the standard deviation of the ensemble members (ensemble spread) (dashed).
- ABOM2 appears to do best in this regard. This is reflected in the large improvement of ensemble mean prediction skill over the deterministic skill.

On-going ISVHE Research

1. **MJO and BSISO prediction skill in ISVHE**
   June-Yi Lee and Bin Wang lead
2. Intrinsic modes of MJO and BSISO in ISVHE coupled models
   June-Yi Lee and Bin Wang lead
3. **MJO predictability**
   Neena Mani and Duane Waliser lead
4. ISV prediction over the eastern Pacific
   Neena Mani and Duane Waliser lead
5. Prediction of MJO teleconnection
   Net Johnson leads
6. **Your Project Title ----- Many more things to do!**
   Your Name ------ Please contact June-Yi & Bin.

Thank you for your attention.