Predictability of Eastern Pacific Intraseasonal Variability

Neena Joseph Mani[1,2]

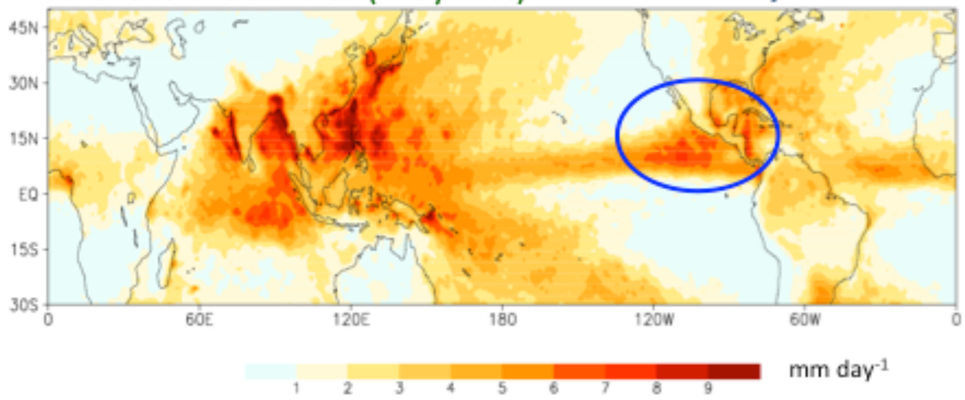
[1]Joint Institute for Regional Earth System Sci. & Engineering / UCLA, USA
[2]Jet Propulsion Laboratory, California Institute of Technology, USA

Xianan Jiang[1,2] Duane Waliser [1,2] June Yi Lee [3,4] and Bin Wang [3]
[3] International Pacific Research Center, University of Hawaii, Honolulu
[4] Pusan National University, South Korea

and participating modeling groups

Based on
J. M. Neena, X. Jiang, D. Waliser, J-Yi Lee and B. Wang: 2014, ***Eastern Pacific Intraseasonal Variability: A predictability perspective*** *J Climate..*

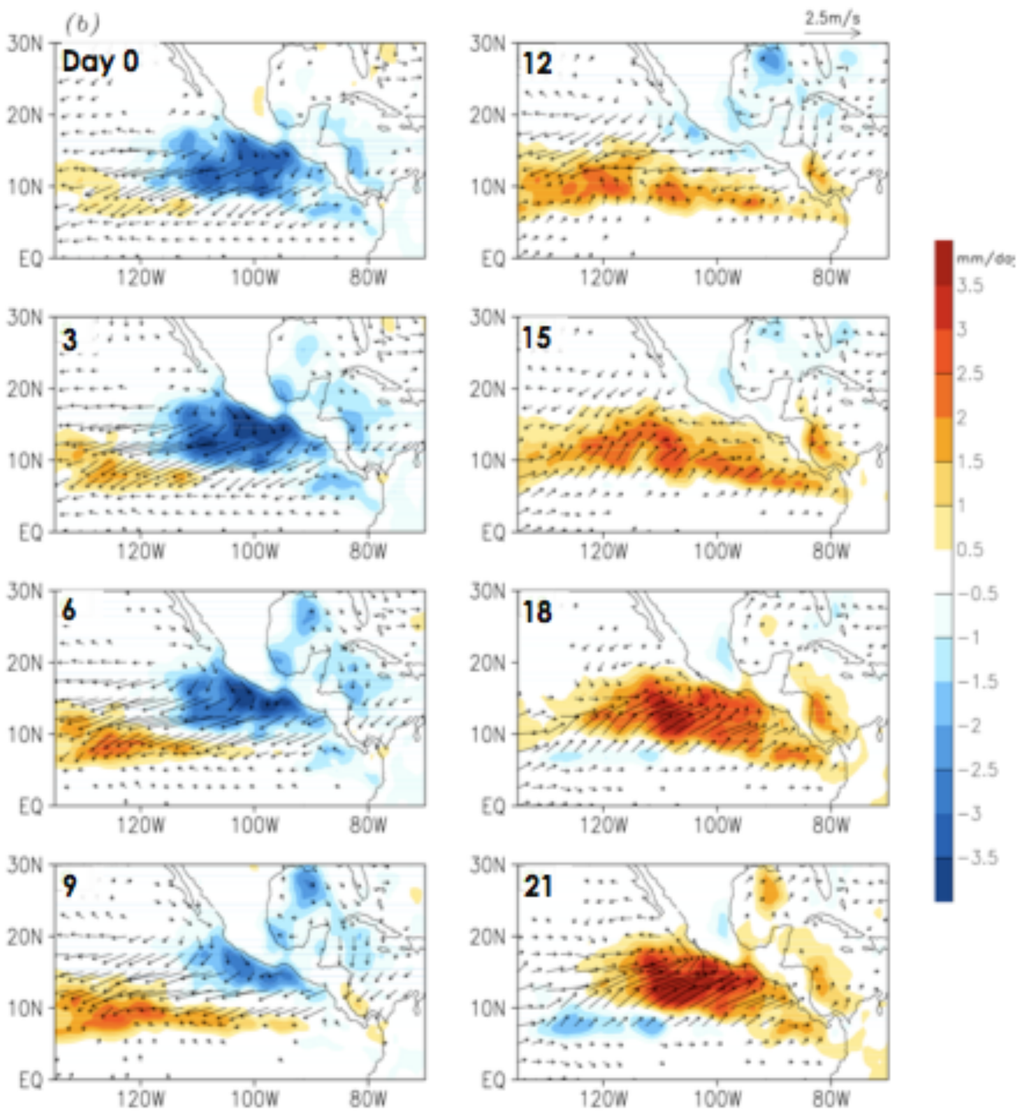
Eastern Pacific ISV



The eastern Pacific warm pool represents a region of strong ISV during boreal summer.

The dominant mode of EPAC ISV is of 30–50 day periodicity characterized by both eastward as well as northward propagation (e.g., Jiang and Waliser, 2008, Jiang and Waliser (2009),Maloney et al, 2008).

Evolution of 40-day ISV Mode



Jiang and Waliser (2008)

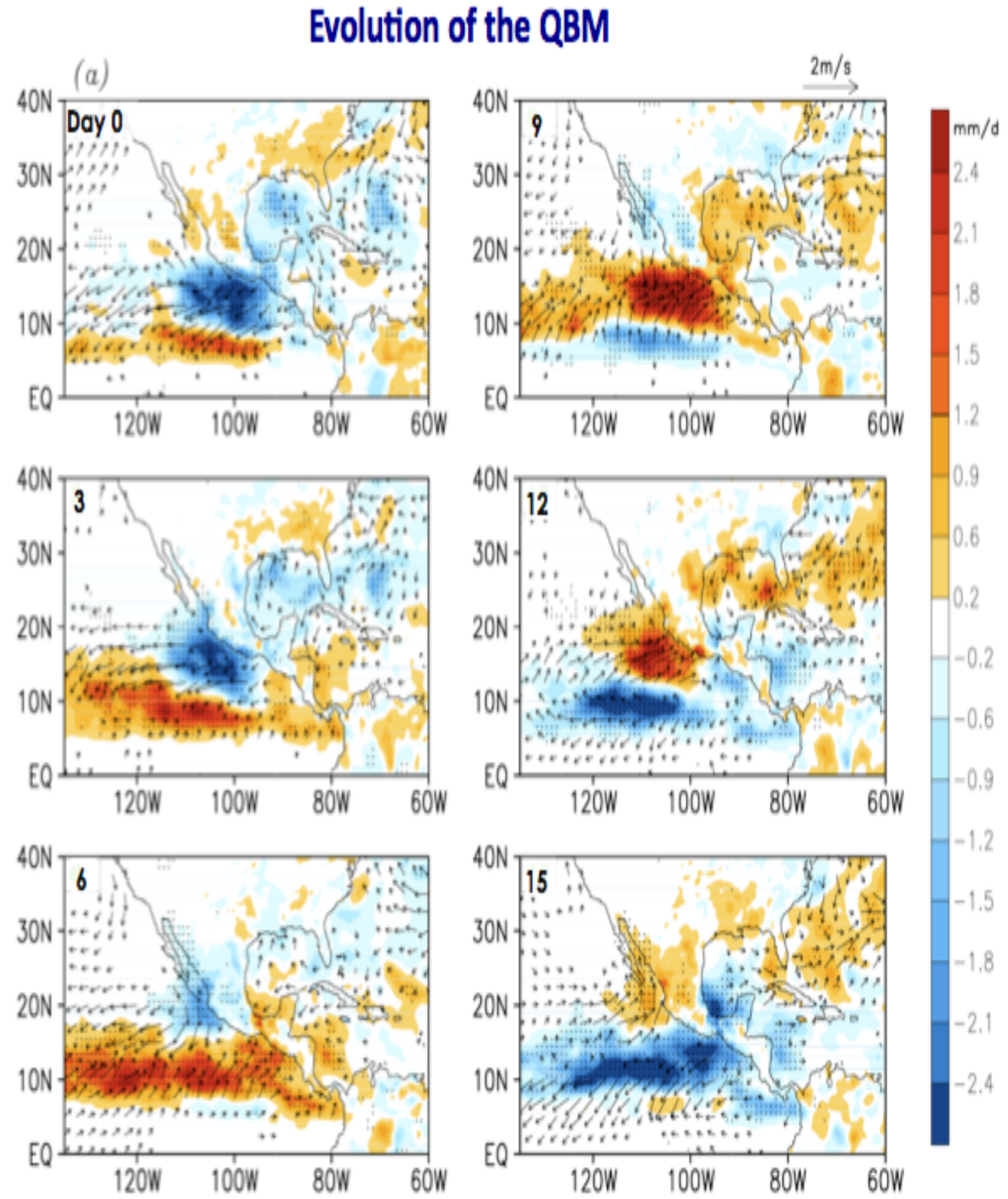
In addition to the 30-50 day mode a quasi biweekly mode of ISV was discovered over the warm pool.

Is the EPAC ISV a local expression of the MJO? (Maloney and Hartmann, 2000; Maloney et al 2007).

Eastward propagating convective signals from West to east Pacific.

Or a mode driven by local convection circulation feedbacks (Jiang et al. 2012; Jiang et al. 2013; Rydbeck et al (2013).).

A see-saw pattern of convective activity exists between the west and east Pacific (Maloney and Esbensen 2007; Maloney et al. 2008)



Jiang and Waliser (2009)

Eastern Pacific ISV

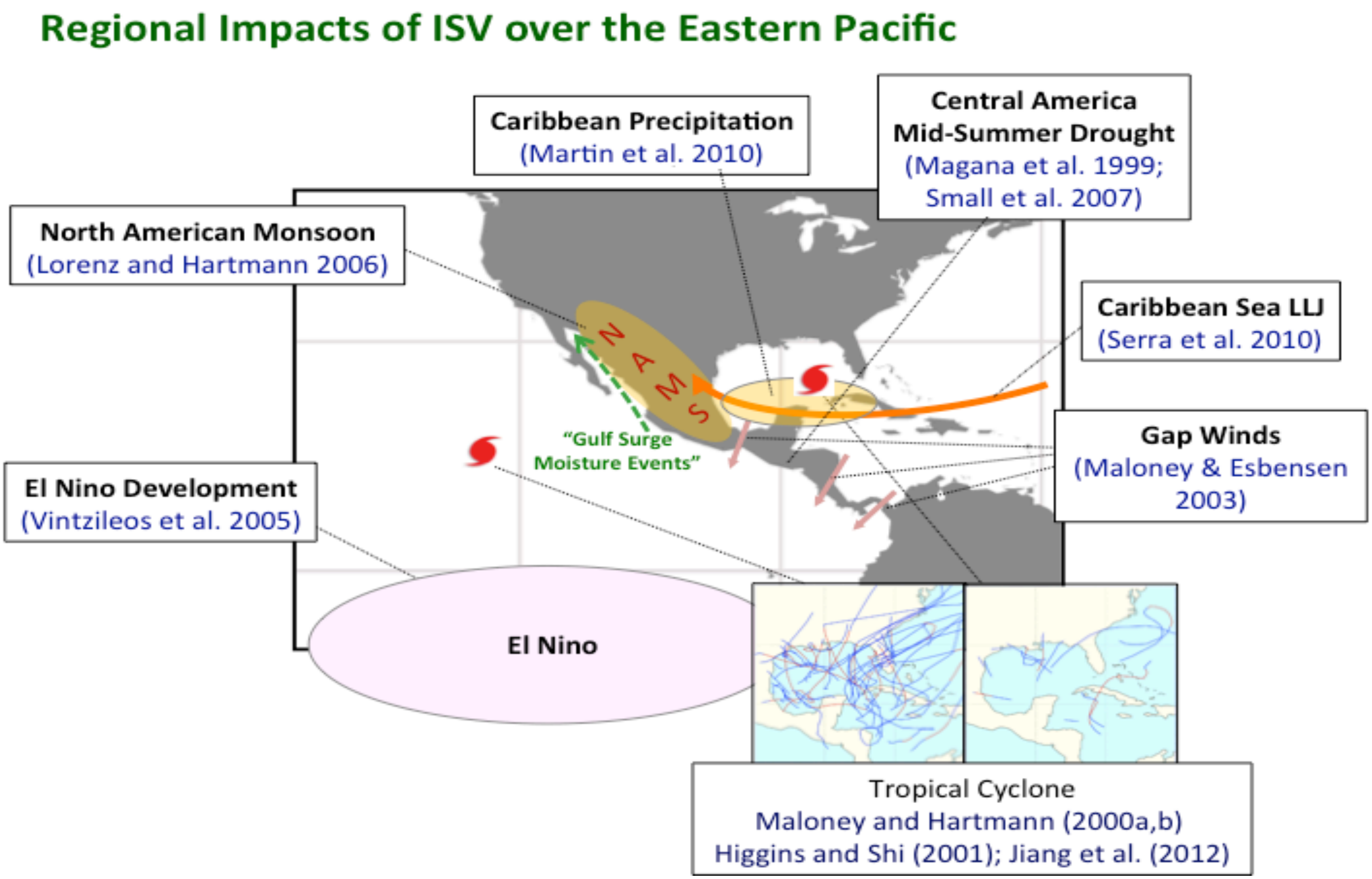


Figure courtesy, X. Jiang (UCLA/JPL)

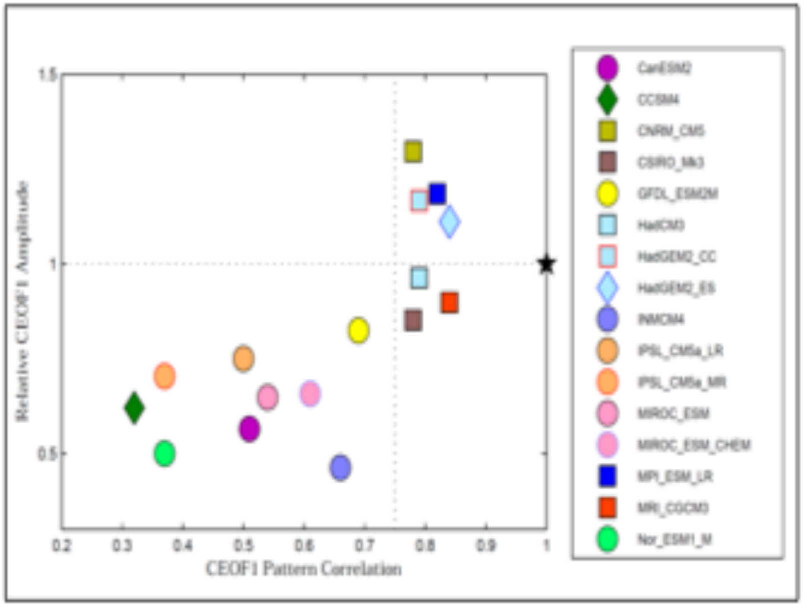
GCM simulations of EPAC-ISV

Most GCMs underestimate the intraseasonal variance over the eastern Pacific (Lin et al, 2008).

Only models with higher horizontal resolution and model physics could capture the EPAC ISV modes reasonably. Especially the QBM (Jiang et al 2010)

Only seven out of the 16 CMIP5 GCMs captured the spatial pattern of the leading ENP ISV mode (Jiang et al, 2012, 2013). The biases are still quite high.

Model fidelity in representing EPAC ISV is closely associated with the ability to simulate a realistic summer mean low-level circulation.



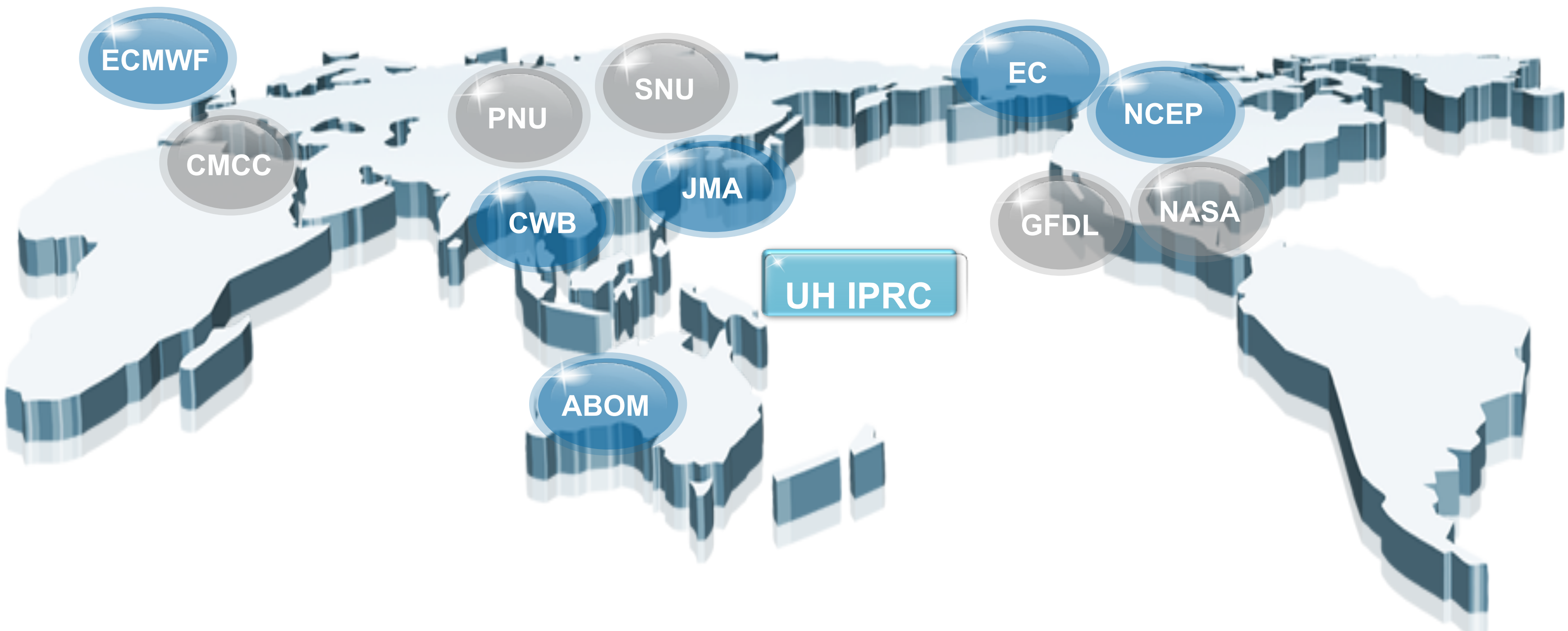
Jiang et al. 2012

But we are yet to understand the fidelity of the models in the prediction mode.
Few, if any multi-model studies have explored the predictability and prediction skill of EPAC ISV

CLIVAR/ISVHE

Intraseasonal Variability Hindcast Experiment

The **ISVHE** is the **FIRST/BEST** coordinated multi-institutional ISV hindcast experiment supported by **APCC, NOAA CTB, CLIVAR/AAMP & MJO WG/TF, and AMY.**

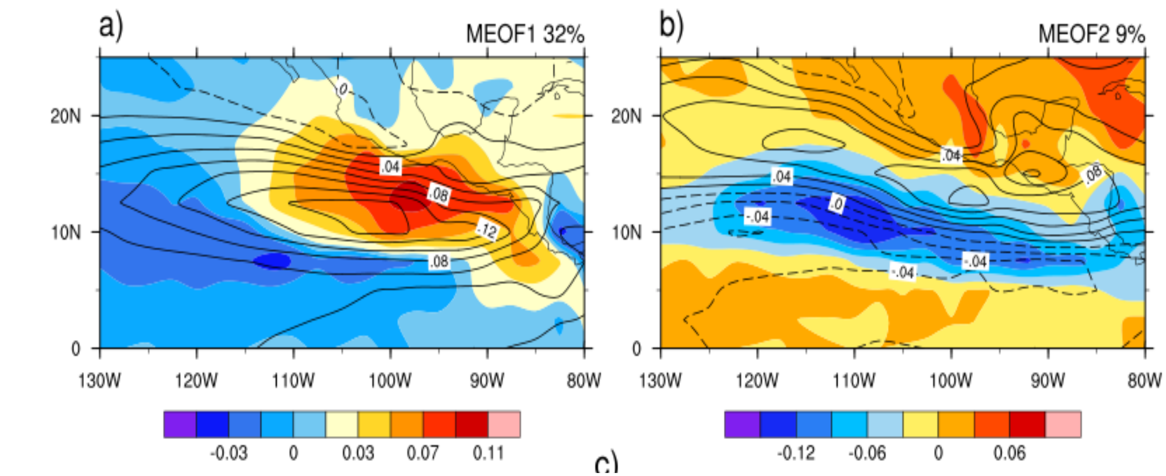


Supporters

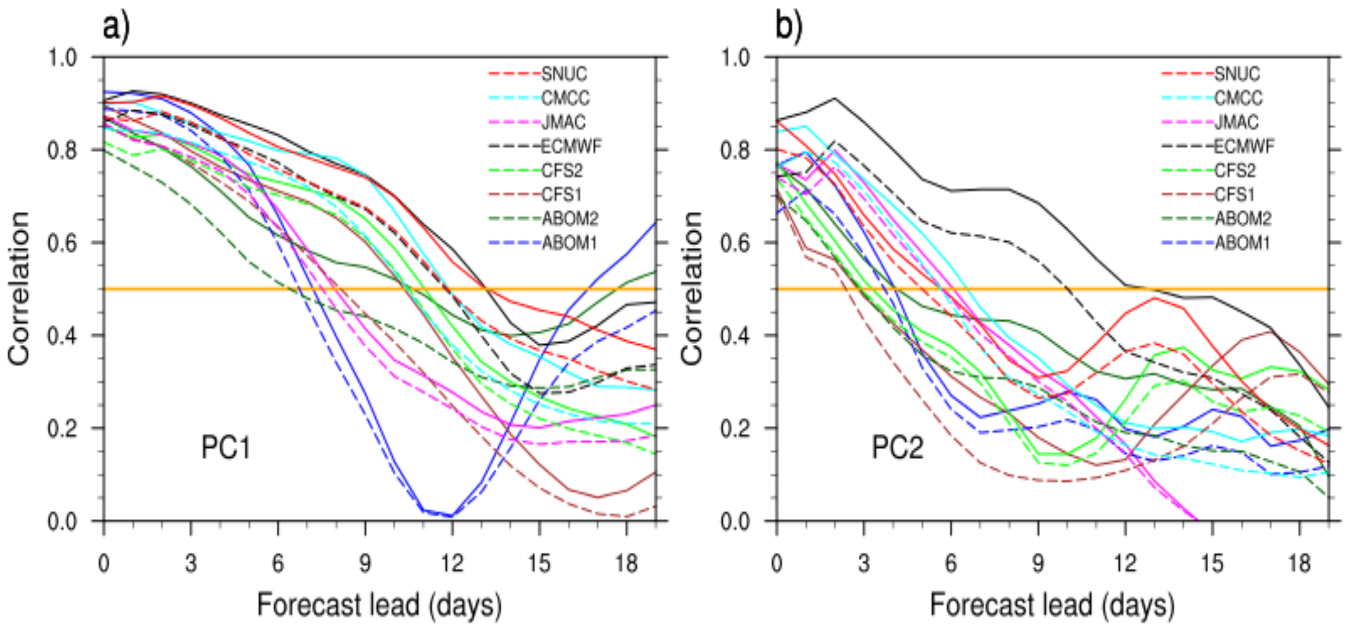
CTB

Additional support provided to this work by

Prediction skill for EPAC ISV



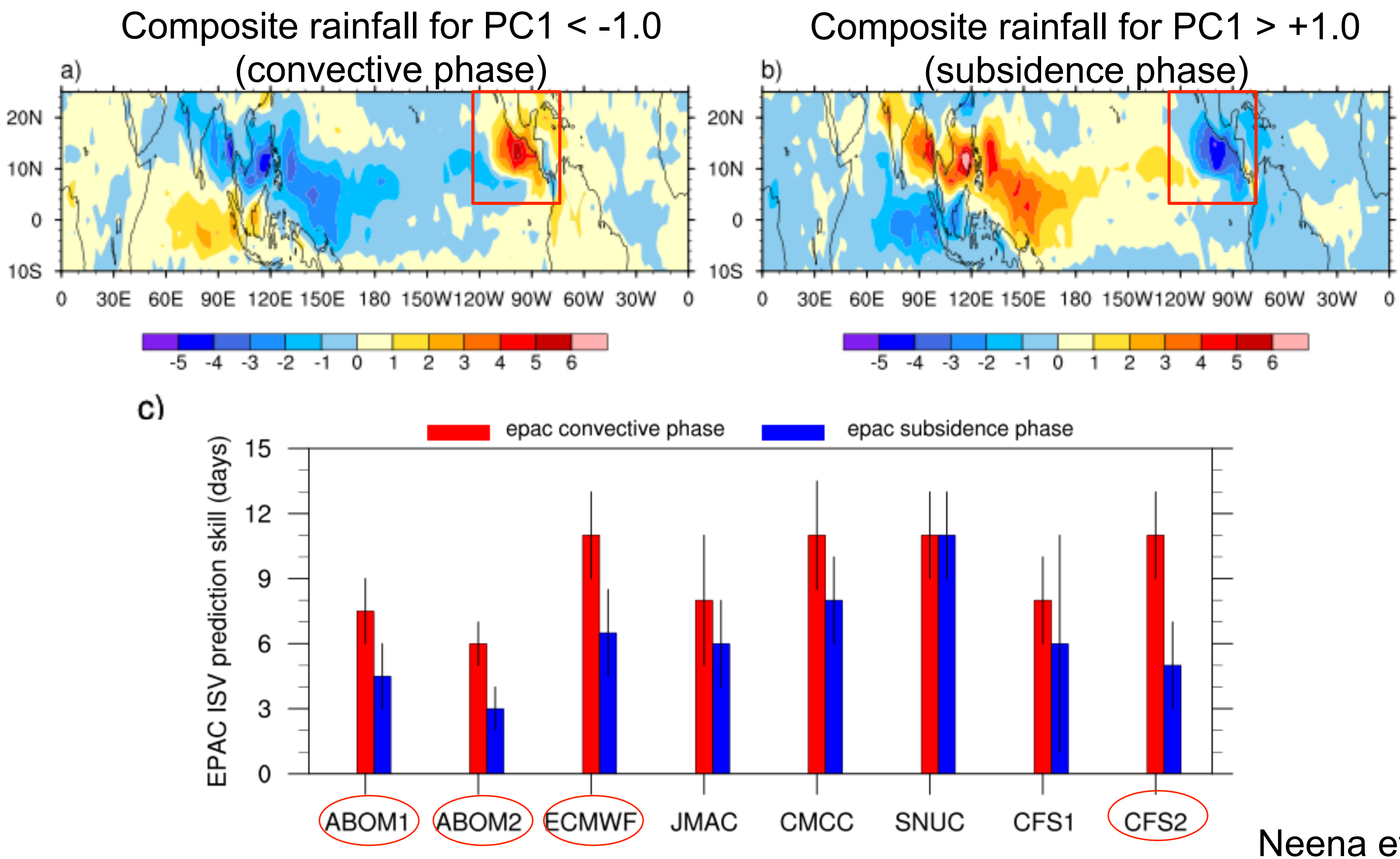
The EPAC ISV mode is isolated using combined EOF analysis of 20-100 day filtered TRMM precipitation and U850 anomalies



PC1 prediction skill ~7-15 days

PC2 skill < 7 days in all models except ECMWF

Prediction Skill for the EPAC ISV convective vs subsidence phases



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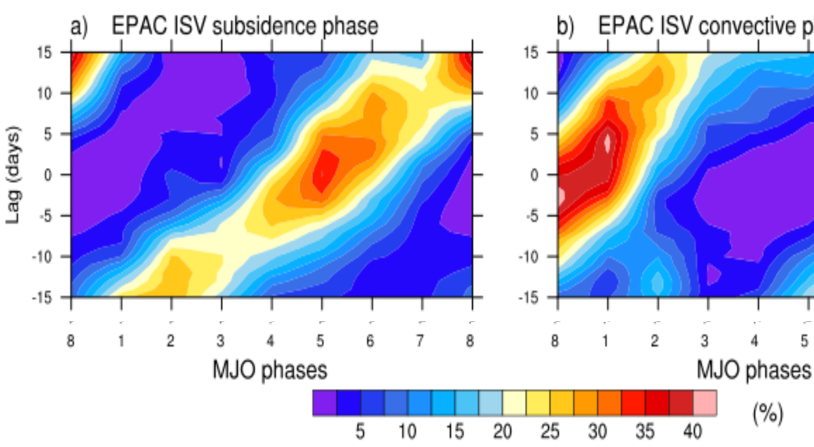
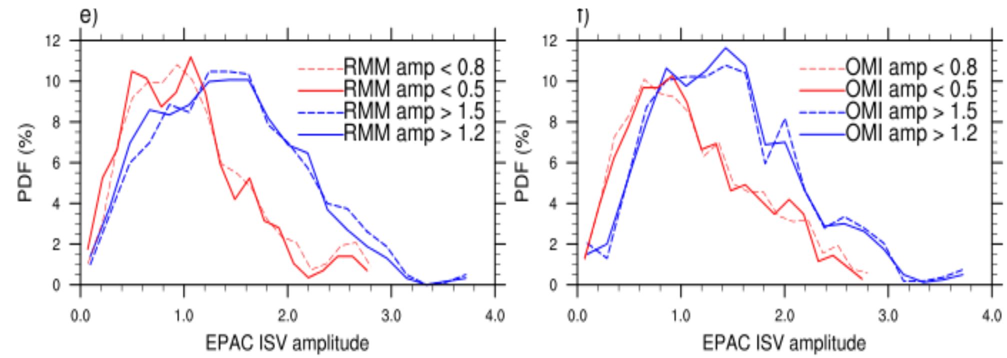
Higher prediction skill (3-5 days) is associated with hindcasts initiated from the EPAC ISV convective phase as compared to those in the subsidence phase.

EPAC ISV and the MJO



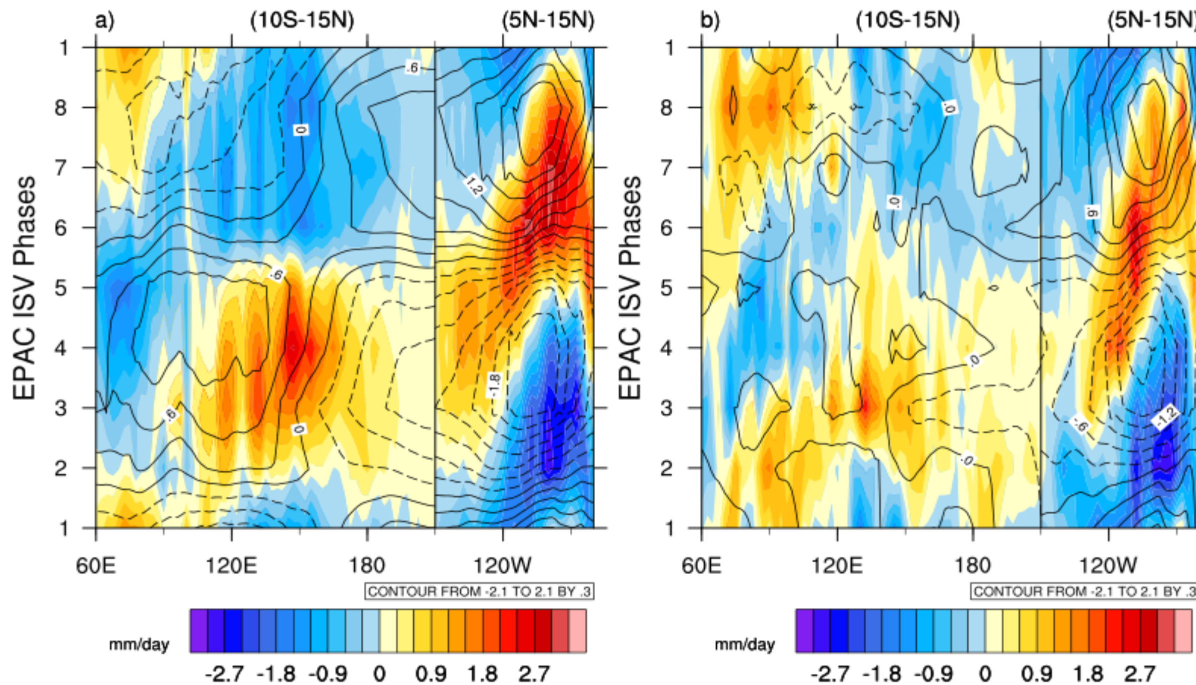
Probability of occurrence of MJO (shown as percentage) in the eight RMM phases for a) subsidence b) convective phase of EPAC ISV.



Probability distribution of EPAC ISV amplitude associated with active MJO conditions (in blue) and quiescent MJO conditions (in red;

EPAC ISV is convective phase is phase locked with subsidence phase of MJO convective activity over the western Pacific warm pool.

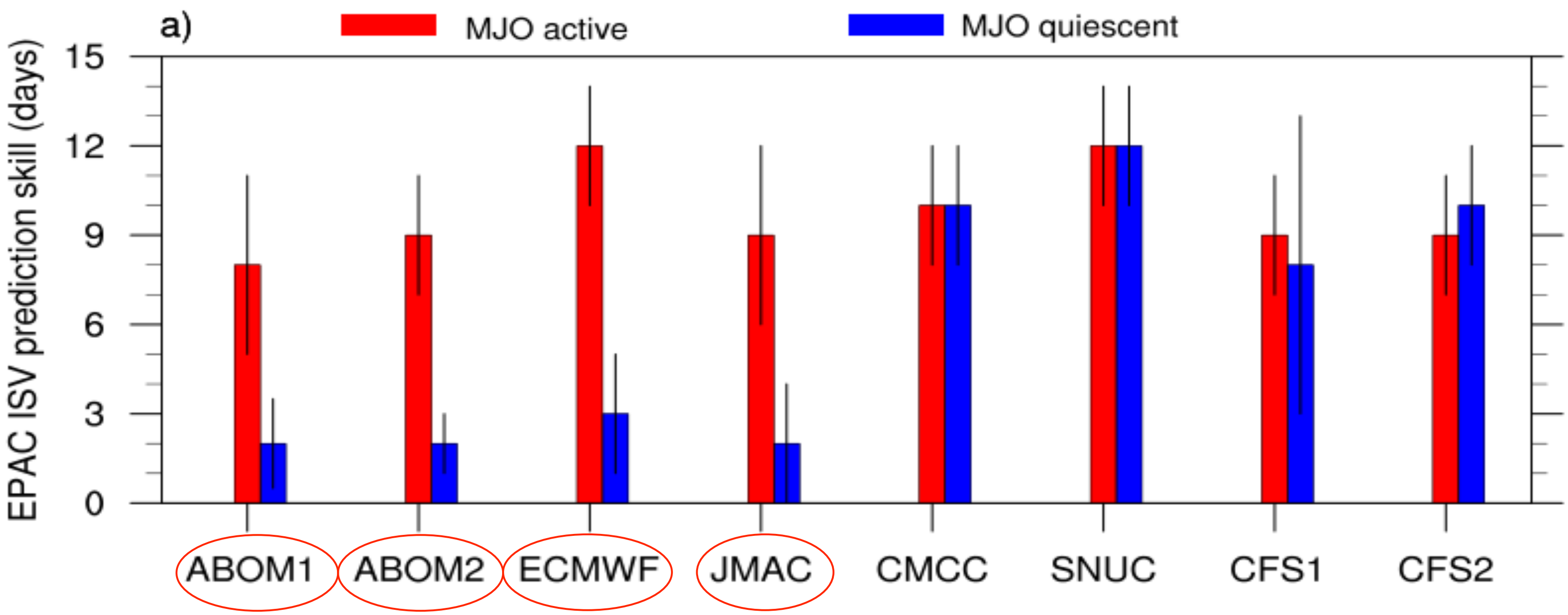
EPAC ISV associated with strong MJO conditions have a stronger amplitude than that associated with quiescent MJO conditions.



Eastward propagation of precipitation and wind anomalies in the EPAC ISV phase composites for a) active MJO conditions and b) quiescent MJO conditions .

EPAC ISV Prediction Skill vs MJO Activity

Hindcasts divided between Active MJO (>= 1.2) and Quiescent MJO (< 0.8)



Four models exhibit distinctly higher prediction skill for EPAC ISV under active MJO conditions

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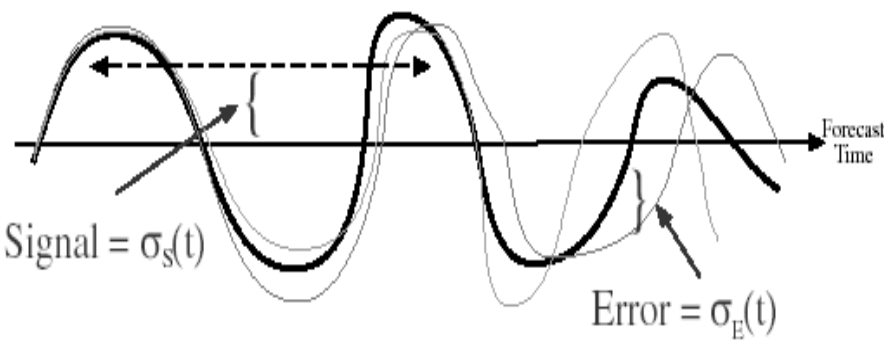
Two estimates of EPAC ISV predictability from model hindcasts

Single Member Approach

Error -- Difference between hindcast PC values for two ensemble members.

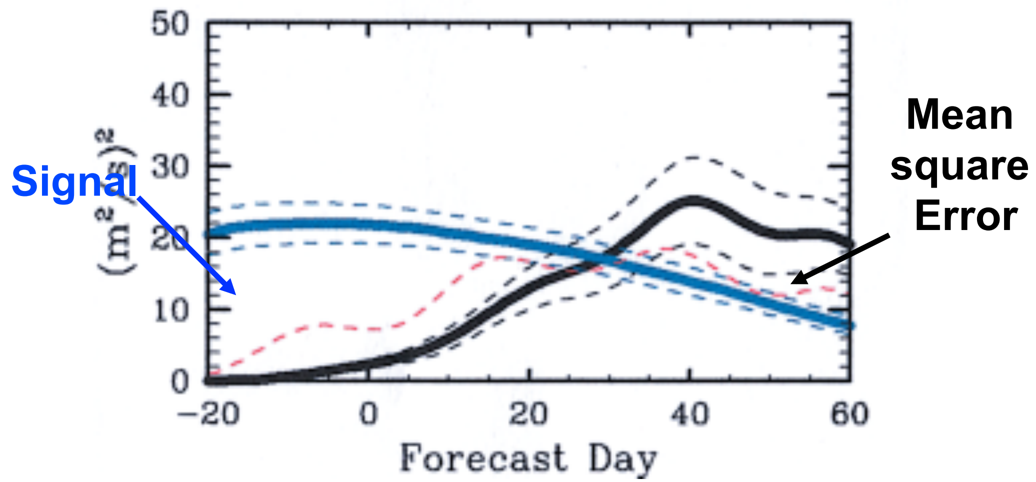


Initial Condition Differences Based On Forecasts 1 Day Apart

Ensemble Mean Approach

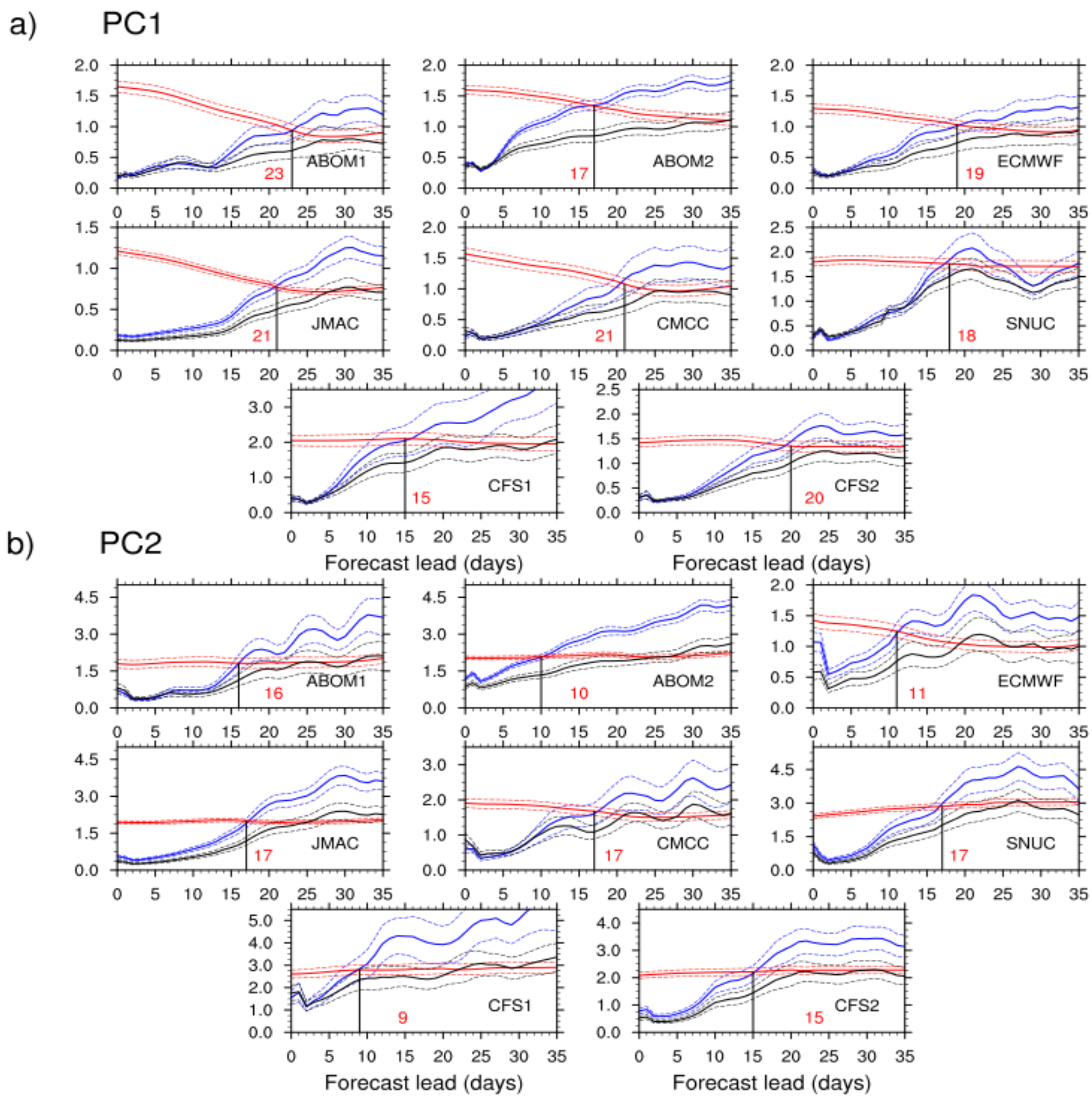
Error -- Difference between hindcast PC values for an individual ensemble member and the ensemble mean of all other members.

Error $$\sigma^2_{\mathrm{E}_{ijk}} = (X^k_{ij} - X^0_{ij})^2$$



As in
Waliser et al. (2003, 2004);
Liess et al. (2005); Fu et al. (2007)
Neena et al 2014

EPAC ISV Mode 1 Predictability & Prediction Skill



PC1 predictability ~15-23 days

PC2 predictability ~9-17 days

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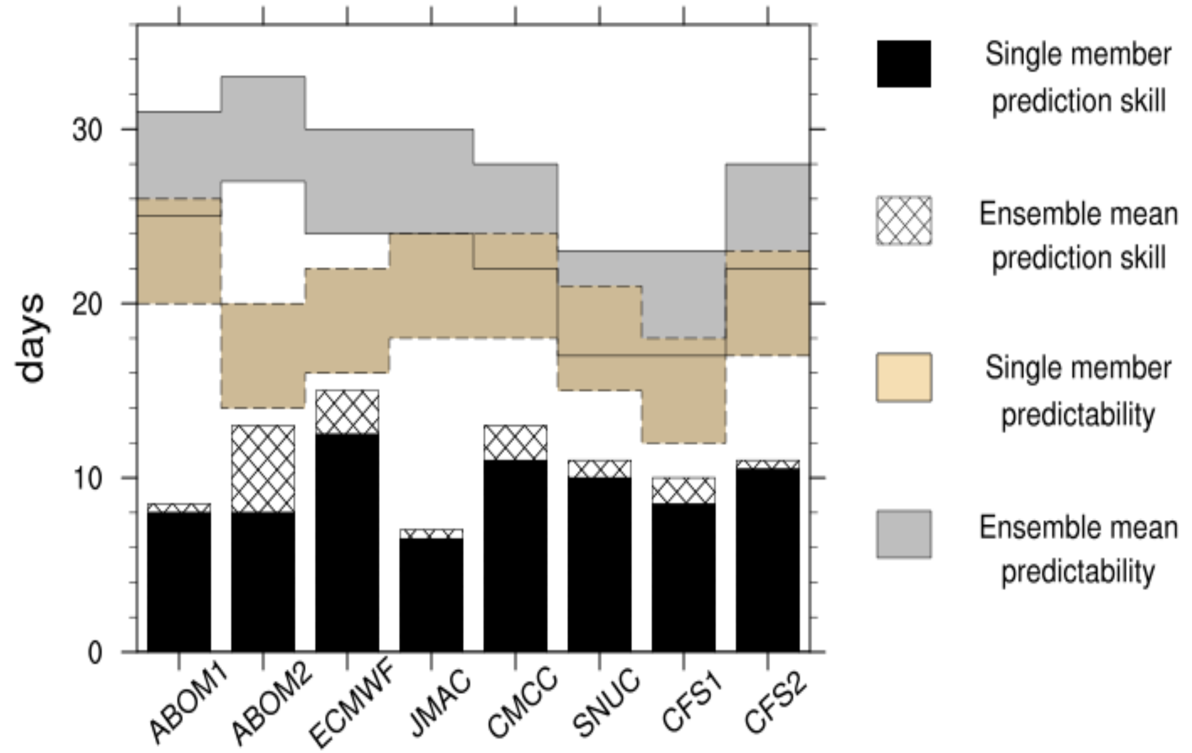
Quantifying the "Gap" between Prediction Skill & Predictability for EPAC ISV mode 1



Skill ~ 10 days

Skill ~ 12 days

Pred ~ 15-23 days

Pred ~ 20-30 days

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Typical single member prediction skill for E.Pac ISV is 7-12 days.

Ensemble prediction only slightly improves the skill.

Predictability estimates for E.Pac ISV is about 20-30 days.

* Predictability estimates are shown as +/- 3 day range

Summary

The predictability & prediction skill of boreal summer EPAC ISV is investigated in the ISVHE hindcasts of eight coupled models.

- EPAC ISV predictability based on individual ensemble members is about 15-20 days while for ensemble means it is about 20-30 days.

- EPAC ISV prediction skill slightly better in some most/some models when initial state has convection vs subsidence in EPAC and for active vs quiescent MJO conditions.

- Ensemble average EPAC ISV forecasts does not show much improvement over single member in the EPAC for the model/forecast systems analyzed.

- The EPAC ISV amplitude is weaker during quiescent MJO conditions. Four models EPAC ISV prediction skill showed a strong dependence on the MJO amplitude at hindcast initiation.

- The relative roles of MJO forcing, other remote forcings from W.Pacific and local feedbacks in initiating and sustaining the EPAC ISV is still not clear. Exploring such mechanisms would be quite relevant for EPAC ISV simulation and prediction.

Thank You