Predictability of Eastern Pacific Intraseasonal Variability

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

See-saw of convective activity between west and east Pacific (Maloney and Esbensen 2007; Maloney et al. 2008)

The EPAC ISV includes a 30–50 day mode and a quasi biweekly mode characterized by both eastward as well as northward propagation (e.g., Jiang and Waliser, 2008, Jiang and Waliser (2009), Maloney et al, 2008).

Regional expression of MJO (Maloney and Hartmann, 2000; Maloney et al 2007).
Eastward propagating convective signals from West to east Pacific.

Regional Impacts of ISV over the Eastern Pacific

- Caribbean Precipitation (Martin et al. 2010)
- Central America Mid-Summer Drought (Magan et al. 1999; Small et al. 2007)
- Caribbean Sea LLJ (Serra et al. 2010)
- Gap Winds (Maloney & Esbensen 2003)
- Tropical Cyclone
  Maloney and Hartmann (2000a,b)
  Higgins and Shi (2001); Jiang et al. (2012)

Figure courtesy, X. Jiang (UCLA/JPL)
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.
The ISVHE is the FIRST/BEST coordinated multi-institutional ISV hindcast experiment supported by APCC, NOAA CTB, CLIVAR/AAMP & MJO WG/TF, and AMY.
The EPAC ISV mode is isolated using combined EOF analysis of 20-100 day filtered TRMM precipitation and U850 anomalies.

Prediction skill for EPAC ISV 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

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

Convective phase of EPAC ISV is phase locked with subsidence phase of MJO over 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.

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).
Four models exhibit distinctly higher prediction skill for EPAC ISV under active MJO conditions.
Two estimates of EPAC ISV predictability from model hindcasts

**Single Member Approach**

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

**Ensemble Mean Approach**

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

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

a) PC1

PC1 predictability
~15-23 days

b) PC2

PC2 predictability
~9-17 days
The ‘Gap’ between current Prediction Skill & Predictability for EPAC ISV mode 1

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

Ensemble prediction only slightly improves the skill.

Predictability estimates for EPAC ISV is about 20-30 days.

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

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

EPAC ISV prediction skill slightly better in some most/some models when initial state has convection vs subsidence over the EPAC.

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 forcing 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!