

Impacts of Initial Conditions on Monsoon Intraseasonal Forecast



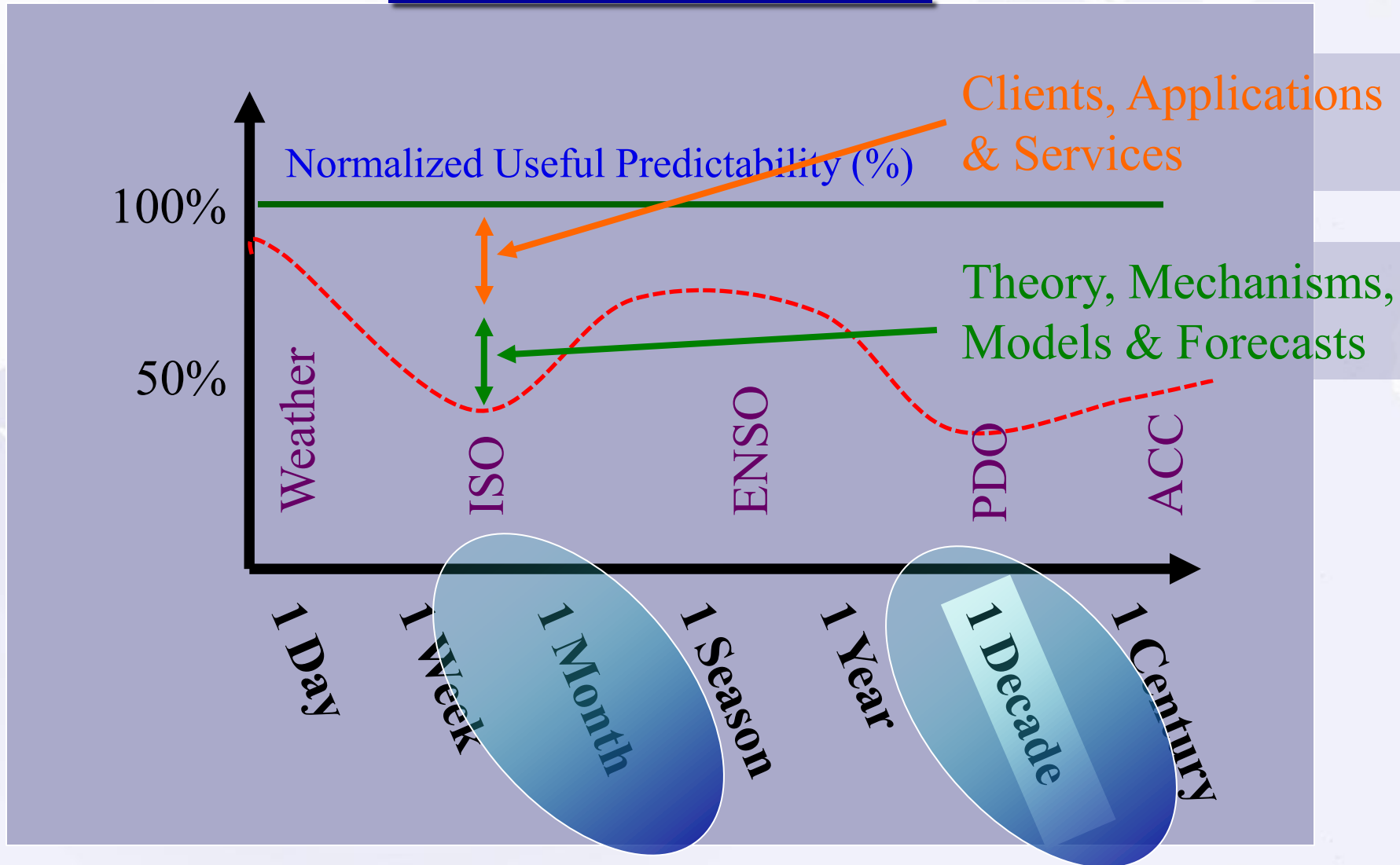
Guam CNMI
Palau FSM
Marshall Islands
Hawaii
American Samoa

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SOEST, University of Hawaii at Manoa

Collaborators: B. Wang, J. Y. Lee, et al.

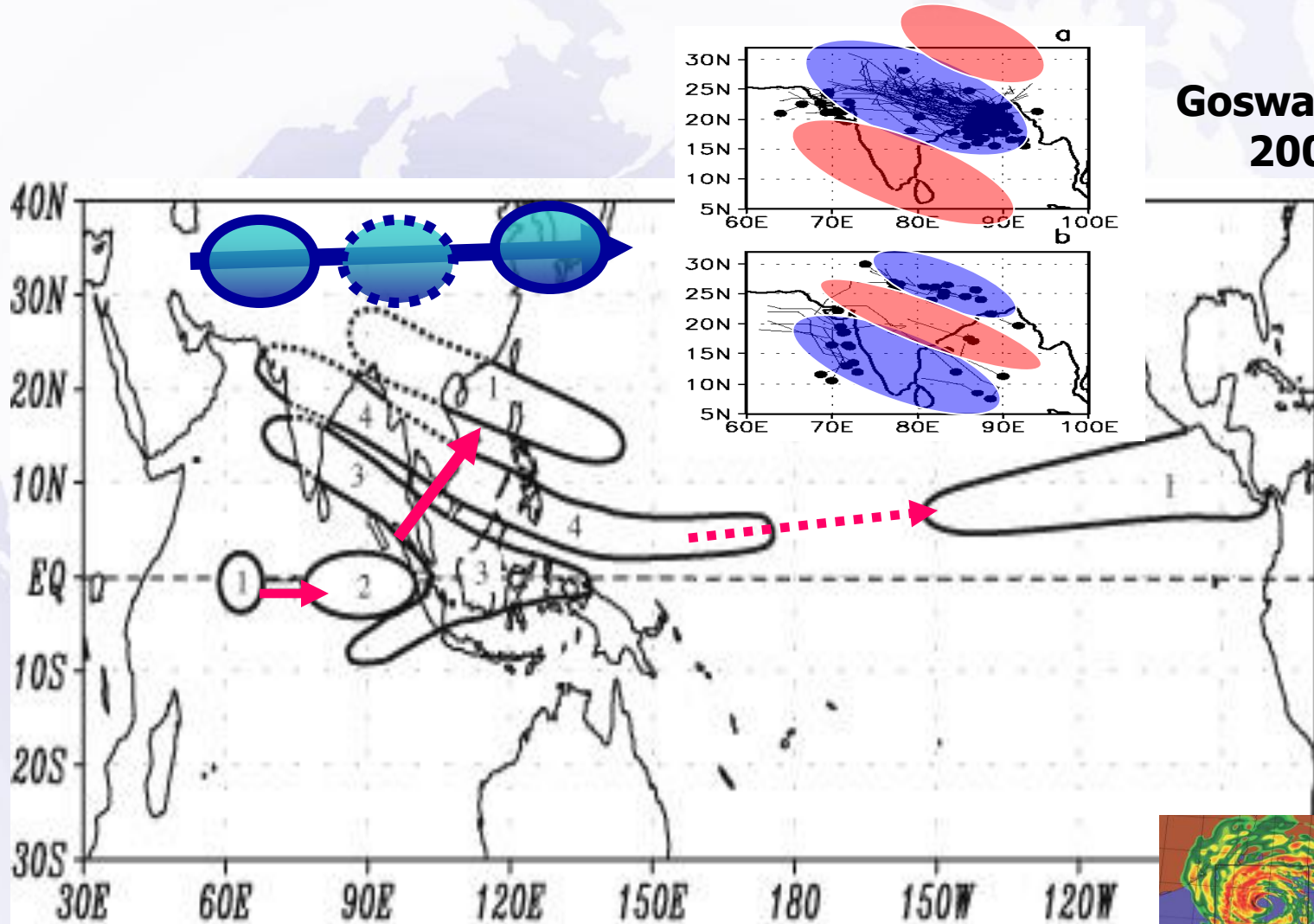
Seamless Forecast



Courtesy Duane Waliser

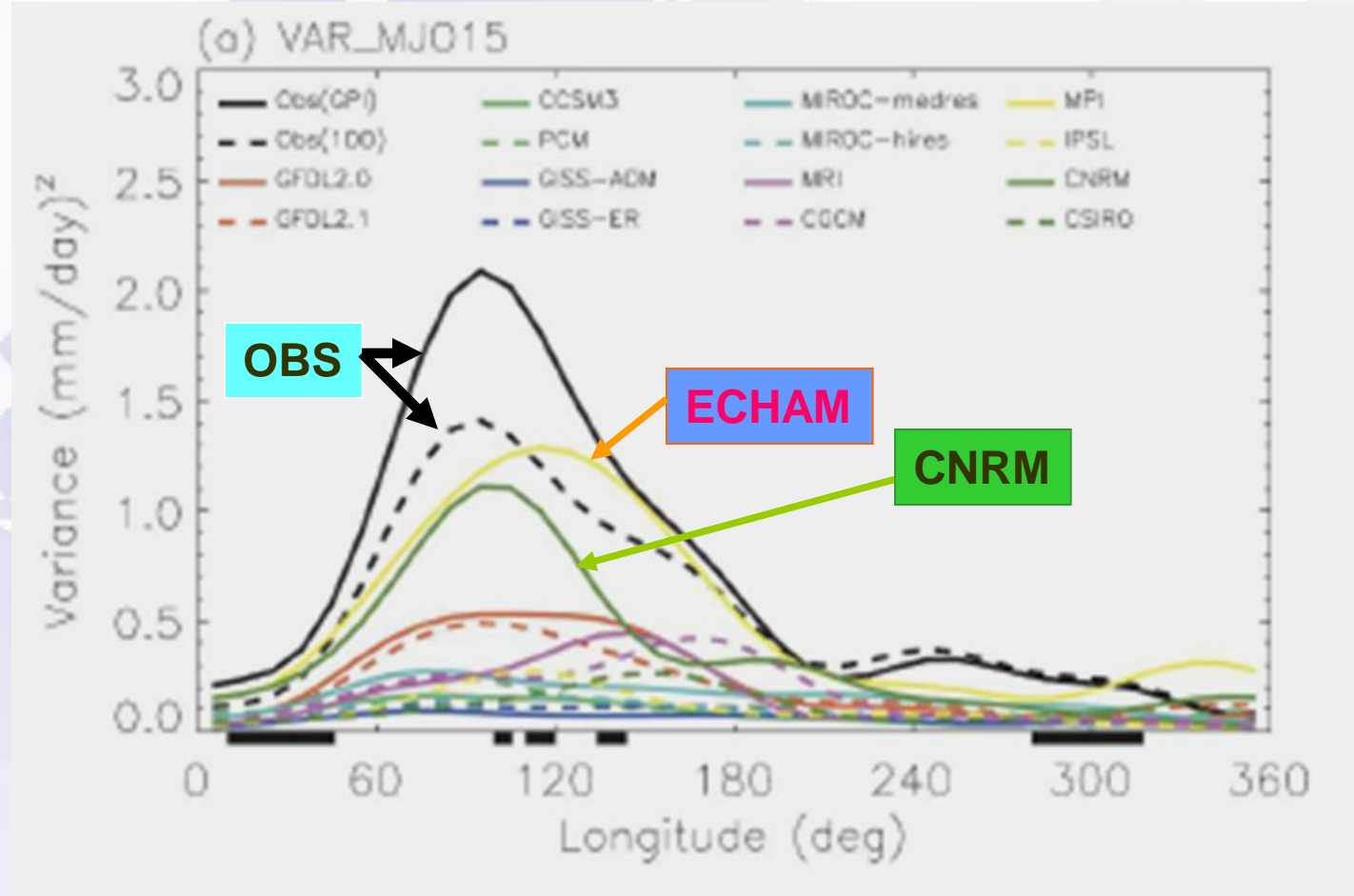
Monsoon Intraseasonal Oscillation

**Goswami et. al.
2003**



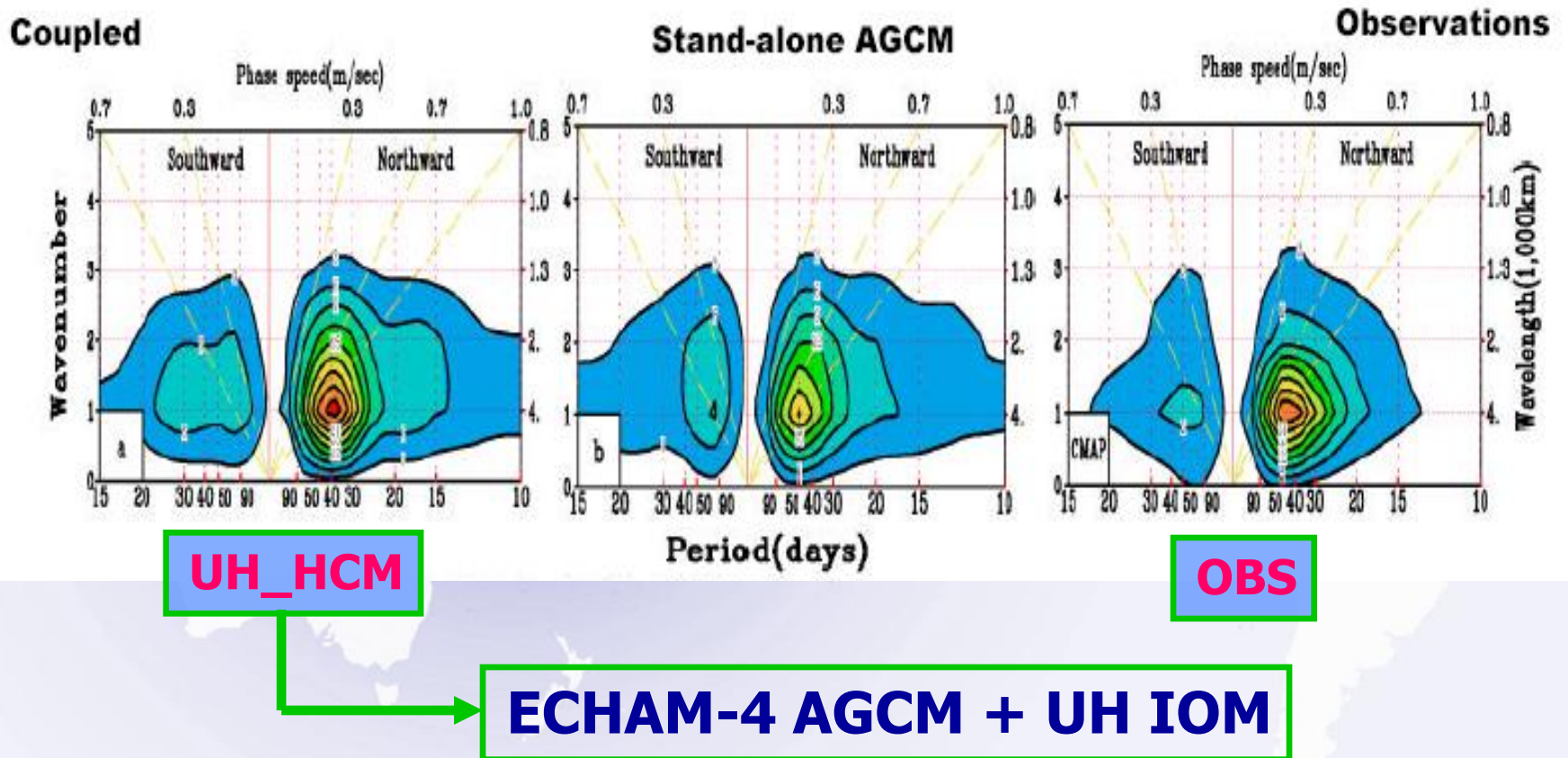
Wang et al. 2006; Ding and Wang 2007

ISO Intensity in 14 IPCC AR-4 Climate Models



Lin et al. (2006); Sperber and Annamalai 2008; Kim et al. (2009)

NP-ISO is well Simulated by UH HCM

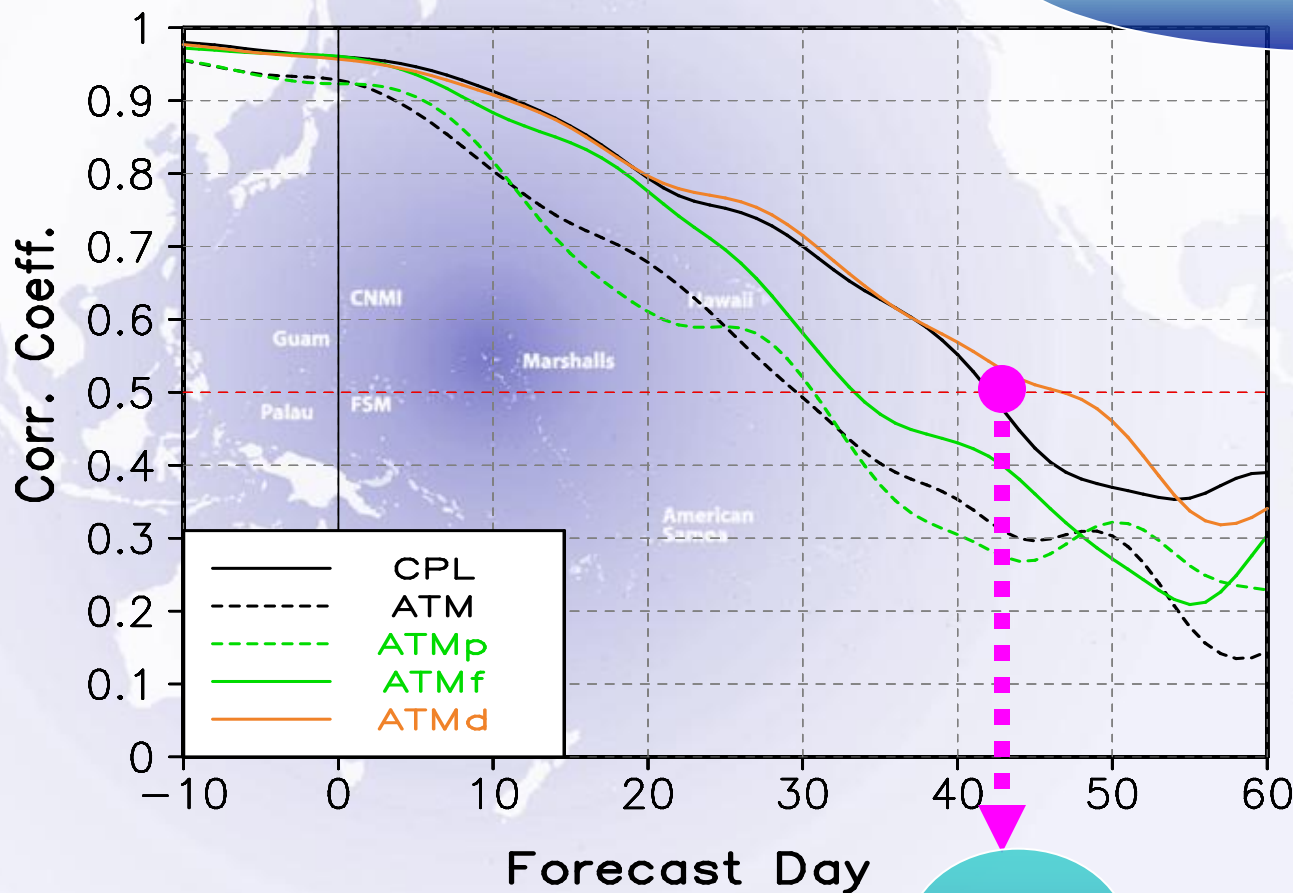


Fu et al., 2003; Fu and Wang 2004

Potential

ISO Predictability is Beyond 1-month in UH_HCM

Anomalous Correlation Coefficient over [10N–30N, 65E–120E]



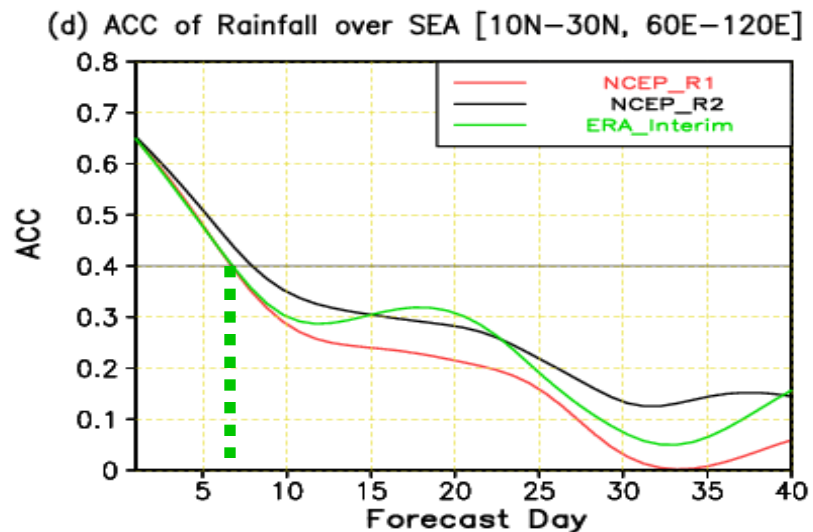
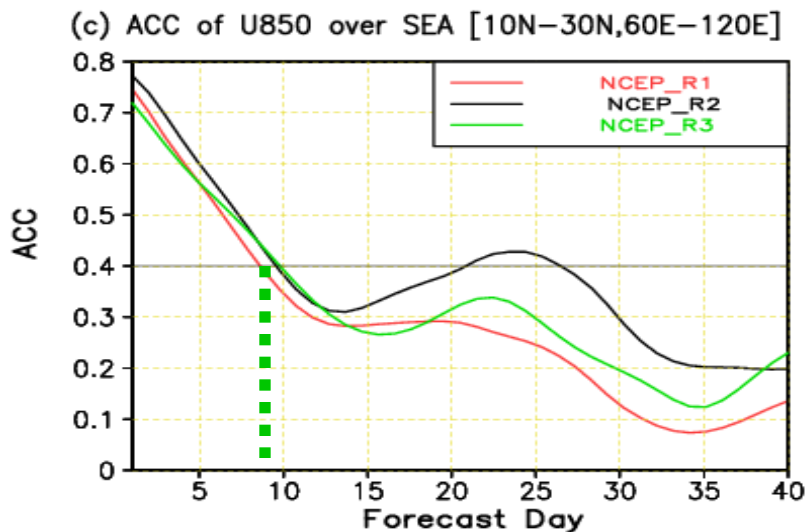
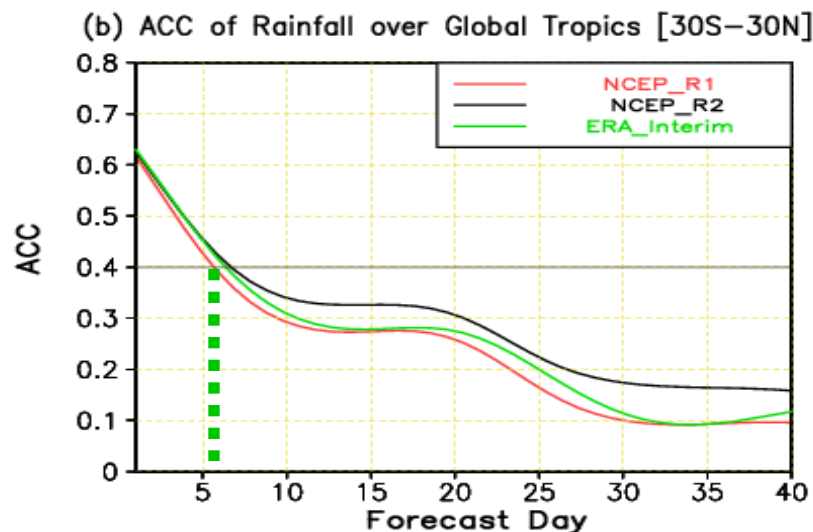
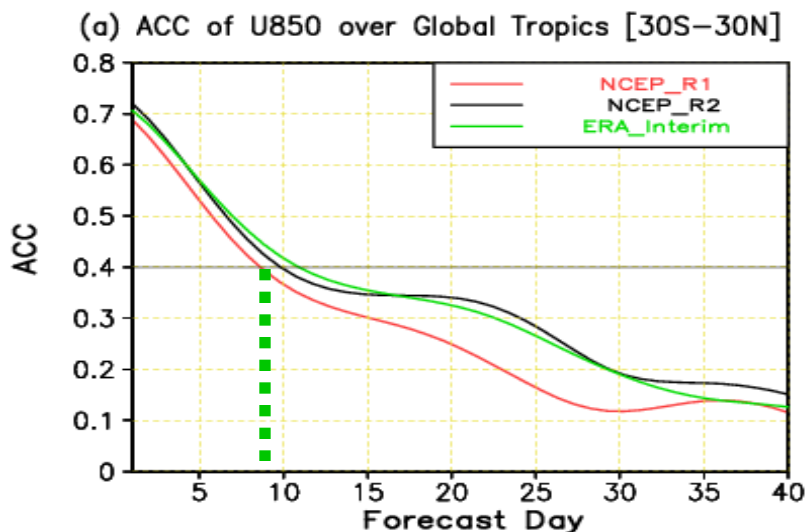
42 days

Fu et al., 2007; Fu et al. 2008

Experimental ISO Prediction with UH HCM

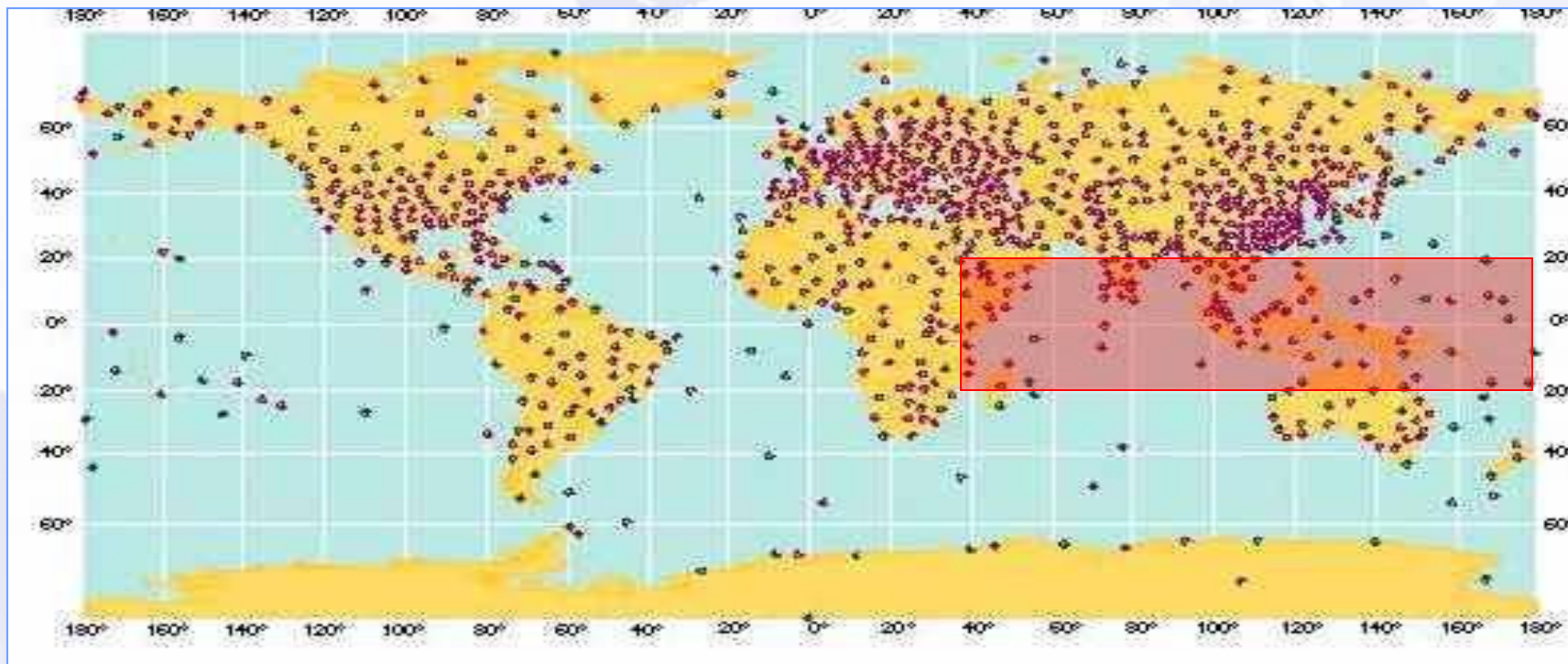
- **Target Period: May-October 2004-2008**
- **Forecast Interval: Every 10 days, totally 16 forecasts**
- **10 Ensembles: Perturbations are 10% of daily differences**
- **Integration Length: 60 days**
- **Initial Conditions: NCEP R1/R2; ERA-Interim and modified reanalysis**
- **Skill Measure: Anomaly Correlation Coefficient over Southeast Asia and global tropics.**

ISO Prediction Skill in 2004 Summer



ACC of Filtered U850

ACC of Filtered Rainfall



Lack of observations + Model difficulties in representation of ISO

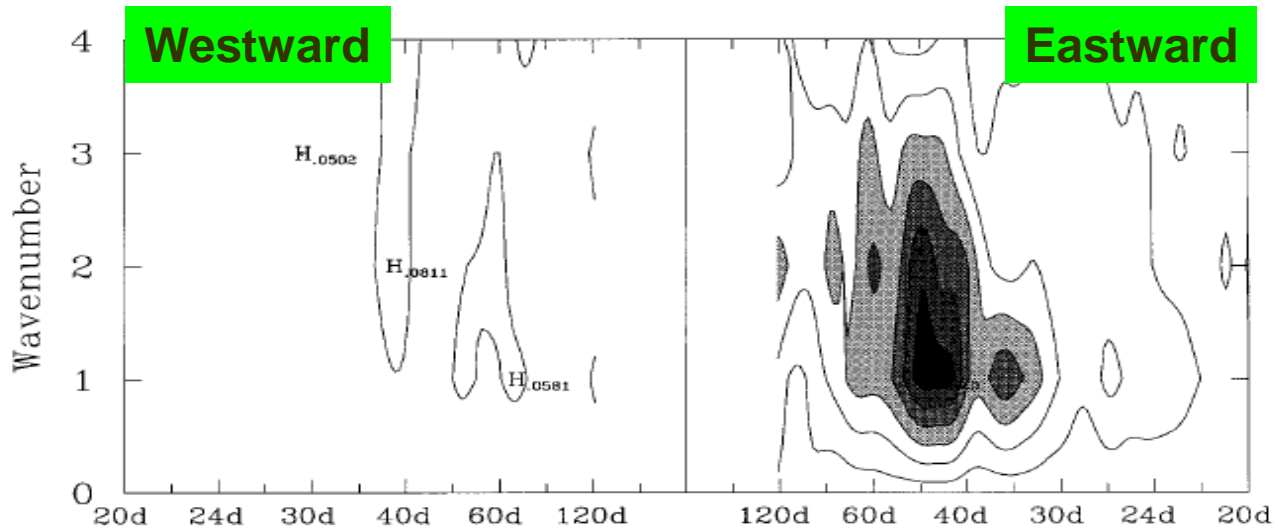


Underestimated ISO Signal in Analysis/Reanalysis Datasets

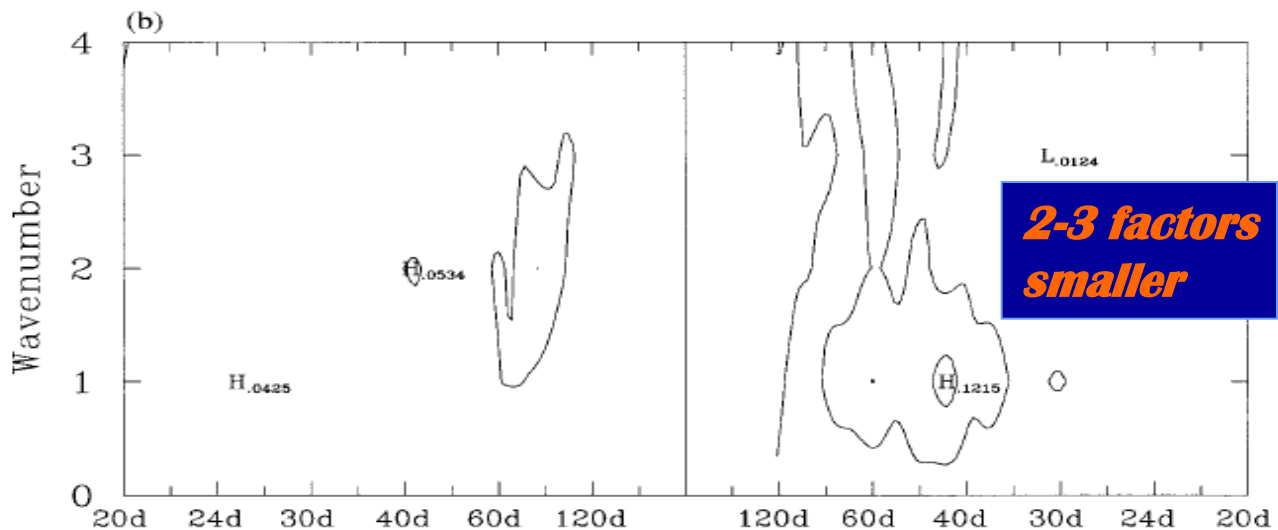
NCEP Reanalysis underestimates ISO

(1 July 1986 – 30 June 1993)

**Observed
OLR**



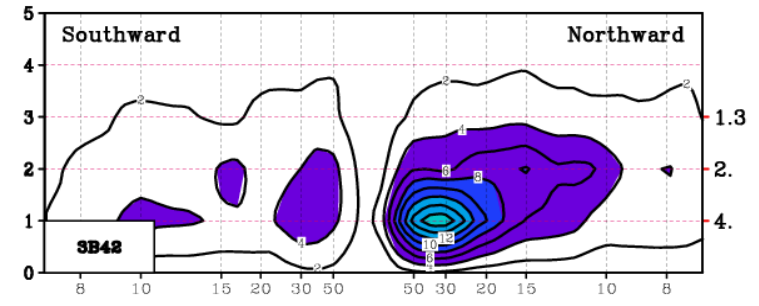
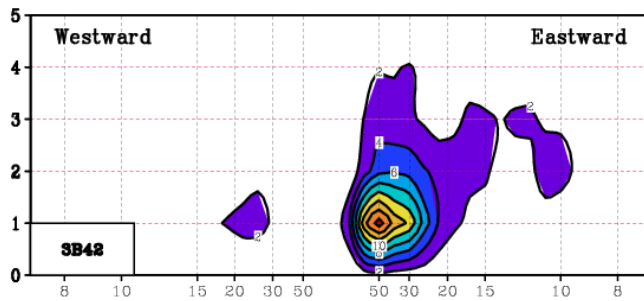
**NCEP
Reanalysis
OLR**



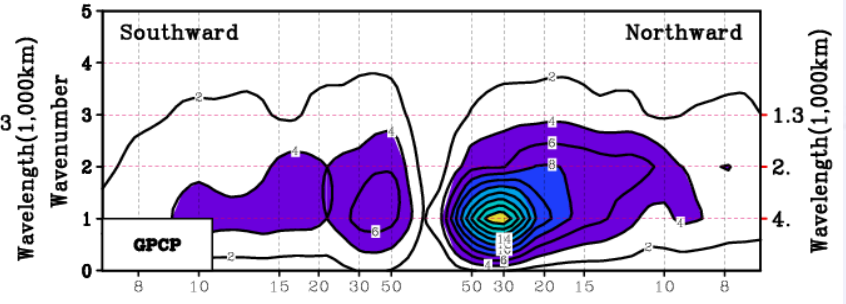
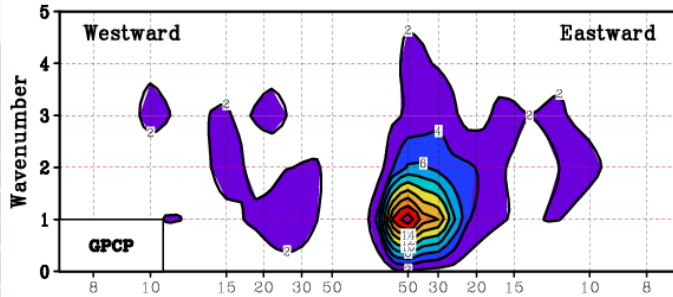
Shinoda et al. (1999)

NCEP Reanalysis underestimates ISO (2004 Summer)

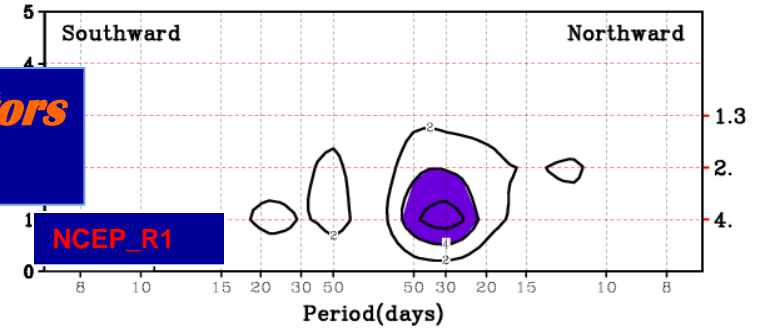
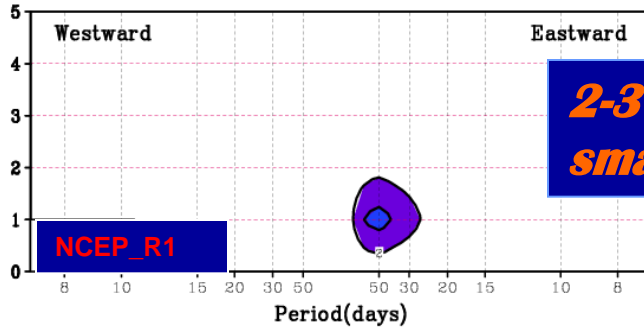
**TRMM
3B42**



GPCP



**NCEP
Reanalysis
Rainfall**



**2-3 factors
smaller**

Eastward Propagation

Northward Propagation

Forecast Sensitivity Experiments

EXP.	Initial Conditions
NCEP_R_f	AC¹ + Filtered²
NCEP_R_unf	AC + Filtered + High-frequency³
2*NCEP_R_f	AC + 2*Filtered
3*NCEP_R_f	AC + 3*Filtered
3*NCEP_R_unf	AC + 3*Filtered + High-frequency

¹AC (Annual Cycle) ⇒ mean + first three harmonics

²Filtered ⇒ 30-90-day variability

³High-frequency ⇒ Total - AC - Filtered

Daily Rainfall in 2004 Summer along the Equator

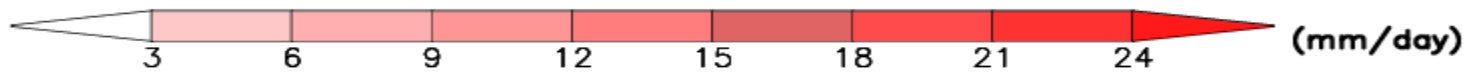
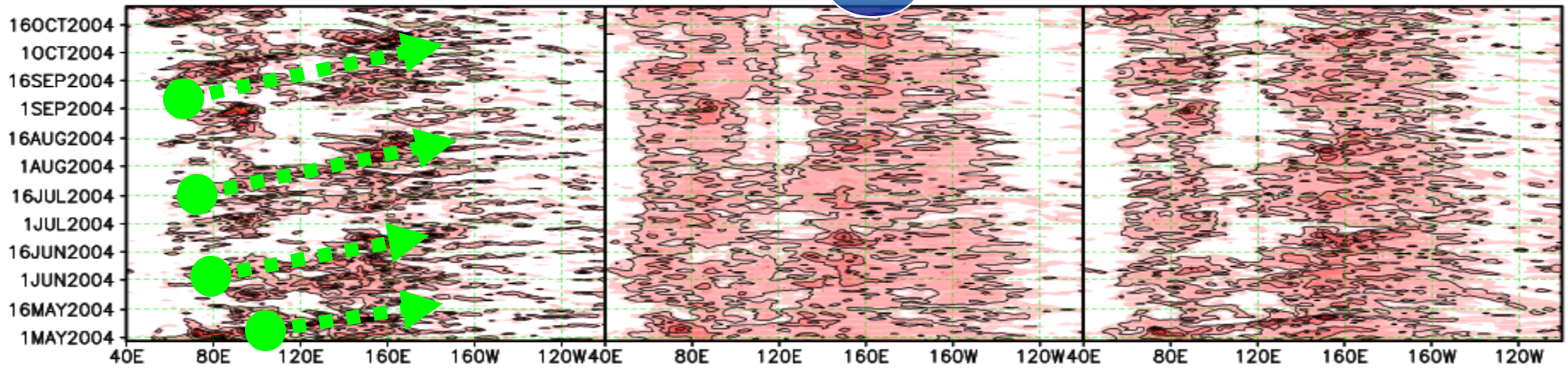
Daily Rain Rate (mm/day) in 2004 Summer

R1

(a) TRMM 3B42

(b) NCEP-R

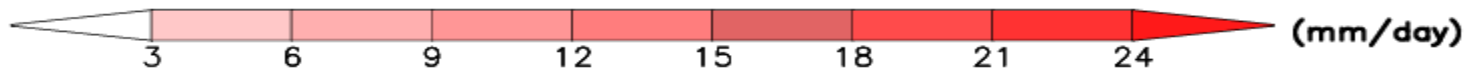
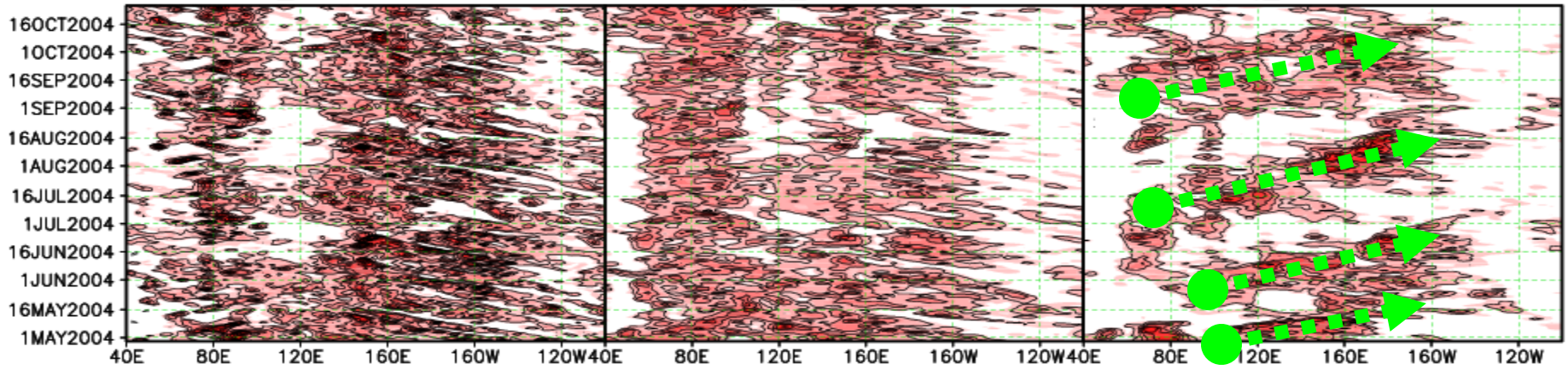
(c) ERA-Interim



(d) NCEP_R2

(e) Nudging_R2

(f) Nudging_3*fs

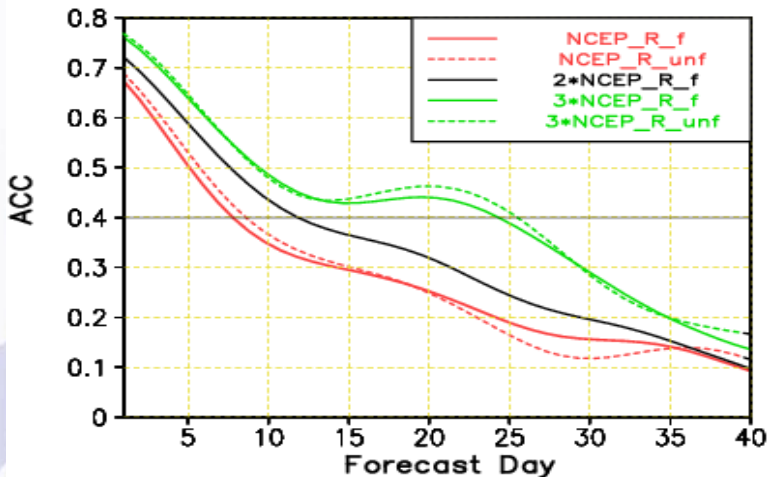


(10°S-10°N)

ISO Prediction Skills in 2004 Summer

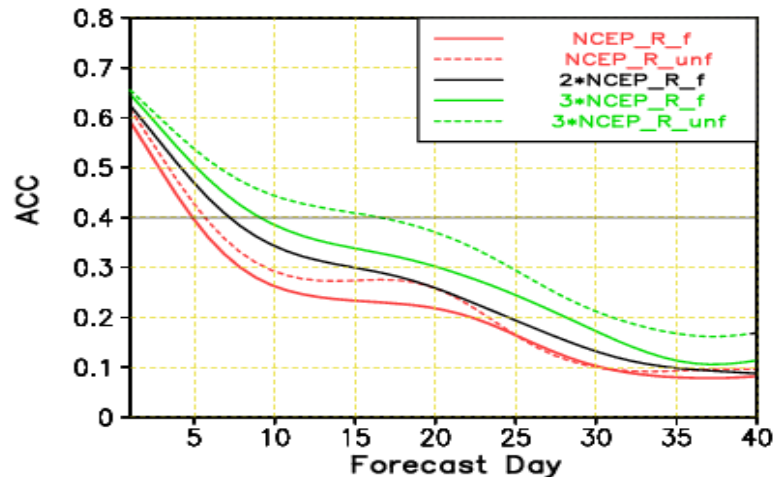
ACC of Filtered U850

(a) ACC of U850 over Global Tropics [30S–30N]

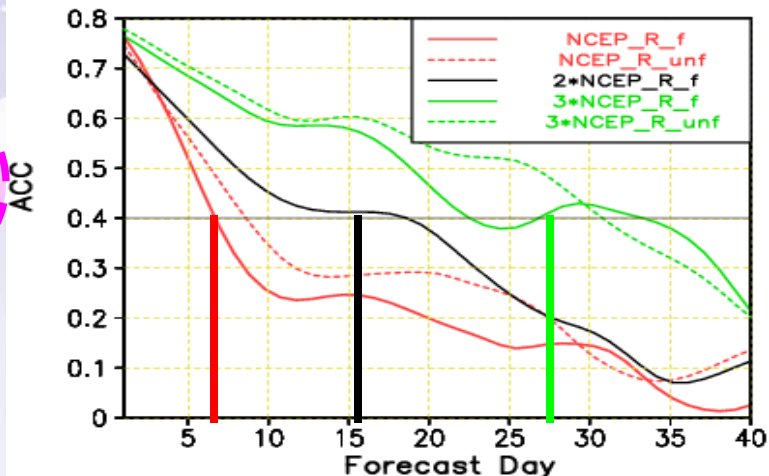


ACC of Filtered Rainfall

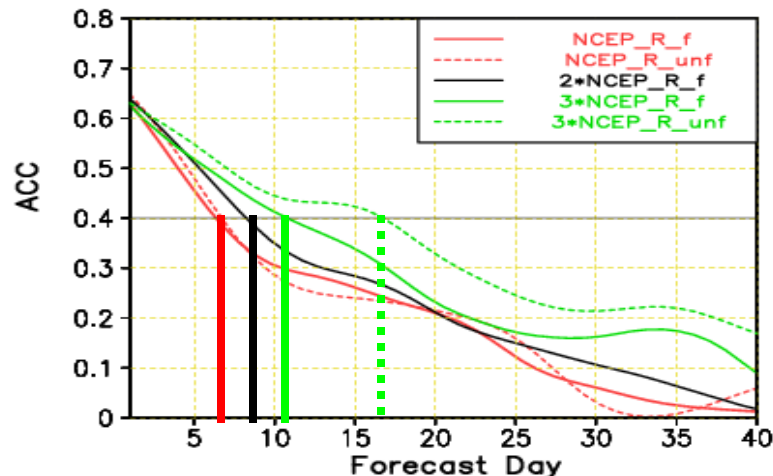
(b) ACC of Rainfall over Global Tropics [30S–30N]



(c) ACC of U850 over SEA [10N–30N, 60E–120E]



(d) ACC of Rainfall over SEA [10N–30N, 60E–120E]



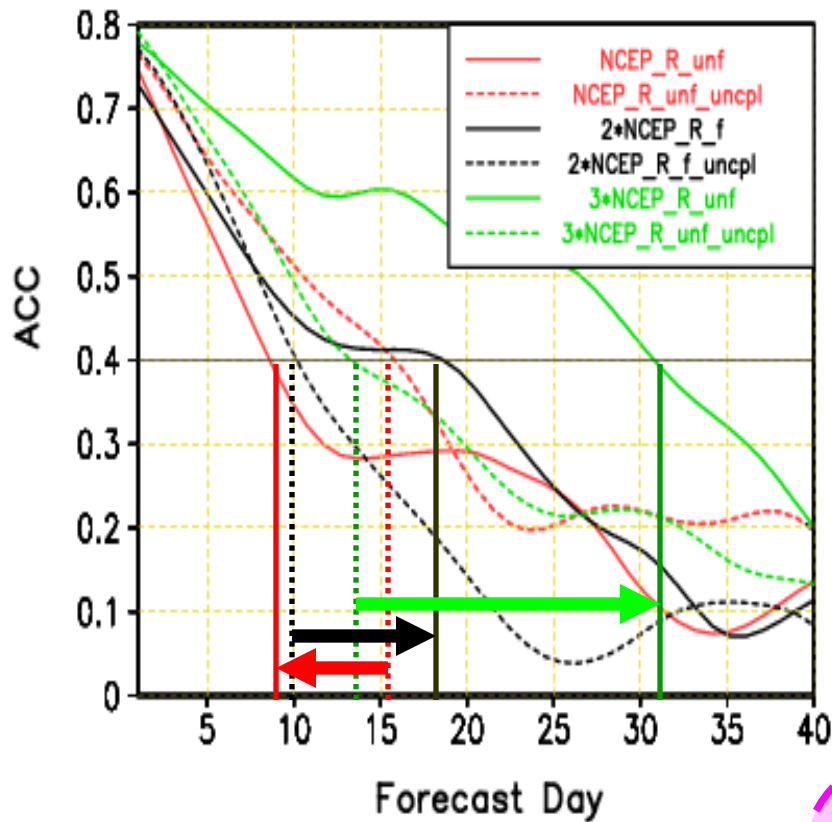
Global
Tropics

South-
East
Asia

Role of Air-sea Coupling Increases as Initial Conditions Improve

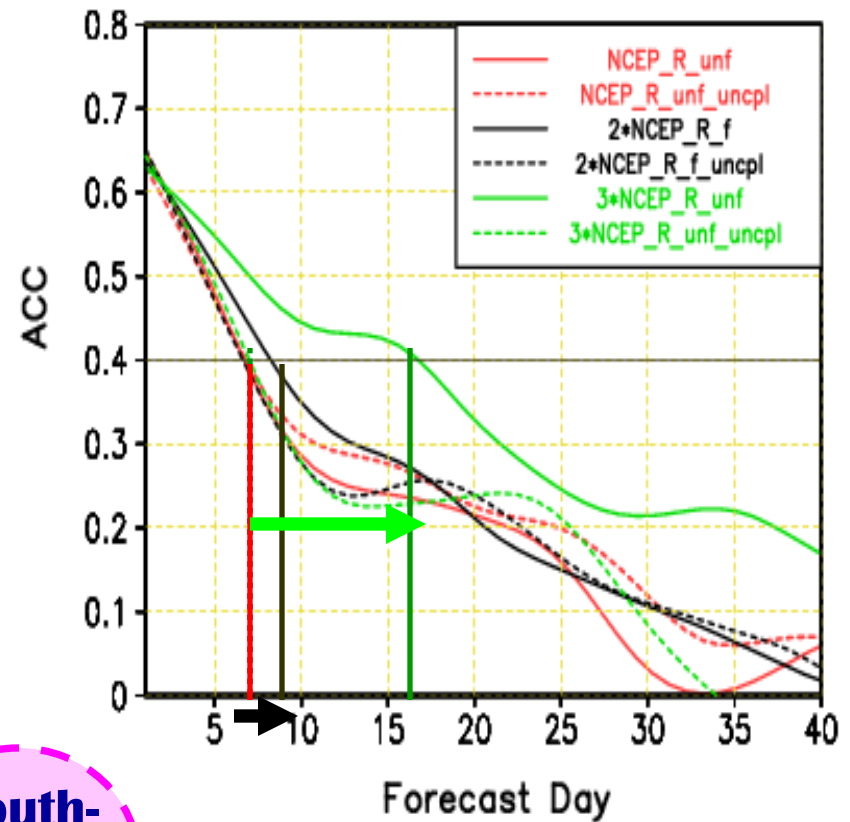
ACC of Filtered U850

ACC of U850 over Southeast Asia

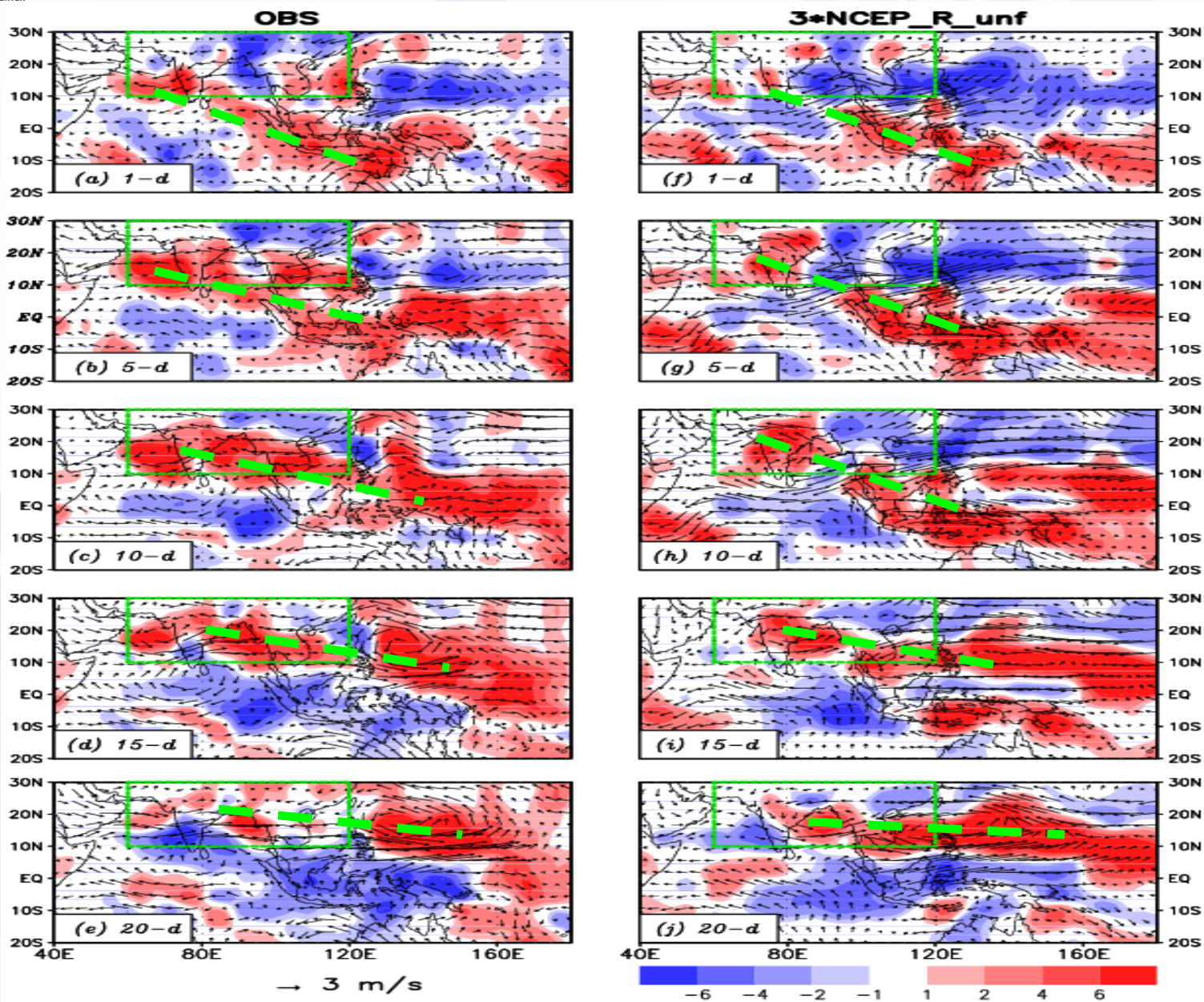


ACC of Filtered Rainfall

ACC of Rainfall over Southeast Asia



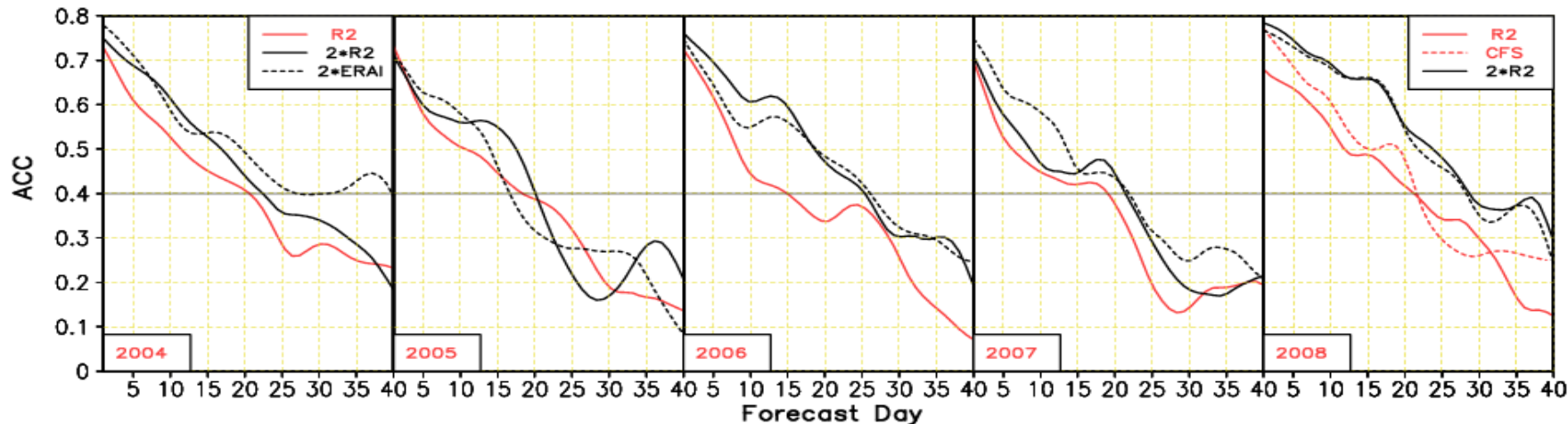
South-East Asia



ISO Prediction Skills in 2004-2008 Summers

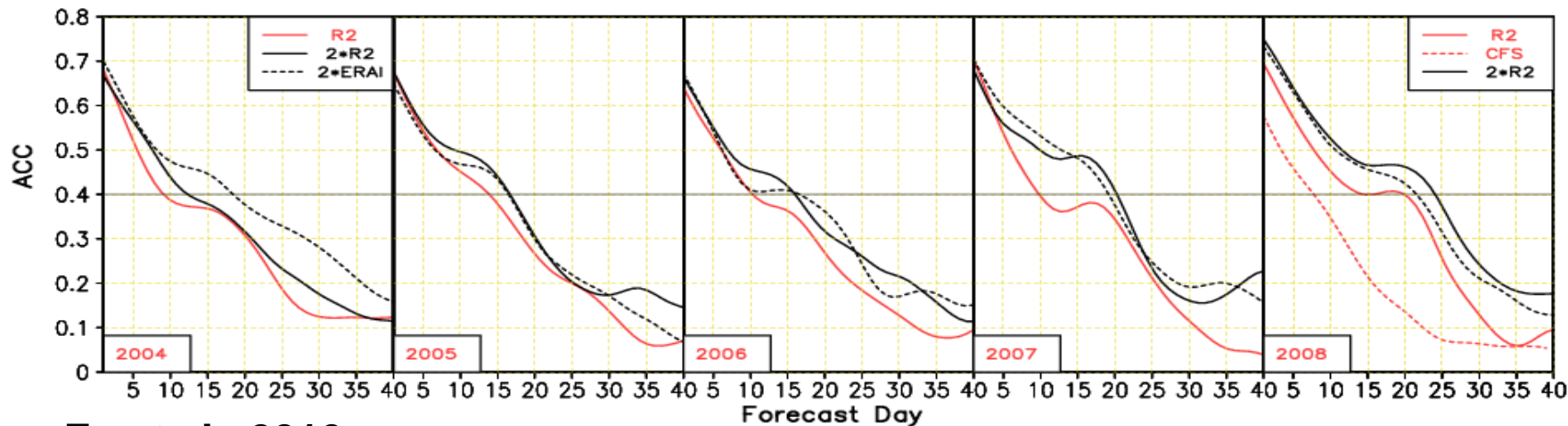
ACC of Filtered U850

(a) ACC of U850 over Southeast Asia [10N-30N,60E-120E]

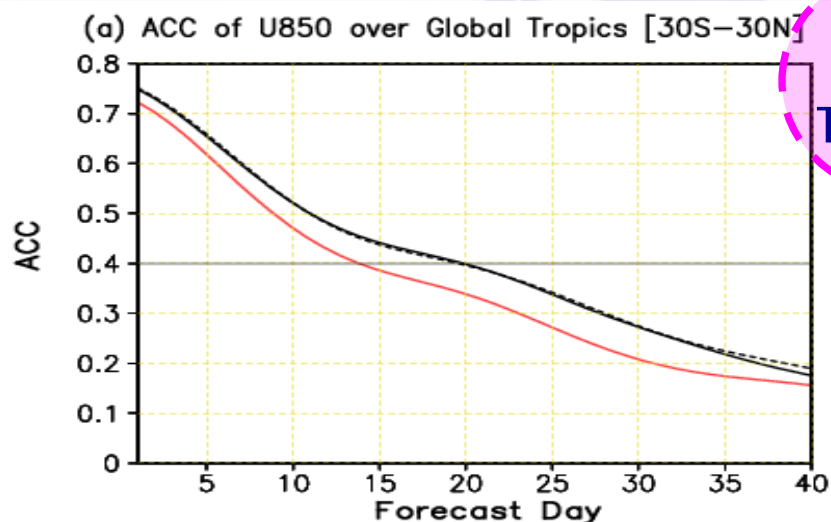


ACC of Filtered Rainfall

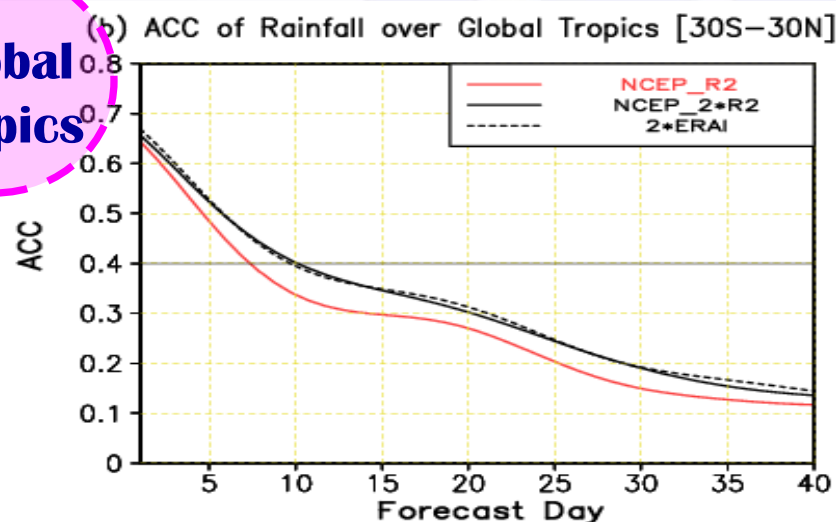
(b) ACC of Precipitation over Southeast Asia [10N-30N,60E-120E]



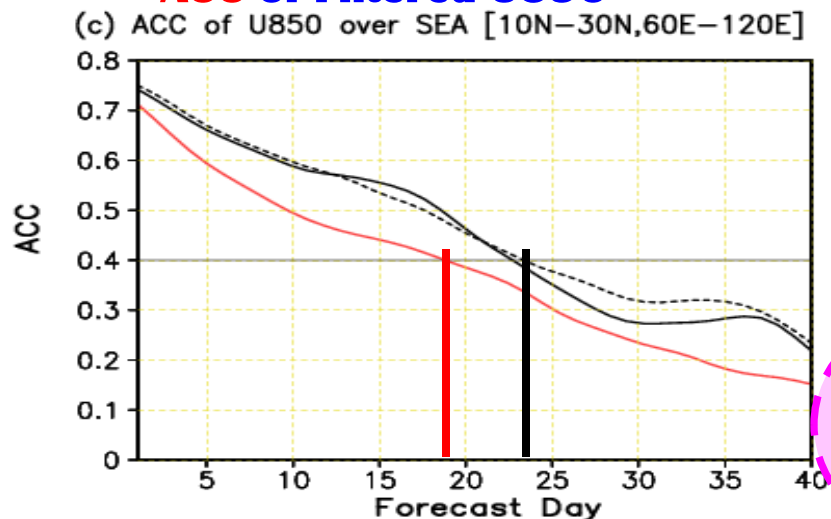
ISO Prediction Skills of Five-Summer Mean



Global Tropics

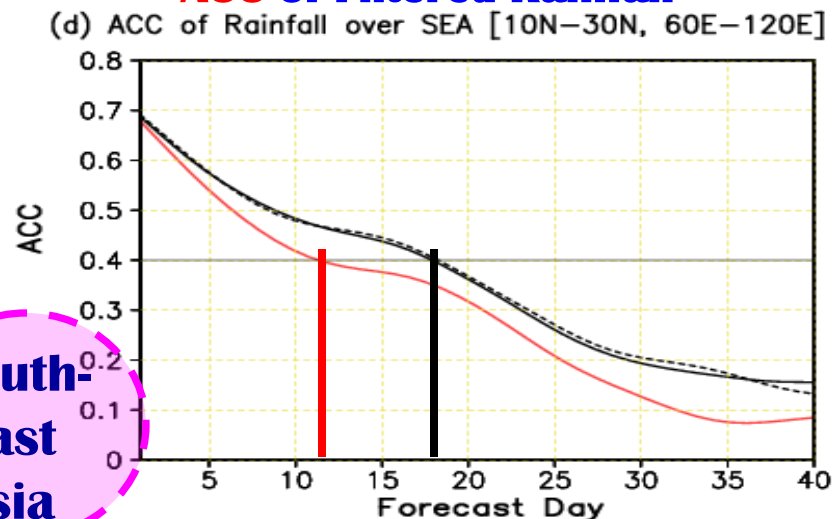


ACC of Filtered U850



South-East Asia

ACC of Filtered Rainfall



Summary

- **ISO signals** have been **underestimated** in current reanalysis datasets (e.g., **NCEP-R/ERA-Interim**). Enhanced intraseasonal signals in **initial conditions** significantly improves ISO prediction.
- Including **high-frequency disturbances** in initial conditions generally extends ISO prediction.
- Role of **air-sea coupling** on ISO prediction increases as initial conditions improve.

Thank You Very Much!

CNMI
Guam
Palau
FSM
Marshall Islands
Hawaii

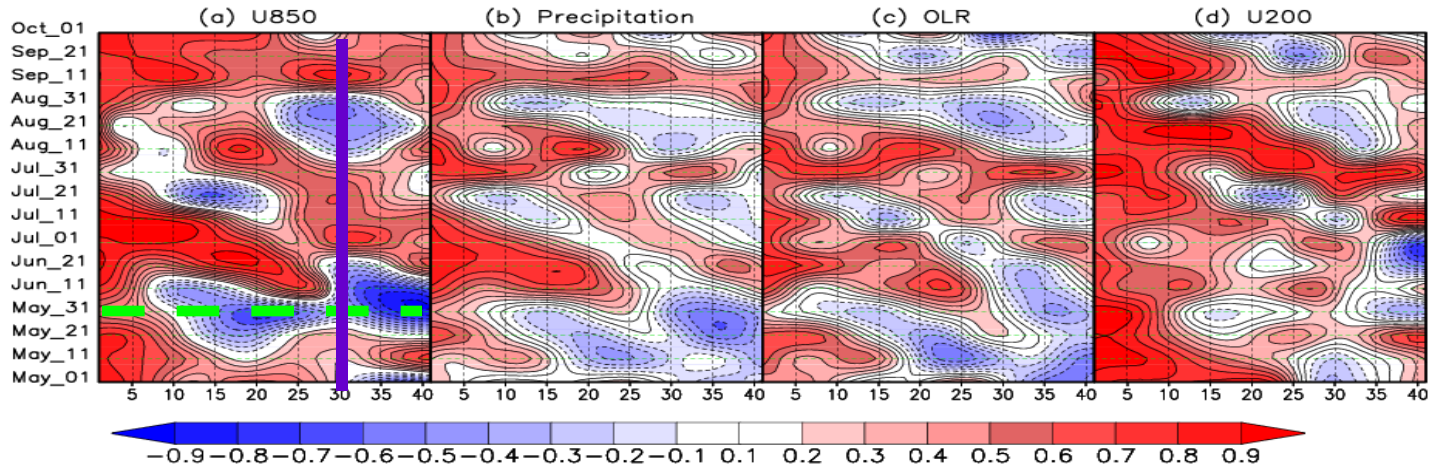


APCC Symposium, Busan, June 23, 2010

ISO Forecast Skill in 2004 Summer

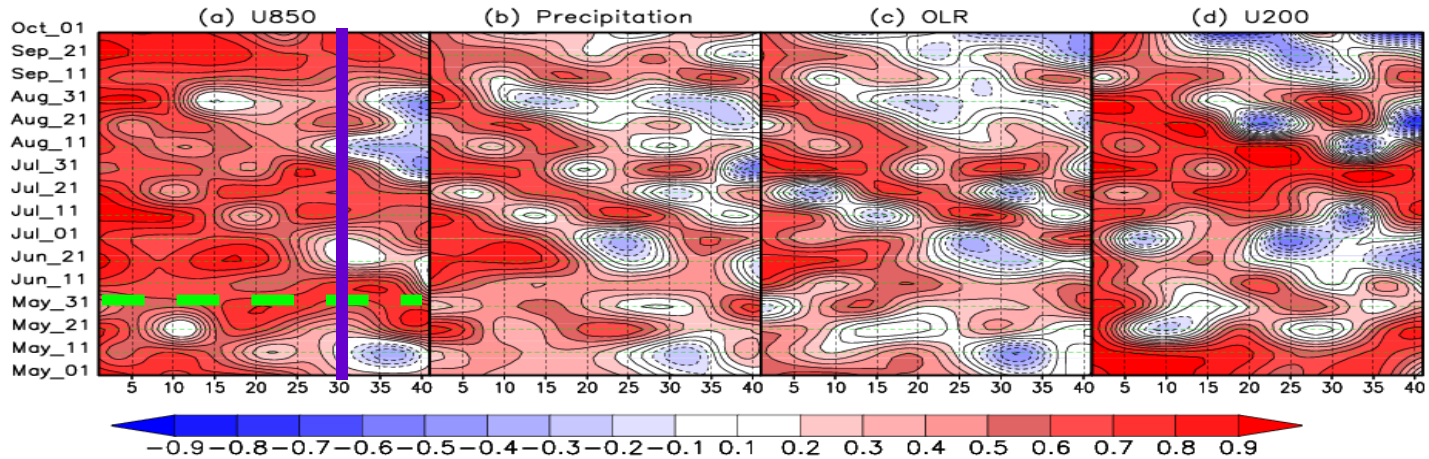
(Over Southeast Asia)

ACC of 30–90–day Filtered Forecasts in 2004 Summer



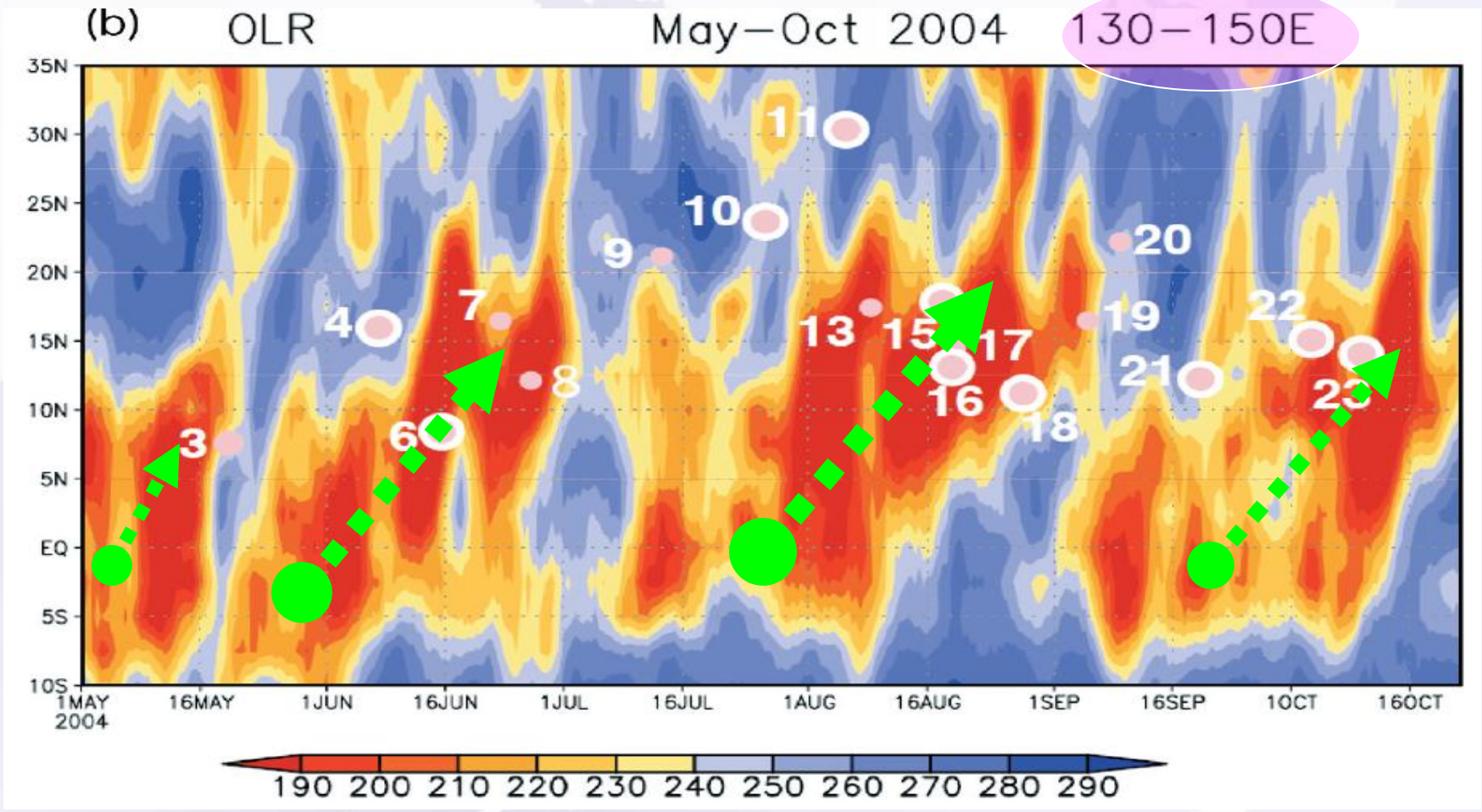
*Original
NCEP
Reanalysis*

ACC of 30–90–day Filtered Forecasts in 2004 Summer



*Enhanced
ISO in
NCEP
Reanalysis*

TCs Modulated by MISO in 2004



RECORD-BROKEN TEN TYPHOONS LANDFALL ON JAPAN IN THIS YEAR
NAKAZAWA (2006, SOLA)