ENSO-related Seasonal Predictability in East Asia and Skills of JMA/MRI Unified Models

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Contents

- Skills of JMA Operational 0.5-month-lead Seasonal Forecast System.

- Seasonal Predictability in East Asia.

- Skills of new JMA/MRI –Coupled GCM for 4-month-lead Seasonal Forecast System.

I. Skills of JMA Operational Three-month Forecast System

- Two-tired way
- Persistent SSTA
- TL95L40 JMA/MRI-Unified AGCM
- 31-member Ensemble
- Once a month
- about 0.5-month lead-time
- Hindcast : 1983-2003 5-members Ensemble

ROC for Positive Anomaly

	NH Ts	Tropics Rain
MAM	**68.0**	**62.3**
JJA	**66.4**	**62.2**
SON	**66.0**	**62.8**
DJF	**66.0**	**61.6**

Hindcast Skill in Japan
after Downscaling (OBS-to-OBS)

Correlation Skill of Surface Air Temperature

	Northern Japan	Eastern Japan	Western Japan	Southern Japan
Spring	0.40	0.32	0.18	0.26
Summer	0.60	0.41	0.38	0.29
Autumn	0.51	0.38	0.12	0.15
Winter	0.33	0.27	0.30	0.47

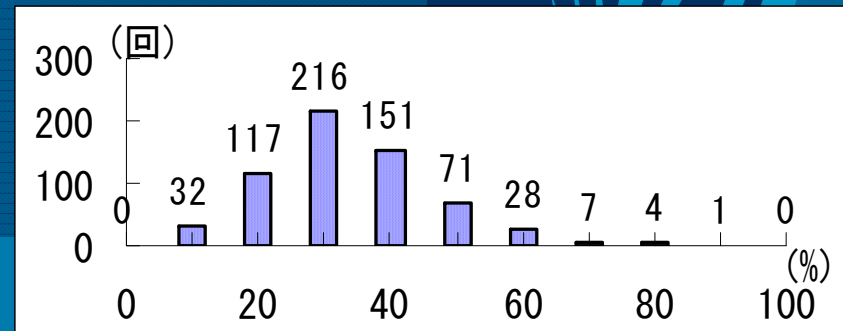# Reliability of JMA Tercile Forecast (**Not Hindcast**) in Japan after Statistical Downscaling (Obs -> Obs)
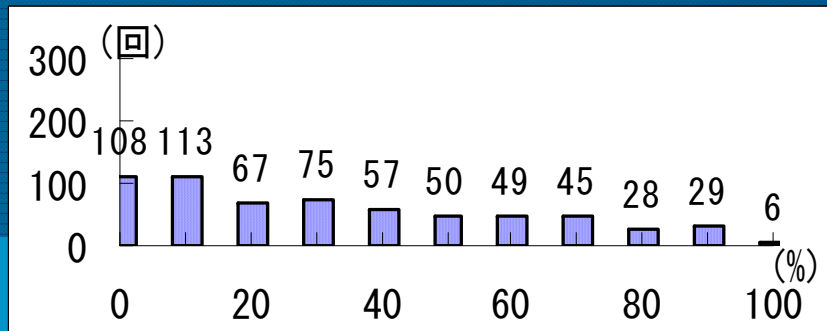
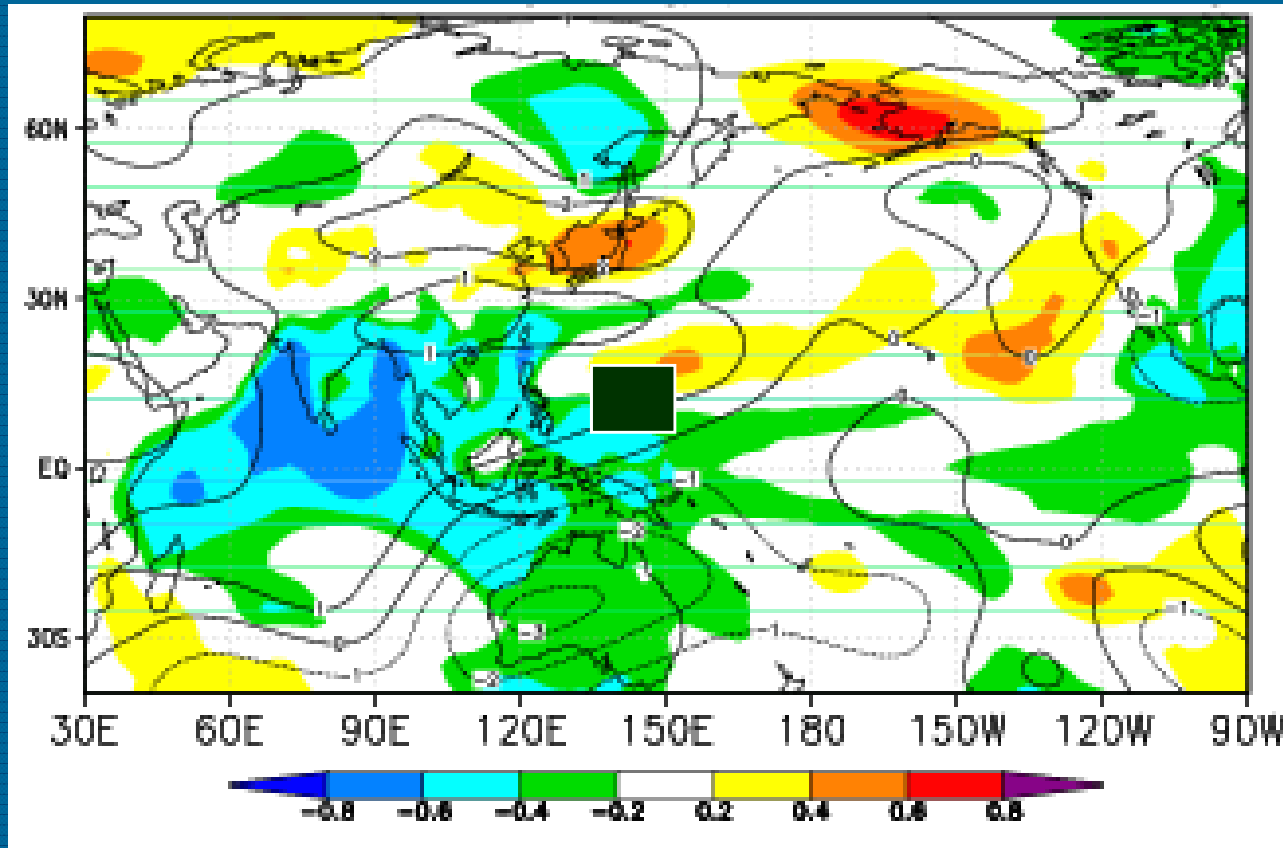**Surface Air Temperature**
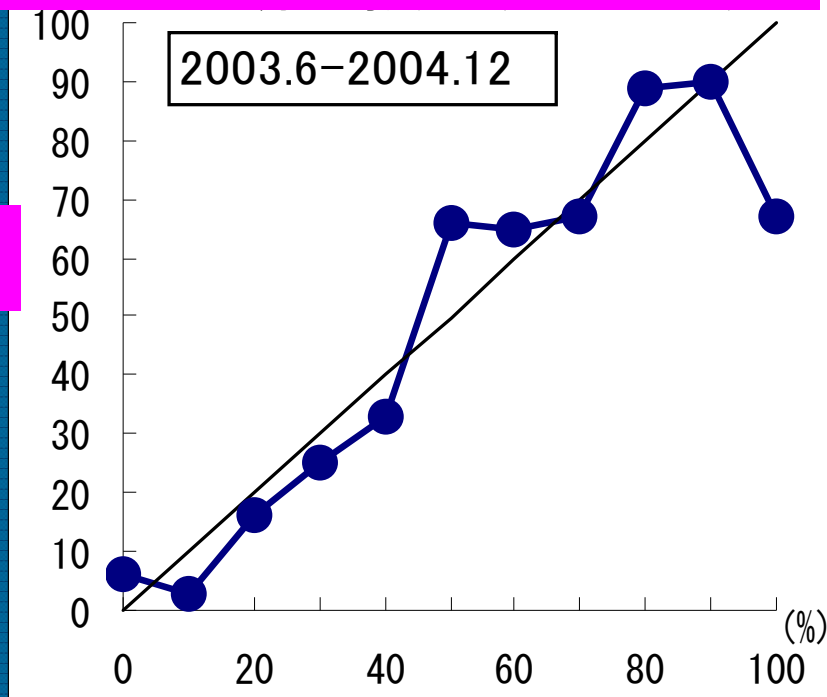
Precipitation

Reliability

2003.6−2004.12

2003.6−2004.12

Forecast Number

108 113 67 75 57 50 49 45 28 29 6

0 32 117 216 151 71 28 7 4 1 0
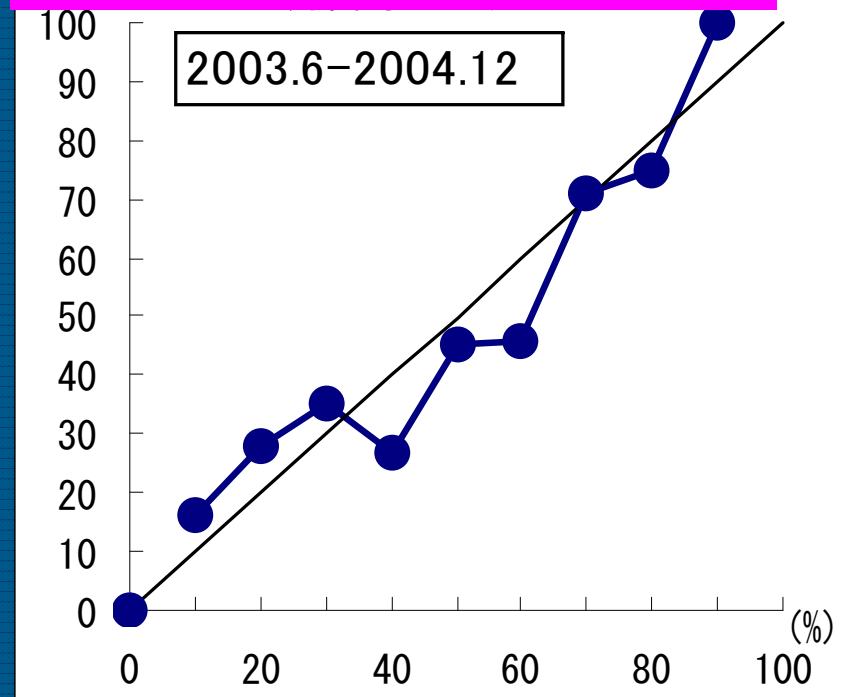
II.-1
Why the JJA seasonal forecast show good skills in Japan?

Observed T850 Correlation with Western Pacific Precipitation
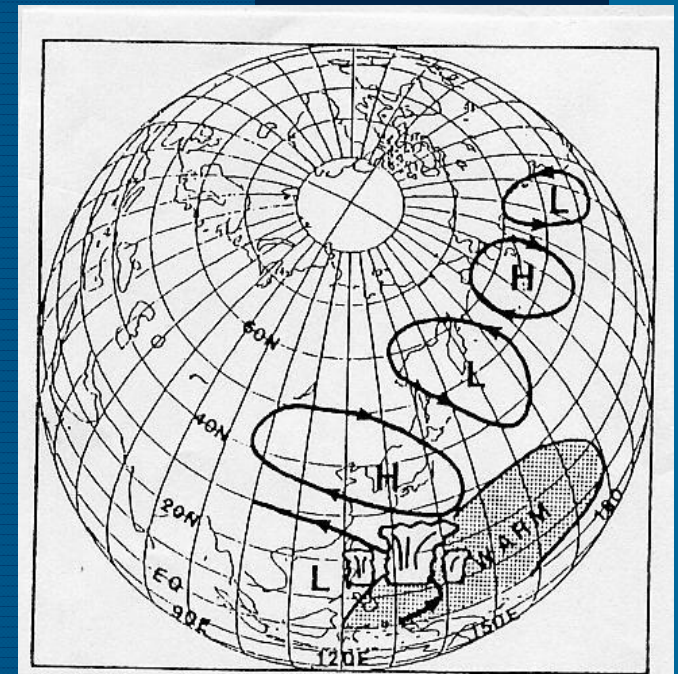**(130-150E,10-20N)**

PJ-Pattern

Fig. 18. Schematic pictures showing the relationships between SST anomalies, convective activities and atmospheric Rossby-wave trains.
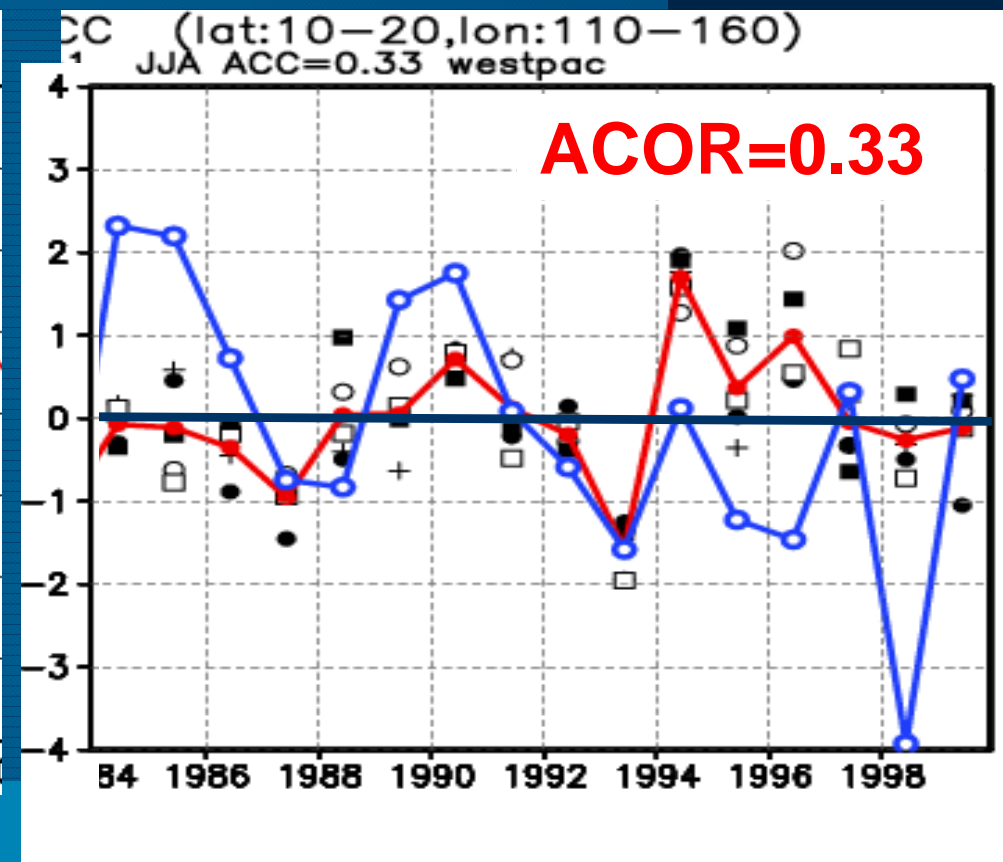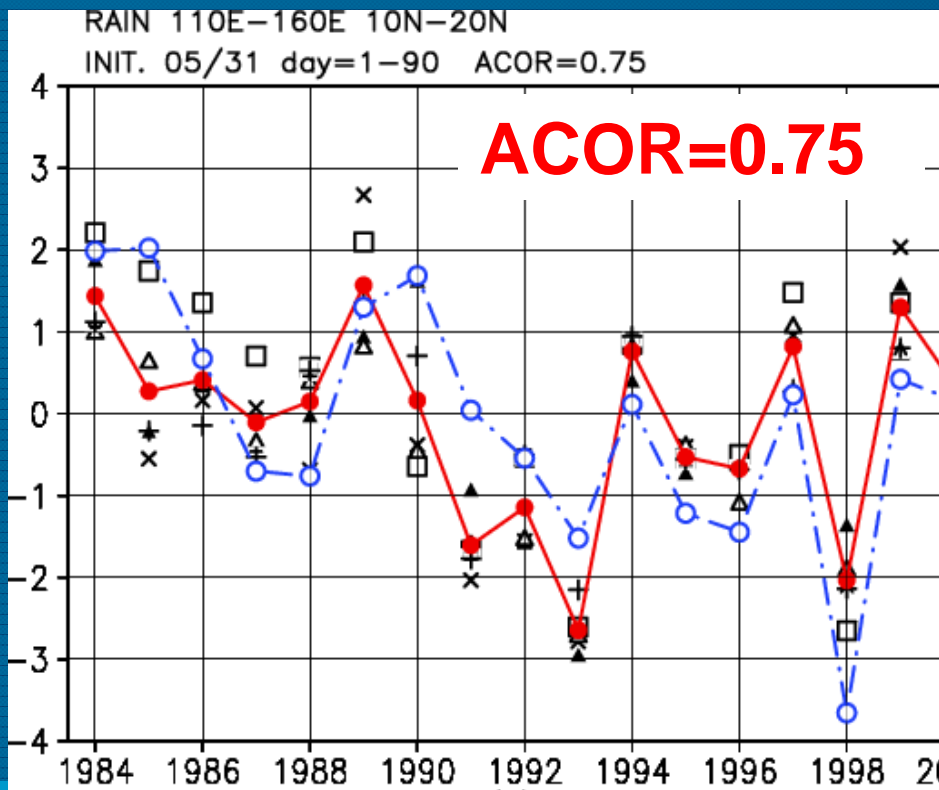
Nitta(JMSJ,1987)

Skills of JJA WP Precipitation
(110-160E,10-20N) from C. Kobayashi, et al. (2005)

Good HINDCAST

(Persistent SST anomaly)

Not SMIP?

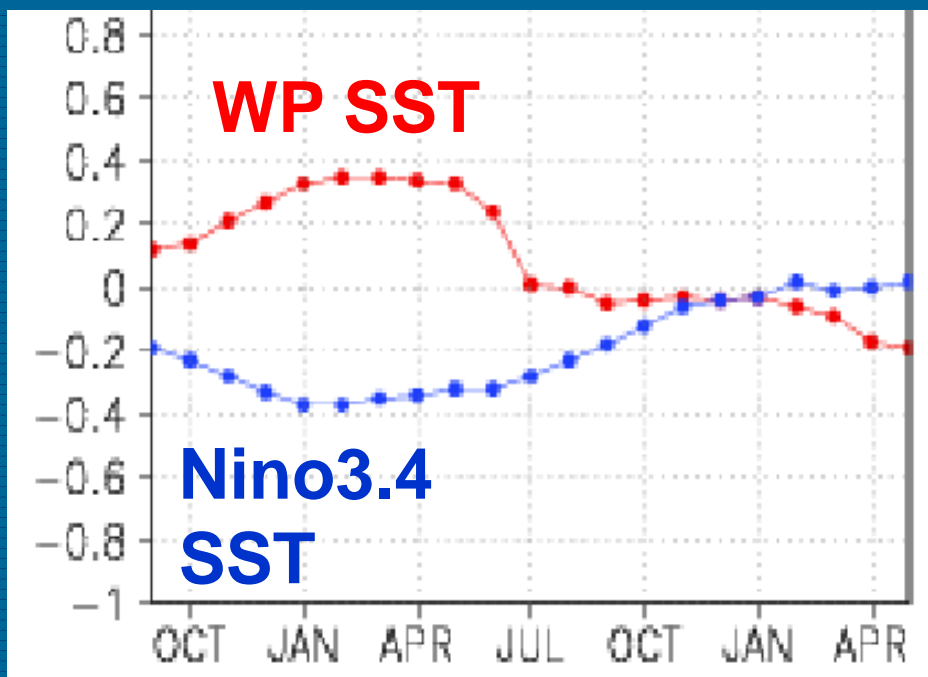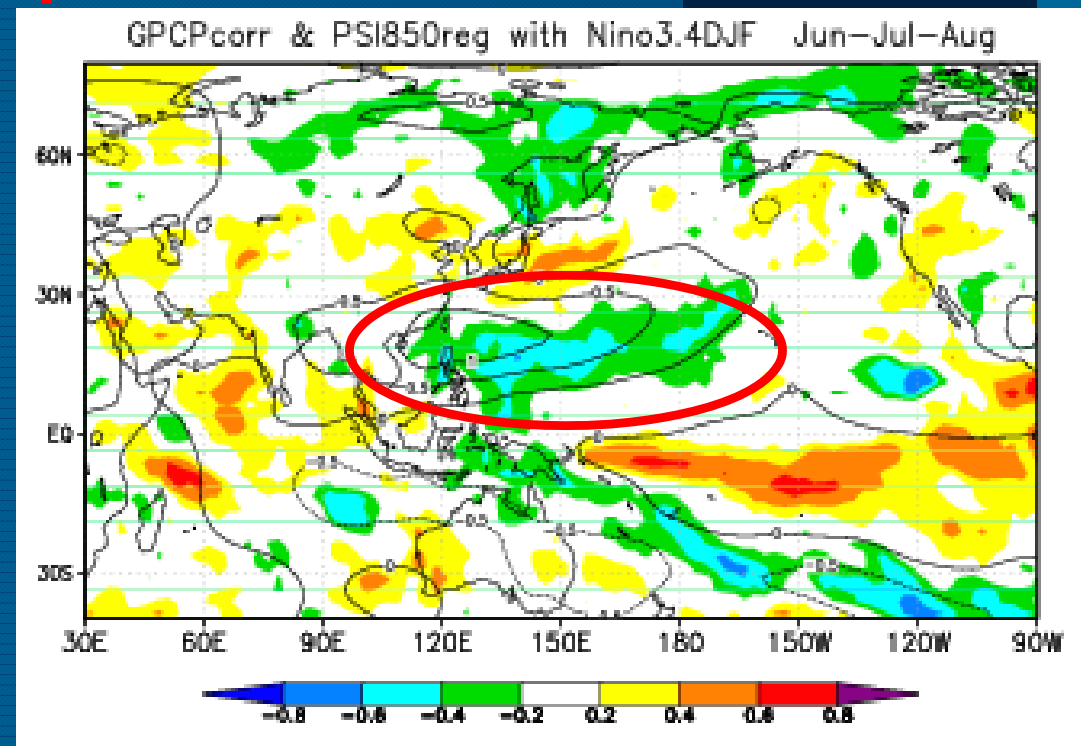(Real SST anomaly)

ACOR=0.75

ACOR=0.33

JJA WP Precipitation is correlated with (Not JJA) the previous DJF and MAM Nino3.4 SST

JJA GPCP correlation with the previous DJF Nino3.4 SST

Observed Lag Correlation of WP__OLR

WP SST

Nino3.4 SST

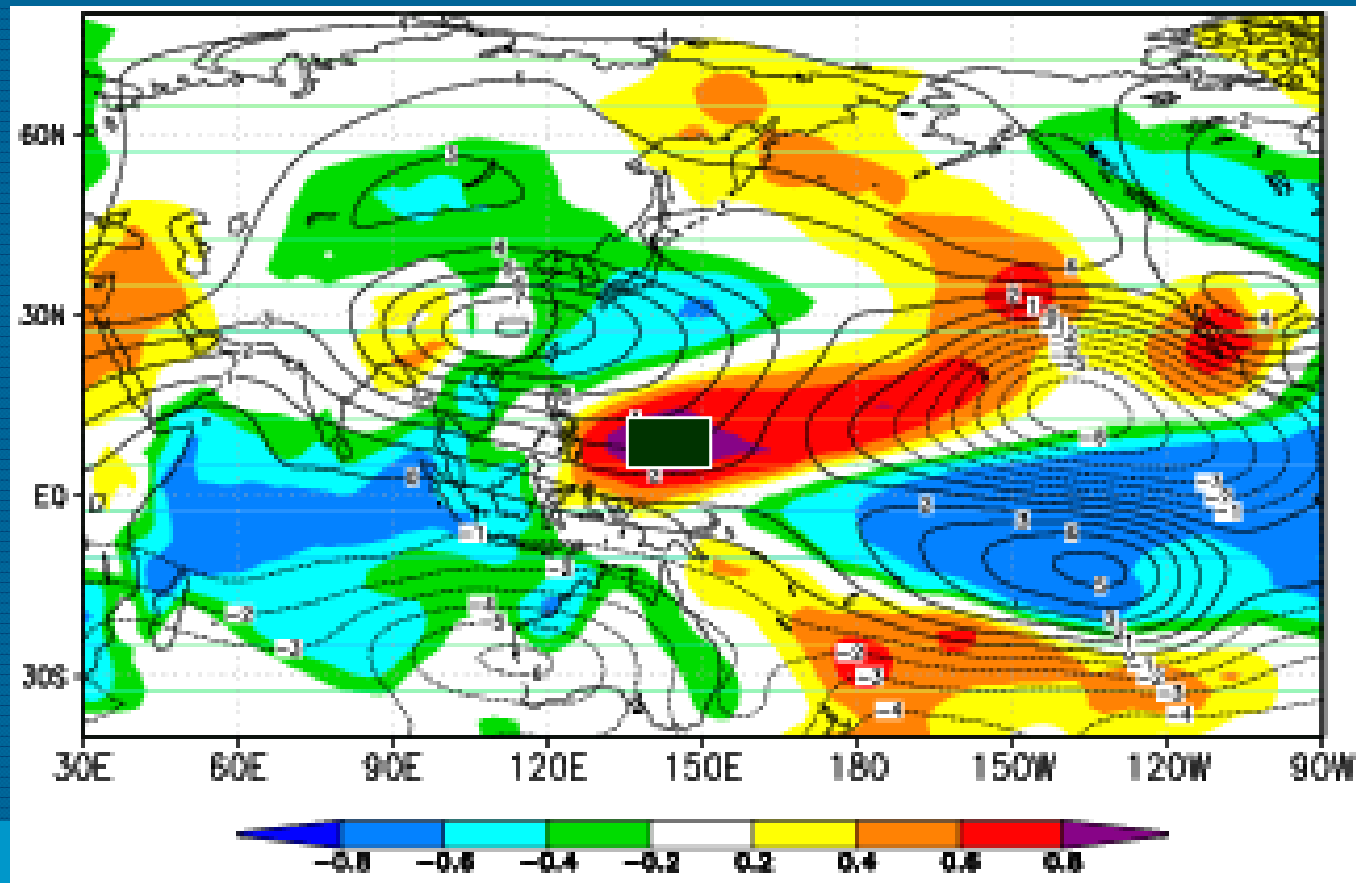GPCPcorr & PSI850reg with Nino3.4DJF   Jun-Jul-Aug
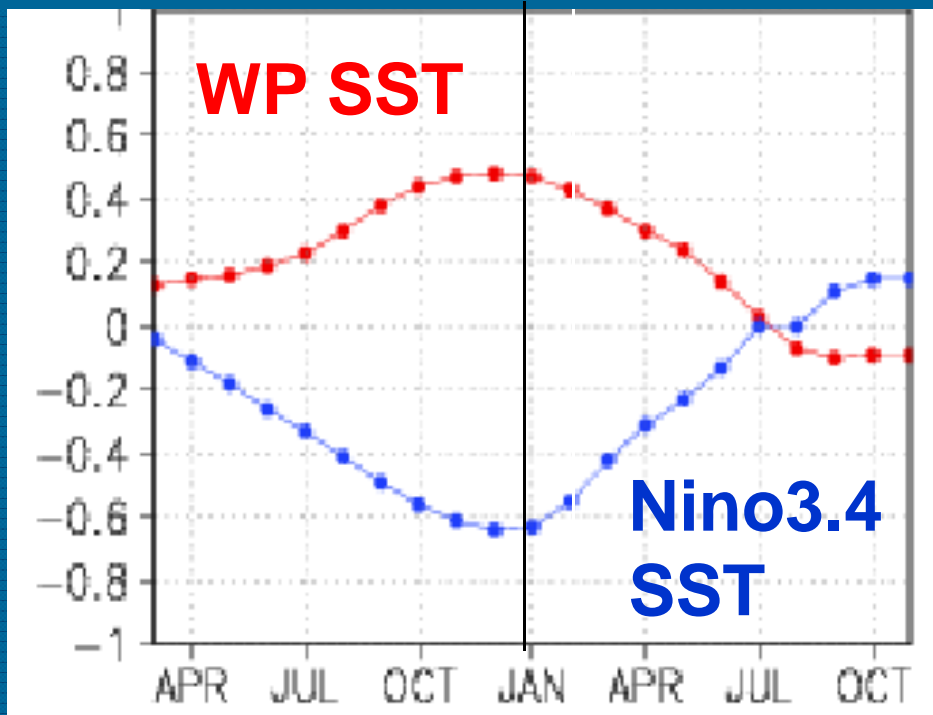
From T.Ose et al., 2003

II.-2
WP Precipitation is important also for DJF East Asia Seasonal Forecast.

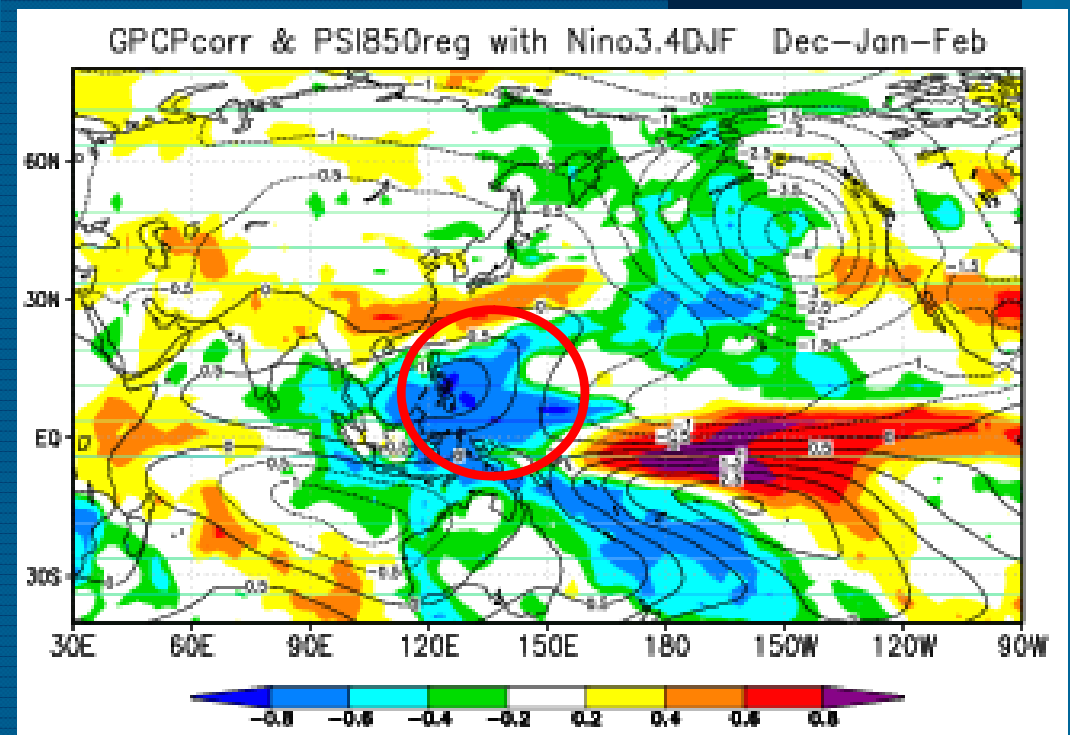**Observed T850 correlation with WP Precipitation in DJF** (130-150E,5-15N)

DJF WP precipitation is correlated with DJF Nino3.4 SST as expected.

Observed Lag Correlation of WP__OLR
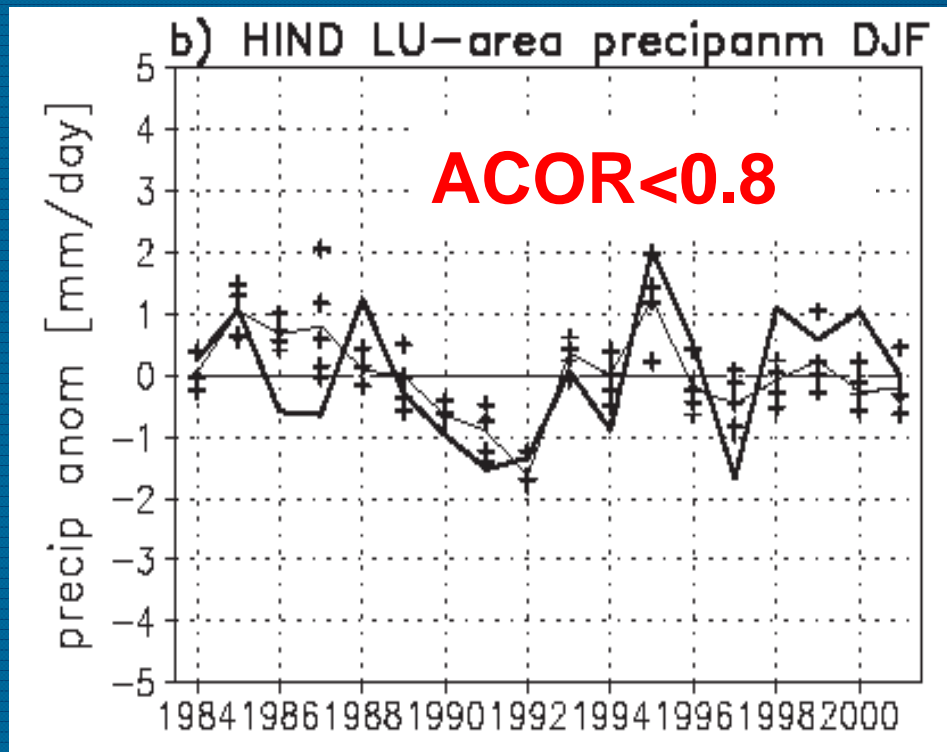
DJF GPCP correlation with DJF Nino3.4 SST

WP SST

Nino3.4 SST

From T.Ose et al., 2003

Skills of DJF WP Precipitation
(110-160E,10-20N) from C. Kobayashi, et al. (2005)

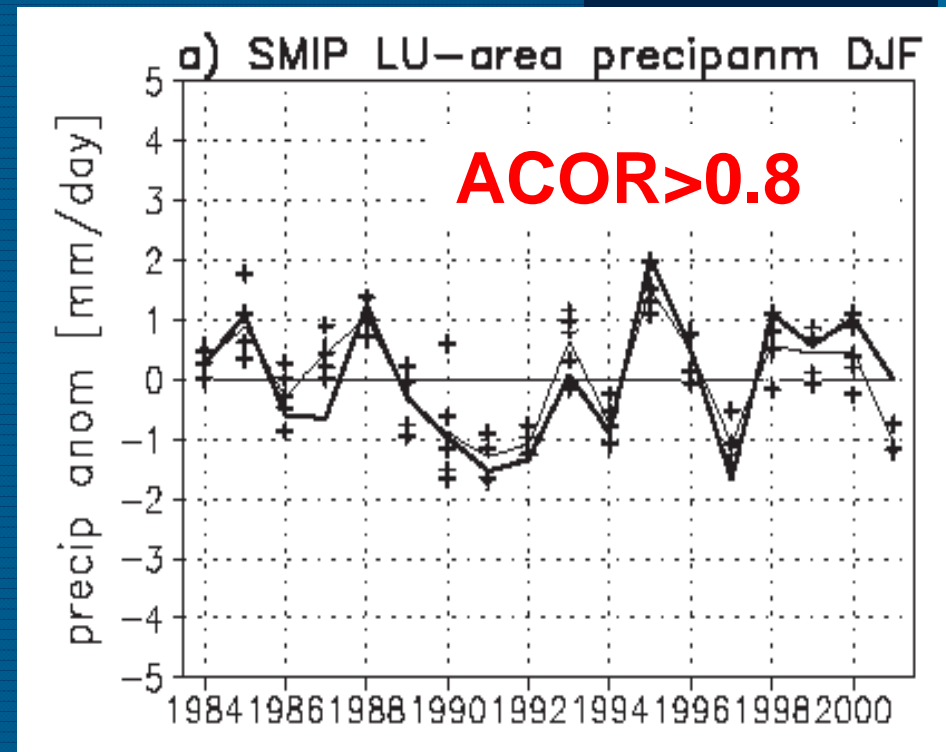**Not so Good HINDCAST**   **Good SMIP**

(Persistent SST anomaly)   (Real SST anomaly)

III. Development of JMA/MRI-Coupled GCM

See Poster by Yasuda et al. on Tuesday

	Operational for El Nino Prediction	New CGCM
AGCM	T42L20	TL95L40
OGCM	65S-70N, 0-360E 2.5° by 0.5-2.0° L20	75S-75N, 0-360E 1.0° by 0.3-1.0° L50
Coupling	Every 24-hour Wind-stress, Heat-flux Adjustment	Every 1-hour Wind-stress, Heat-flux Adjustment
Ocean Assimilation	JMA-ODAS 3D-VAR(T,S) T, S on GTS, COBE-SST, SSH	MOVE/MRI.COM Usui et al. (2006) 3D-VAR(T,S) T, S on GTS, COBE-SST, SSH vertical EOF modes of T-S coupling

Improved Ocean Assimilation System

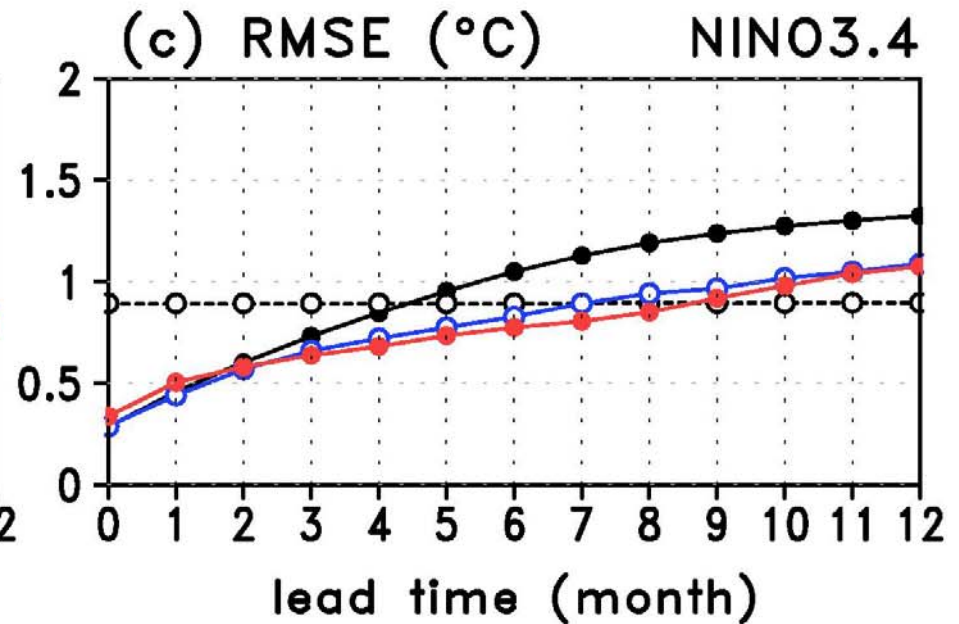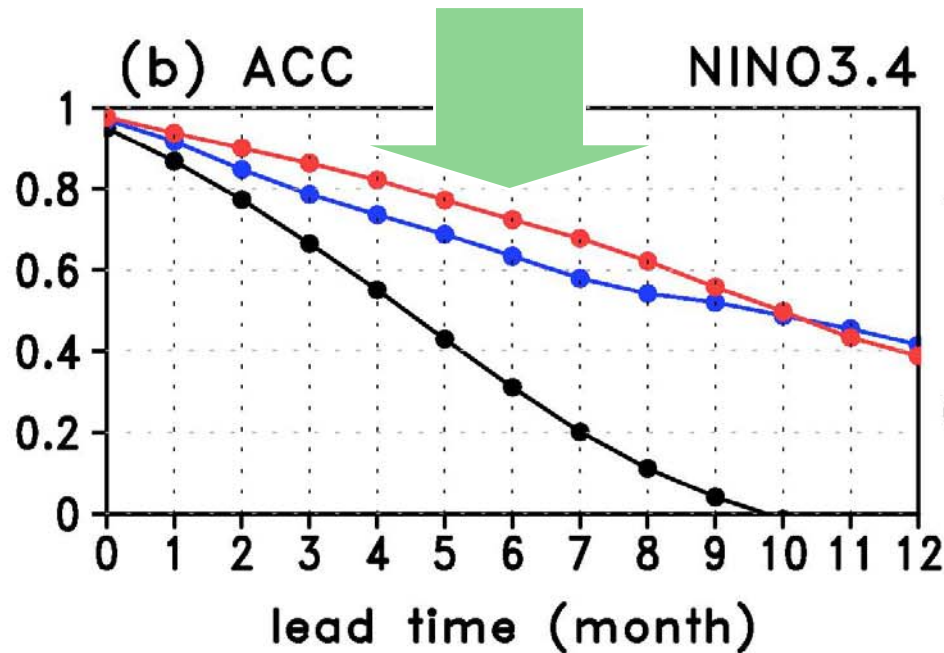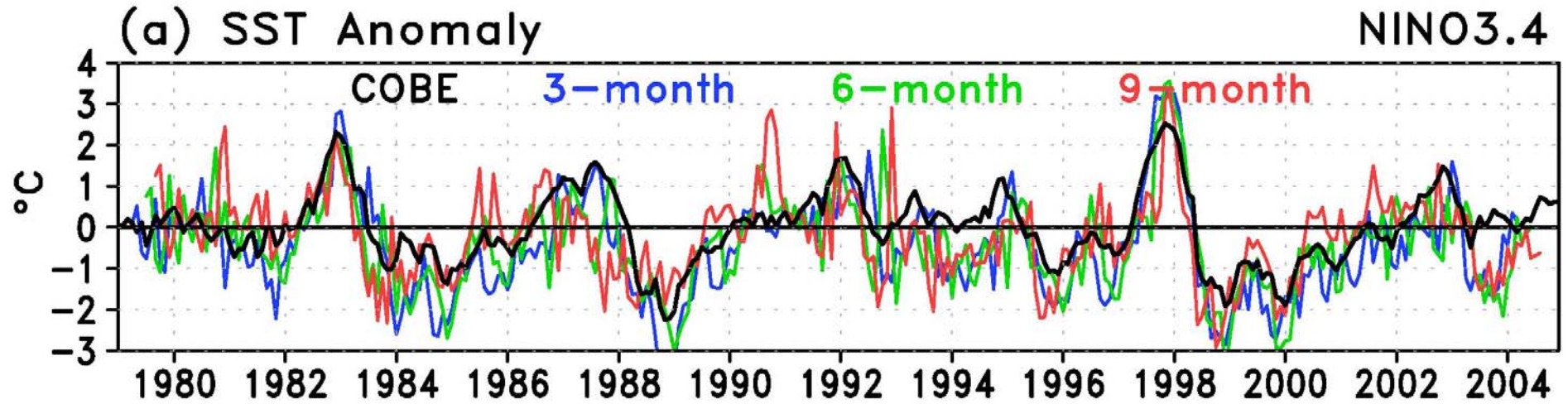**See Poster by Yasuda et al. on Tuesday**

Operational

New
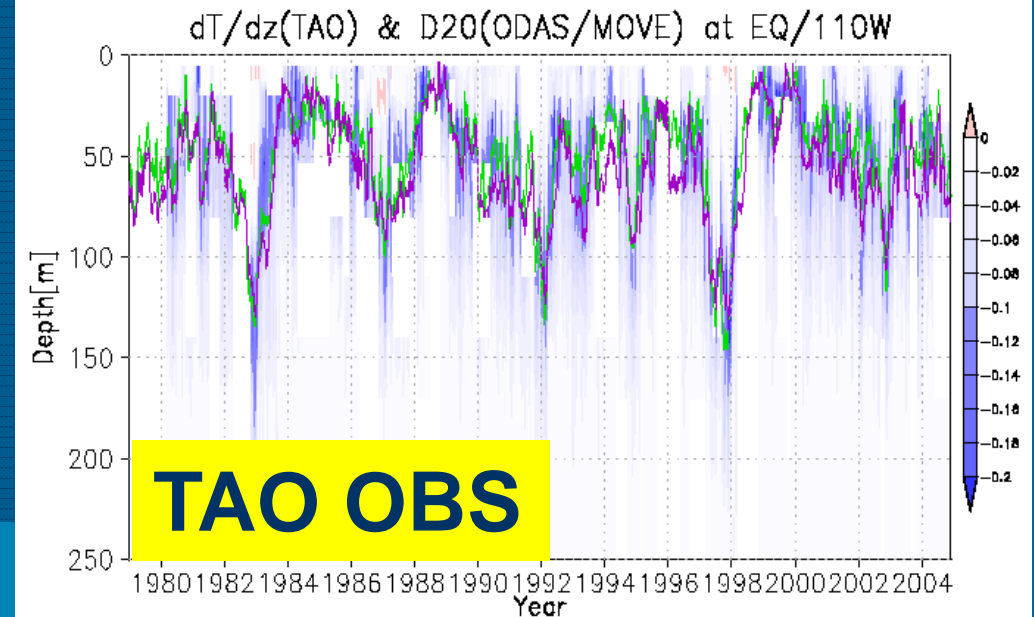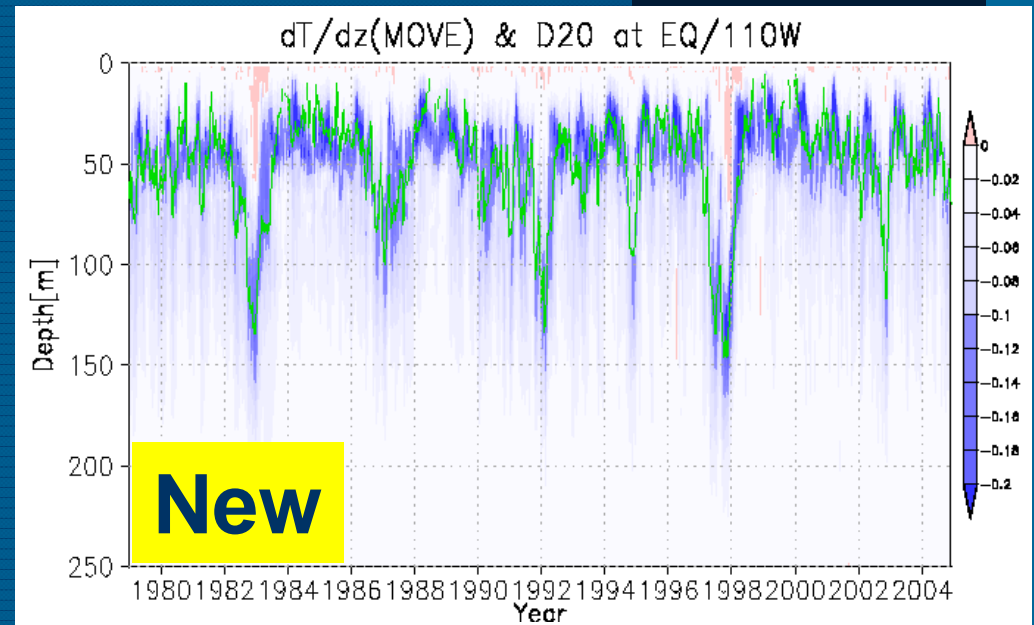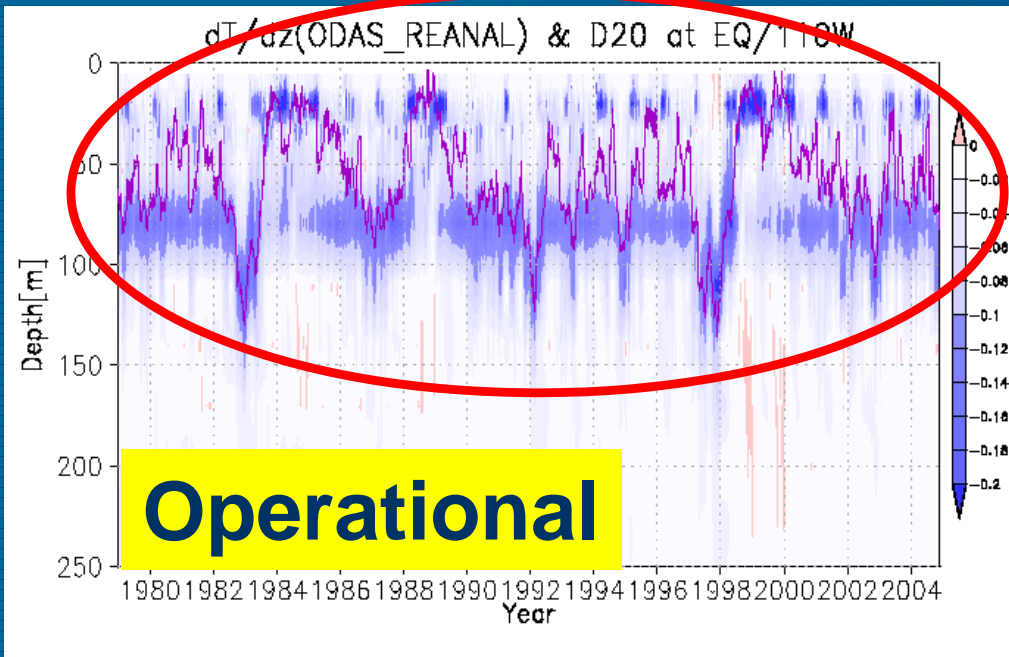
**Time Sequences of
20℃-Depth (Line)
Temperature-Gradient (Shade)
At (110W, 0N)**

TAO OBS

Improved NINO3.4 SST Prediction

Seasonal Forecast Tests of CGCM in TFSP-type Experiments

- Experiments
  - Five-member from 12Z the last five days in January and July
  - 1984-2005（22years）

- Scores for
  - JJA and DJF after **4-month lead-time**
  - ACC, ROC

- **Compared with AGCM Hindcast** from Feb.10 and Aug.10,
  Prescribed SST is obtained statistically based on Nino3.4 SST predicted by JMA El Nino Prediction model.
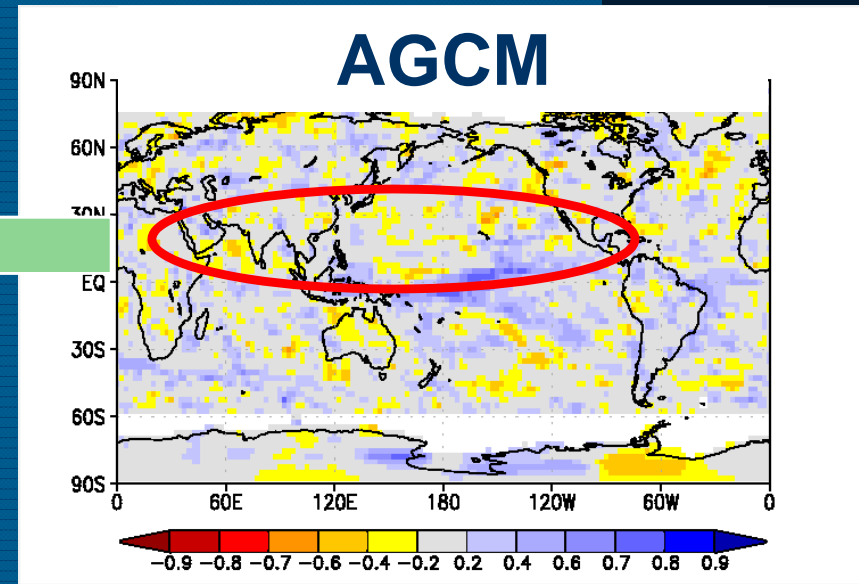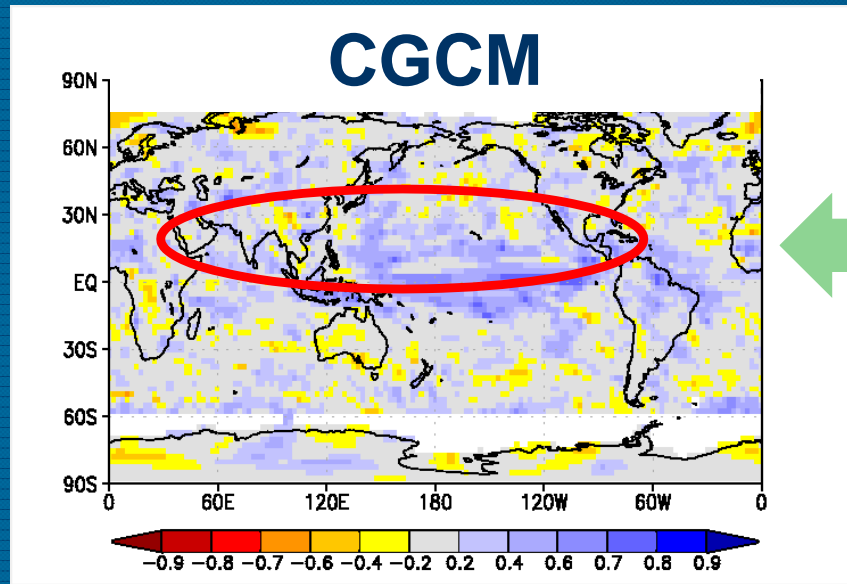
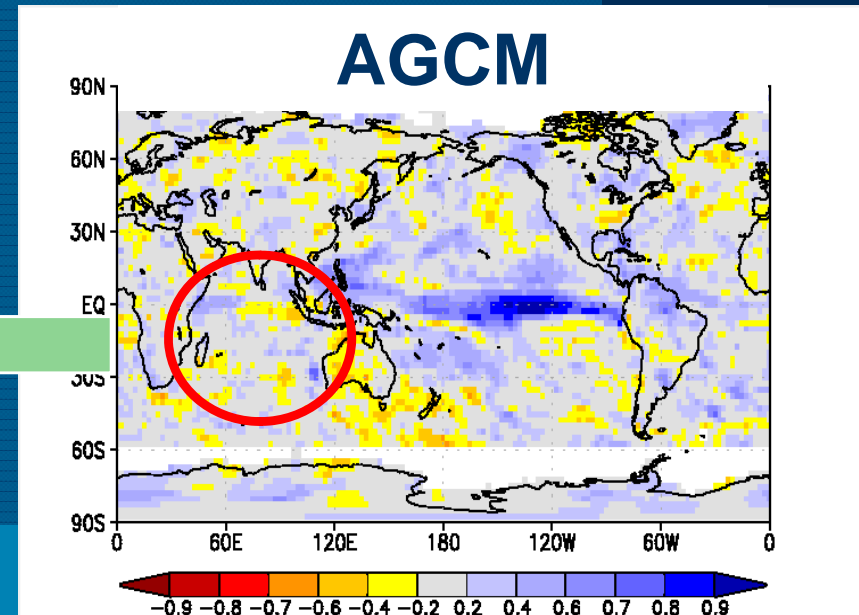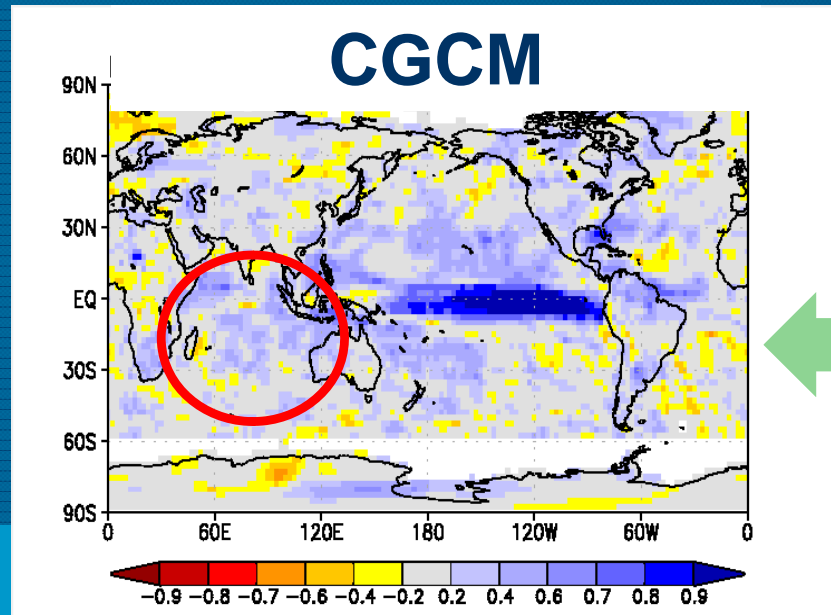**See Poster by Takaya et al. on Tuesday**

Improved Precipitation Skills
Correlation (Hindcast-CMAP)
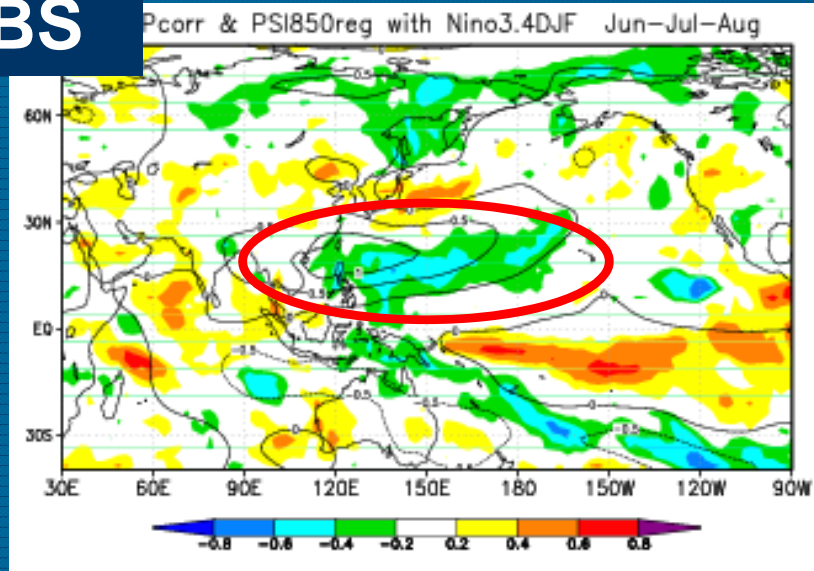
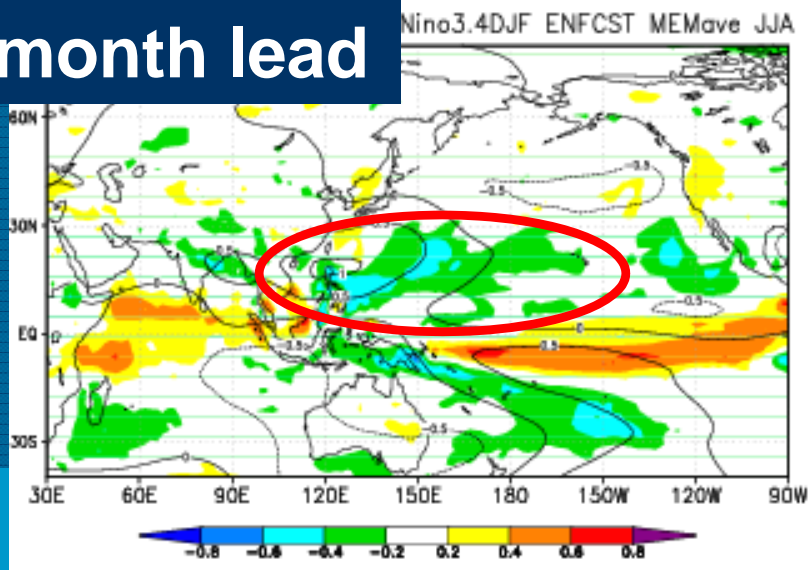# Reproduced **memory effect of DJF Nino3.4** SST in the following JJA WP Precipitation
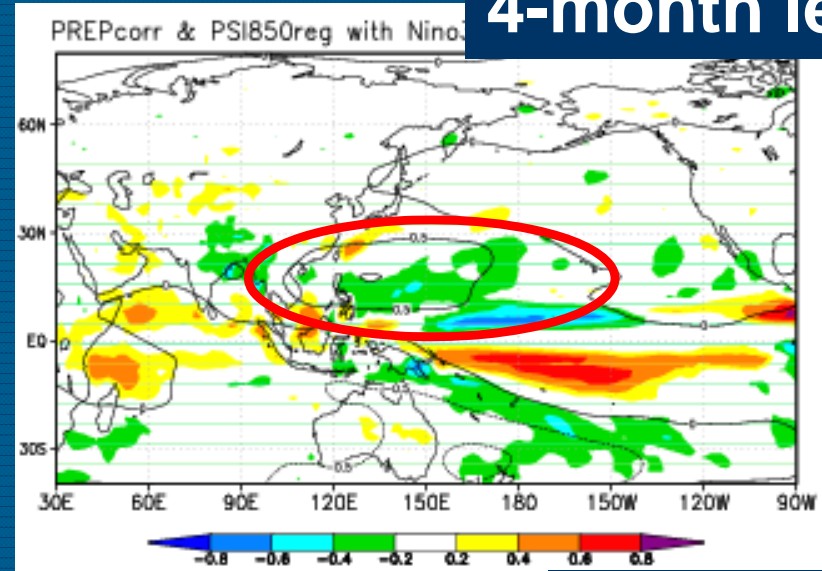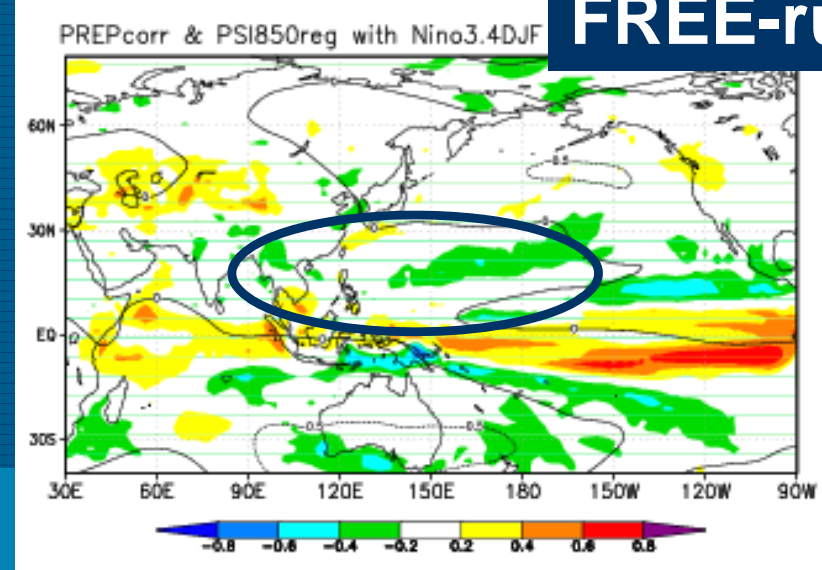
Local Precipitation-SST Relationship
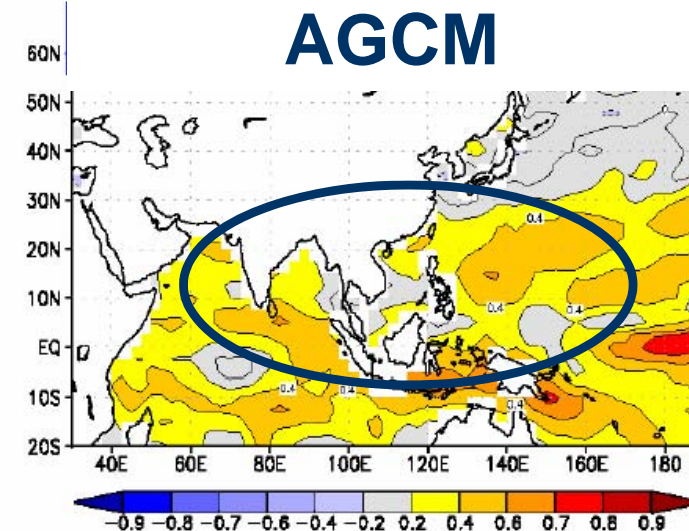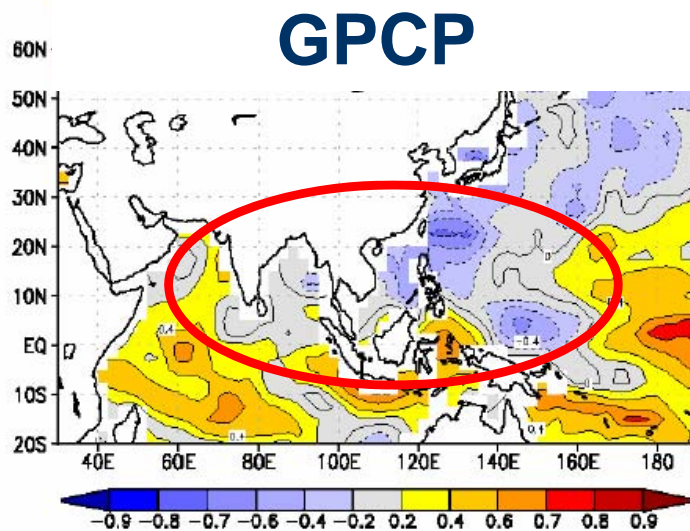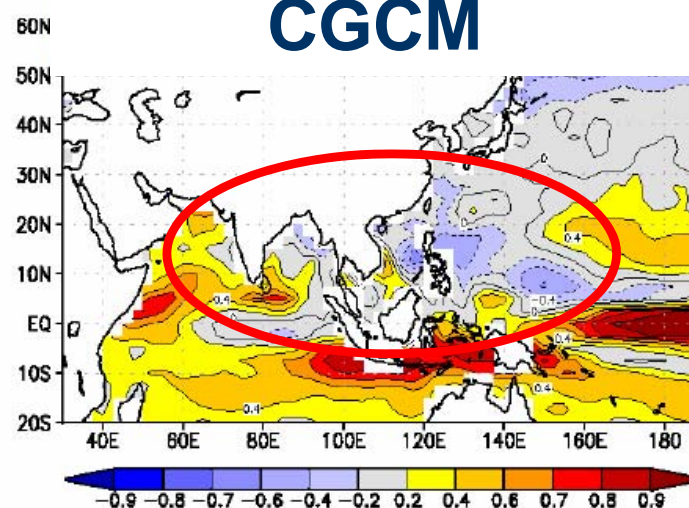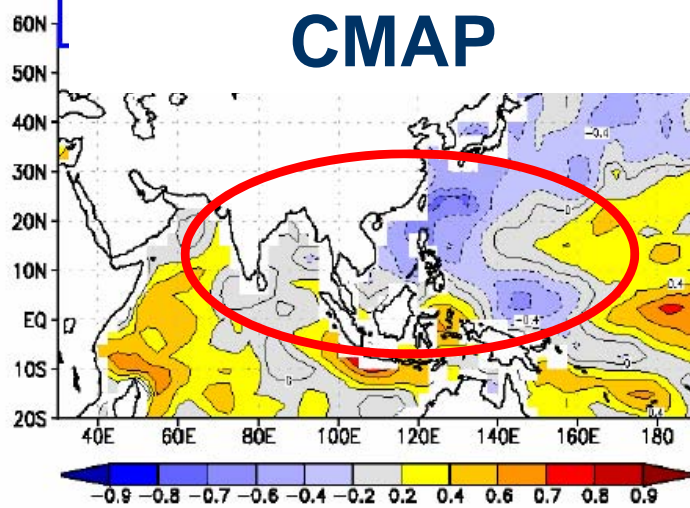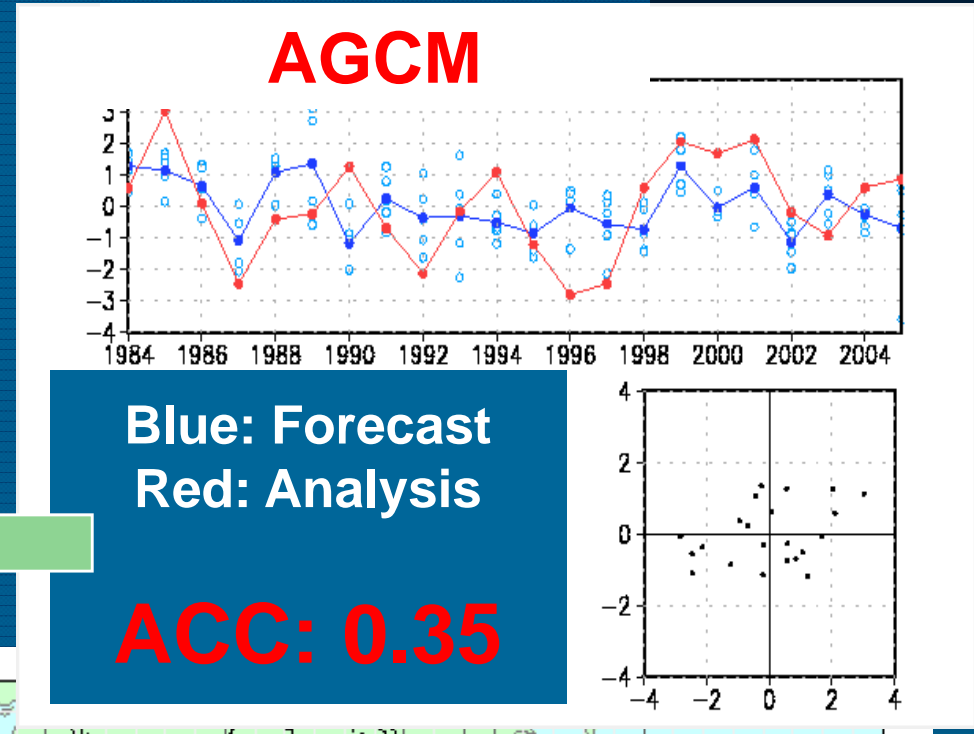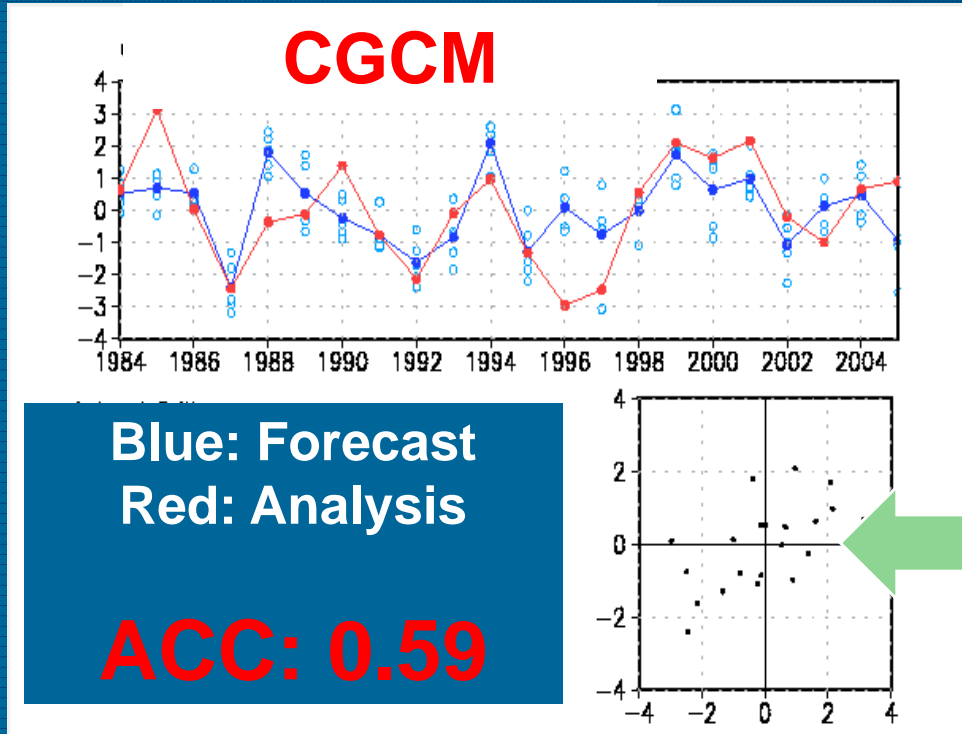## is similar to OBS in CGCM, not in AGCM.
See Poster by Takaya et al. on Tuesday

Local correlation between Precipitation and SST

South Asia Summer Monsoon Index (WYI)
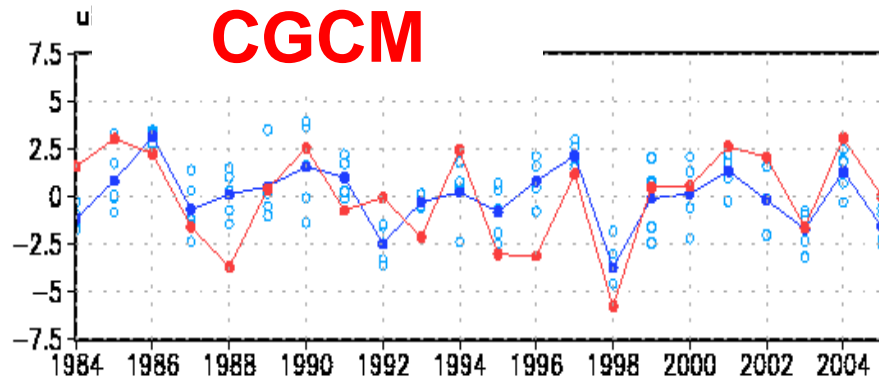## (4-month lead: JJA from JAN)

See Poster by Takaya et al. on Tuesday

CGCM

AGCM

Blue: Forecast
Red: Analysis

ACC: 0.59

Blue: Forecast
Red: Analysis

ACC: 0.35

WYI Definition：
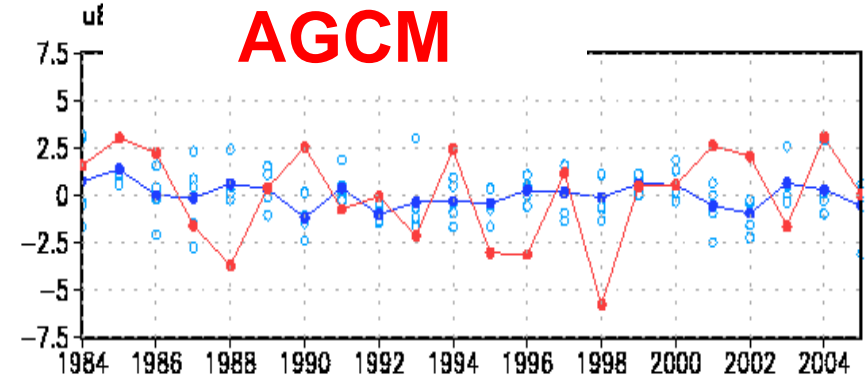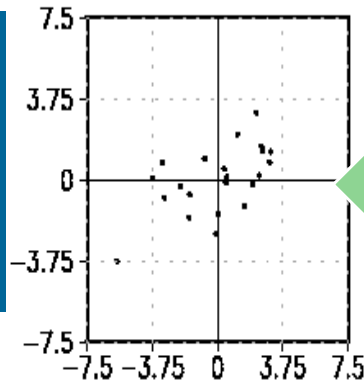**(0-20N,40-110E) Mean of U850–U200**
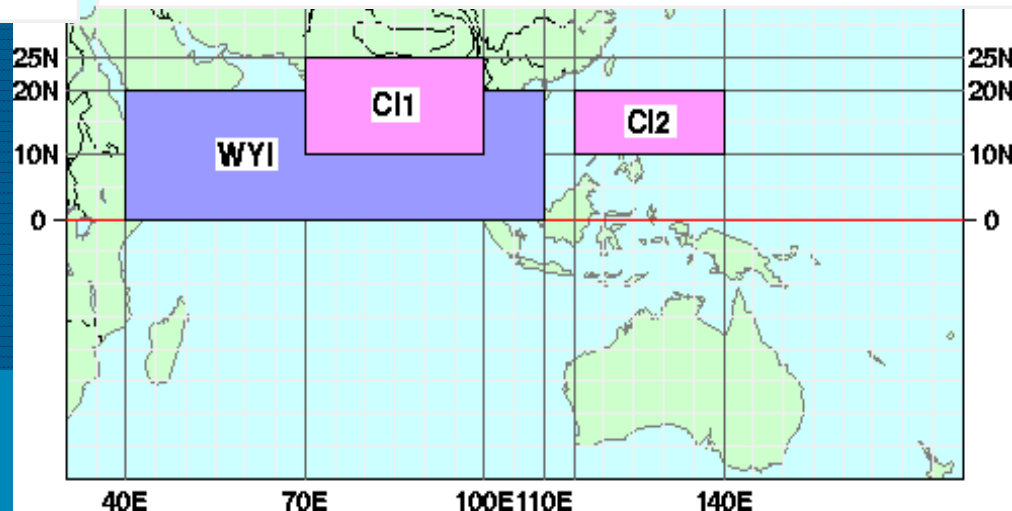
East Asia Summer Monsoon Index (DU2)
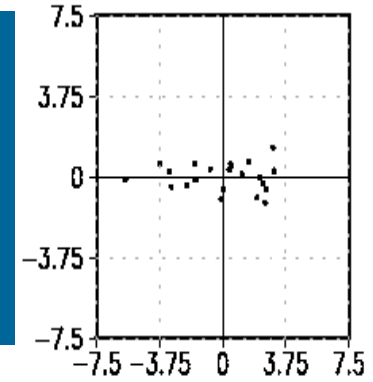## (4-month lead: JJA from JAN)
See Poster by Takaya et al. on Tuesday

CGCM
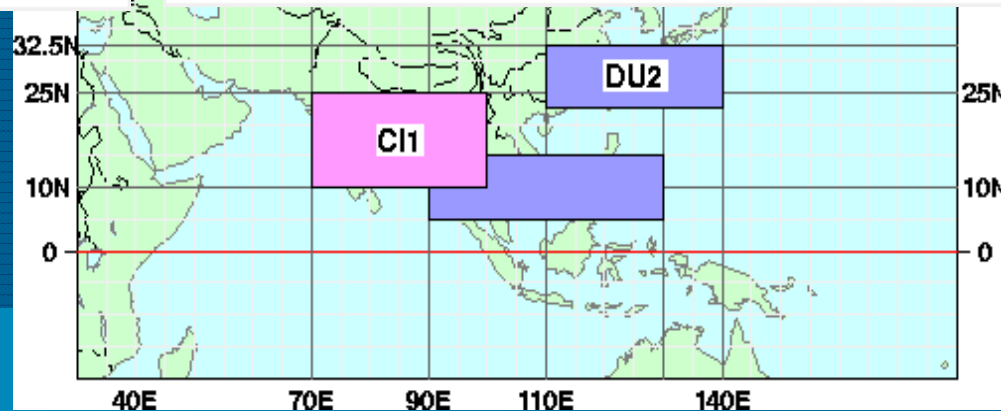
Blue: Forecast
Red: Analysis

ACC: 0.58

AGCM

Blue: Forecast
Red: Analysis

ACC: -0.05

DU2 Definition：
Area Mean of U850 (5-15N,90-130E)-(22.5-32.5N,110-140E)

ROC Scores for Surface Air Temperature
(**4-month lead**, 3-month Average, Positive Anomaly)

See Poster by Takaya et al. on Tuesday

DJF from JUL

CGCM	NH	58.3
	TP	69.8
	PAC	57.9
	JAP	61.6
AGCM	NH	55.1
	TP	66.7
	PAC	55.0
	JAP	57.1

JJA from JAN

CGCM	NH	57.9
	TP	67.9
	PAC	58.0
	JAP	62.3
AGCM	NH	57.3
	TP	64.0
	PAC	56.7
	JAP	59.0

SUMMARY

- JMA Operational Three-month Forecast shows practically good skills for Japan by using the OBS-to-OBS downscaling.

- East Asia has ENSO-related high seasonal predictability via WP precipitation simply in DJF and a bit complicatedly in JJA.

- New JMA/MRI Coupled GCM improves 4-month-lead prediction for almost all aspects including Asia monsoon through more realistic air-sea interactions.