



Seasonal outlook of the East Asian Summer in 2014

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Structure of this presentation

**Part I Interannual variability of
summer climate in East Asia**

Part II Current condition

Part III Numerical prediction

✂ In this presentation,

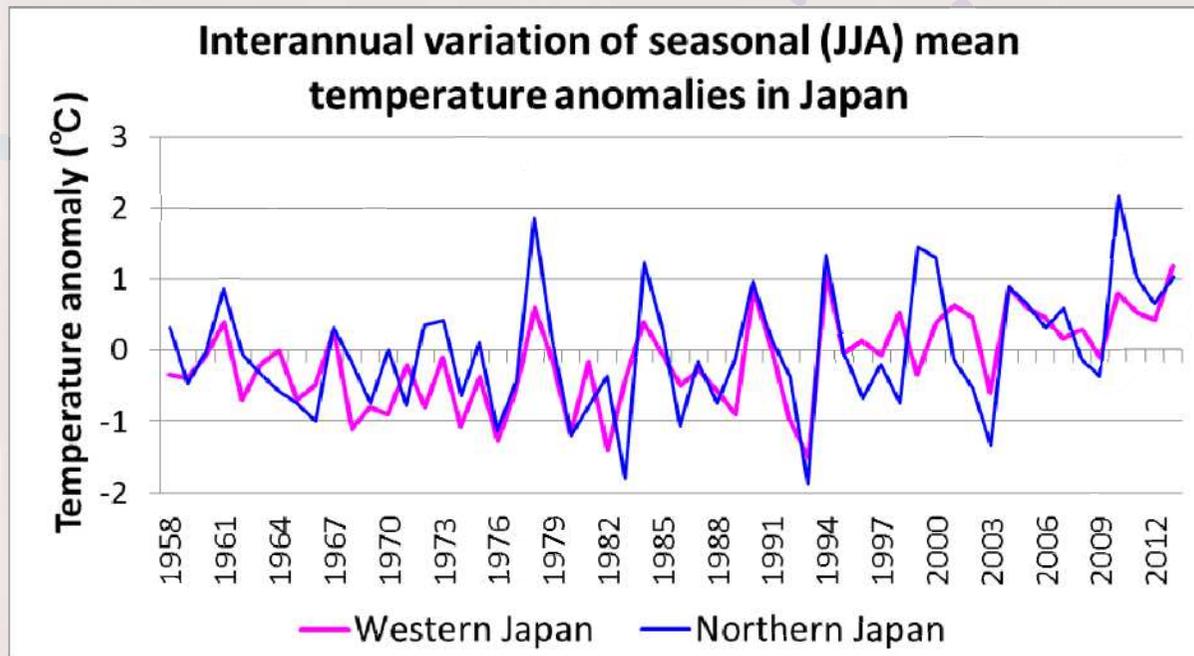
* Base period for normal is 1981-2010.

* Atmospheric analysis data are JRA-55.

* SST data are COBE-SST and OLR data are provided by NOAA.

Part I
Interannual variability
of summer climate in East Asia

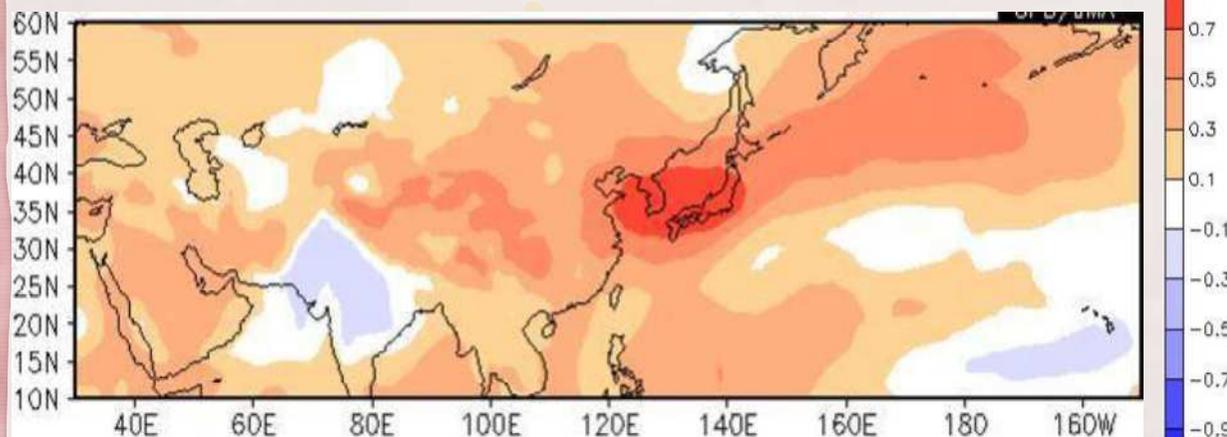
Interannual variation of summer mean temperature



Temperature ranks during recent 10 years (2004-2013)

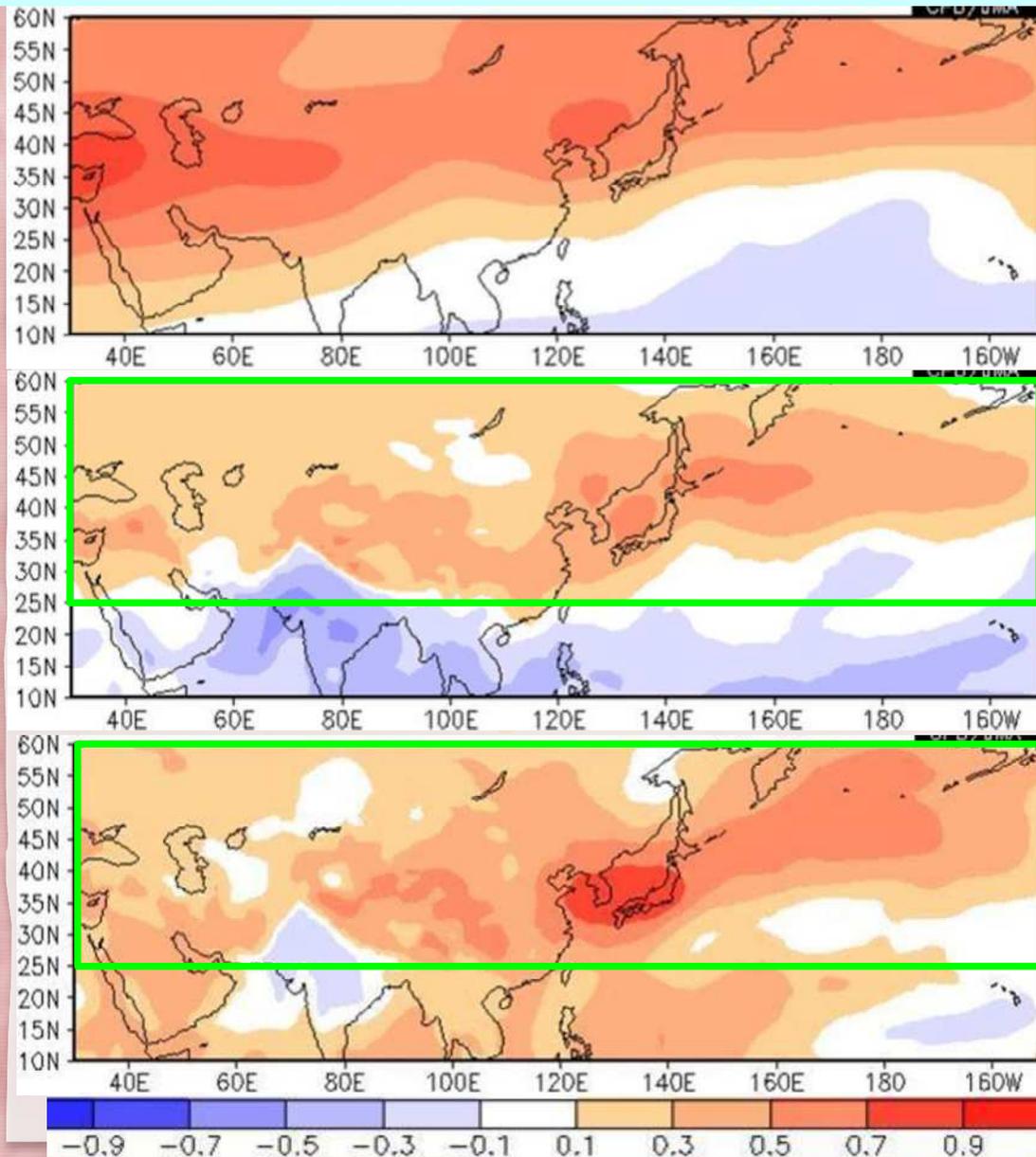
	Below normal	Near normal	Above normal
Northern Japan	0	2	8
Eastern Japan	1	3	6
Western Japan	0	3	7
Okinawa	0	4	6

Correlation coefficient of 850hPa temperature to temperature in Western Japan (JJA, 1958-2013)



Hot summer has been dominant in Japan recently.
 # Interannual variation of temperature in East Asia is almost similar.

The major atmospheric mode associated with summer mean temperature over East Asia



Distribution of eigen vector of EOF 1st mode for 200hPa stream function over East Asia (JJA, 1958-2013)

EOF1 indicates an Asian scale north-south variation of sub-tropical jet stream.
→ Call this mode “Major mode” in this presentation

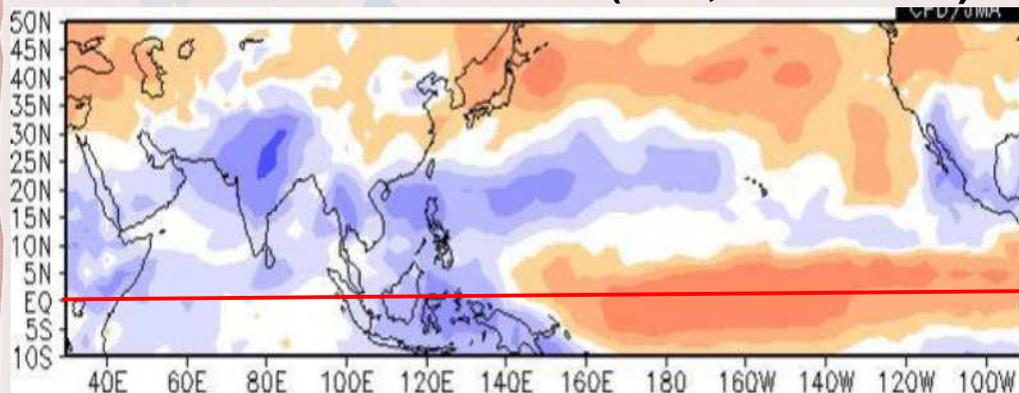
Correlation coefficient of 850hPa temperature to the score of EOF 1st mode for 200hPa stream function

An interannual variation of temperature around Japan is mainly dominated by this major mode.

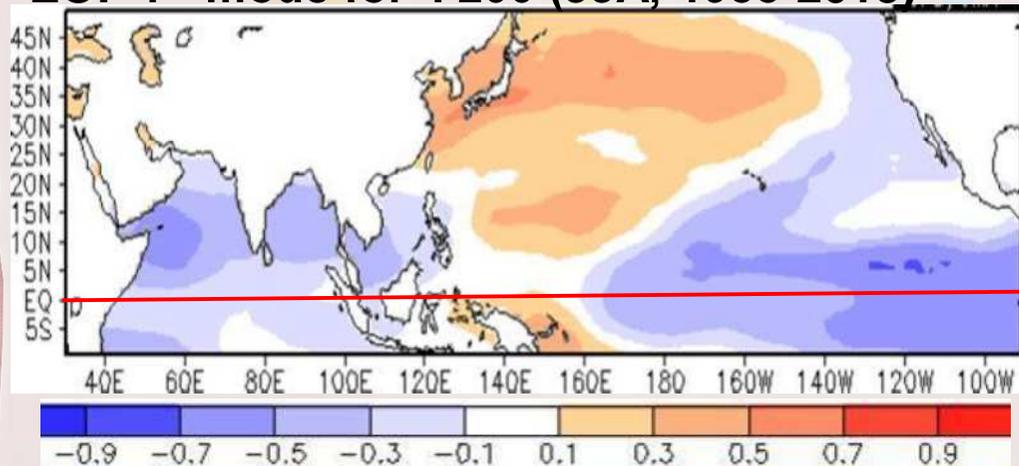
Correlation coefficient of 850hPa temperature to temperature in Western Japan (JJA, 1958-2013)

Relationship between the major mode and tropical convective activities and SSTs

Correlation coefficient of OLR to the score of EOF 1st mode for Ψ_{200} (JJA, 1979-2013)



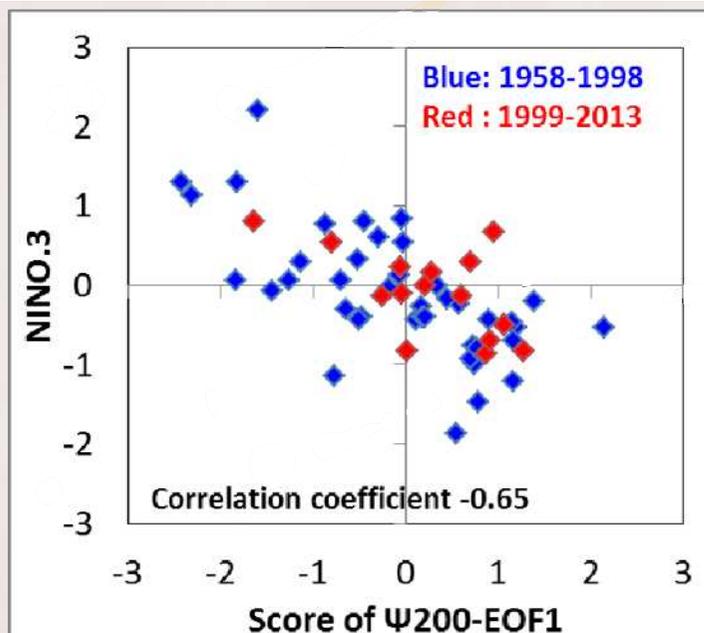
Correlation coefficient of SST to the score of EOF 1st mode for Ψ_{200} (JJA, 1958-2013)



The major mode is the result of enhanced convection in Asian monsoon.

The major mode is closely related to ENSO.

Relationship between NINO.3 and the major mode has not changed much over a half century.



Another major atmospheric mode associated with mid-summer temperature over East Asia

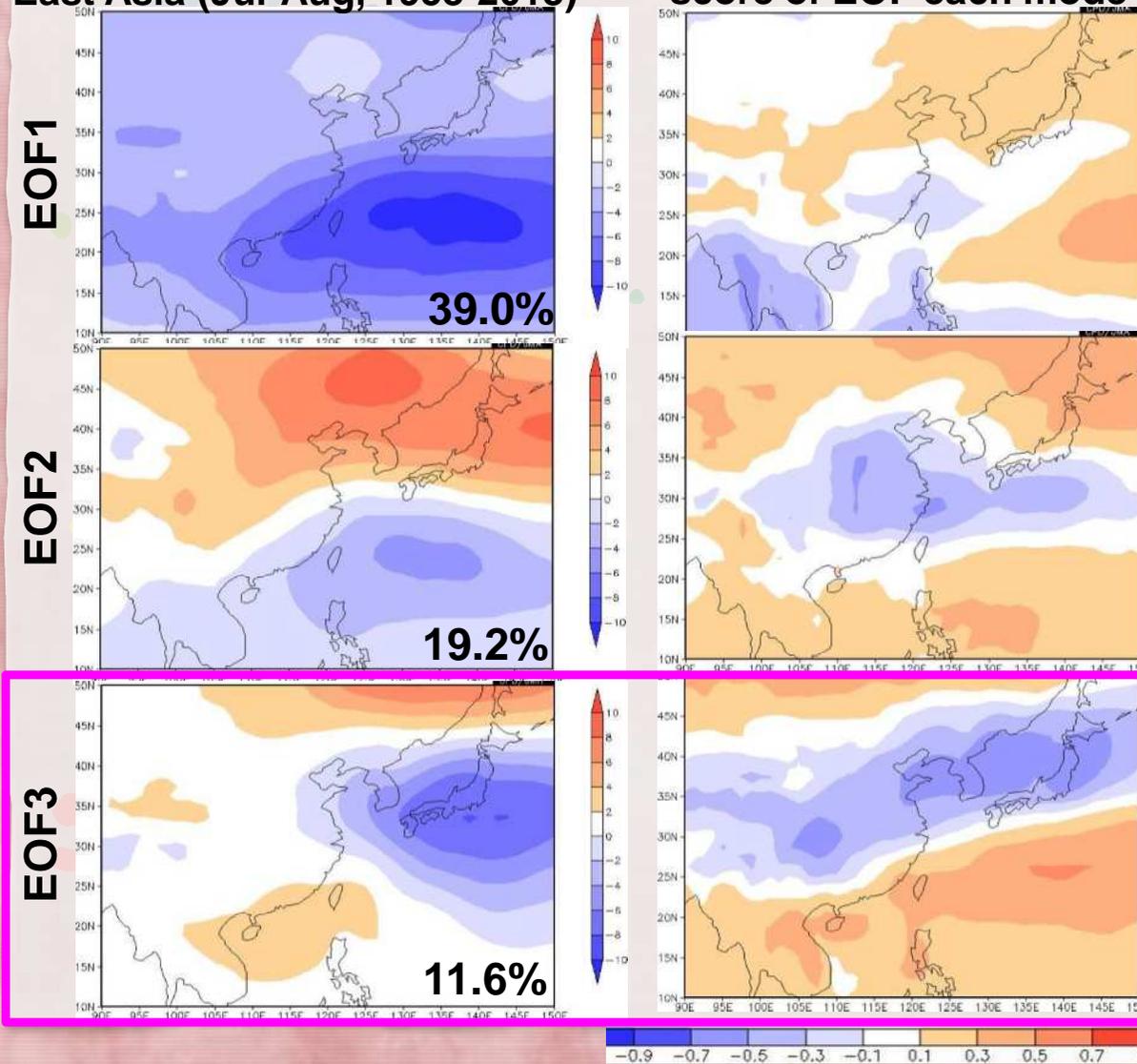
Distribution of eigen vector of EOF each mode for 850hPa height over East Asia (Jul-Aug, 1958-2013)

Correlation coefficient of 850hPa temperature to the score of EOF each mode

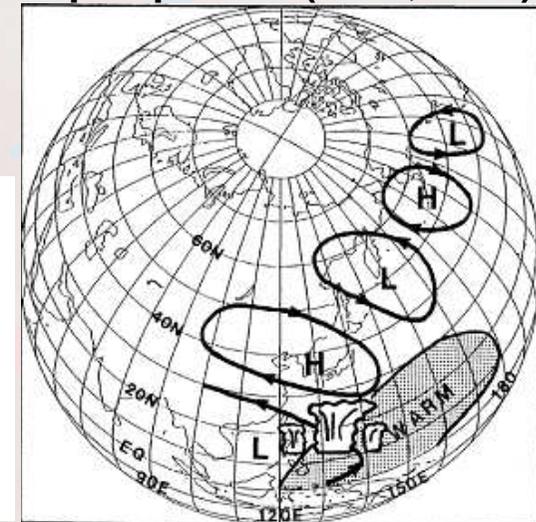
Correlation coefficient of NINO.3 to the score of EOF each mode

	EOF1	EOF2	EOF3
NINO.3	0.00	-0.18	0.03

EOF3 is well correlated to temperatures in East Asia.
This mode is the same as P-J pattern.

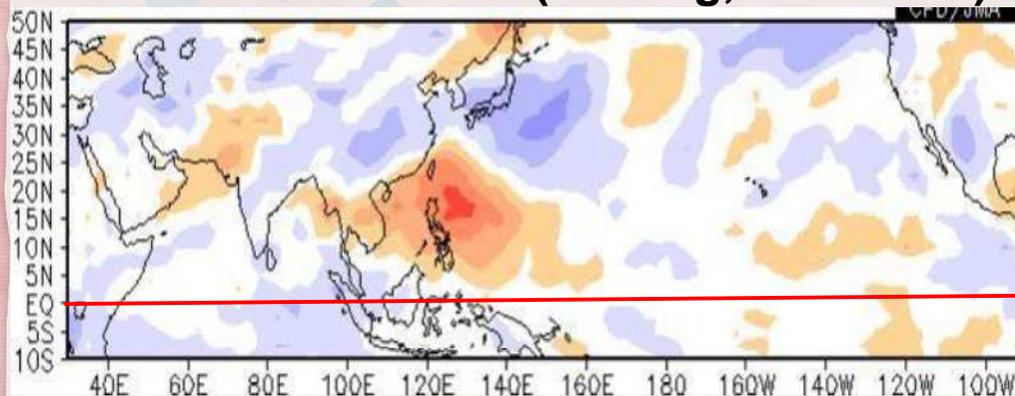


Schematic chart of Pacific-Japan pattern (Nitta, 1987)



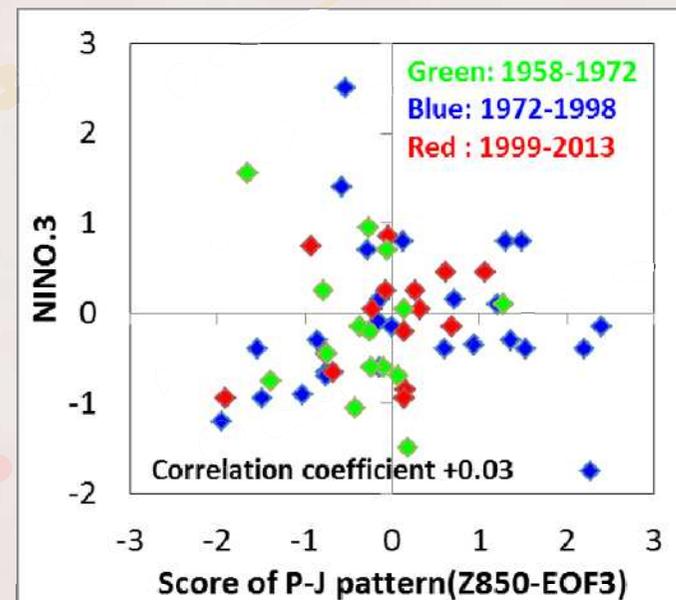
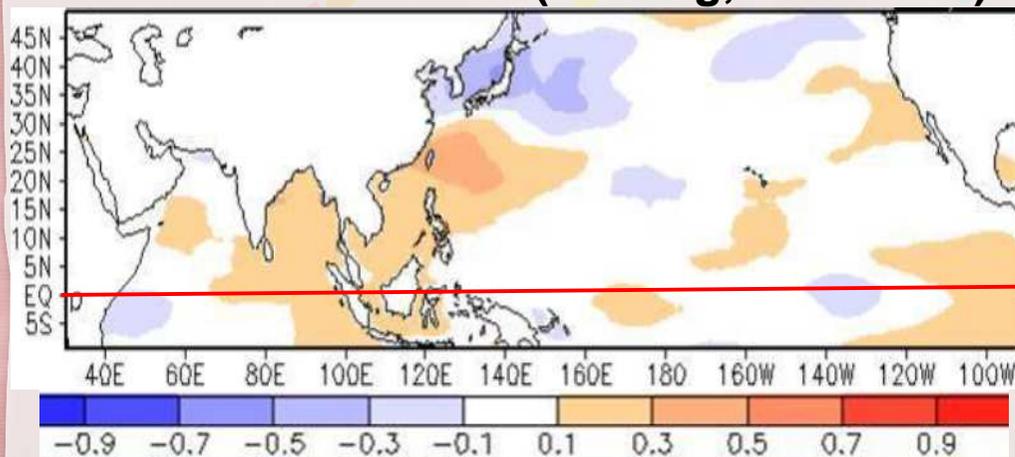
Relationship between the P-J pattern and tropical convective activities and SSTs

Correlation coefficient of OLR to the score of EOF 3rd mode for Z850 (Jul-Aug, 1979-2013)



The P-J pattern is excited by enhanced convection around the Philippines.
The P-J pattern is not related to ENSO.

Correlation coefficient of SST to the score of EOF 3rd mode for Z850 (Jul-Aug, 1958-2013)



Summary of Interannual variability



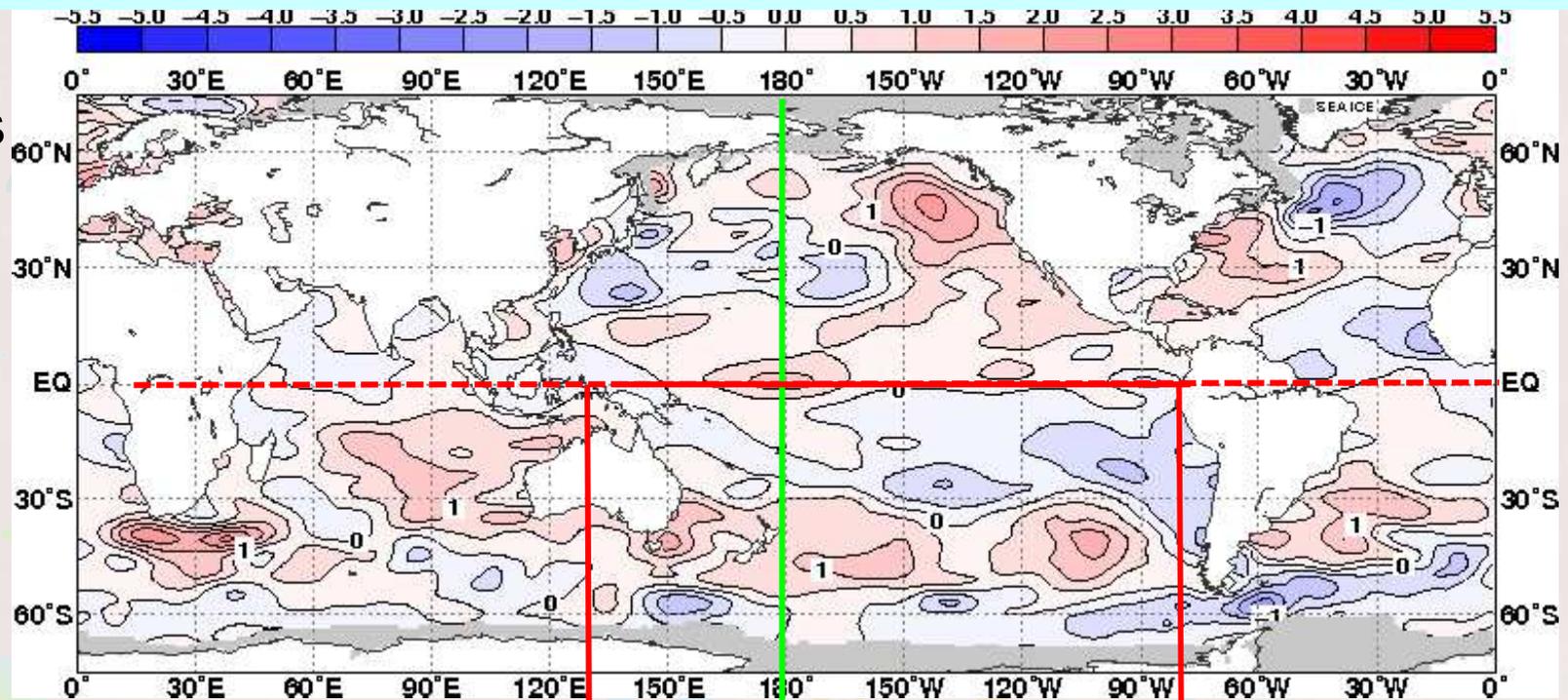
- Interannual variation of temperature in East Asia shows a same tendency.
- Two major modes which bring interannual variation of temperature in East Asia are,
 1. Zonally north-south variation of sub-tropical jet
→ link to ENSO
 2. The P-J pattern
→ not link to ENSO,
but convection around the Philippines.

Part II

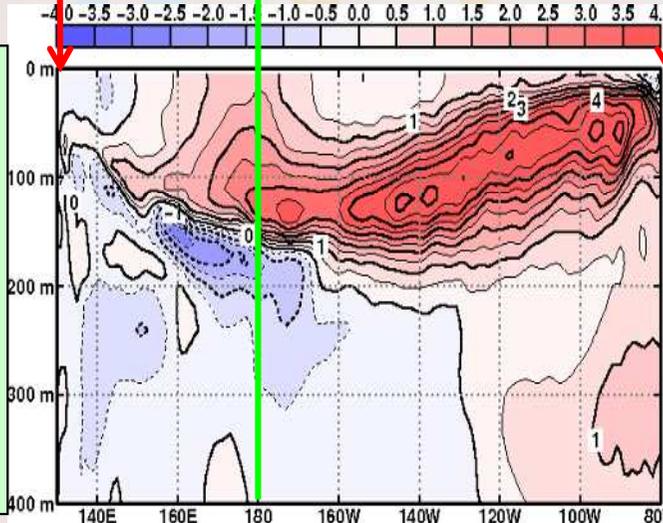
Current conditions

Oceanic conditions in Mid-April

SST anomalies

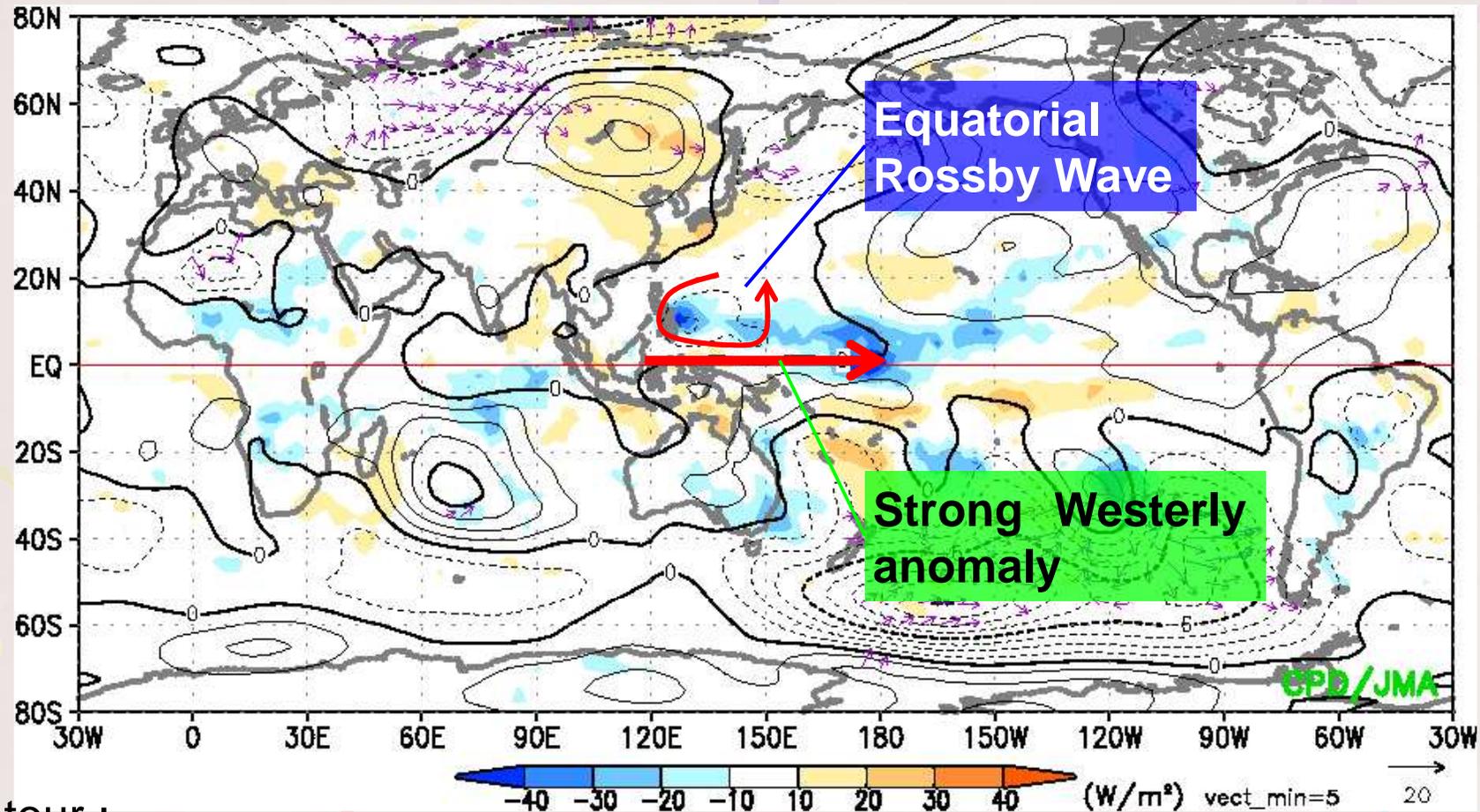


The distribution of SST anomalies shows an ENSO neutral condition.
Positive anomalies are dominant in sub-surface sea temperature along the equatorial central and eastern Pacific



Sub-surface sea temperature anomalies in the equatorial Pacific

Atmospheric conditions in Mid-Mar. to Mid-Apr.



Contour :

850hPa stream function anomalies

Color shade :

OLR anomalies

**# Convection are enhanced around the dateline.
As a result of Rossby response to the enhanced convection, cyclonic circulation anomalies are dominant over the western Pacific.**

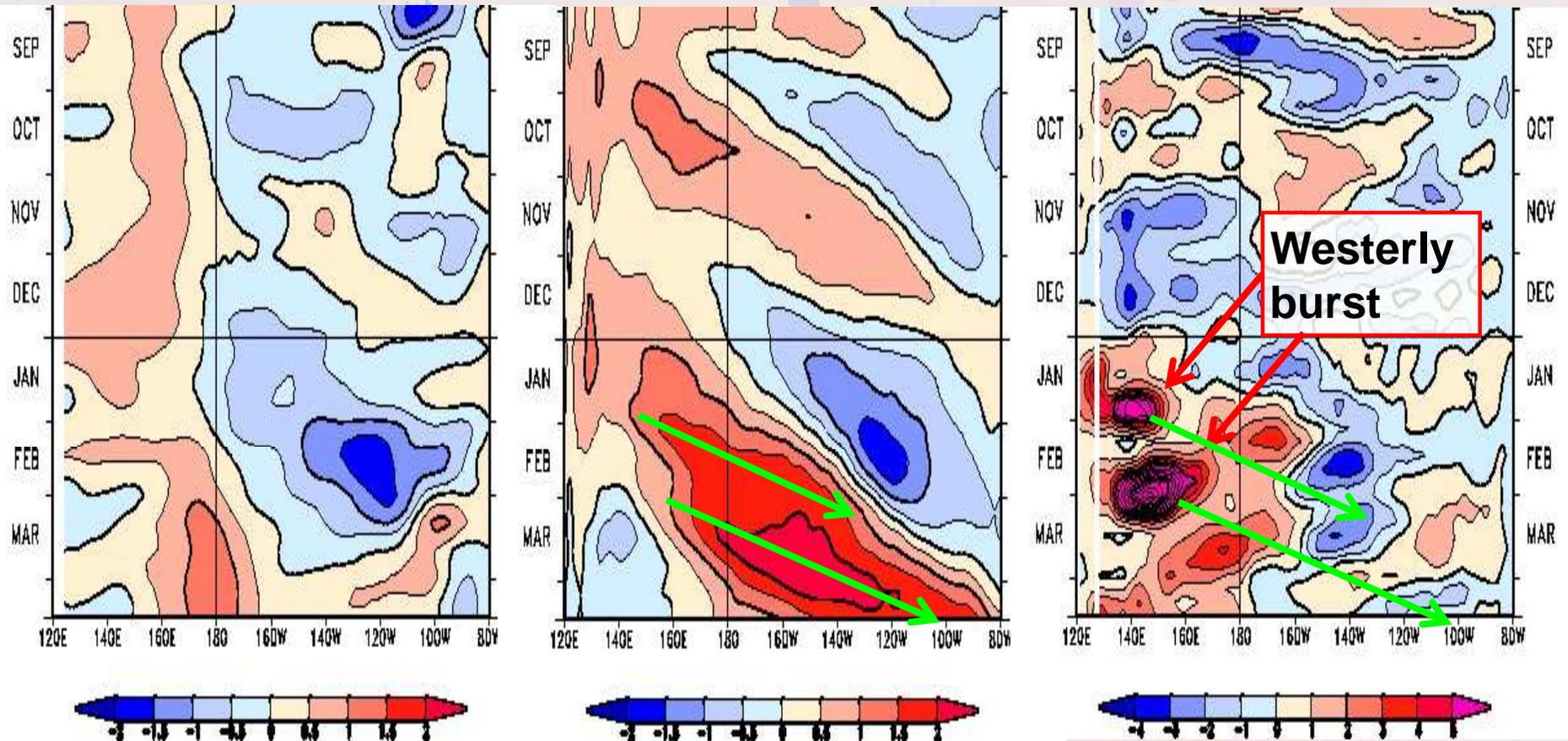
Inter-seasonal evolution of oceanic conditions

Time-Longitude cross section along the equator

SST

Ocean Heat Content

zonal wind stress



Strong westerly bursts excited warm Kelvin waves with large amplitude.
Kelvin waves will reach the west coast of South America in a few days.

Summary of current conditions



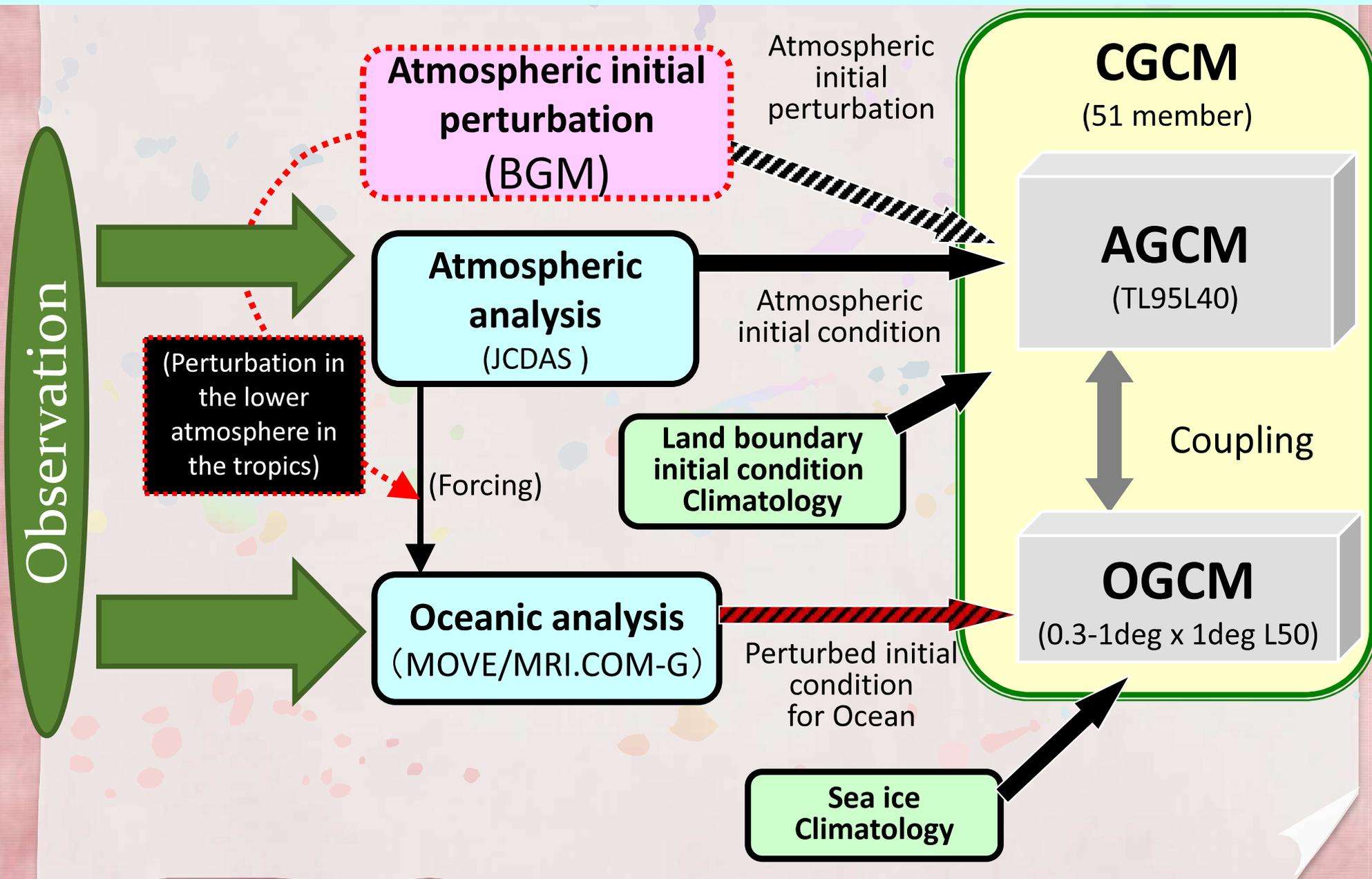
- ENSO neutral conditions have continued during the boreal winter and the first half of spring.
- However, warm Kelvin waves which were excited by twice strong westerly bursts seen in January and February over the equatorial western Pacific migrated with large amplitude along the equatorial central Pacific in March.
- These warm Kelvin waves will reach the west coast of South America in the end of April.

Part III

Numerical prediction

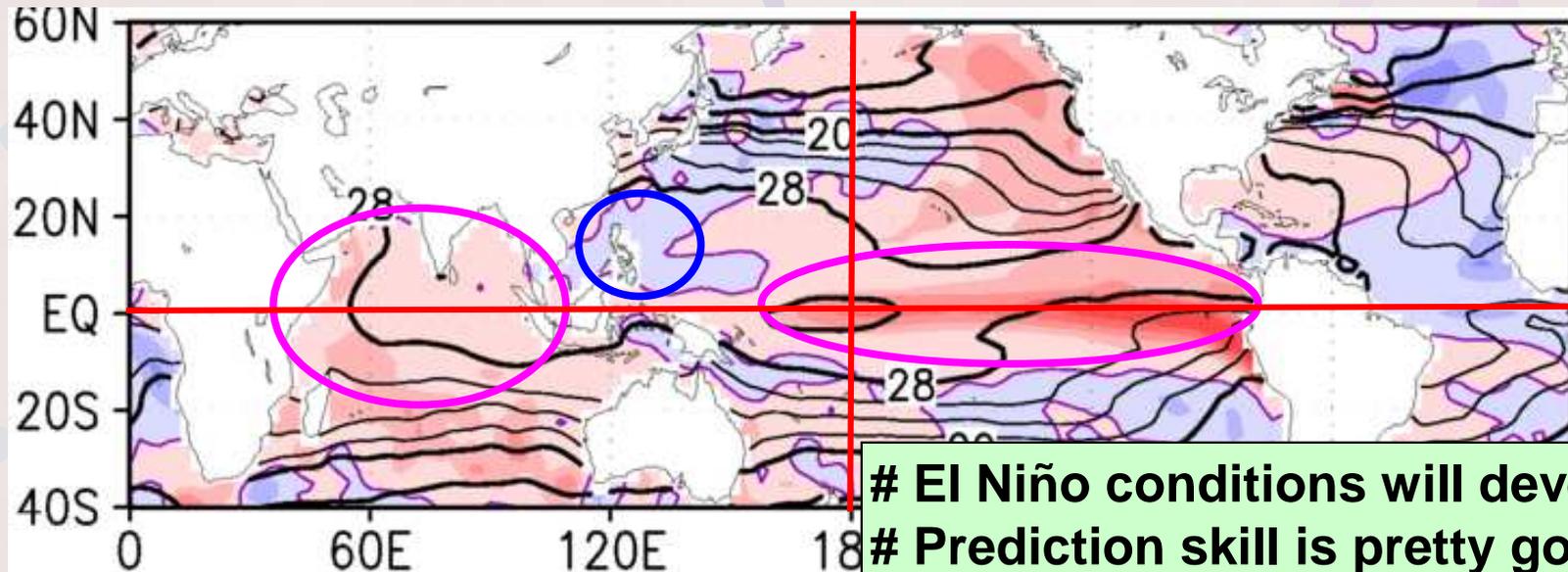
Result of CGCM and its interpretation

Configuration of JMA Seasonal Prediction System

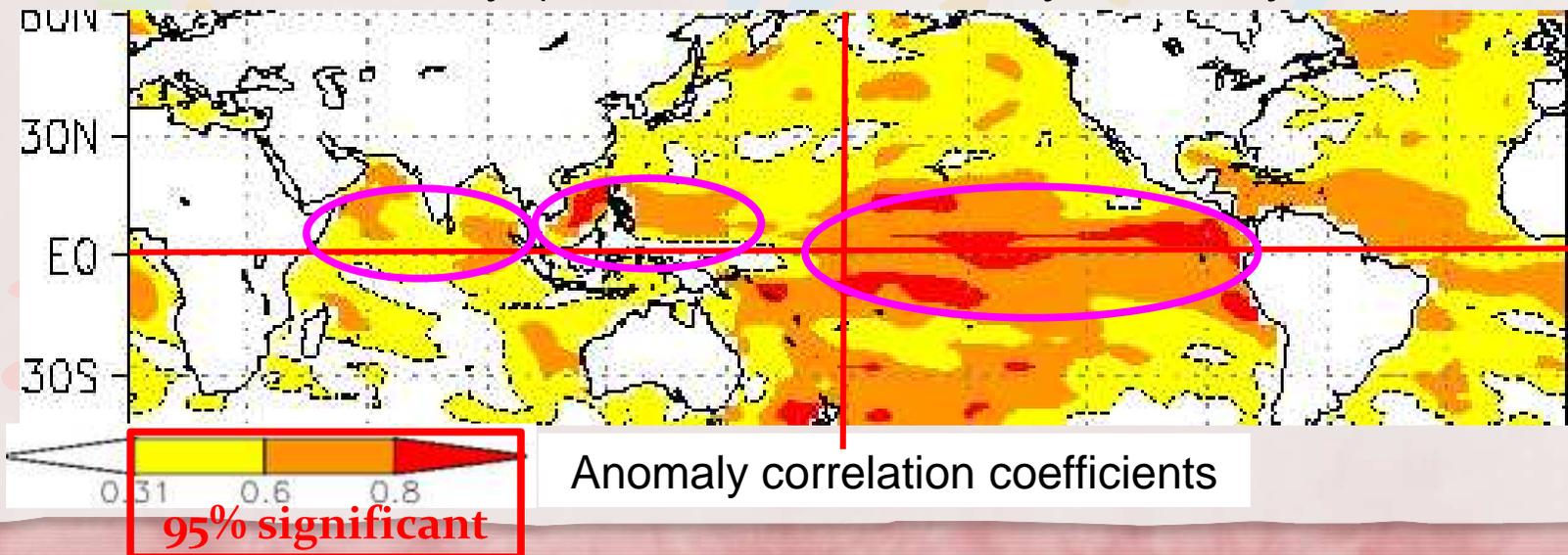


Predicted oceanic conditions in JJA (1)

SST anomalies

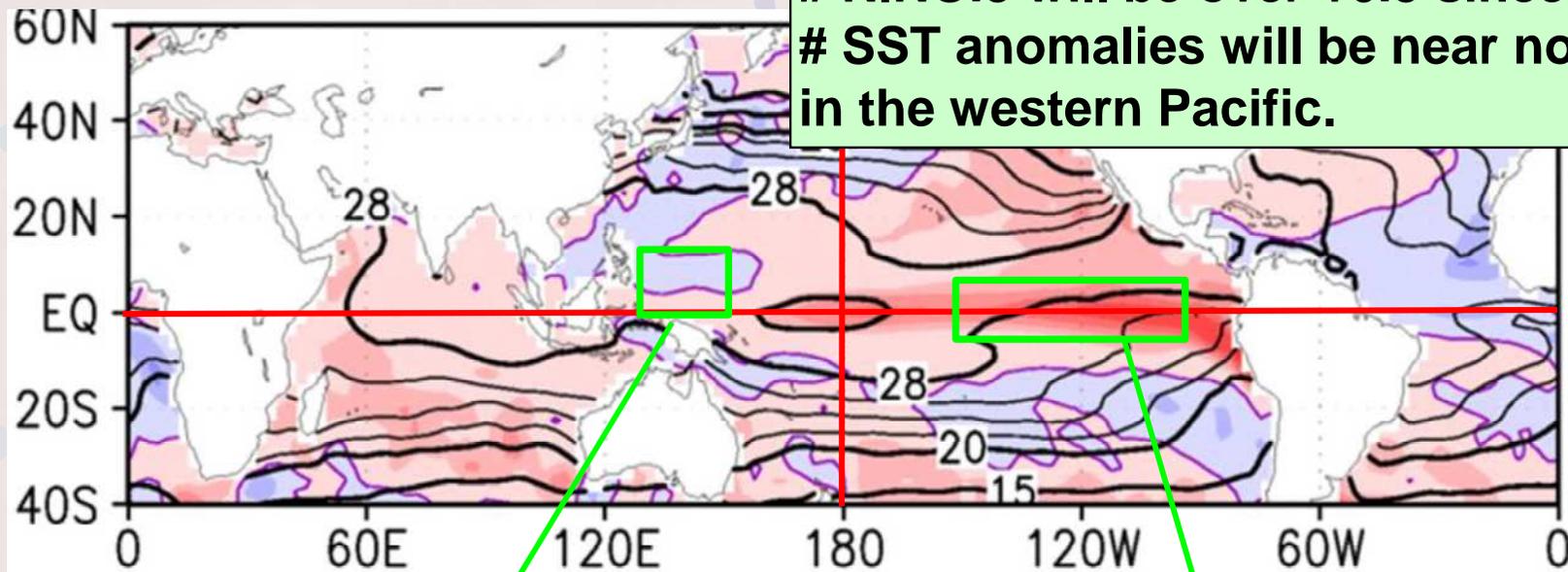


Prediction accuracy (verification result by the 30-year hindcast)

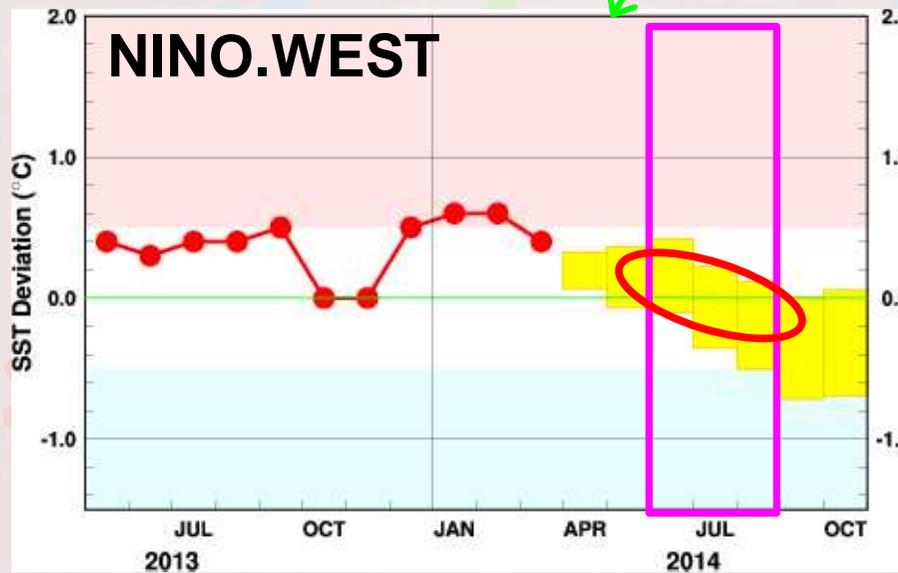


Predicted oceanic conditions in JJA (2)

SST anomalies

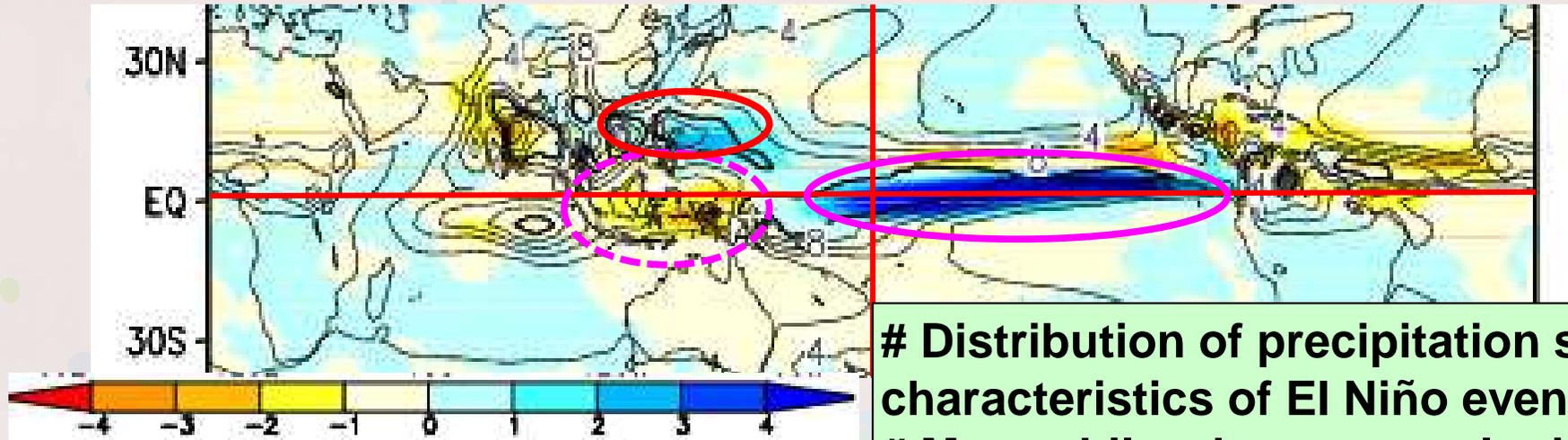


NINO.3 will be over +0.5 since June.
SST anomalies will be near normal in the western Pacific.



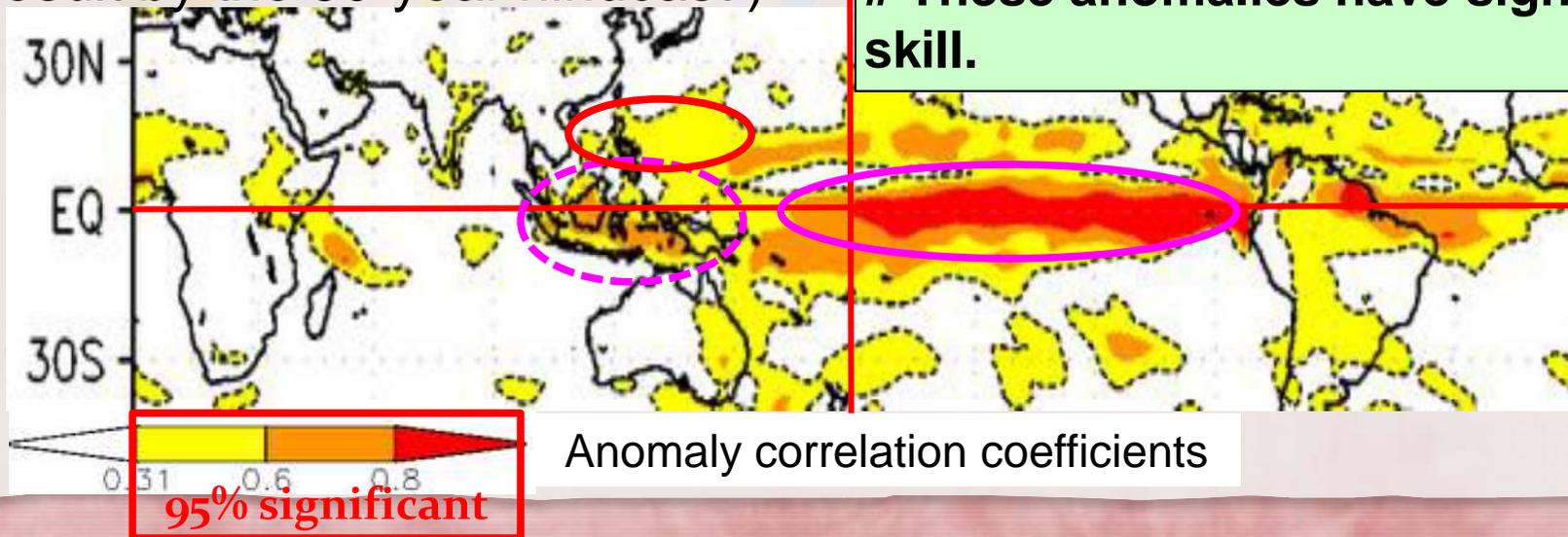
Predicted sub-tropical circulation in JJA (1)

Precipitation and anomalies



Distribution of precipitation shows characteristics of El Niño events.
Meanwhile, above normal rainfall is predicted around the Philippines.
These anomalies have significant skill.

Prediction accuracy (verification result by the 30-year hindcast)

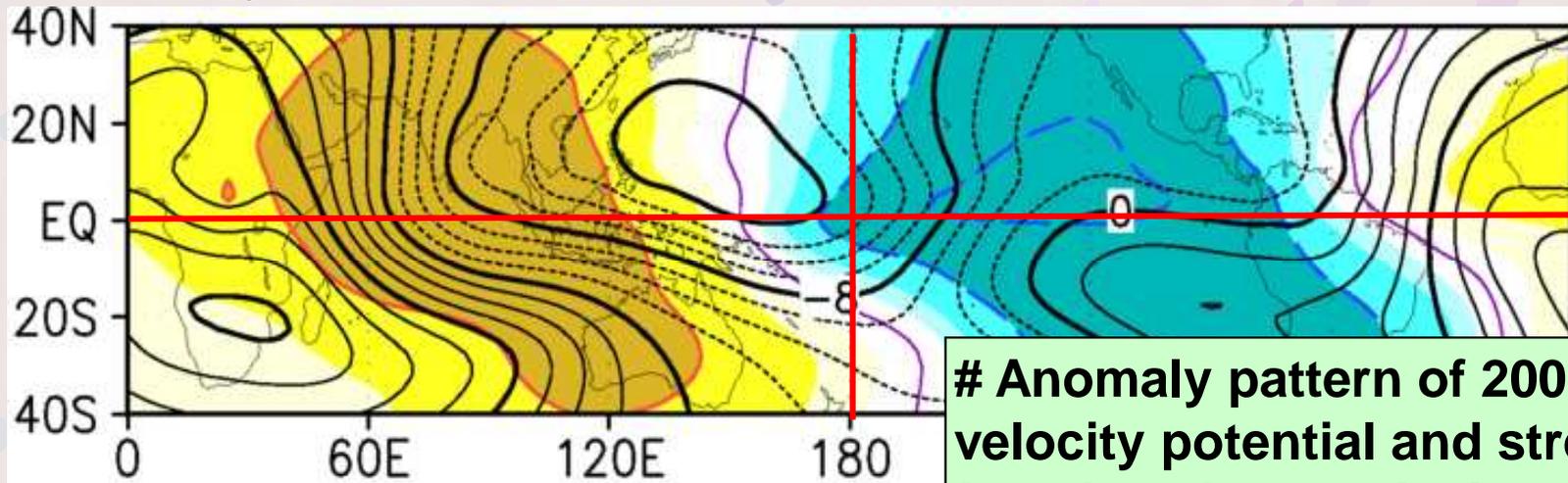


Anomaly correlation coefficients

95% significant

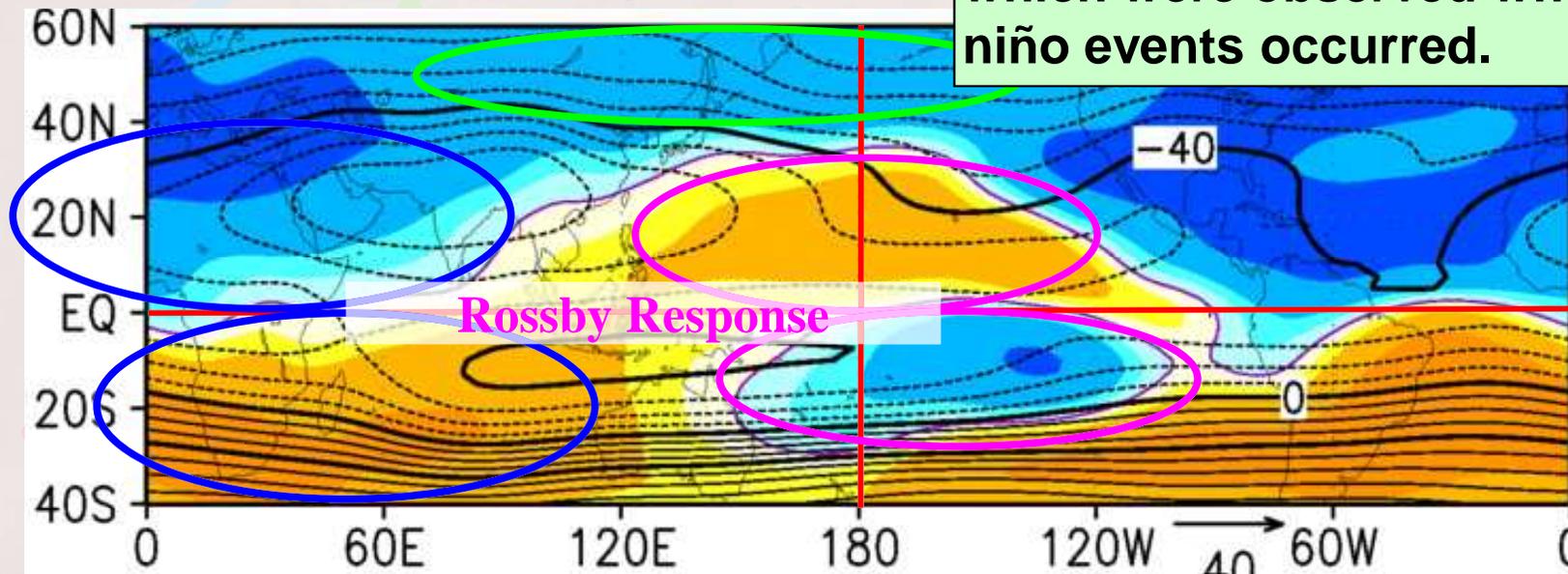
Predicted sub-tropical circulation in JJA (2)

200hPa velocity potential and anomalies



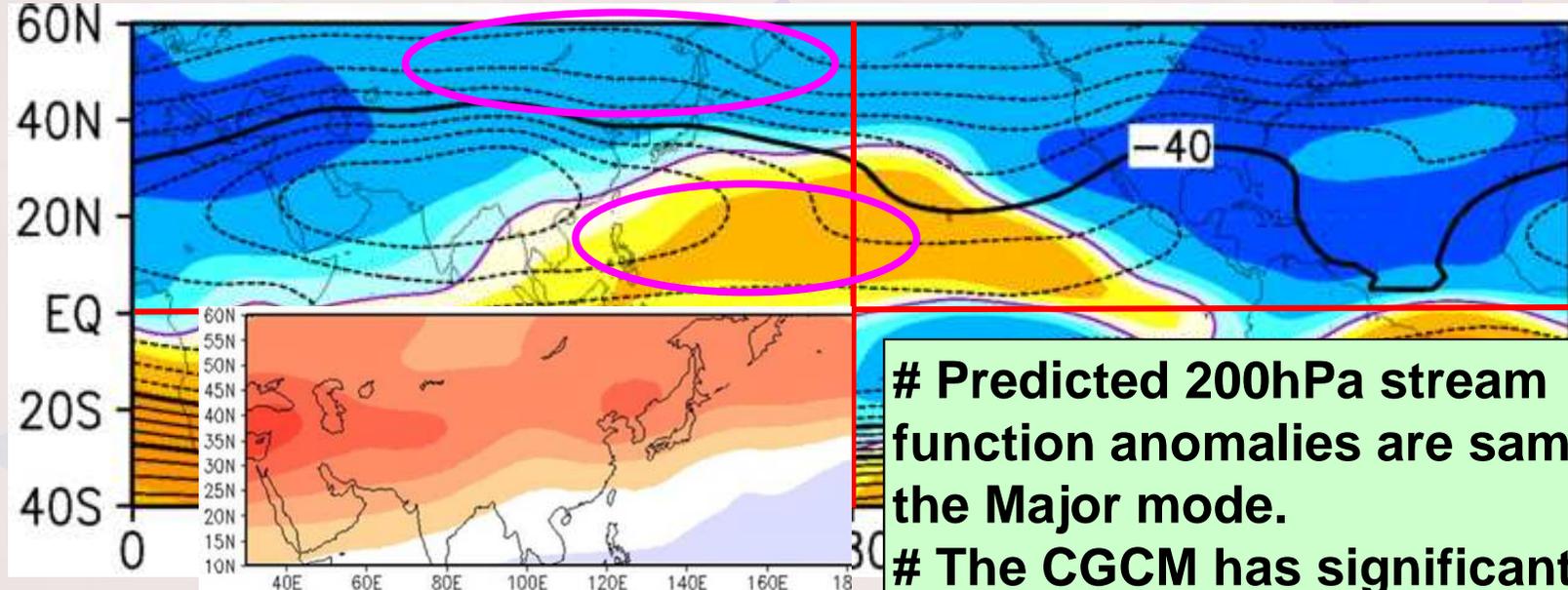
Anomaly pattern of 200hPa velocity potential and stream function show typical patterns which were observed when El Niño events occurred.

200hPa stream function and anomalies



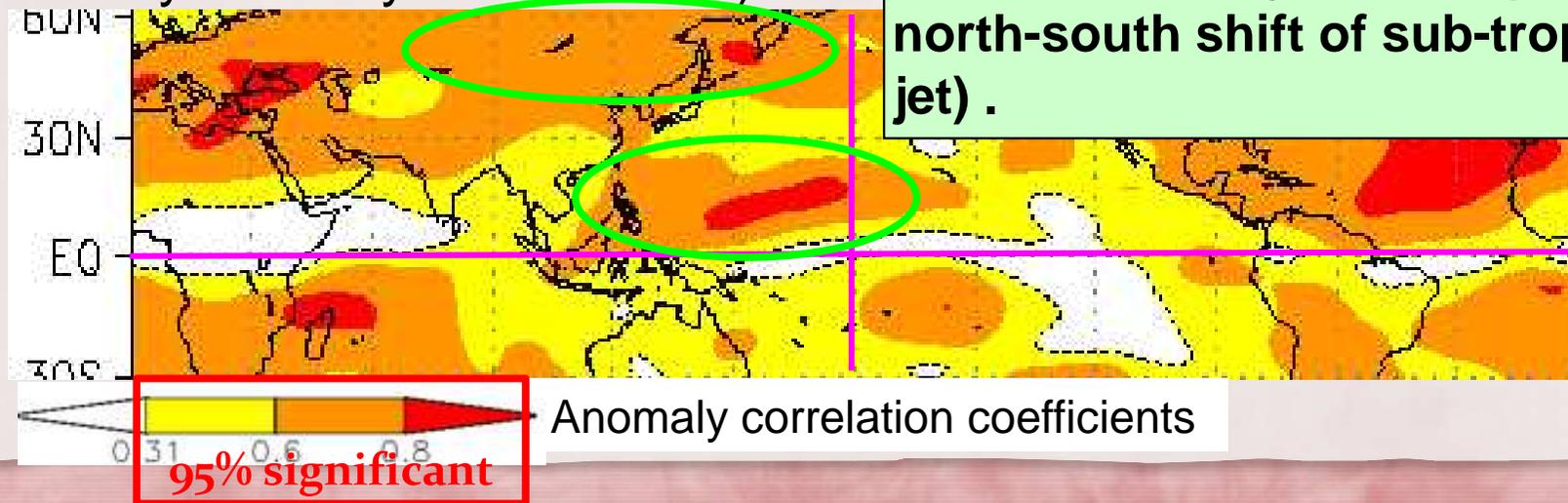
Predicted sub-tropical circulation in JJA (3)

200hPa stream function and anomalies



Predicted 200hPa stream function anomalies are same as the Major mode.
 # The CGCM has significant skill in not only the Rossby response, but also the Major mode (zonal north-south shift of sub-tropical jet) .

Prediction accuracy (verification result by the 30-year hindcast)

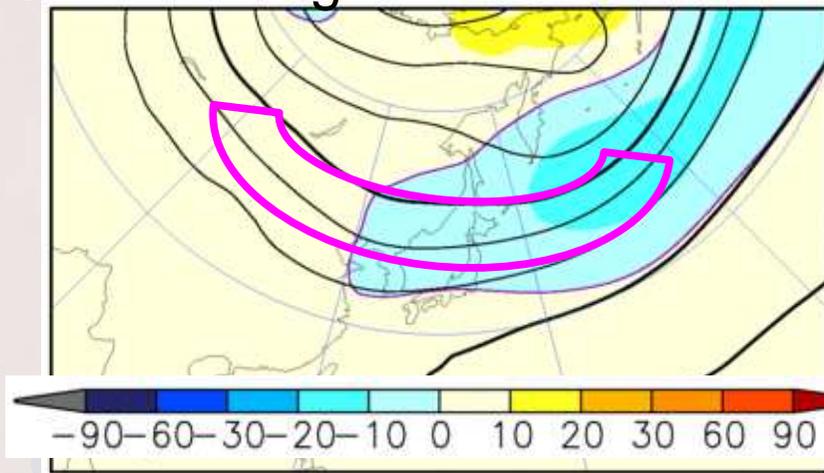


Anomaly correlation coefficients

95% significant

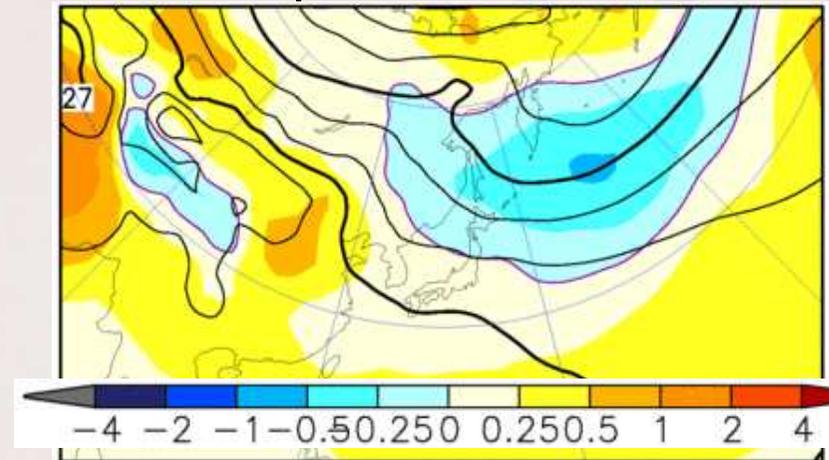
Predicted East Asian circulation in JJA

500hPa height and anomalies



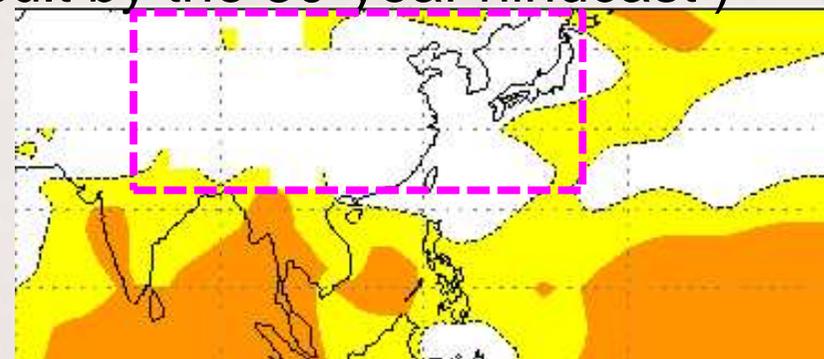
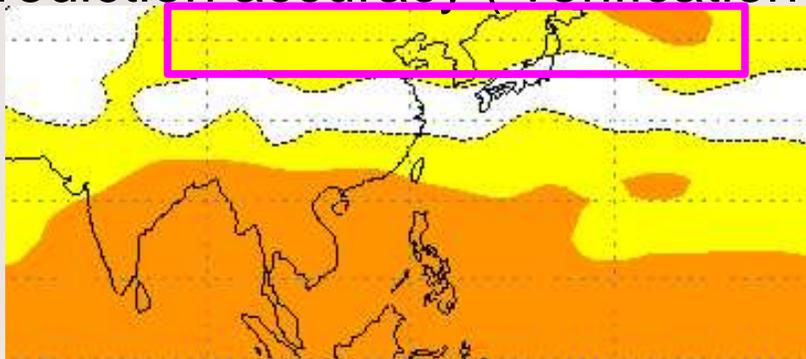
Negative anomalies along 40N associated with southward shift of sub-tropical jet have significant skill.

850hPa temperature and anomalies



Meanwhile, there is no area where 850hPa temperature has good skill over East Asia.

Prediction accuracy (verification result by the 30-year hindcast)



Anomaly correlation coefficients

Predicted East Asian circulation in Jul. and Aug.

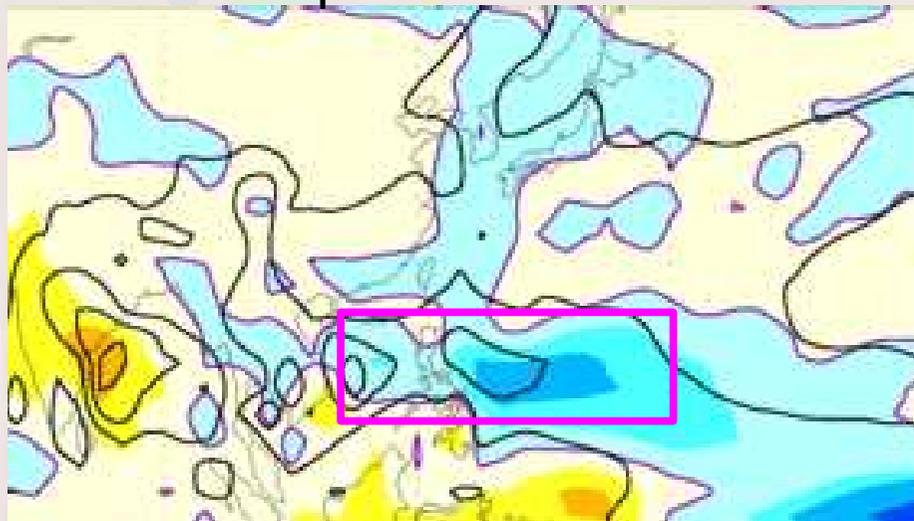
850hPa Wind anomaly vectors



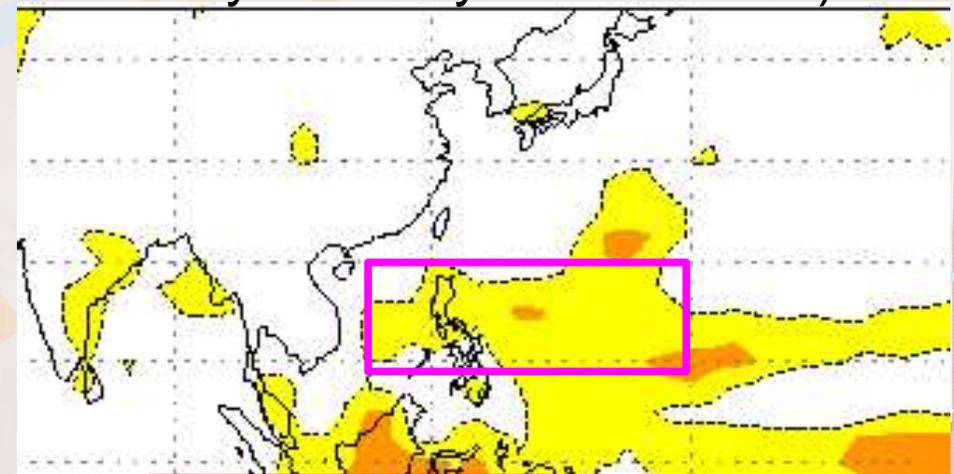
In the lower troposphere, the P-J pattern is predicted in Jul. and Aug.

The P-J pattern is excited by enhanced convection around the Philippines where significant skill is found.

Precipitation anomalies



Prediction accuracy (verification result by the 30-year hindcast)

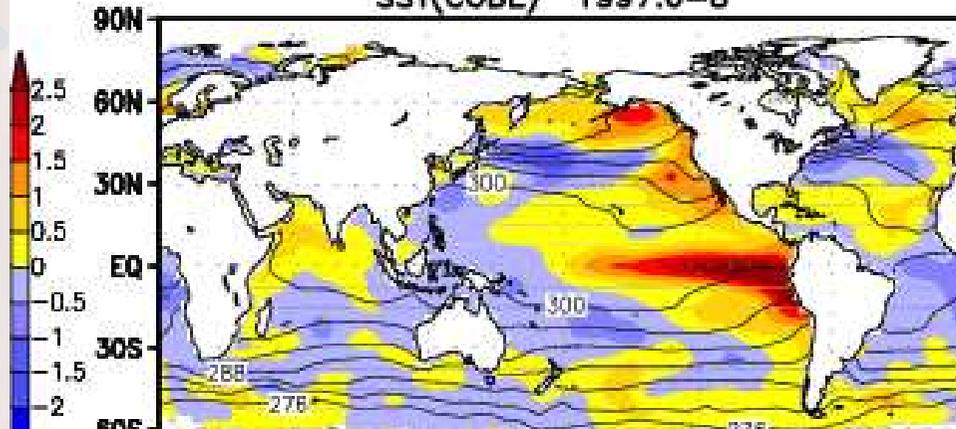


Anomaly correlation coefficients

In case of 1997

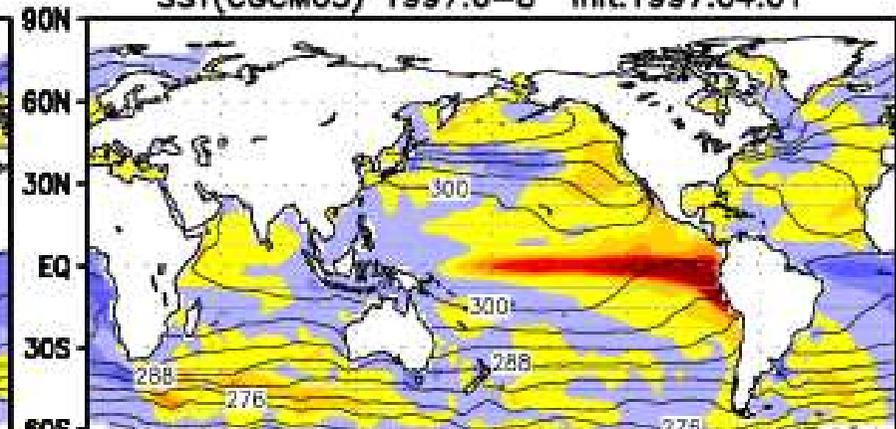
Analysis

SST(COBE) 1997.6-8

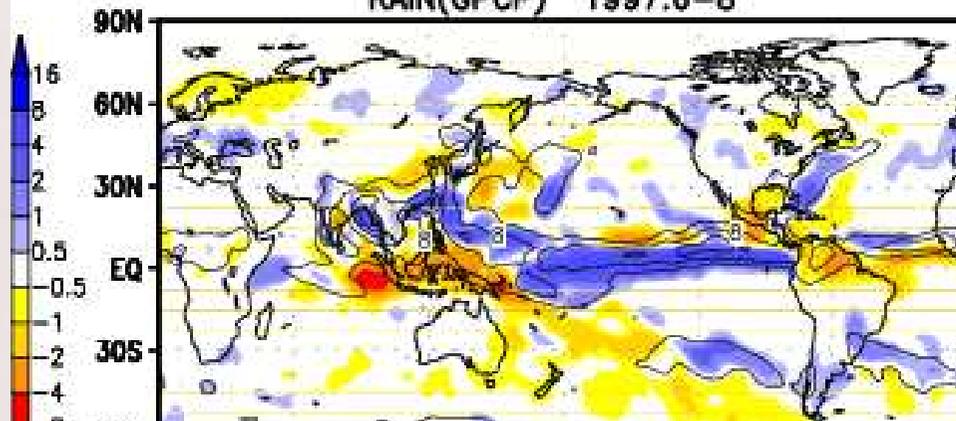


Hindcast (initial Apr. 1997)

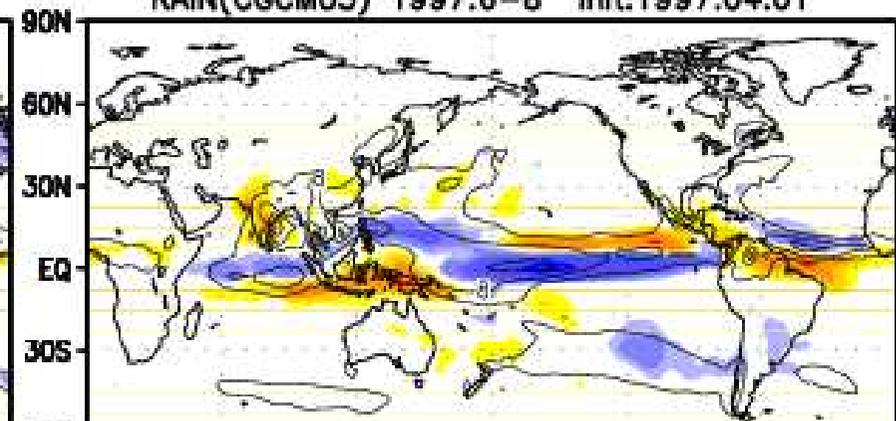
SST(CGCM03) 1997.6-8 init:1997.04.01



RAIN(GPCP) 1997.6-8



RAIN(CGCM03) 1997.6-8 init:1997.04.01



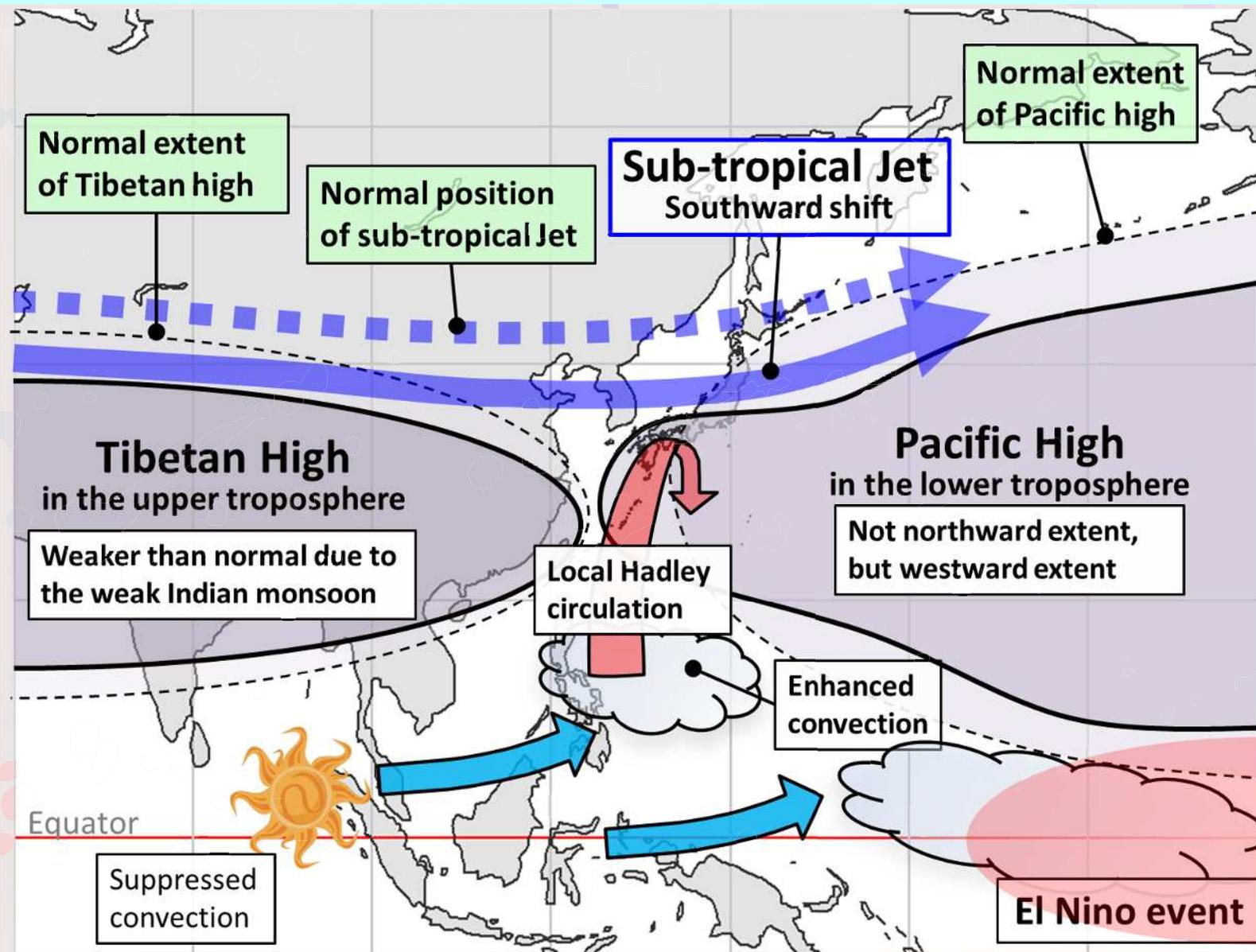
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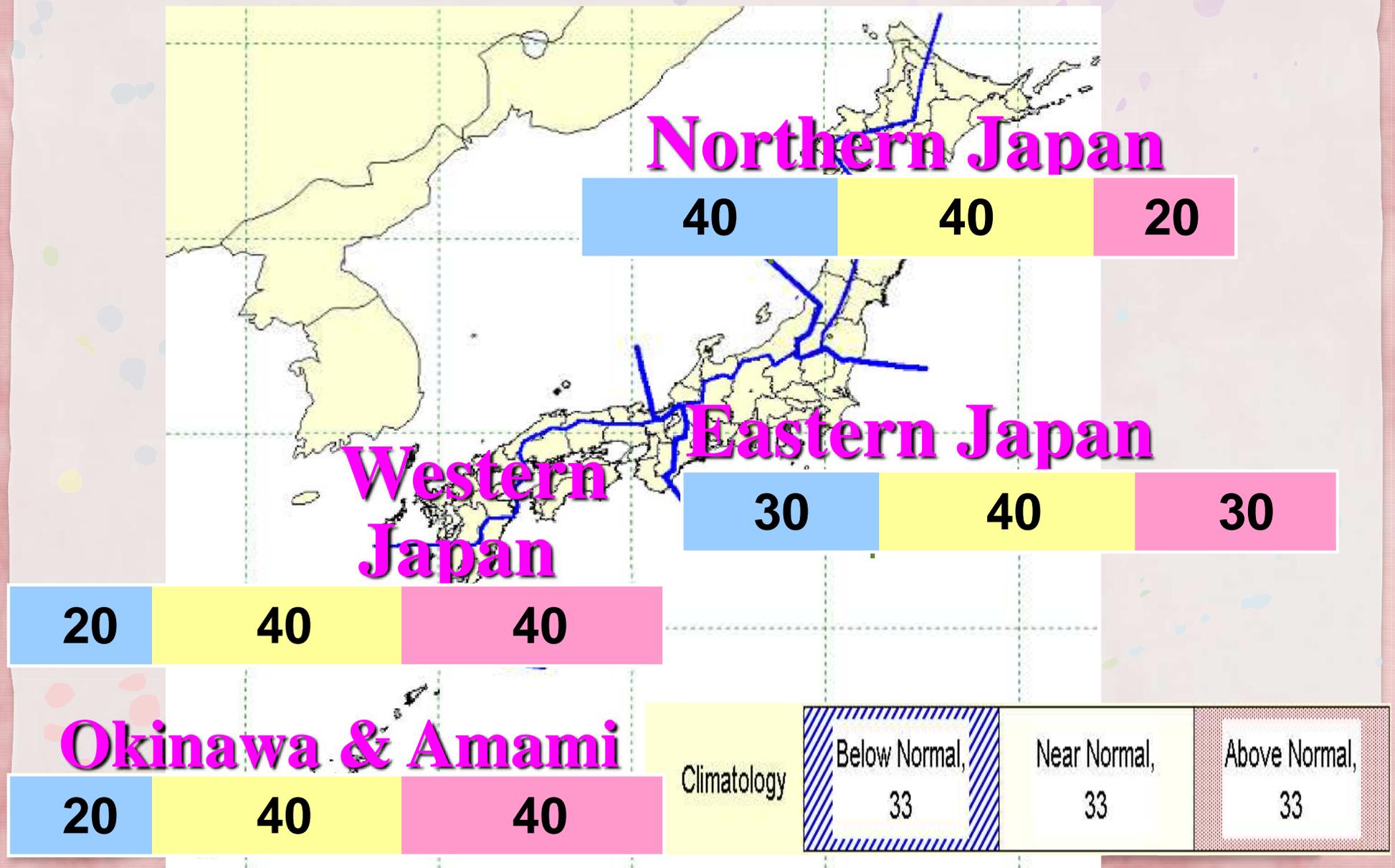
summary of Numerical prediction and its interpretation

- It is likely that El Niño conditions will develop during the boreal summer 2014.
- Predicted atmospheric circulation anomalies with significant skills are as follows,
 - Asian summer monsoon will be generally weaker than normal.
 - The sub-tropical jet will shift southward compared to the normal latitude. This means weak Tibetan high.
 - These characteristics are consistent with those observed during past El Niño events.
- Meanwhile, the key point is that enhanced convection around the Philippines is predicted.
 - This means North West Pacific Monsoon will be more active than normal and the P-J pattern will be dominant in mid-summer.
 - We estimate that this is the signal for summer 2014.

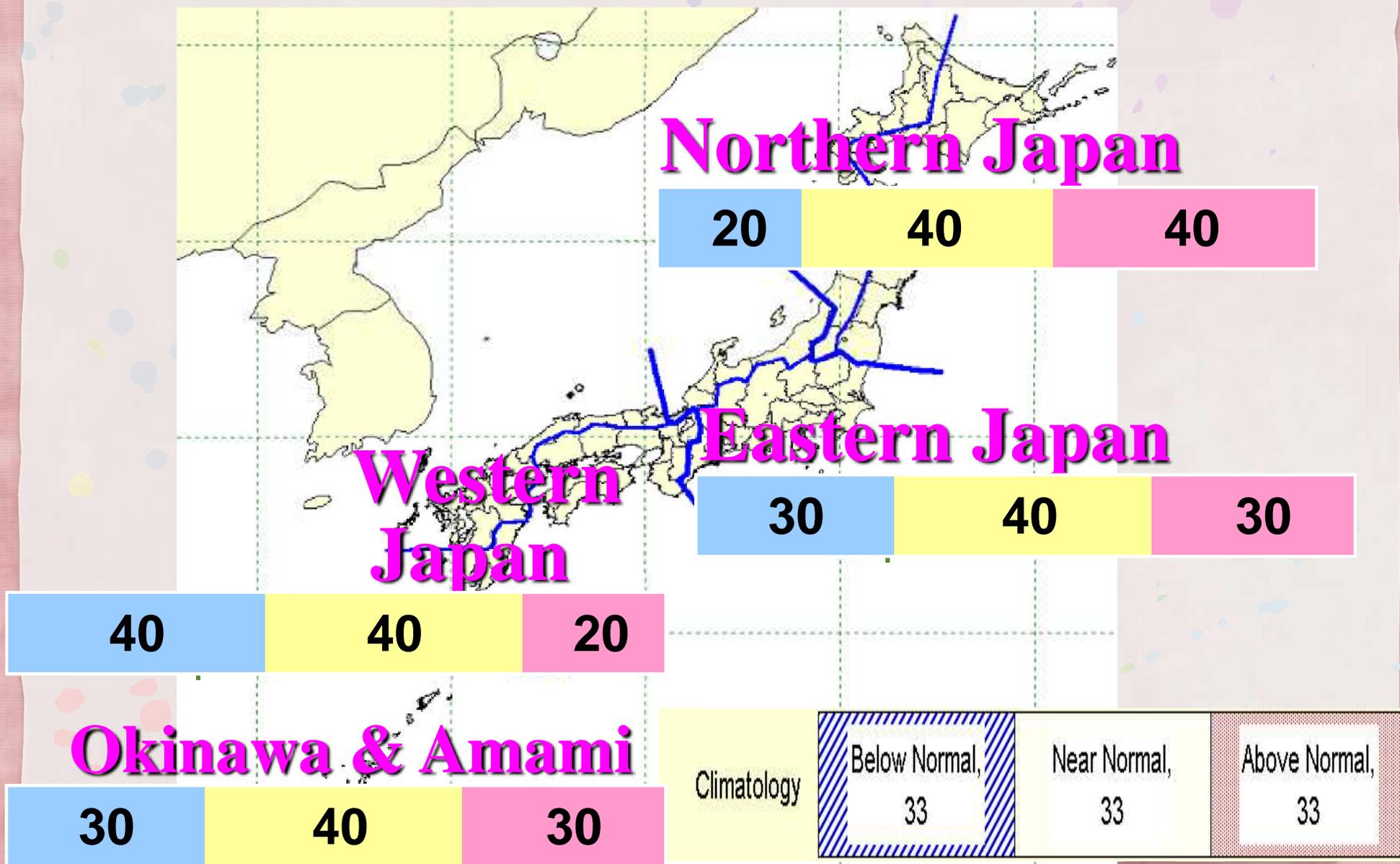
Schematic chart of outlook for East Asian circulation in JJA 2014



Probability forecast of seasonal mean temperature for JJA 2014 in Japan



Probability forecast of seasonal precipitation for JJA 2014 in Japan



Thank you

