



JMA's Outlook for 2006 Summer

1. El Niño Monitoring and Outlook for 2006
2. Summer Season Outlook over Japan in 2006

Climate Prediction Division

Japan Meteorological Agency

FORC RA-II 7 April 2006

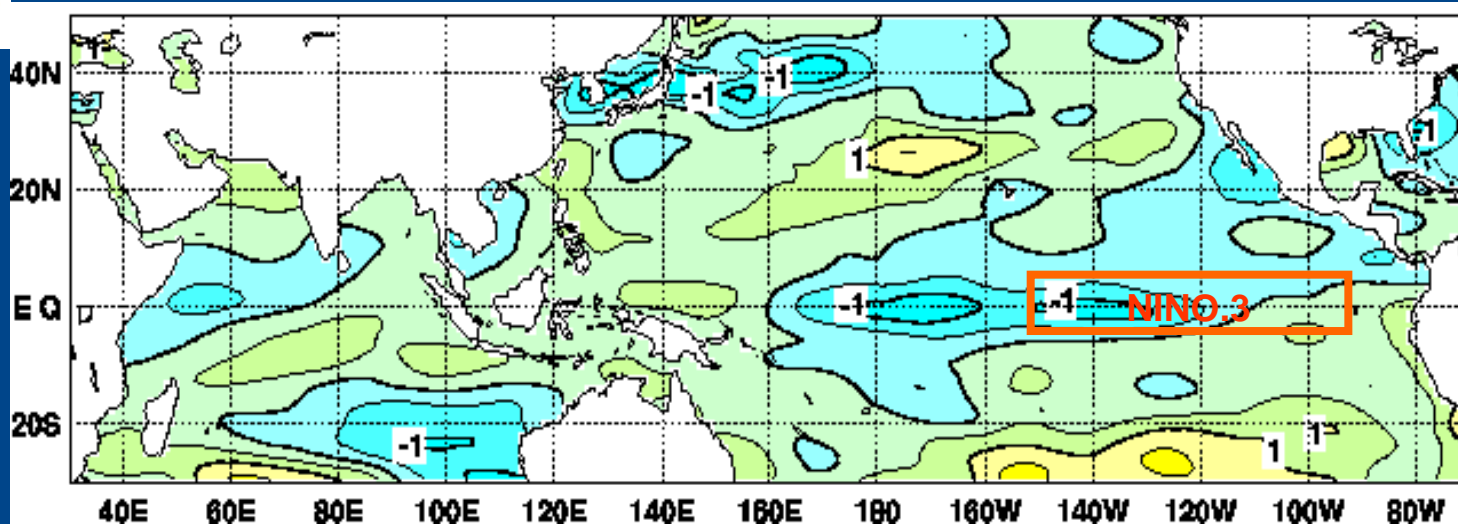


1. El Niño Monitoring and Outlook

< URL: http://okdk.kishou.go.jp/products/el_nino/index.html >



Equatorial SST Anomalies and SOI

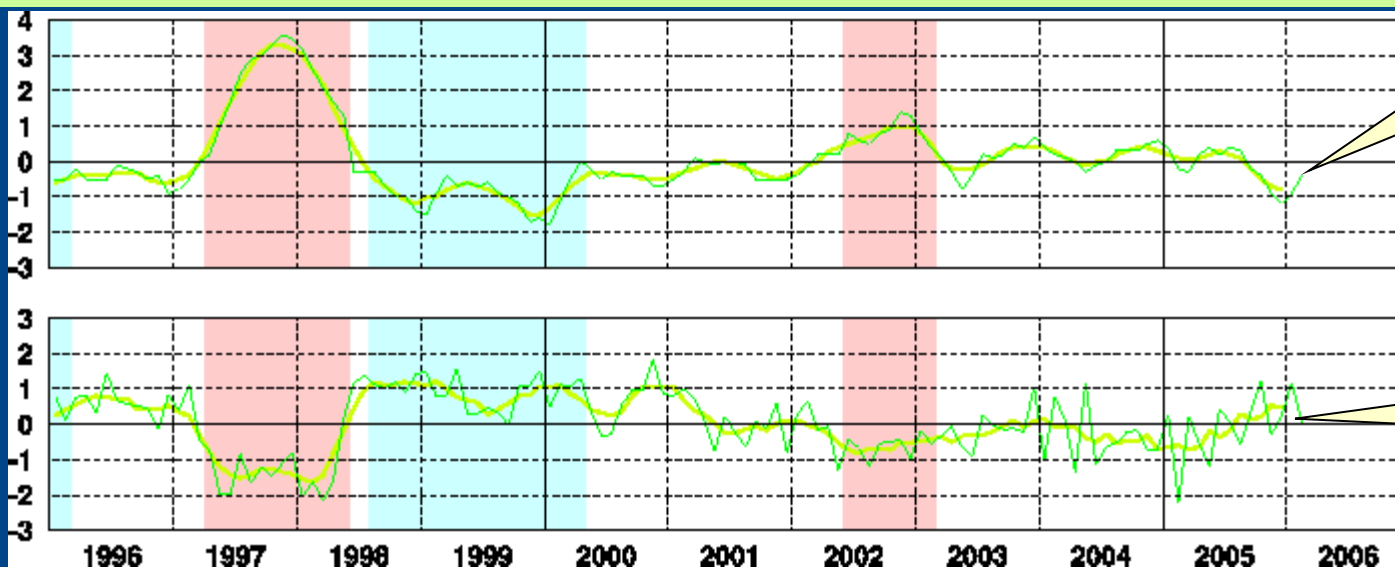


February
2006

Negative SST anomalies were dominant in the central and eastern equatorial Pacific, while positive ones in the western part.

**NINO.3
SST
deviation
(150W-90W,
5S-5N)**

SOI



-0.4°C

+0.1

SOI: Southern Oscillation Index

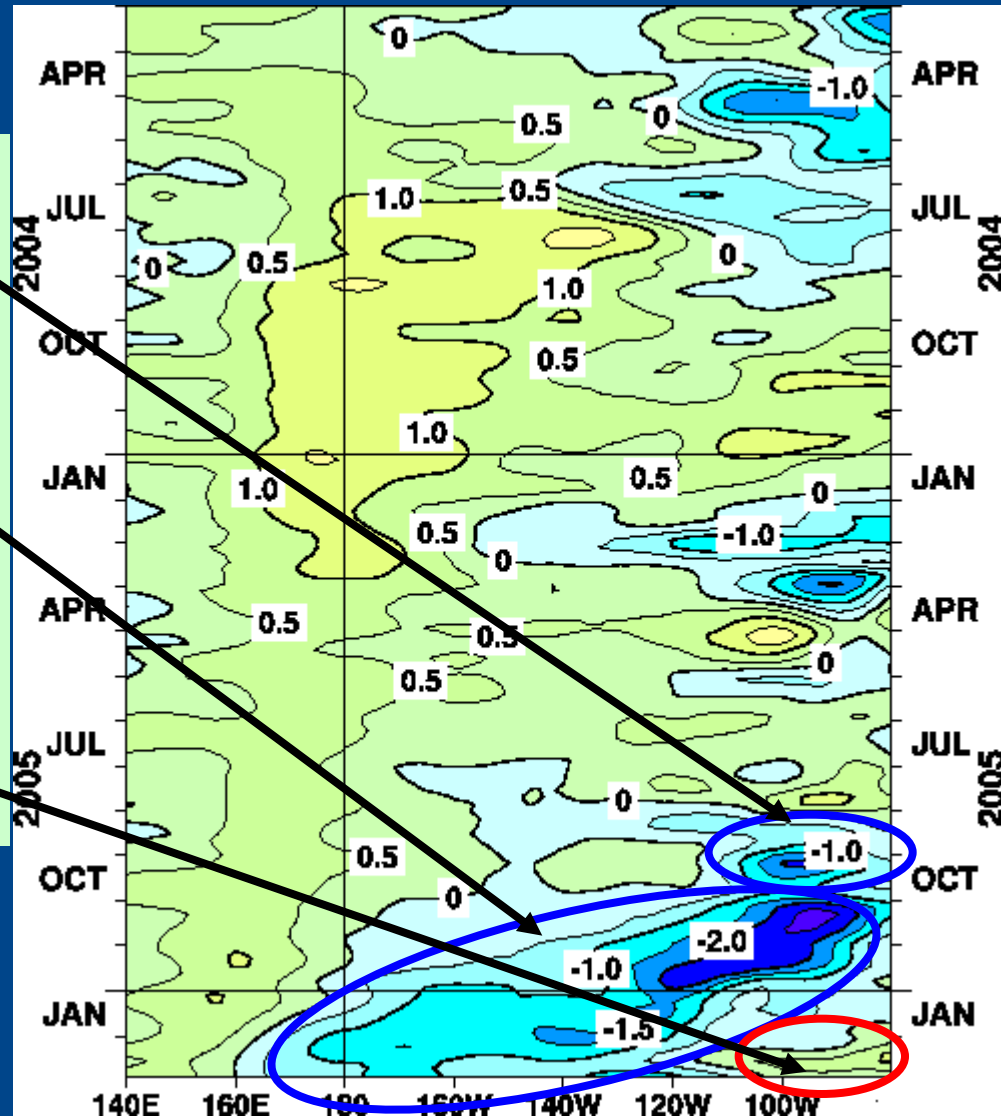


Recent evolution of the Equatorial Pacific SST Anomalies

A: Negative SST anomalies developed in the eastern equatorial Pacific in September to October 2005.

B: The negative anomalies were strengthened and expanded westward during November 2005 to February 2006.

C: Weak positive SST anomalies appeared in far eastern equatorial Pacific in the mid-February 2006.

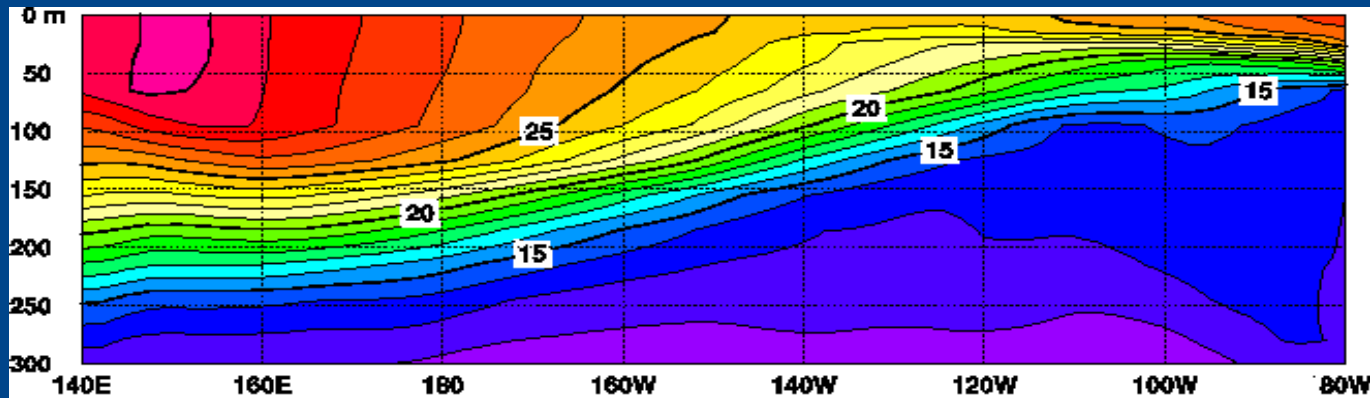


Time
↓

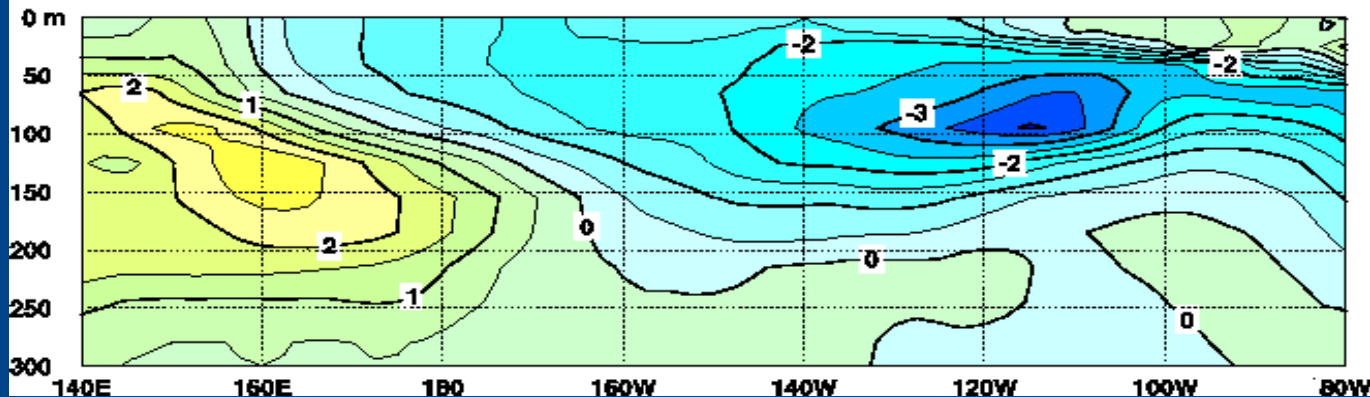
Longitude



Depth-longitude section of subsurface temperature (upper) and anomalies (lower) along the equator in the Pacific



February
2006



Longitude

Positive-in-west and negative-in-central/east pattern is dominant in February 2006.

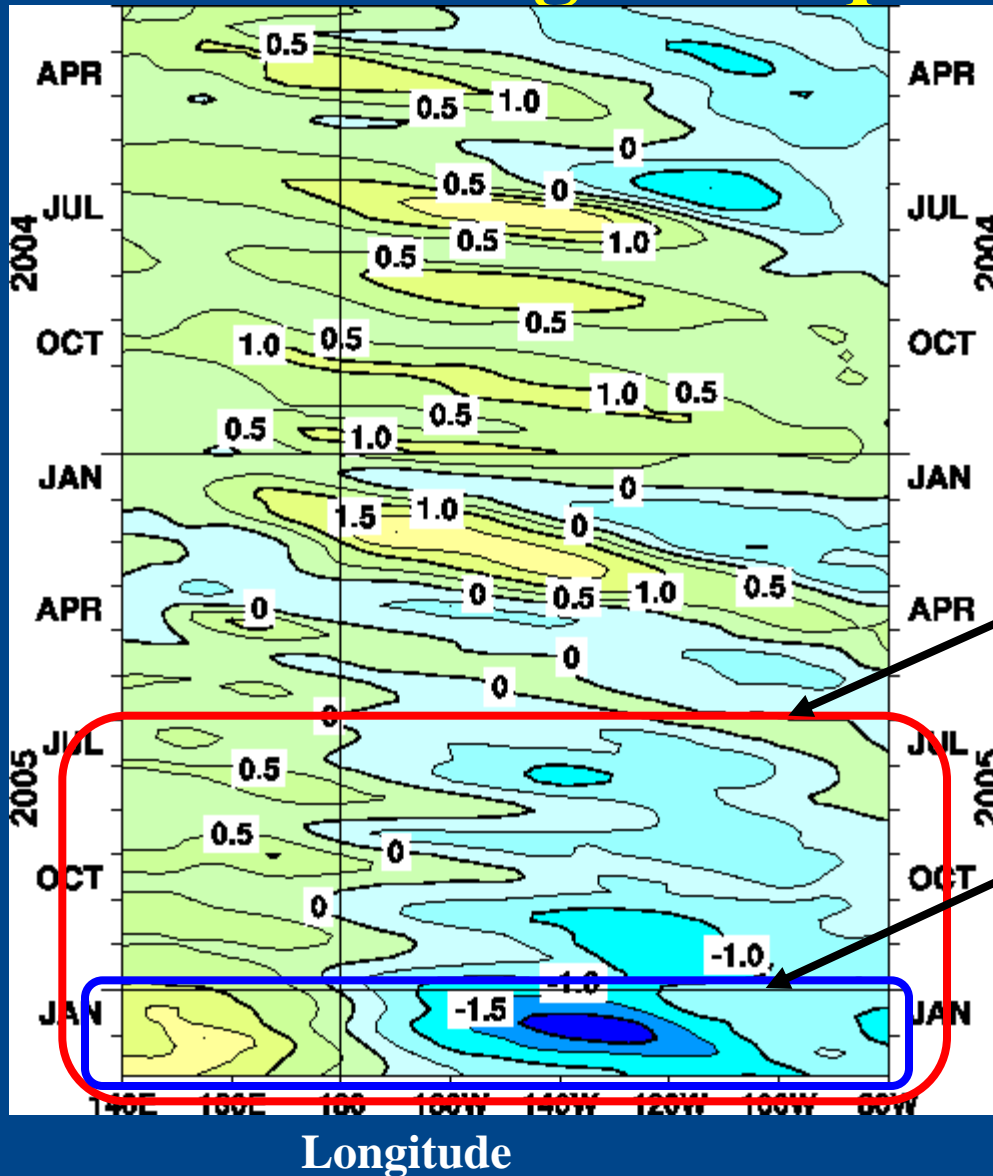


Recent Evolution of Ocean Heat Content along the Equatorial Pacific

Ocean Heat Content (OHC) :
vertically averaged
temperatures in the top 260m.

Positive-in-west and negative-in-central/east pattern has continued since July 2005.

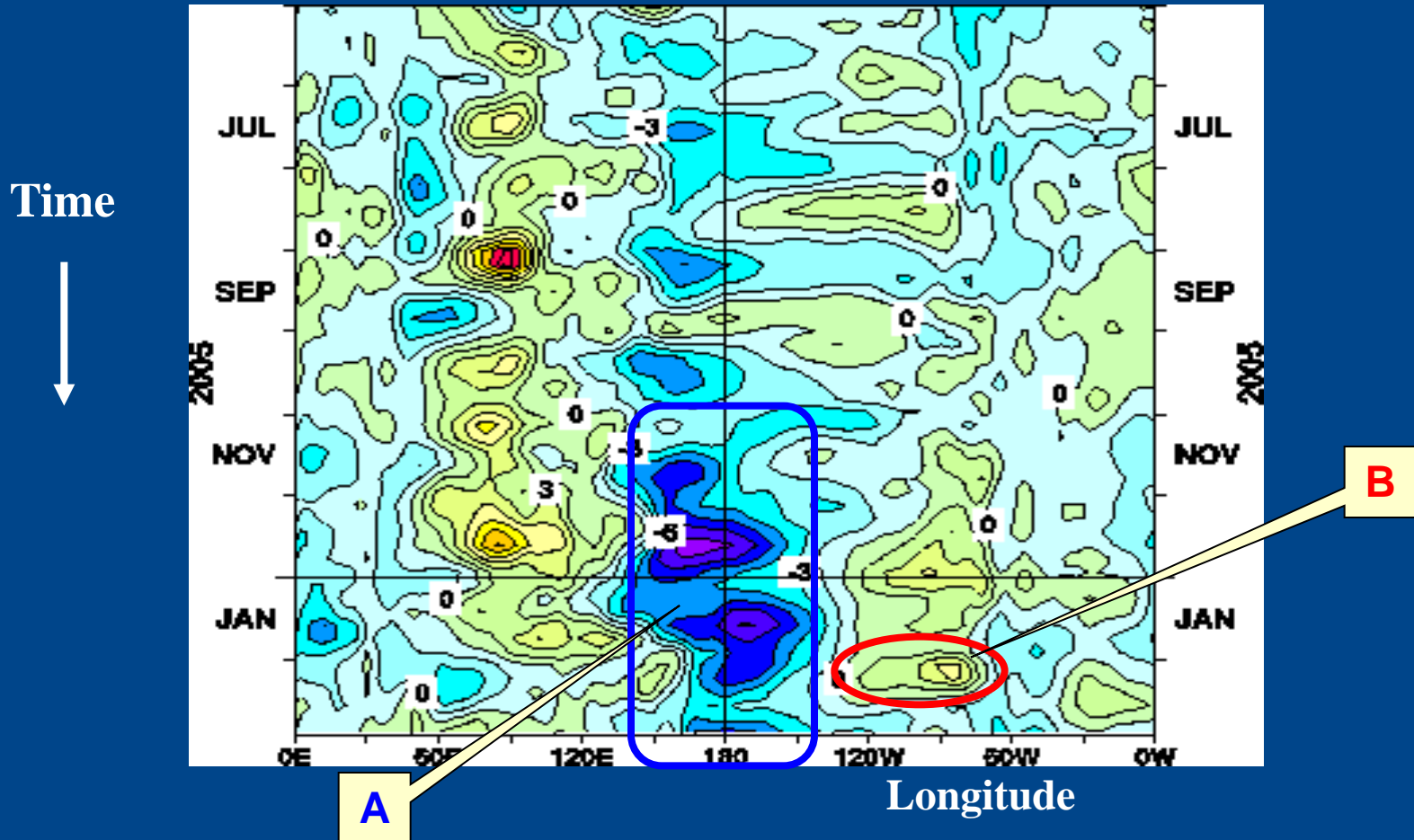
The pattern enhanced during January and February 2006.



Longitude



Zonal wind anomalies at 850 hPa along the equator in the Pacific



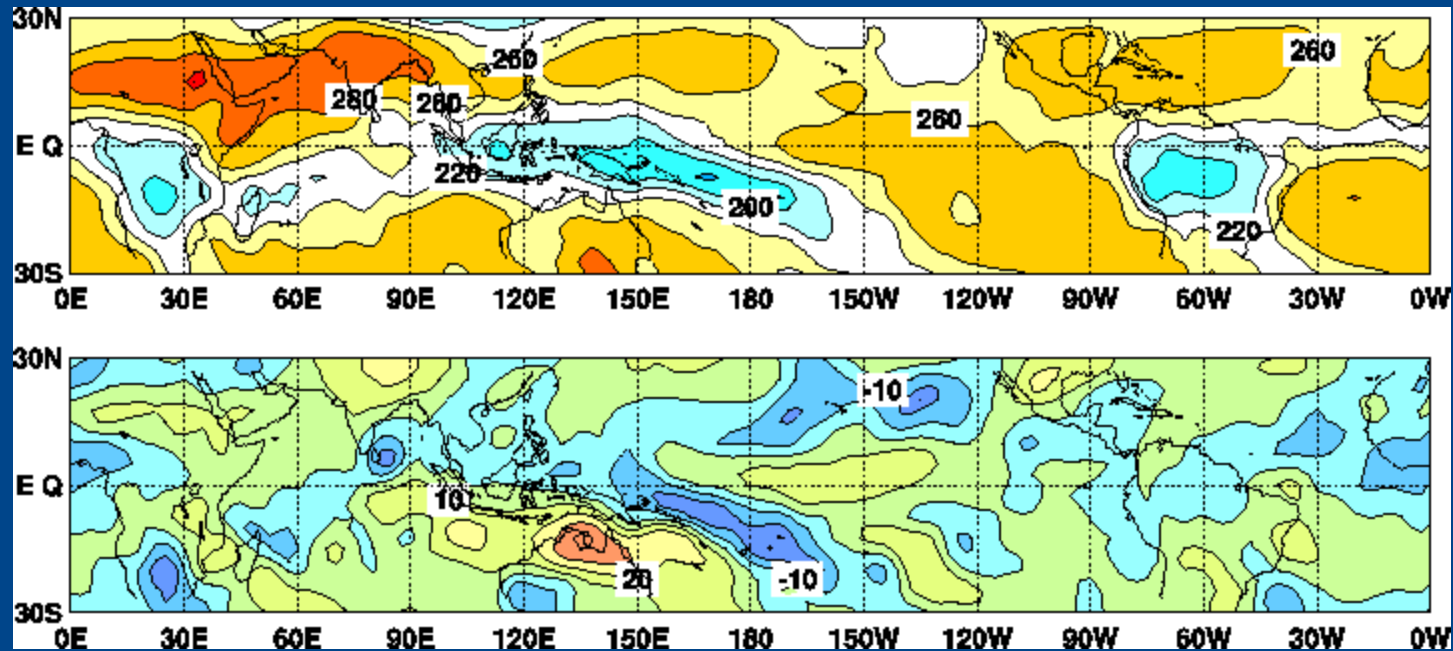
A: Strong easterly wind anomalies have prevailed in the central equatorial Pacific since November 2005.

B: Westerly wind anomalies were found in early February 2005. They are considered to be a cause of the temporal SST increase in the far eastern equatorial Pacific.



Convective activities

Monthly mean outgoing longwave radiation (OLR) and anomalies in February 2006. Base period for normal is 1979-2000. Original data were provided by NOAA.



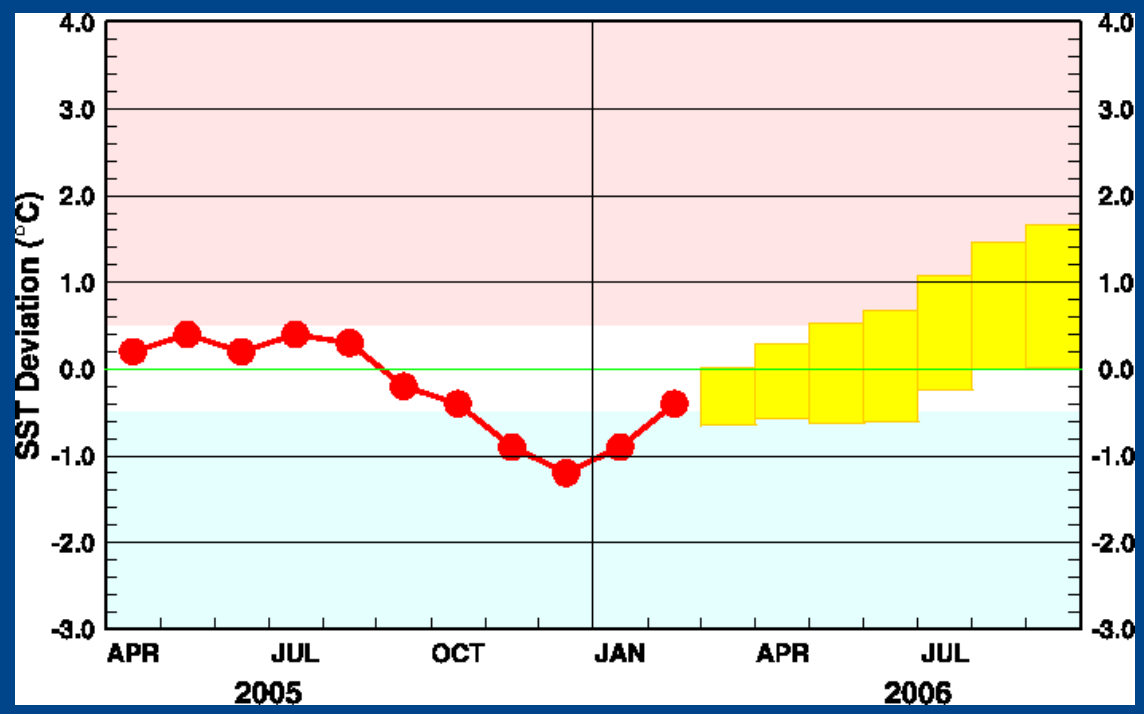
In February 2006, convective activities were near normal over much of the equatorial Pacific, except for around 160E where they are above normal.



NINO.3 SST Forecast

by JMA El Niño Forecast Model

Outlook of the SST deviation for NINO.3 by the El Niño forecast model. This figure indicates a time series of the monthly sea surface temperature (SST) deviation for NINO.3 (5N-5S, 150W-90W). Thick lines with closed circles show the observed SST deviation and boxes show the predicted one for the next six months by the El Niño forecast model. Each box denotes the range where the SST deviation will be included with the probability of 70%.



The NINO.3 SST will be close to normal during spring and be slightly above normal afterwards.



Summary

Current Diagnosis

- Negative sea surface and subsurface temperature anomalies were dominant in the central and eastern equatorial Pacific, while positive ones in the western part.
- Easterly wind anomalies prevailed at the lower level of troposphere over the equatorial Pacific.

El Niño Outlook

- It is likely that the current cooler-than-normal SST condition in the central and eastern equatorial Pacific will be La Niña.
- The current condition will continue until the coming spring. The SSTs for NINO.3 is likely to be around normal during the next summer.



2. Summer Season Outlook over Japan in 2006



Focus for this Summer Season Outlook

1. Oceanic condition

- Niño 3 sea surface temperatures
- Sea surface temperature in the western equatorial Pacific

2. Long-term trend

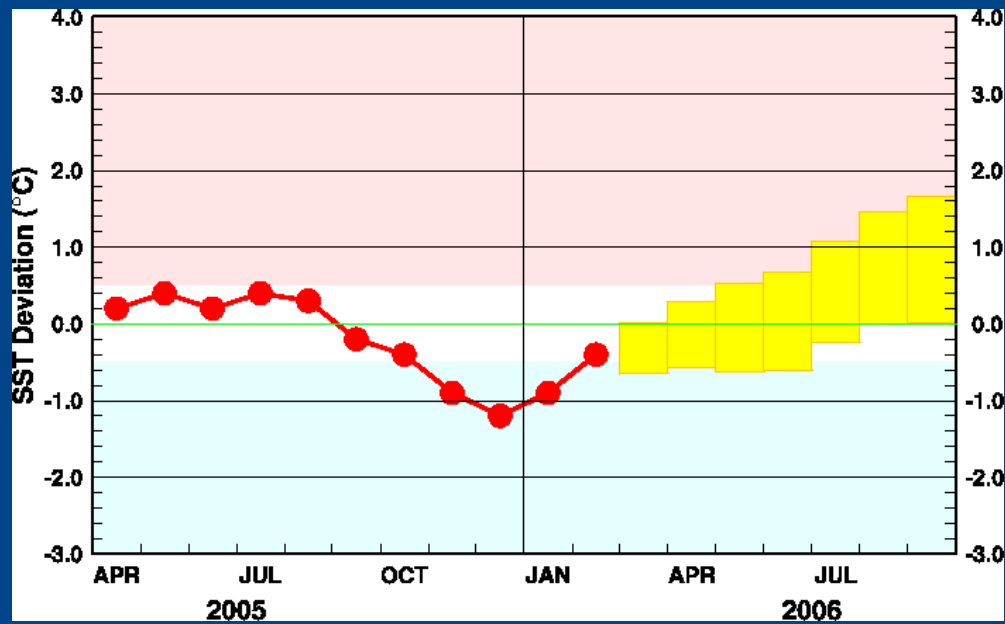
- Seasonal mean temperatures over Japan
- Tropospheric thickness temperature averaged over the Northern Hemisphere mid-latitudes
- General Circulation Indices

3. Numerical and Statistical Prediction



Oceanic condition (El Niño Outlook)

- The Region B (Niño 3) SST is likely to be around normal during summer 2006.

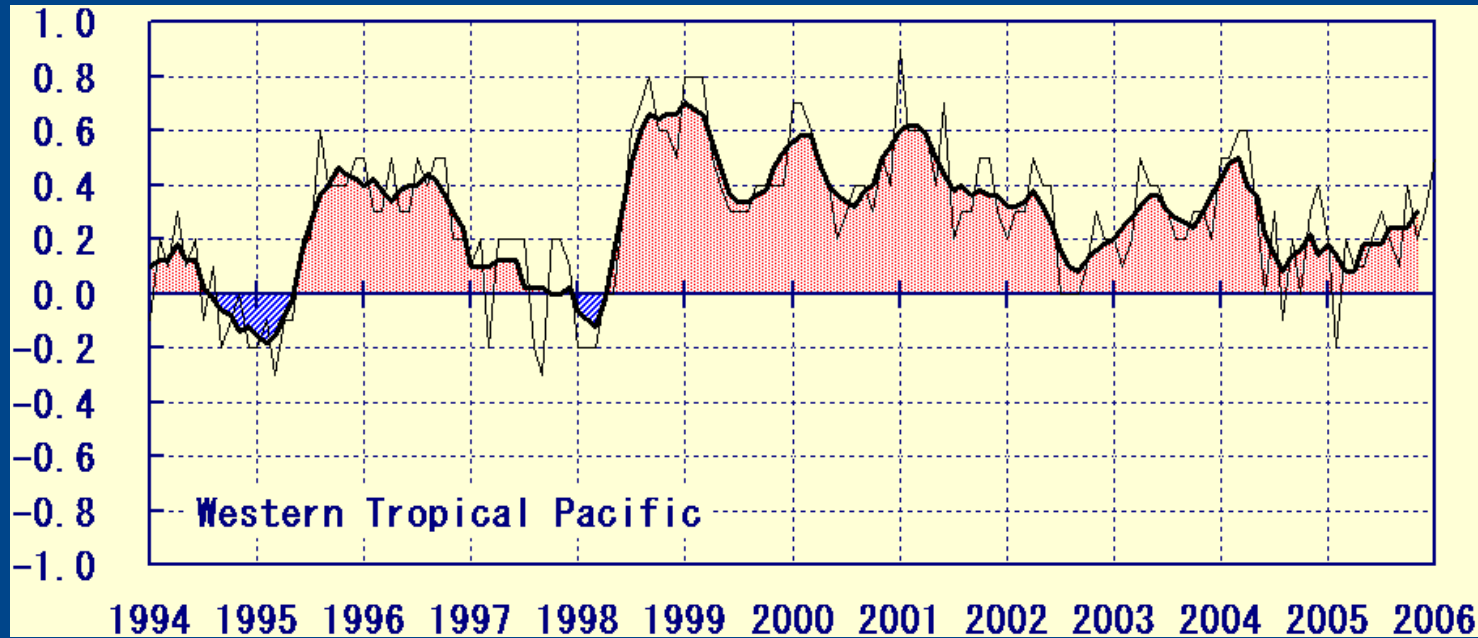


Outlook of the SST deviation for Region B (Niño.3)
with the El Niño forecast model with MOS



Long-term trend (1)

Monthly mean SST anomalies in the western tropical Pacific

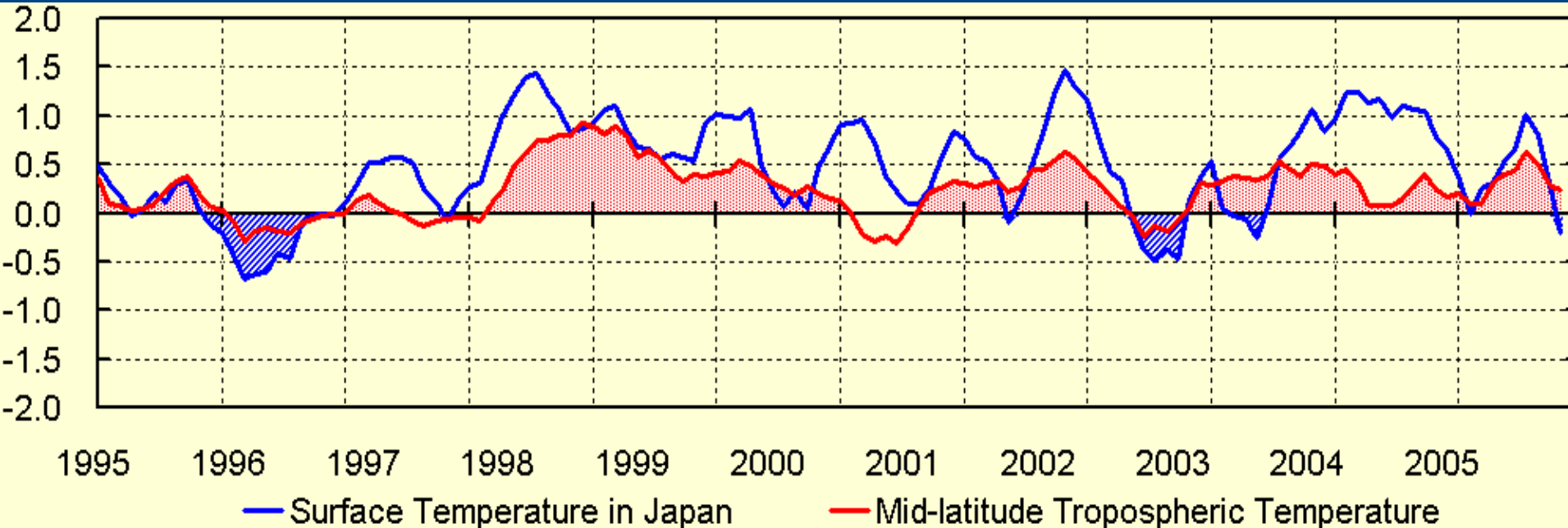


- ◆ SSTA has been high since late 1990's except in El Niño events.
- ◆ It is likely that SSTA in the western North Pacific is above normal during summer 2006.
- ◆ Considering the high correlation between the SSTA and summer-average temperature in western Japan, higher-than-normal temperature in Western Japan is probable.



Long-term trend (2)

Mid-latitude tropospheric temperature (Red) and Surface temperature in Japan (Blue)



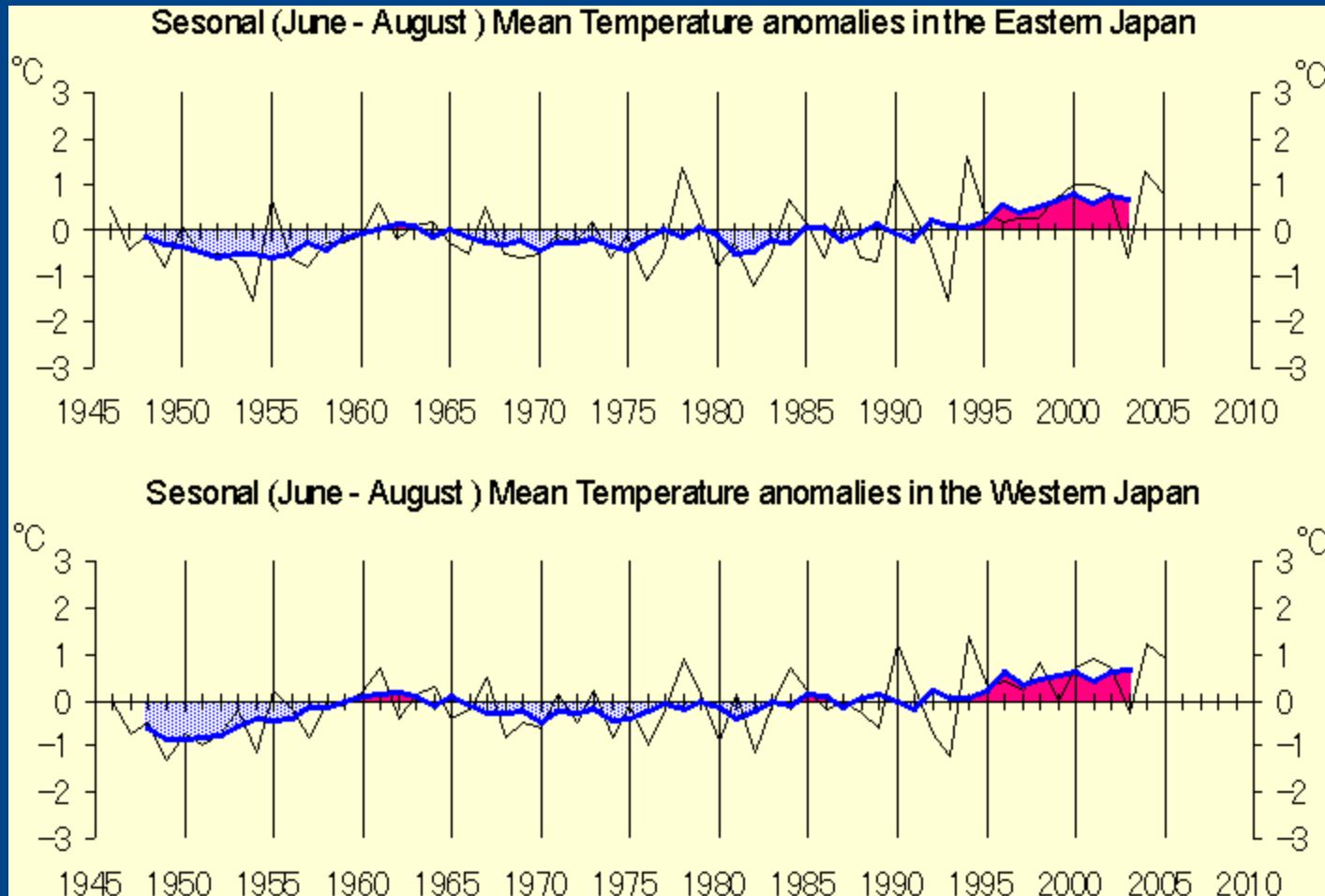
In the last ten years

- ◆ Tropospheric temperature tends to be above normal.
- ◆ Surface temperature in Japan tends to be above normal, too.
- ◆ Those two time series seem to have a good correlation.



Long-term trend (3)

Surface Temperature in Japan region

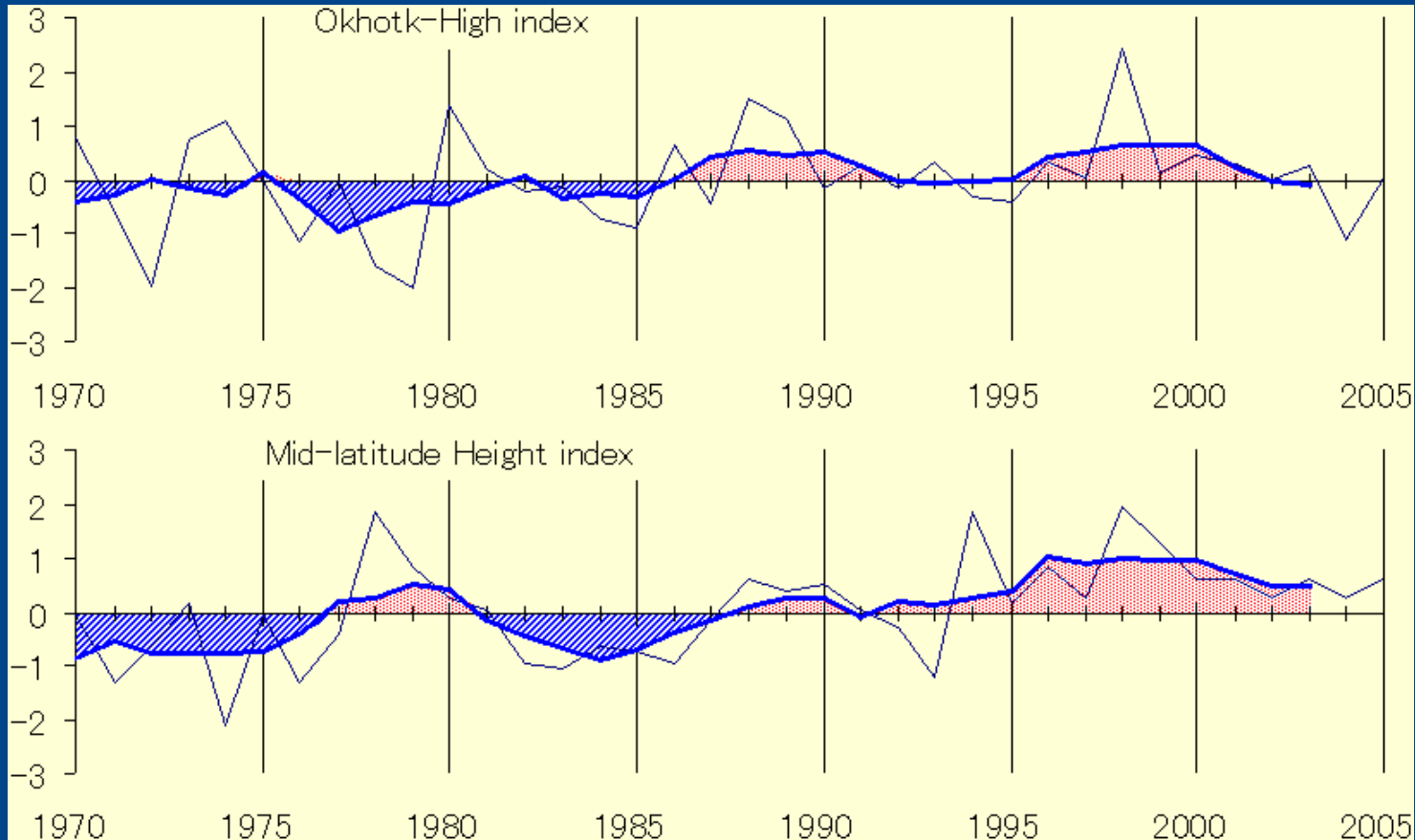


- ◆ Seasonal mean surface temperature in Japan was mostly above normal in recent years.
- ◆ Especially in Eastern and Western Japan, and Nansei Is.



Long-term trend (4)

General Circulation Indices

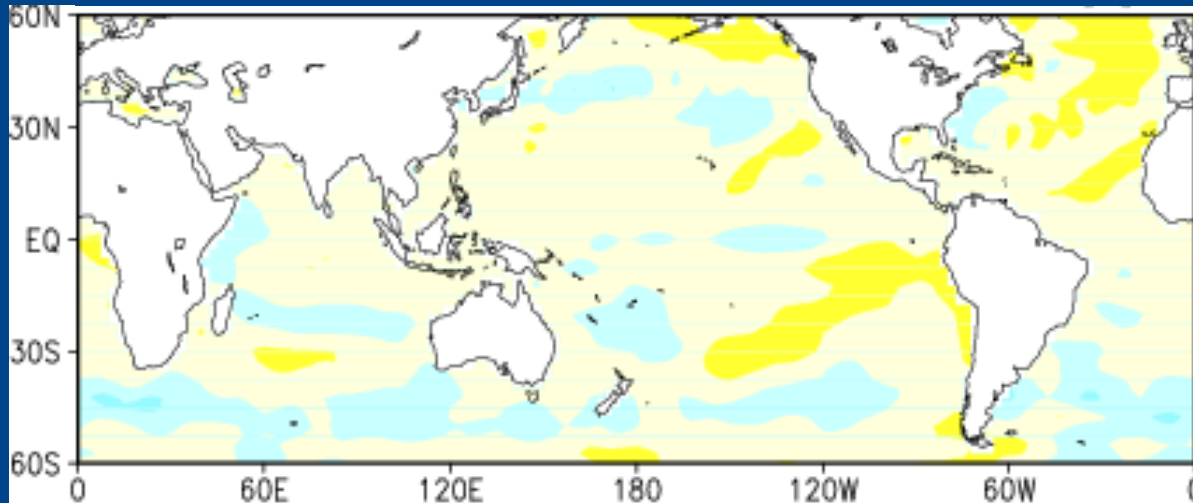


- ◆ Okhotsk High Index has a tendency to be positive since 1990's, reflecting sometimes cool summers in the Northern Japan.
- ◆ Mid-latitude height Index has a tendency to be positive since 1990's, reflecting frequent hot summers in the Eastern and Western Japan.



Numerical Prediction (1)

SST Anomaly fed to the model Contour interval: 0.5 °C

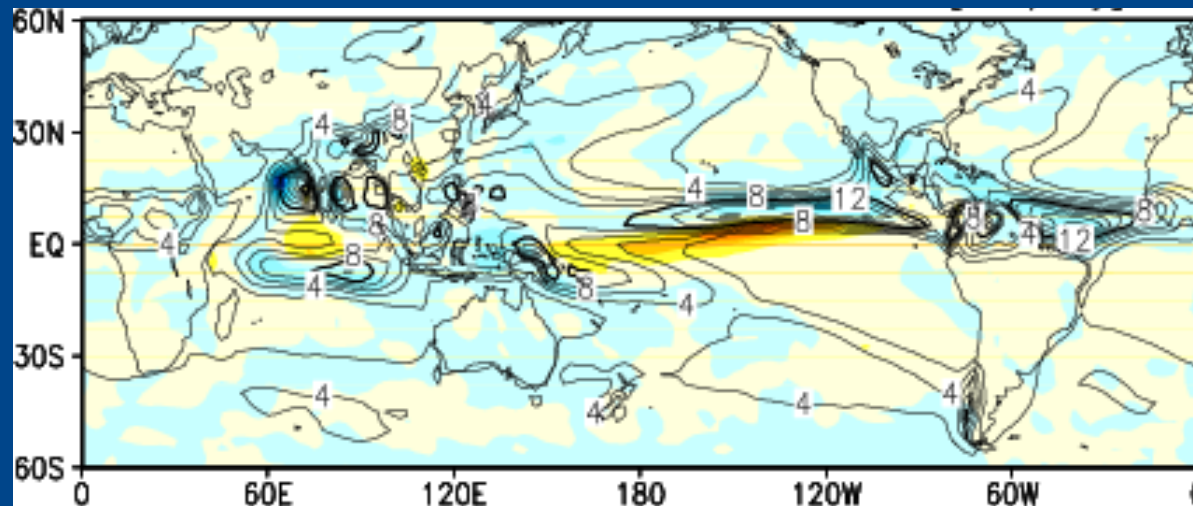


◆ No significant SSTA in the tropics

Slight negative anomalies: in the central equatorial Pacific, and the western Indian Ocean

Slight positive anomalies: in the eastern tropical Pacific, and in the northern Atlantic

Predicted precipitation & anomaly Contour interval: 2 mm/day



◆ No significant precipitation anomalies

Slight positive anomalies: in the western tropical Pacific, in the southern Indian Ocean, and in the Arabian Sea.

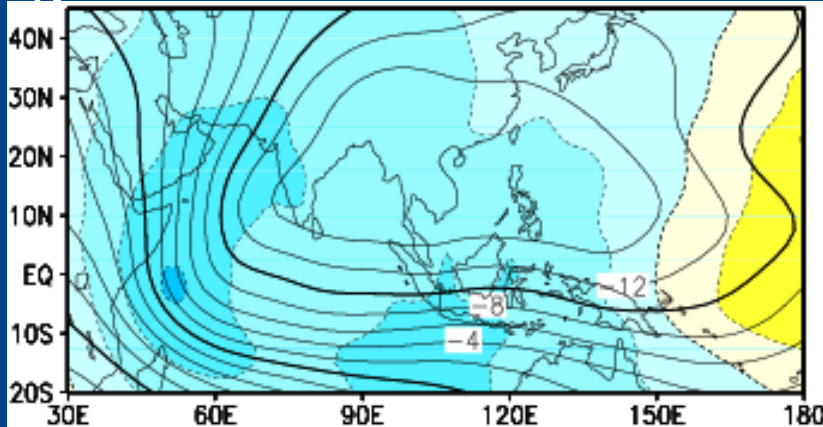
Slight negative anomalies: in the central and eastern equatorial Pacific, and in the central equatorial Indian Ocean



Numerical Prediction (2)

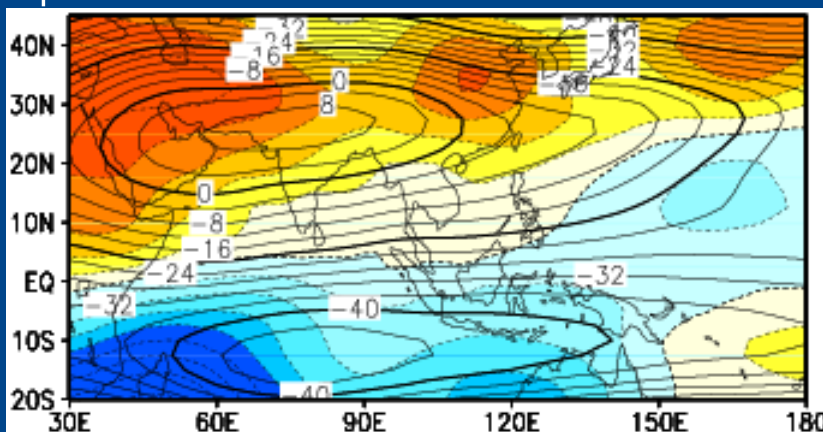
Prediction of velocity potential (χ) and stream function (ψ)

χ 200A Contour interval: $1 \times 10^6 \text{m}^2/\text{s}$



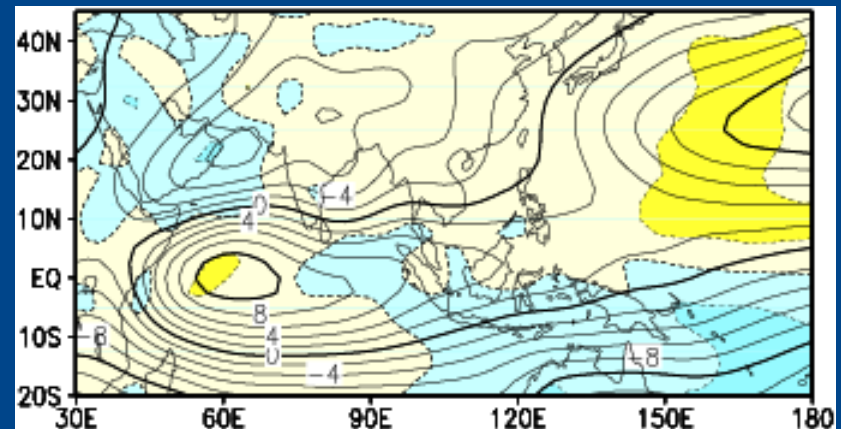
- ◆ Divergence anomalies over the western Indian Ocean
- ◆ Convergence anomalies over the eastern Pacific
- ◆ These suggest stronger-than-normal Walker circulation

ψ 200A Contour interval: $1 \times 10^6 \text{m}^2/\text{s}$



- ◆ Anti-cyclonic anomalies prevailed in the mid-latitudes, especially over the western Asia and the eastern Asia

ψ 850A Contour interval: $0.5 \times 10^6 \text{m}^2/\text{s}$

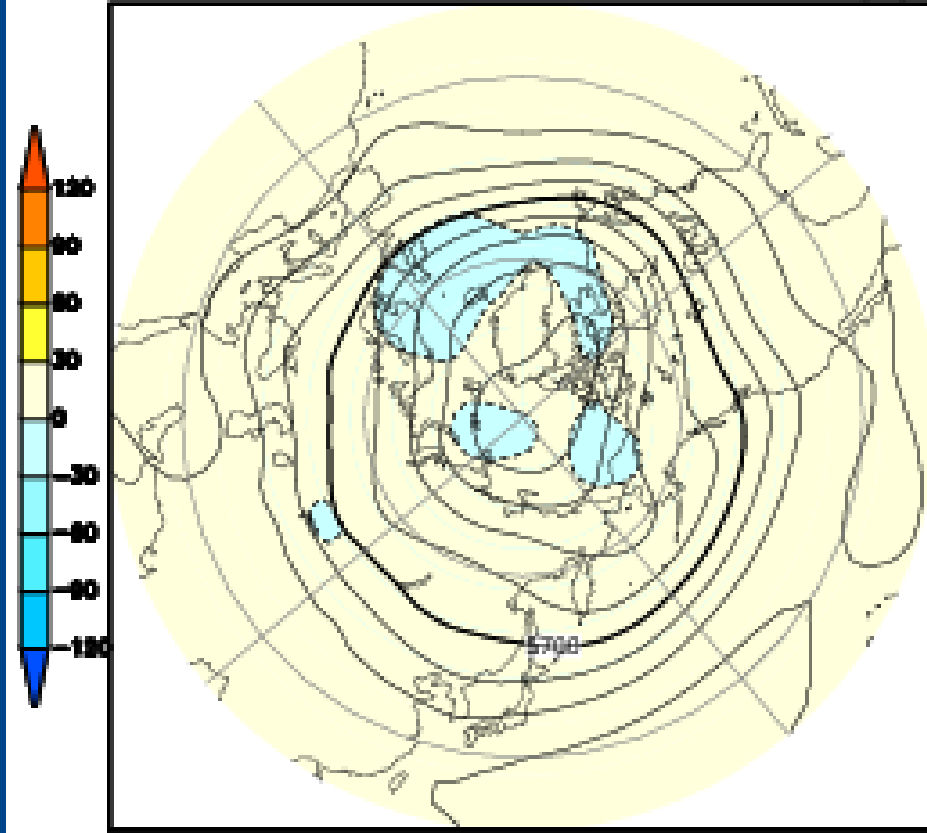


- ◆ Indication of stronger-than-normal Somali Jet in the southern Arabian Sea, stronger-than-normal North Pacific High in the west of the dateline



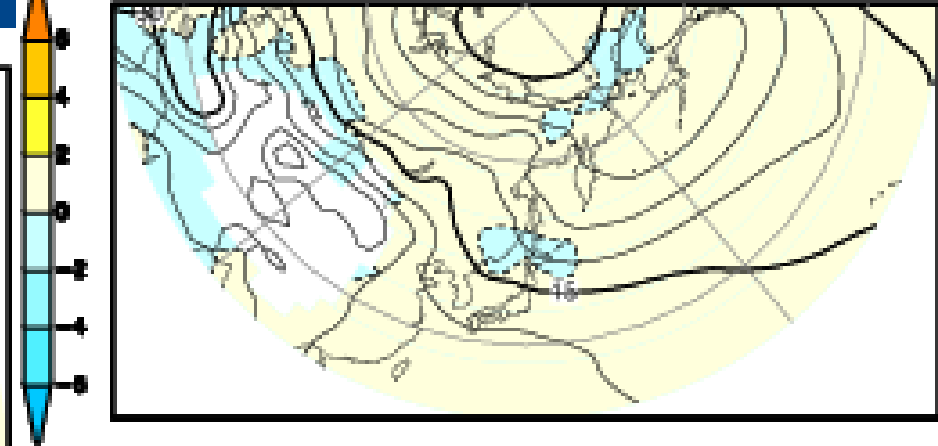
Numerical Prediction (3)

Z500 (FORECAST) from 2006 3 14 12 kt= 1896 [m]

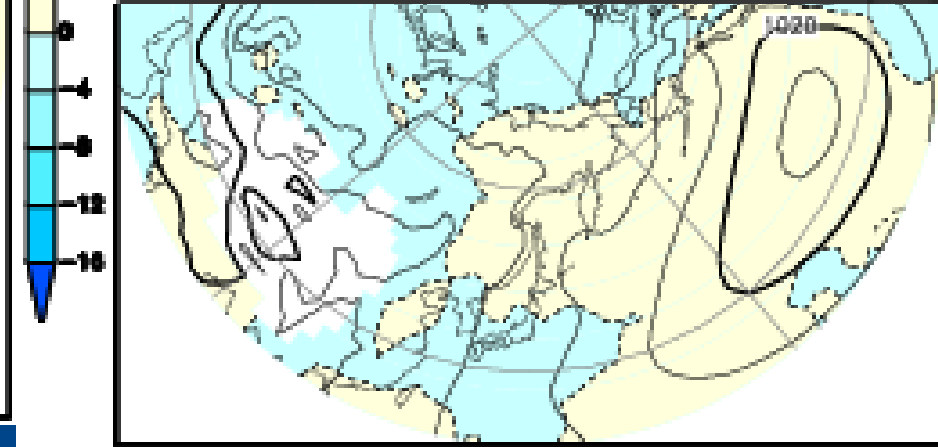


◆ Slight positive Z500 anomalies prevail over the Northern Hemisphere with slight negative anomalies in the arctic area

T850 (FORECAST) from 2006 3 14 12 kt= 1896 [C]



PSEA (FORECAST) from 2006 3 14 12 kt= 1896 [hPa]



◆ Slight positive SLP anomalies are seen over the sea of Okhotsk and slight negative T850 anomaly is located over the north part of Japan.



Statistical interpretations of the EPS outputs

- ◆ Model outputs are translated into probabilities of three-month average temperature with a **multiple regression scheme**.

Probability (%)	Temperature		
	Below Normal	Near Normal	Above Normal
Northern Japan	11	44	45
Eastern Japan	5	42	53
Western Japan	6	24	70
Nansei Islands	1	9	90

- ◆ Seasonal mean temperature in JJA 2006 :
categories of “normal” or “above normal” have high probability.
- ◆ Reliability of prediction is high only in Nansei Islands.



Statistical Prediction (2)

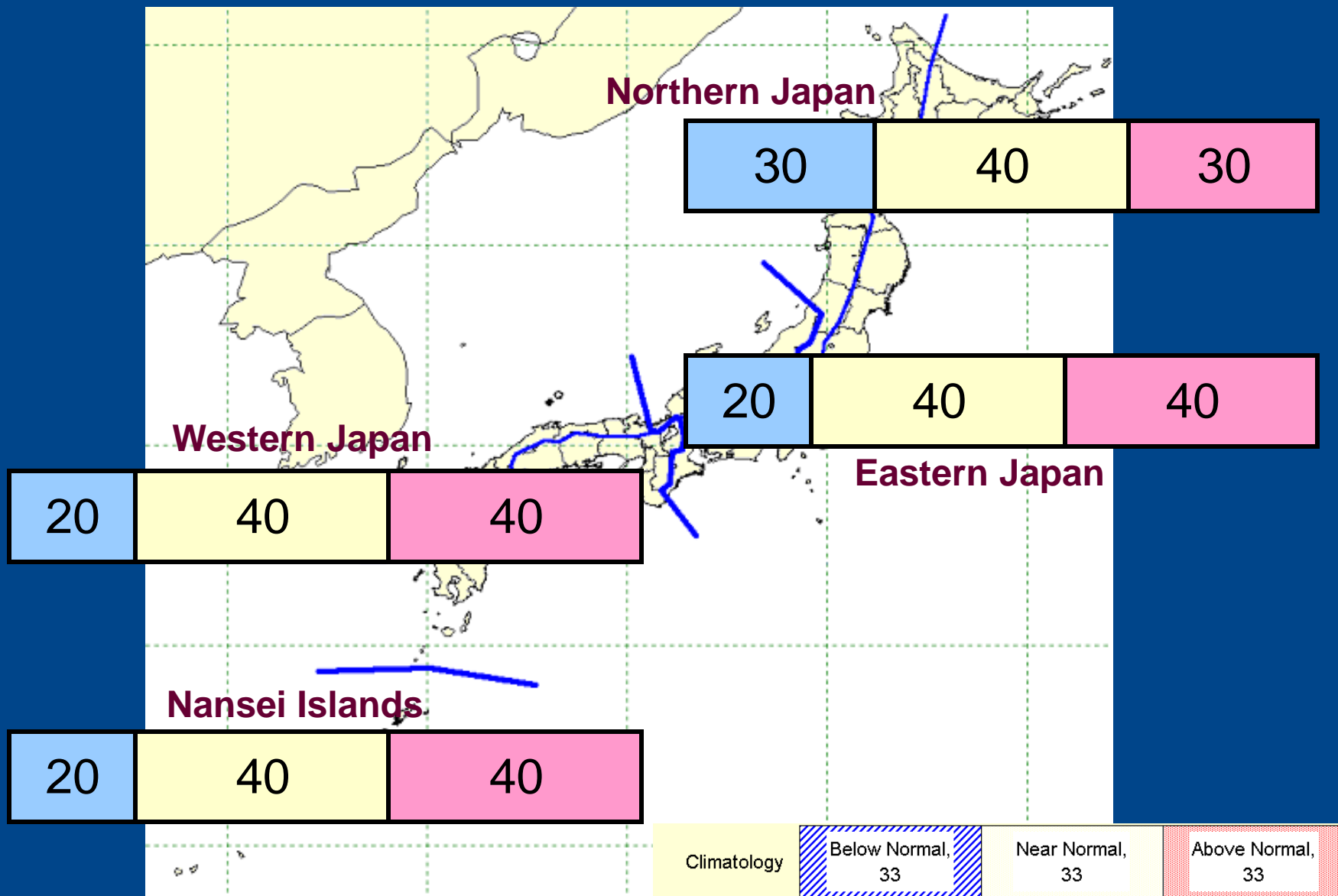
- ◆ Using **CCA (Canonical Correlation Analysis)** method
Predictor : seasonal mean temperature, precipitation etc.
Predictand : global sea surface temperature

Probability (%)	Temperature		
	Below Normal	Near Normal	Above Normal
Northern Japan	19	27	54
Eastern Japan	14	31	55
Western Japan	19	19	62
Nansei Islands	10	29	61

- ◆ Seasonal mean temperature in JJA 2006 :
categories of “normal” or “above normal” have high probability.
- ◆ Reliability of prediction is high except Northern Japan.

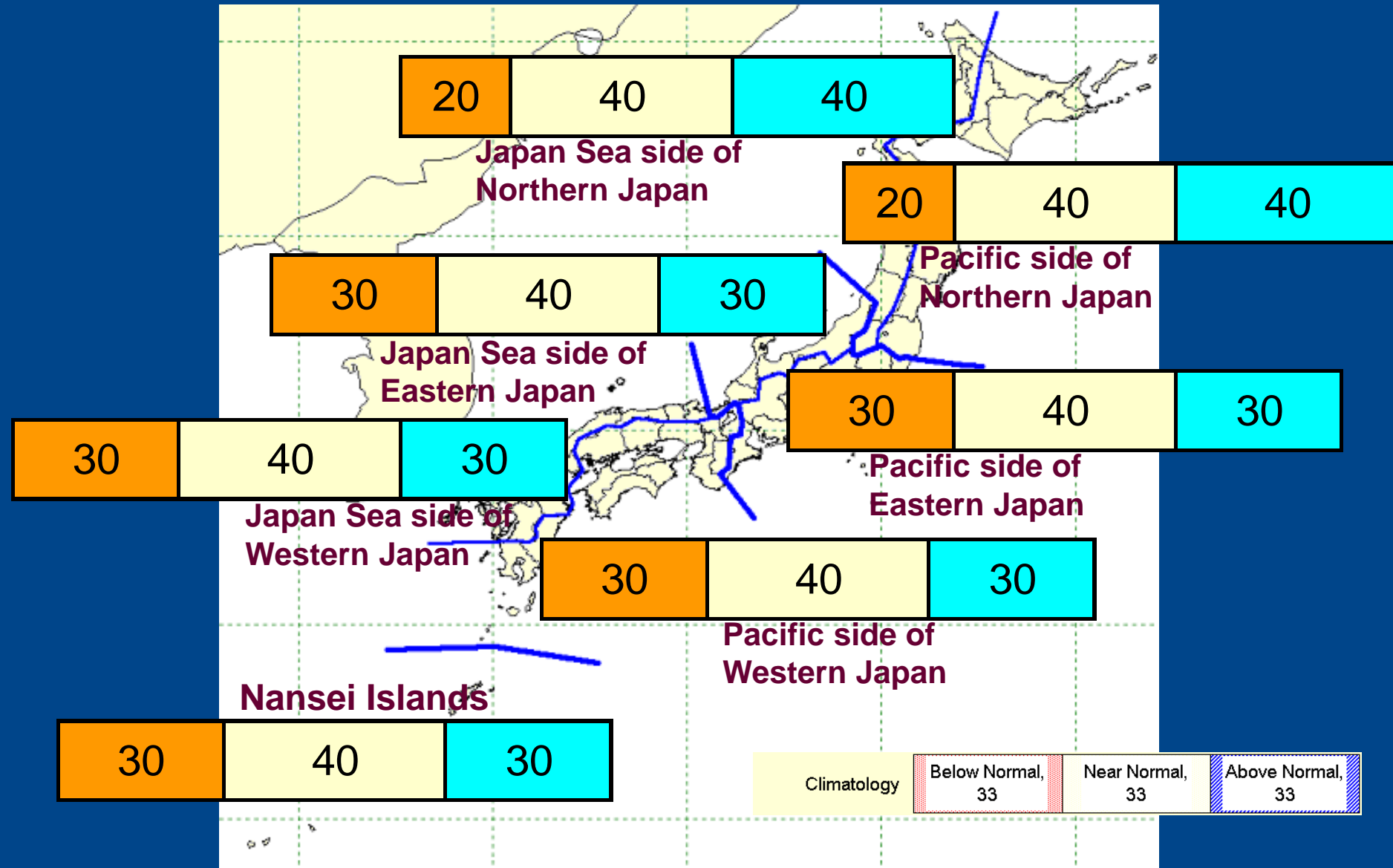


Probability of Seasonal-mean Temperature for Summer (June – August) 2006





Probability of Seasonal Precipitation for Summer (June – August) 2006





Conclusion

- 1. Summer outlook over Japan is : Near-normal or warmer-than-normal temperatures in Eastern, Western Japan and Nansei Islands, and near-normal temperature in Northern Japan. Near-normal or wetter-than-normal conditions in Northern Japan, and near-normal condition elsewhere.**
- 2. The sea surface temperature in the equatorial Pacific is predicted near-normal during the coming summer.**
- 3. Mid-latitude mean tropospheric temperature has been high in the last three years, and this condition is likely to continue.**
- 4. Seasonal mean surface temperature in Japan was mostly above normal in recent years.**
- 5. Recently, Okhotsk high tends to appear and numerical model suggests its temporal appearance and some influence to the northern part of Japan.**
- 6. Both numerical and statistical models predict warmer-than-normal summer.**



Thank you.