



# **The JMA's warm season outlook for 2007 Summer**

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# Structure of this presentation

**Part I Recent trend**

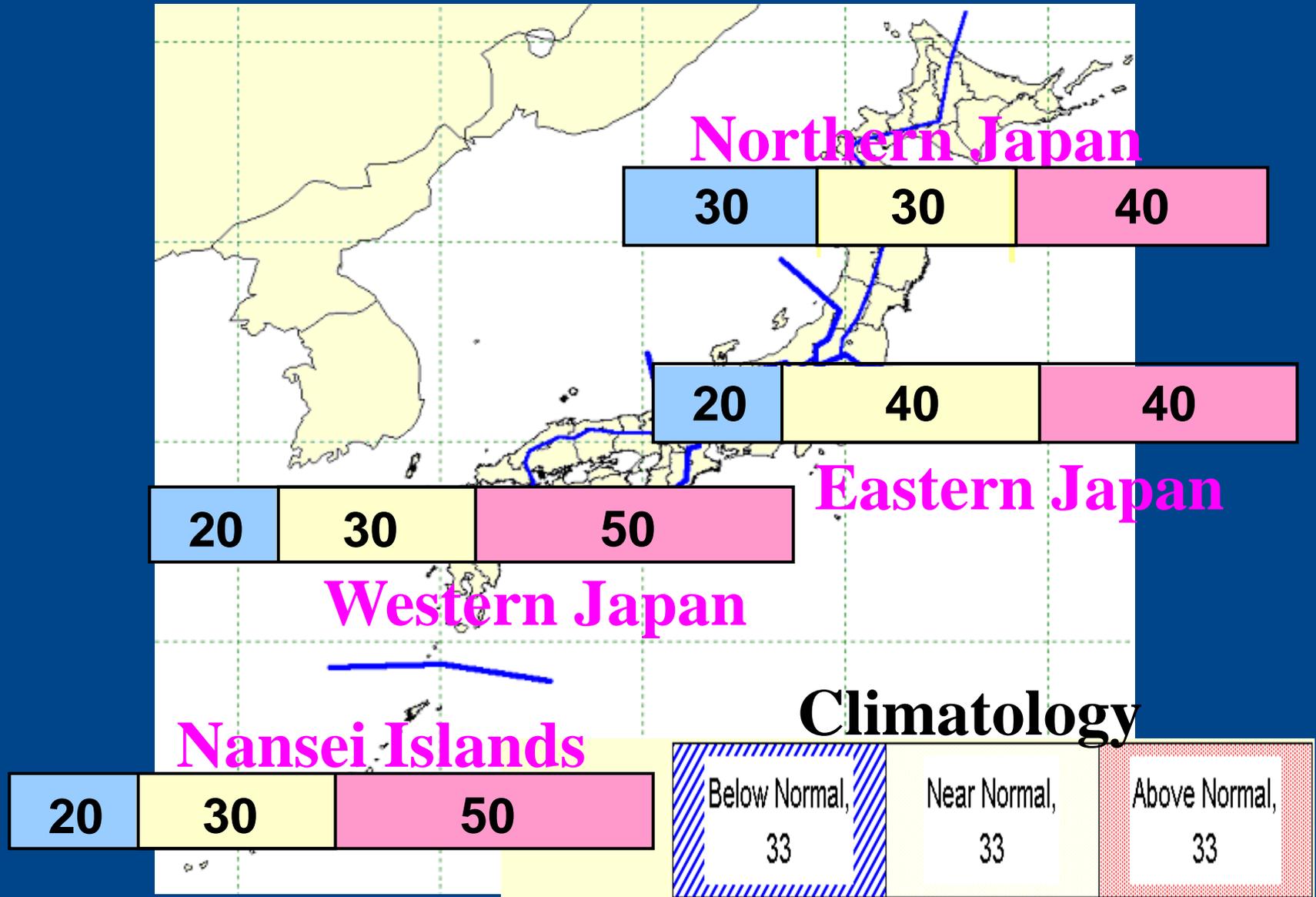
**Part II Oceanic condition and outlook**

**Part III Numerical prediction**

**Conclusion**



# Probability of seasonal mean temperature for summer ( June – August ) 2007



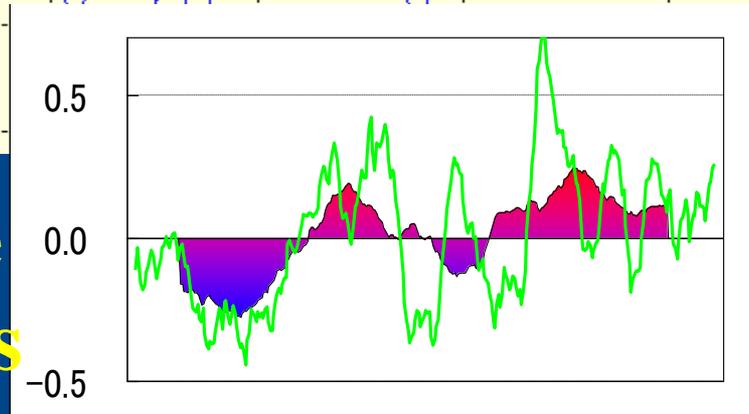
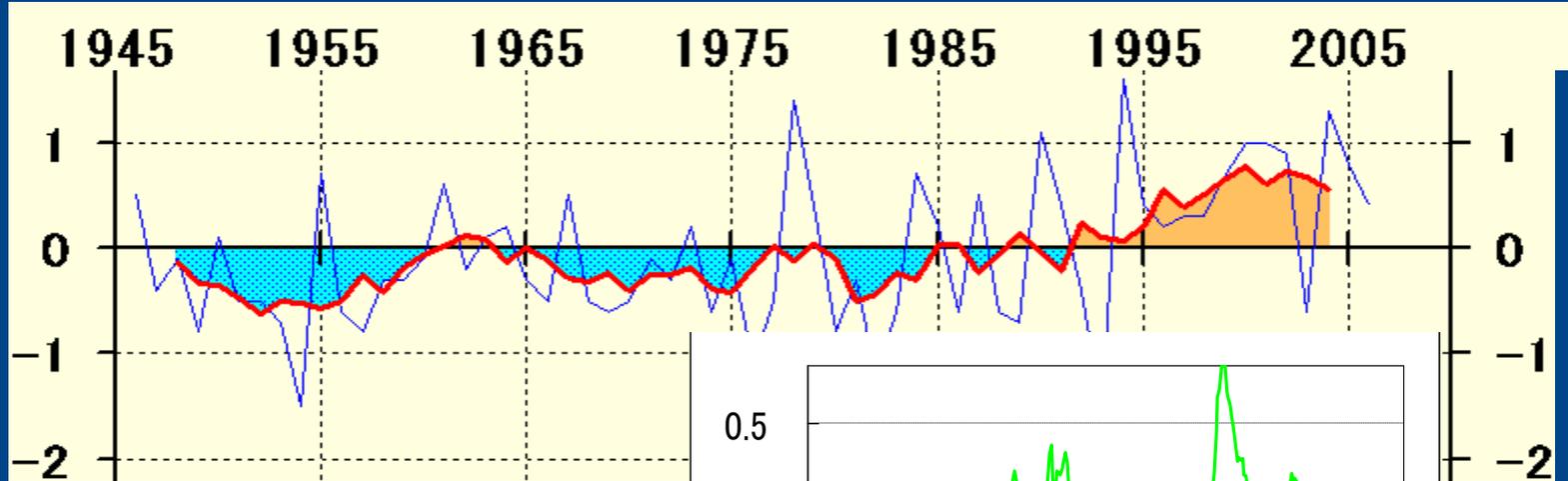


# Part I Recent trend



# Long-term trend (1)

## Surface temperature over the Eastern Japan



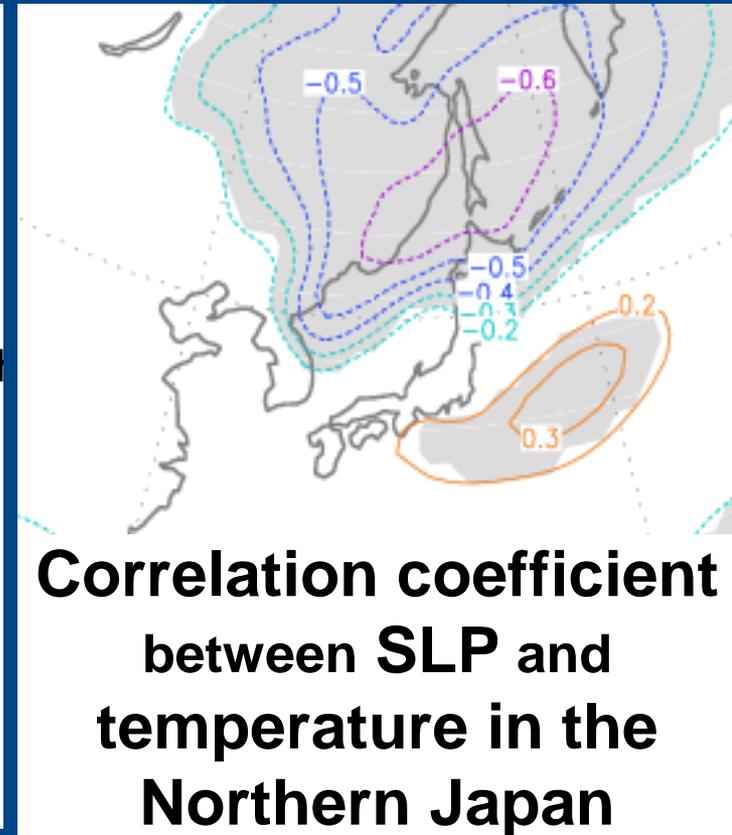
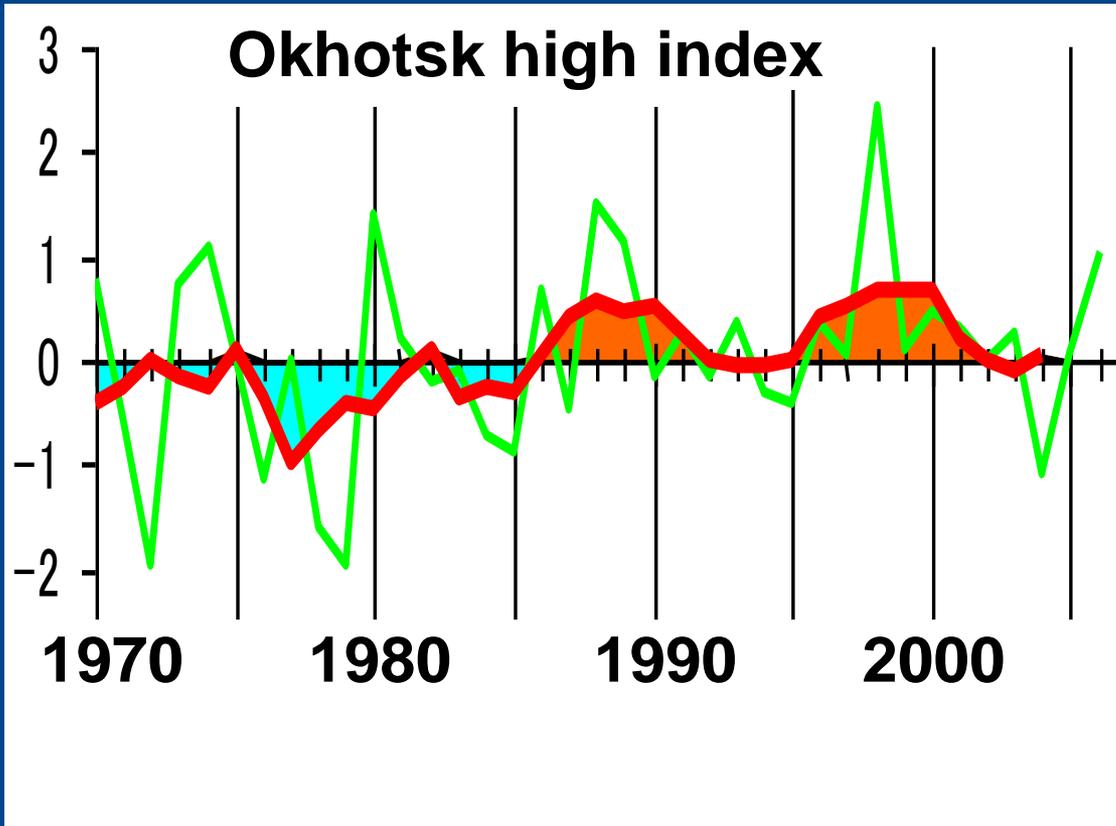
## Thickness temperature in the NH mid-latitudes

◆ Seasonal mean surface temperature in Japan was mostly above normal in recent years.

This is consistent with the warming trend of tropospheric thickness temperature.



# Long-term trend (2) General Circulation Indices



◆ Okhotsk High Index has a tendency to be positive since late 1980's, reflecting sometimes cool summers in the Northern Japan.



# Statistical forecast for seasonal (JJA) mean temperature (1)

Optimal Climate Normal	Probability (%)		
	Below Normal	Near Normal	Above Normal
Northern Japan	20	30	50
Eastern Japan	10	20	70
Western Japan	10	20	70
Nansei Islands	10	30	60

◆ For the last 10 years, there is a obvious tendency to be a hot summer ( categorized to “above normal” ) in each region.



# Part I Summary of recent trend

- ◆ Warming trend of summer temperatures over Japan.
- ◆ Warming trend of the tropospheric thickness temperature.
- ◆ Positive trend of the Okhotsk high Index.
- ◆ OCN predicts a hot summer over Japan with high probability.



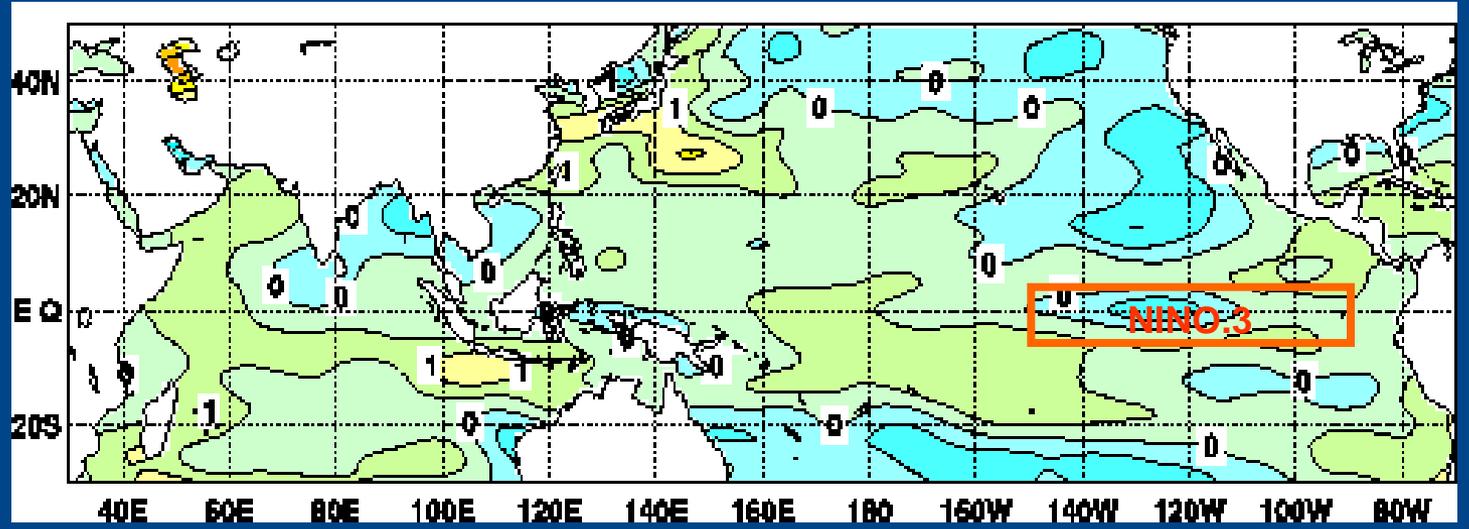
# **Part II Oceanic condition and outlook**

- ◆ **Current condition diagnosis**
- ◆ **Statistical forecast for summer (JJA) temperatures using global SSTs in DJF**
- ◆ **NINO.3 SST forecast**



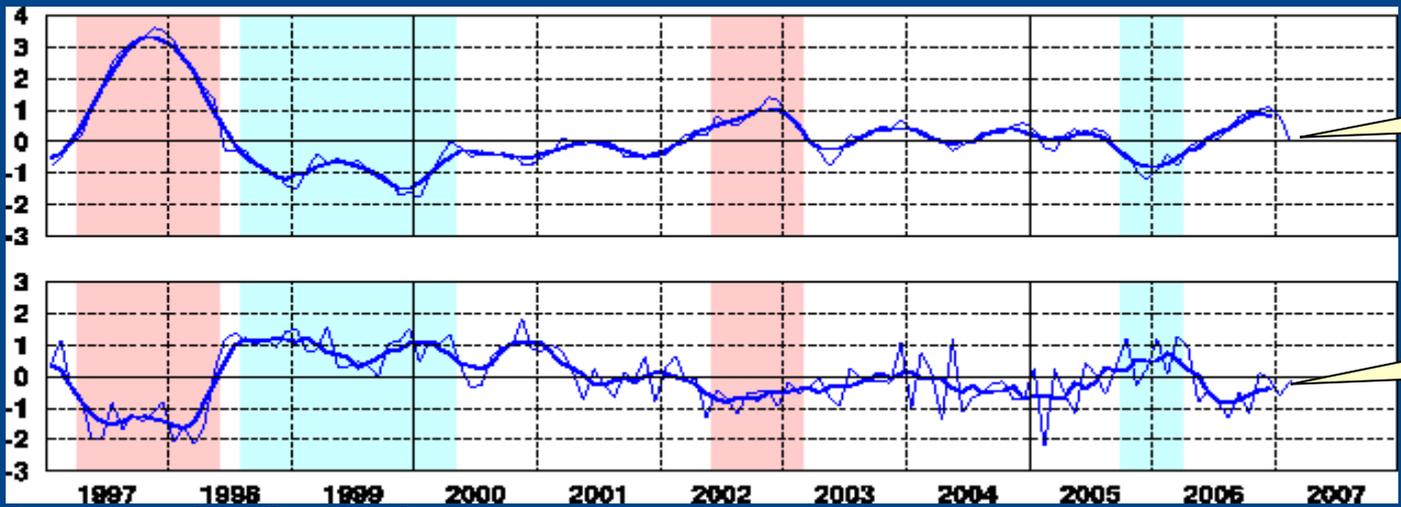
# Equatorial SST anomalies and SOI

February  
2007



Positive SST anomalies have changed to negative ones in the eastern equatorial Pacific, while positive ones remain in the central part.

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



0.0

-0.1

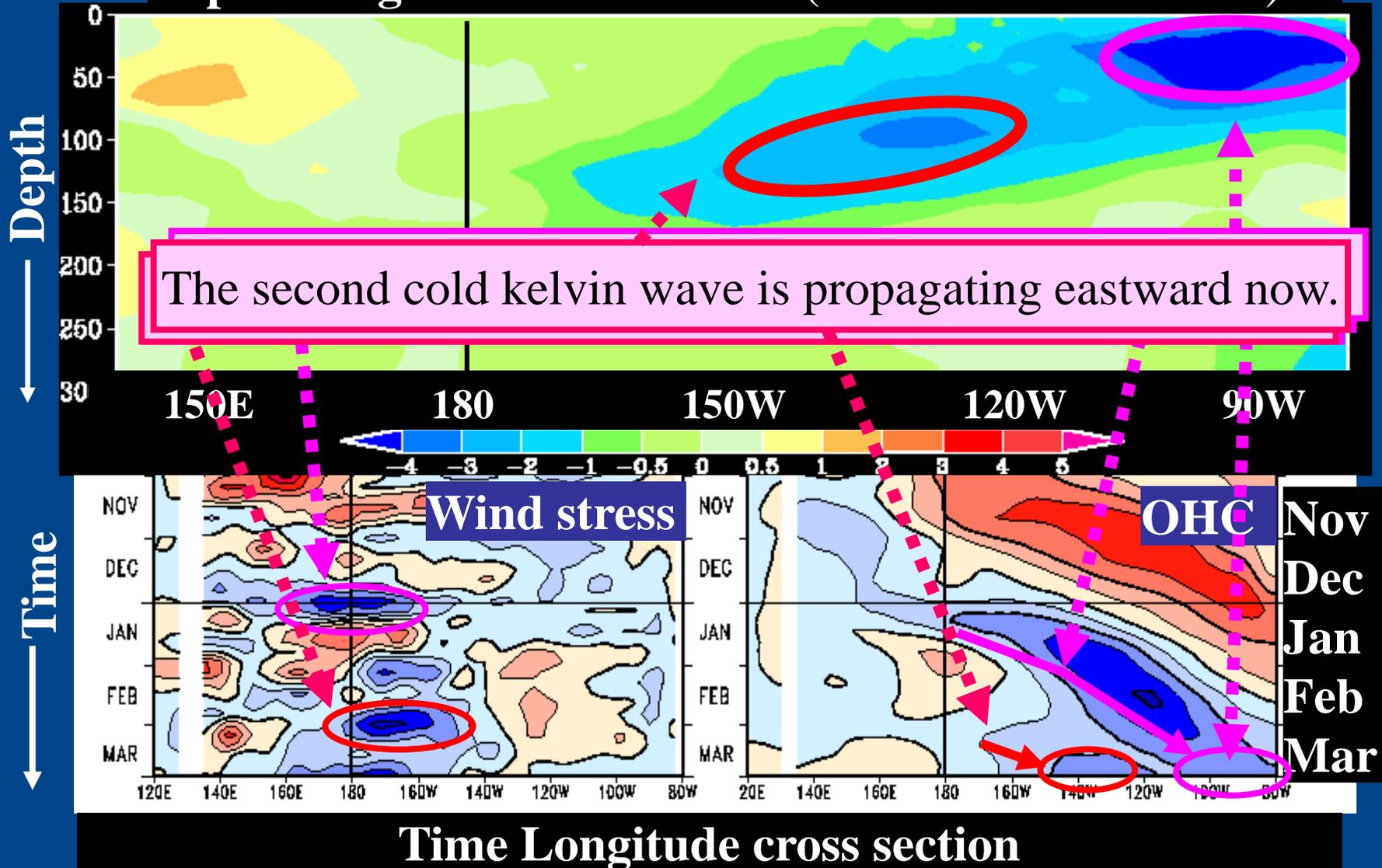
**SOI**

SOI: Southern Oscillation Index



# Subsurface temperature anomalies along the equator in the Pacific

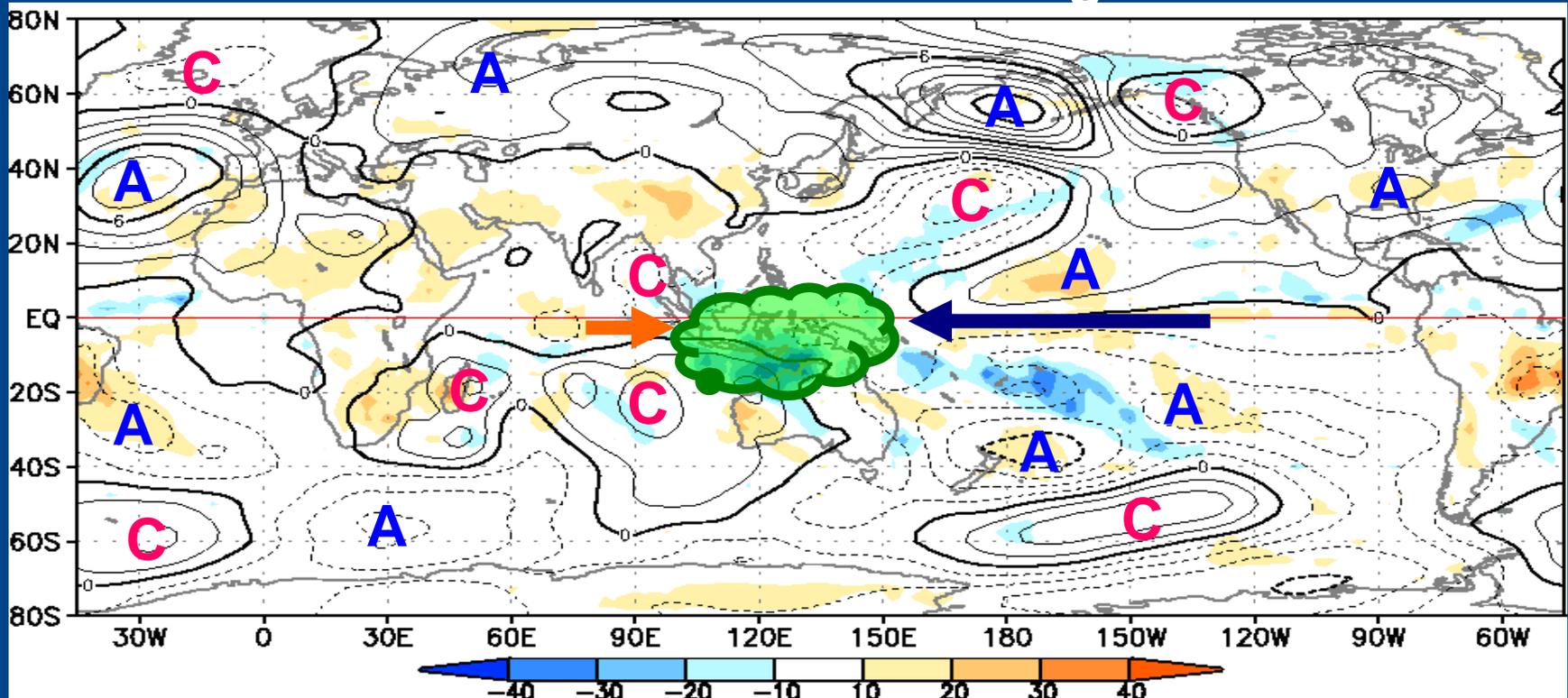
Depth Longitude cross section ( Late in March 2007 )





# Convective activities and lower tropospheric circulation anomalies

Outgoing Longwave Radiation (by NOAA) anomalies and 850hPa stream function anomalies averaged in recent 30 days.



In recent 30 days, convective activities were above normal over the Maritime continent, while below normal over the tropical central Pacific.



# Diagnosis of oceanic conditions

- ◆ **Negative sea surface and subsurface temperature anomalies were dominant in the central and eastern equatorial Pacific, while positive ones in the western part.**
  - ◆ **Convective activities were enhanced over the Maritime Continent.**
  - ◆ **Easterly wind anomalies prevailed at the lower level of troposphere over the equatorial Pacific.**
- 
- ◆ **These conditions indicate that the El Niño event has ended.**
  - ◆ **Current conditions are similar to the conditions when the oceanic and atmospheric conditions in the equatorial Pacific are on track for La Niña event.**



# Statistical forecast for JJA mean temperature (2)

<< CCA (Canonical Correlation Analysis) >>

Predictor : seasonal mean temperature

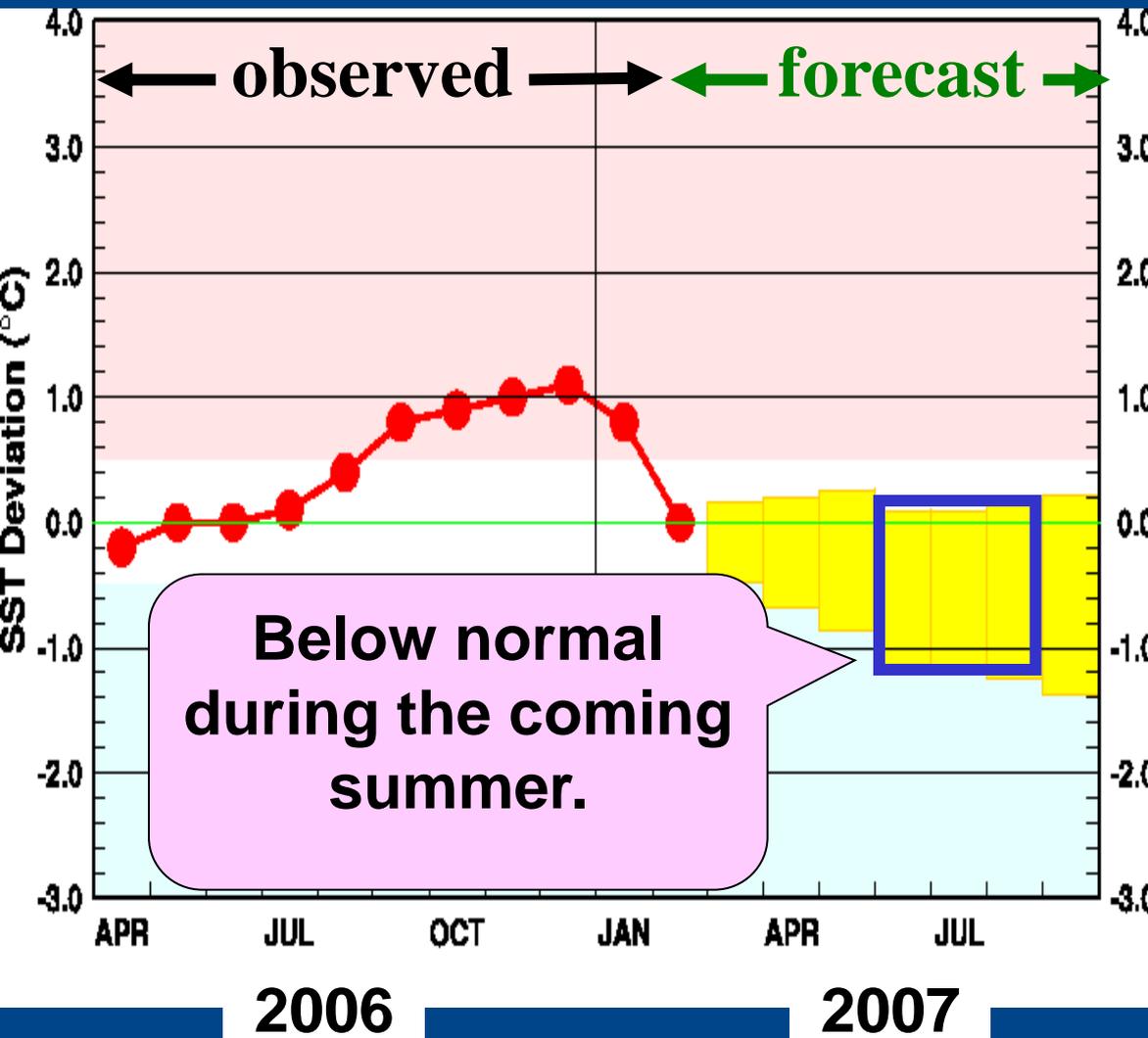
Predictand : some major modes of principal component analysis for global SSTs in winter 2007.

Canonical Correlation Analysis	Probability (%)		
	Below Normal	Near Normal	Above Normal
Northern Japan	21	29	50
Eastern Japan	7	24	69
Western Japan	10	13	77
Nansei Islands	2	13	85

- ◆ Seasonal mean temperature in JJA 2007 : categories of “above normal” have high probability.
- ◆ Reliability of prediction is high except Northern Japan.



# NINO.3 SST forecast by JMA El Niño forecast model



## model spec

### CGCM

Atmosphere : T42L40

Ocean : 2.5x0.5-2.0deg  
L20

### Ensemble

method : LAF  
(5days interval)

size : 12 members

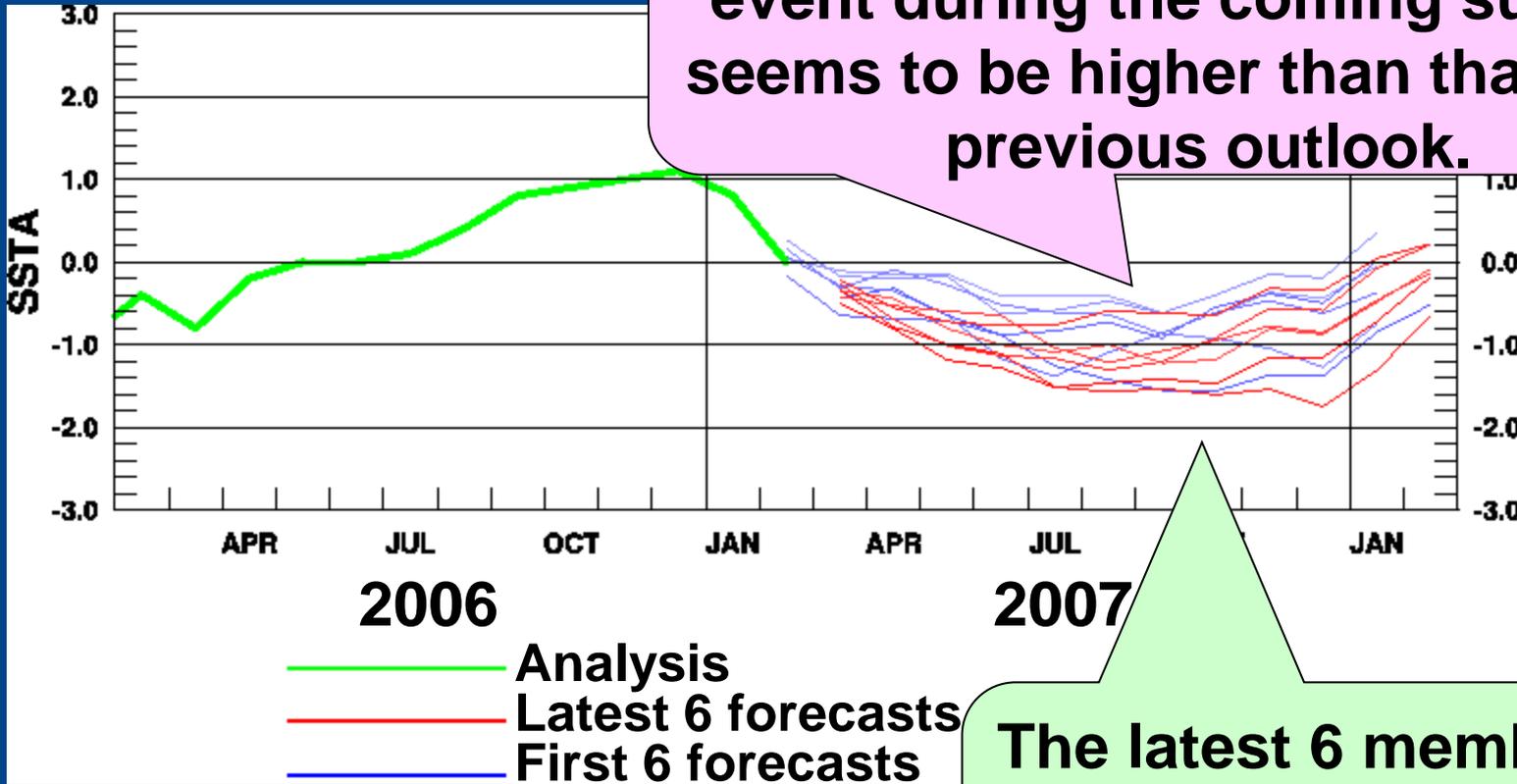


Each yellow box denotes the range where the SST deviation will be included with the probability of 70%.



# NINO.3 SST forecast by JMA El Niño forecast model

The probability of being a La Niña event during the coming summer seems to be higher than that in the previous outlook.



The latest 6 members predict lower SSTs than the first 6 members.

Forecasts of the latest 12 members



## Part II Summary of oceanic condition and outlook

- ◆ It is likely that the oceanic and atmospheric conditions in the equatorial Pacific will proceed toward a La Niña event in the months ahead.
- ◆ The probability of being a La Niña event during the coming summer seems to be higher than that in the previous outlook.
- ◆ CCA predicts a hot summer over Japan with high probability.



# Part III Numerical prediction

- ◆ **Outline of EPS**
- ◆ **Atmospheric circulation anomalies by ensemble means of EPS predictions**
- ◆ **Statistical interpretation for summer temperatures**



# Numerical prediction (1)

Seasonal  
forecast model  
spec

**AGCM**

Atmosphere : TL95L40

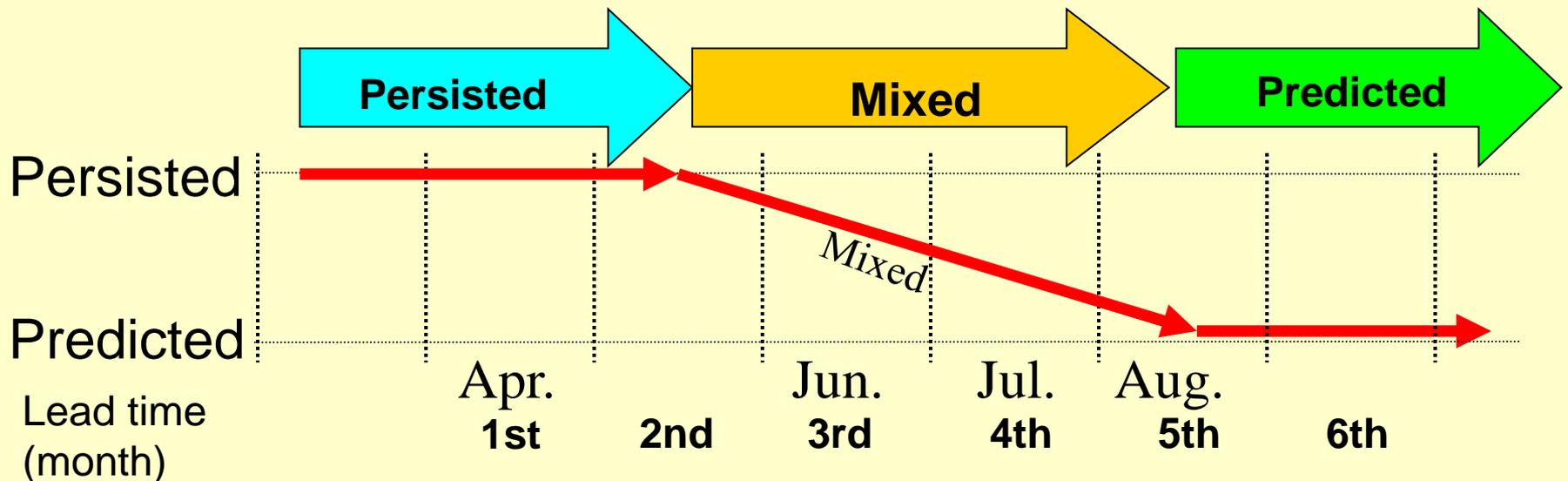
SST : refer to the below chart

**Ensemble**

method : Singular Vector

size : 31 members

## How to merge persisting SSTs and predicted SSTs





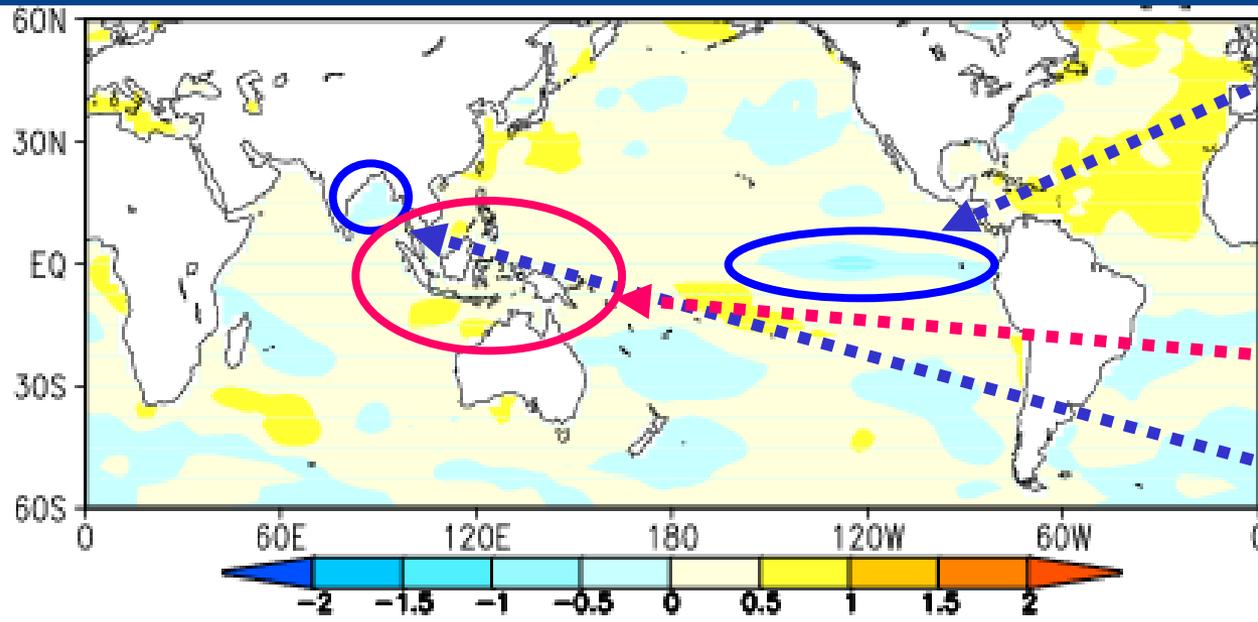
# Numerical prediction (2)

How to make predicted SSTs using the El Niño forecast model result.

For global ocean grid,

- 1<sup>st</sup> Remove long-term trends.
- 2<sup>nd</sup> Calculate each grid SST using predicted NINO.3 SST by the El Niño forecast model with the linear regression to NINO.3 SST.
- 3<sup>rd</sup> Add long-term trends to 2<sup>nd</sup> step results.

## SST anomalies fed to the model



- ◆ Negative anomalies along the equator in the eastern Pacific.
- ◆ Positive anomalies are dominant around the Maritime Continent.
- ◆ Negative anomalies are also found in the Bay of Bengal .

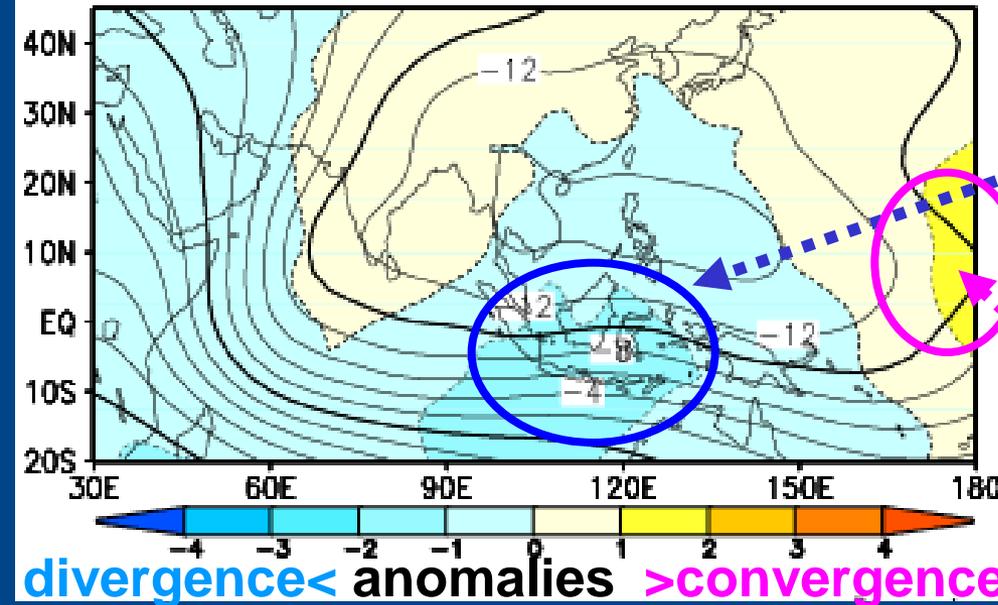


# Numerical prediction (3)

## Prediction of velocity potential ( $\chi$ ) and precipitation

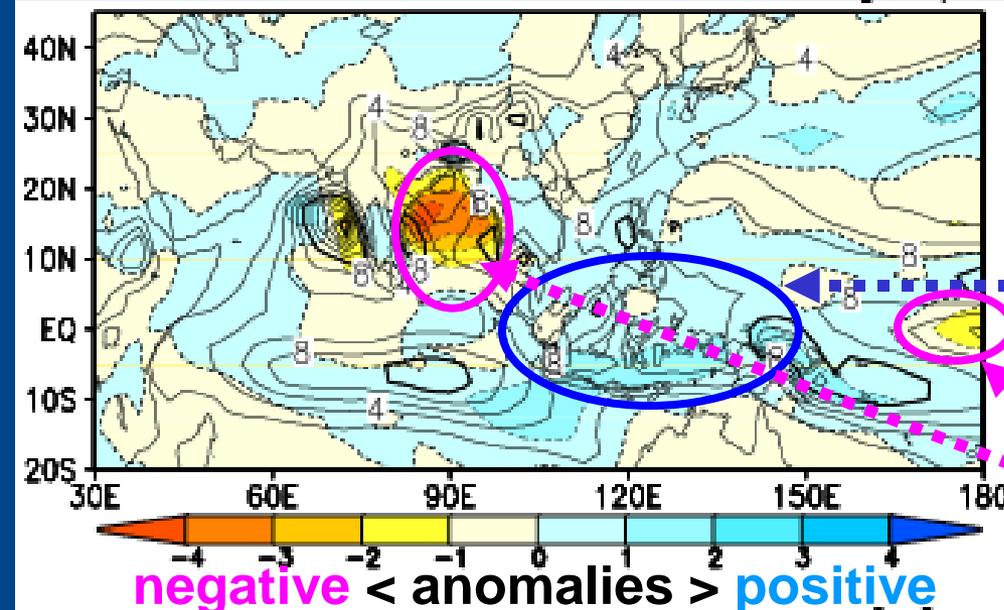
200hPa velocity potential ( $\chi$ ) and anomalies

- ◆ Divergence anomalies over the Maritime Continent
- ◆ Convergence anomalies over the central Pacific



Precipitation and anomalies

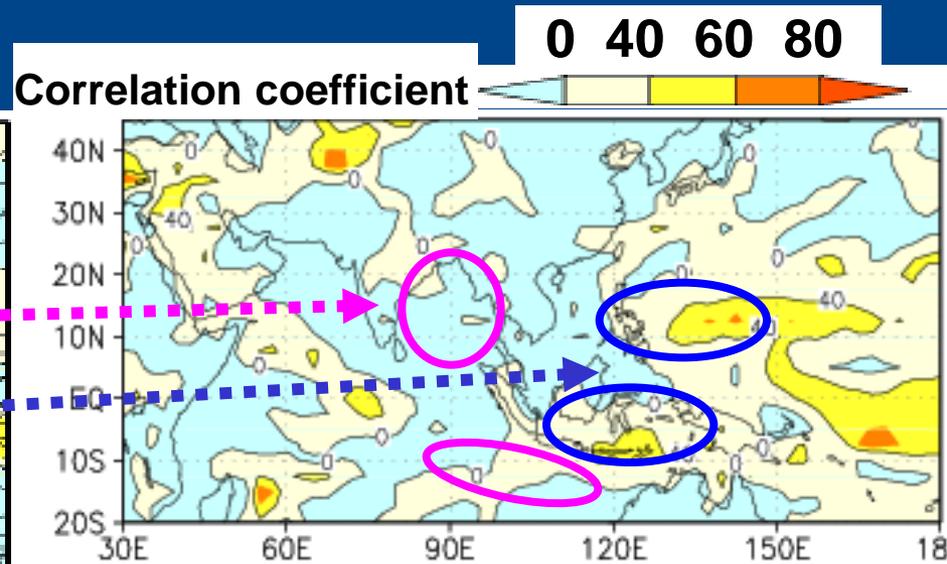
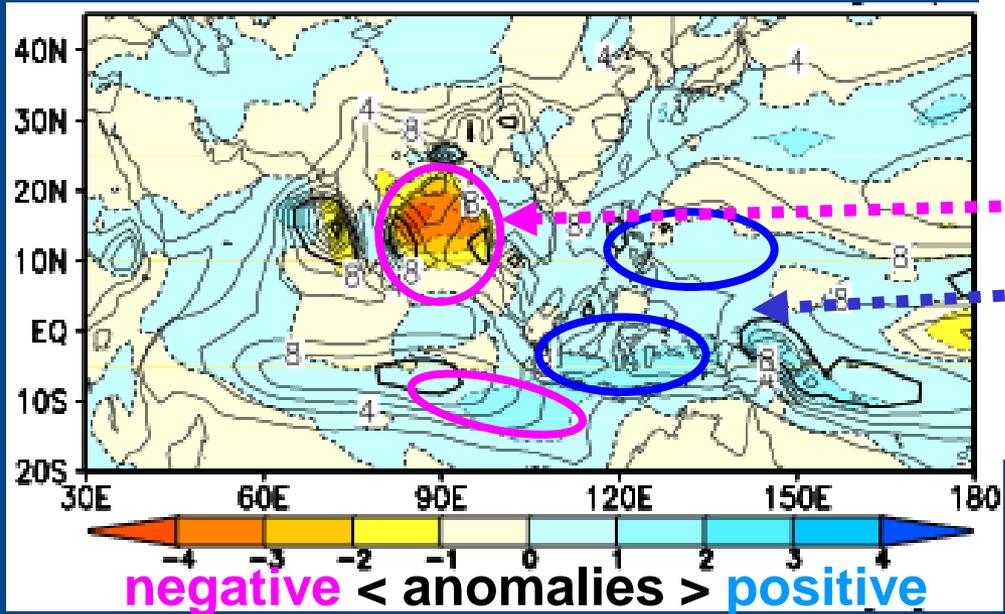
- ◆ Positive anomalies over the Maritime Continent
- ◆ Negative anomalies over the equatorial central Pacific and the Bay of Bengal.





# Numerical prediction (4)

## Compare precipitation forecast with verification skills by hindcasts



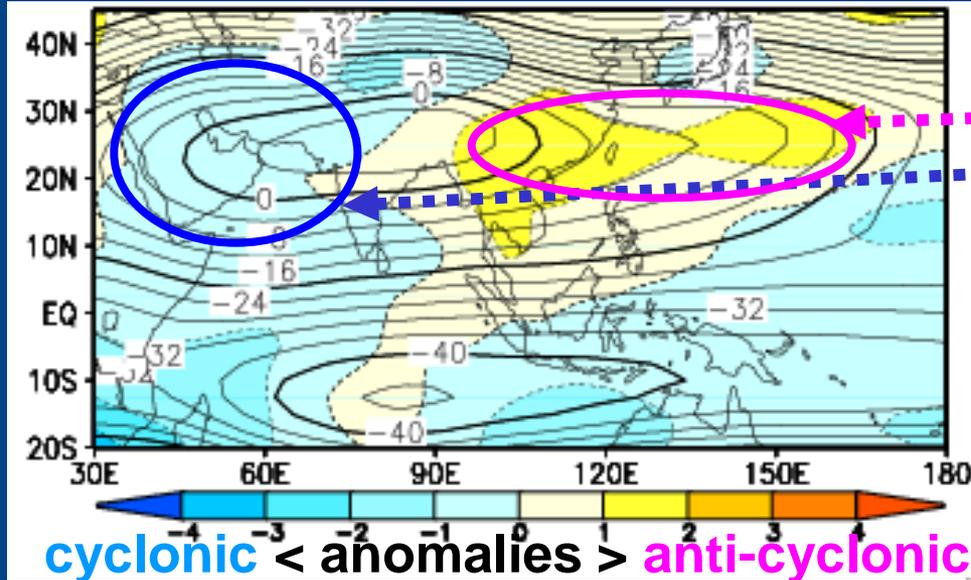
Verification of deterministic forecast of precipitation

- ◆ Our EPS has a good skill in precipitation around the Maritime Continent and east of the Philippines.
- ◆ There is no skill in precipitation around the Bay of Bengal and off the southwestern of Indonesia.
- ◆ Predicted precipitation pattern seems to be oversensitive to SST anomalies especially in the Indian ocean.



# Numerical prediction (5)

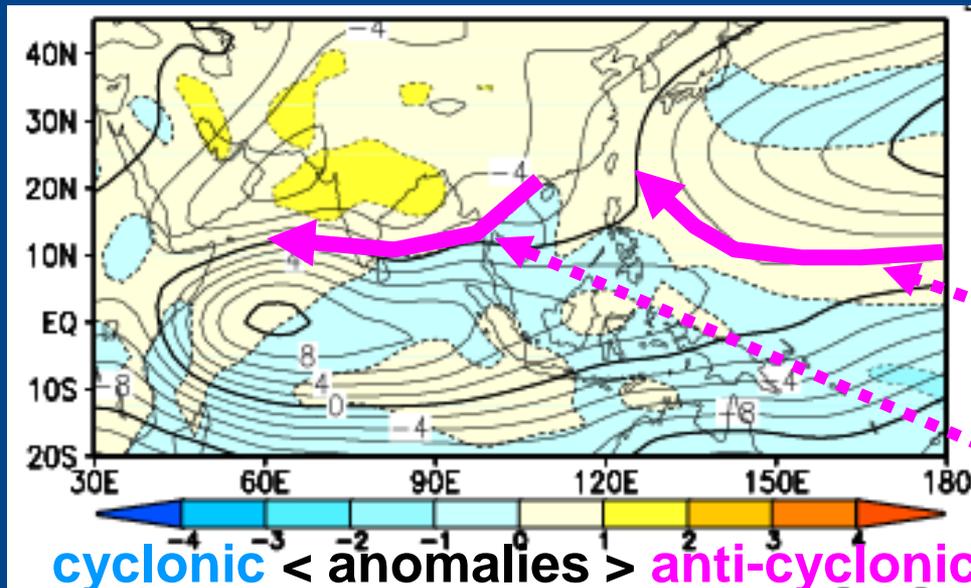
## Prediction of 200hPa and 850hPa stream functions ( $\psi$ )



### $\Psi_{200}$ and anomalies

◆ Anti-cyclonic and cyclonic anomalies prevailed over China to the south of Japan and the western Asia, respectively.

- ◆ Predicted week monsoon westerlies seem to be too weak.
- ◆ Sub-tropical high over the western Pacific is stronger than normal and extend to the East China Sea.

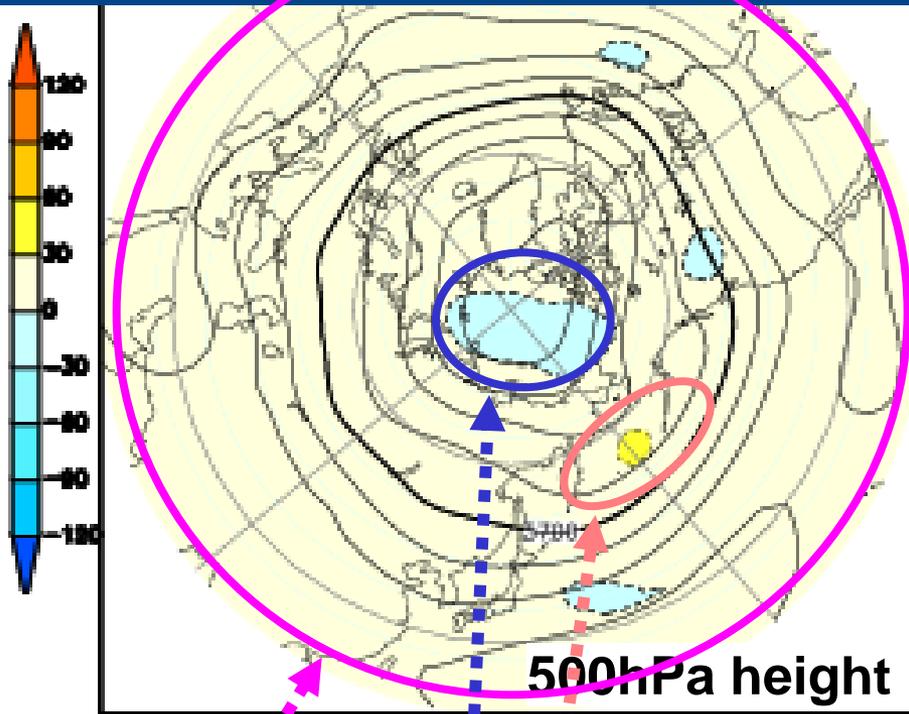


### $\Psi_{850}$ and anomalies

- ◆ Trade wind over the western Pacific are stronger than normal.
- ◆ Monsoon westerlies are weaker than normal from the Arabian Sea to the Bay of Bengal.

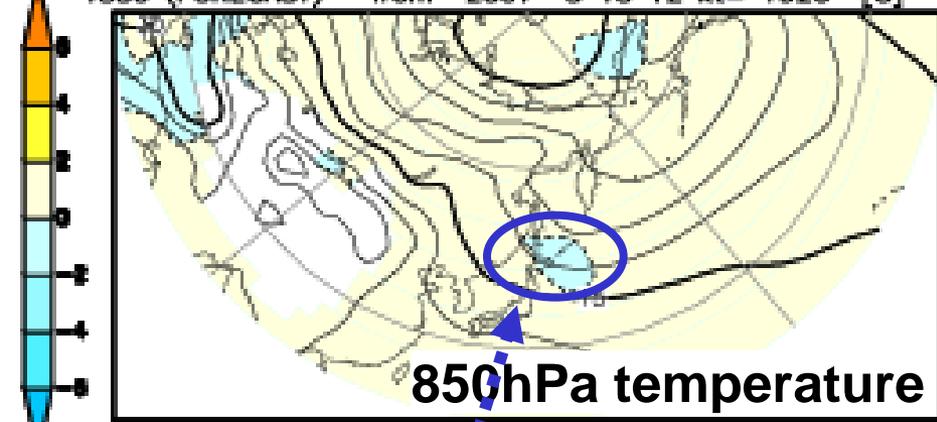


# Numerical prediction (6)

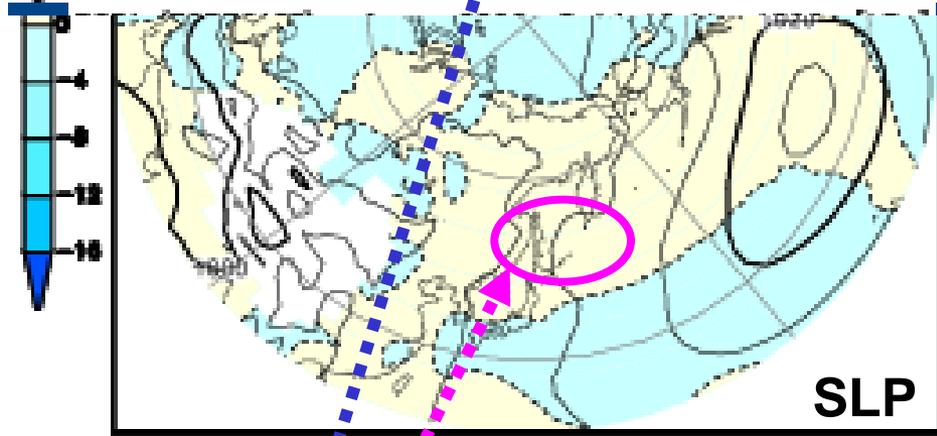


500hPa height

- ◆ Slight positive Z500 anomalies prevail over the Northern Hemisphere with slight negative anomalies in the arctic area.
- ◆ Positive anomalies are dominant around the Aleutian.



850hPa temperature



SLP

- ◆ 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

- ◆ The EPS outputs are translated into probabilities of temperature with a **multiple regression scheme**.

EPS interpretations	Probability(%)		
	Below Normal	Near Normal	Above Normal
Northern Japan	10	47	43
Eastern Japan	6	35	59
Western Japan	10	27	63
<b>Nansei Islands</b>	0	11	89

- ◆ Seasonal mean temperature in JJA 2007 : categories of “normal” or “above normal” have high probability.

- ◆ **Reliability of prediction is high only in Nansei Islands.**



# Part III Summary of numerical prediction

- ◆ Enhanced convection around the South China Sea and the Philippines.
- ◆ Stronger-than-normal sub-tropical high in the northwestern Pacific.
- ◆ A period of Okhotsk high with some degree of probability.
- ◆ Statistical interpretation predicts a hot summer over Japan (except for the Northern Japan) with a high probability.

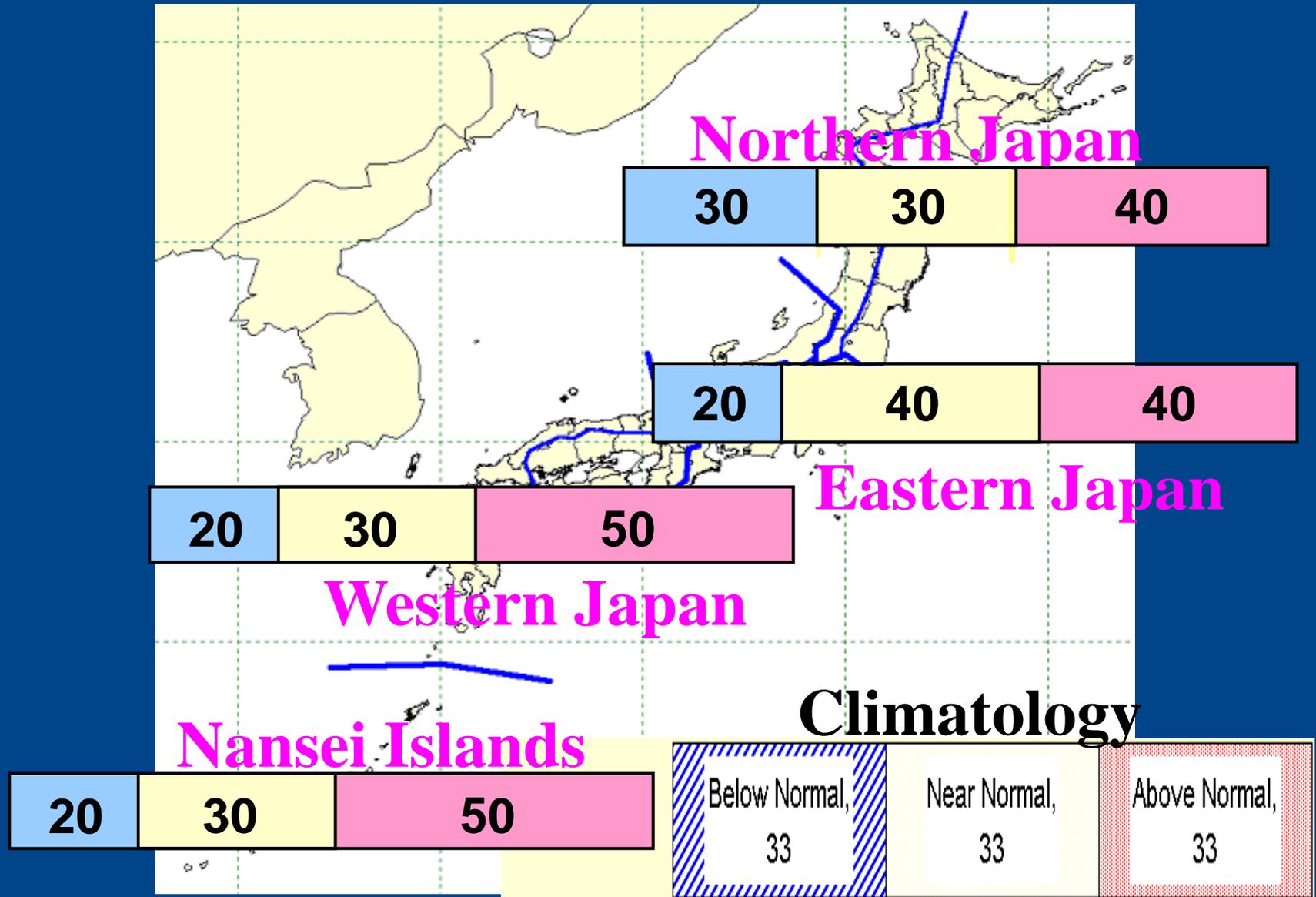


# Conclusion

- ◆ It is likely that the oceanic and atmospheric conditions in the equatorial Pacific will proceed toward a La Niña event in the months ahead.
- ◆ Both enhanced convection around the Philippines and a stronger-than-normal subtropical high are predicted by EPS.
- ◆ Recent warming trend in Japan is remarkable and all statistical models predict a hot summer over Japan with high probabilities.
- ◆ The potential of cold summer caused by Okhotsk high is not negligible for the Northern Japan.



# Probability of seasonal mean temperature for summer ( June – August ) 2007



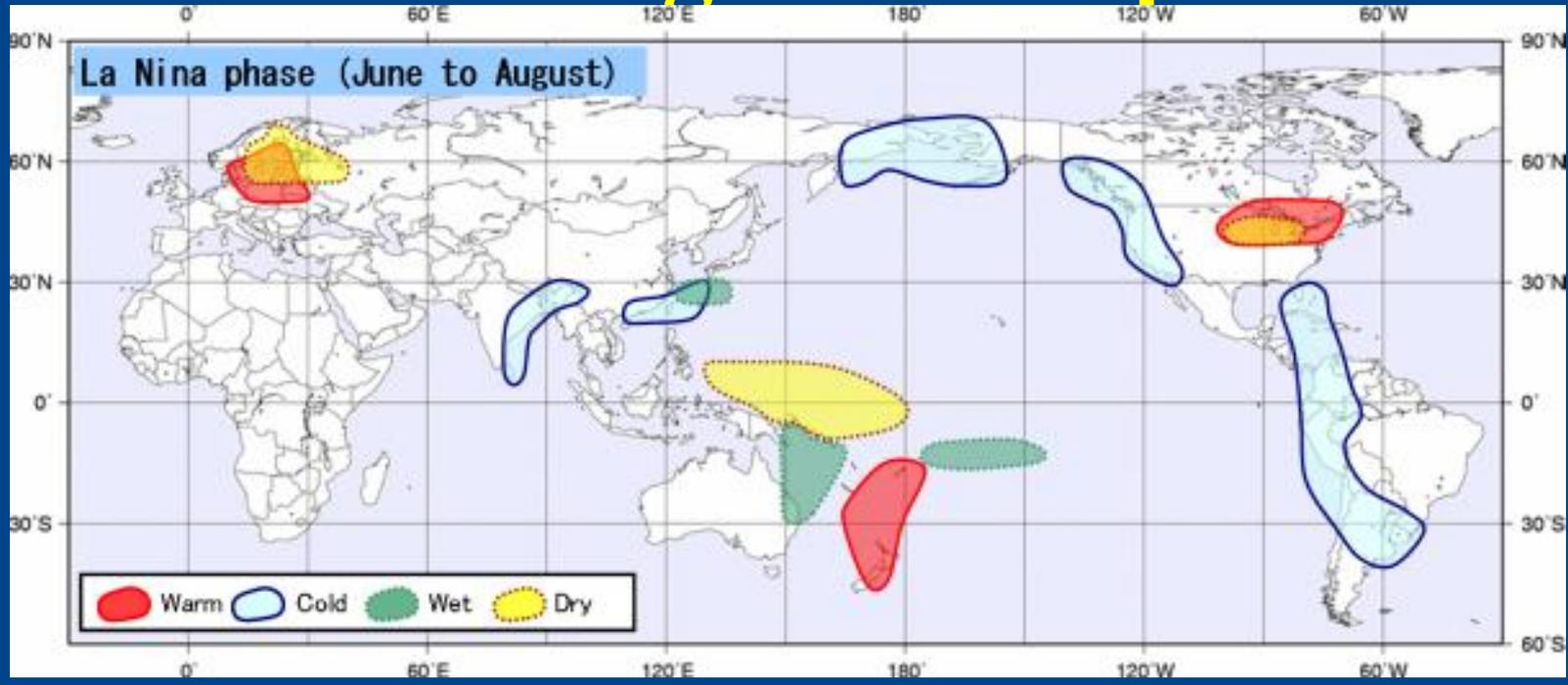


*Thank you.*

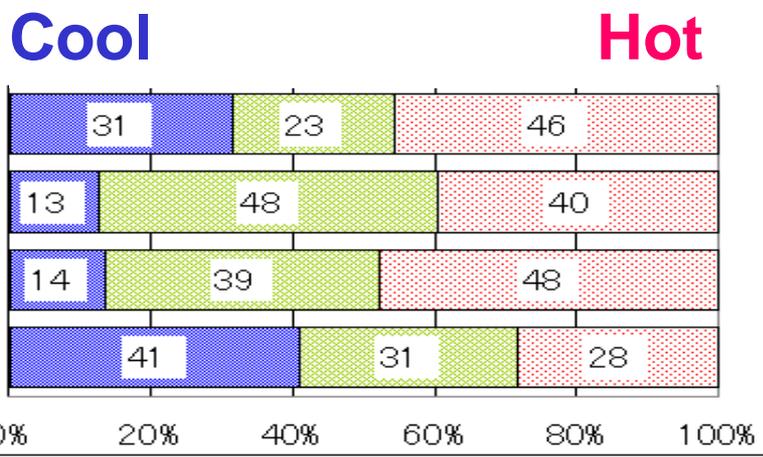




# Climate tendency during La Niña phase



N. Japan  
E. Japan  
W. Japan  
Nansei Is.



## Temperature tendency during La Niña phase in Japan



# Probability of seasonal mean precipitation for summer ( June – August ) 2007

