The JMA's cold season outlook for 2007/08 Winter

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Structure of this presentation

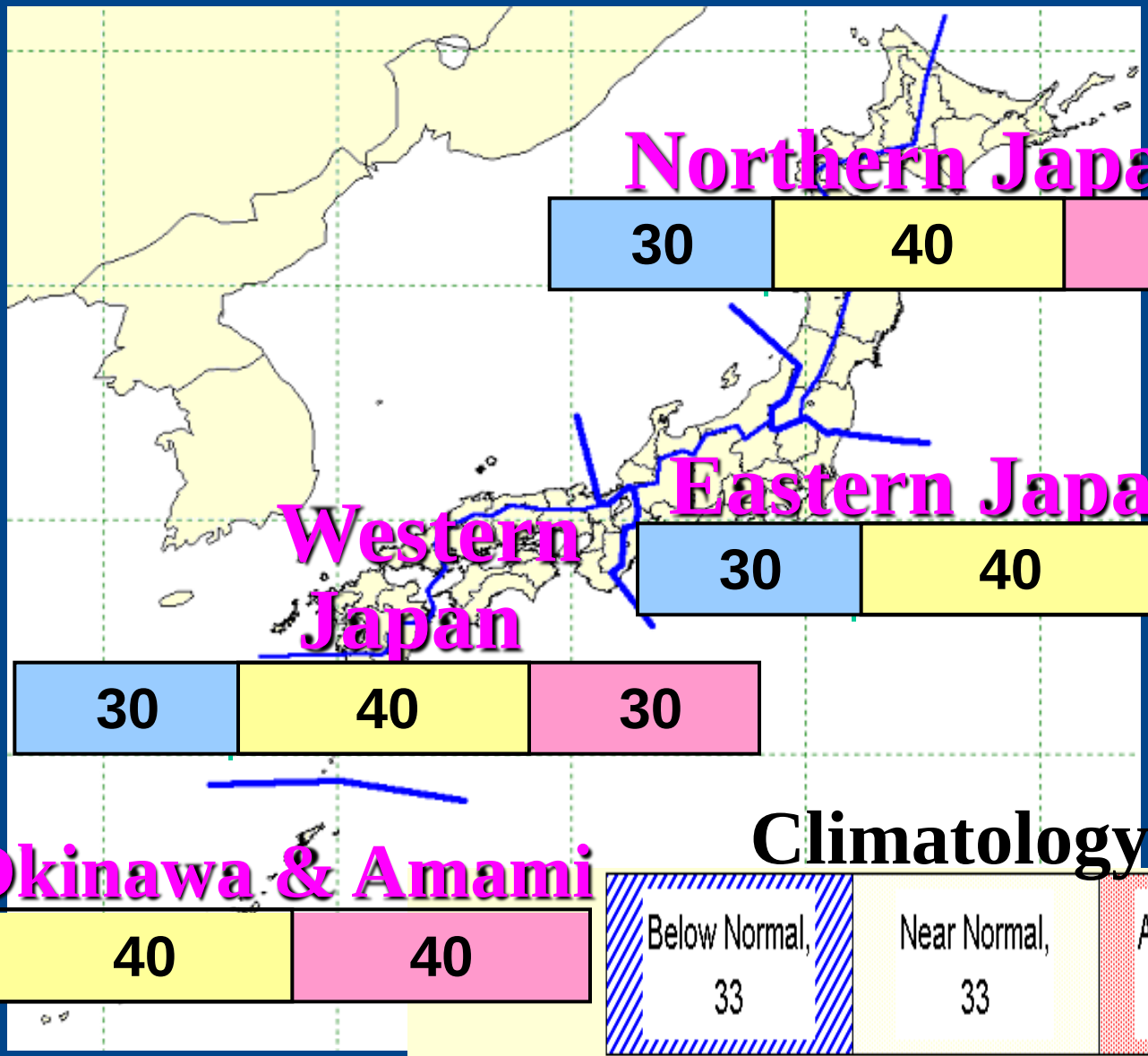
Part I Recent trend

Part II Oceanic condition and outlook

Part III Numerical prediction

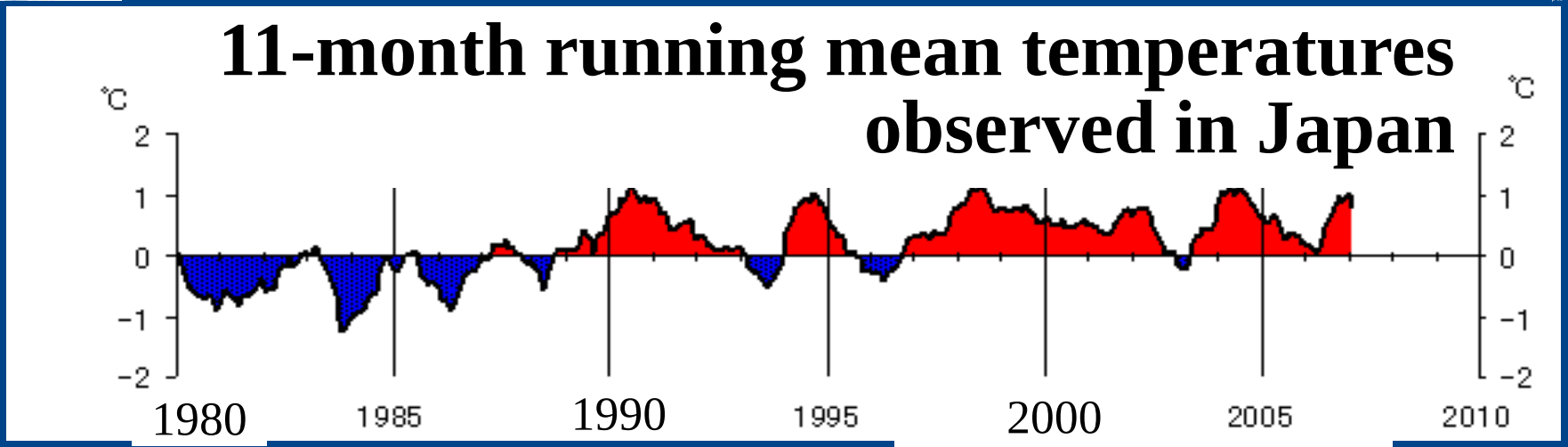
Conclusion

Probability of seasonal mean temperature for winter (Dec. 2007 – Feb. 2008)

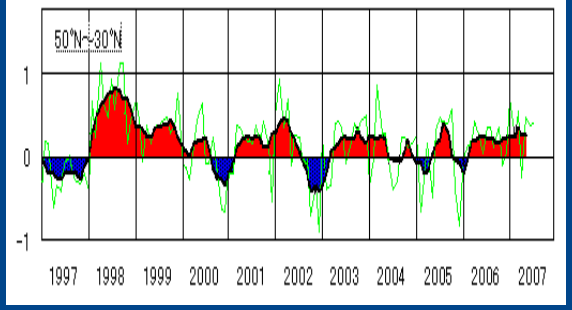


Part I Recent trend

Long-term trend



Thickness temperature in the NH mid-latitudes



◆11-month running mean temperatures in Japan were mostly above normal in recent years.

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

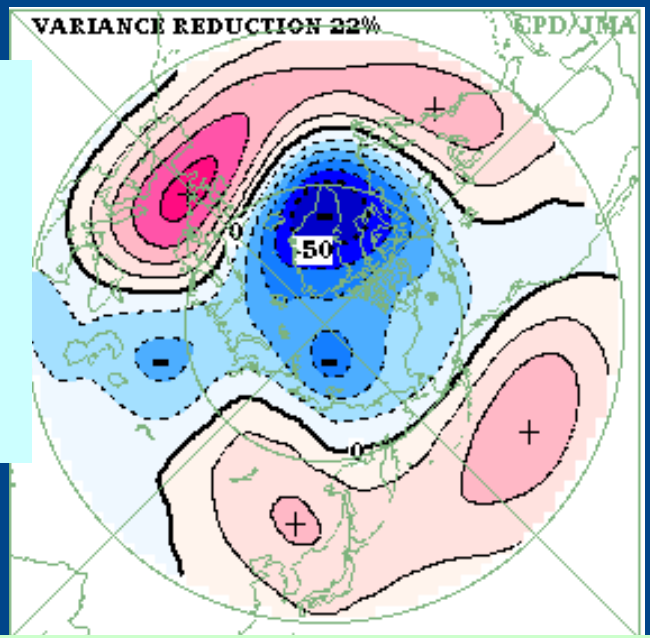
Statistical forecast for seasonal (DJF) mean temperature

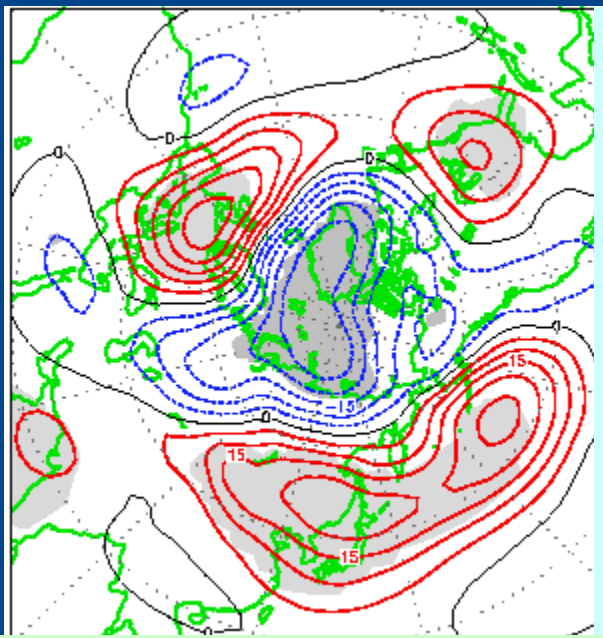
Optimal Climate Normal	Probability (%)		
	Below Normal	Near Normal	Above Normal
Northern Japan	30	40	30
Eastern Japan	10	30	60
Western Japan	10	50	40
Okinawa & Amami	0	30	70

◆ For the last 10 years, there has been an obvious tendency of warm or normal winters except for Northern Japan where there is no tendency.

Decadal variation of Arctic Oscillation

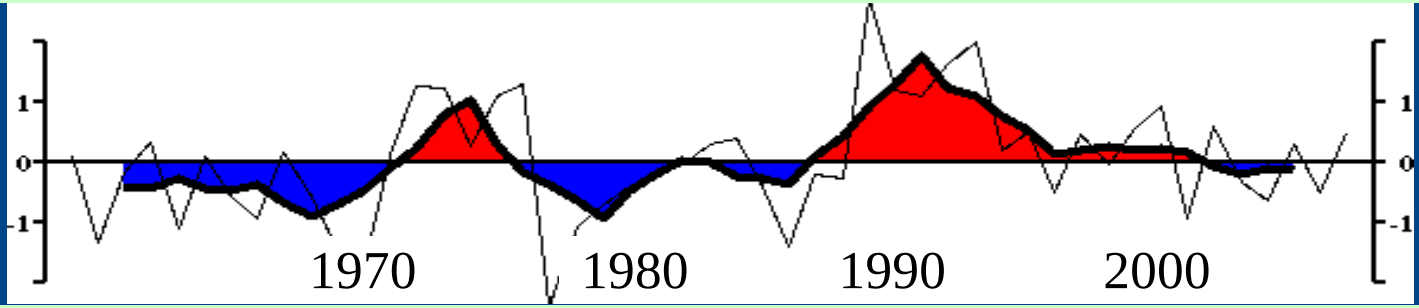
EOF 1st mode for DJF mean 500hPa height





Regression coefficient of DJF mean 500hPa height for Northern Japan temperature

◆**The AO is closely connected with the winter climate in Japan.**



Time series of the DJF mean score of EOF 1st mode

◆**The AO has been near normal since the significantly positive phase during the early 1990's ended.**

Part I Summary of recent trend

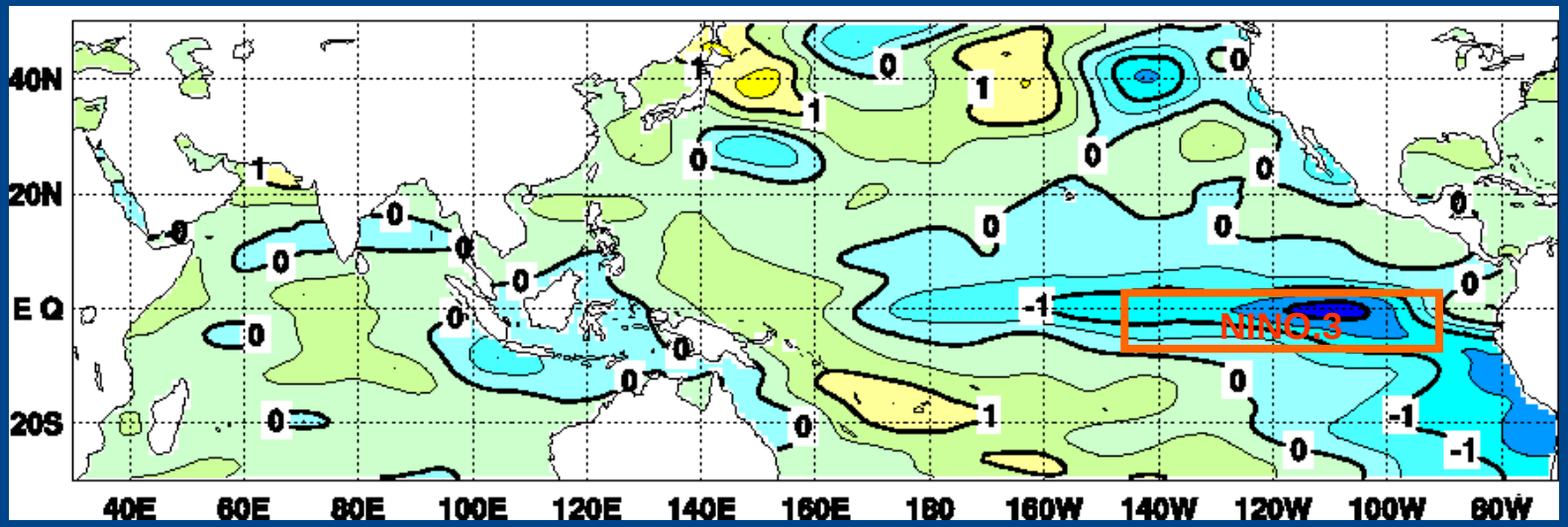
- A warming trend of temperatures over Japan consistent with a warming trend of the tropospheric thickness temperature.
- OCN predicts a warm or normal winter except for Northern Japan.
- The phase of Arctic Oscillation in the long period view is neither positive nor negative.

Part II Oceanic condition and outlook

- Current condition diagnosis & forecast
- Statistical climate features in Japan during La Niña winter

Equatorial SST anomalies and SOI

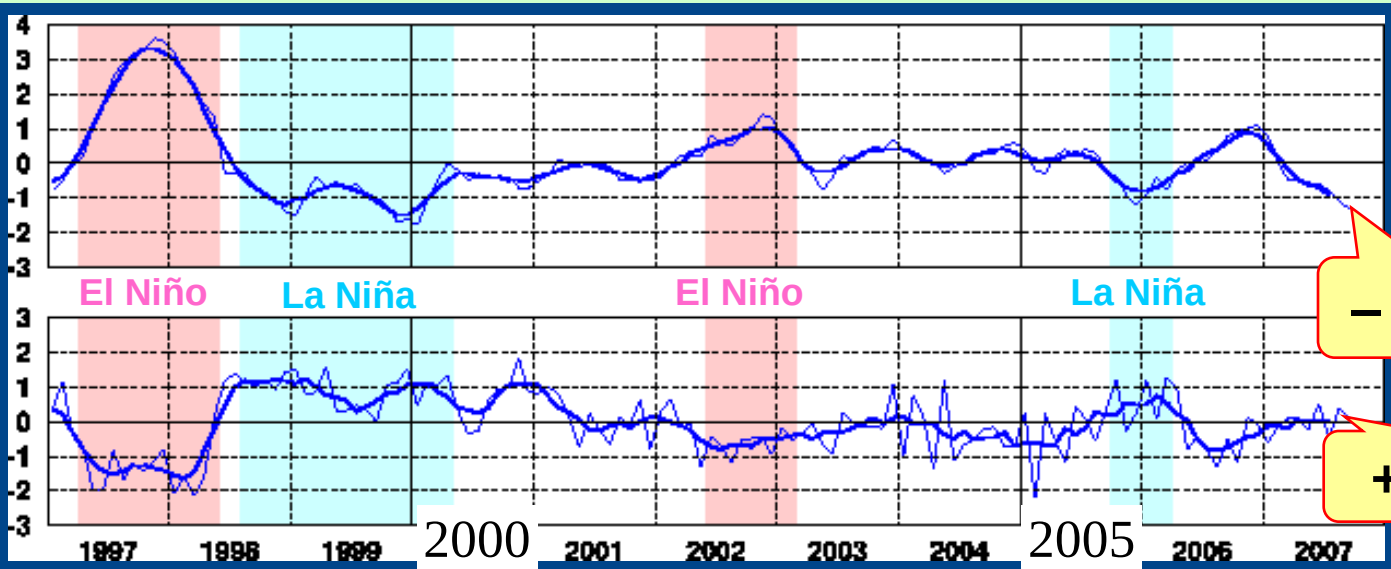
Sep. 2007



SSTs were below normal in the central and eastern equatorial Pacific and positive anomalies are prominent in the western.

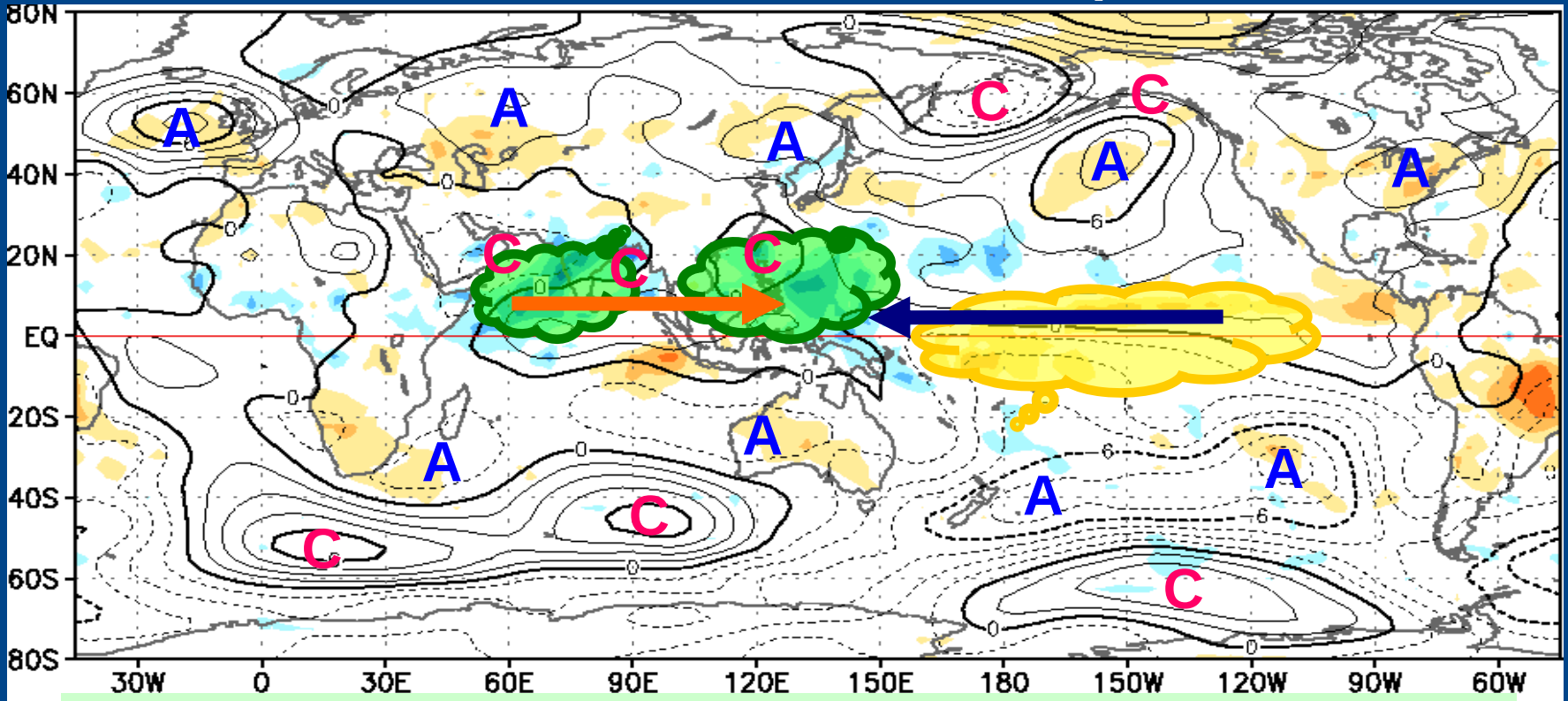
NINO.3 SST deviation (150W-90W, 5S-5N)

SOI Southern Oscillation Index



Convective activities and lower tropospheric circulation anomalies

Outgoing Longwave Radiation (by NOAA) anomalies and 850hPa stream function anomalies in September.



In September, convective activities were above normal around the Philippines and India, while below normal over the tropical central Pacific.

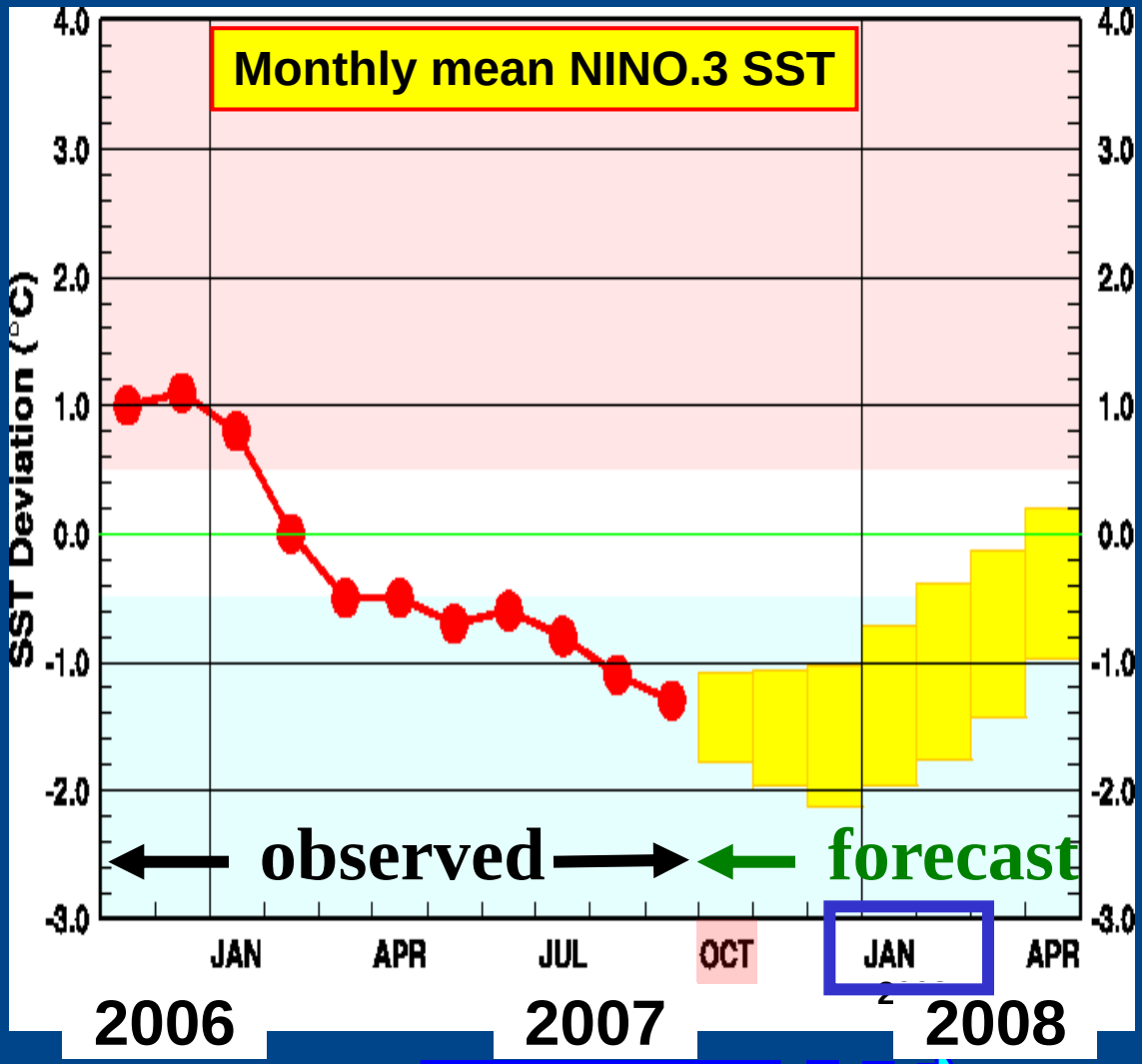
Diagnosis of oceanic conditions

◆ All of above mentioned anomalies were strengthened in September.

◆ These conditions indicate that the La Niña event seems to enter its mature phase in this autumn.

◆Against the precedent during past La Niña events, SSTAs are above normal in the western Indian Ocean and below normal near the Indonesia. This is only a little worrying point.

NINO.3 SST forecast by JMA El Niño forecast model



model spec

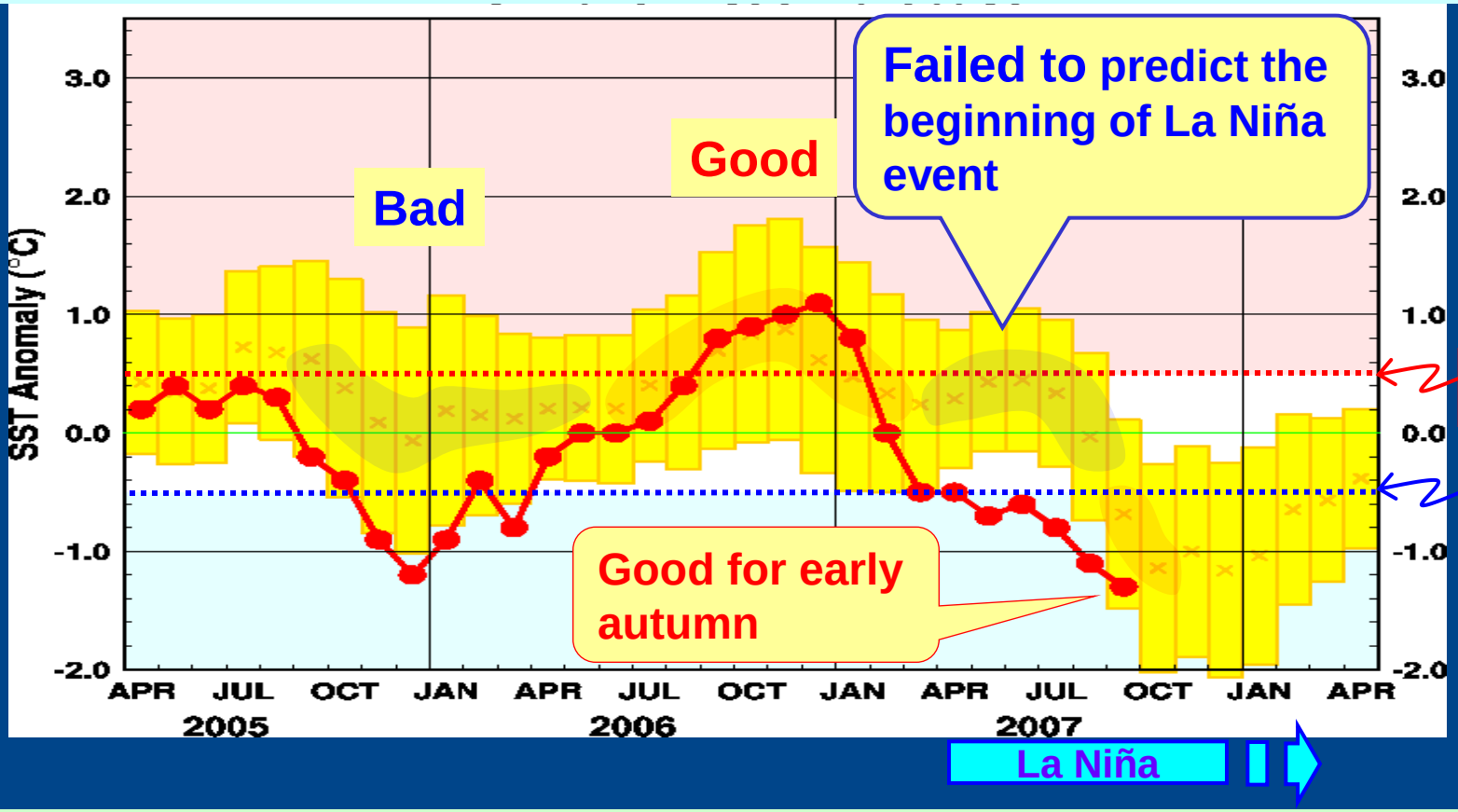
CGCM
- Atmosphere : T42L40
- Ocean : 2.5x0.5-2.0deg L20

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%.

Verification of NINO.3 SST forecast by JMA El Niño forecast model

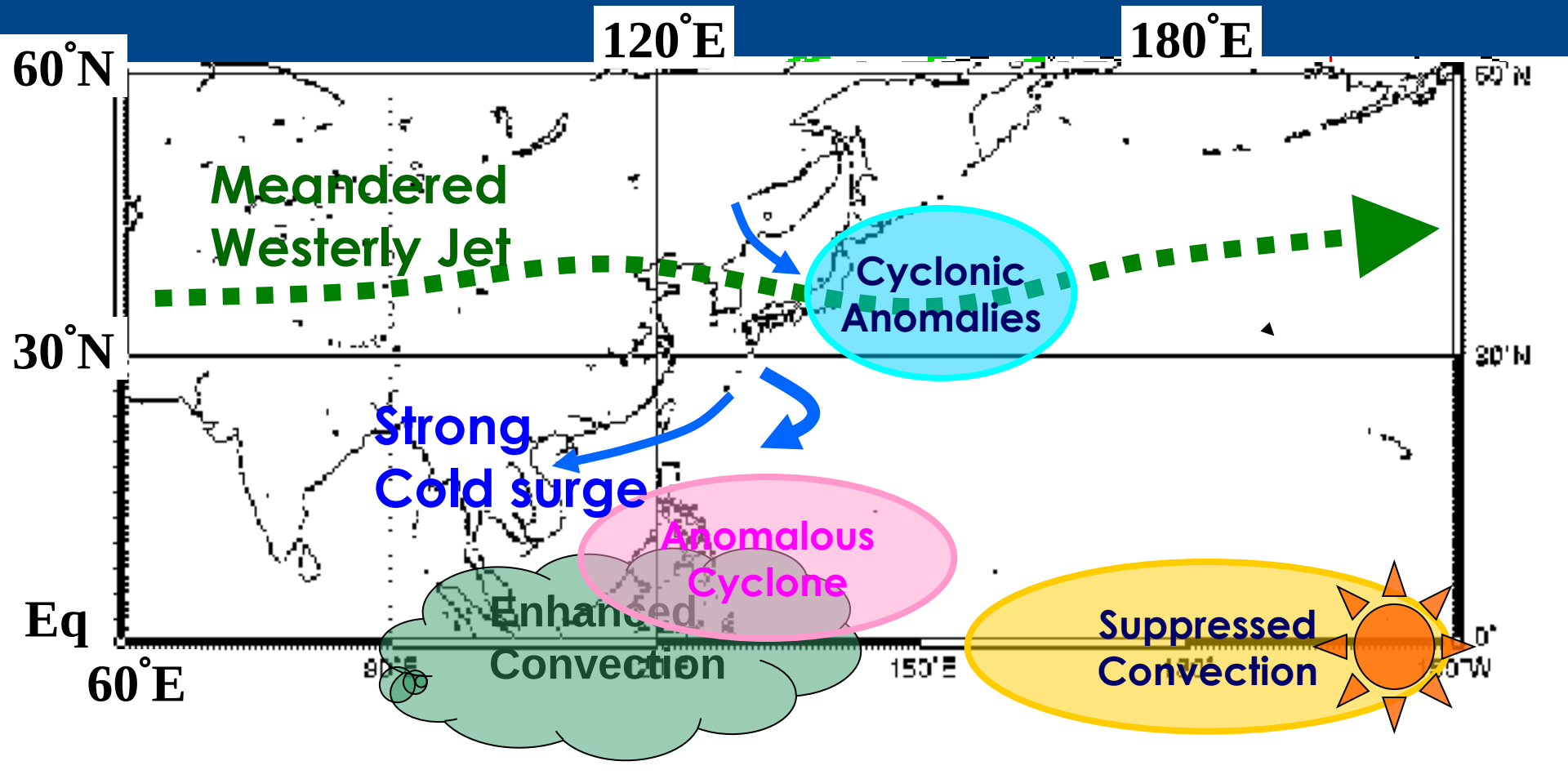
Recent 6-month lead forecast results for NINO.3 SSTA



◆The 6-month lead NINO.3 forecasts (yellow boxes) have reasonable agreement with observation (red solid line).

Anomalous circulation over East Asia typically appeared in La Niña winter

Correlation coefficient analysis between the convective activity over the Maritime Continent and atmospheric circulation fields



Winter mean temperatures typically appeared in La Niña winter

Past La Niña winter	Appearance Rate (%)		
	Below Normal	Near Normal	Above Normal
Northern Japan	37	46	17
Eastern Japan	36	49	15
Western Japan	51	34	16
Okinawa & Amami	37	29	34

◆ Categories of “above normal” for winter mean temperatures have **low** probabilities except for Okinawa.

→ Cold or normal winter is predicted.

Part II Summary of oceanic condition and outlook

< The status of La Niña event >

- Mature phase in this autumn
- Continue until the next spring

< The influence of La Niña event in Asia>

According to statistical studies,

- Strong cold surge over Southeast Asia
- Meandered westerly jet and strong north-west monsoon around Japan
- A cold or normal winter in Japan except for Okinawa.

Part III Numerical prediction

- Outline of EPS
- Atmospheric circulation anomalies by ensemble means of EPS predictions
- Statistical interpretation for winter mean temperatures

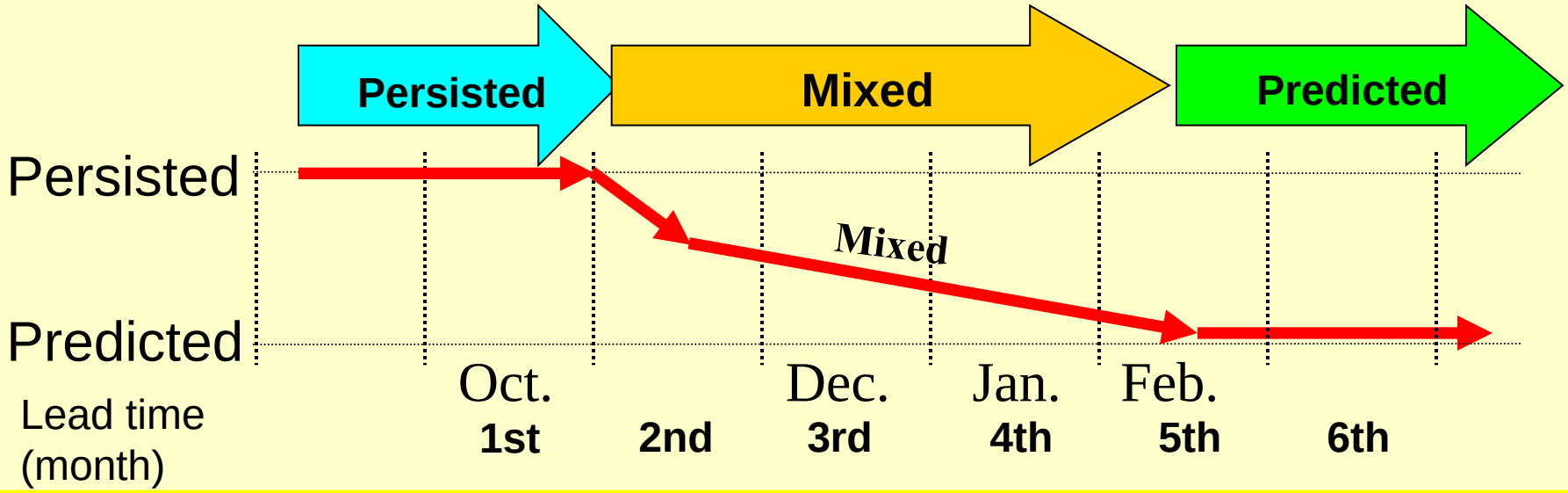
Numerical prediction (1)

Seasonal forecast model spec

AGCM
Atmosphere : TL95L40
SST : refer to the below chart

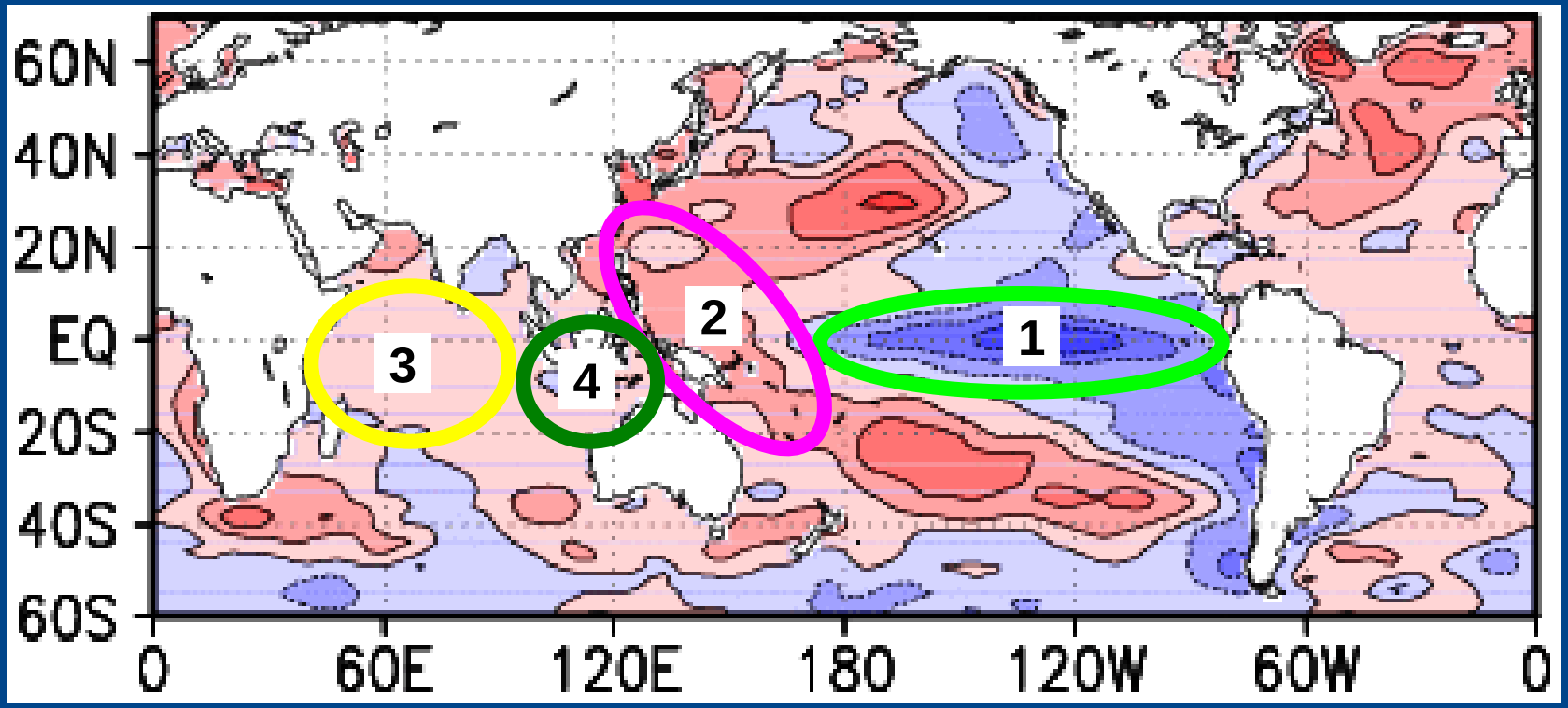
Ensemble method :
Singular Vector
Ensemble size :
51 members

How to merge persisting SSTs and predicted SSTs



Numerical prediction (2)

SST anomalies fed to the model (DJF mean)



◆1 Negative anomalies are significant along the equator in the central and eastern Pacific.

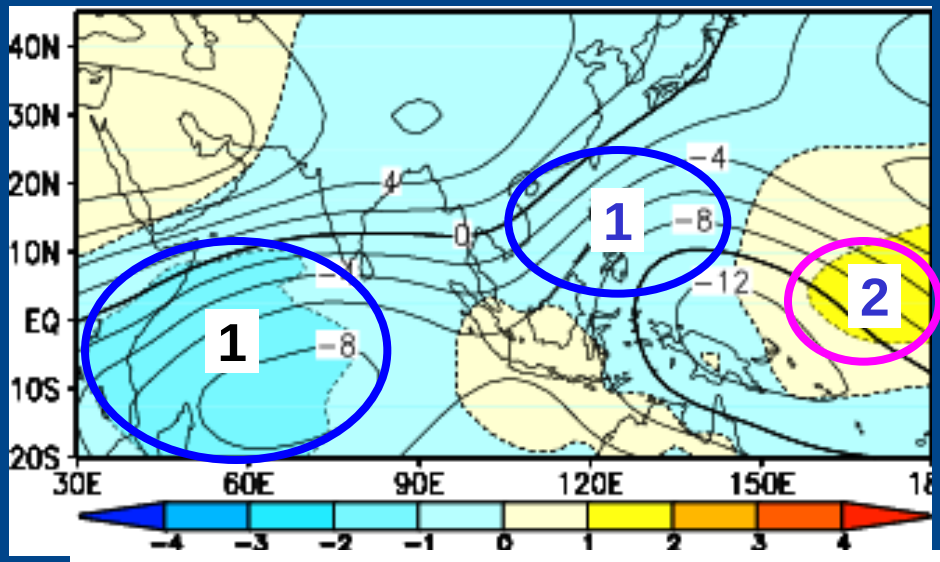
◆2 Positive anomalies are dominant in the western Pacific.

◆3 Positive anomalies are also found in the Indian Ocean.

◆4 Anomalies around Indonesia are almost near normal.

Numerical prediction (3)

Prediction of velocity potential (χ) and precipitation

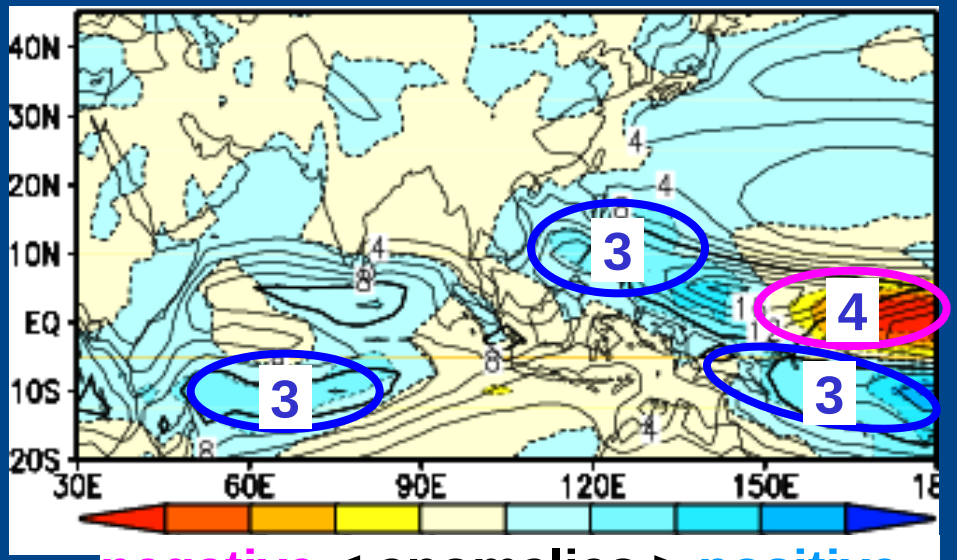


divergence< anomalies >convergence

200hPa velocity potential(χ) and anomalies

◆1 Divergence anomalies over the Indian Ocean and around the Philippines

◆2 Convergence anomalies near the dateline along the equator



negative < anomalies > positive

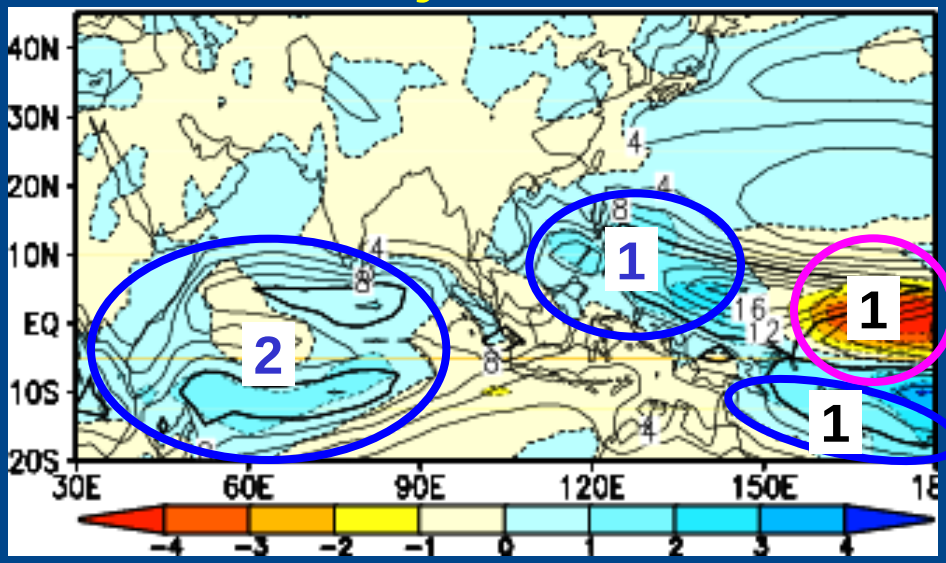
Precipitation and anomalies

◆3 Positive anomalies over around the Philippines, along the SPCZ and over the Indian Ocean

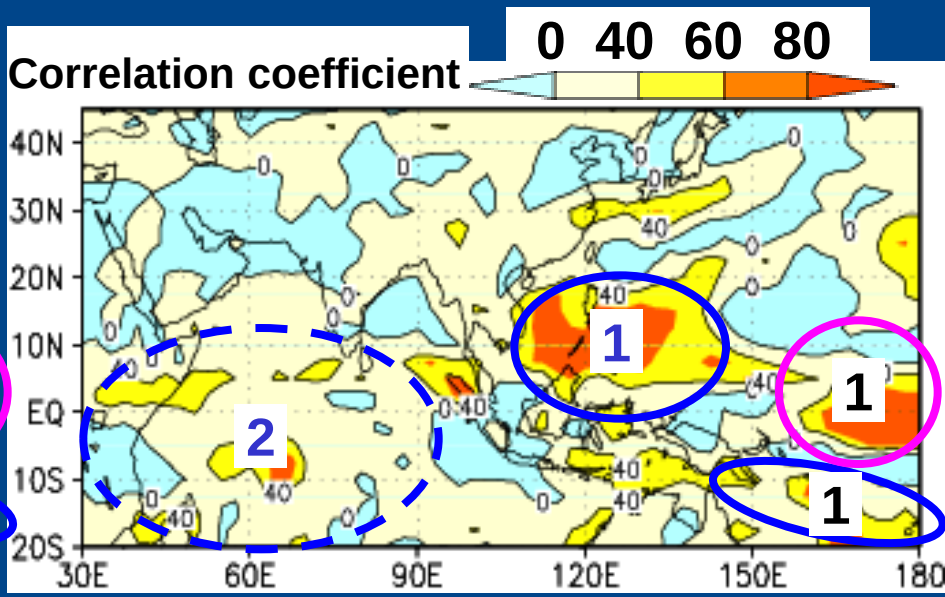
◆4 Negative anomalies along the equator in the central Pacific

Numerical prediction (4)

Compare precipitation forecast with verification skills by hindcasts



negative < anomalies > positive



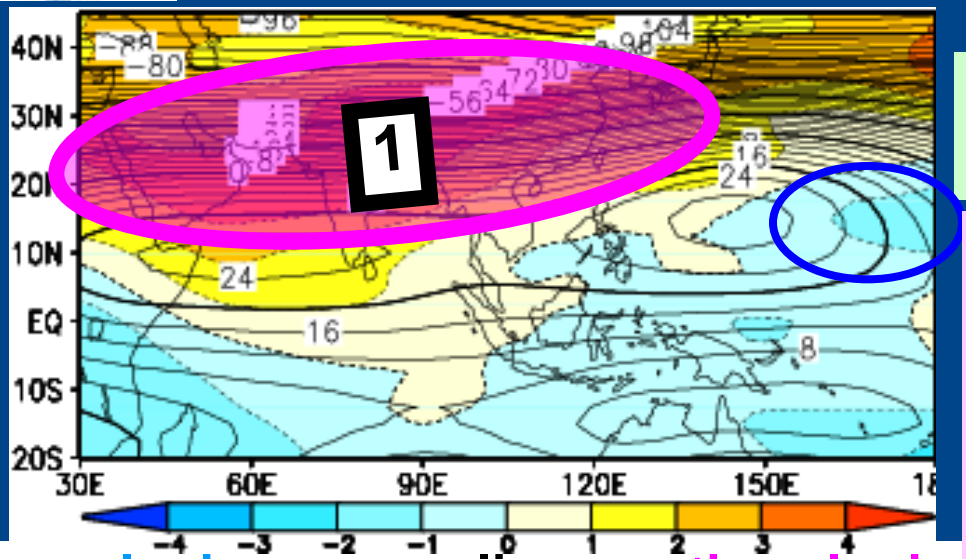
Verification of deterministic forecast of precipitation

◆1 Our EPS has a good skill in precipitation around the Philippines, near the dateline and along the SPCZ.

◆2 There is a little skill in precipitation over the Indian Ocean.

Numerical prediction (5)

Prediction of 200hPa and 850hPa stream functions (ψ)



cyclonic < anomalies > anti-cyclonic

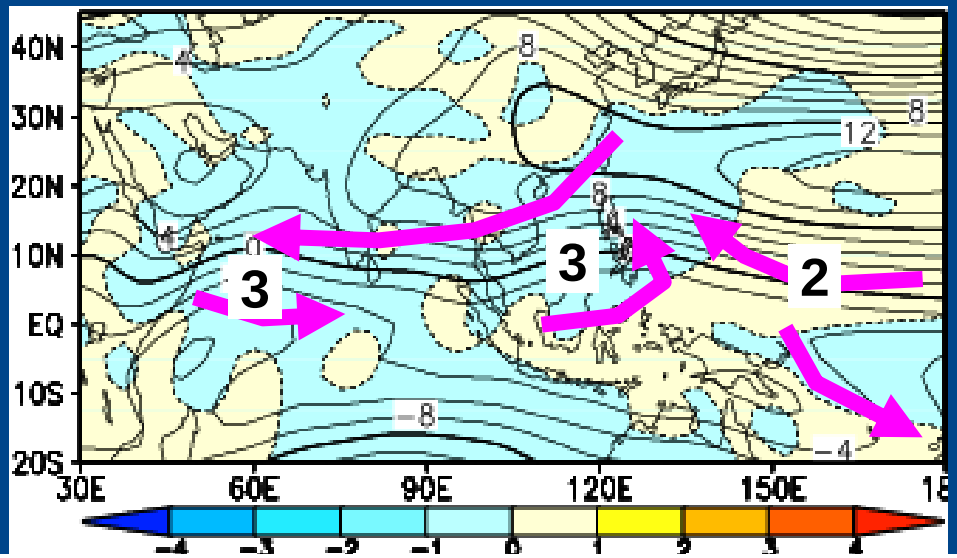
Ψ200 and anomalies

◆1 Anti-cyclonic anomalies prevail from South Asia to East Asia.

◆ In the Pacific, the Walker circulation seems to be stronger than normal.

◆ Cold surge in Southeast Asia also seems to be stronger than normal.

◆ Sub-tropical jet over Asia seems to shift slightly northward compared to its normal position.



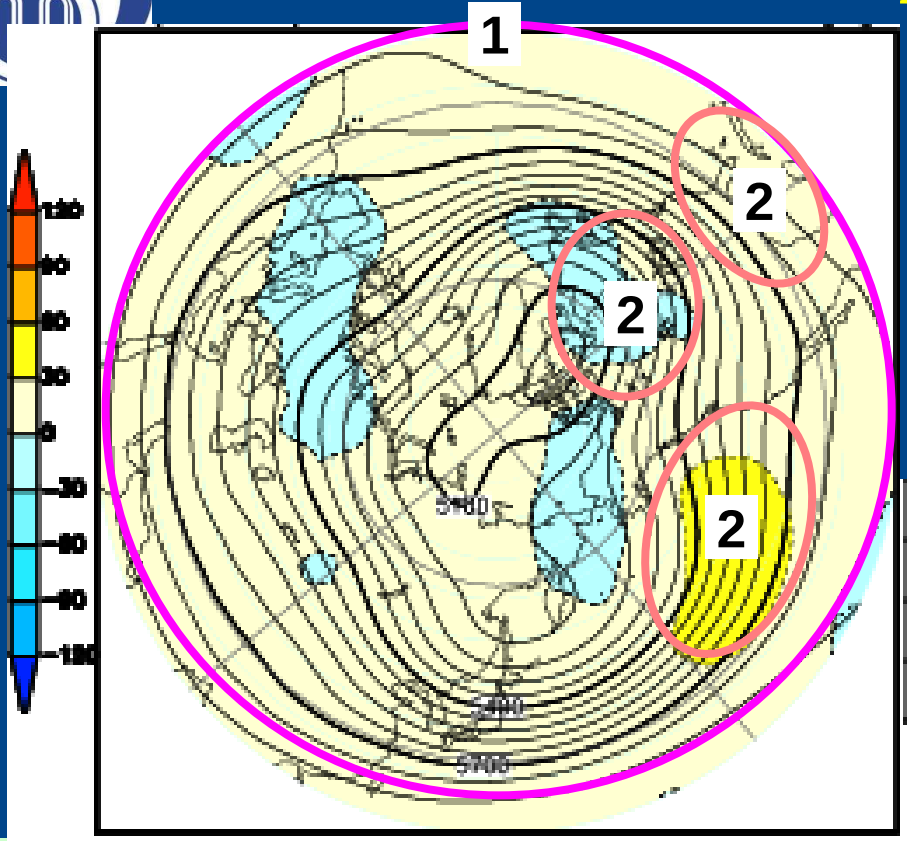
cyclonic < anomalies > anti-cyclonic

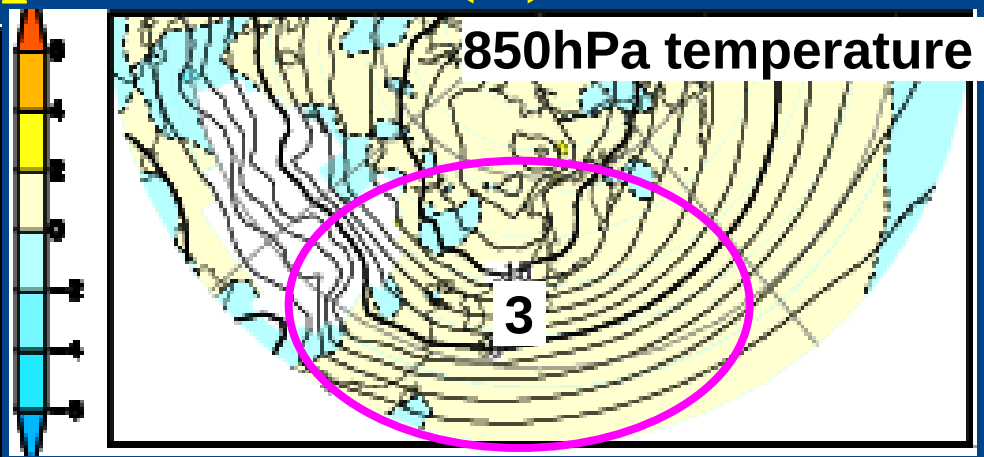
Ψ850 and anomalies

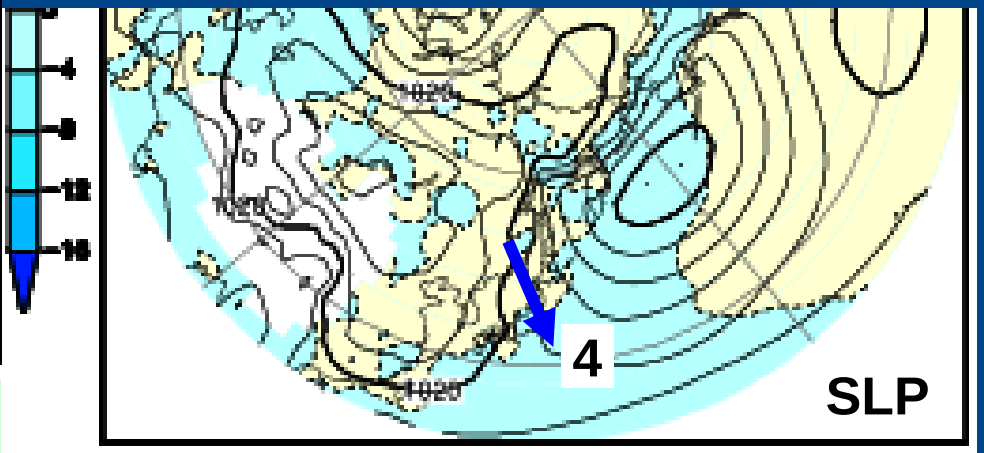
◆2 Trade wind over the western Pacific are stronger than normal.

◆3 Cyclonic anomalies are found around the Philippines and in the western Indian Ocean.

Numerical prediction (6)







◆1 Slightly positive Z500 anomalies prevail over almost the Northern Hemisphere.

◆2 Positive anomalies are dominant in the eastern Pacific. This seems to be like a positive TNH patterns enhanced by the La Niña.

◆3 Slightly positive T850 anomalies prevail over East Asia.

◆4 The Aleutian Low shifts westward, then the north-west monsoon over Japan seems to be slightly stronger than normal.

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	16	22	62
Eastern Japan	9	34	57
Western Japan	12	46	42
Okinawa & Amami	9	28	63

◆ Categories of “normal” or “above normal” have high probability for seasonal mean temperature in DJF 2007/08.

◆ According to verification, this method has a little skill.

Part III Summary of numerical prediction

- The Enhanced convection is predicted around the Philippines and in the western Indian Ocean.
- The sub-tropical jet over Asia seems to shift slightly northward compared to its normal position.
- The cold surge in Southeast Asia seems to be stronger than normal.
- Statistical interpretation predicts a warm winter over Japan (except for Western Japan) with a high probability.

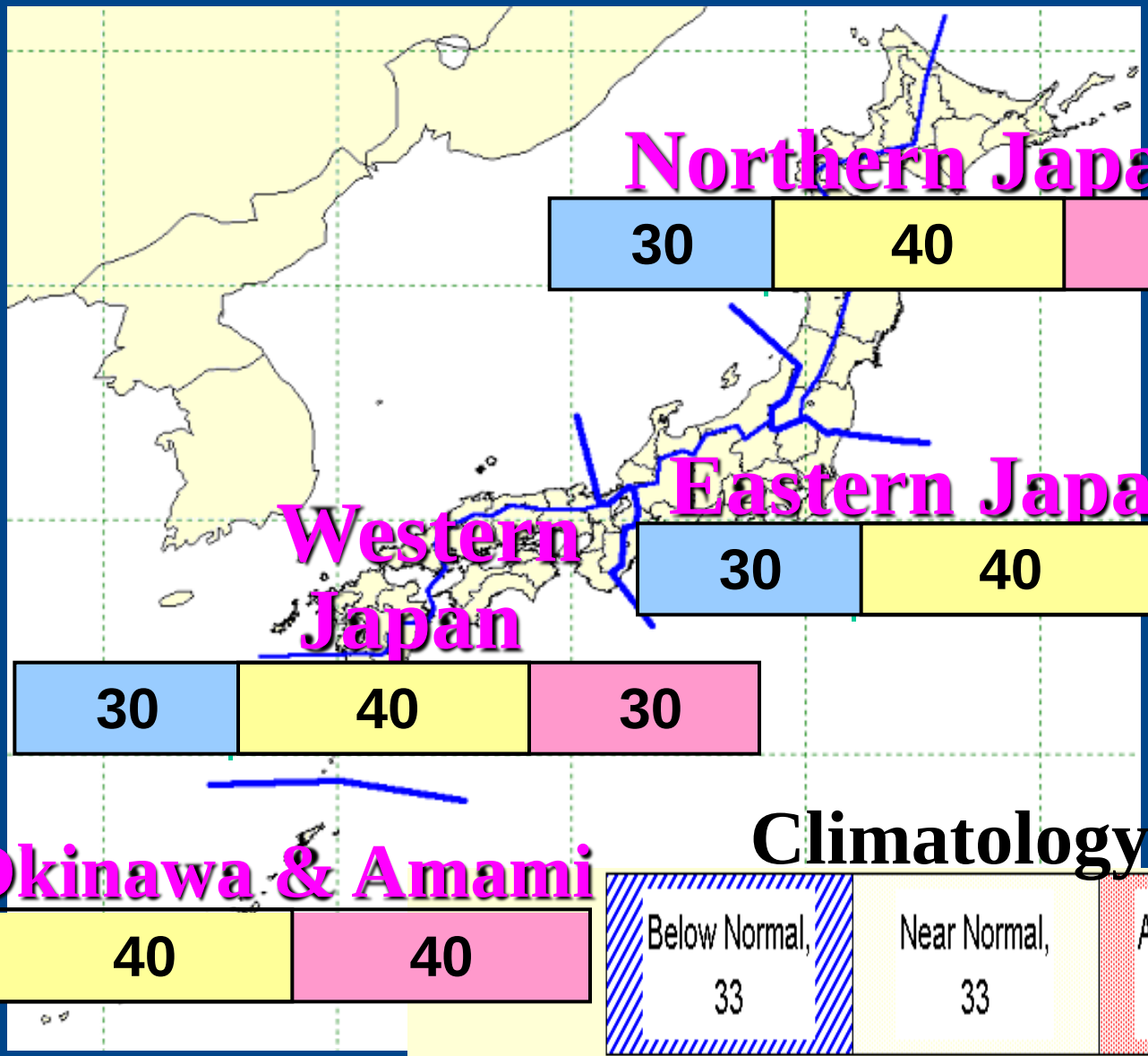
Conclusion (1)

- The La Niña event has developed to a mature phase in this autumn and it is predicted to continue during the next spring.
- A signal of warm winter and a signal of cold winter cancel each other, so the base of winter mean temperature is predicted to be near normal.
- More to the point, the warm effect by the long-term trends and the cold effect by the La Niña event are balanced.

Conclusion (2)

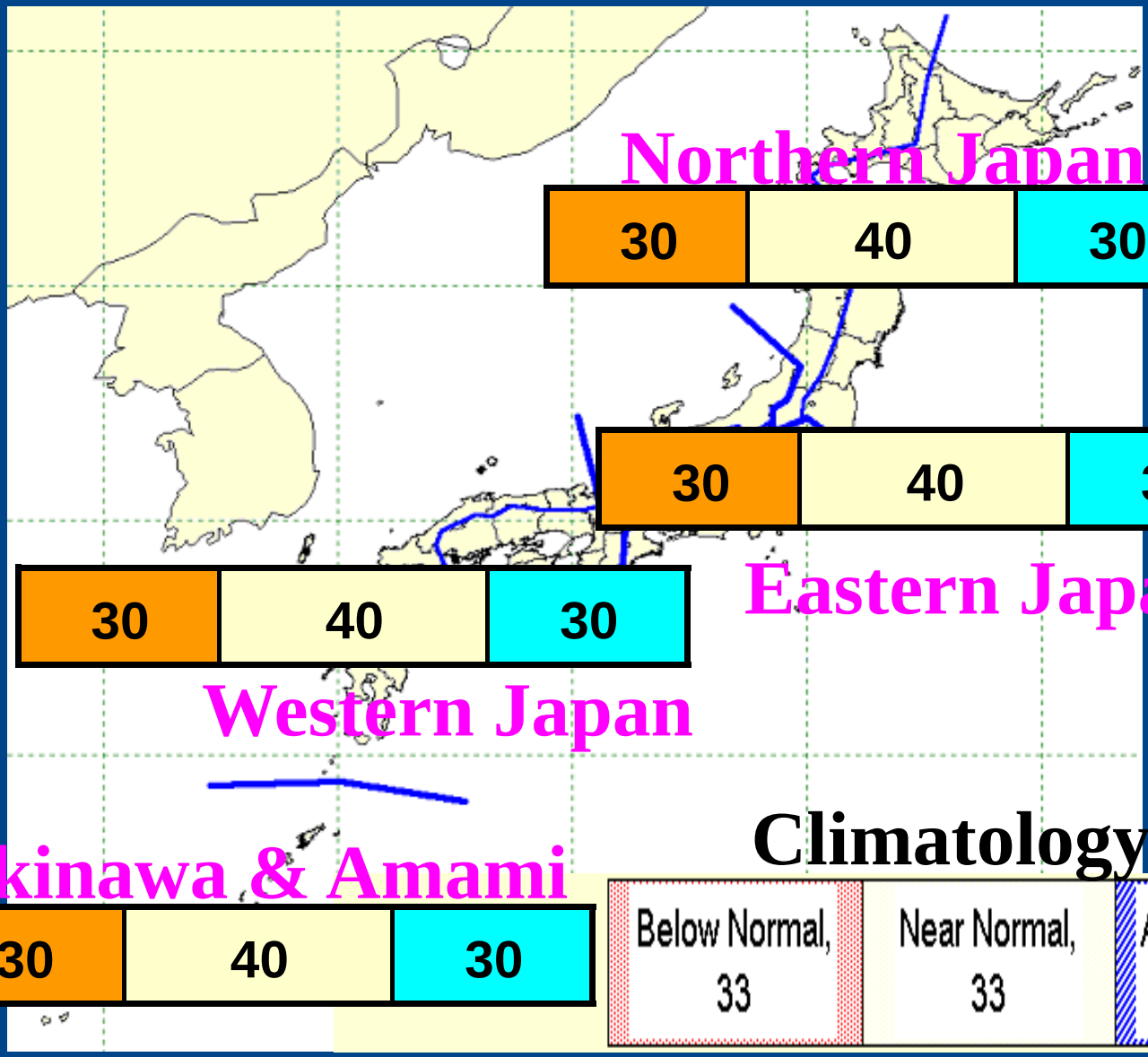
- Taking into account that the Arctic Oscillation which is closely connected with winter climate in Japan is not predicted as a significant signal, probability of warm or cold winter is expected to be small.
- Nonetheless, we should carefully keep monitoring the situation of the Arctic Oscillation because the active convection around the Maritime Continent affected by the La Niña event will work synergistically in increasing the possibility of major cold waves if the Arctic Oscillation becomes a certain level of negative phase.

Probability of seasonal mean temperature for winter (Dec. 2007 – Feb. 2008)



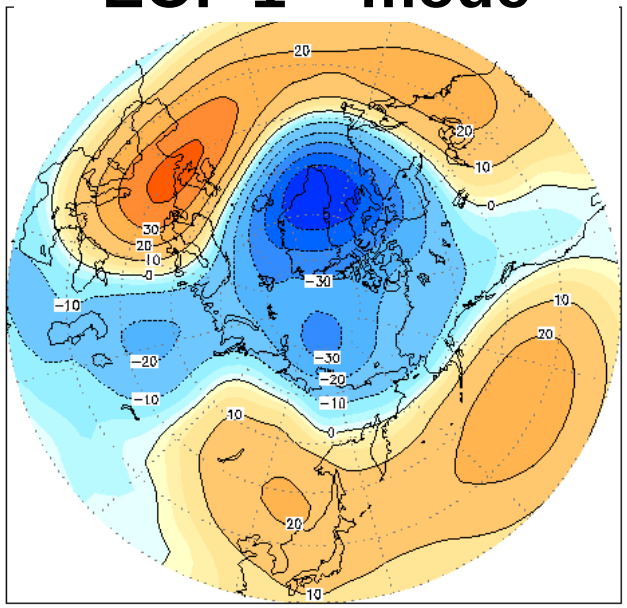
Thank you.

Probability of seasonal mean precipitation for winter (DJF) 2007/08

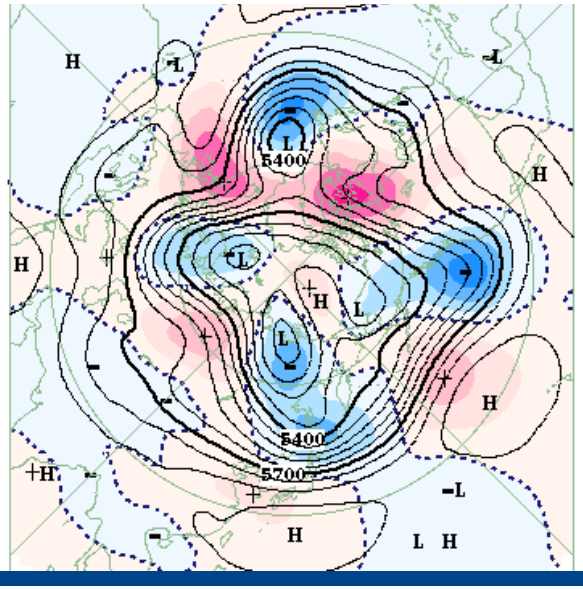


Current status of AO

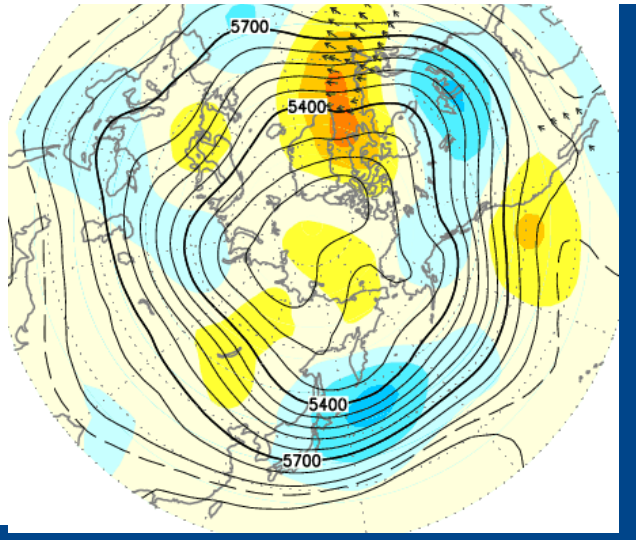
EOF 1st mode



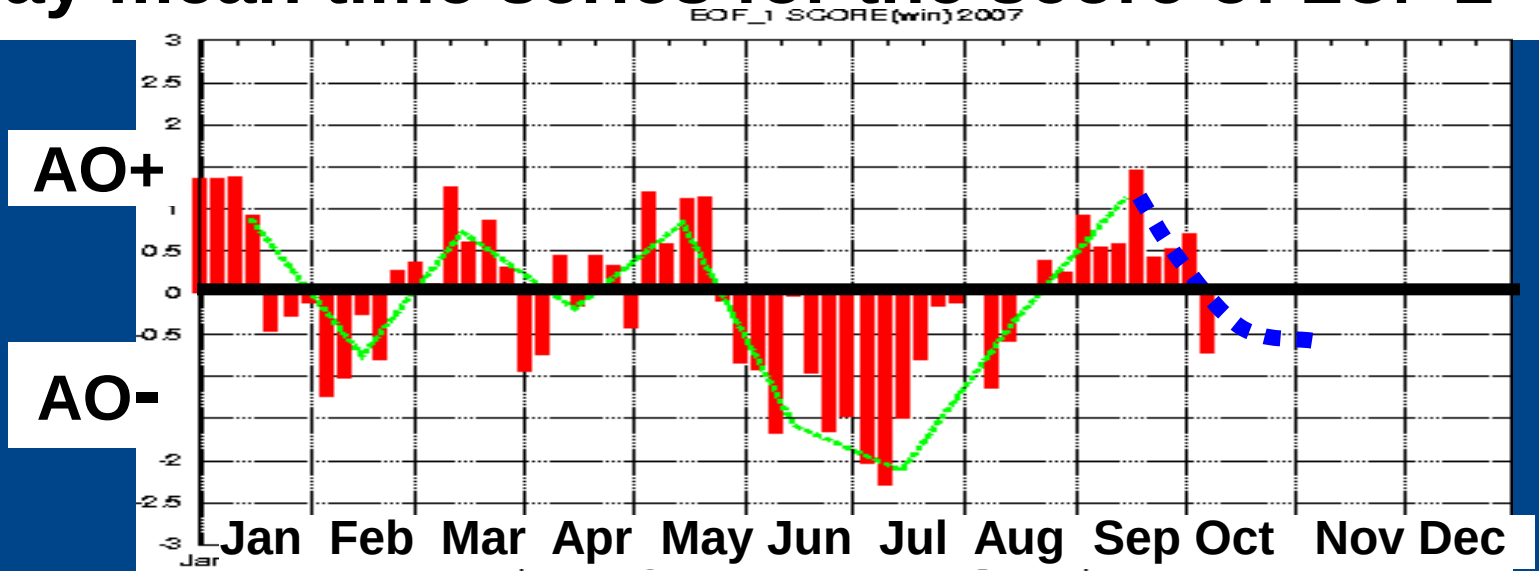
2nd 5-day mean in Oct.



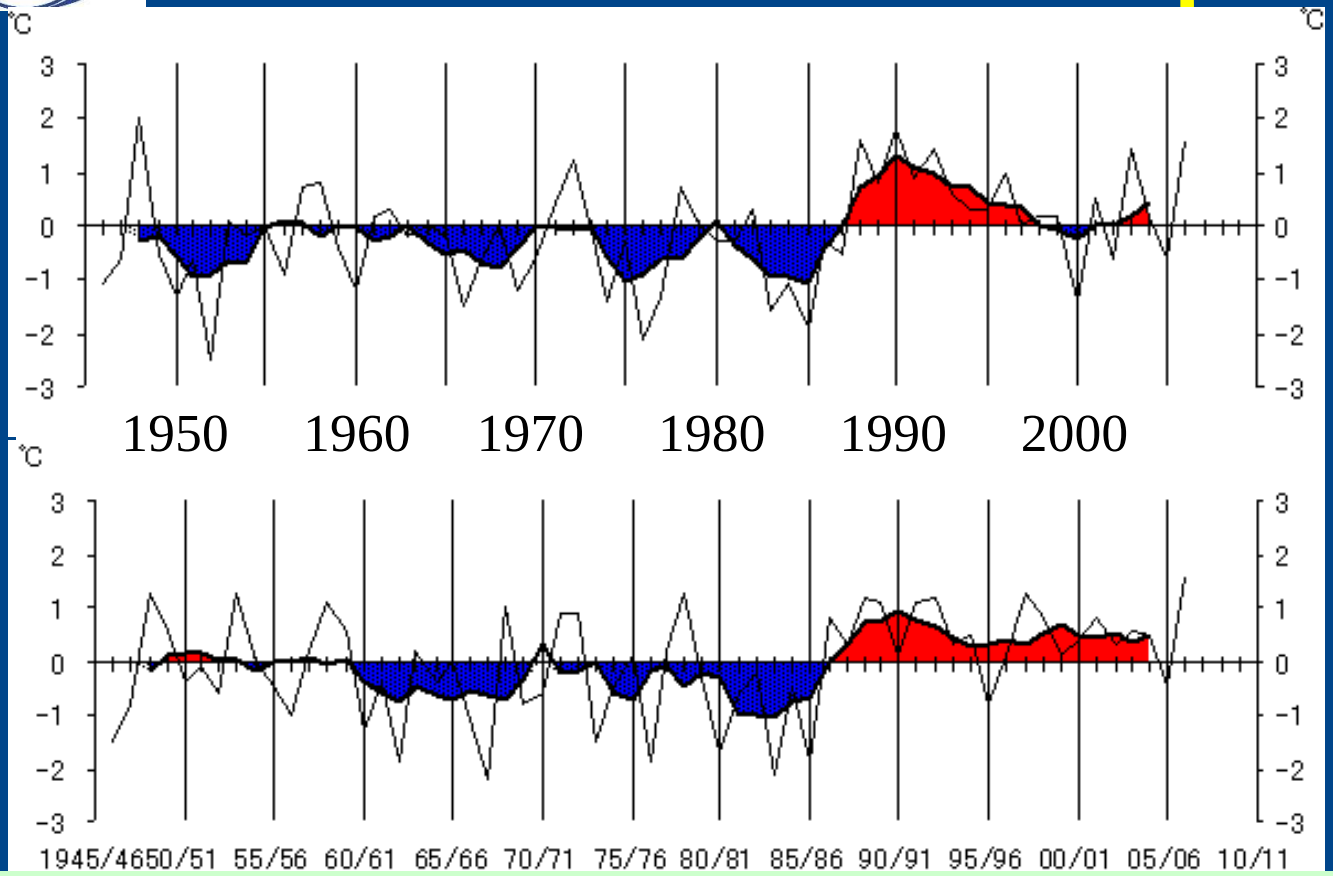
Latest prediction for late Oct. by 1month forecast



5-day mean time series for the score of EOF 1st mode



Long-term trend (2)
– winter mean temperature -

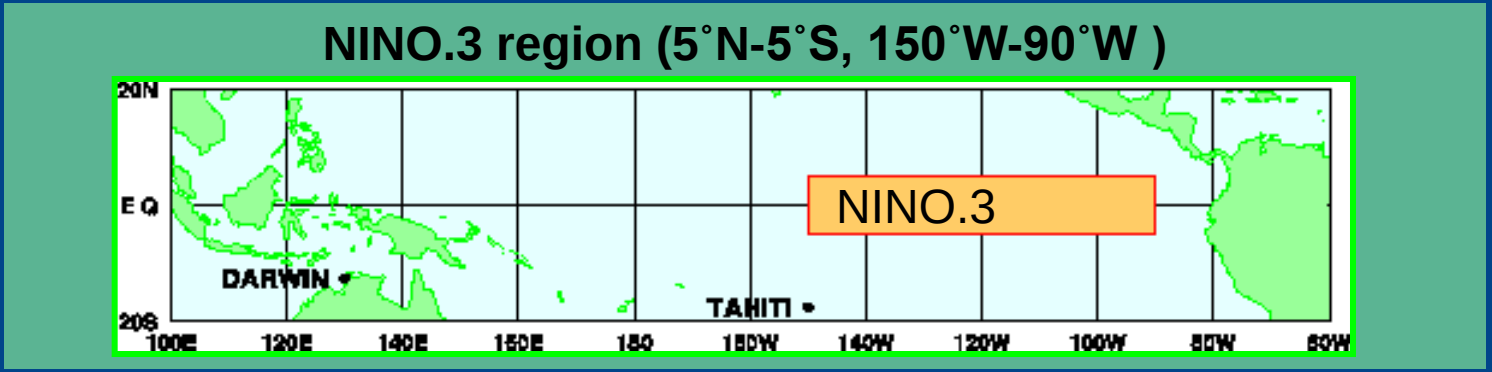


Northern Japan

Western Japan

◆ **Recently, winter mean temperatures were near normal with a large interannual variation in Northern Japan, while they were mostly above normal in Western Japan.**

JMA Definitions for El Niño and La Niña events

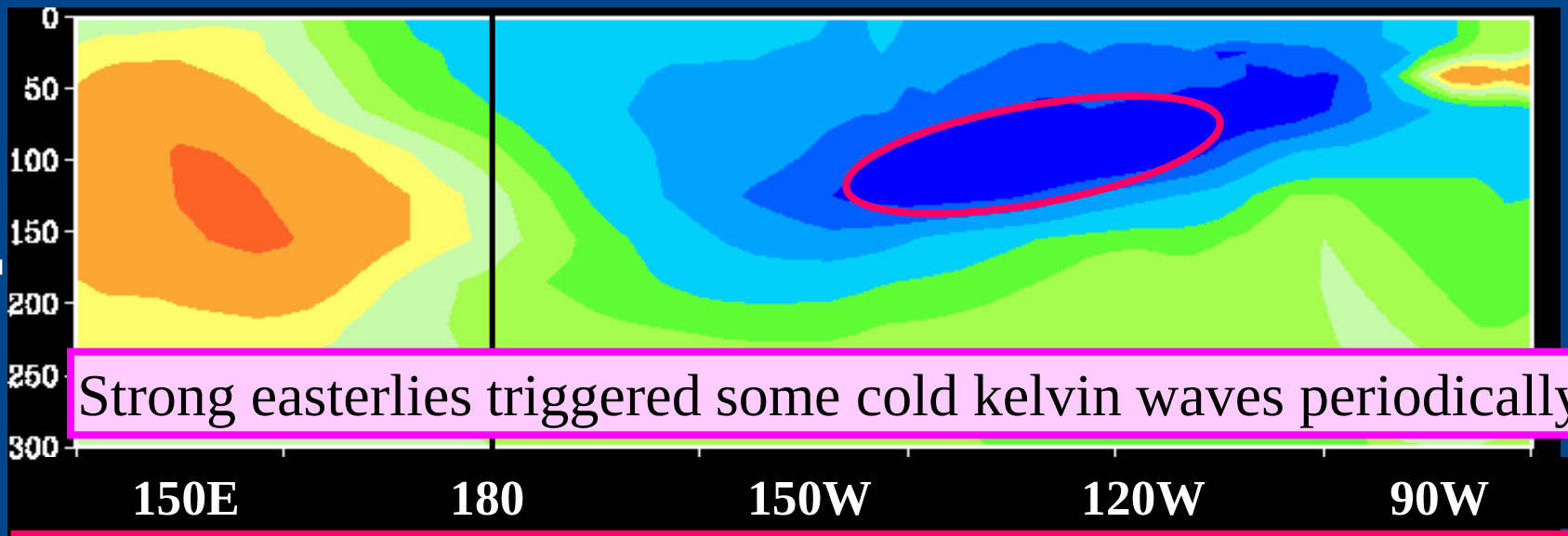


- **Based on 5-month running mean values of NINO.3 SST deviations from the climatological mean based on a sliding 30-year period.**

El Niño: the value is greater than or equal to +0.5 ˚C continuously for six months or longer.

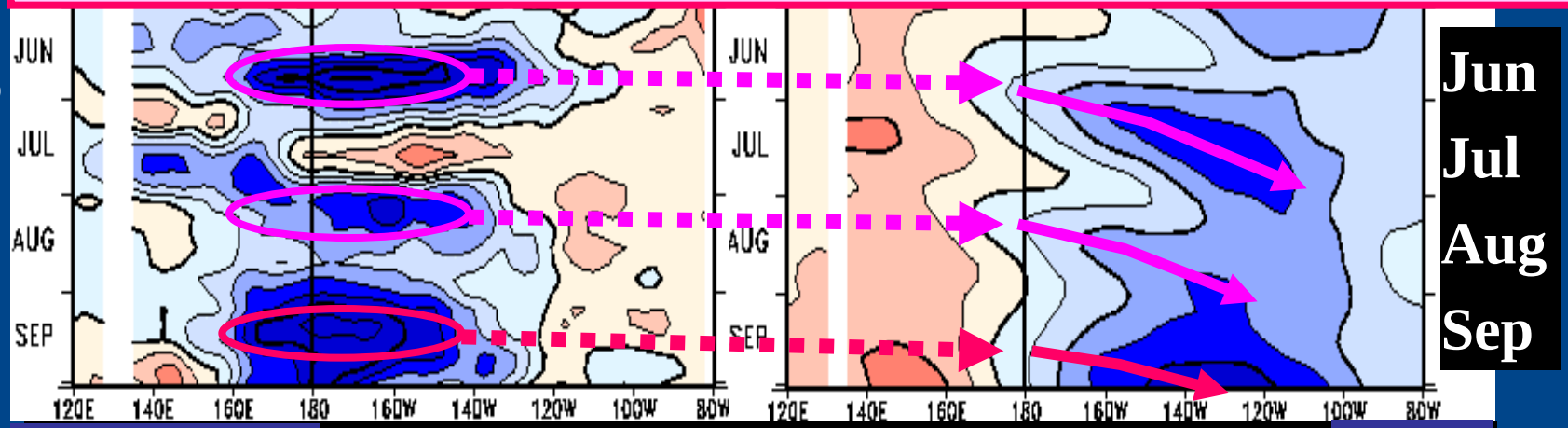
La Niña: the value is less than or equal to –0.5 ˚C continuously for six months or longer.

Subsurface temperature anomalies along the equator in the Pacific in September



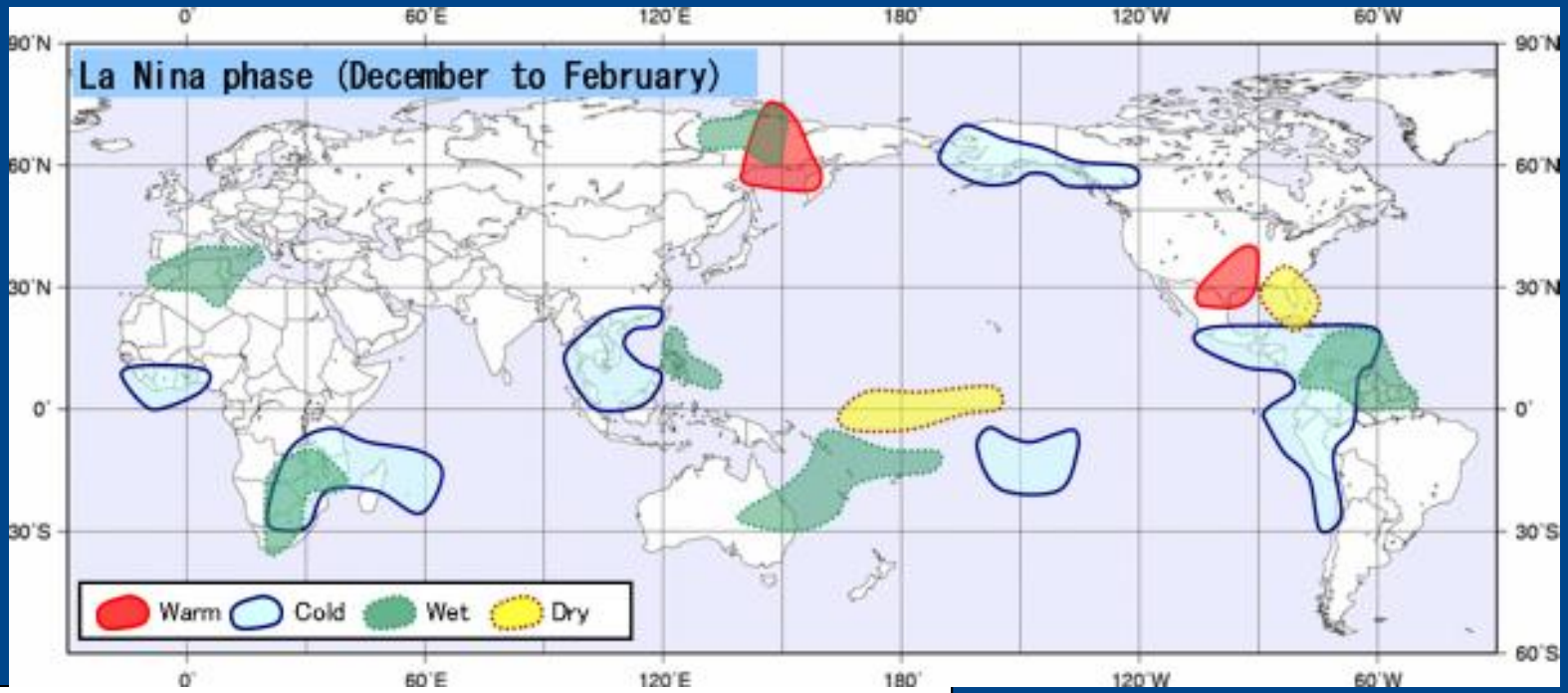
Strong easterlies triggered some cold kelvin waves periodically.

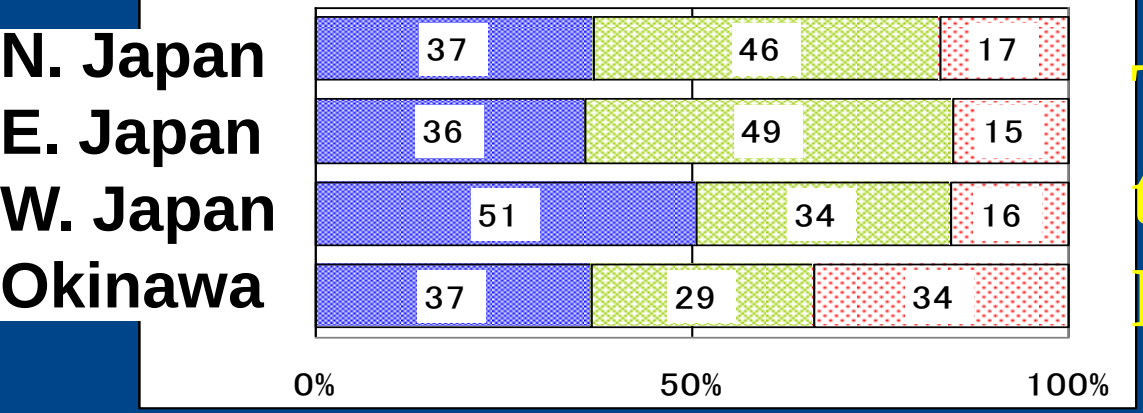
Largely amplified cold kelvin wave was triggered in September.



Wind stress | Time Longitude cross section | OHC

Climate tendency during La Niña phase





Temperature tendency during La Niña phase in Japan

Numerical prediction (2)

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

For global ocean grid,

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