



Seasonal Outlook for summer 2011 over Japan

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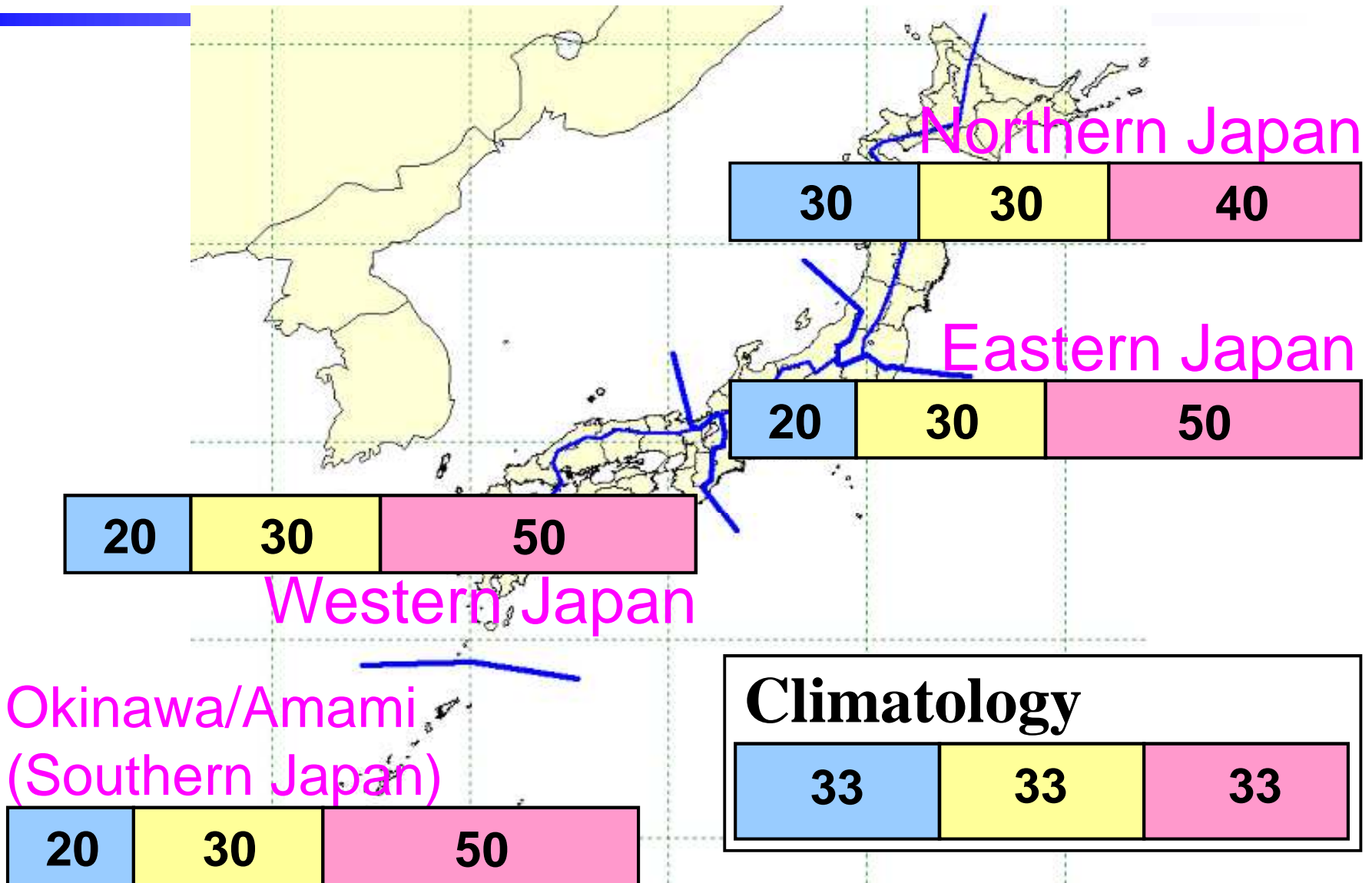


Outline

- JMA's probability forecasts for summer
- Long-term Trends for Japan
- Numerical Prediction for Summer 2011
 - Oceanic condition
 - Atmospheric condition
- Summary

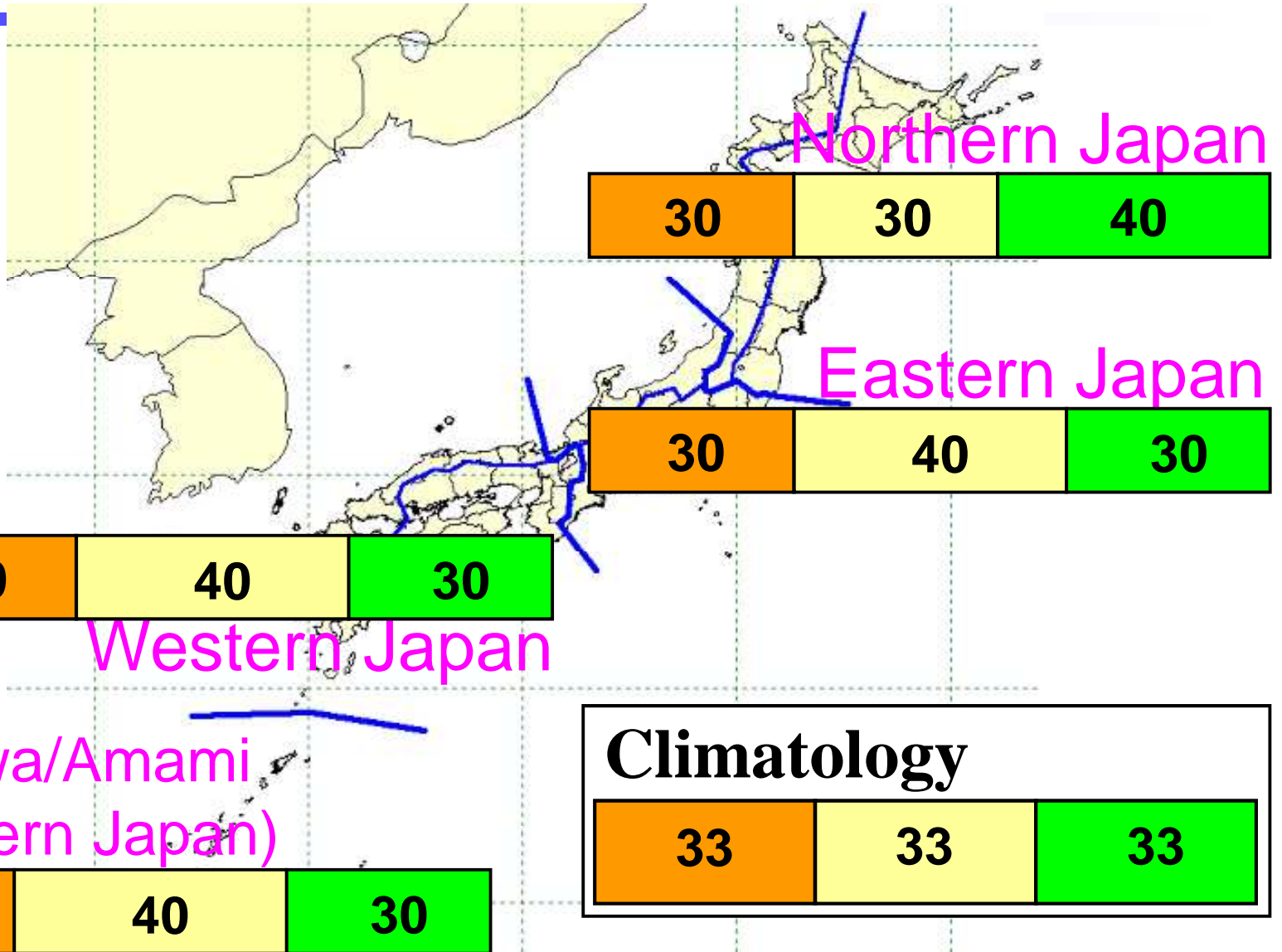


Probability of seasonal mean temperature for summer (June – August) 2011





Probability of seasonal mean precipitation for summer (June – August) 2011



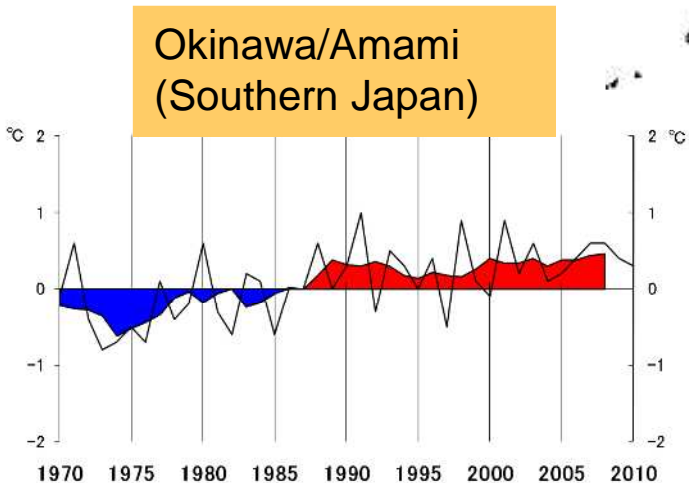
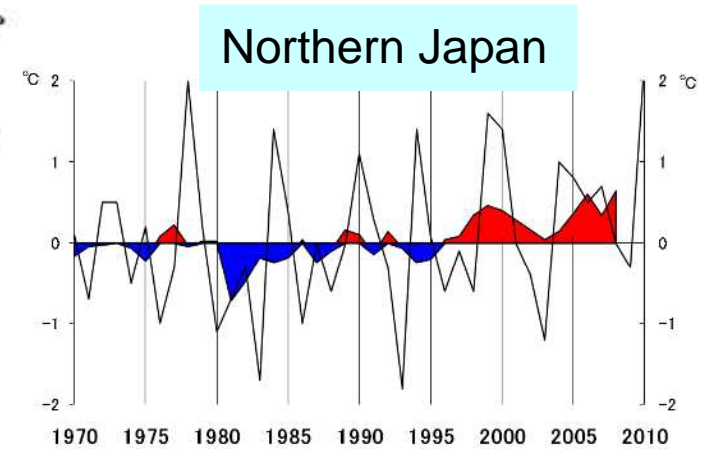
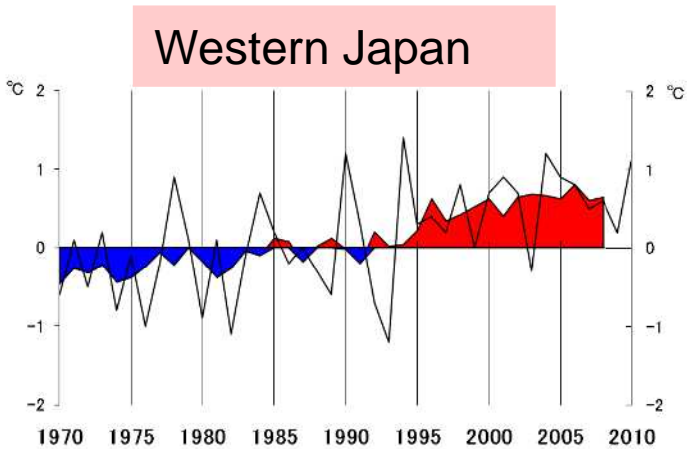


Long-term Trends

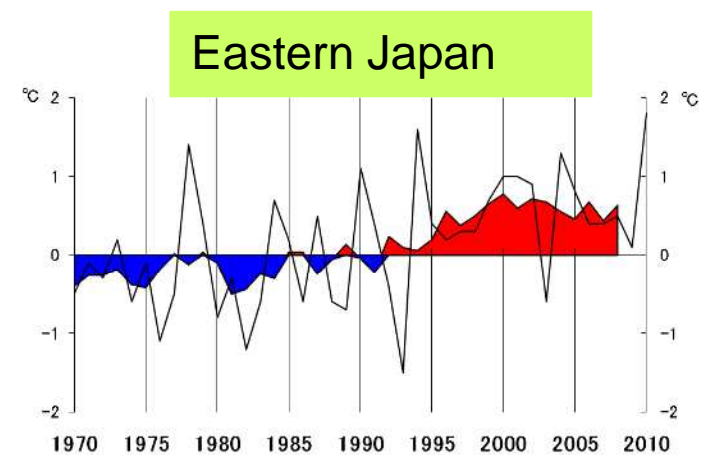


Long-term Trends

Summertime Area-averaged Temperature



Okinawa/Amami (Southern Japan)



Long-term upward trends are clear in the summertime temperatures over Japan except for the Northern Japan. In the Northern and Eastern Japan, last summer was the hottest summer in the history of observation.



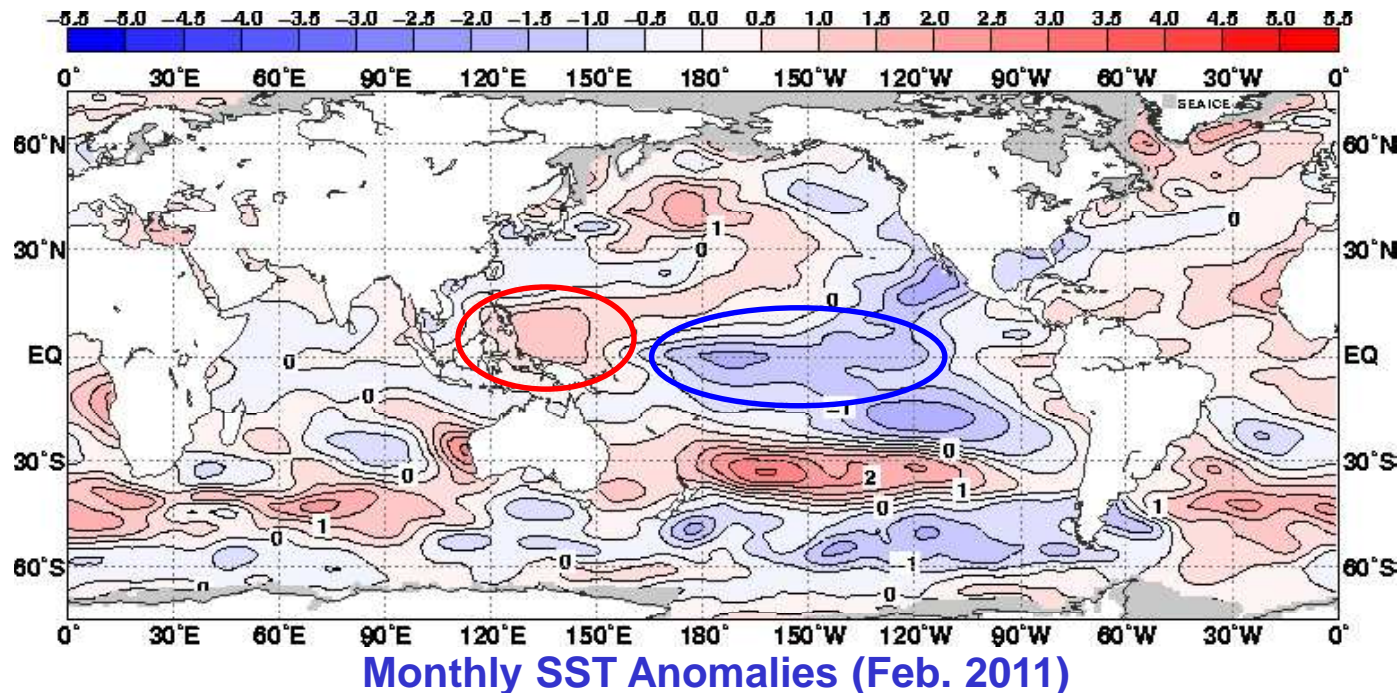
Numerical Prediction for summer 2011



Numerical Prediction (1)

Oceanic Condition in February 2011

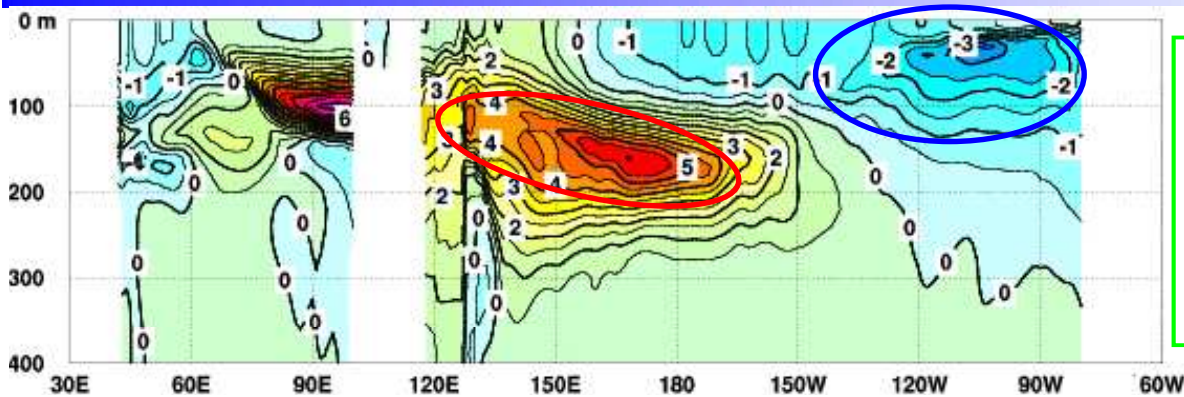
In February 2011, SST anomalies were remarkably negative in the central equatorial Pacific, and were positive near Indonesia. This indicates that La Niña conditions continued.





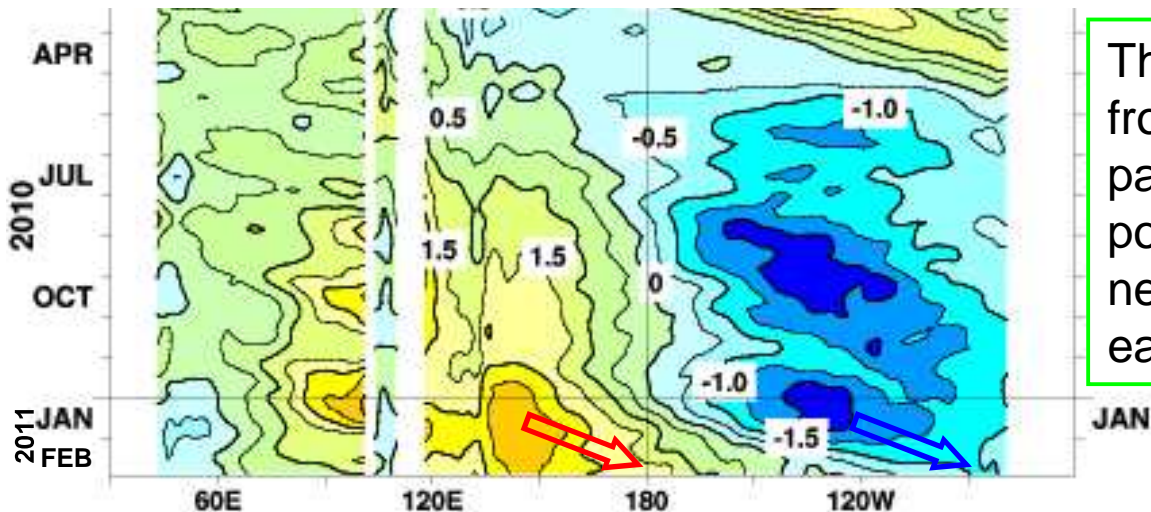
Numerical Prediction (2)

Ocean Heat Content along the equator



Subsurface temperature anomalies were remarkably positive in the western equatorial Pacific, and were negative in the eastern parts.

Depth-longitude cross section of subsurface temperature anomalies along the equator in the Indian and Pacific Oceans. (Feb. 2011)



The positive anomalies expanded from the western part to the central part in February. Migration of the positive anomalies would weaken negative SST anomalies in the eastern equatorial Pacific.

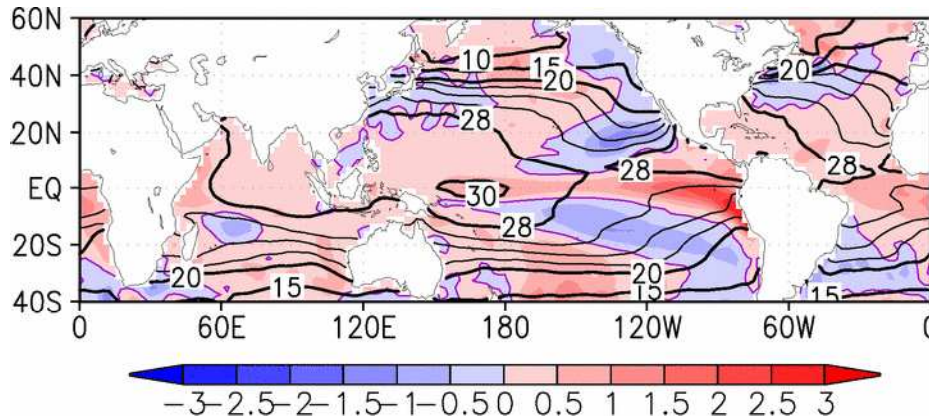
Time-longitude cross section of ocean heat content (OHC; vertically averaged temperature in the top 300 m) anomalies along the equator in the Indian and Pacific Oceans. (Feb. 2011)



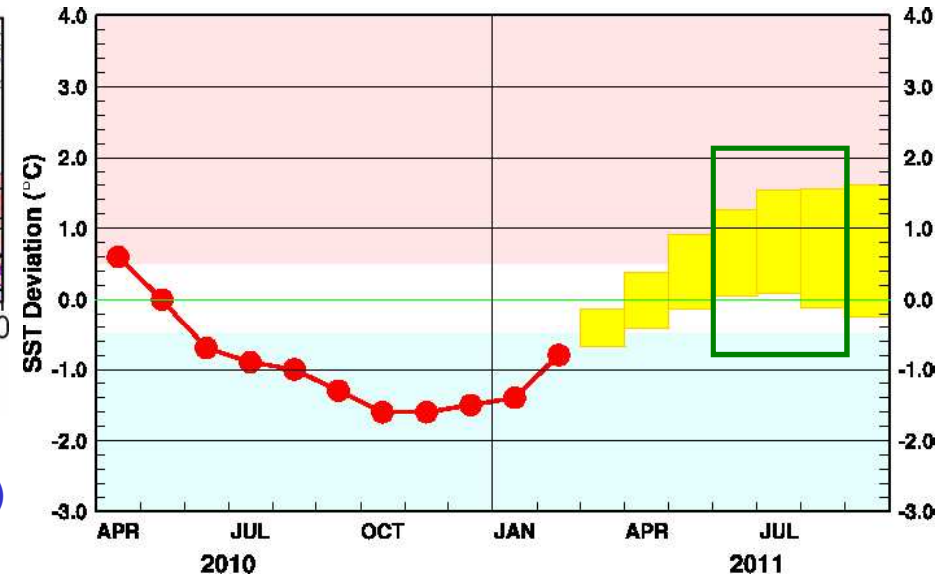
Numerical Prediction (3)

NINO.3 SST forecast

JMA's numerical model predicts El Niño-like SST anomalies in this summer. However, at the end stage of La Niña conditions in spring, the prediction of NINO.3's SSTs in summer has relatively low accuracy and tends to be higher than the observed one. Considering the hind-cast results, NINO.3 SST will be mostly near normal during summer 2011.



SST Forecast and Anomalies (Jun-Aug mean)



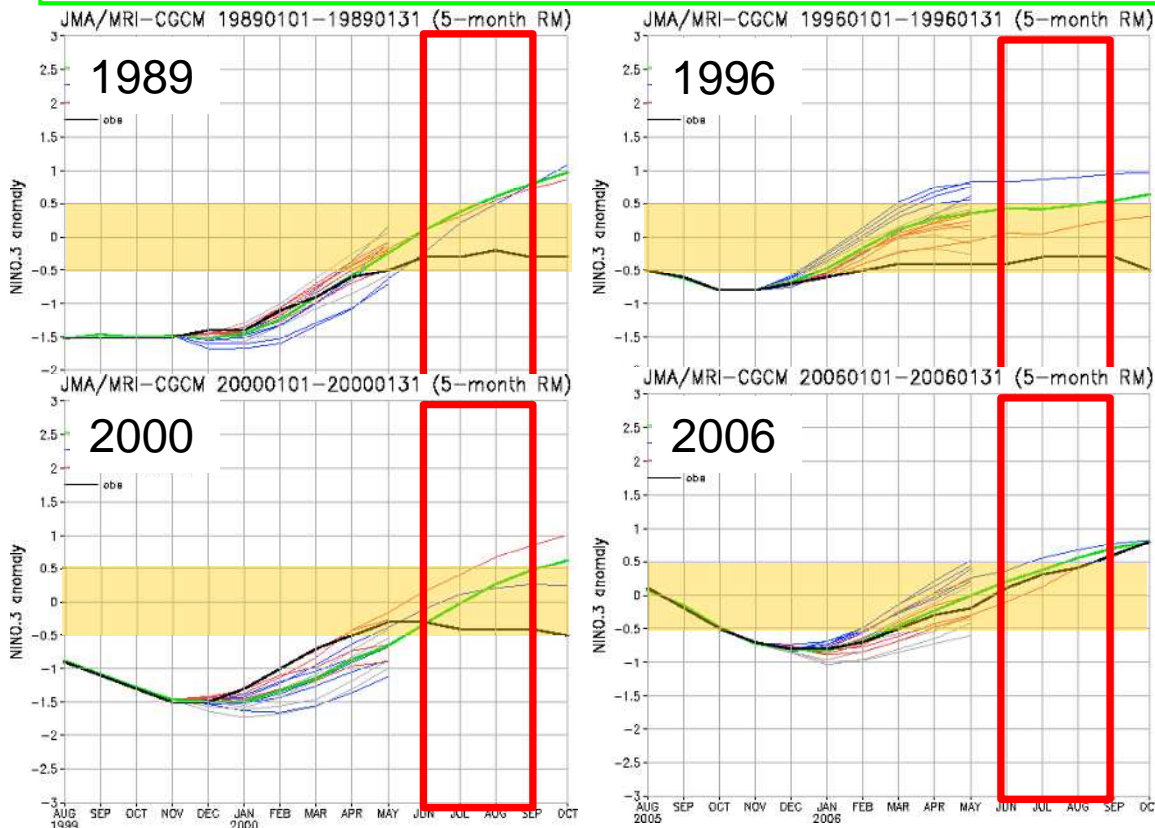
The monthly SST deviation in NINO.3.



Numerical Prediction (4)

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Examples of hindcast at the end stage of La Niña conditions in spring

Black line shows the observed SST deviation and green line shows the ensemble prediction.

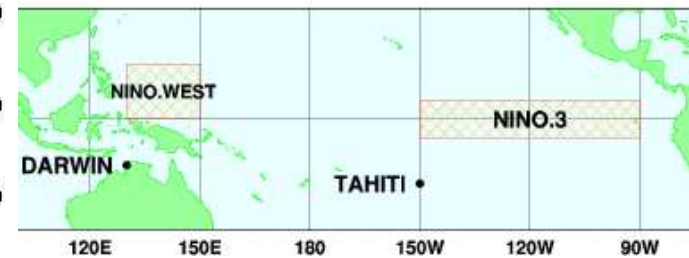
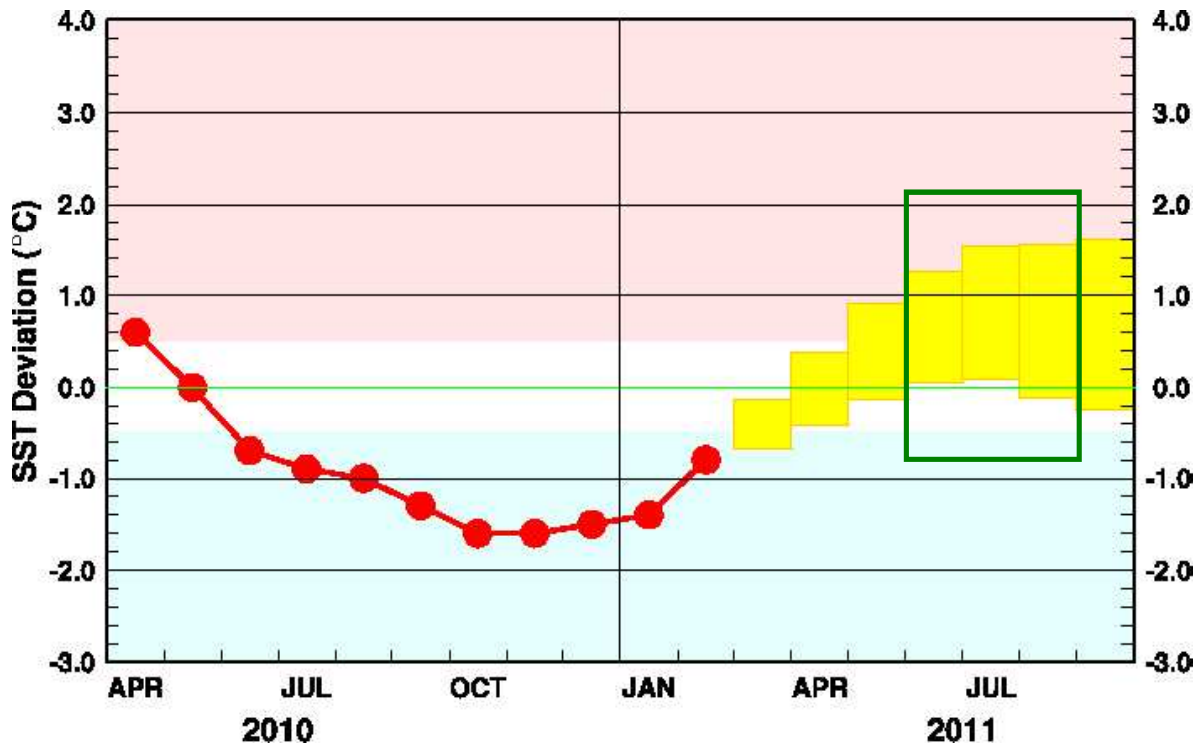


Numerical Prediction (5)

NINO.3 SST forecast

The current La Niña conditions are likely to end in spring and subsequent neutral conditions will continue during summer.

A time series of the monthly SST deviation in NINO.3.



Red line with closed circles shows the observed SST deviation and yellow boxes show the predicted one by the numerical model. Each box denotes the range where the deviation will be included with the probability of 70%.

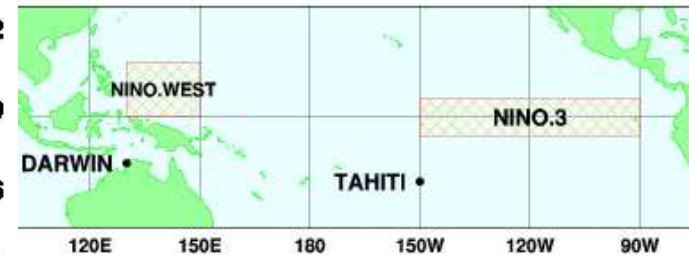
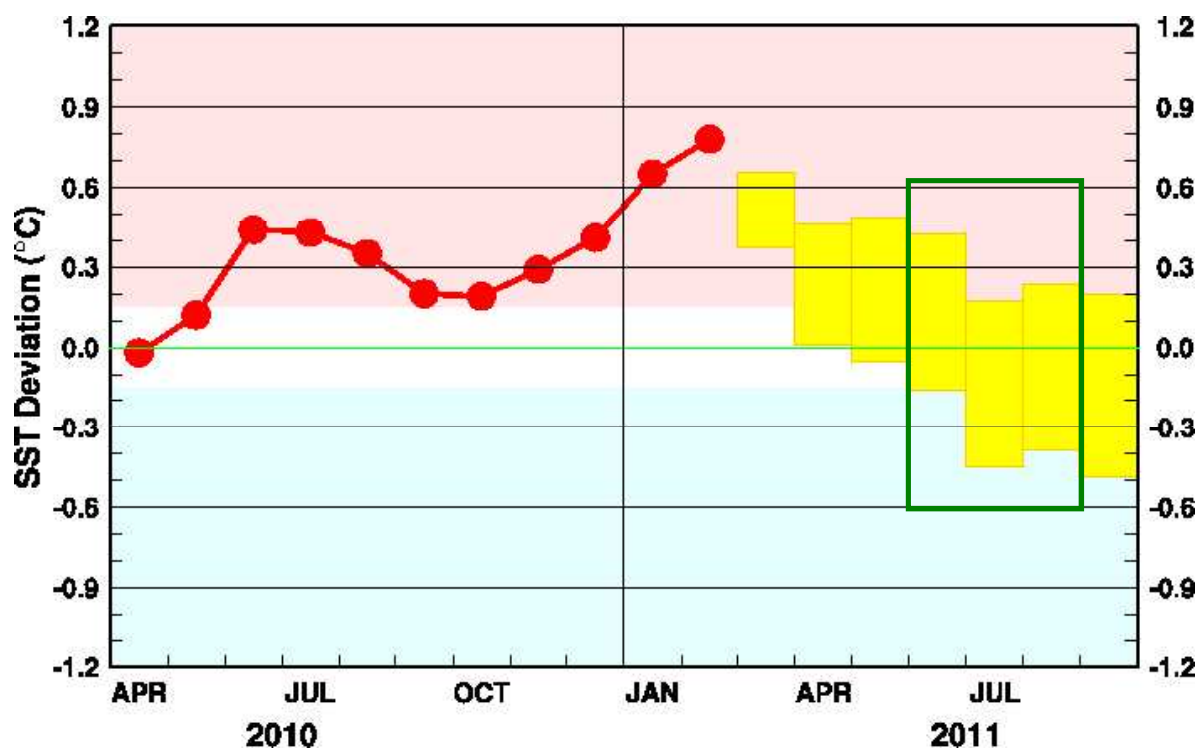


Numerical Prediction (6)

NINO.WEST SST forecast

The SST averaged over the NINO.WEST region has been above normal since June 2010. It is likely that the SSTs in the region will become near normal in this summer.

A time series of the monthly SST deviation in NINO.WEST.



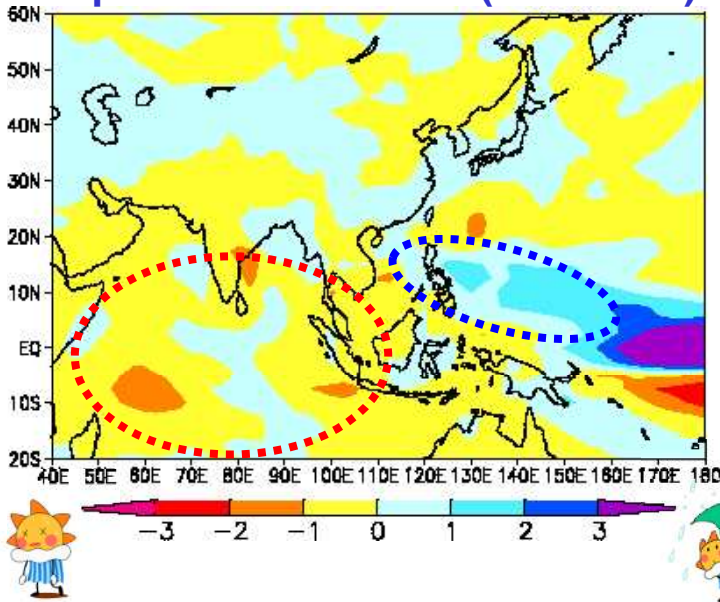
Red line with closed circles shows the observed SST deviation and yellow boxes show the predicted one by the numerical model. Each box denotes the range where the deviation will be included with the probability of 70%.



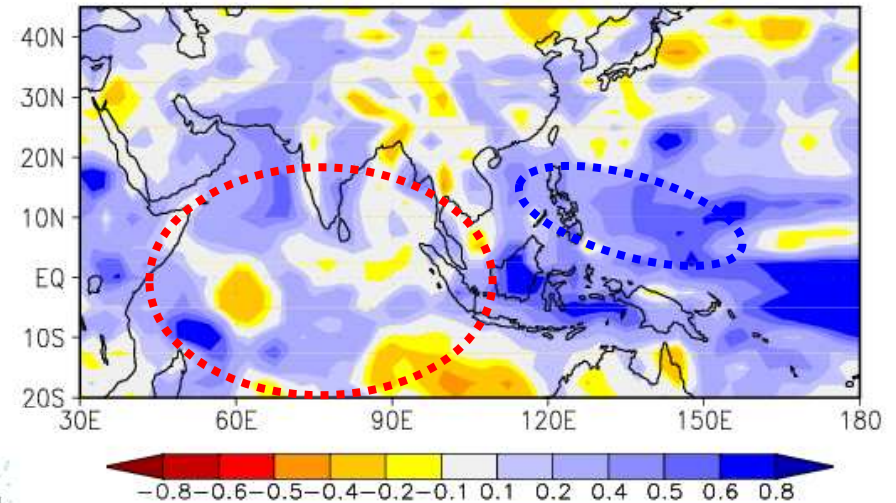
Numerical Prediction (7)

Precipitation Forecast

Precipitation Anomalies (JUN-AUG)



Anomaly Correlation with GPCP data



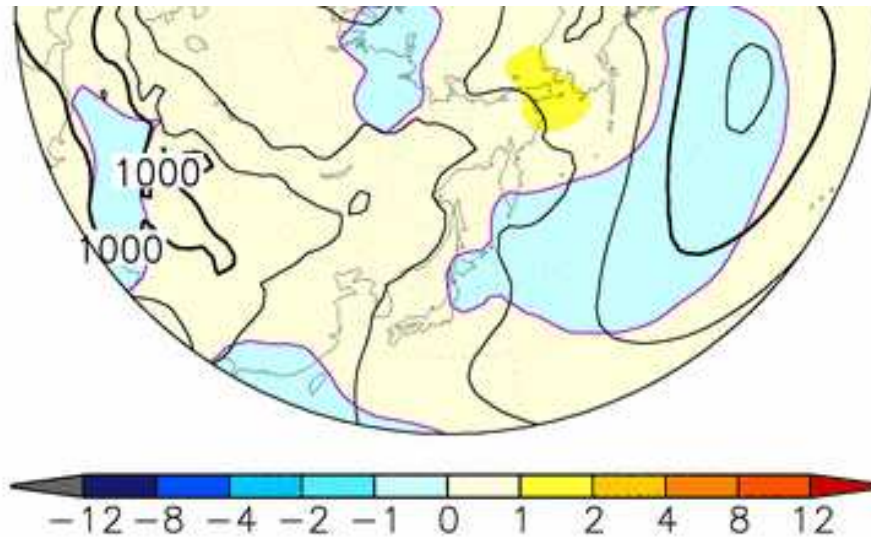
3-month precipitation are predicted to be above normal around and to the east of Philippines, in association with the suppressed convective activity in the tropical Indian Ocean. As a result, the extension of the North Pacific high will be near normal around Japan despite the predicted El Niño-like SST anomalies.



Numerical Prediction (8)

Extension of the North Pacific High

Sea Level Pressure Forecast and Anomalies



3-month precipitation are predicted to be above normal around and to the east of Philippines, in association with the suppressed convective activity in the tropical Indian Ocean. As a result, the extension of the North Pacific high will be near normal around Japan despite the predicted El Niño-like SST anomalies.

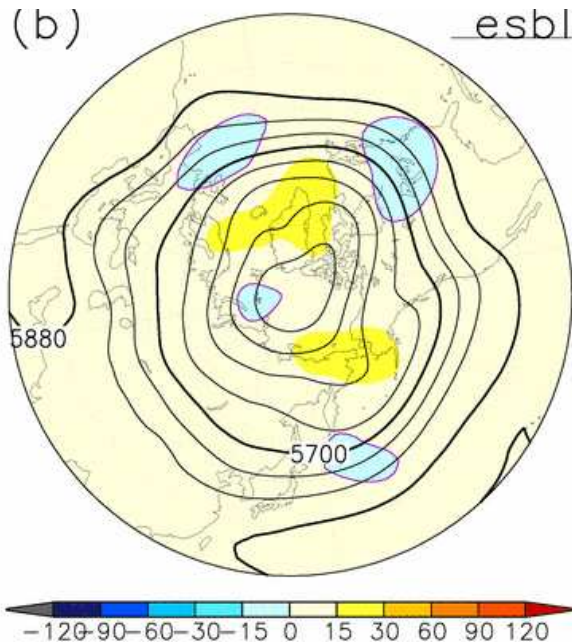


Numerical Prediction (9)

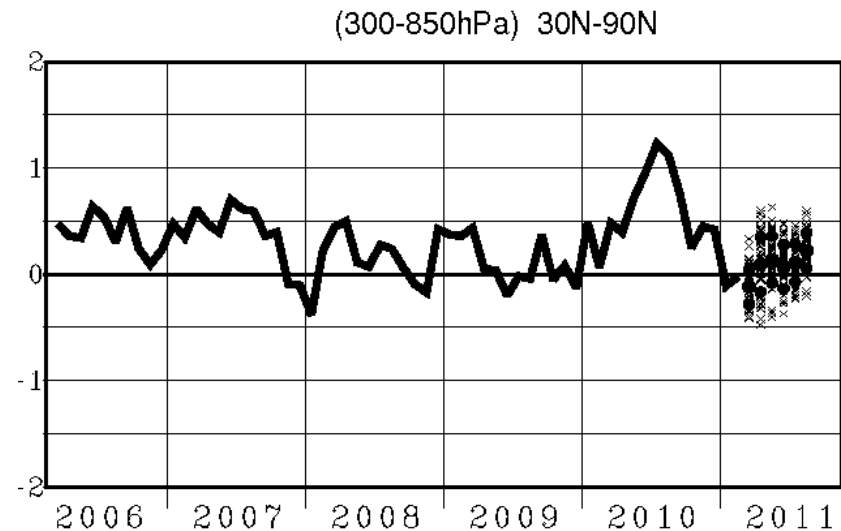
500 hPa Height and Anomalies

500 hPa height anomalies are predicted to be positive over almost whole of the Northern Hemisphere due to the influence of recent warm trend. This indicates that the summer-averaged temperature will be above normal in Japan.

500hPa Height Forecast and Anomalies (Jun.-Aug. mean)



The troposphere thickness temperature 300hPa-850hPa, zonal mean 30N-90N





Summary

Long-term trends

- Warm trends over Japan except for Northern part.

Oceanic Prediction

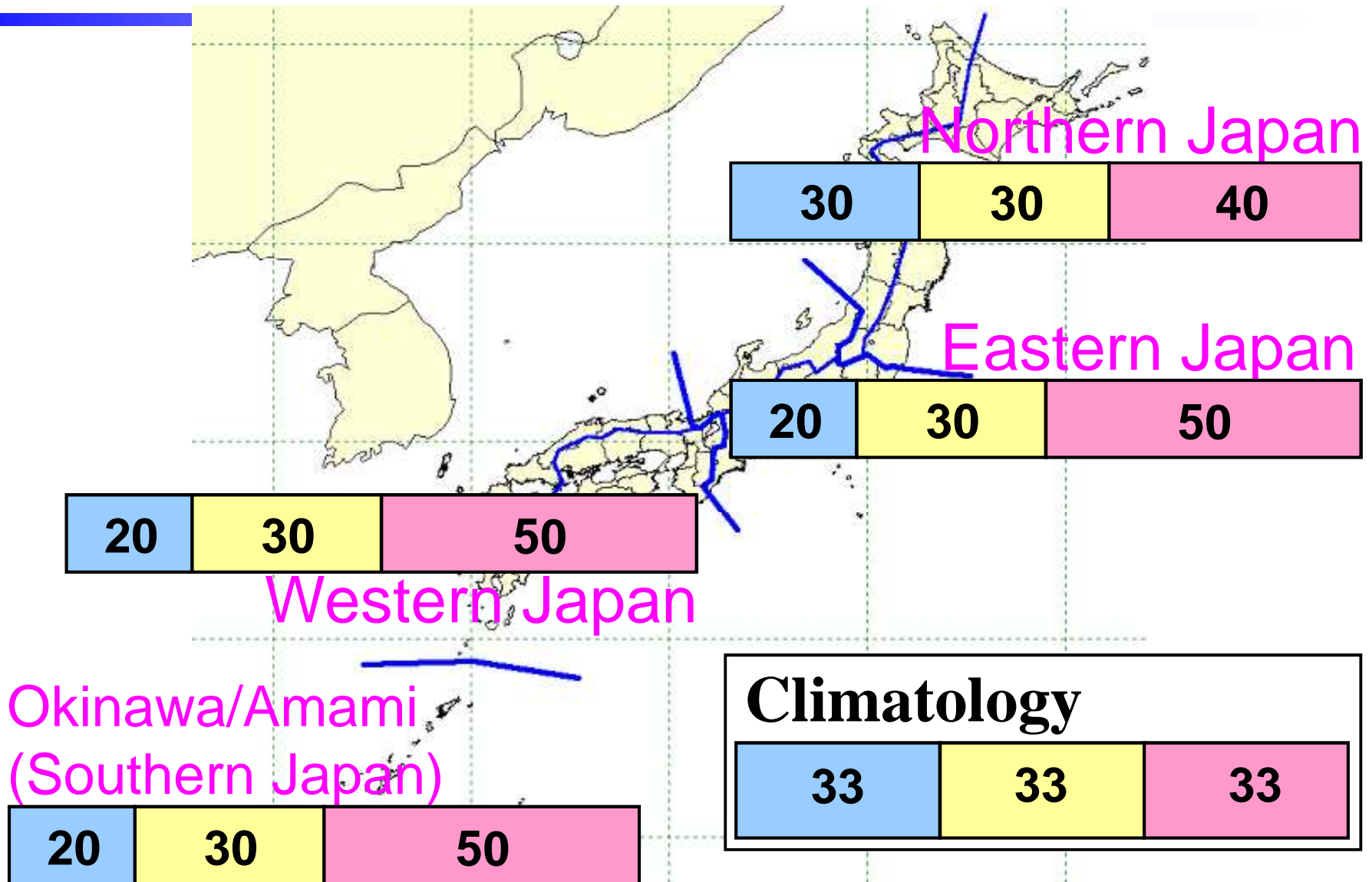
- Neutral ENSO conditions.

Atmospheric Prediction

- The strength of the North Pacific high and the circulation pattern are expected to be almost normal around Japan .
- Positive anomalies of 500hPa height and troposphere thickness temperature, over most of the Northern Hemisphere.



Probability of seasonal mean temperature for summer (June – August) 2011





Thank you.

Tokyo Climate Center website

<http://ds.data.jma.go.jp/tcc/tcc/index.html>

Climate and Outlook in Japan on TCC website

<http://ds.data.jma.go.jp/tcc/tcc/products/japan/index.html>



Outline of the EPS for seasonal forecast



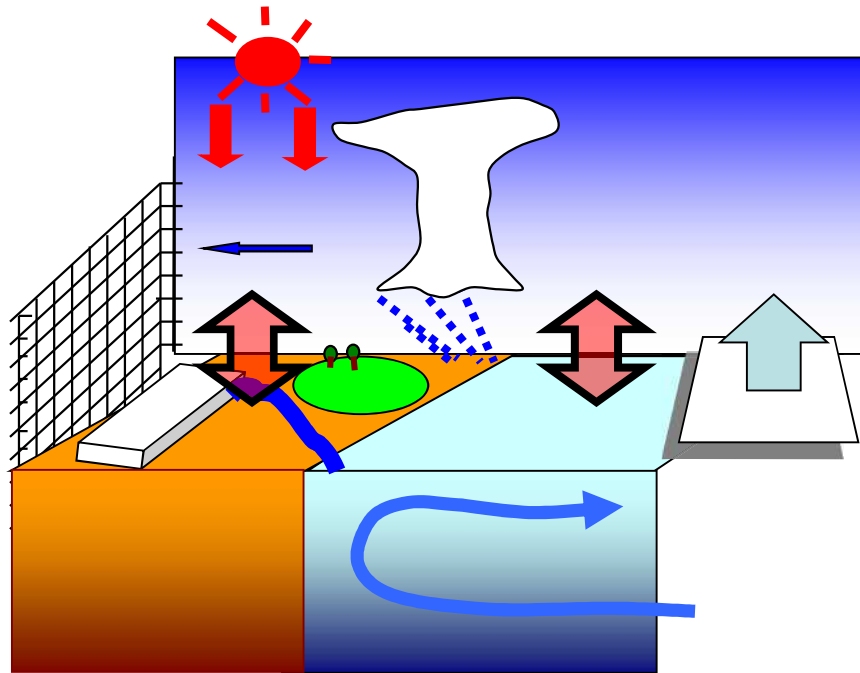
CGCM: JMA/MRI-CGCM

AGCM: JMA-GSM based on JMA/MRI unified model

- TL95: 1.875 deg ~ 180km
- L40: model top = 0.4hPa
- Land: SiB
- Sea ice: climatology
- Initial condition: JRA-25/JCDAS
- Initial perturbation: BGM (TRO, NH)

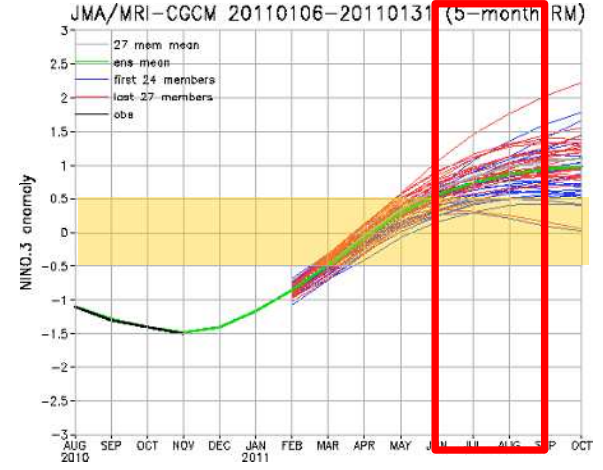
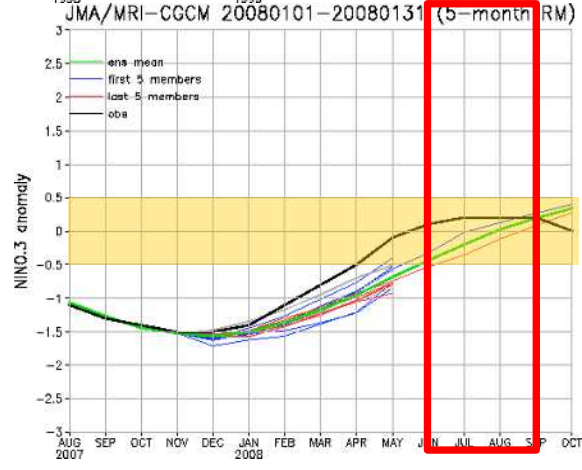
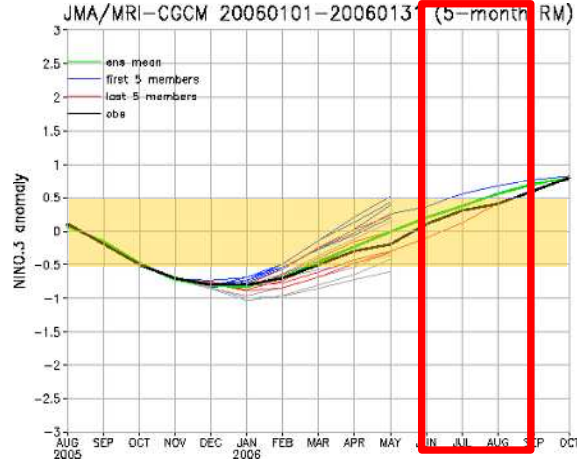
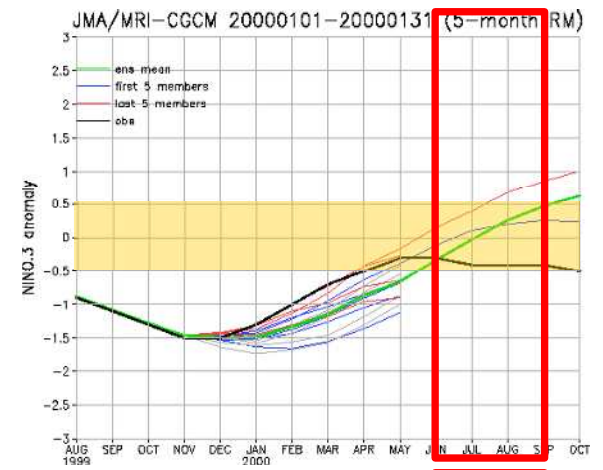
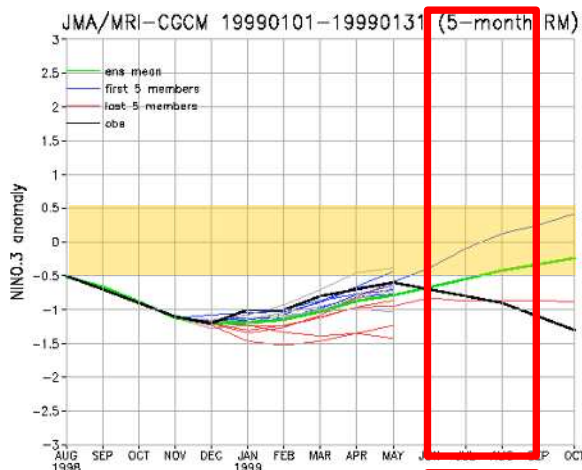
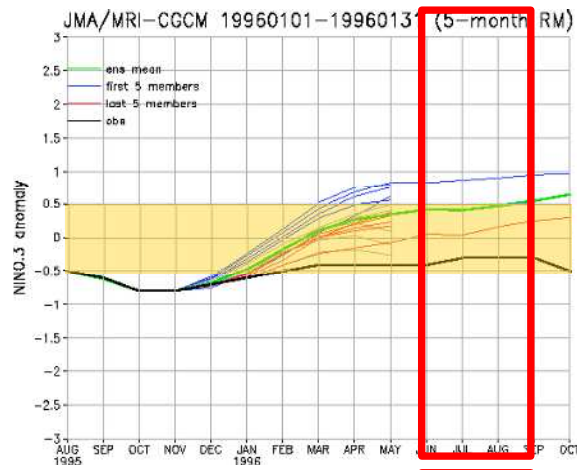
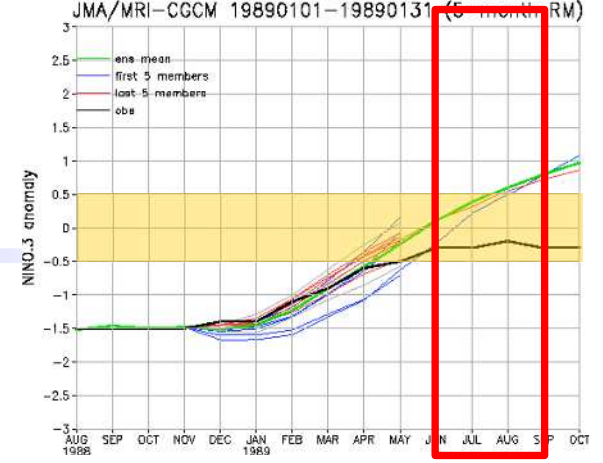
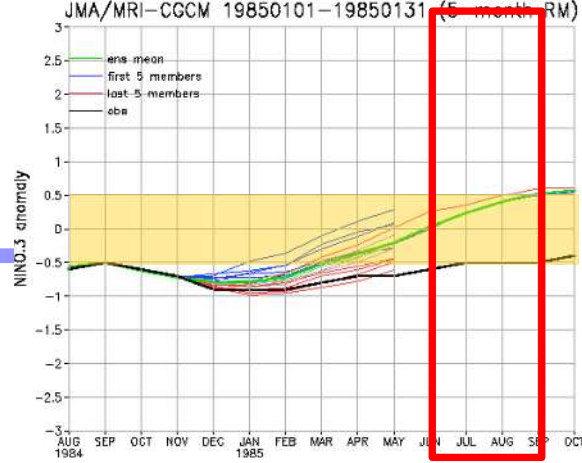
OGCM: MRI.COM

- 1.0deg in lon. X 0.3-1.0 deg in lat.
- 75N-75S, 0-360E
- L50
- Initial condition: MOVE/MRI-COM-G
- Initial perturbation: driven with BGM (TRO) of AGCM



ENSEMBLE: BGM&LAF

- Combination of BGM and LAF
- 9 members for each initial date
- Size: 51 (ENSO forecast: 30)
- Once a month



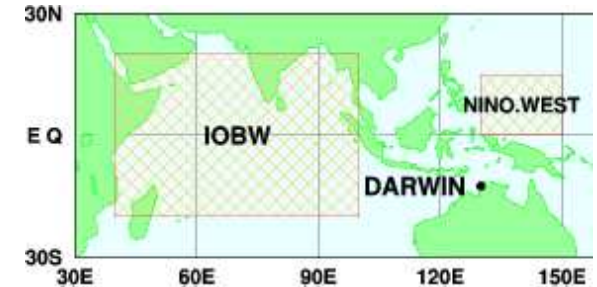
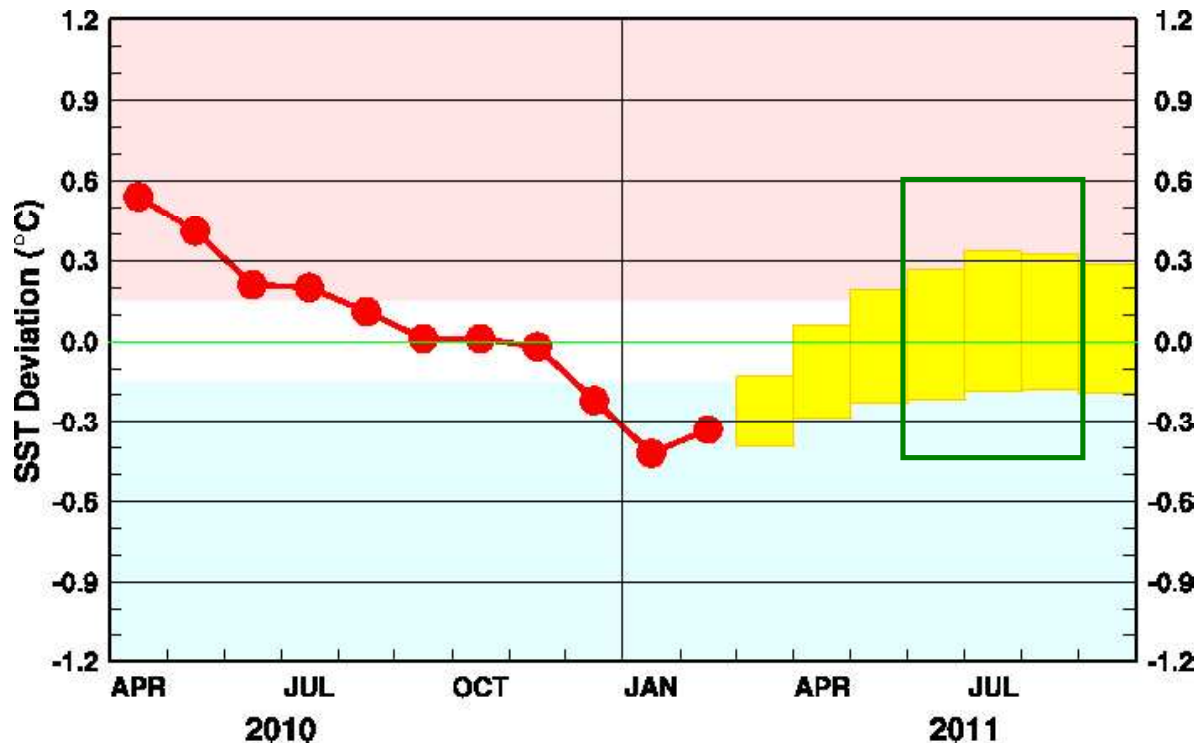


Oceanic Numerical Prediction (5)

Indian Ocean SST forecast

The SST averaged over the tropical Indian Ocean (IOBW) region has been below normal since December. It is likely that the SST in the IOBW region will gradually become near normal in the months ahead.

A time series of the monthly SST deviation in Indian Ocean.



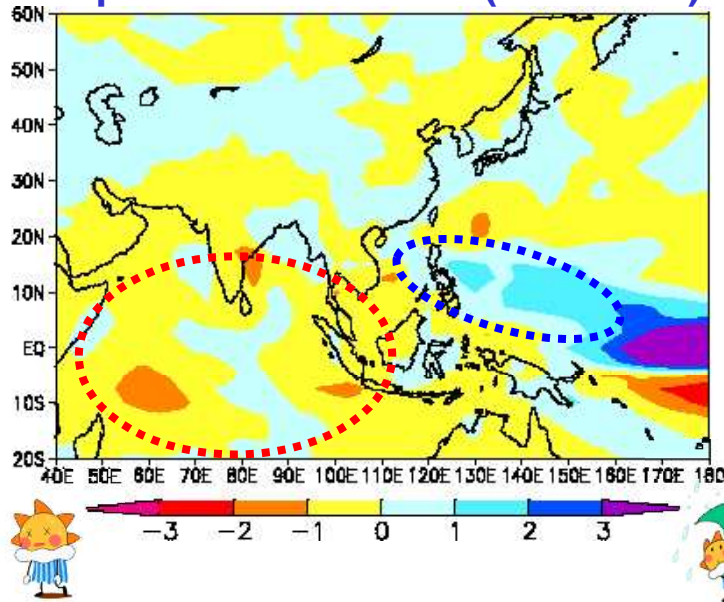
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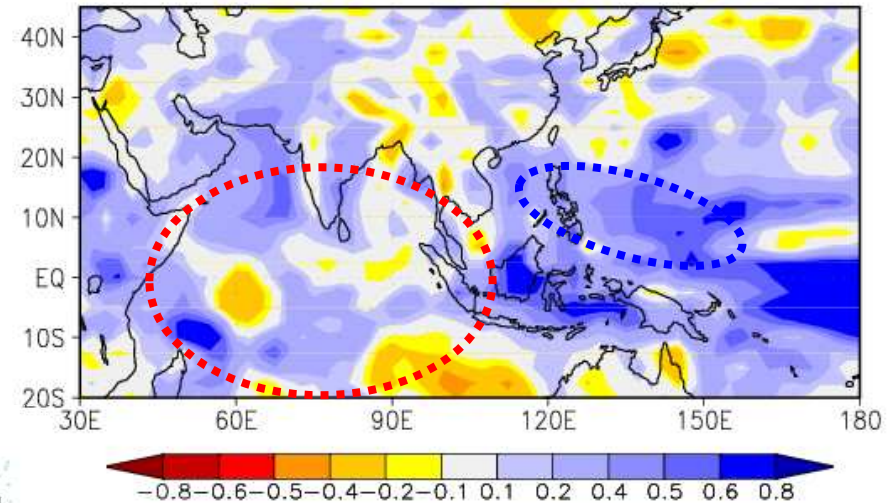
Numerical Prediction (1)

Precipitation and Extension of the North Pacific High

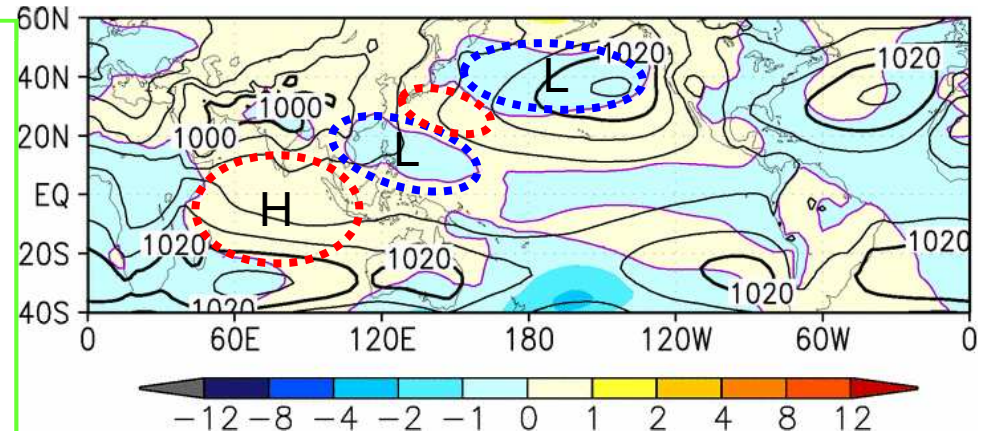
Precipitation Anomalies (JUN-AUG)



Anomaly Correlation with GPCP data



Sea Level Pressure Forecast and Anomalies



3-month precipitation are predicted to be above normal around and to the east of Philippines, in association with the suppressed convective activity in the tropical Indian Ocean. As a result, the extension of the North Pacific high will be normal around Japan in spite of El Niño-like SST.



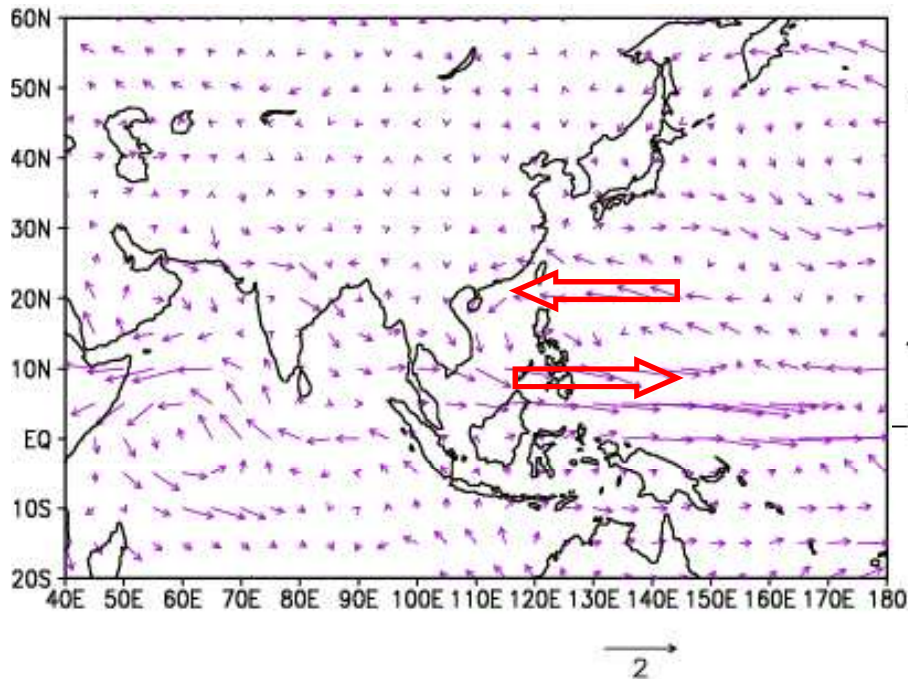
Numerical Prediction (2)

Large-Scale Monsoon Circulation

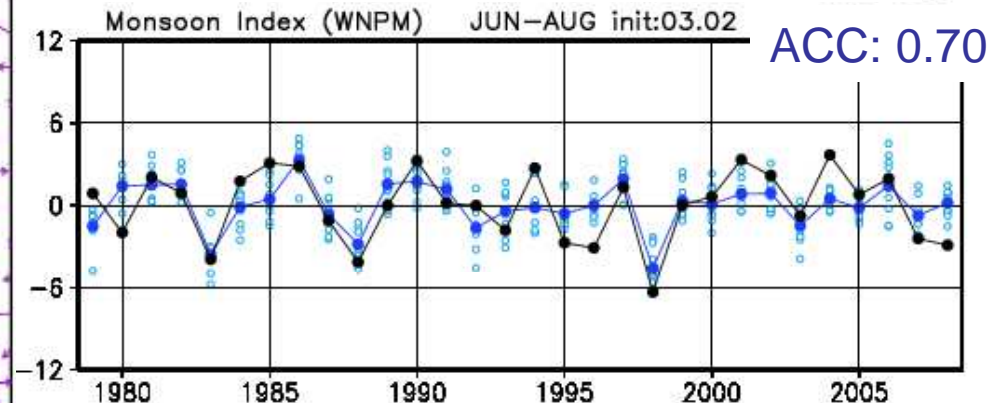
Over Philippines, a cyclonic circulation anomaly is predicted in the lower troposphere. The Western North Pacific Monsoon index is predictable respectively well.

It is therefore expected that the North Pacific high will be intensified.

850hPa Wind Anomalies



Verification for Western North Pacific Monsoon index (Wang et al., 2001)



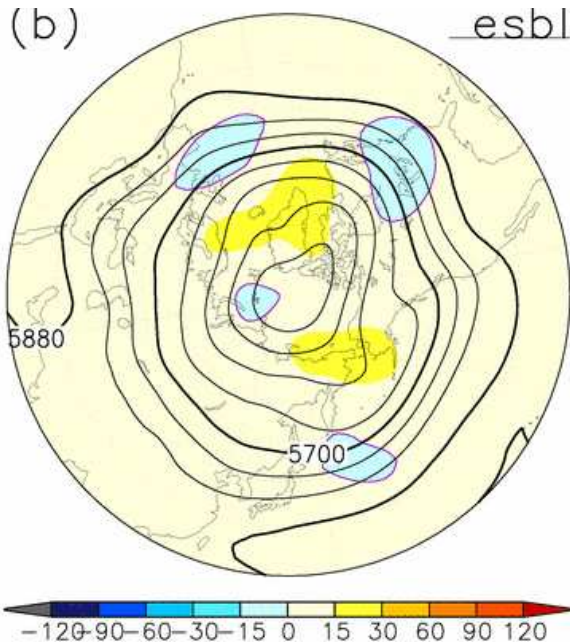


Numerical Prediction (2)

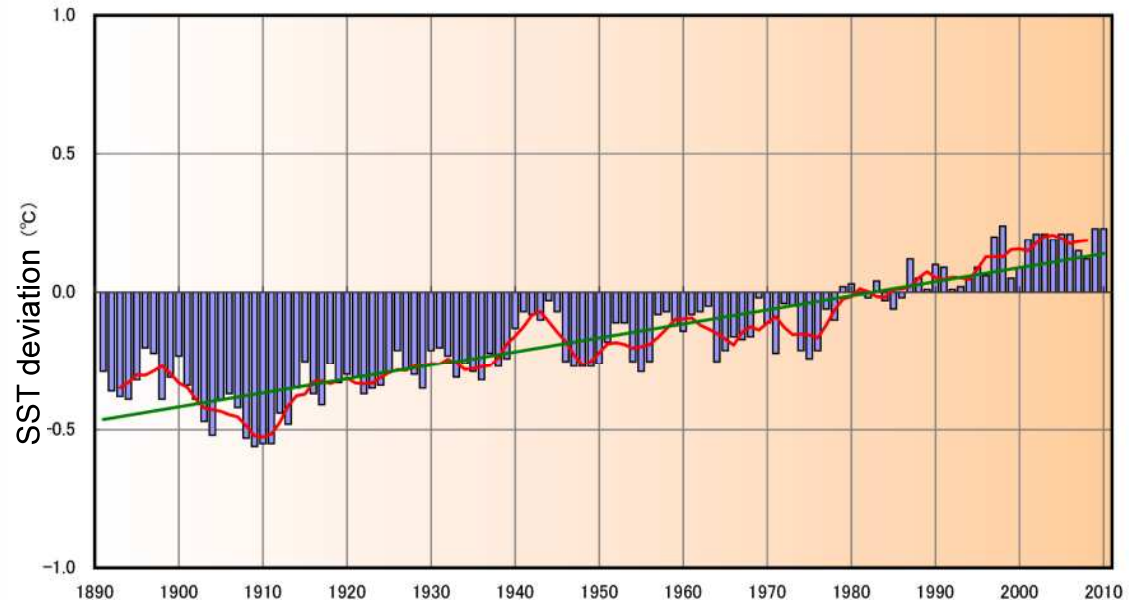
500hPa Height and Anomalies

500hPa height anomaly is predicted to be positive over almost whole of the Northern Hemisphere. It is considered to be due to the influence of oceanic warm trend. This result indicates that the summer-averaged temperature will be above normal in Japan.

500hPa Height Forecast and Anomalies



The annual SST deviation (global average).

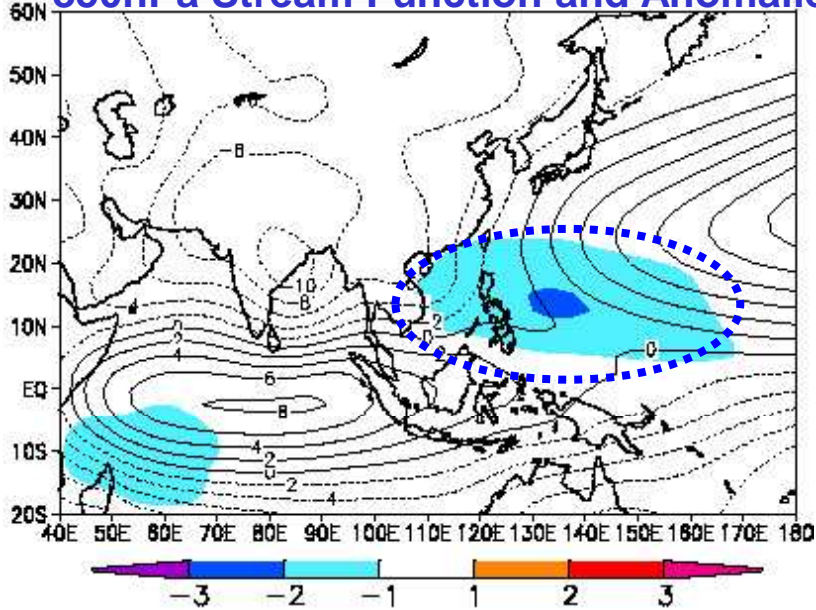




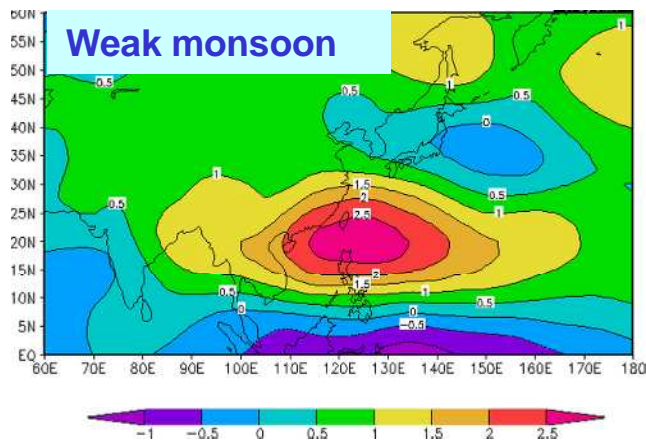
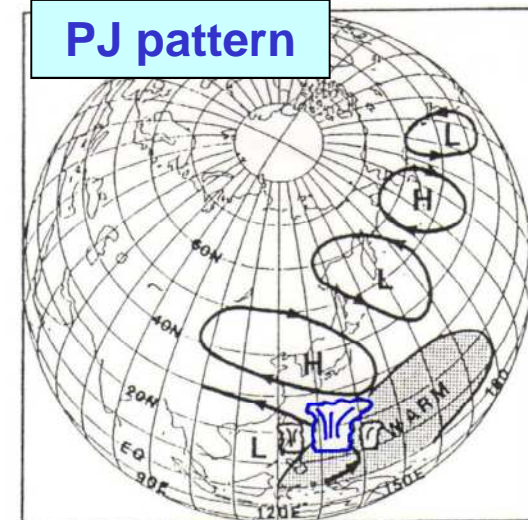
Numerical Prediction (4)

Extension of the North Pacific High

850hPa Stream Function and Anomalies



Nitta (1987)



Composites of 850hPa Stream Function fields for weak monsoon years.

(1980, 1983, 1993, 1996, 1998, 2007)

Hot summer hit southern Japan in all of those years.

Data Source: JRA-25



Numerical Prediction (3)

MOS products

Summertime Temperature

MOS products	Probability(%)		
	Below Normal	Near Normal	Above Normal
Northern Japan	32	37	31
Eastern Japan	18	41	41
Western Japan	21	22	57
Okinawa/Amami(Southern Japan)	19	35	46

The numerical guidance are generated using Model Output Statistics (MOS) technique based on hindcast experiments.



Okinawa/Amami
(Southern Japan)

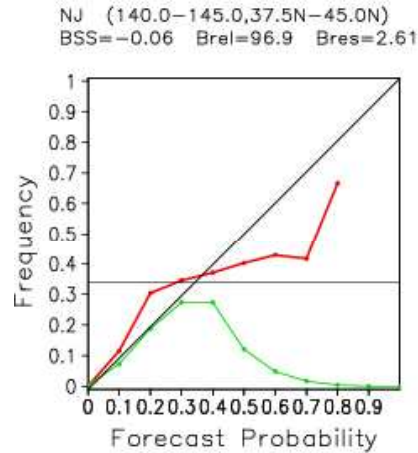


Numerical Prediction (7)

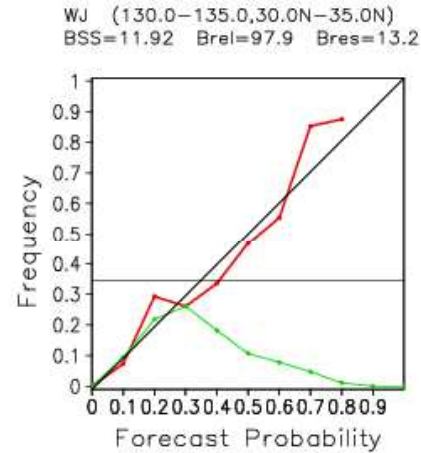
Skill of the Numerical Guidance

Reliability Diagram for temperature

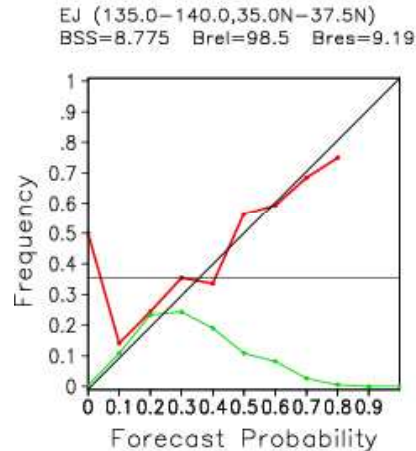
Northern Japan



Western Japan



Eastern Japan



Southern Japan

