Seasonal outlook for winter 2020/2021 over Japan

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Outline

- JMA’s ensemble prediction for winter 2020/2021
- Cold season outlook over Japan
- Summary

In this presentation,

* Cold season outlook issued on 25th September 2020
* Initial date : 3 September 2020
* 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.

※JMA‘s seasonal forecast model:

Atmosphere-ocean coupled general circulation model named JMA/MRI-CGCM2

- Note on a known model bias
In the JMA's seasonal forecast model, La Nina-like circulation anomalies are sometimes predicted to extend more westward compared to observations. This model bias needs to be duly accounted for in the following discussion.

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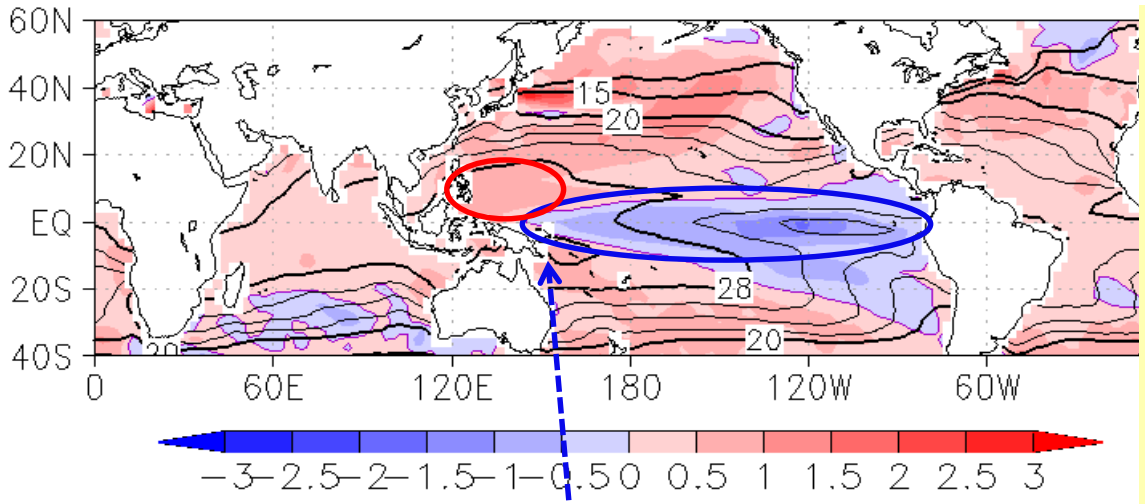
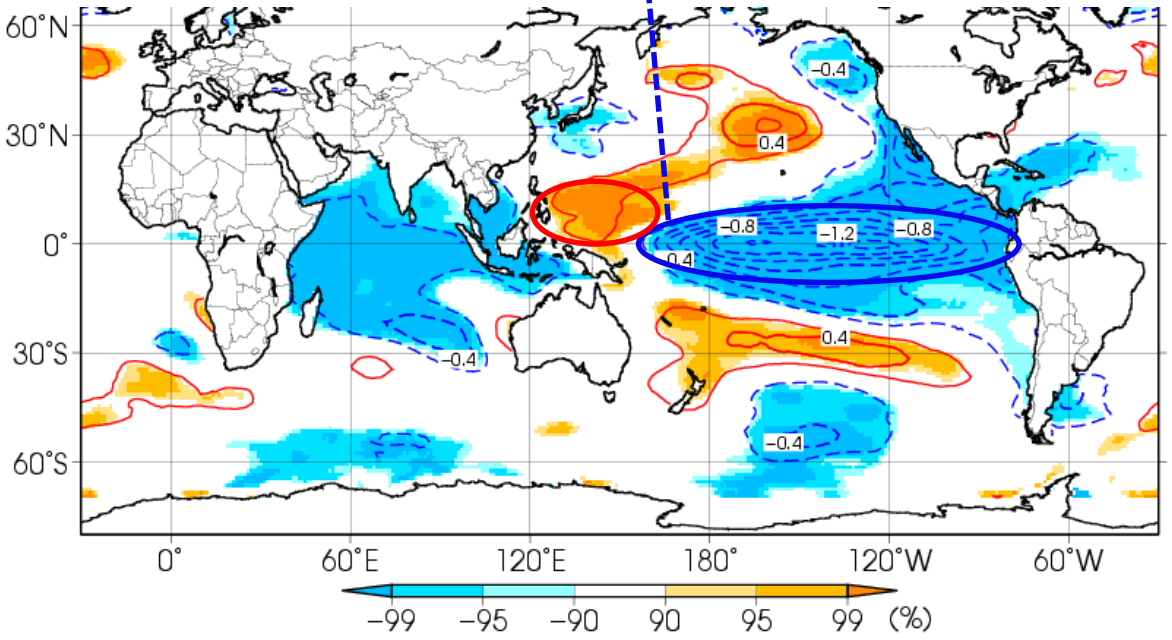
Oceanic conditions in DJF 2020/21

SST(contour) and anomalies(shade)

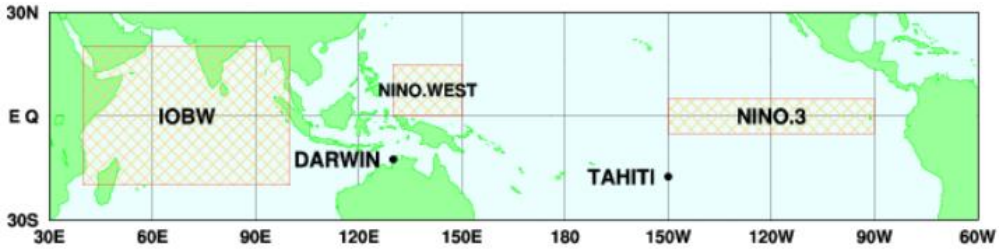


Composite map of SST anomalies during La Niña events

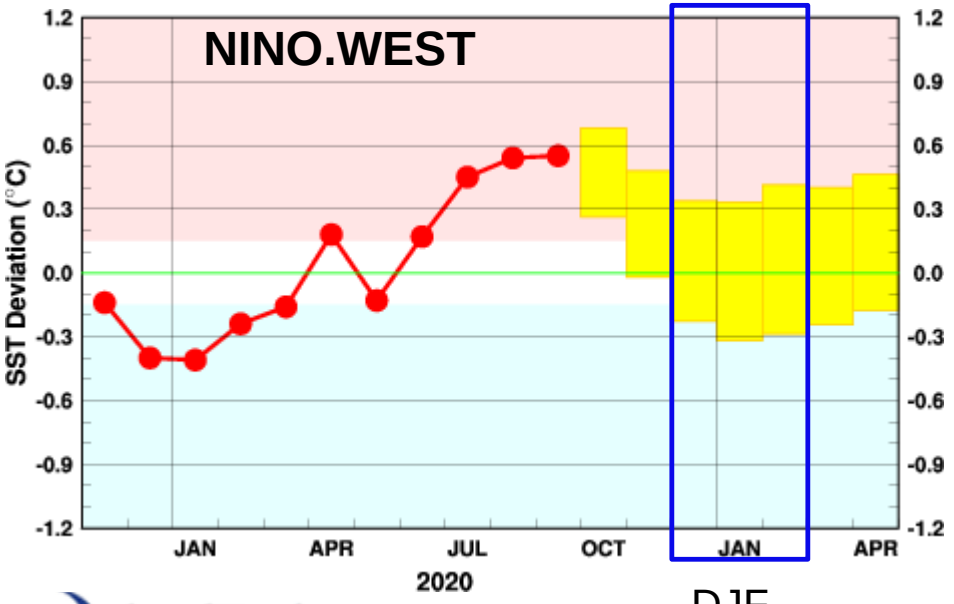


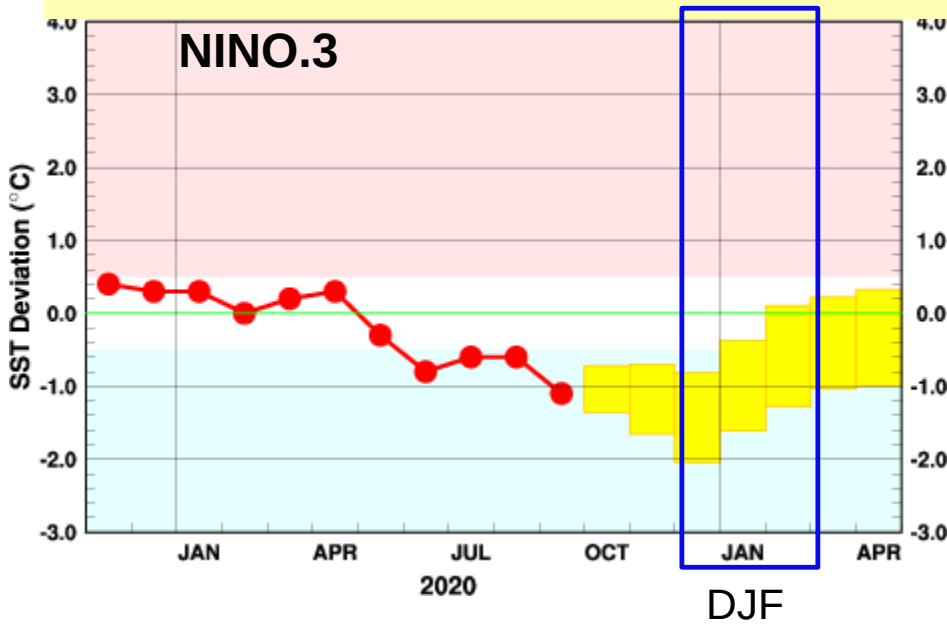
- In the equatorial Pacific, negative anomalies are expected from the central to eastern parts.
- Those are slightly westward shift compared to the La Niña composite pattern.
- This westward shift is considered a model bias.

El Niño outlook



- JMA‘s coupled prediction system suggests that the NINO.3 SST will be below normal from June.
- It is considered that La Niña conditions are present in the equatorial Pacific.
- La Niña conditions are likely (90%) to continue until boreal winter.
- The area-averaged SST in the tropical western Pacific (NINO.WEST) region is likely to be above or near normal until boreal winter.





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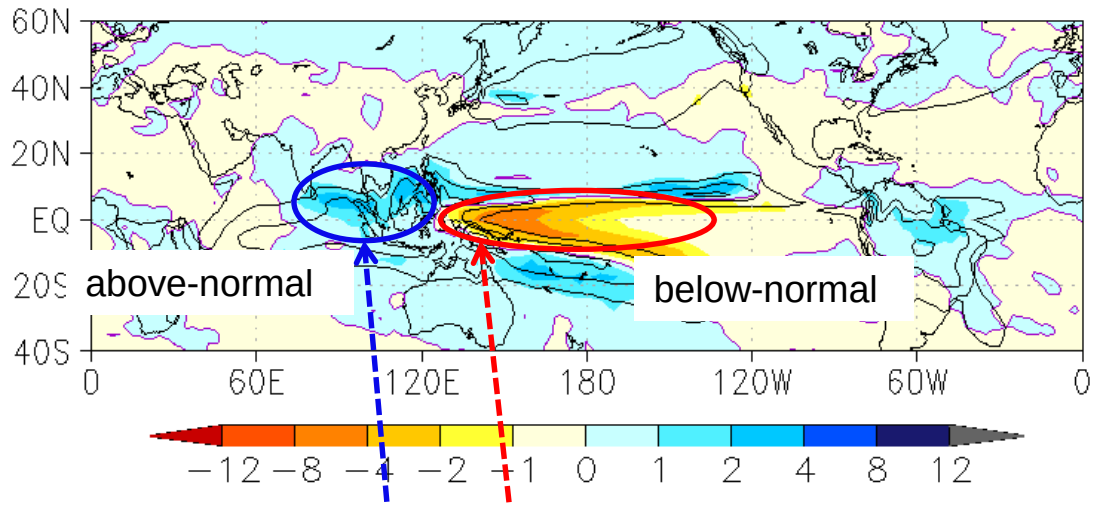
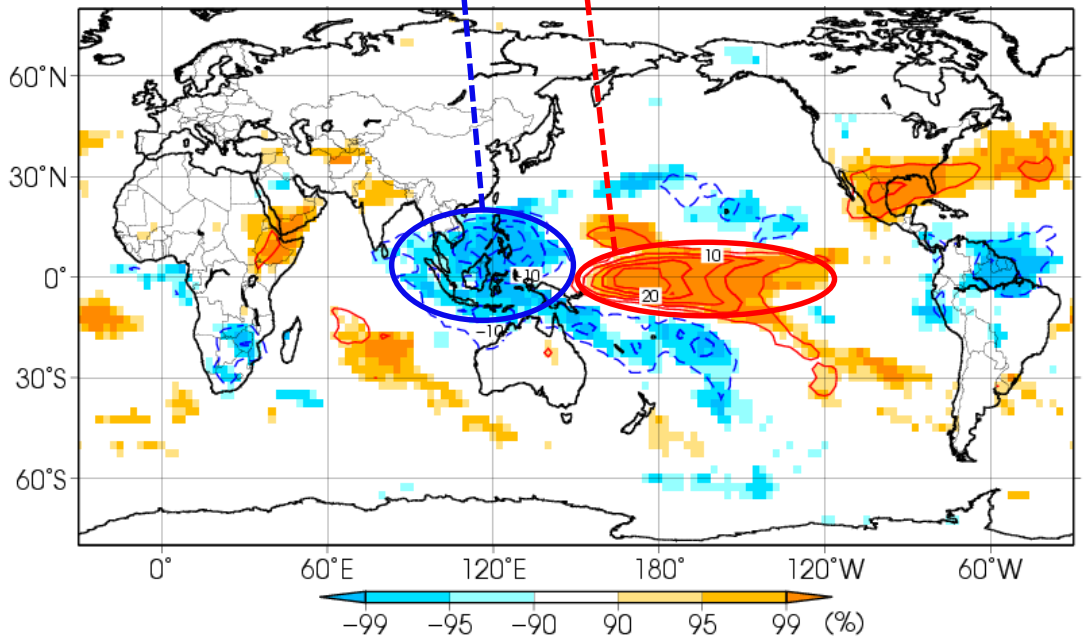
Global circulation in DJF 2020/21

Precipitation(contour) and anomalies(shade)



Composite map of OLR anomalies during La Niña events

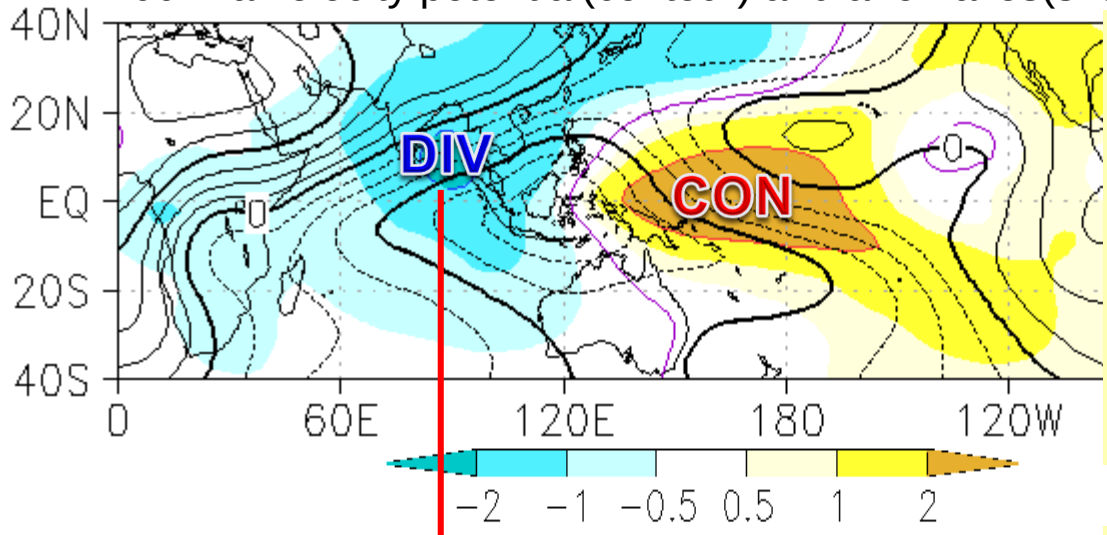


- Above-normal precipitation is predicted over the southern part of Southeast Asia.
- The pattern of precipitation anomalies are comparatively similar to those observed during the past La Niña events, but slightly westward shift compared to the La Niña composite pattern.
- This westward shift is also considered a model bias.

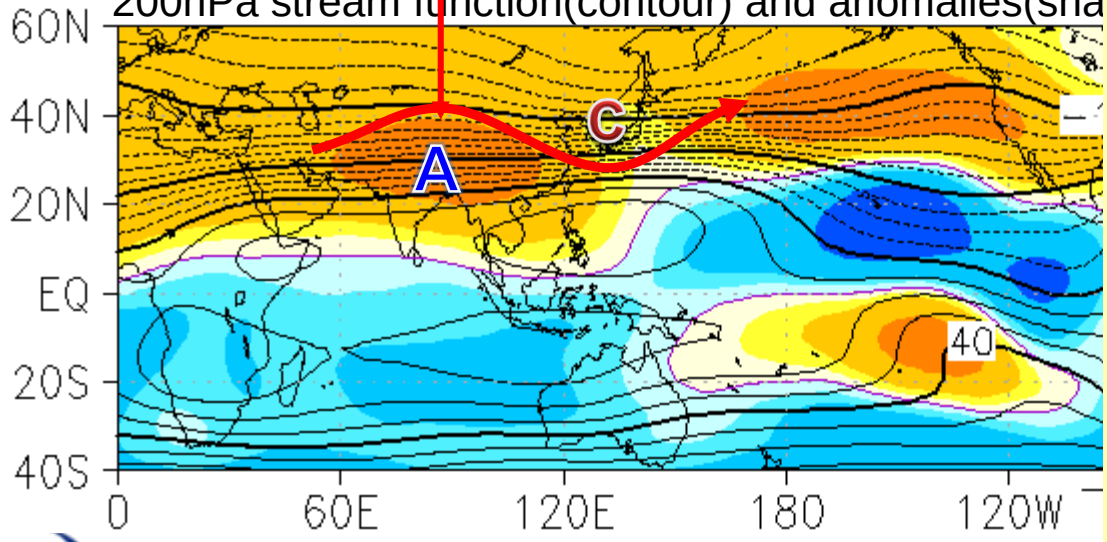
Contours : anomalies at intervals of 5 W/m^2.
Shading : the confidence level.
The base period for composite analysis is 1979 - 2012, while that for the three-month means of November-December-January and December-January-February is 1979/80 - 2012/13.

Global circulation in DJF 2020/21

200hPa velocity potential(contour) and anomalies(shade)



200hPa stream function(contour) and anomalies(sha



10^6 m^2/s

In the 200-hPa velocity potential field,

- divergence anomalies(**DIV**) are predicted from Southeast Asia to eastern part of the Indian Ocean.
- convergence anomalies(**CON**) are predicted over the central and western tropical Pacific.

In the 200-hPa stream function field,

- anti-cyclonic circulation anomalies over the Southern Eurasia (**A**) are generated in response to **DIV**.
- the relative cyclonic anomalies are predicted around Japan(**C**).
- These A and C patterns indicate that the subtropical jet will shift northward over Southern Eurasia and meander southward around Japan.

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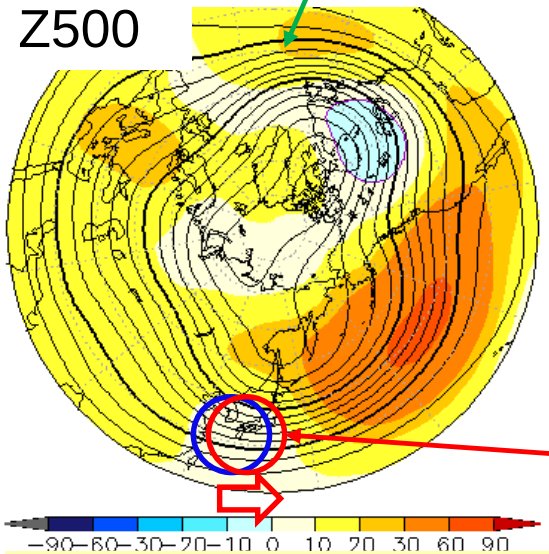
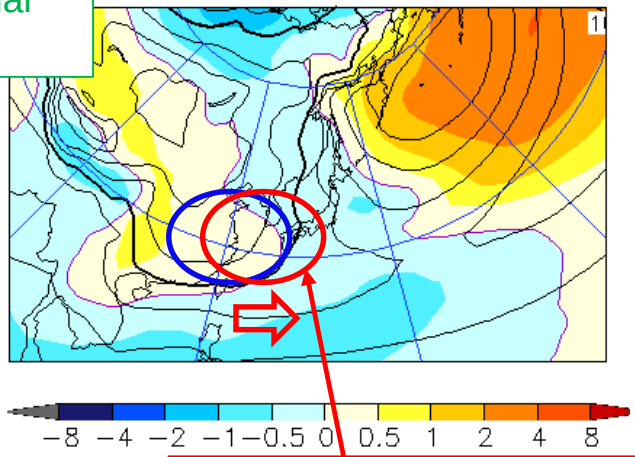
Focusing on East Asia

In the Northern Hemisphere, we consider that there are no clear signal in annular mode pattern.

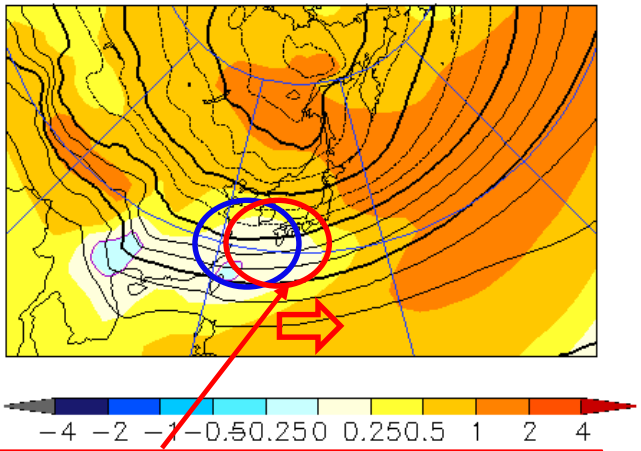
Z500



SLP



T850



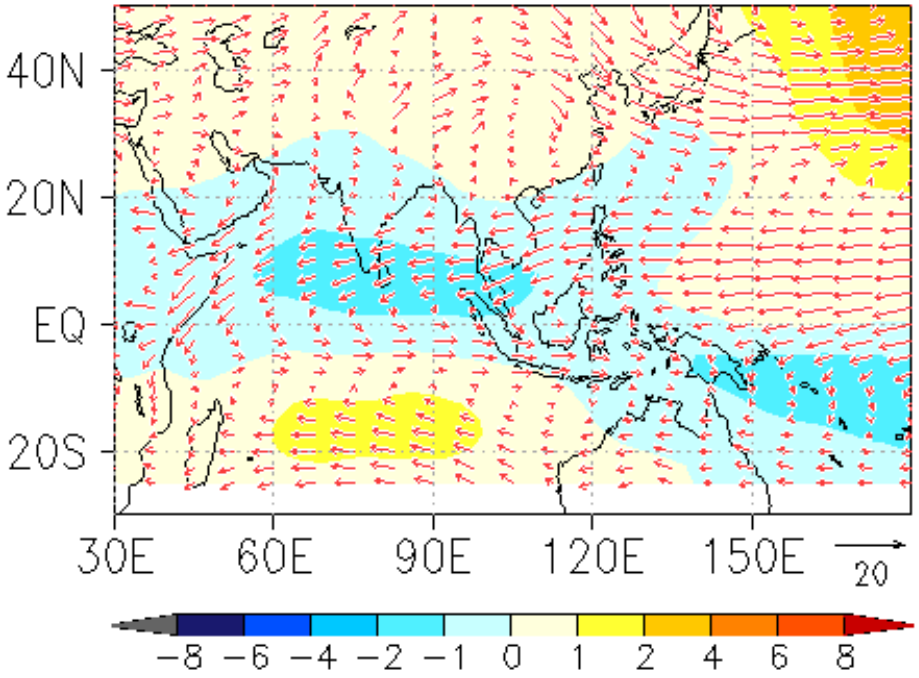
Taking the model tendency to predict La Niña pattern too west into account, we consider the predicted atmospheric circulation pattern in and around Japan should be shifted eastward.

Numerical prediction

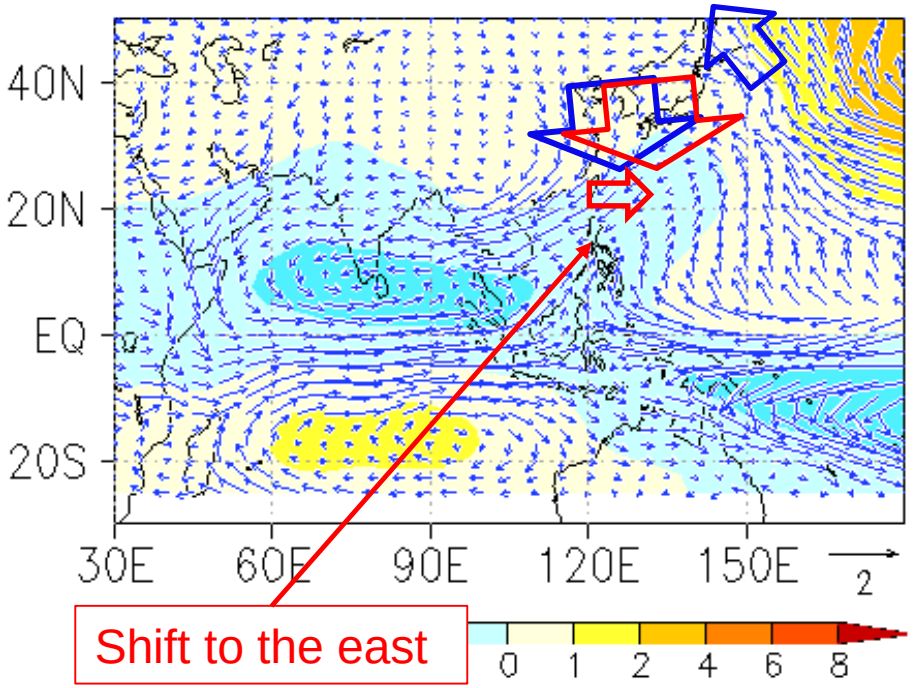
- In the 500hPa height field, positive anomalies are predicted over the northern part of the North Pacific and Eurasia continent. On the other hand relatively weak positive anomalies are predicted around Western Japan.
- In the sea level pressure field, positive anomalies are predicted over the southeastern part of the Siberian High.
- In the 850hPa temperature field, positive anomalies are predicted over the Eastern Siberia and over the northern part of the North Pacific. On the other hand relatively weak positive anomalies are predicted around Western Japan.

East Asian winter monsoon

850hPa wind (vector)
850hPa stream function anomalies(shade)



850hPa wind anomalies (vector)
850hPa stream function anomalies(shade)



Numerical prediction

・The winter monsoon will be slightly stronger than normal in and around Western Japan.

・On the other hand, it will be weaker than normal around Northern Japan.

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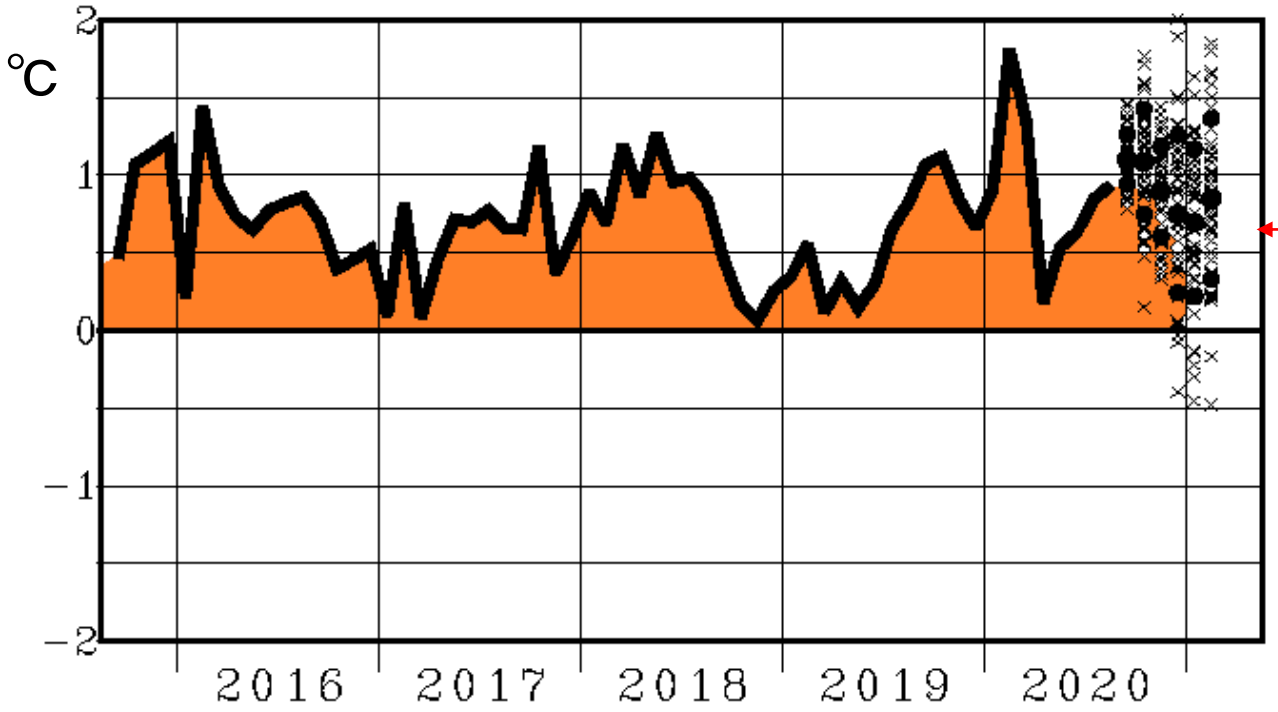
Tropospheric thickness

Zonal mean thickness temperature (300hPa - 850hPa, 30N – 50N)



Base period for normal is 1981-2010

Thickness temperature

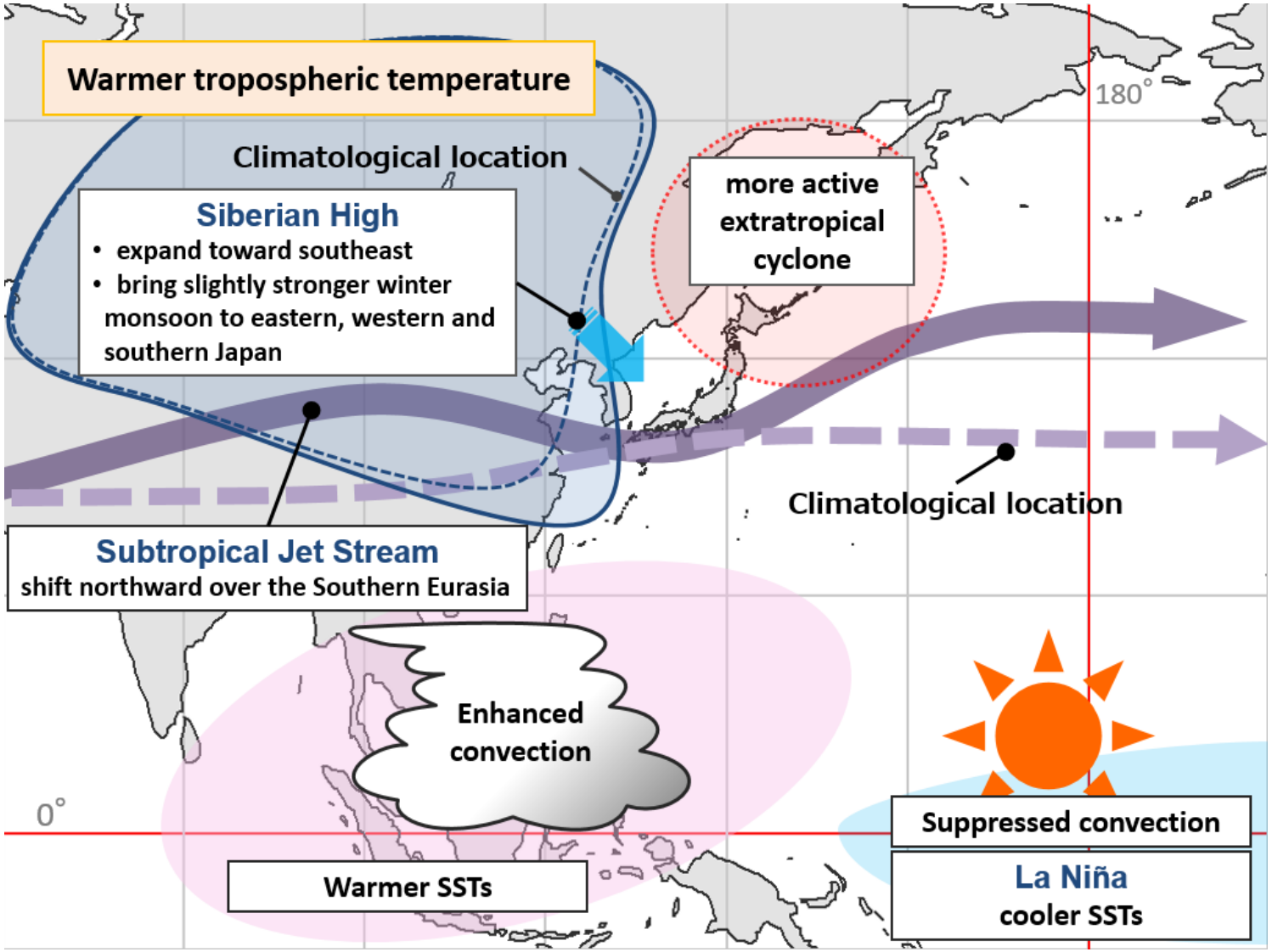
$$T = \frac{g(Z_{300} - Z_{850})}{R \ln P_{850}/P_{300}}$$

z: height
p: pressure levels
g: standard gravity
R: gas constant for dry air

Overall temperatures in the troposphere are expected to be higher than normal in association with the global warming.

These tendencies are likely to increase the chance of above-normal temperatures over mid-latitude regions.

Conceptual diagram for East Asian circulation in DJF 2020/21



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Probability forecast of seasonal mean temperature for DJF 2020/21 in Japan

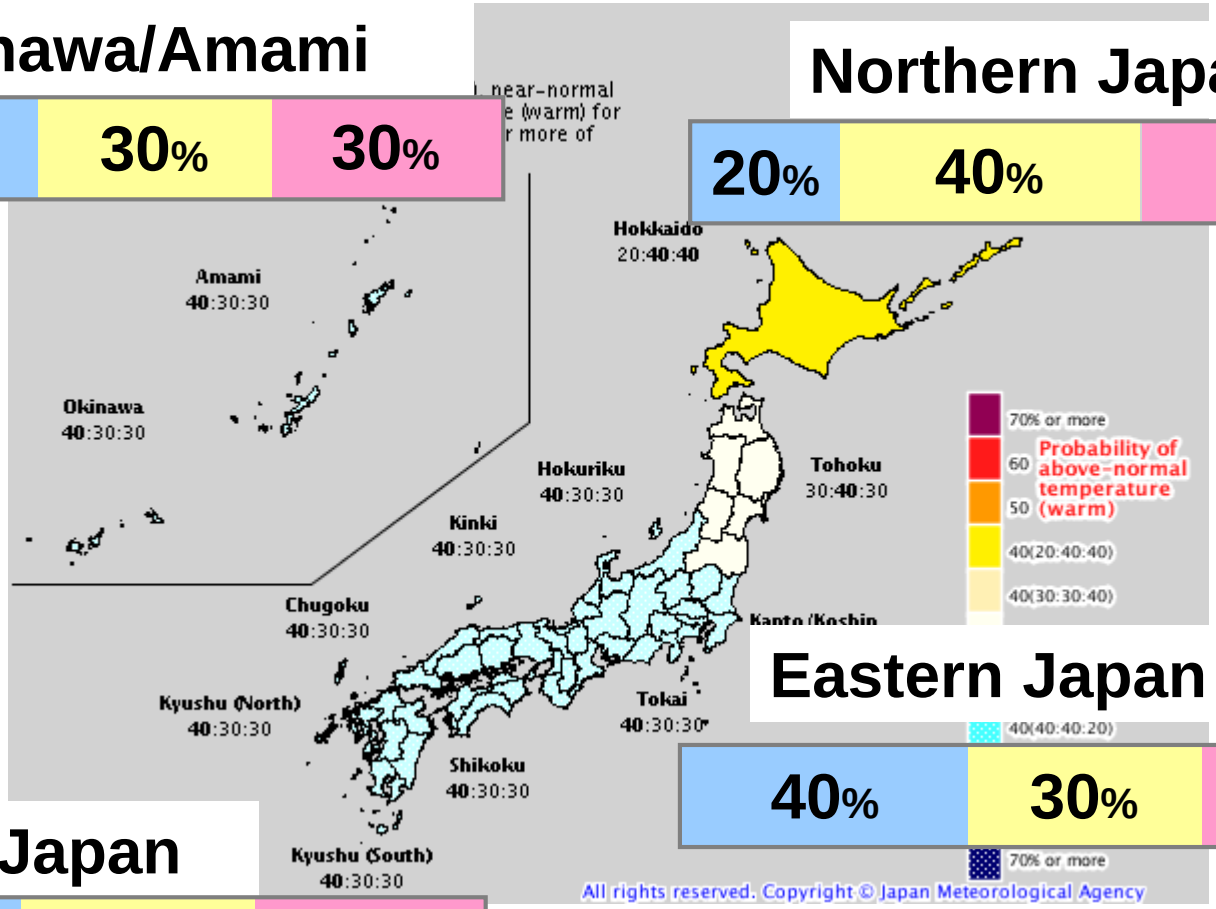
Cold season outlook issued on 25th September 2020

Okinawa/Amami

40%	30%	30%

Northern Japan

20%	40%	40%



Eastern Japan

40%	30%	30%

Western Japan

40%	30%	30%

Climatology

Below normal	Near normal	Above normal
33%	33%	33%

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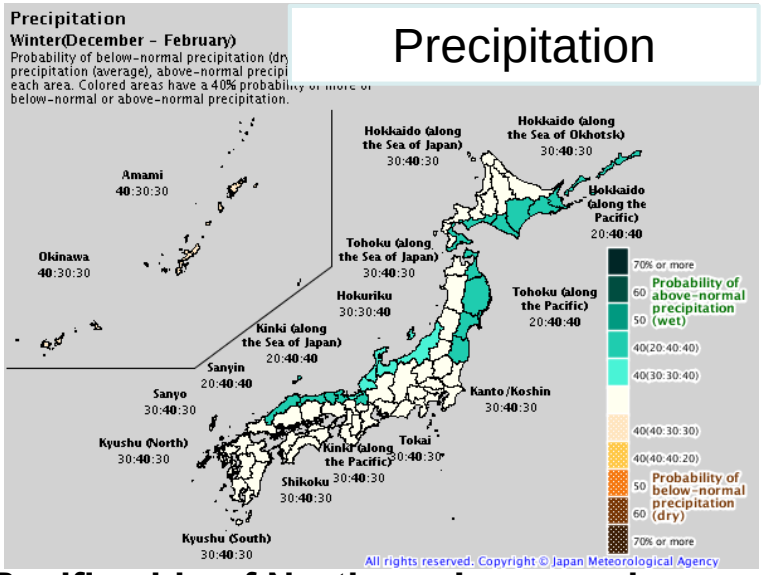
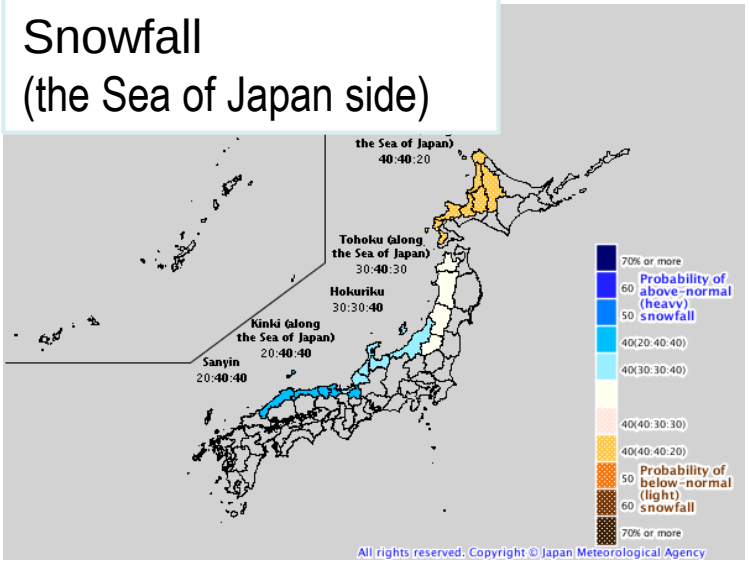
Probability forecast of seasonal precipitation/snowfall for DJF 2020/21 in Japan

Precipitation



Snowfall (the Sea of Japan side)



Pacific side of Northern Japan and Sea of Japan side of Western Japan

20%	40%	40%

Sea of Japan side of Eastern Japan

30%	30%	40%

Okinawa/Amami

40%	30%	30%

Other

30%	40%	30%

Northern Japan

40%	40%	20%

Eastern Japan

30%	30%	40%

Western Japan

20%	40%	40%

In Western Japan Snowfall are also expected to be above-normal tendencies.

Summary

・From the numerical prediction, in response to the SST anomaly patterns, the subtropical jet stream is predicted to meander southward over Japan, suggesting the slightly stronger than normal winter monsoon over Eastern, Western Japan and Okinawa/Amami.

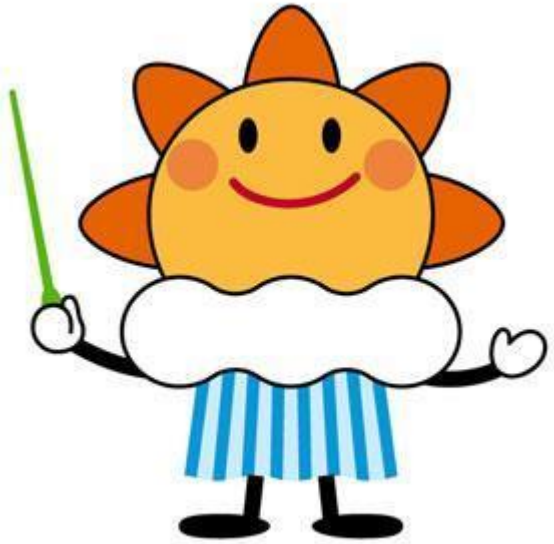
・ On the other hand, intensity of Siberian High is predicted to be weaker than normal in the northeast of its normal extent, suggesting the weaker-than-normal winter monsoon in Northern Japan.

・Overall temperatures in the troposphere are expected to be above-normal over the Northern Hemisphere in association with the prevailing long-term trend.

・Considering above, it is likely that seasonal mean temperatures will be slightly lower than normal tendencies in Eastern, Western and Okinawa/Amami, On the other hand, higher than normal tendencies in Northern Japan.

・In the Sea of Japan side, Seasonal snowfall amounts for Western Japan will be above-normal tendencies and Northern Japan will be below-normal tendencies.

Thank you for your attention !



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