

Cold Season Outlook for Winter 2014/2015 over Japan



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Japan Meteorological Agency (JMA)*

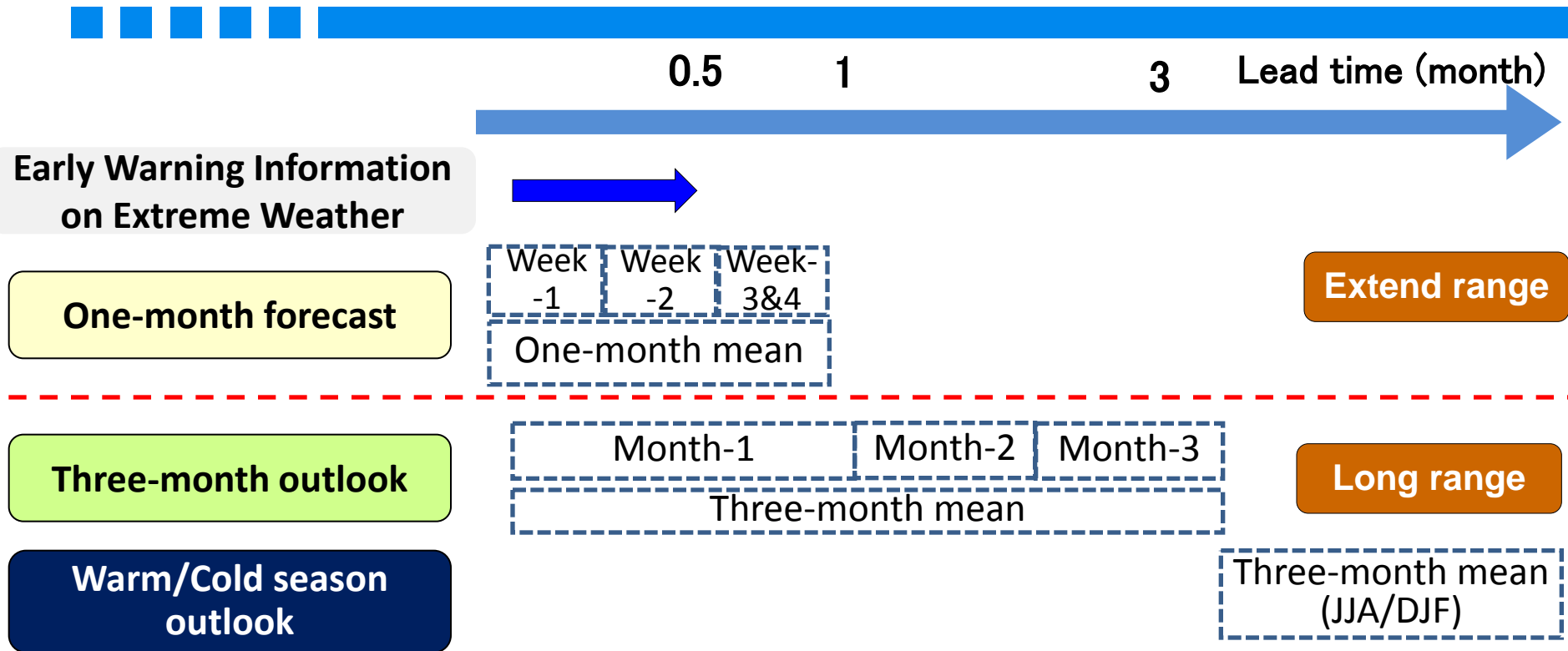
Outline

- Introduction
 - Seasonal prediction services at JMA
 - JMA's seasonal EPS
- Current oceanic condition (skipped)
- Prediction by the JMA's seasonal EPS and its interpretation
- Summary

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Seasonal prediction services at JMA



	Issuing date
One-month forecast	Every Thursday
Three-month outlook	around 25th of every month
Warm season outlook	around 25th February (updated around 25th March and April)
Cold season outlook	around 25th September (updated around 25th October)

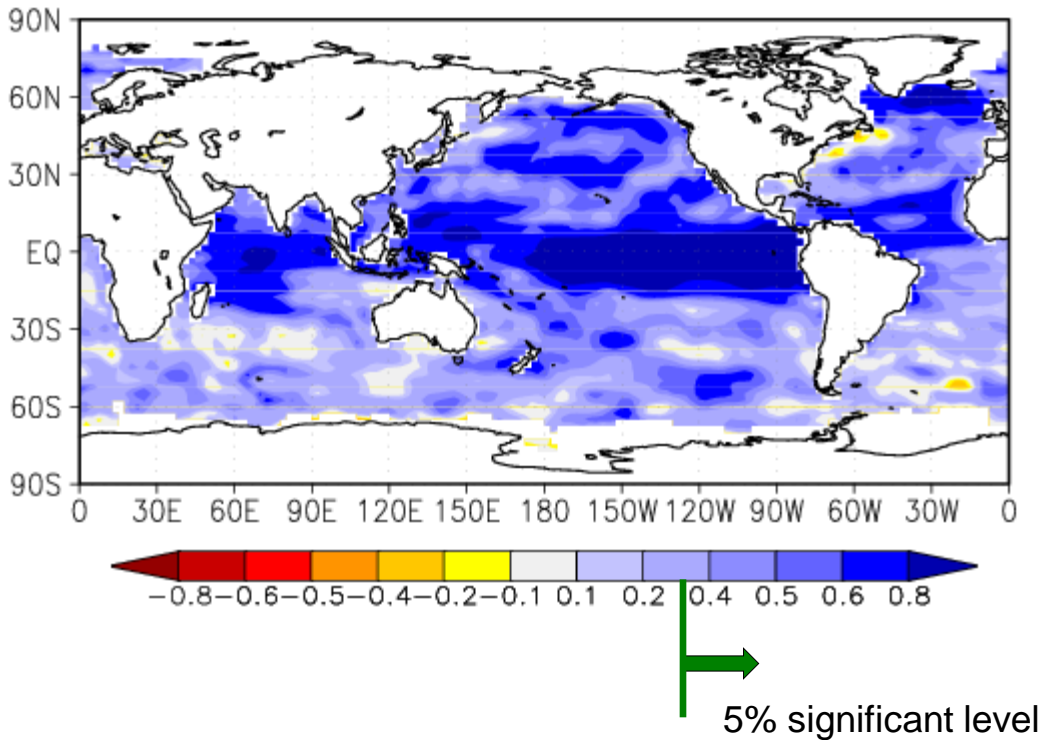
JMA Seasonal Prediction System

Model	CGCM (MRI/JMA-CGCM)
Resolution	<ul style="list-style-type: none">•Atmospheric component Resolution: about 180 km, 40 vertical levels (<u>T_L95 L40</u>)•Oceanic component Resolution: Horizontal 1.0° longitude, 0.3°–1.0°, 50 vertical levels
Ensemble size	• <u>Size: 51</u> (9 BGMs & 6 initial days with 5-day LAF)
Frequency of forecast issuance	Once a month
Hindcast	1979-2010 (32 years) Verification data: JRA-25/JCDAS, GPCP ver. 2.1

In this presentation,

- Cold season outlook** (updated on 24 October 2014) based on the JMA's seasonal EPS with the initial month of October.
- Target period of forecast: **DJF 2014/15**
- Climate base period : 1981-2010

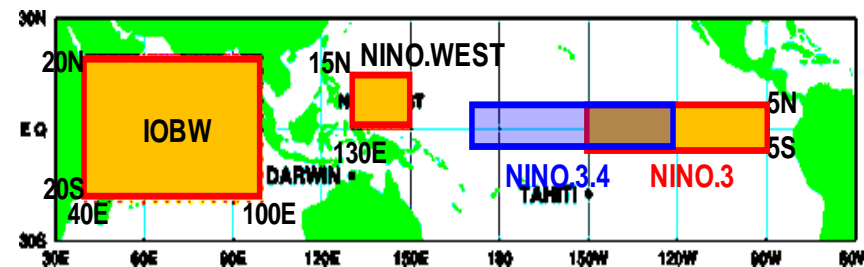
Prediction skill of SST (Anomaly Correlation for DJF with initial-October)



SST indices		Anomaly correlation
NINO.3	150W-90W 5S-5N	0.94
NINO3.4	170E-120W 5S-5N	0.93
NINO.WEST	130E-150E EQ-15N	0.86
IOBW	40E-100E 20S-20N	0.87

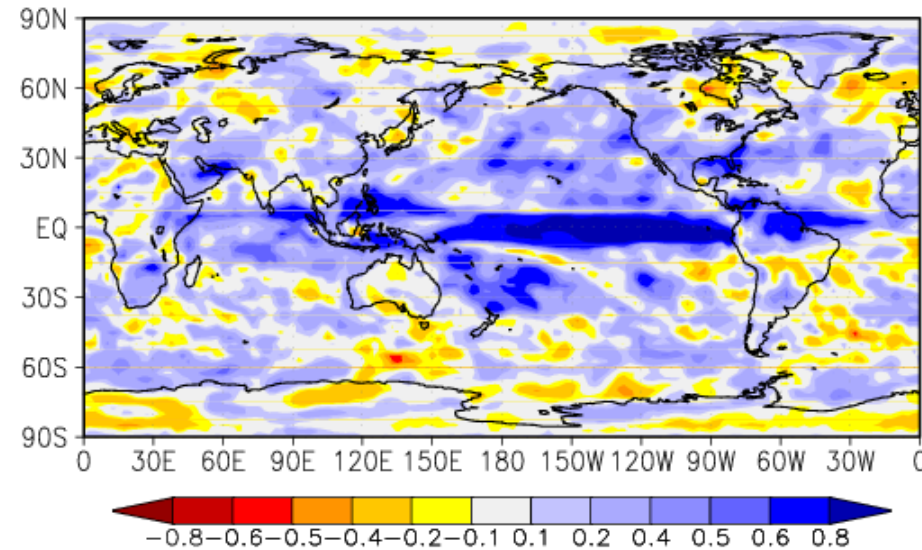
(Verification period: 1979-2008)

- In the tropics, prediction skill of SST is generally higher than the significant level.

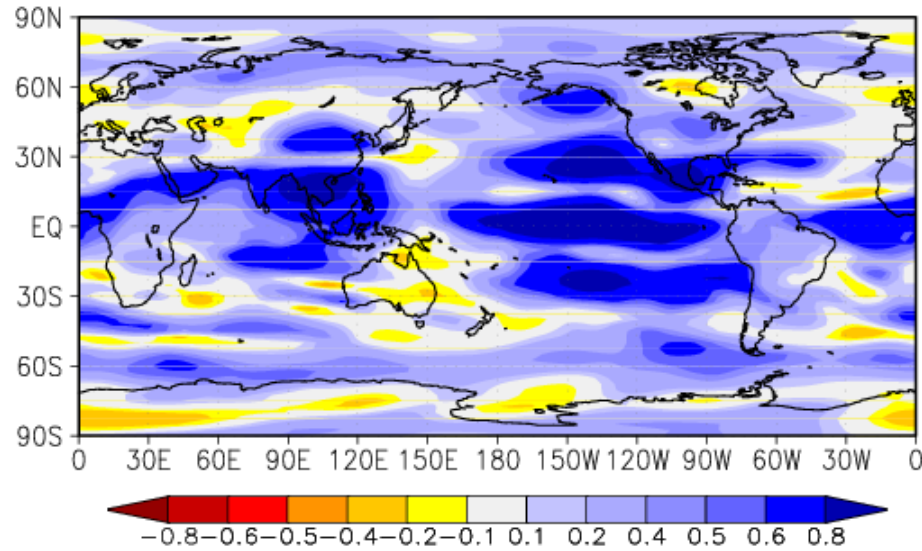


Prediction skill of surface temp. and precipitation (Anomaly Correlation for DJF with initial-October)

(Precipitation)



(200 hPa zonal wind; U200)



- Prediction skill of precipitation is high in the tropics.
- In the East Asia, AC is slightly positive in the southern part, while near-zero in the northern-part.

- In the tropics and some region of the mid-latitudes, prediction skill of atmospheric field is high, which is supported by well reproduce of ENSO.
- As for the high-latitudes, prediction skill is insufficient.

➤ Predicted characteristics in high-latitudes should be interpreted with caution.

Outline

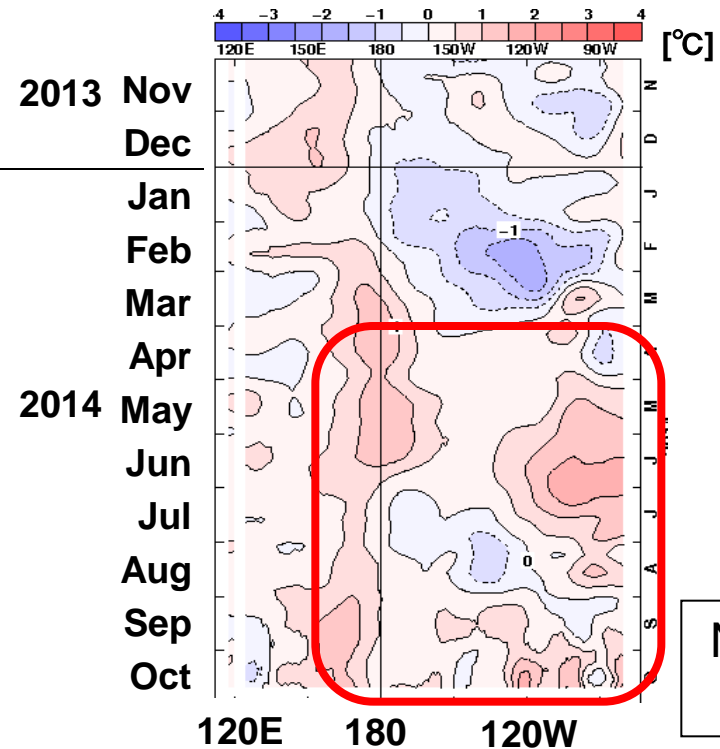
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SST and OHC (top 300 m) in the equatorial Pacific

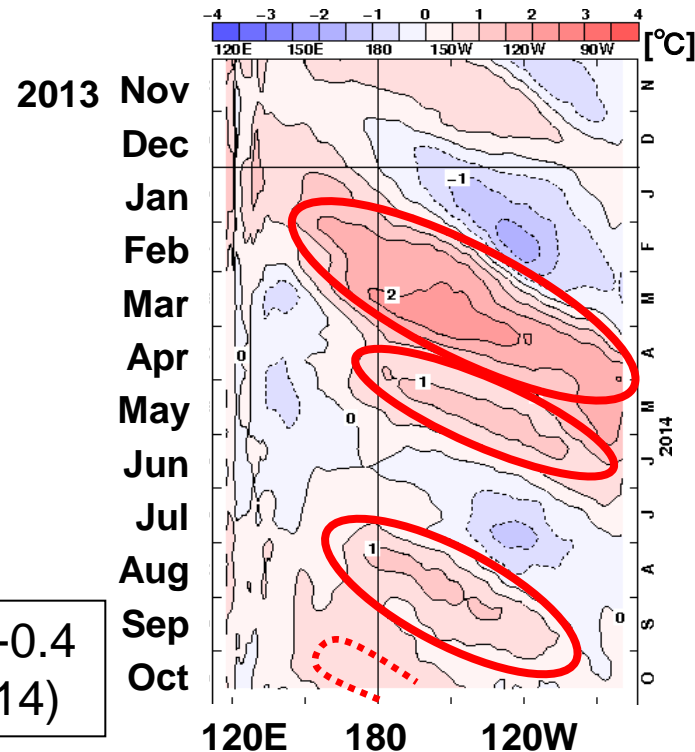
Time-longitude cross section along the EQ

SST anomaly

OHC (Ocean Heat Content; 0~300m) anomaly



NINO.3: +0.4
(Sep. 2014)



- **Positive anomalies of SST sustain from the west of dateline to the eastern part of the Pacific.**
- Currently, those anomalies are small, indicating **ENSO neutral condition.**

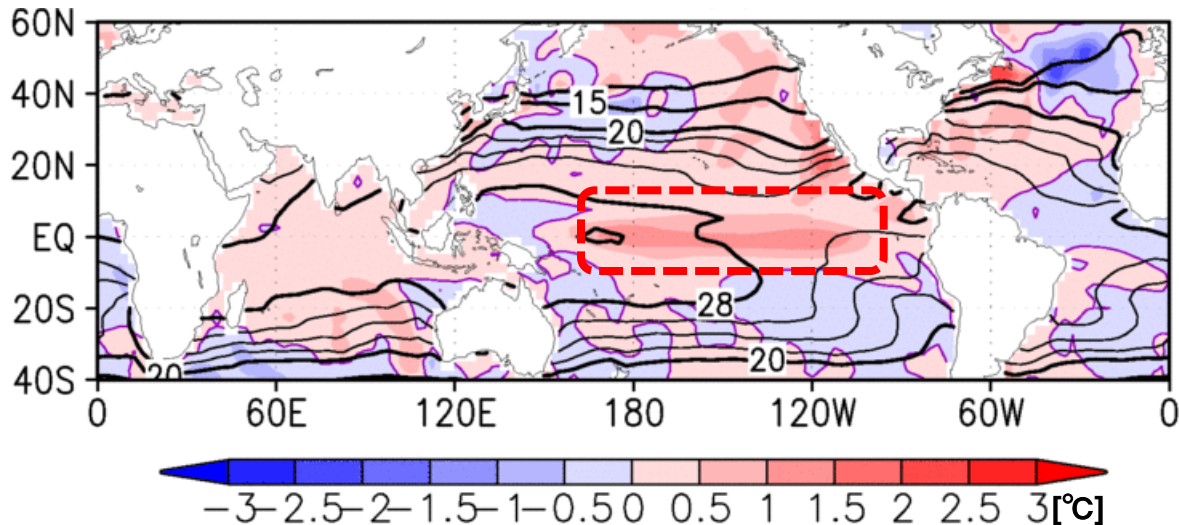
- **Warm Kelvin wave** propagated in spring, which contributed warming SSTs in the equatorial Pacific.
- Currently, **OHC anomalies are positive** in the equatorial Pacific, supporting positive SSTs in the region.

Outline

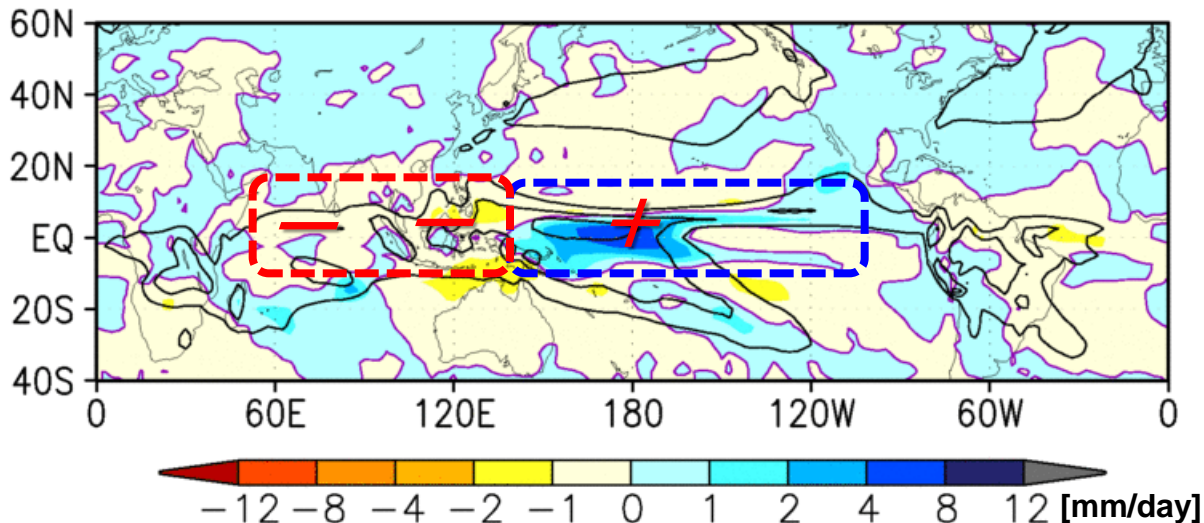
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Predicted SSTs and Precipitation for DJF

(SST anomalies)



(Precipitation anomalies)



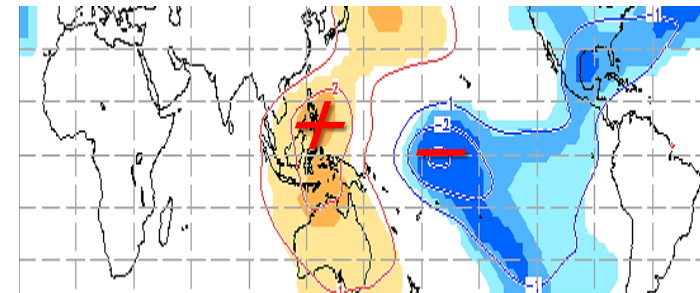
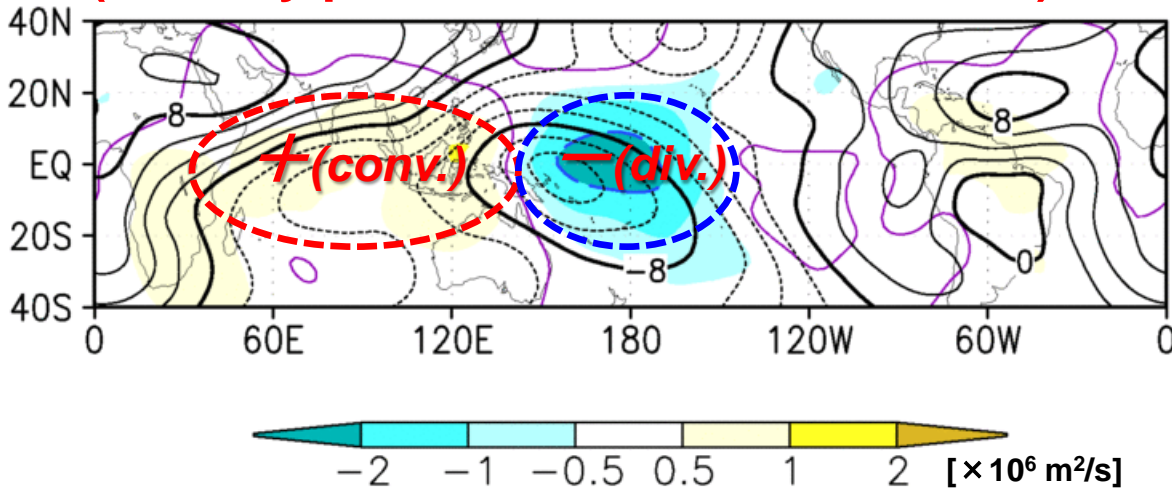
- **Positive SST anomalies** are predicted from the west of dateline to the eastern part of the equatorial Pacific.
- ✓ According to the [El Niño Outlook](#) (issued on 10 Oct.), the **possibility of development of El Niño conditions is comparable** to that of continuation of ENSO neutral conditions.

- **Precipitation anomalies** are predicted to be **positive** around the dateline of the tropical Pacific, while **negative** from the tropical Indian Ocean to the Maritime continent.

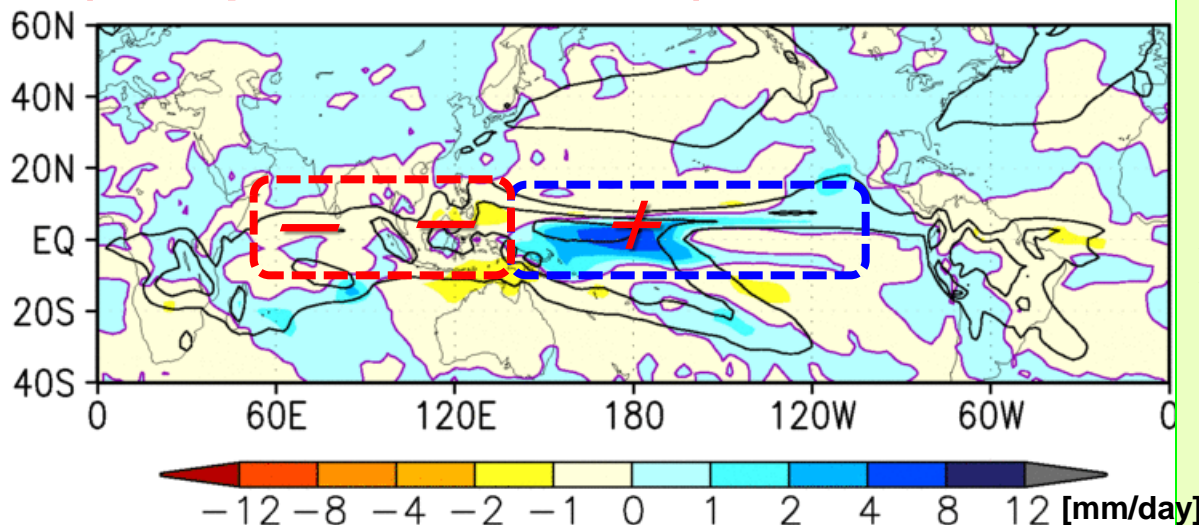
Predicted Atmospheric Fields in the Tropics for DJF

(Velocity potential at 200 hPa; CHI200)

(El Niño composite for CHI200)



(Precipitation anomalies)

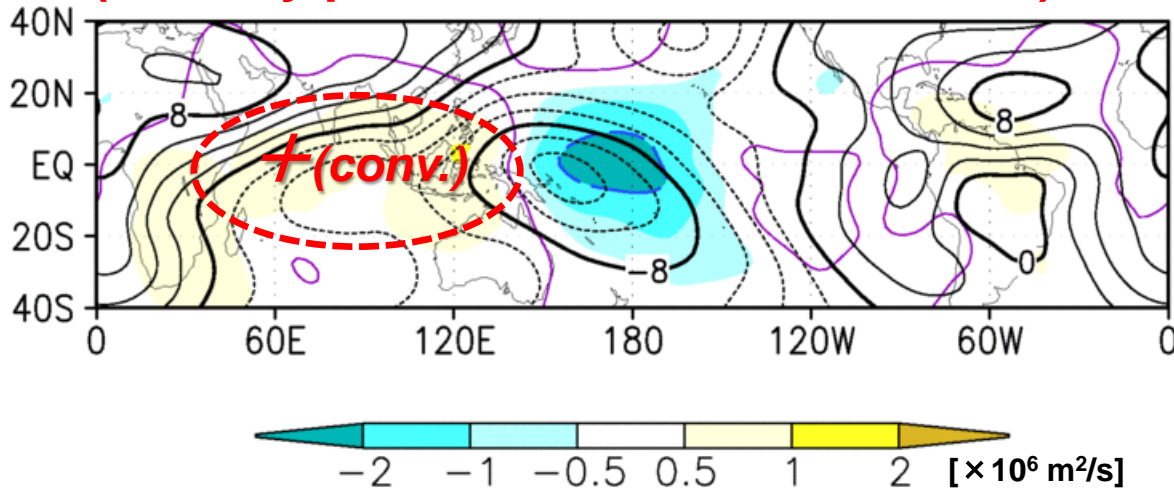


- **Velocity potential** anomalies at 200hPa are predicted to be **negative** (i.e., **more divergent**) around the dateline of the tropical Pacific and **positive** (i.e., **more convergent**) from the Indian Ocean to the Maritime continent.

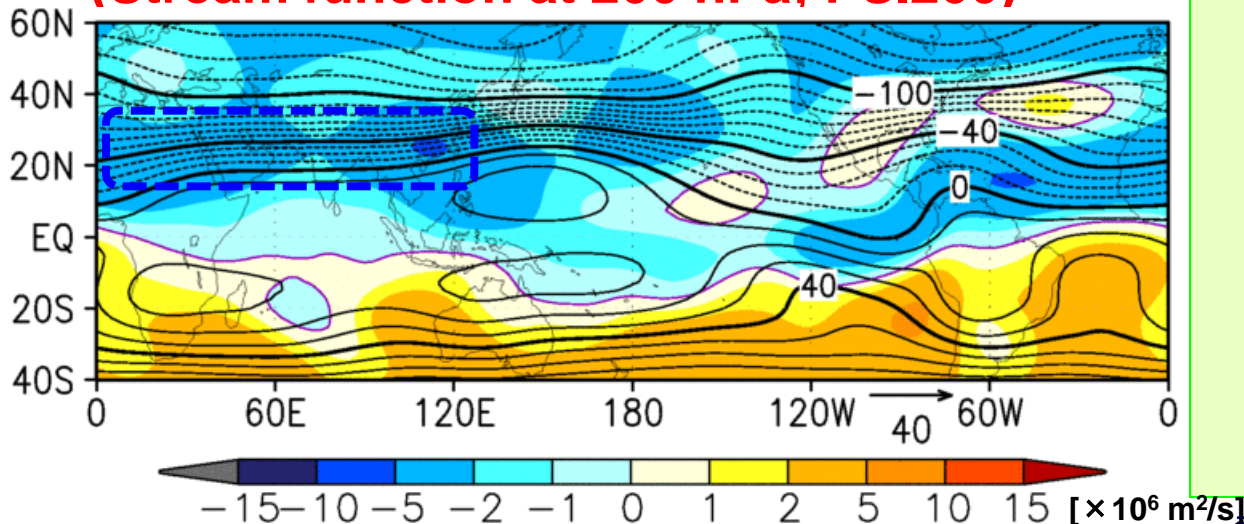
- Comparing with the typical ENSO responses, **anomaly pattern of convections is shifted westward.**

Predicted Atmospheric Fields in the Tropics for DJF

(Velocity potential at 200 hPa; CHI200)



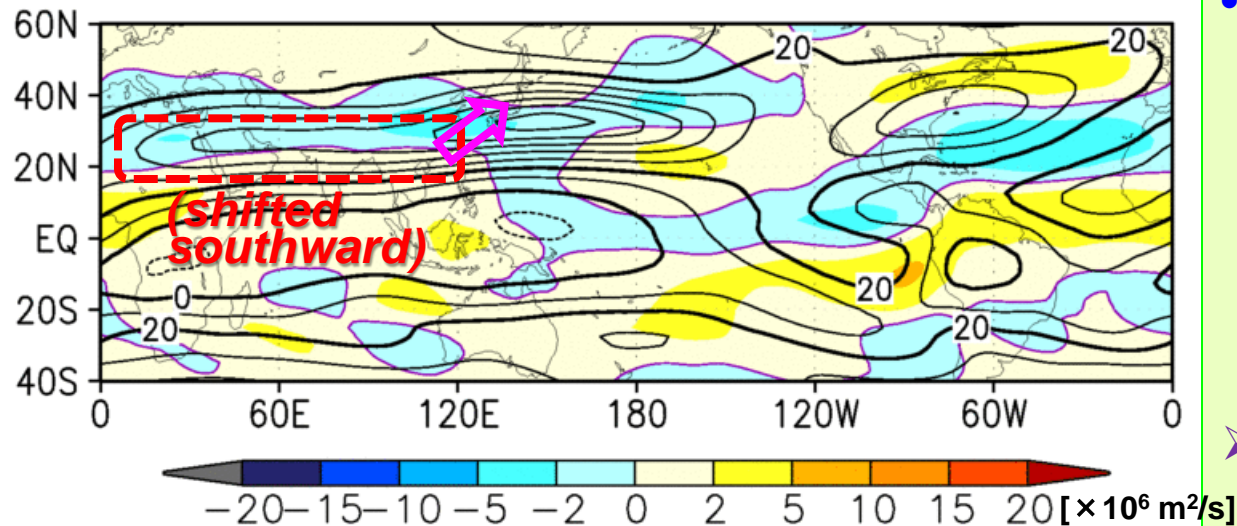
(Stream function at 200 hPa; PSI200)



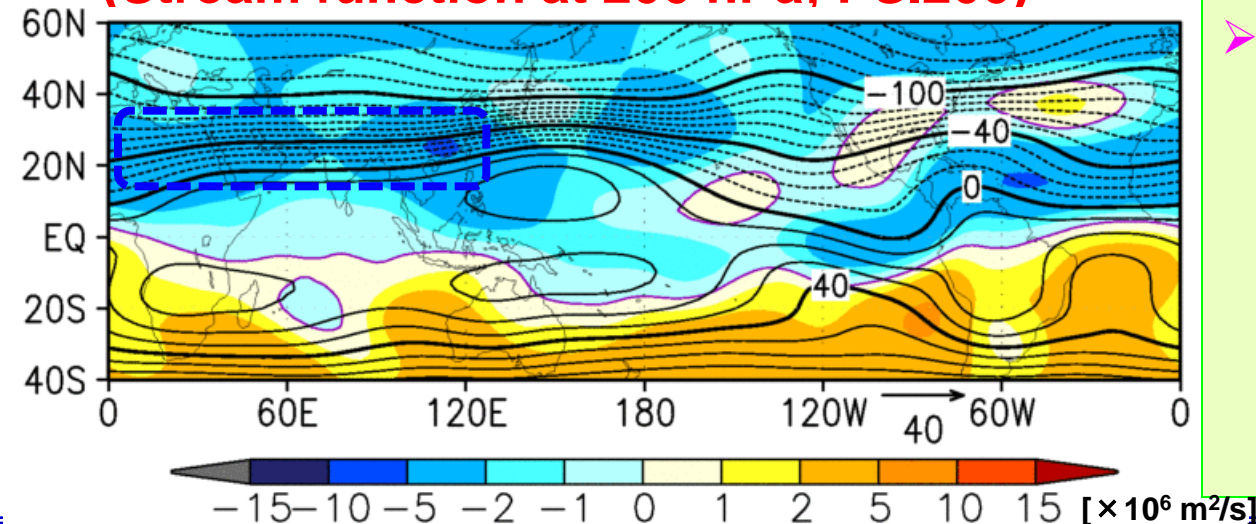
- **Stream function** anomalies at 200hPa are predicted to be **negative (i.e., cyclonic)** in the mid-latitudes of the **Eurasian continent**, reflecting inactive convections from the tropical Indian Ocean to the Maritime continent.

Predicted Atmospheric Fields in the Tropics for DJF

(Zonal wind at 200 hPa; U200)



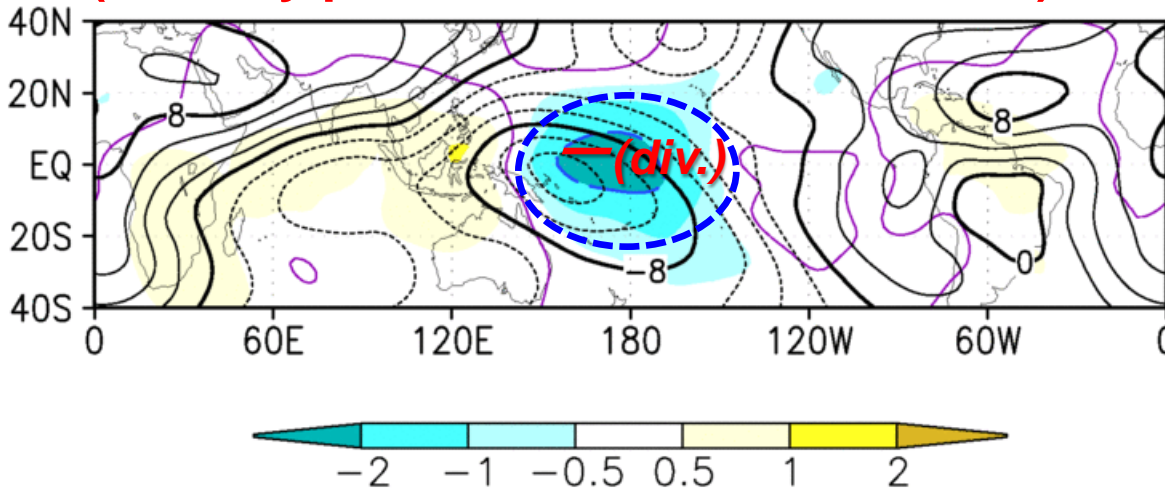
(Stream function at 200 hPa; PSI200)



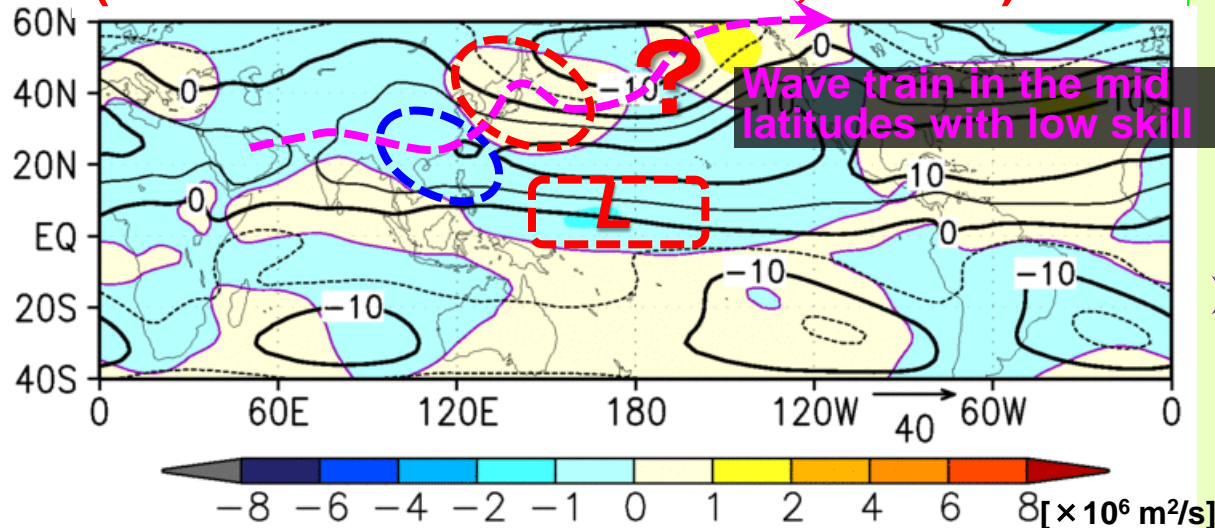
- **Stream function** anomalies at 200hPa are predicted to be **negative (i.e., cyclonic)** in the mid-latitudes of the **Eurasian continent**, reflecting inactive convections from the tropical Indian Ocean to the Maritime continent.
- **Subtropical jet** is expected to **shift southward** over the Eurasian continent.
- **Southwestward anomalies of the upper flow** are expected in **west of Japan**, which would **reduce winter monsoon** and **enhance the impact of low pressures** in the region.

Predicted Atmospheric Fields in the Tropics for DJF

(Velocity potential at 200 hPa; CHI200)



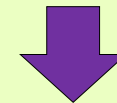
(Stream function at 850 hPa; PSI850)



【North Pacific】

- **Stream function** anomalies at 850hPa are predicted to be relatively negative (**i.e., cyclonic**) in the low-latitudes, reflecting active convections over the central part of the tropical Pacific.

- The model predicts **weak tendency of the Aleutian low**, which is affected by wave train in the mid-latitudes with low prediction skill.



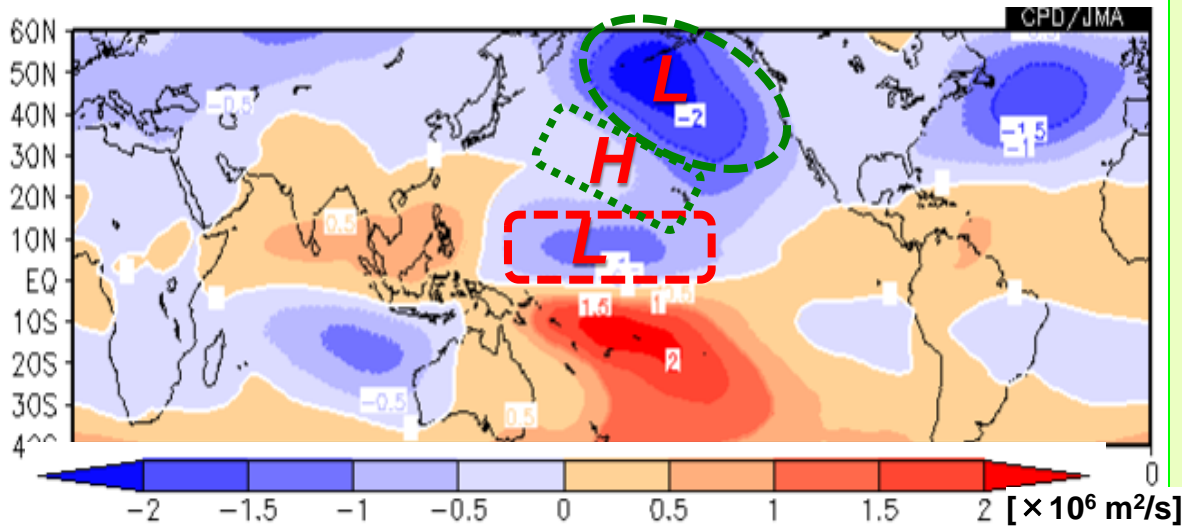
- **Check up a reasonable response to anomaly pattern of convection in the tropics**

Interpretation of the Aleutian low based on the climatological statistics

【Statistics with the Analysis】

Using JRA-55 and GPCP (1981-2013)

(Regression of PSI850 upon precipitation in west of the DL (160E-180E, 10S-10N) for DJF)



【North Pacific】

- According to the statistics, **the Aleutian low** tends to be more enhanced in the southeastern part, in case of active convection in the west of the DL.

➤ Forecasters expect that “the Aleutian low would be more enhanced than the climatology in the southeastern part”.

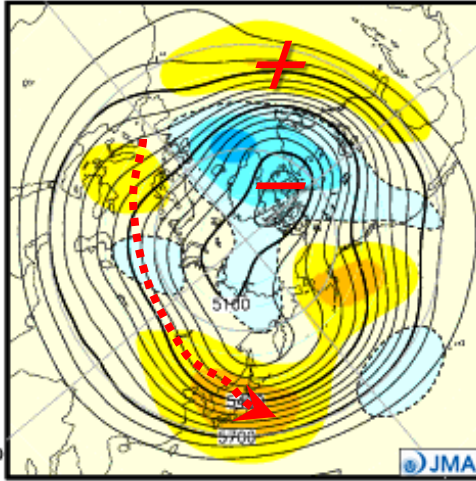
Predicted Atmospheric Fields in the high-latitudes for DJF

(500 hPa geo-potential height; Z500)

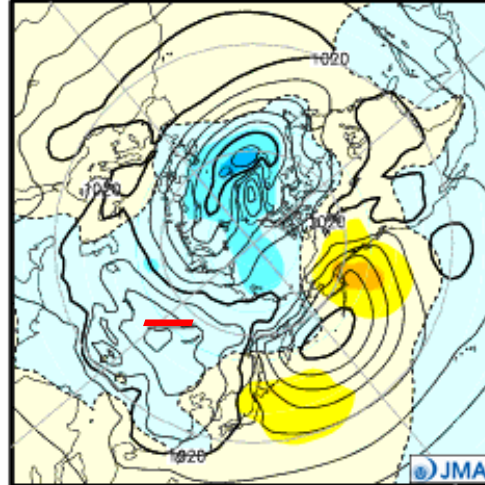
(Sea level pressure; SLP)

(850 hPa temperature)

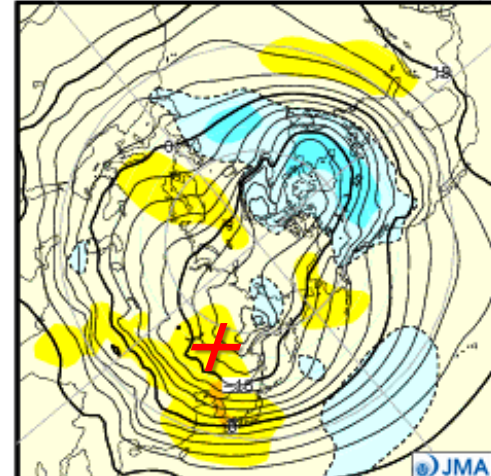
Z500 (FORECAST) from 2014/10/ 8 00Z LT=54 days [m]



PSEA (FORECAST) from 2014/10/ 8 00Z LT=54 days [hPa]



T850 (FORECAST) from 2014/10/ 8 00Z LT=54 days [C]



-120 -90 -60 -30 0 30 60 90 120 [m]

-16 -12 -8 -4 0 4 8 12 16 [hPa]

-4 -3 -2 -1 0 1 2 3 4 [°C]

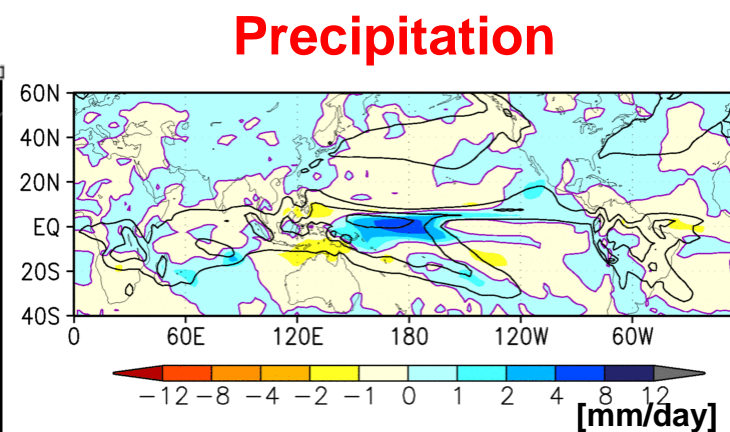
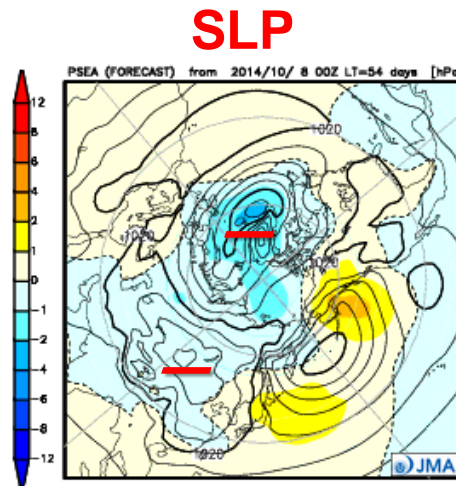
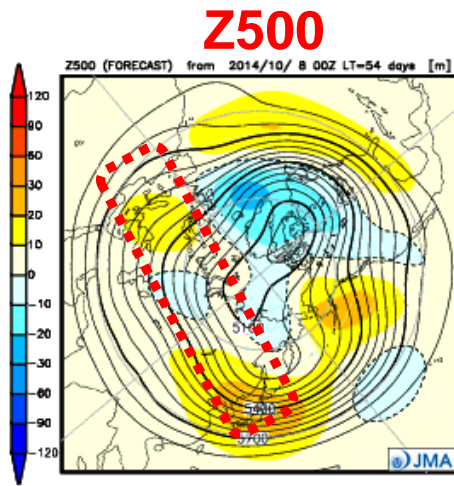
- The model predicts
 - Positive AO (or NAO)
 - Negative EU like pattern (wave train including negative in the western Siberia and positive in the northeast Asia)
 - Bring to **weak tendency of the Siberian** high and **warm tendency in East Asia**

□ However, as prediction skill of the model is insufficient -> The above characteristics should be interpreted with caution

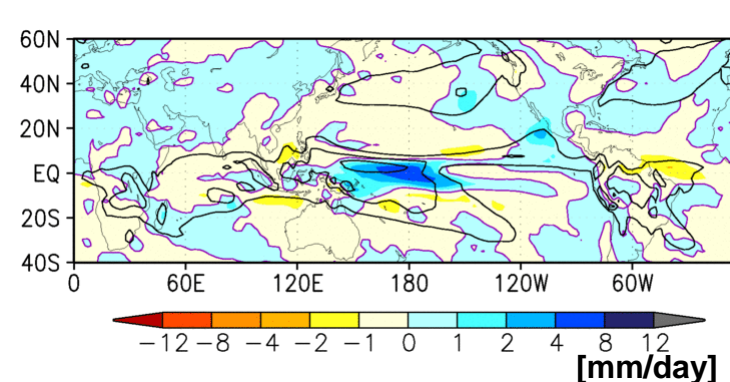
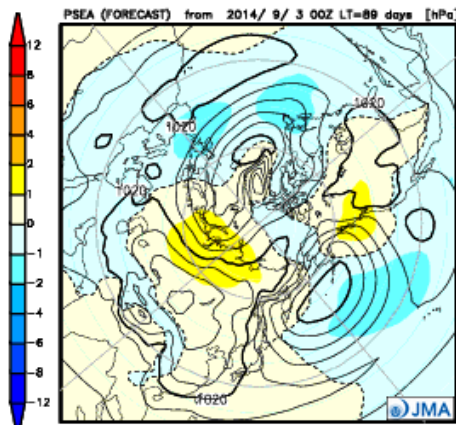
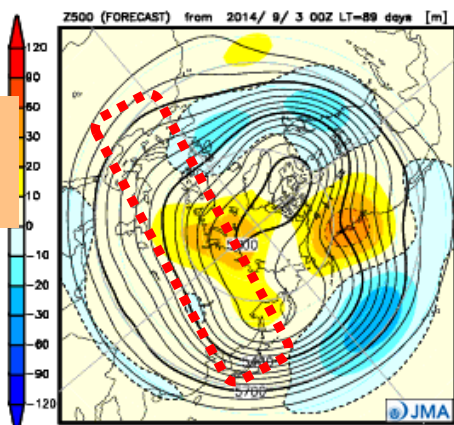
Difficulty to predict in high-latitudes

Comparison with the previous month products

Initial of
October



Initial of
September



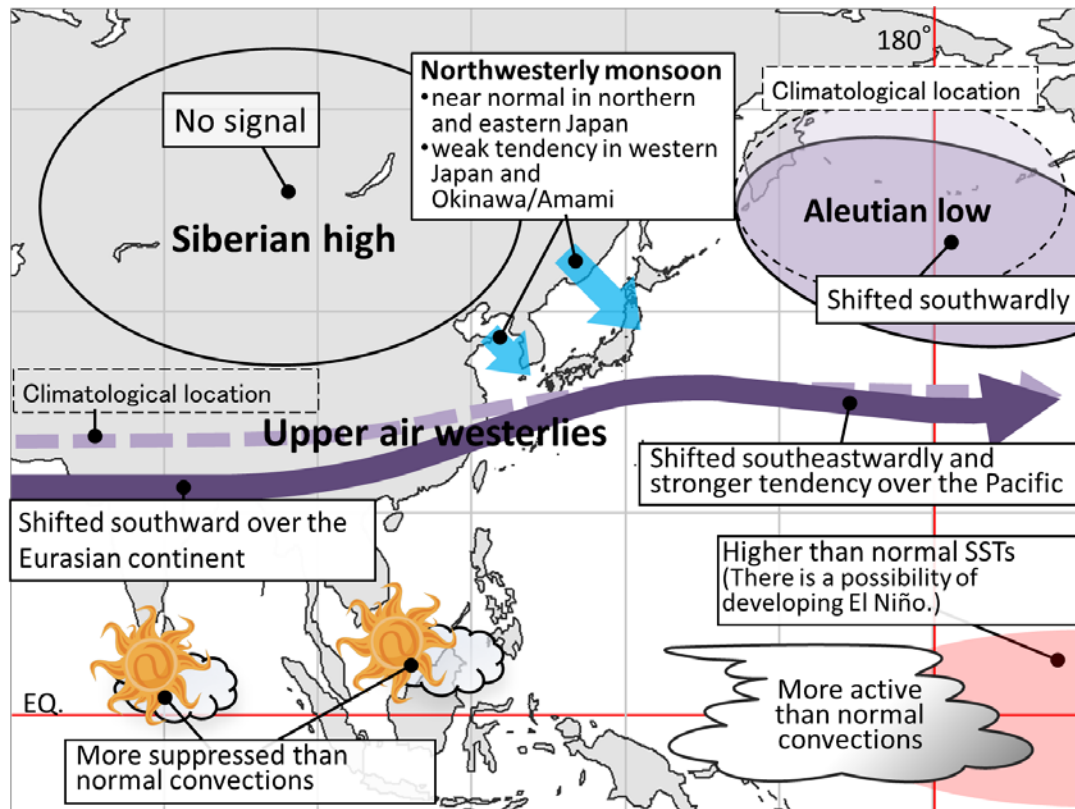
- **Large difference** from the previous month products in the high latitudes, although convection pattern is similar over the tropics, which is the signal for prediction.
- Forecasters assume no-signal for the Siberian high and AO.

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Summary

(Conceptual diagram of expected general characteristics)

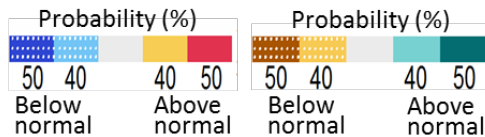


- **Above-normal SSTs** from the west of dateline to the eastern part of the **equatorial Pacific**.
- **Convections** are expected to be **enhanced around the dateline**, while **suppressed** from the Indian Ocean to the Maritime continent.
- **Subtropical jet** is expected to **shift southwardly** over the Eurasian continent.
- **Southwestward anomalies** of the upper flow are expected around west of Japan, which would **reduce winter monsoon** and **enhance the impact of low pressures** in the region.
- **The Aleutian low** is expected to be **enhanced in the southeastern part**.
- **No signal** for **AO** and the **Siberian high** are assumed due to insufficient prediction skill.

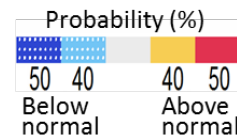
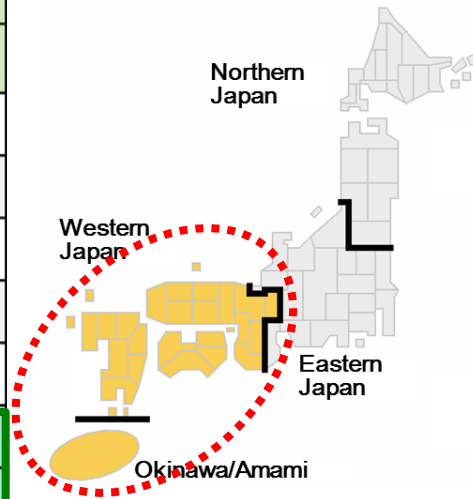
- In East Asia, **northwesterly monsoon** is expected to be generally **weaker-than normal**, which would **bring warm and wet tendency**, while, **near normal** in the northeastern part.

Outlook for winter 2014/15 over Japan

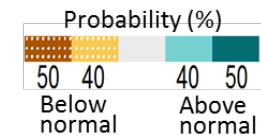
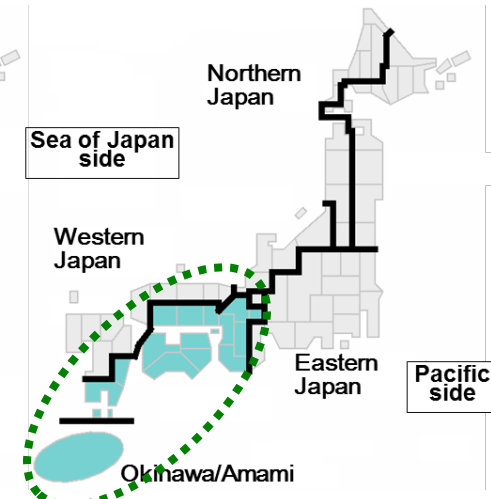
Category		Temperature			Precipitation		
		-	0	+	-	0	+
Northern Japan	Sea of Japan side	30	40	30	30	40	30
	Pacific side				30	30	40
Eastern Japan	Sea of Japan side	30	30	40	30	40	30
	Pacific side				30	30	40
Western Japan	Sea of Japan side	20	40	40	30	40	30
	Pacific side	20	40	40	20	40	40
Okinawa/Amami		20	40	40	20	40	40



Temperature



Precipitation

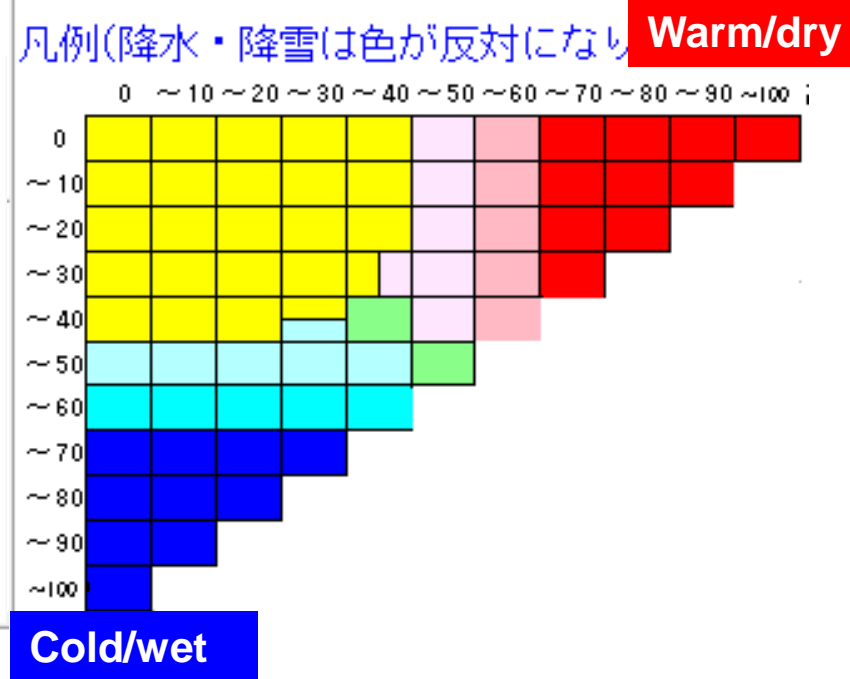
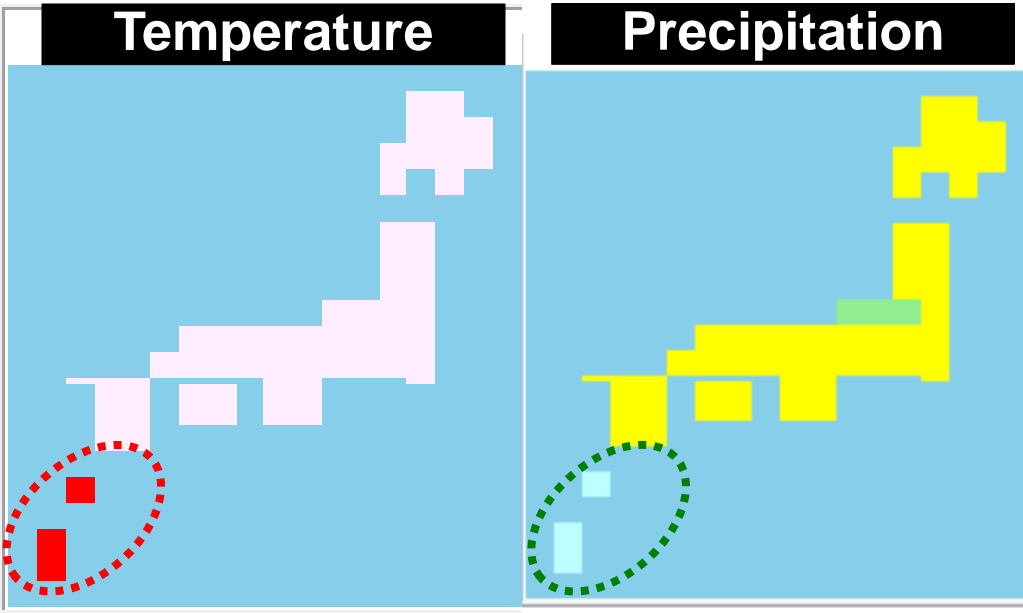


- **Temperatures** are expected to be near- or above-normal in western Japan and Okinawa/Amami.
- **Precipitation** is expected to be near- or above-normal on the Pacific side of western Japan and Okinawa/Amami.

References

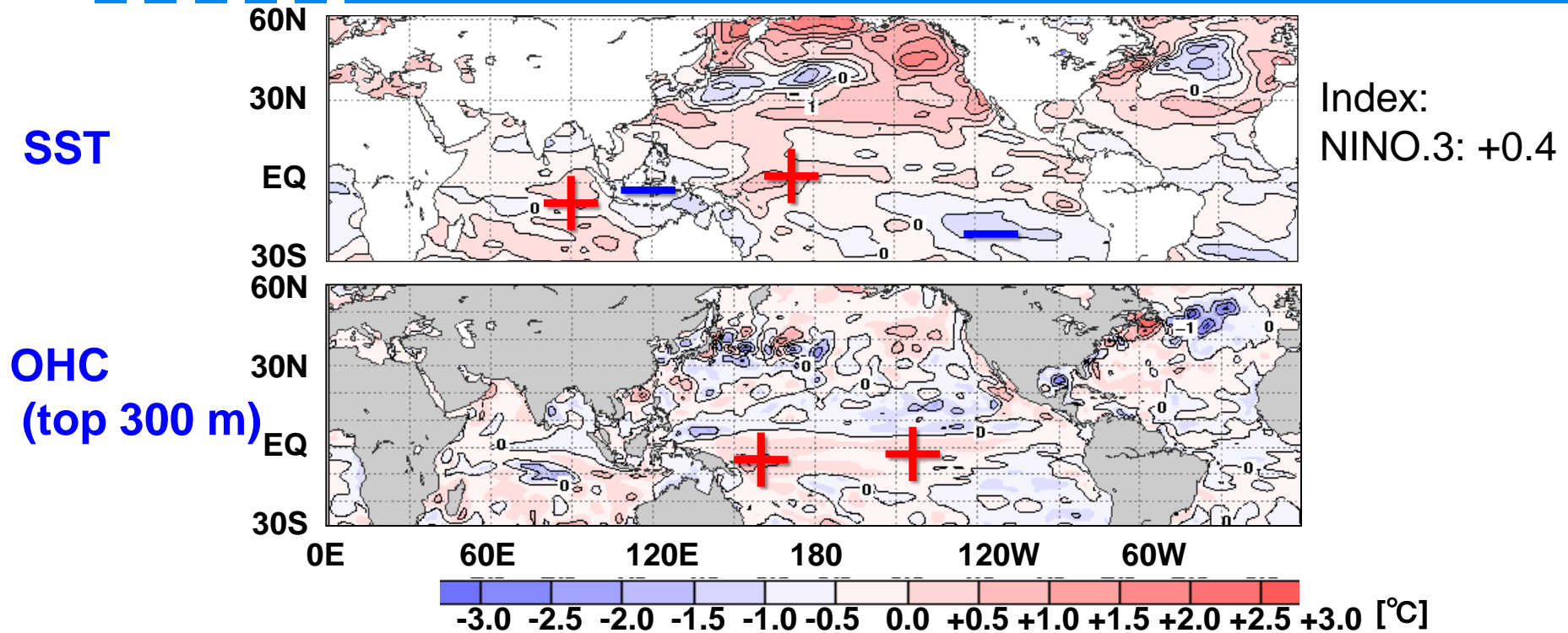
- Tokyo climate center
 - Top page
 - <http://ds.data.jma.go.jp/gmd/tcc/tcc/index.html>
- Monthly Discussion on Seasonal Climate Outlooks
 - http://ds.data.jma.go.jp/gmd/tcc/tcc/products/model/monthly_discussion/latest.pdf
- JMA El Niño outlook
 - <http://ds.data.jma.go.jp/tcc/tcc/products/elnino/outlook.html>
- Numerical model prediction
 - Top page
 - <http://ds.data.jma.go.jp/gmd/tcc/tcc/products/model/index.html>
 - Forecast maps (Ensemble mean forecast map)
 - 3-month prediction
 - <http://ds.data.jma.go.jp/gmd/tcc/tcc/products/model/map/4mE/index.html>
 - Warm/Cold Season Prediction
 - <http://ds.data.jma.go.jp/gmd/tcc/tcc/products/model/map/7mE/index.html>
 - Probabilistic Forecast with the numerical guidance
 - 3-month prediction
 - <http://ds.data.jma.go.jp/gmd/tcc/tcc/products/model/probfcst/4mE/index.html>
 - Warm/Cold Season Prediction
 - <http://ds.data.jma.go.jp/gmd/tcc/tcc/products/model/probfcst/7mE/index.html>
- Climate monitoring
 - Top page
 - <http://ds.data.jma.go.jp/gmd/tcc/tcc/products/clisys/index.html>

Tercile probability forecast with the numerical guidance



- The guidance predicts
 - Warmer than normal temperature in Okinawa/Amami
 - Wetter than normal tendency in Okinawa/Amami

SST and subsurface temperature (OHC) Monitoring (Monthly anomalies in September 2014)

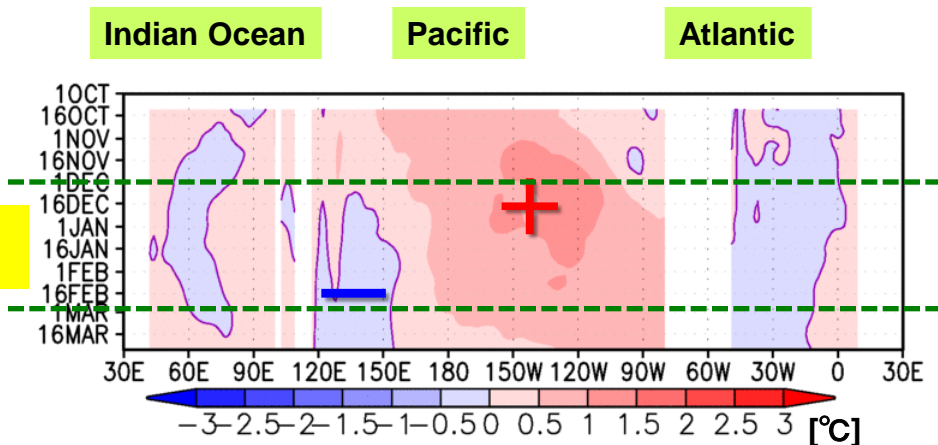


- **SST** anomalies were generally positive in the equatorial.
- However, those anomalies are small in the eastern part, suggesting **ENSO neutral condition**.
- **Subsurface temperature (OHC)** anomalies are positive in the equatorial Pacific, supporting positive SSTs in the region.

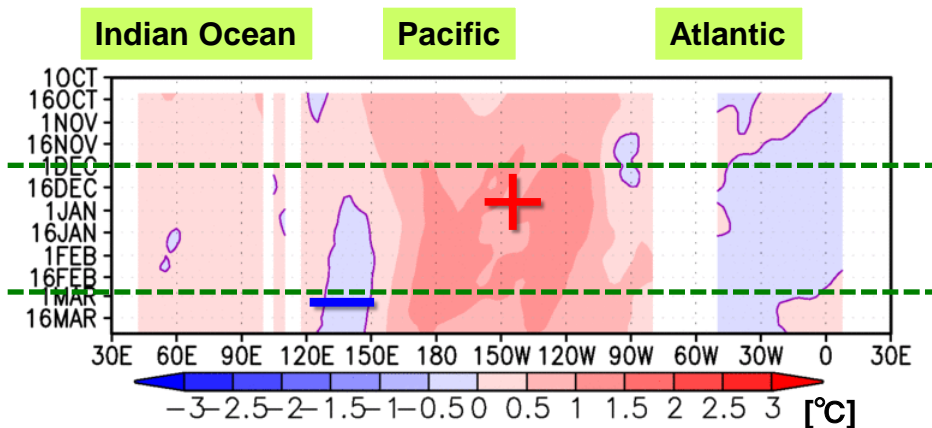
Predicted OHC and SST in the equatorial region

Time-longitude cross section along the EQ

OHC anomalies (Oct. 2014-Mar. 2015)



SST anomalies (Oct. 2014-Mar. 2015)

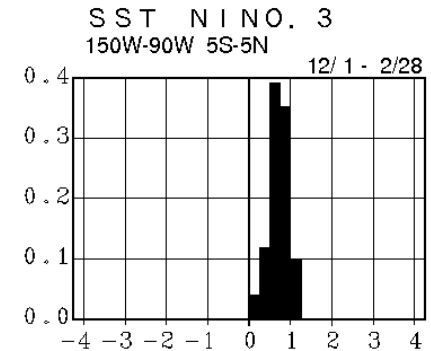
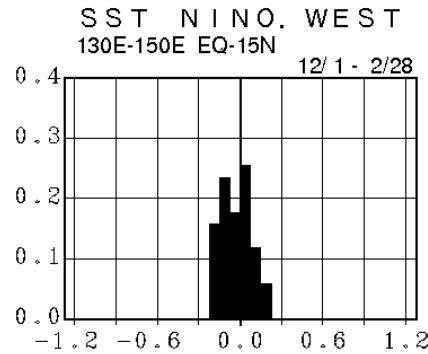
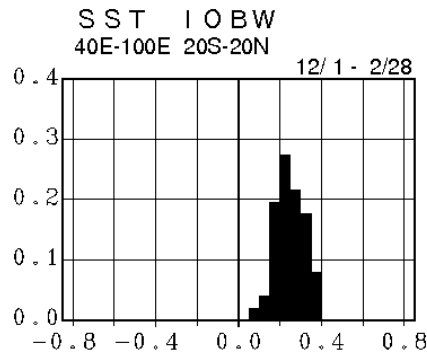
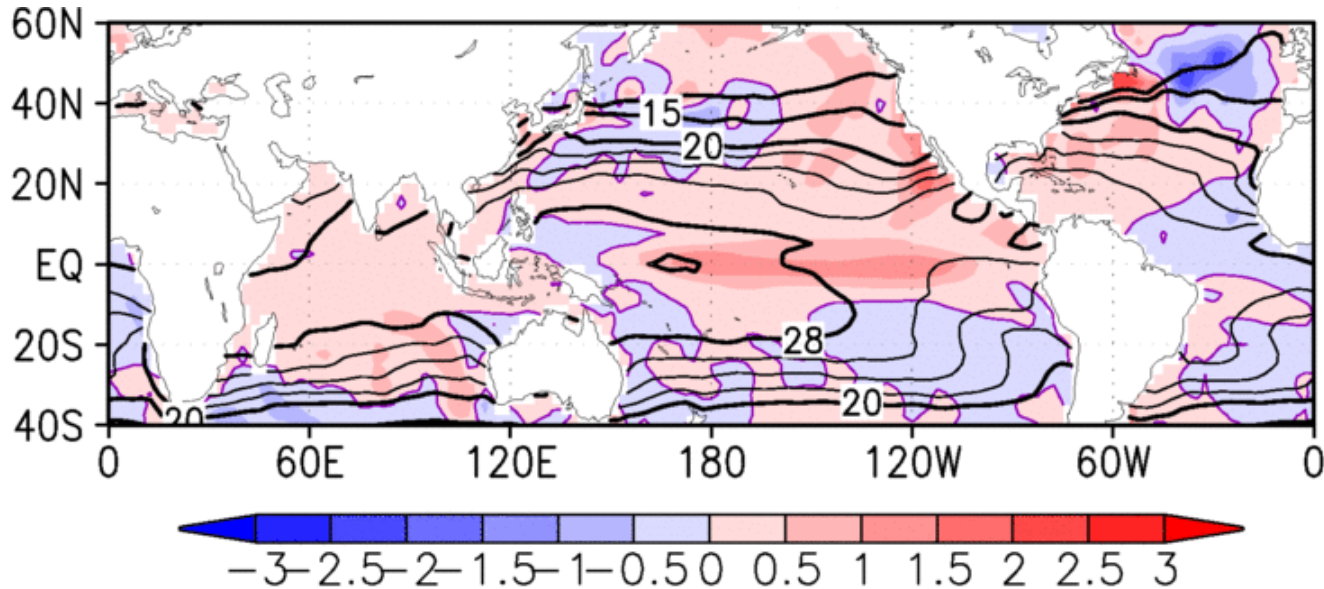


- **Subsurface temperature anomalies** are expected to be **positive** from the west of dateline to the eastern equatorial Pacific.

- **Positive SST anomalies** are sustained in the region.

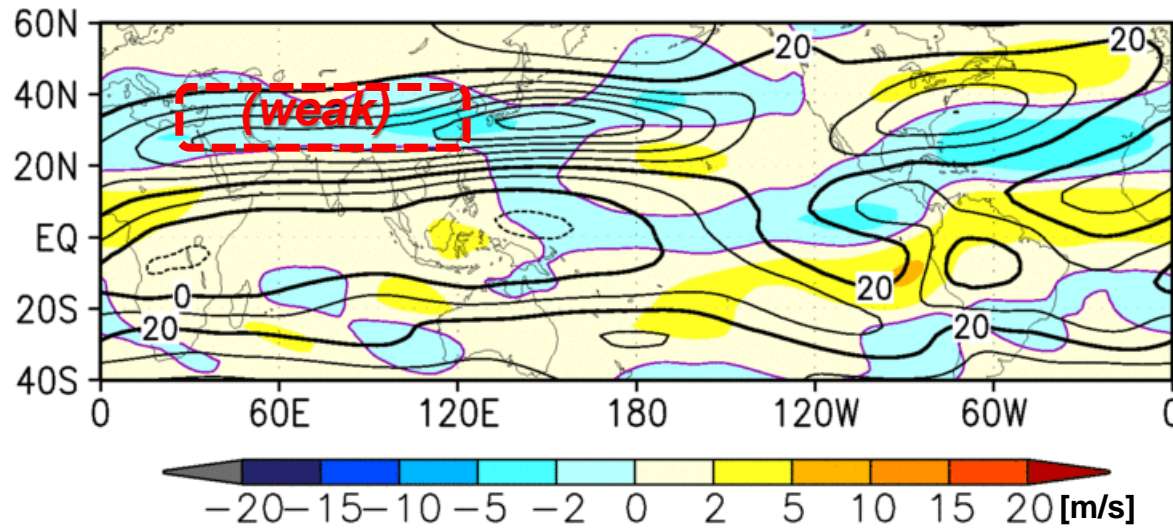
- ✓ According to the [El Niño Outlook](#) (issued on 10 Oct.), the possibility of development of El Niño conditions is **comparable** to that of continuation of ENSO neutral conditions.

Predicted SSTs for DJF

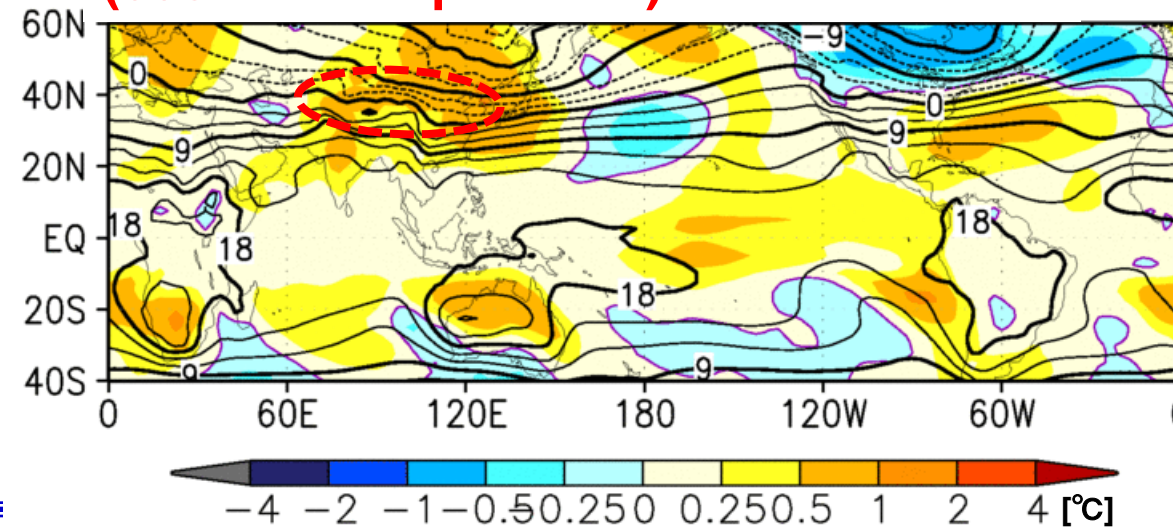


Predicted Atmospheric Fields in the Tropics for DJF

(Zonal wind at 200 hPa; U200)



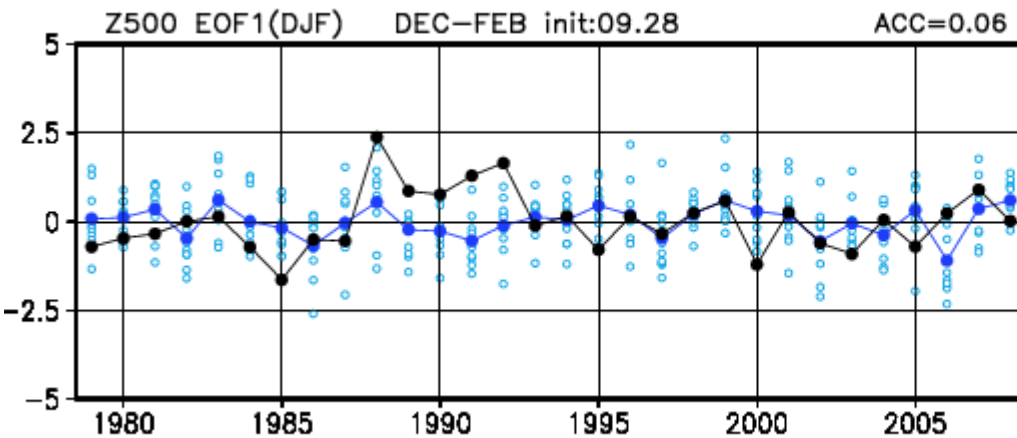
(850 hPa temperature)



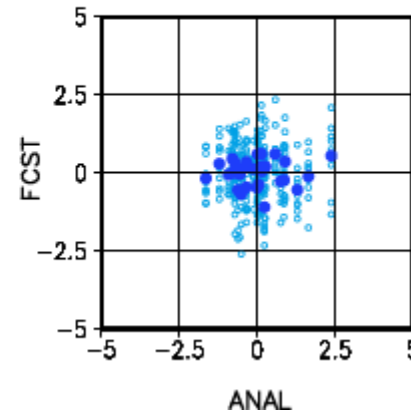
- **Positive anomalies of lower temperature** are predicted on the north side of the subtropical jet stream over the Eurasian continent (about 20° N-40° N) including western part of Japan, which may **relate with weak tendency of upper westerlies** and may make it harder for cold air to move down from higher latitudes.

Prediction skill of AO and EU pattern (hindcast)

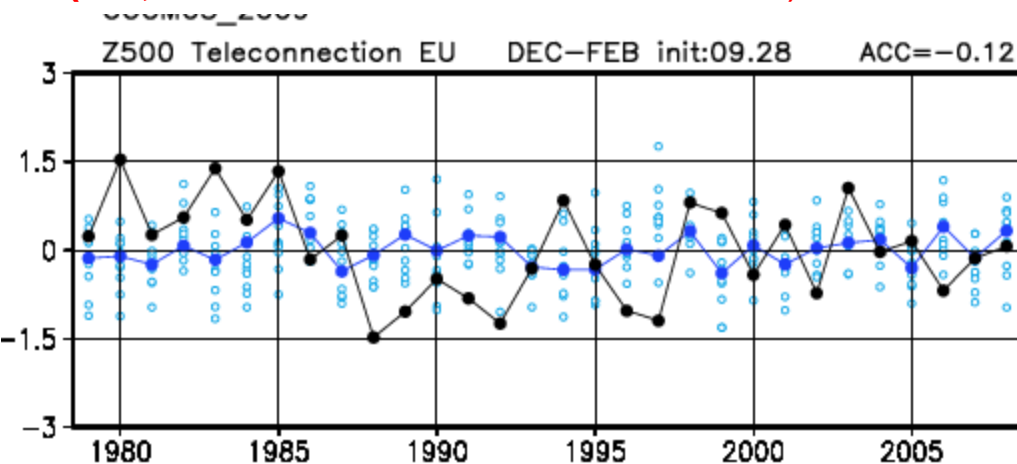
(AO; DJF forecast with init. of October)



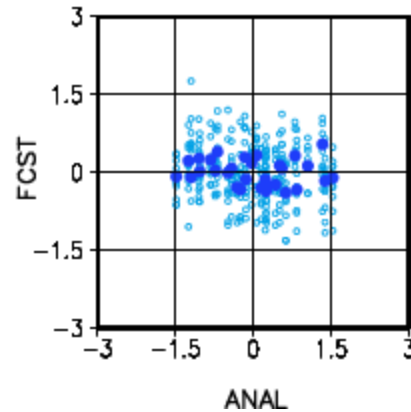
Correlation: 0.06

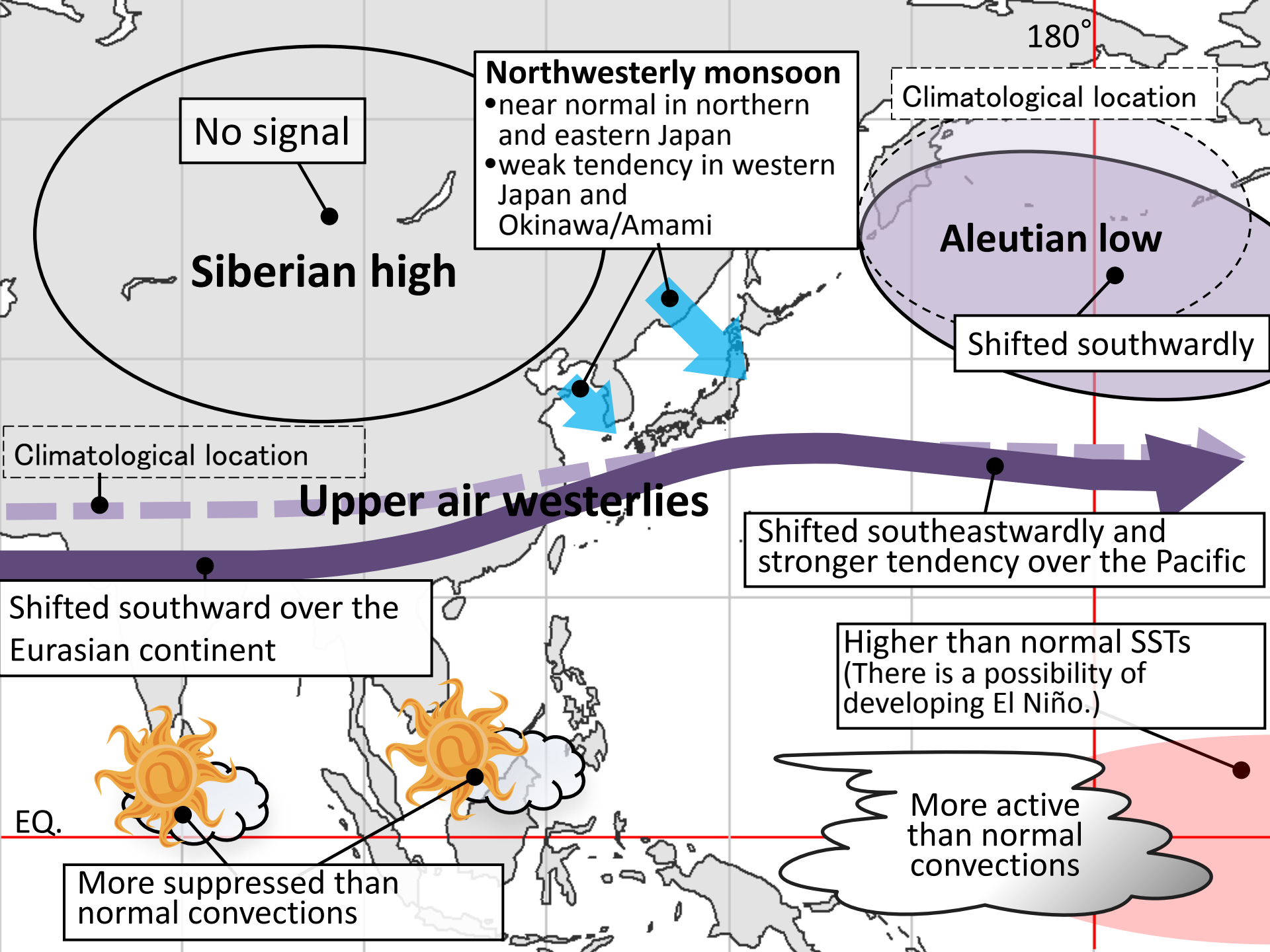


(EU; DJF forecast with init. of October)



Correlation: -0.12

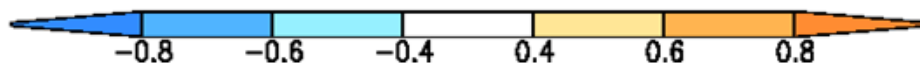
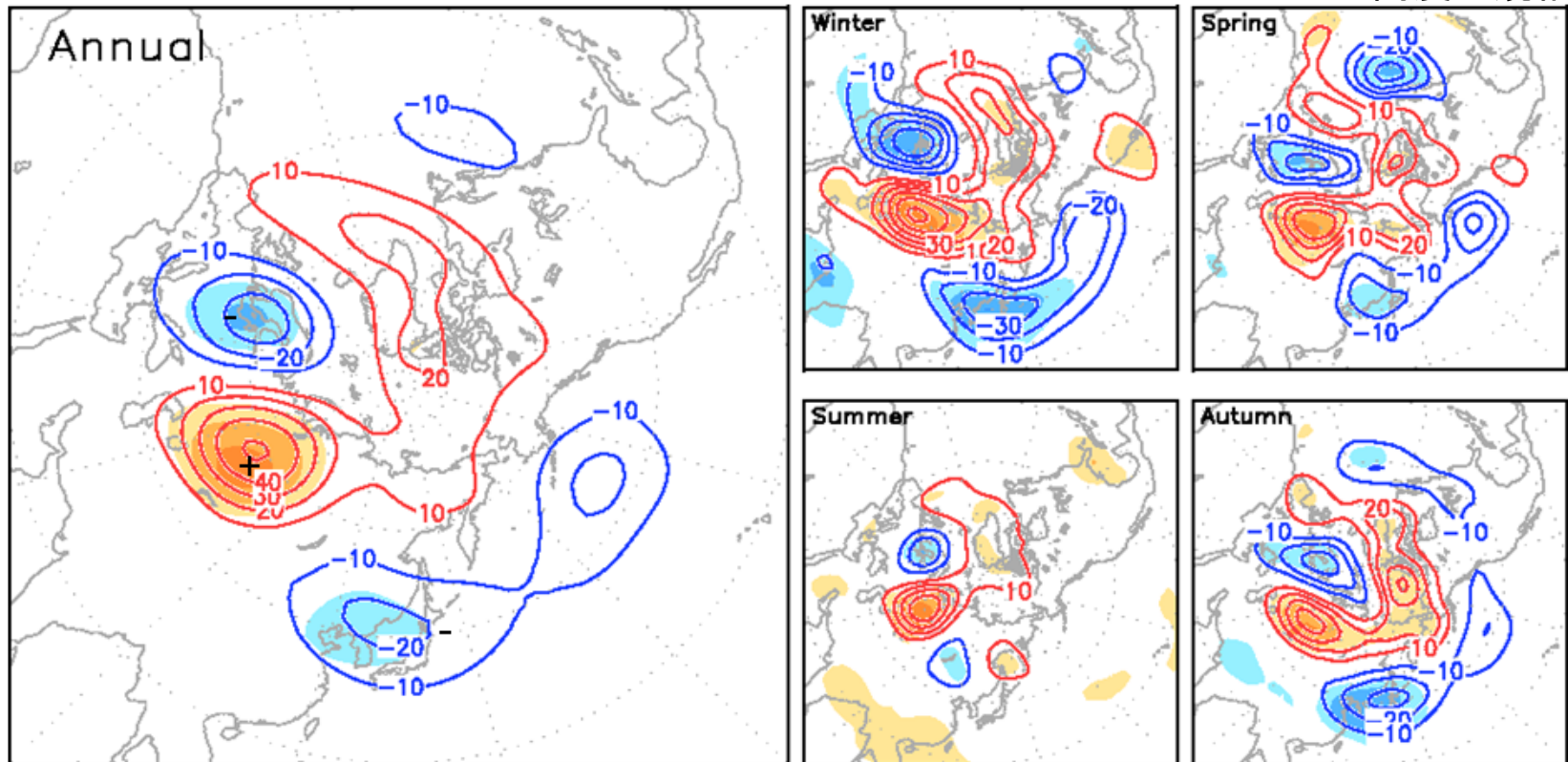




EU (Eurasian) pattern

$$EU = -Z500(55N, 20E)/4 + Z500(55N, 75E)/2 - Z500(40N, 145E)/4$$

Z500: 500hPa高度の規格化偏差

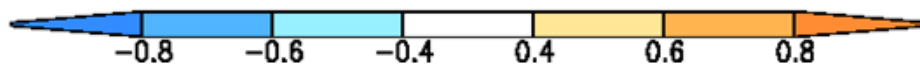
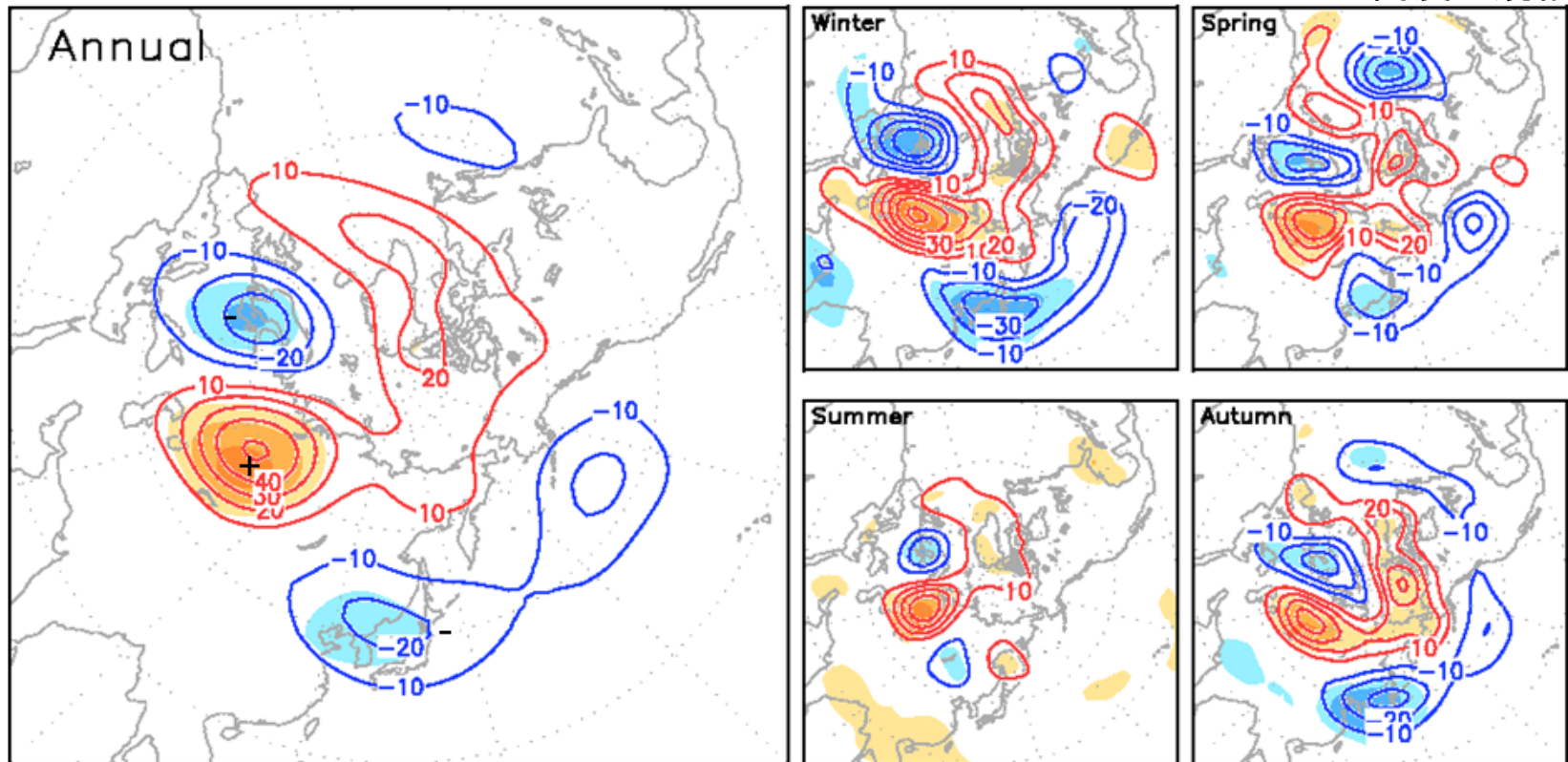


CPD/JMA
JRA-25 and JCDAS

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