

Cold Season Outlook for Winter 2015/2016 over Japan

Akio Narui

Tokyo Climate Center

Japan Meteorological Agency (JMA)

Outline

- JMA Seasonal Prediction System and its skill
- Cold Season Predictions for DJF 2015/16
- Summary

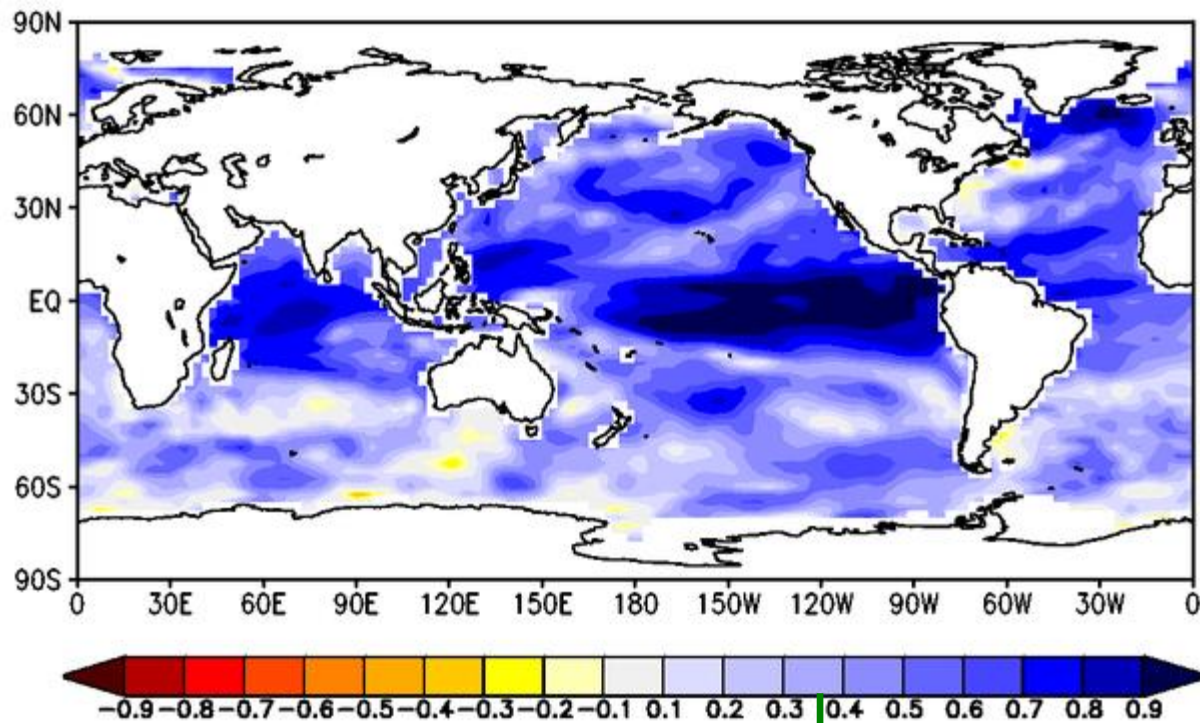
JMA Seasonal Prediction System

Model	CGCM (MRI/JMA-CGCM)
Resolution	<ul style="list-style-type: none">•Atmospheric component Resolution: about 110 km, 60 vertical levels (<u>T_L159 L60</u>)•Oceanic component Resolution: Horizontal 1.0° longitude, 0.3°–0.5°, 52 vertical levels
Ensemble size	• <u>Size: 51</u>
Frequency of forecast issuance	Once a month
Hindcast	1979-2014 (36 years)

In this presentation,

- Cold season outlook** (updated on 23 October 2015) based on the JMA's seasonal EPS with the initial month of October.
- Target period of forecast: **DJF 2015/16**
- Climate base period : 1981-2010

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

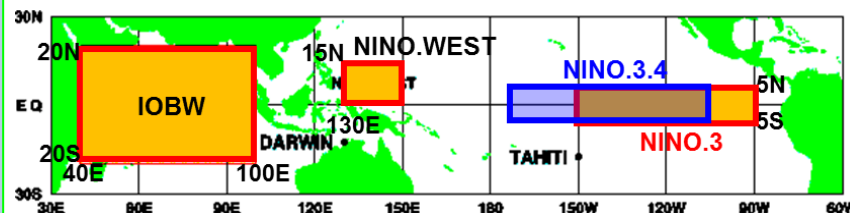


SST indices		Anomaly correlation
NINO.3	150W-90W 5S-5N	0.93
NINO3.4	170W-120W 5S-5N	0.93
NINO.WE ST	130E-150E EQ-15N	0.89
IOBW	40E-100E 20S-20N	0.86

(Verification period: 1981-2010)

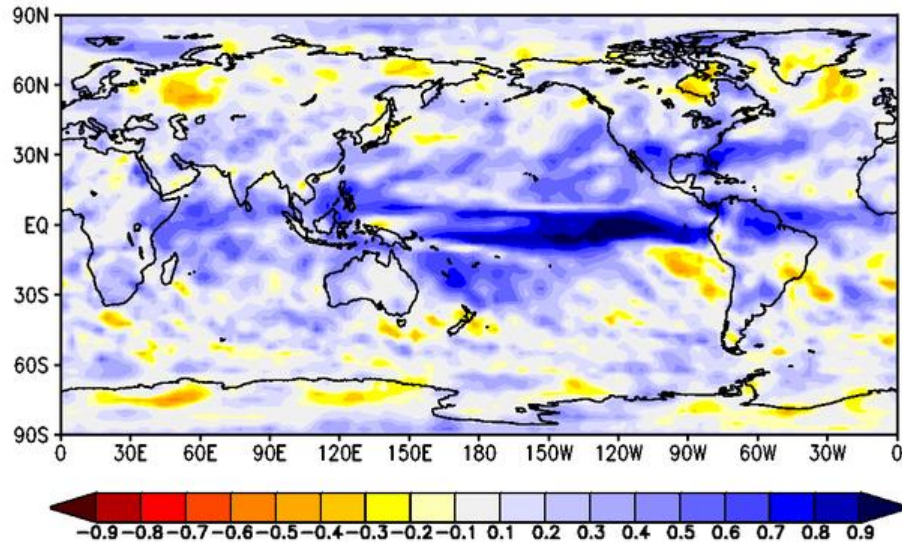
95% significant level

- In the tropics, prediction skill of SST is higher than the significant level. It means that ENSO is predicted well.



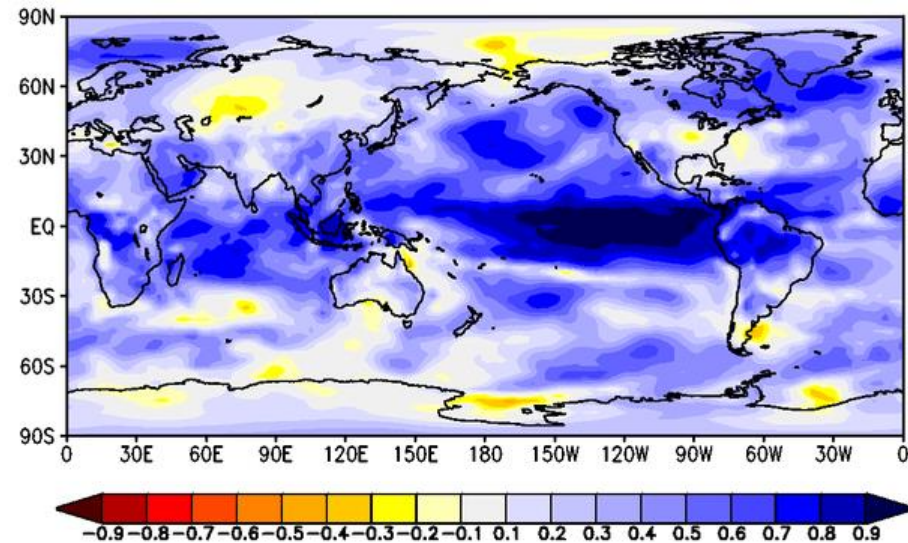
Prediction skill of surface temp. and precipitation (Anomaly Correlation for DJF with initial-October)

Precipitation



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

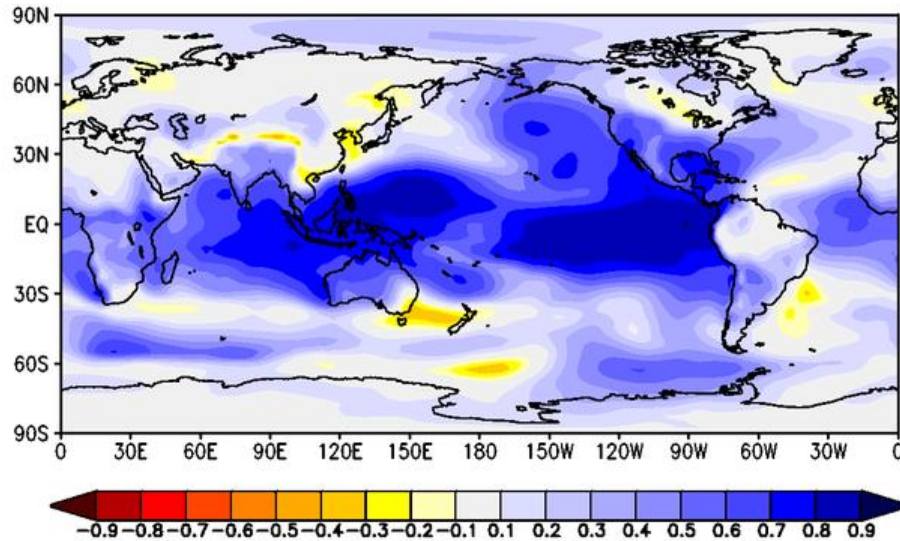
surface temperature



- In the East Asia, prediction skill of surface temperature is positive.

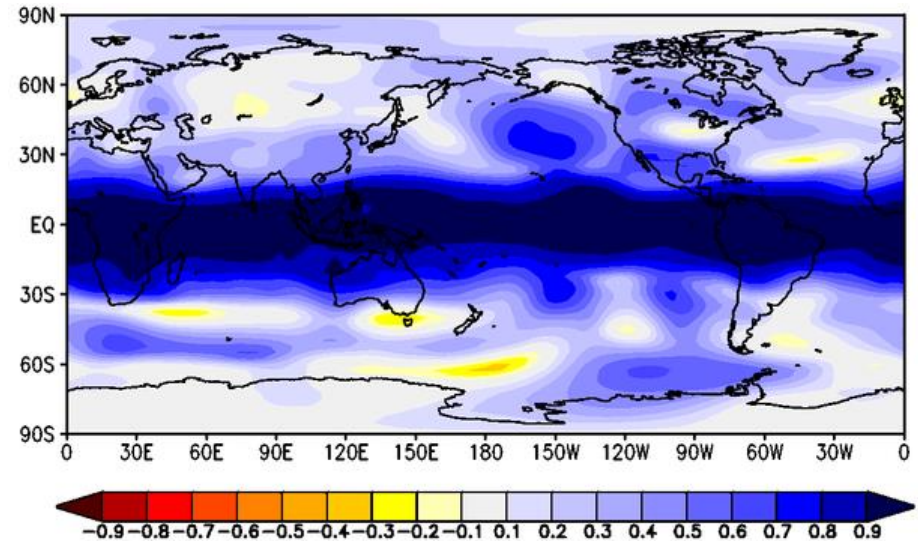
Prediction skill of SLP and 500hPa height (Anomaly Correlation for DJF with initial-October)

surface pressure level



- In the East Asia, prediction skill of SLP is near-zero.

500hPa height



- In the East Asia, prediction skill of 500z is slightly positive.

- As for the high-latitudes, the prediction skill is insufficient.
- Predicted characteristics in high-latitudes are reliable only when they are understood as the response of predicted characteristics in low-latitudes.
- Our seasonal forecast is basically made from signals of low latitudes.

Cold Season Predictions for DJF 2015/16

(Initial date for EPS: 8 October 2015)

Prediction by the JMA's seasonal EPS and its interpretation

Summary

ENSO

- El Niño conditions continue in the equatorial Pacific now.
- It is likely that El Niño conditions will continue through the winter.
- Sea surface temperatures are expected to be above-normal from the west of dateline to the eastern part of the equatorial Pacific.

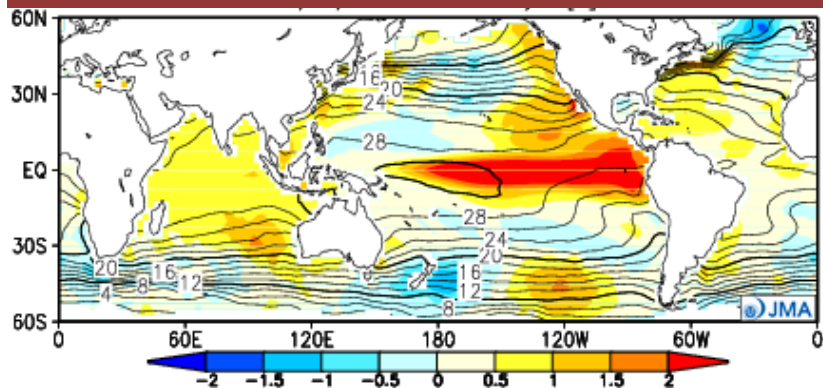
Prediction for December 2015-January 2016-February 2016 (DJF 2015/16)

- In the upper troposphere
 - large-scale divergence anomalies over the Pacific and large-scale convergence anomalies over the Maritime Continent are predicted.
 - Cyclonic circulation anomalies centered over southern China and Anticyclonic circulation anomalies over the sea east of Japan are predicted, reflecting the predicted large-scale pattern of convection anomalies.
- These anomalies in the upper troposphere lead **southwestward anomalies of the upper flow in west of Japan**, indicating **weaker than normal winter monsoon in Eastern Asia**.

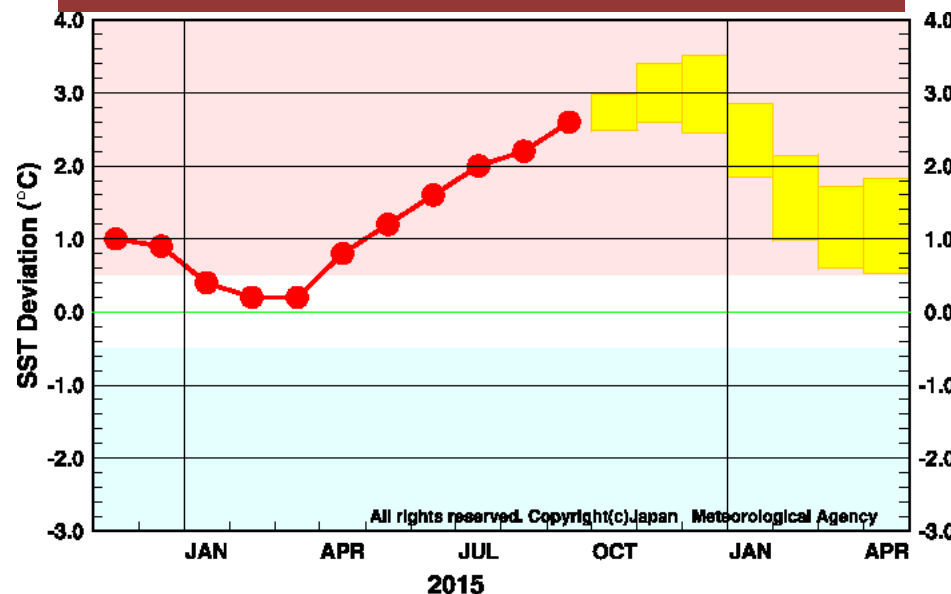
Predicted Sea Surface Temperature (SST) for DJF

- It is likely that El Niño conditions will continue through DJF.
- It is likely that the NINO.WEST SST will be roughly below normal .
- It is likely that the SST over the Indian Ocean will be above normal.
- A high probability of above normal rainfall is predicted for the equatorial Pacific.
- A high probability of below normal rainfall is predicted for the Maritime Continent.

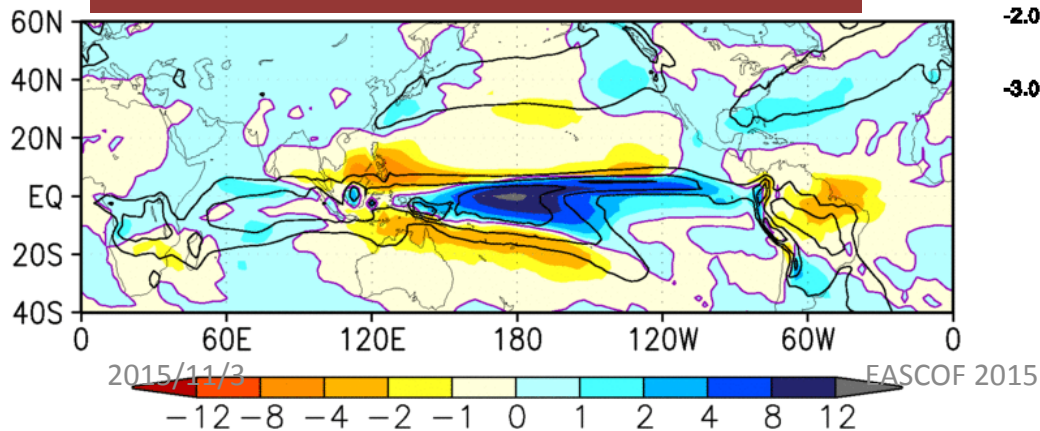
SST anomalies (°C)



Outlook of the SST deviation for NINO.3

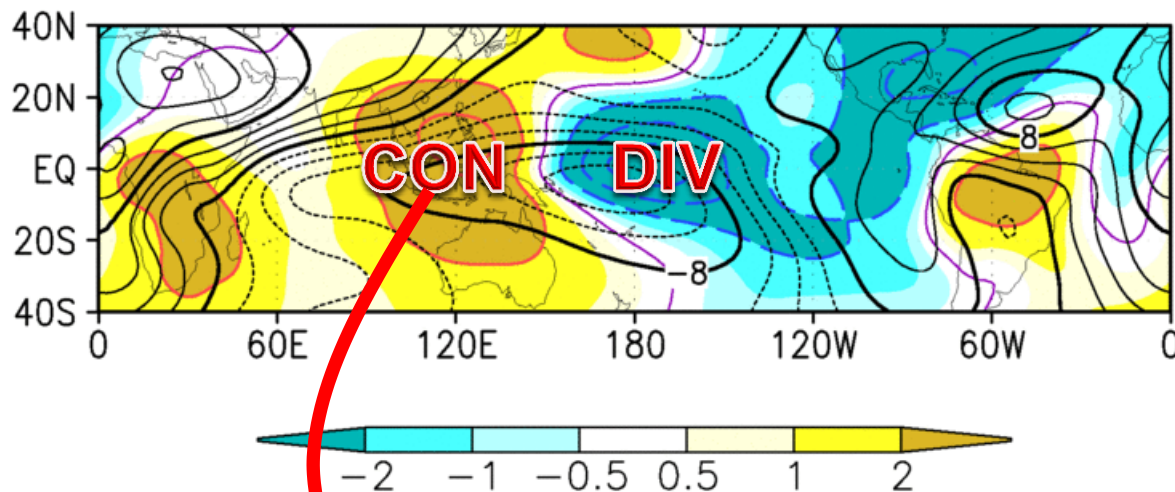


Precipitation anomalies (mm/day)



Our interpretation of the Model output for DJF

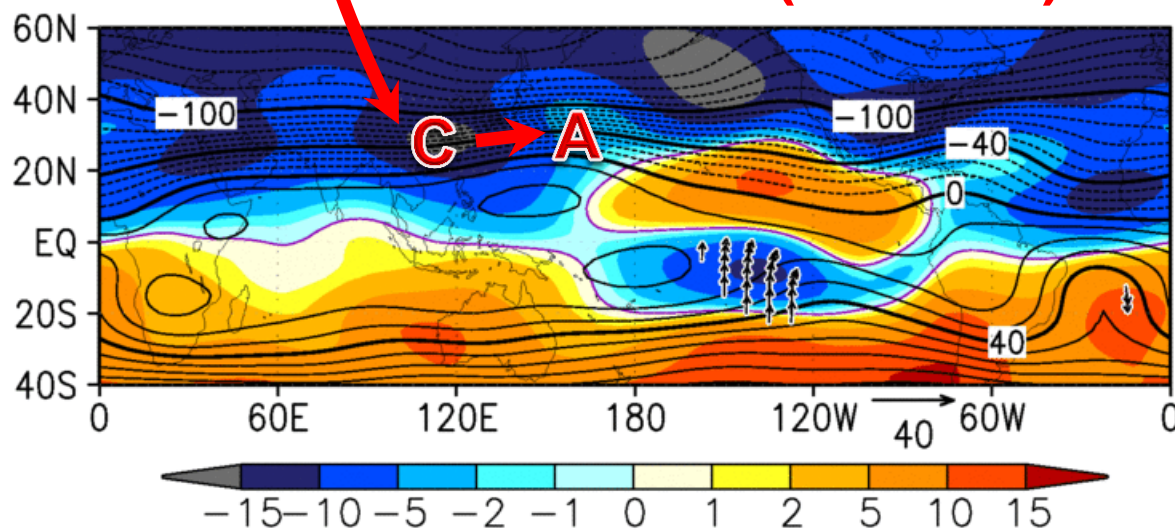
Velocity potential at 200hPa ($10^6 \text{ m}^2/\text{s}$)



In the 200 hPa velocity potential anomalies,

- convergence anomalies over the Maritime Continent (**CON**) and
- divergence anomalies over the tropical Pacific (**DIV**) are predicted, reflecting the predicted precipitation.
- **DIV** is related to enhancement of Aleutian Low.

Stream function at 200hPa ($10^6 \text{ m}^2/\text{s}$)

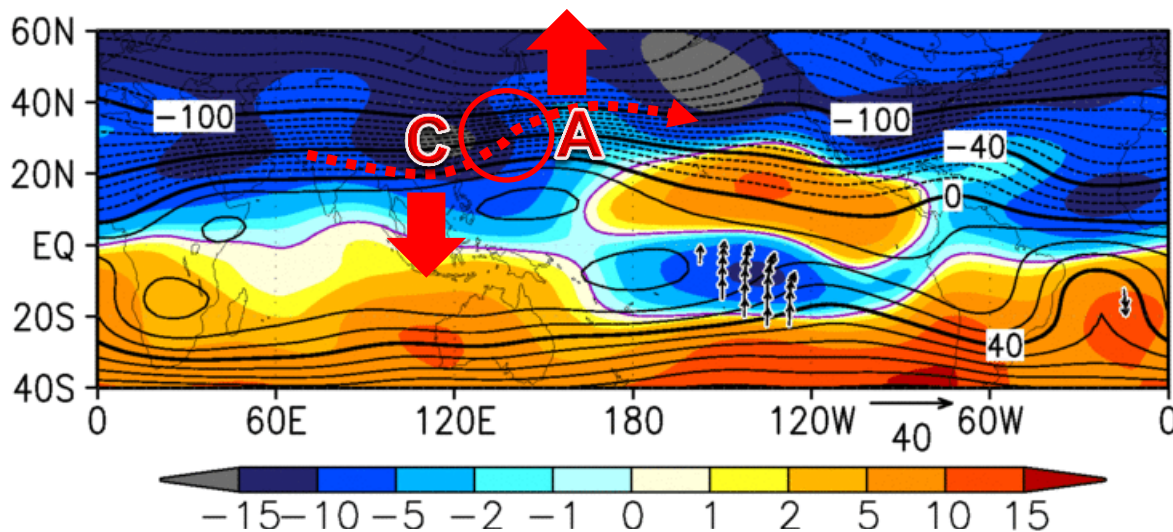


In the 200hPa stream function anomalies,

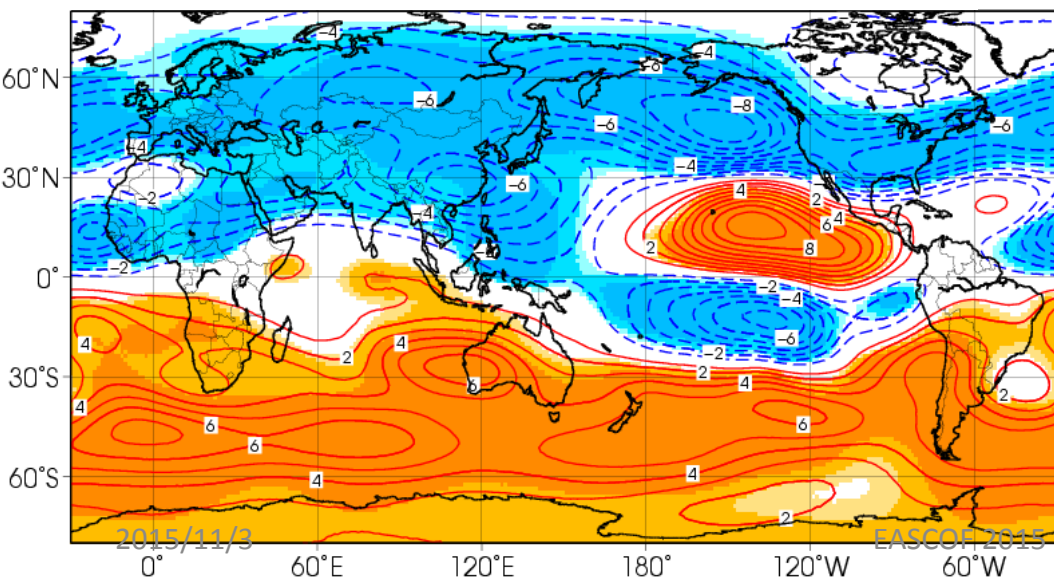
- **CON** creates cyclonic circulation anomalies in the mid-latitudes of the Eurasian continent (**C**) with Matsuno-Gill response and **C** makes anticyclonic circulation anomalies on the east side (**A**) as Rossby wave along the subtropical jet.

Our interpretation of the Model output for DJF

Stream function at 200hPa ($10^6 \text{ m}^2/\text{s}$)



El Niño composite



In the 200hPa stream function,

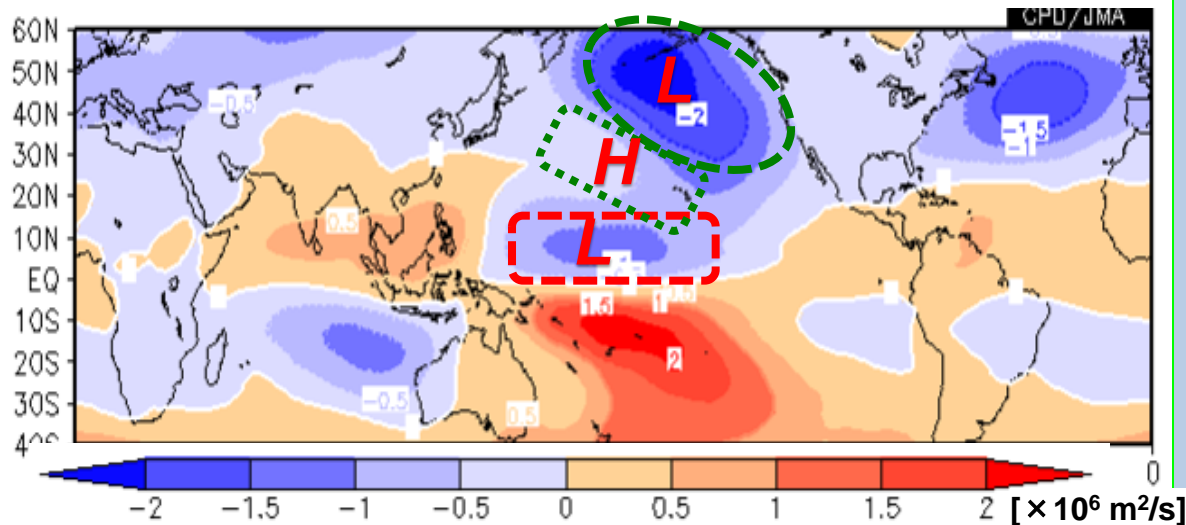
- Cyclonic circulation anomalies over the Eurasian continent **C** indicates that the subtropical jet is shifted southward in the Eurasian continent.
- Anticyclonic circulation anomalies over the sea east of Japan **A** indicates that the subtropical jet is shifted northward near Japan.
- These anomalies lead southwestward anomalies of the upper flow in west of Japan, which would reduce winter monsoon in Eastern Asia.
- These circulation patterns are similar to those observed in the past El Niño episodes.

Interpretation of the Aleutian low based on the climatological statistics

【Statistics with the Analysis】

Using JRA-55 and GPCP (1981-2013)

Regression of 850hPa stream function upon precipitation around the Date Line 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 around the Date Line.

➤ 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

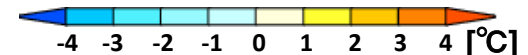
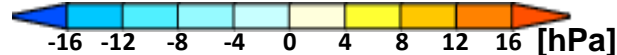
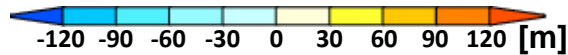
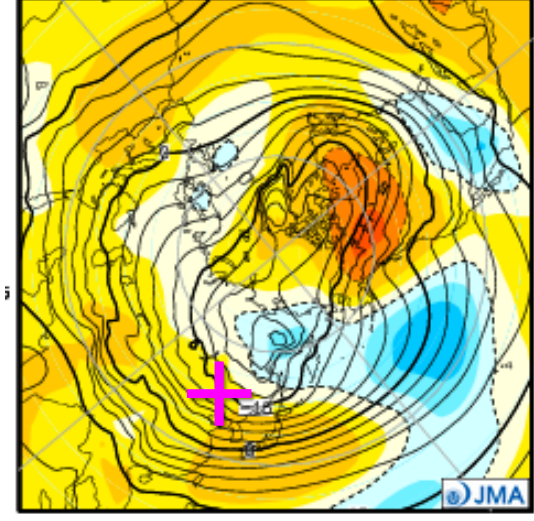
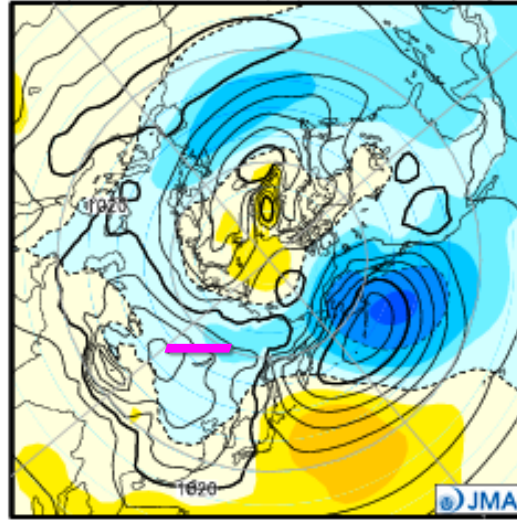
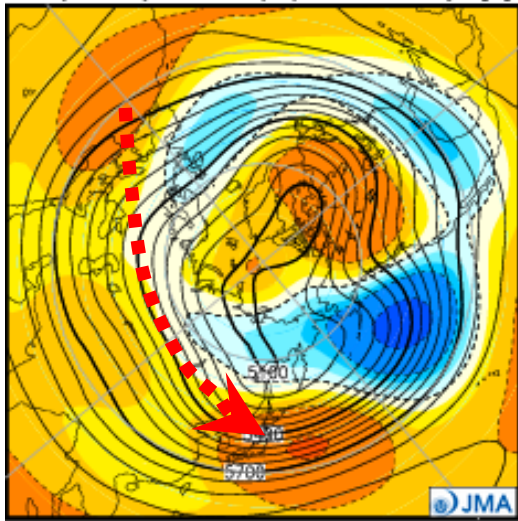
Sea level pressure

850 hPa temperature

Z500 (FORECAST) from 2015/10/ 8 00Z LT=54 days [m]

PSEA (FORECAST) from 2015/10/ 8 00Z LT=54 days [hPa]

T850 (FORECAST) from 2015/10/ 8 00Z LT=54 days [°C]

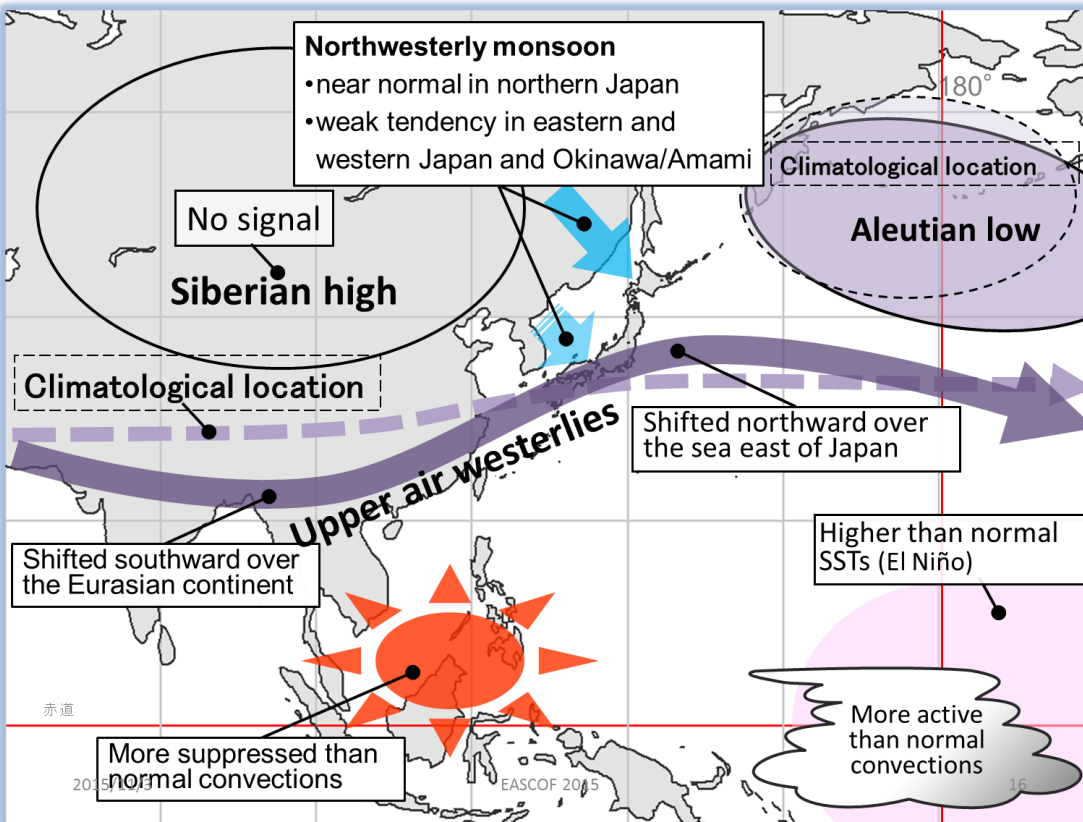


- The model predicts in the high-latitudes
 - Unclear AO pattern
 - Negative EU like pattern (wave train including negative in the western Siberia and positive in the northeast Asia)
 - Bring to **weak tendency of the Siberian high** and **warm tendency in East Asia in the high-latitudes.**

□ However, the above characteristics should be interpreted with caution because prediction skill of the model is insufficient

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 over the Maritime continent.
- Subtropical jet is expected to **shift southwardly over the Eurasian continent and northward over the sea east of Japan.**
- **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.

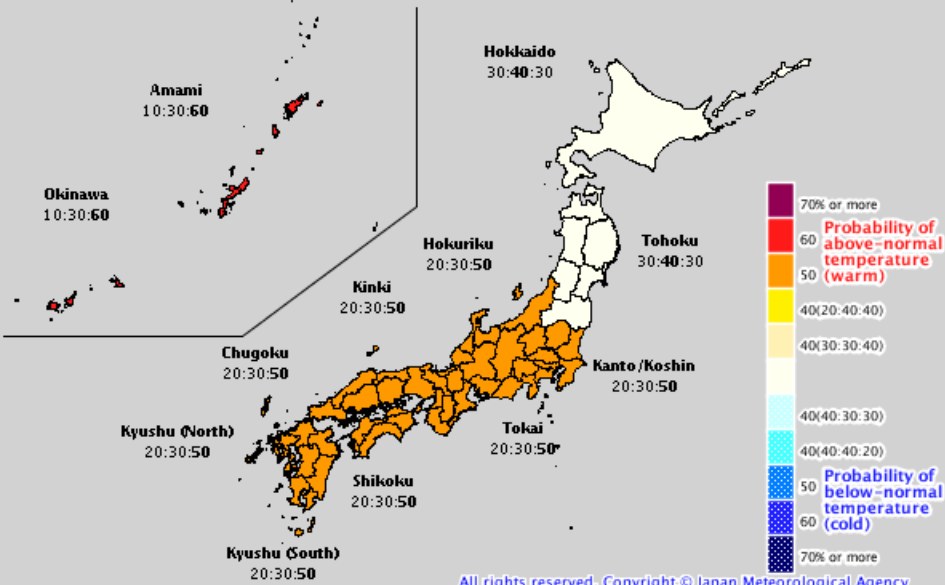
- In East Asia, **northwesterly monsoon** is expected to be generally **weaker-than normal**, which would **bring warm and wet tendency**, while, near normal in the northeastern part.

Outlook for winter 2015/16 over Japan

Average Temperature

Winter(December - February)

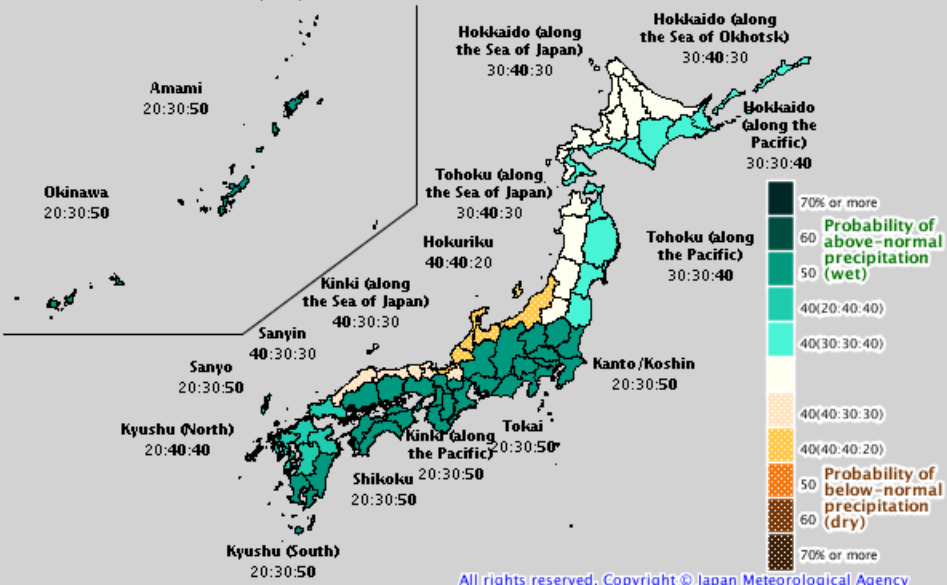
Probability of below-normal temperature (cold), near-normal temperature (average), above-normal temperature (warm) for each area. Colored areas have a 40% probability or more of below-normal or above-normal temperature.



Precipitation

Winter(December - February)

Probability of below-normal precipitation (dry), near-normal precipitation (average), above-normal precipitation (wet) for each area. Colored areas have a 40% probability or more of below-normal or above-normal precipitation.

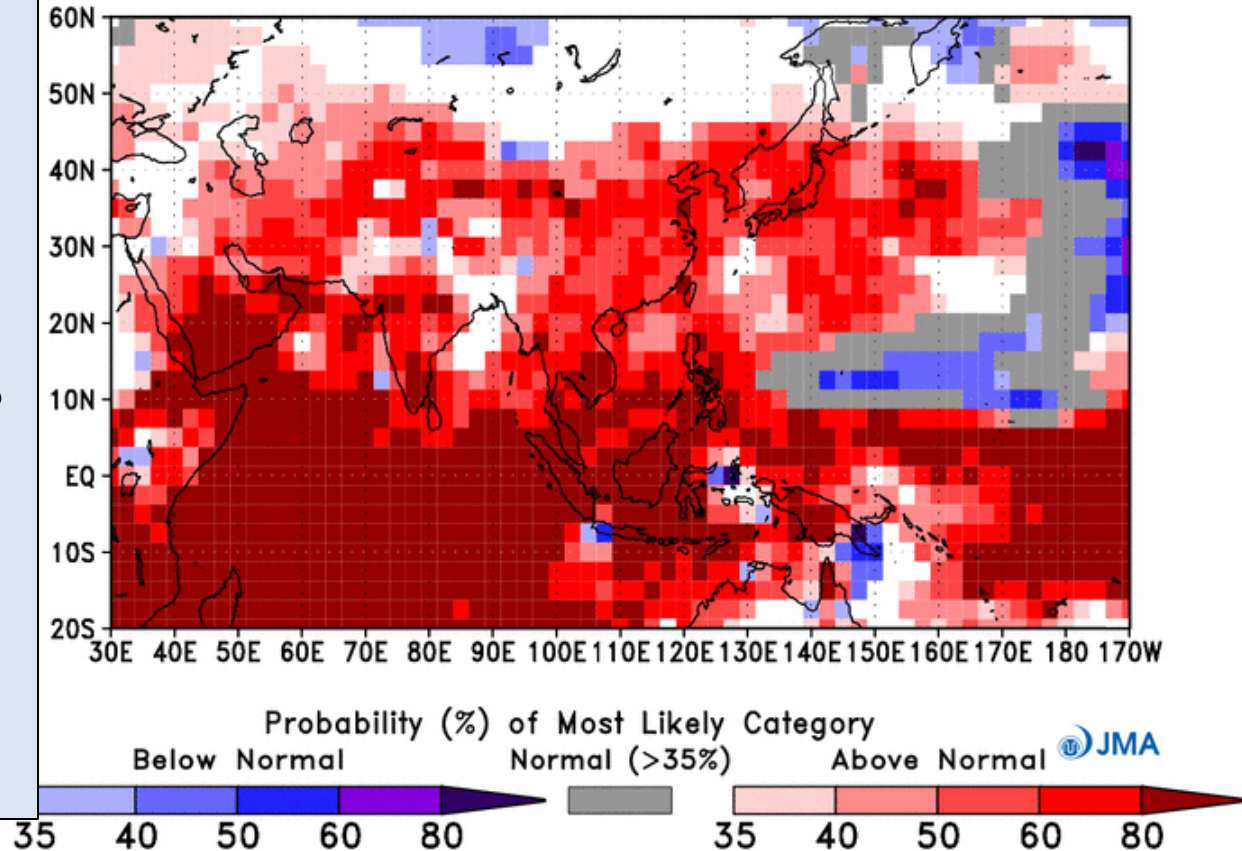


- **Temperatures** are expected to be above-normal in eastern and western Japan and Okinawa/Amami.
- **Precipitation** is expected to be above-normal on the Pacific side of eastern and western Japan and Okinawa/Amami.

<DJF 2015/16> Probability Forecasts (temperature)

- A high probability of above normal temperatures is predicted for a wide swath of the tropics.
- A slightly high probability of above normal temperatures is predicted for East Asia.
- Note that a slightly high probability of below normal temperatures extending to the west and south of New Guinea should be viewed with *low confidence* because of limited model skill at predicting (boreal) cold season temperatures for these regions.

JMA Seasonal Forecast (Forecast initial month is 10 2015)
Most likely category of Surface Temperature for DJF 2015

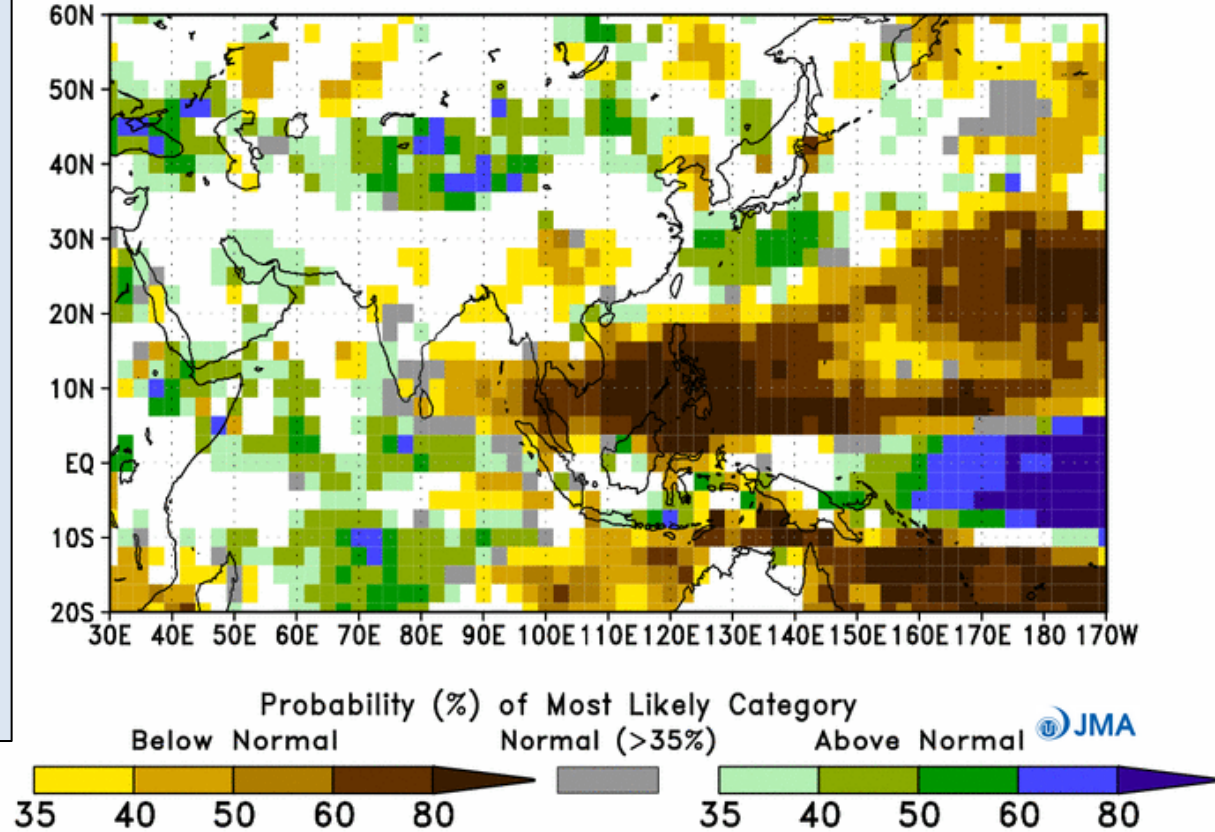


<DJF 2015/16> Probability Forecasts (precipitation)

- A high probability of above normal precipitation is predicted for the equatorial central Pacific.
- A high probability of below normal precipitation is predicted for the southern Indochina to the Philippines.
- A slightly high probability of above normal precipitation is predicted for the equatorial Indian Ocean and to the south of Japan.

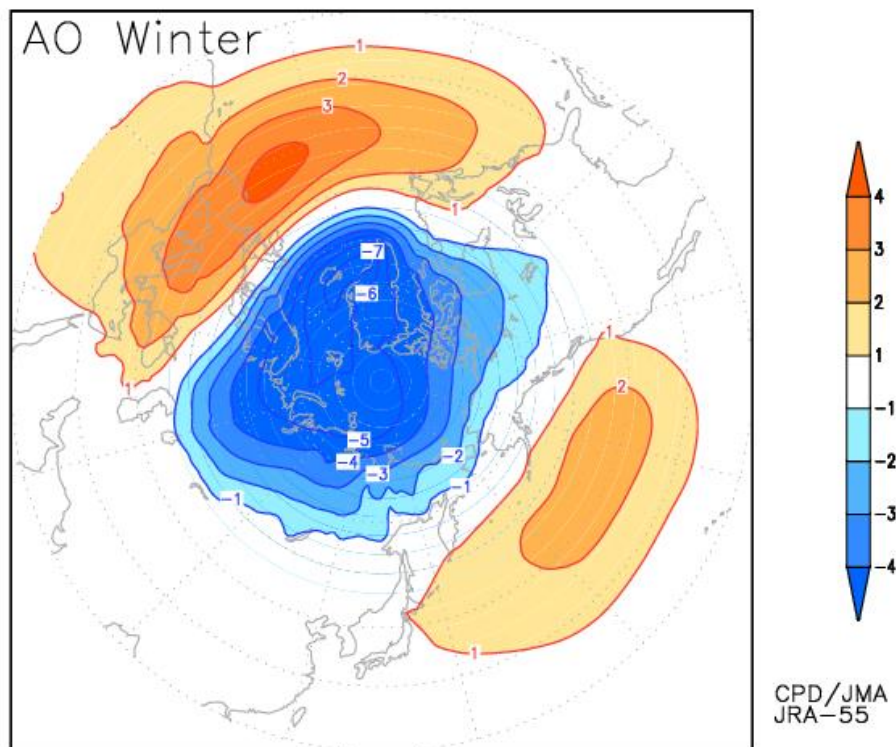
JMA Seasonal Forecast (Forecast initial month is 10 2015)

Most likely category of Precipitation for DJF 2015



Thank you very much.

AO



EU

