Joint Meeting for the Seasonal Prediction of the East Asian Winter Monsoon
6-8 November 2012, Seoul, Republic of Korea

Seasonal Outlook for winter 2012/2013 over Japan

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Contents

JMA’s Ensemble Prediction System (EPS) for seasonal forecast

Long-range Forecast Services (1)

Three-month Forecast (Temperature, Precipitation, Snowfall)	
Date of Issue	About 25th in every month
Forecast Period	1st-,2nd-,3rd-month, 3 months mean

Temperature

Forecast Period	3 months			1st month			2nd month			3rd month		
	Oct-Dec			Oct			Nov			Dec		
category	–	0	+	–	0	+	–	0	+	–	0	+
Northern Japan	20	40	40	20	30	50	30	40	30	40	30	30
Eastern Japan	20	40	40	20	30	50	30	40	30	40	30	30
Western Japan	20	30	50	20	30	50	30	30	40	40	30	30
Okinawa and Amami	20	30	50	20	30	50	20	40	40	40	30	30

(category – : below normal, 0 : near normal, + : above normal, Unit : %)

Climate and Outlook in Japan
http://ds.data.jma.go.jp/tcc/tcc/products/japan/index.html

Long-range Forecast Services (2)

Cold/Warm season Forecast (Temperature, Precipitation, Snowfall)	
Date of Issue	About 25th in Sep., Oct., Feb., Mar., and Apr.
Forecast Period	DJF mean (Cold season), JJA mean (Warm season)

Temperature

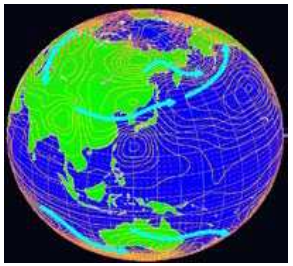
Forecast Period	3 months Dec-Feb		
category	–	0	+
Northern Japan	30	30	40
Eastern Japan	30	40	30
Western Japan	30	40	30
Okinawa and Amami	30	40	30

(category – : below normal, 0 : near normal, + : above normal, Unit : %)

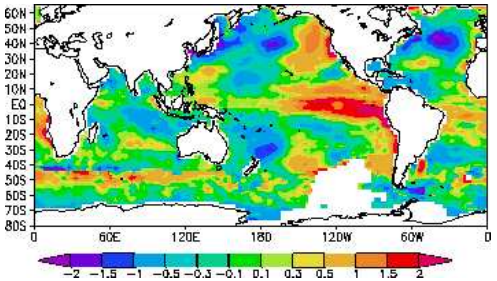
Climate and Outlook in Japan
http://ds.data.jma.go.jp/tcc/tcc/products/japan/index.html

The JMA's EPS for Long-range Forecast Outlook

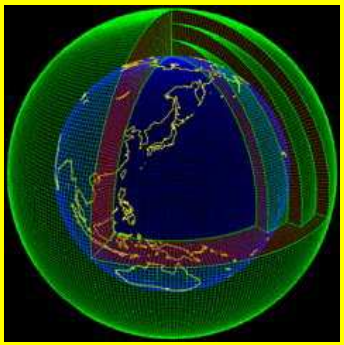
JMA Climate Data Assimilation



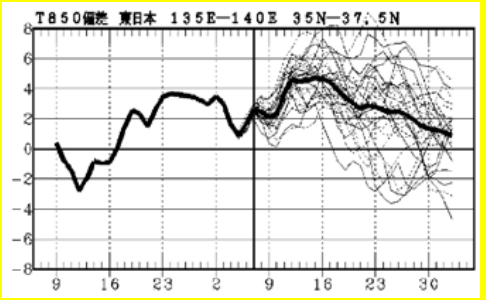
Ocean Data Assimilation



JMA CGCM



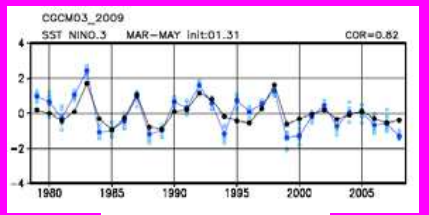
Ensemble Products

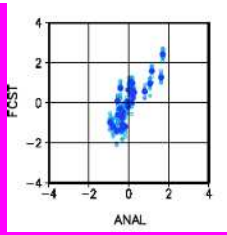


Calibration

Verification

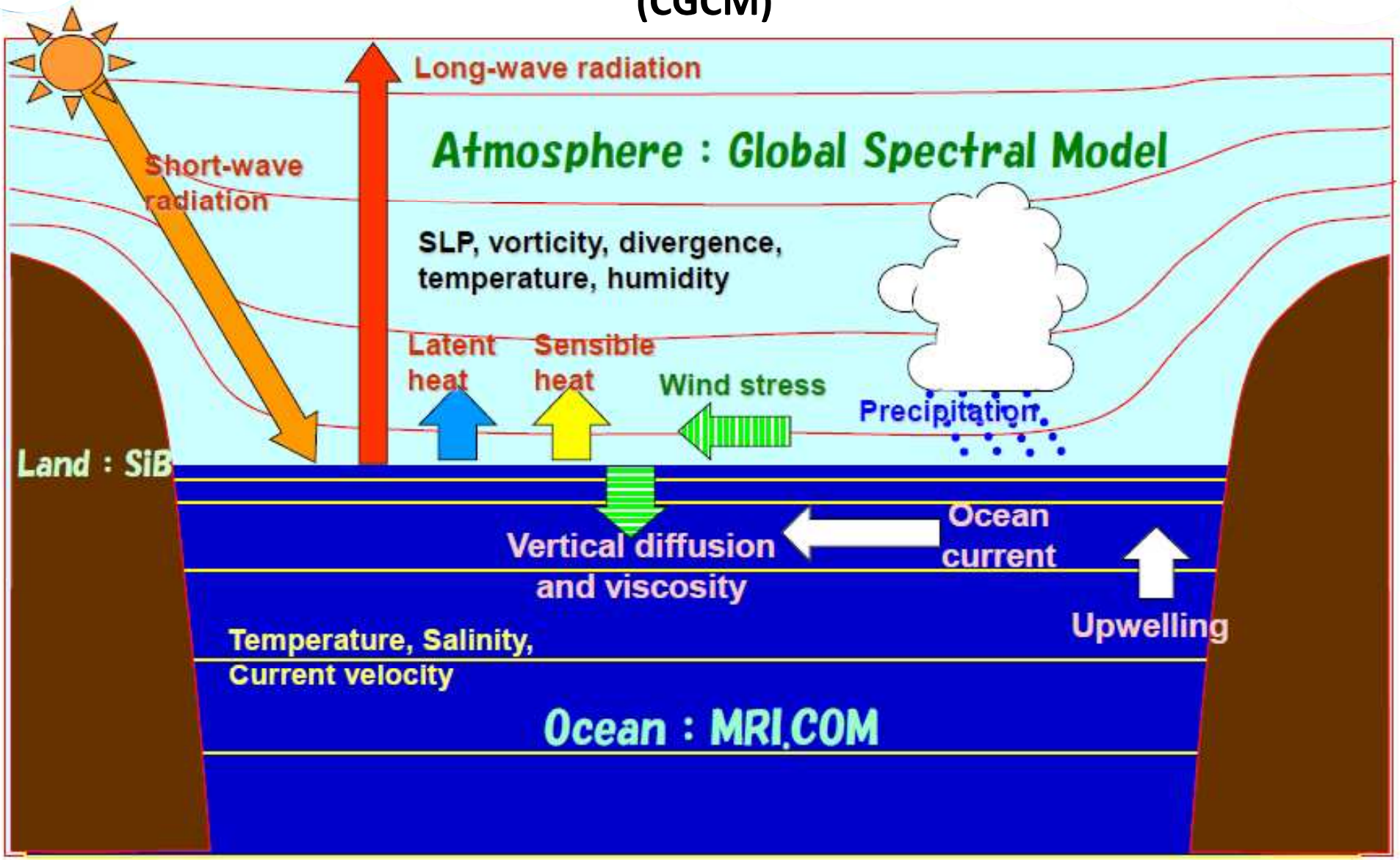
Hindcast





JMA Long-range Forecasting Model

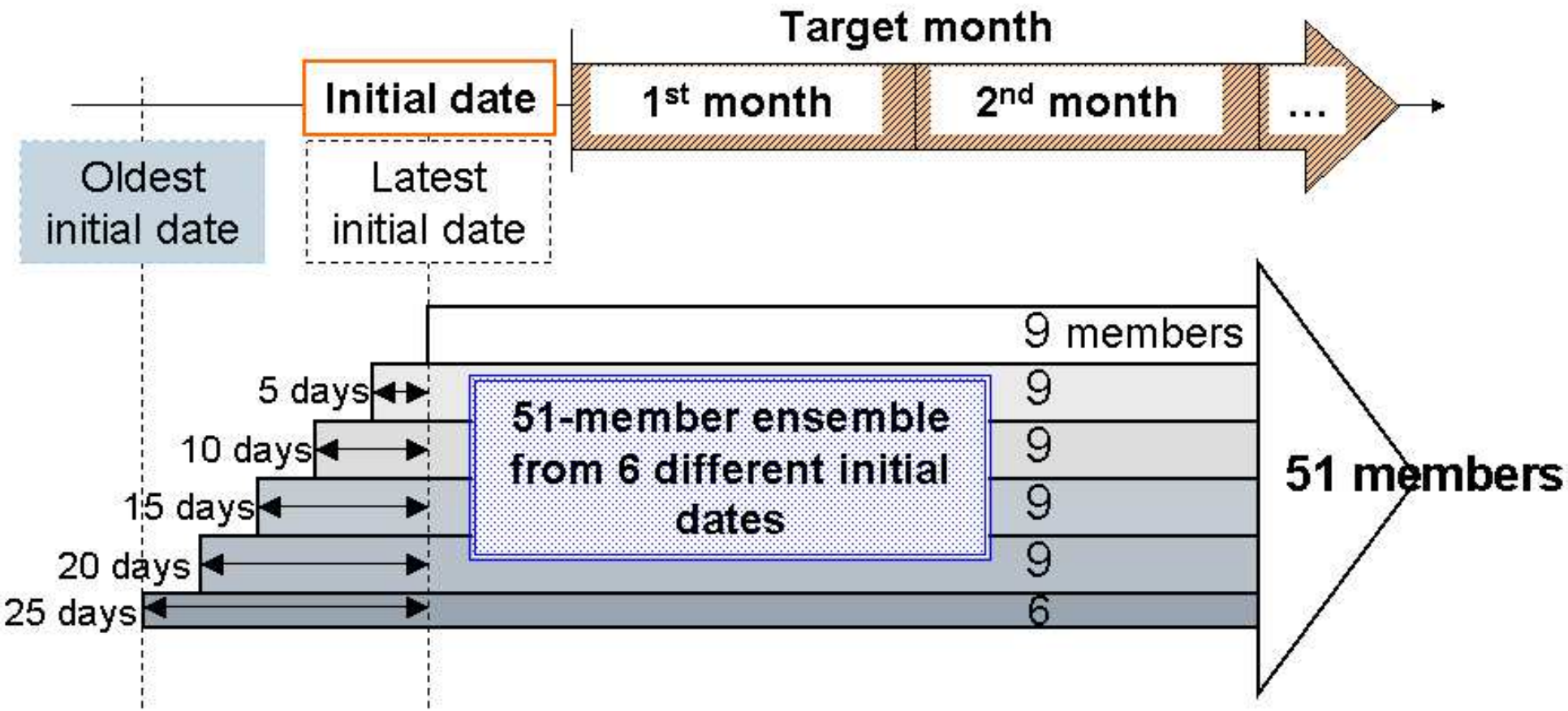
Coupled ocean-atmosphere General Circulation Model (CGCM)



Specifications of the NWP model for Long-range forecast

Model	JMA/MRI-CGCM
Horizontal resolution	AGCM: TL95 (about 1.875º Gaussian grid ~180km) OGCM: 1.0deg in lon. X 0.3-1.0 deg in lat.
Vertical Layers	AGCM: 40 (Top Layer Pressure:0.4hPa) OGCM: 50
Time integration range	7 months
Executing frequency	Every five days (9 members for each initial date)
Ensemble size	51 members from six different initial dates.
Perturbation method	Breeding Growing Mode (BGM) & Lagged Average Forecast (LAF) method
SST	One-tiered method
Land surface Parameters	Climatology

Schema of aggregation for the ensemble members in the EPS for long-range forecasting



Oceanic conditions

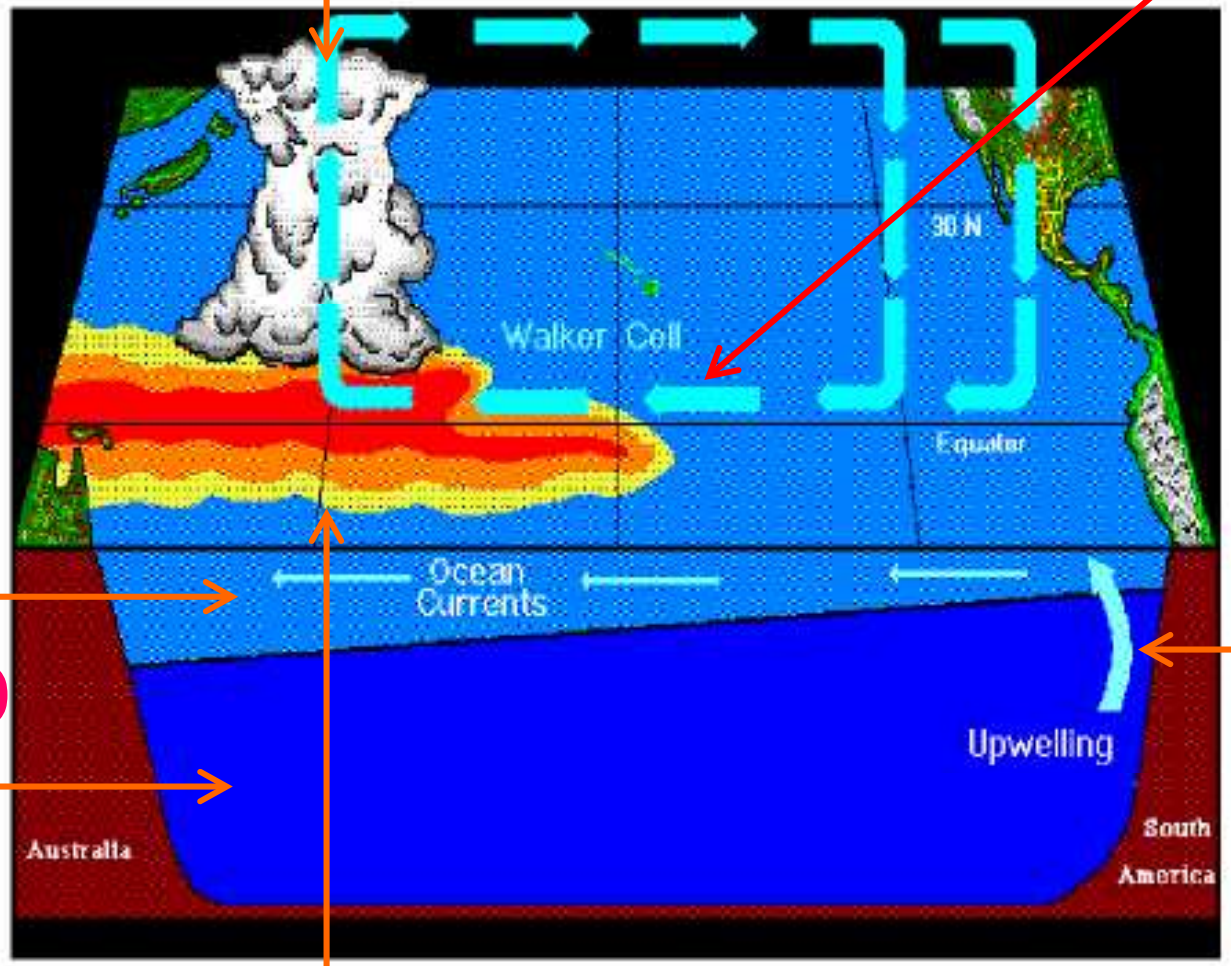
Normal condition of the equatorial Pacific

Low sea level pressure
ascending motion

Active Convection

High sea level pressure
descending motion

Easterly
= Trade wind



Equator

Surface Waters(warm)

Deep Waters (cold)

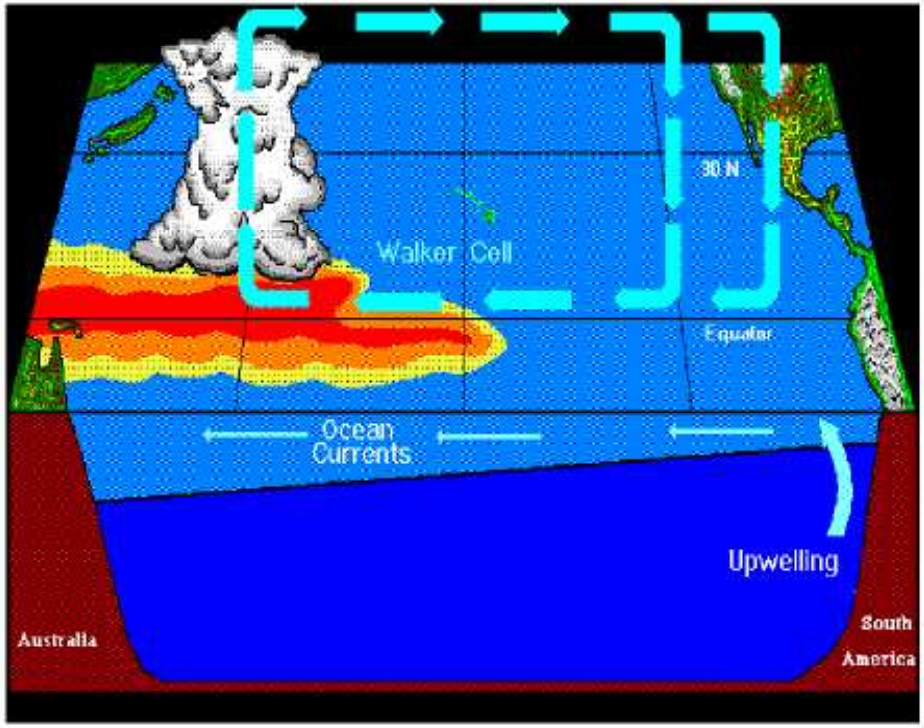
Upwelling

From : NOAA homepage

High SST

Air-sea interaction during **El Niño**

Normal condition



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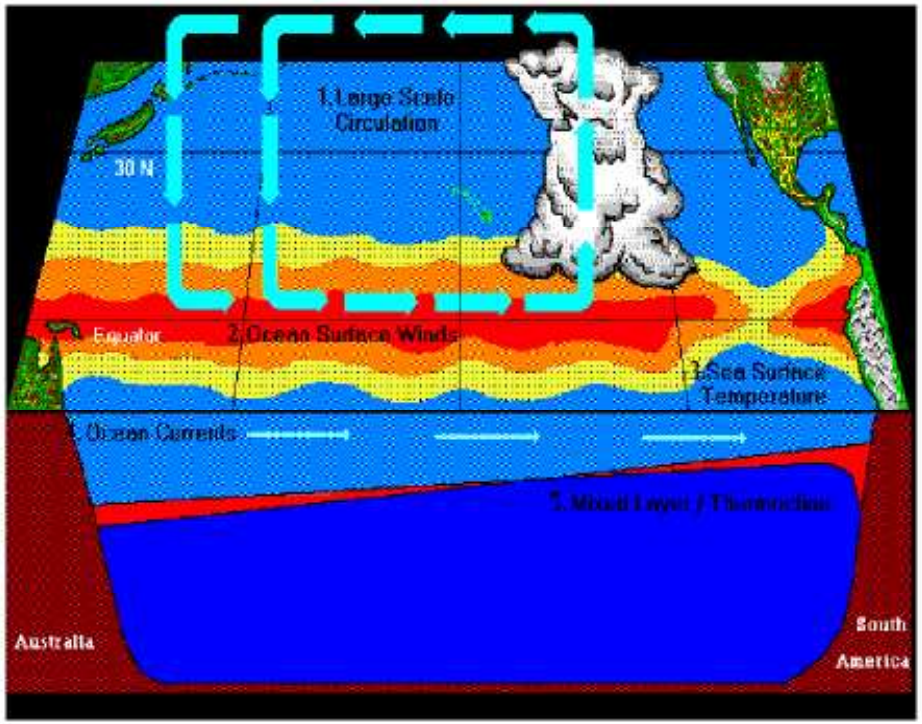
El Niño condition



From : NOAA homepage

Weakening of easterly trade winds

Eastward shift of the surface warm waters

Eastward shift of the active convection

Weakening of the effect of upwelling

SST warming

In September 2012, the NINO.3 SST deviation was +0.3˚ C.

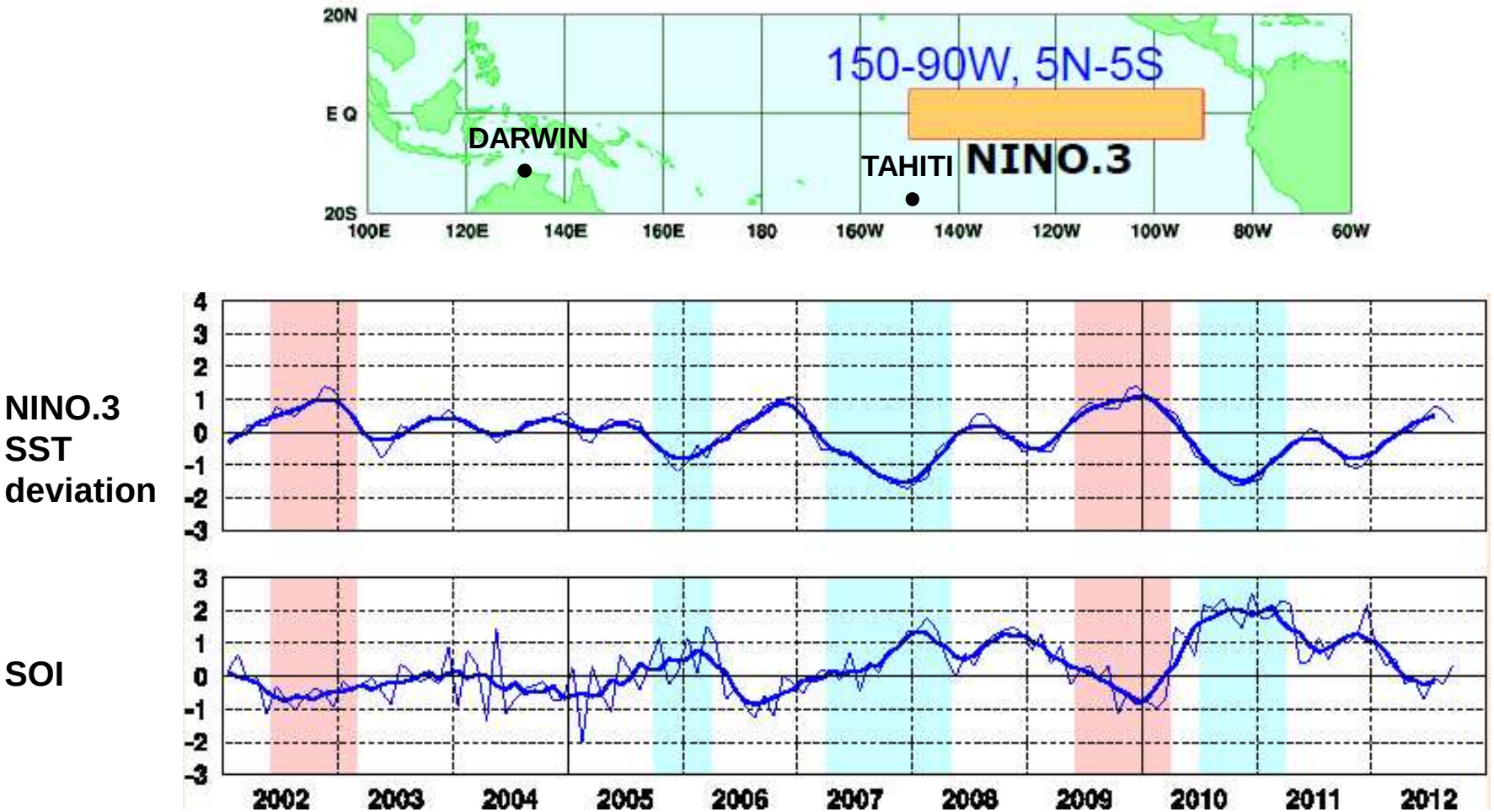


Fig.1 Time series of sea surface temperature (SST) deviations from the climatological mean based on a sliding 30-year period for NINO.3, (the 2nd panel) and Southern Oscillation Index (the 3rd panel).
Thin lines indicate a monthly mean value, and smoothed thick curves, a 5-month running mean.
Red shaded areas denote El Niño periods, and blue, La Niña ones (*).

* JMA defines that the El Niño (La Niña) is such that the 5-month running mean SST deviation for NINO.3 continues +0.5ºC (-0.5ºC) or higher (lower) for six consecutive months or longer.

Although SSTs in the most part from the central equatorial Pacific to the eastern part were above normal, they came closer to normal than in August.

Jul. 2012

Aug. 2012

Sep. 2012

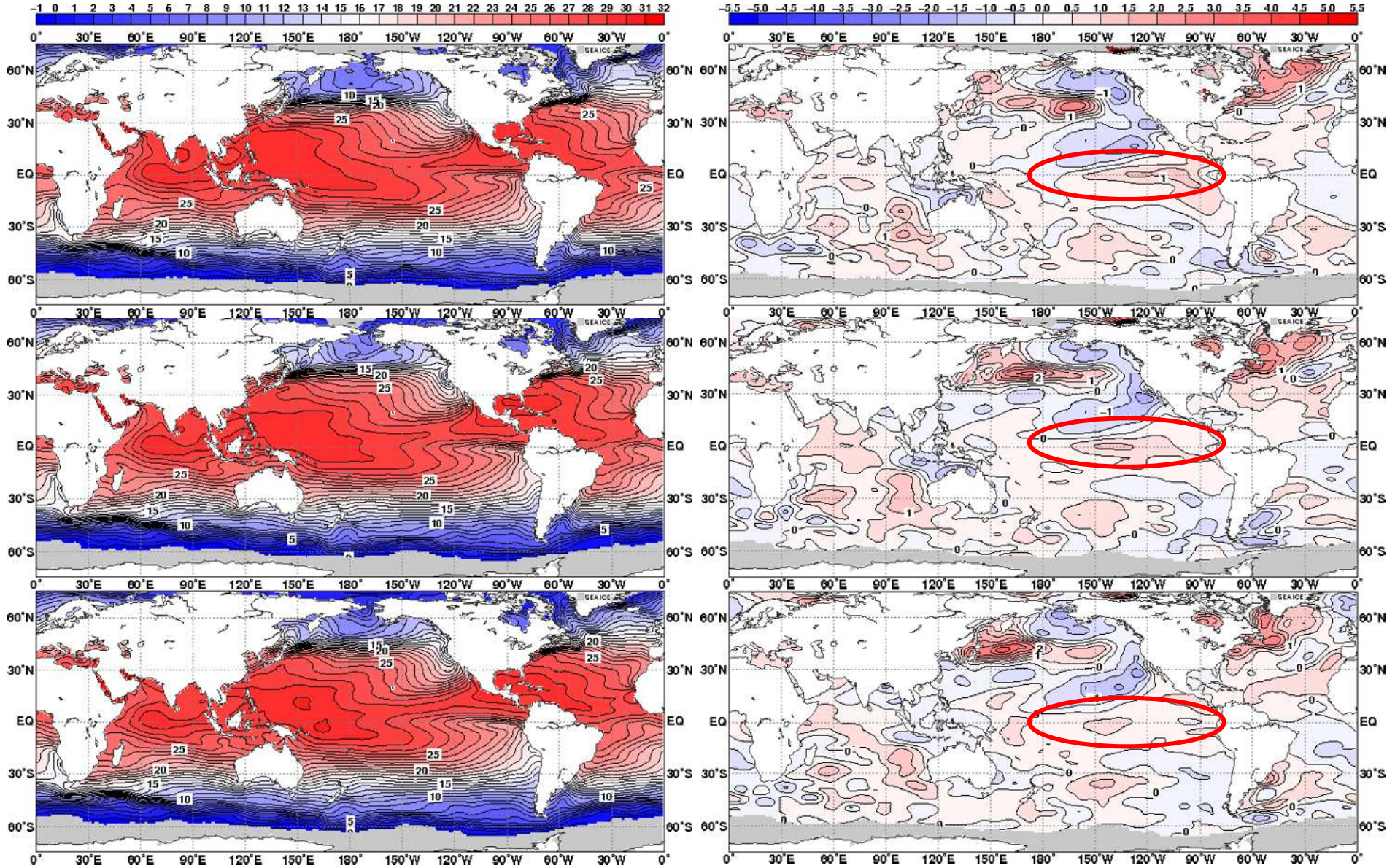


Fig.2 Monthly mean SST (left) and anomalies (right) in the global oceans.
Base period for normal is 1981-2010.

Subsurface temperatures were above normal in the western equatorial Pacific. Those in the central part, which had been above normal in August, came closer to normal, and temperatures below normal were found at the depths near 140m.

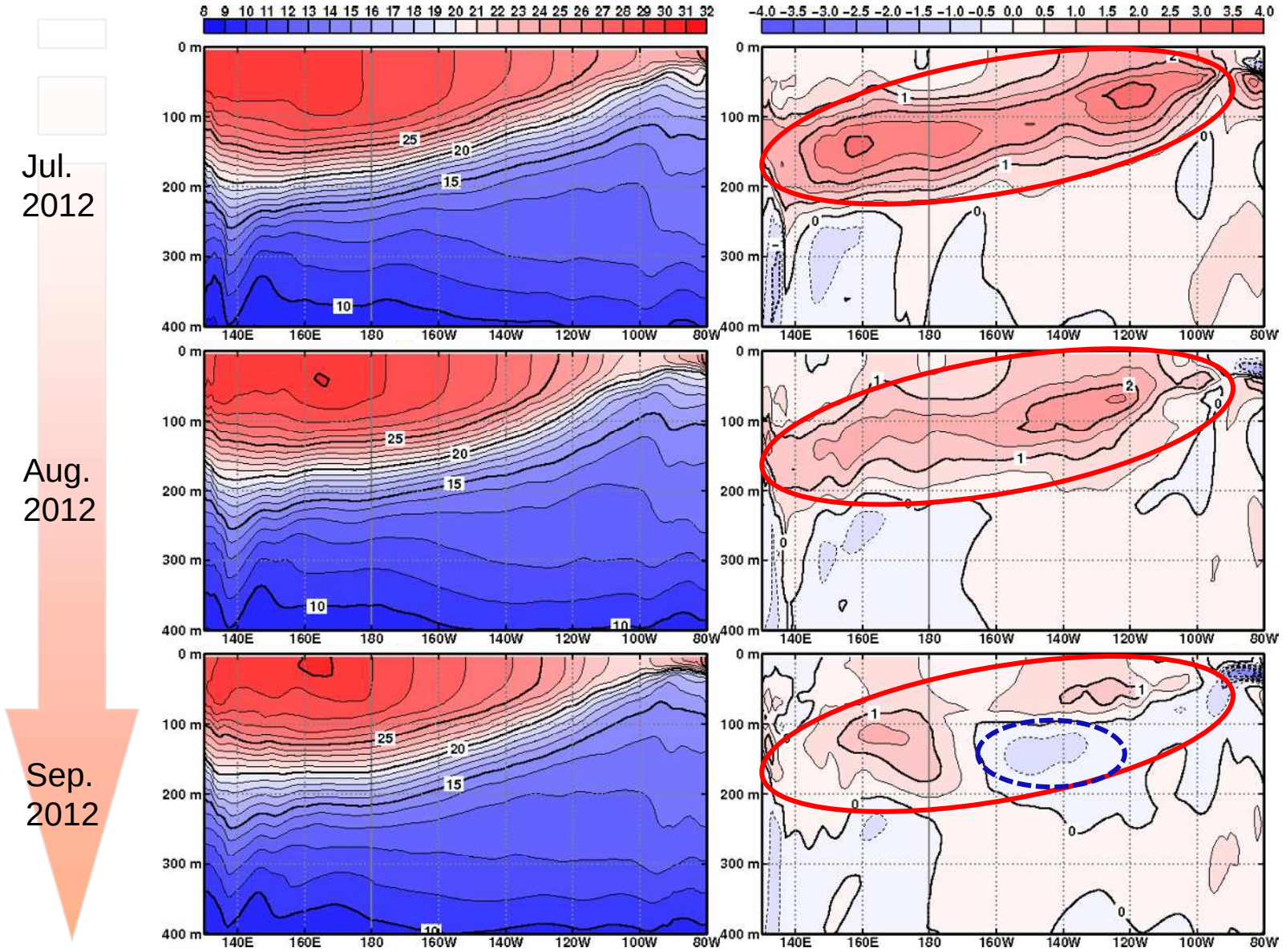


Fig.3 Depth-longitude cross sections of temperature and anomalies along the equator in the Pacific Ocean by the ocean data assimilation system. Base period for normal is 1981-2010.

In the atmosphere, the convective activities were above normal in the western equatorial Pacific. Easterly winds in the lower troposphere were weaker than normal in the western part, and stronger than normal in the central part.

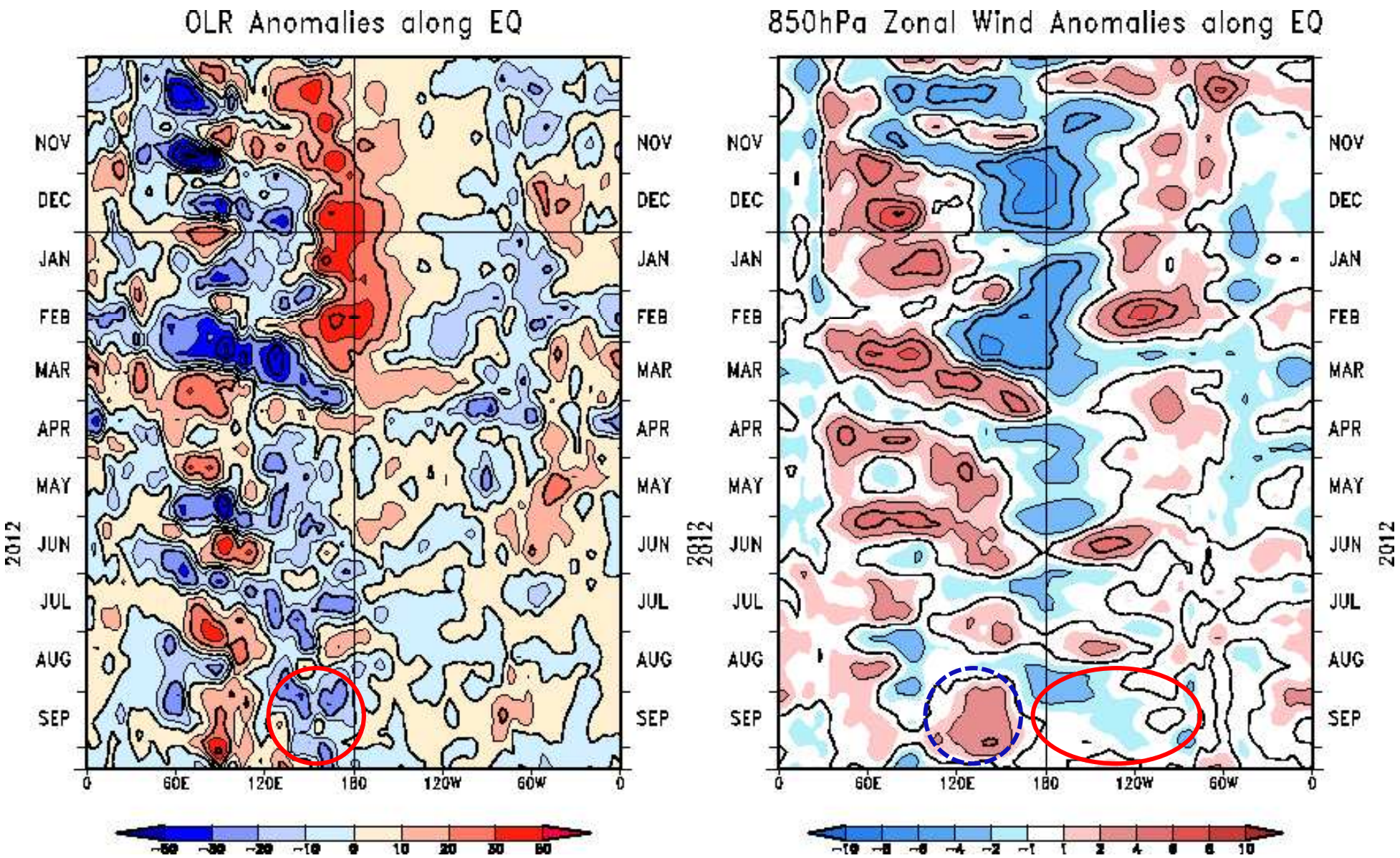


Fig.4 Time-longitude cross sections of OLR (left) and zonal wind anomalies at 850 hPa (right) along the equator. Base period for normal is 1981-2010. Normal is calculated from JRA-25.

These oceanic and atmospheric conditions indicate that El Niño conditions weakened in the equatorial Pacific.

The JMA's El Niño prediction model predicts that the NINO.3 SST will be mostly near normal during the prediction period (Fig.5). Taking prediction uncertainties into account, however, it remains possible that El Niño conditions will persist until the northern hemisphere winter. **Considering all the above, it is equally likely that El Niño conditions will last until the northern hemisphere winter, or will transition to ENSO neutral conditions during autumn and winter.**

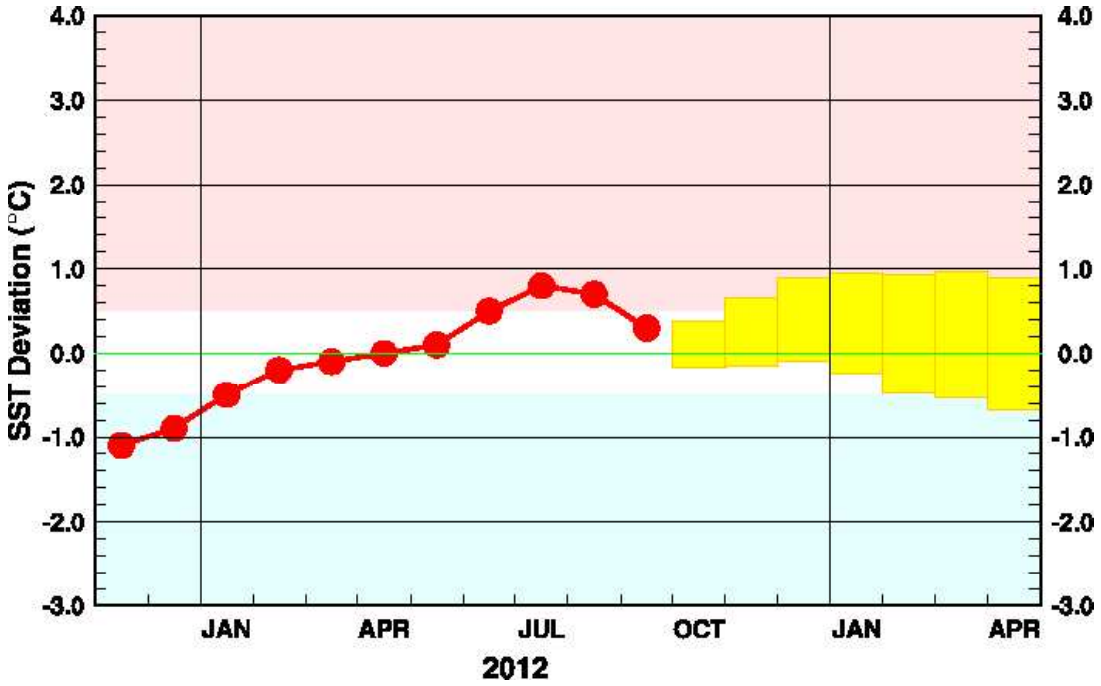
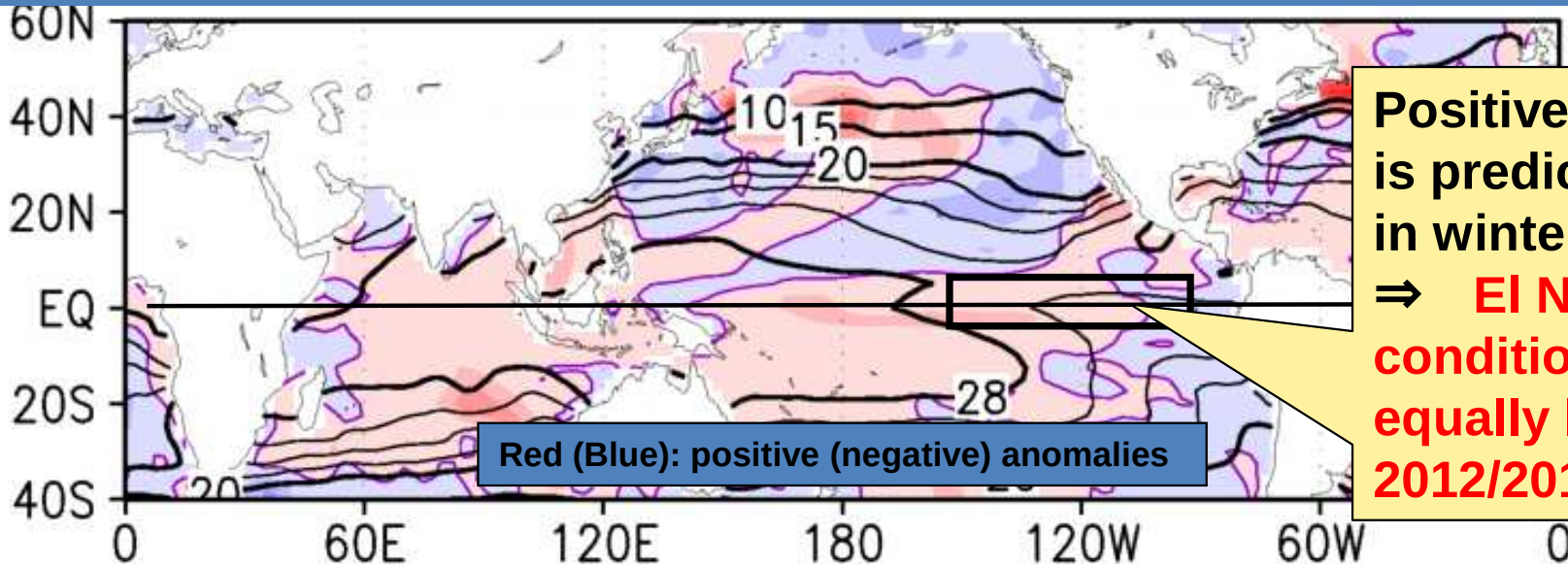


Fig.5 Outlook of the SST deviation for NINO.3 by the El Niño prediction model.
Thick line with closed circle shows the observed SST deviation and boxes show the predicted one for the next six months by the El Niño prediction model. Each box denotes the range where the SST deviation will be included with the probability of 70%.

Interpretation of ensemble prediction products

Predicted 3-month averages (Dec.2012-Feb.2013)

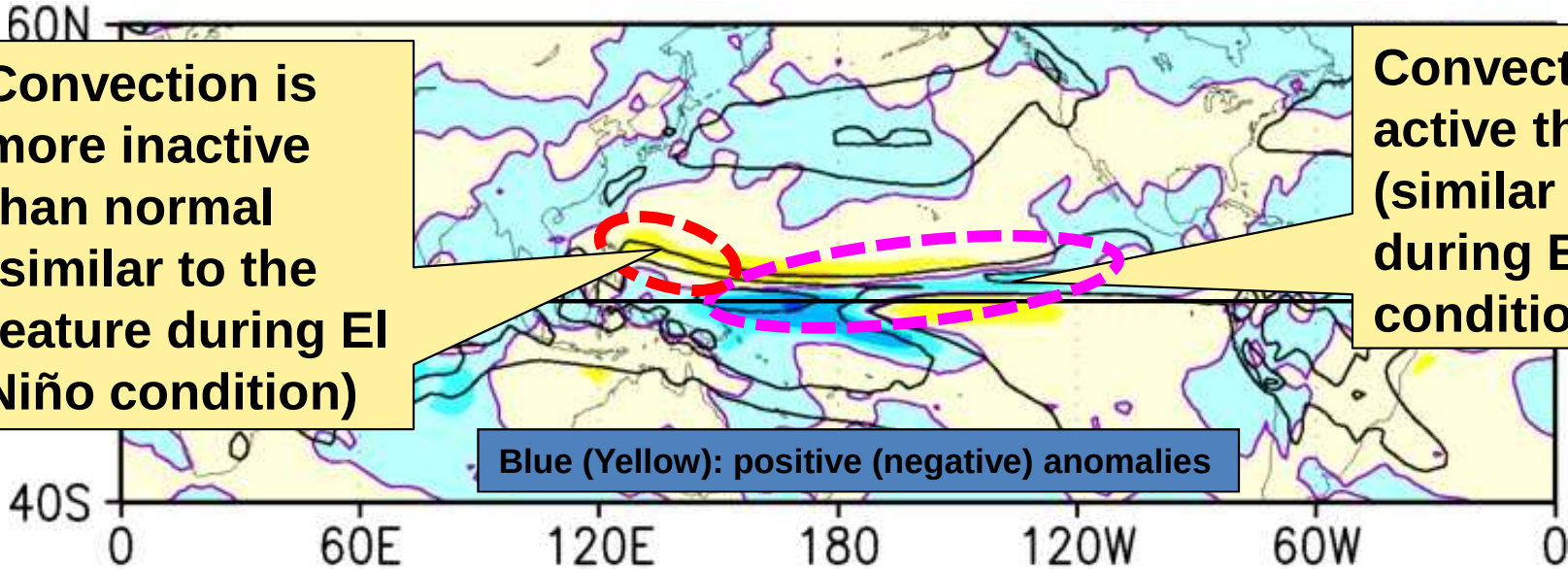
SST anomalies (affecting the distribution of precipitation anomalies)



Positive SST anomaly is predicted for NINO.3 in winter 2012/2013.

⇒ El Niño and neutral conditions will be equally likely in winter 2012/2013.

Precipitation anomalies (affecting the flow pattern of the Westerlies)

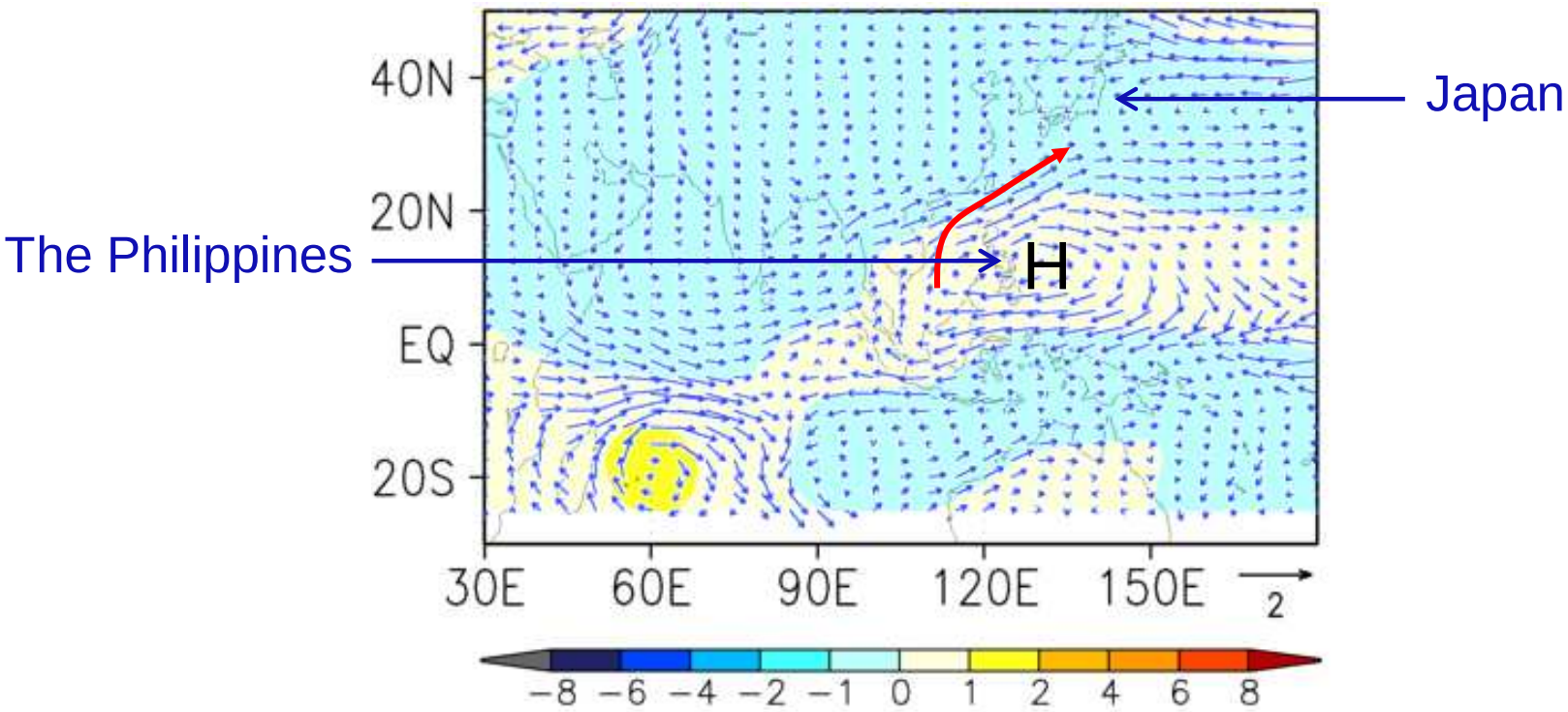


Convection is more inactive than normal (similar to the feature during El Niño condition)

Convection is more active than normal (similar to the feature during El Niño condition)

Predicted 3-month averages (Dec.2012-Feb.2013)

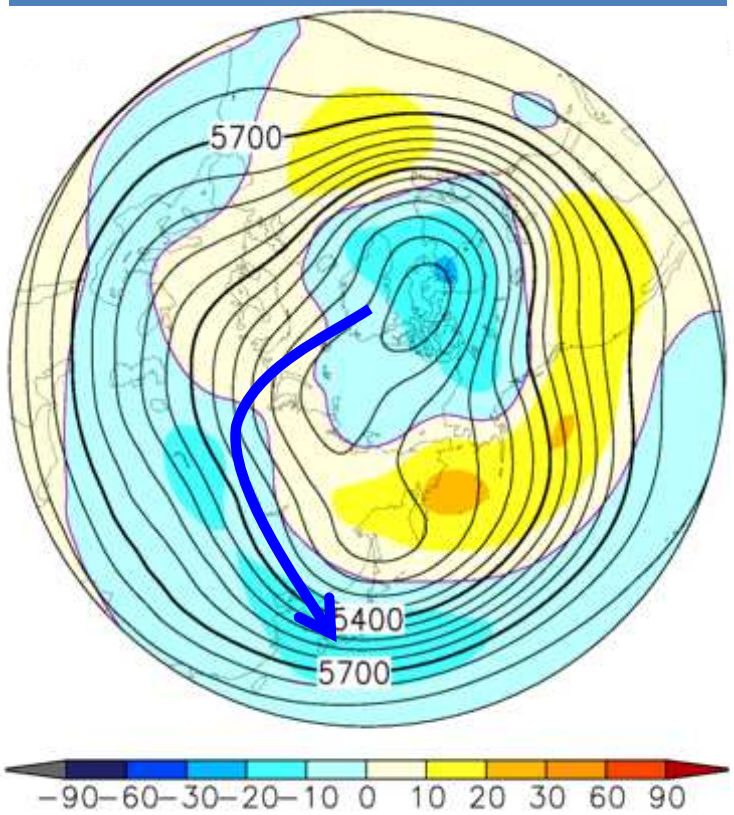
Anomalies of stream function (colors)
and wind (vectors) at 850 hPa



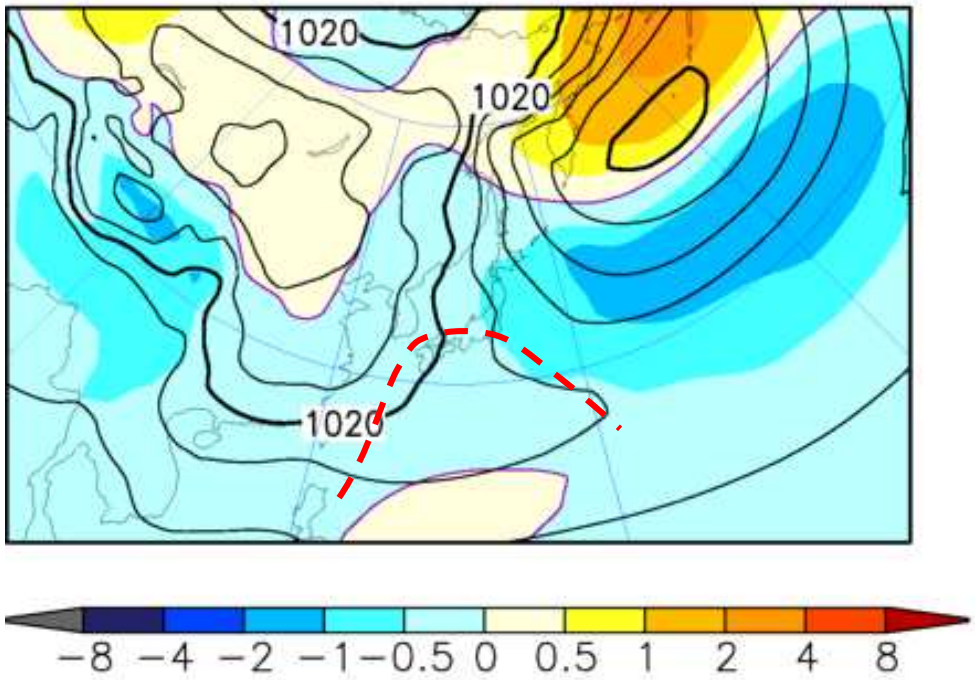
Corresponding to the inactive convection east of the Philippines, anti-cyclonic circulation anomaly in the lower troposphere is predicted. There is a possibility that the anti-cyclonic circulation anomaly extending to the south of Japan will bring warm and humid air to the southern part of Japan and create favorable conditions for the genesis of cyclones there.

Predicted 3-month averages (Dec.2012-Feb.2013)

500-hPa height (lines)
and its anomalies (colors)



Sea level pressure (lines)
and its anomalies (colors)

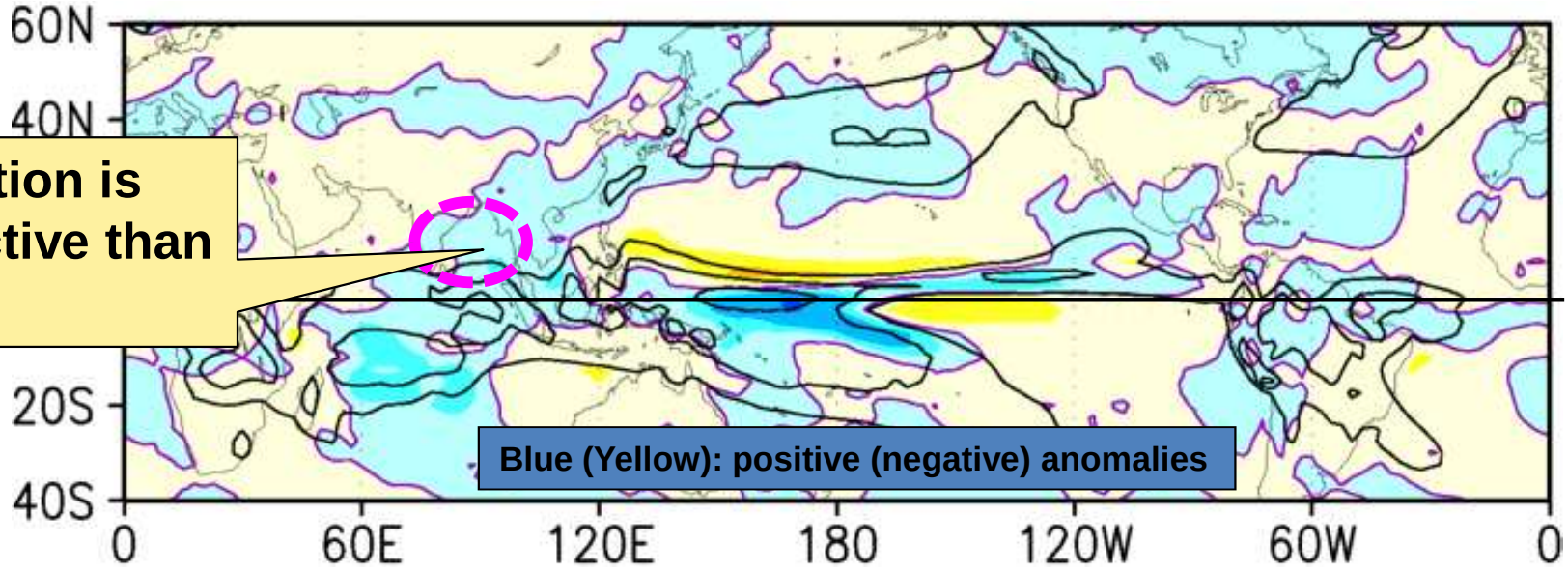


The southern positive anomaly should be extended northward (red broken line), if most of the northern negative anomalies are supposed to be “unpredictable noises”.

1. Both negative anomalies of 500-hPa height and sea level pressure around Japan should be neglected, if they are parts of wave trains along the jet stream (the seasonal forecast model does not have a level of skill sufficient to predict such wave trains in mid- and high-latitudes).
2. The model has a skill sufficient to predict convection east of the Philippines. The southern positive anomalies of sea level pressure corresponds to significant inactive convection there.

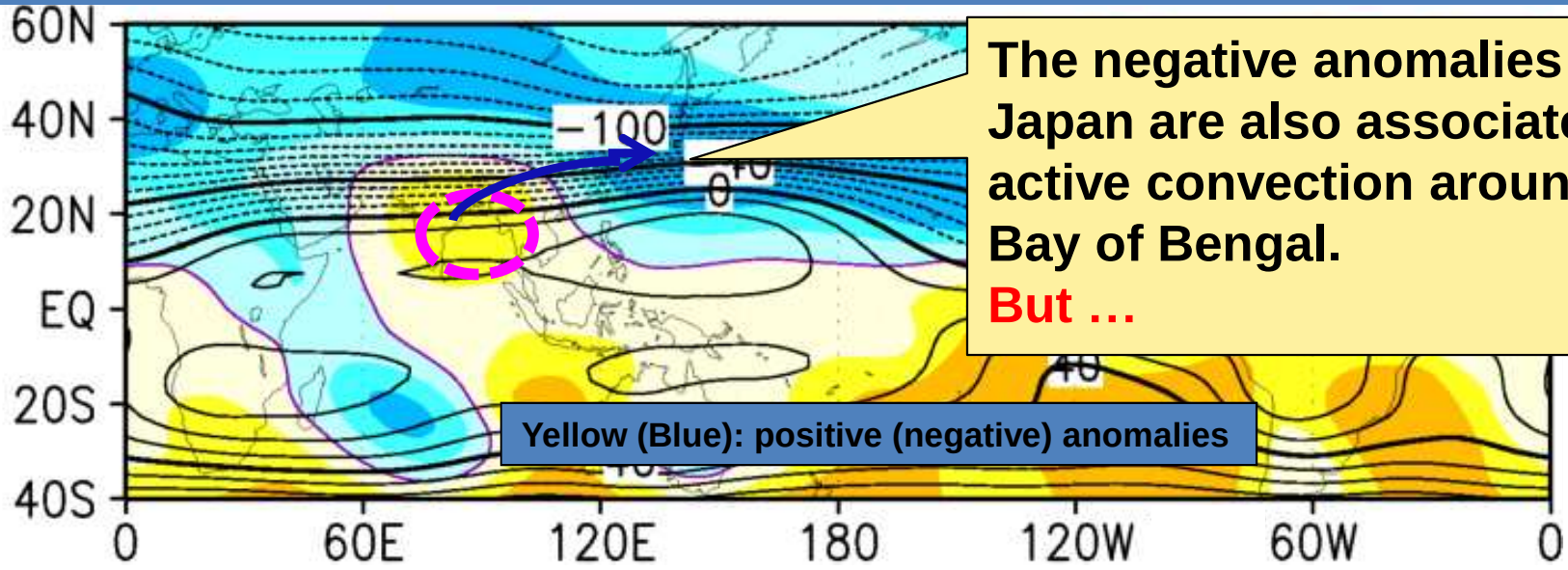
Predicted 3-month averages (Dec.2012-Feb.2013)

Precipitation anomalies (affecting the flow pattern of the Westerlies)



Convection is more active than normal

200-hPa stream function and its anomalies



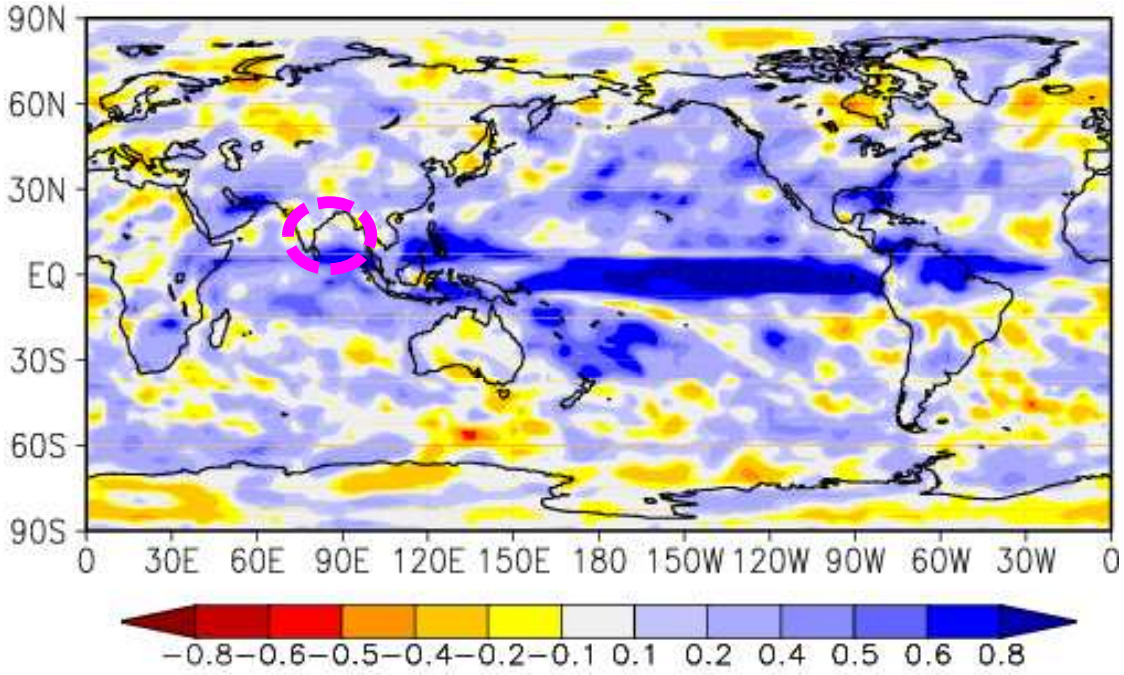
The negative anomalies around Japan are also associated with active convection around the Bay of Bengal.

But …

Prediction skill of the JMA's CGCM

Anomaly correlations between forecasted anomalies and analyzed anomalies of precipitation (GPCP Ver.2.1)

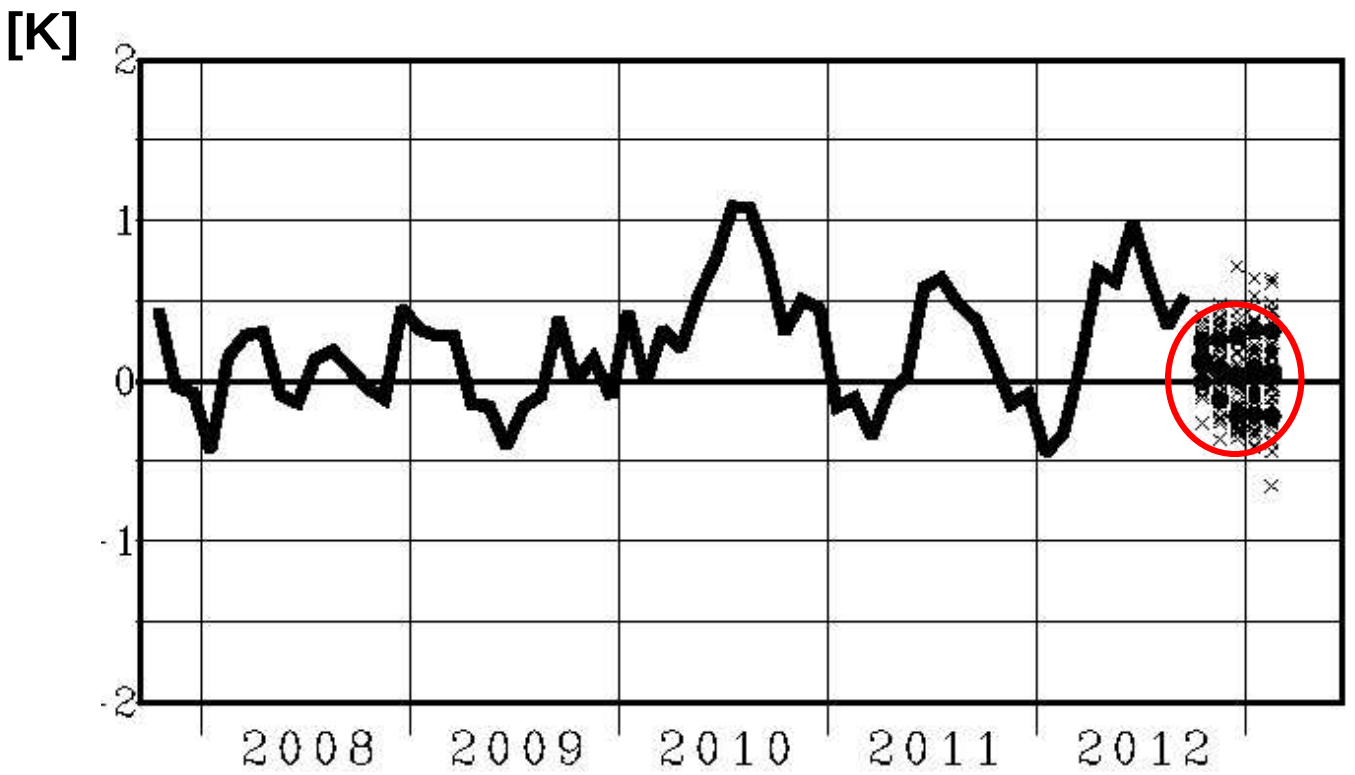
Initial: 2012/09/28, Lead Time: 2 months (Dec.-Feb.)



The model hindcast (30 years from 1979 to 2008) suggests that the model does not have a level of skill sufficient to predict the convection around the Bay of Bengal. So, both the positive anomalies of 200-hPa stream function around the Bay of Bengal and the negative anomalies around Japan should be supposed to be "unpredictable noises".

Predicted time series by JMA's CGCM

Zonal mean temperature anomaly calculated from thickness in the troposphere (300 hPa – 850 hPa) in northern mid- and high-latitudes (30° N – 90° N)



Zonal mean temperature anomaly in the troposphere in northern mid- and high-latitudes is predicted to be near normal.
→ "Base temperature anomalies" for Japan should be set to zeros.

Conclusions

Grounds for Cold Season Outlook

1. It is equally likely that El Niño conditions will last until the northern hemisphere winter, or will transition to ENSO neutral conditions during autumn and winter.

2. As one of the features of El Niño, convection is predicted to be inactive in the western tropical Pacific. Corresponding to this, anti-cyclonic circulation anomaly in the lower troposphere is predicted. There is a possibility that the anti-cyclonic circulation anomaly extending to the south of Japan will bring warm and humid air to the southern part of Japan and create favorable conditions for the genesis of cyclones there.

3. Remarkable southward meandering of the jet stream over Japan is predicted associated with active convection around the Bay of Bengal. However, the model does not have a level of skill sufficient to predict the convection around the Bay of Bengal. Moreover, the positive (negative) phase of the Arctic Oscillation (AO) tends to cause a weak (strong) winter monsoon and above-normal (below-normal) temperatures in northern Japan. However, the spread of AO index among the ensemble members is large.

4. Considering the prediction skill of the model results in the mid- and high-latitudes mentioned above, it is most likely that the feature of El Niño will appear around Japan in response to the tropical conditions.

Expected weather for winter 2012/2013 Japan

1. Northwesterly winter monsoon is expected to be near normal over northern Japan.

2. Northwesterly winter monsoon is expected to be weaker than normal over eastern Japan, western Japan, and Okinawa and Amami. Cyclonic systems are expected to tend to pass through the Pacific sides of these regions.

Expected surface conditions for winter 2012/2013 Japan

1. Temperatures are likely to be above or near normal in eastern Japan, western Japan, and Okinawa and Amami.

2. Precipitation amounts are likely to be above or near normal in Okinawa and Amami.

Summary of the Outlook for Japan (December 2012 to February 2013)

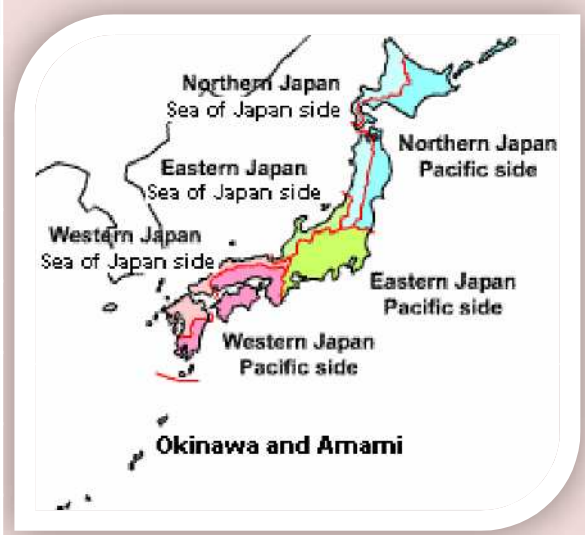
Temperature

Category	−	0	+
Northern Japan	30	40	30
Eastern Japan	20	40	40
Western Japan	20	40	40
Amami and Okinawa	20	40	40

(Category −: below normal, 0 : normal, + : above normal, Unit : %)

Precipitation

Category		−	0	+
Northern Japan	Sea of Japan side	30	40	30
	Pacific side	30	40	30
Eastern Japan	Sea of Japan side	40	30	30
	Pacific side	30	30	40
Western Japan	Sea of Japan side	30	40	30
	Pacific side	30	30	40
Amami and Okinawa		20	40	40



(Category −: below normal, 0 : normal, + : above normal, Unit : %)

Thank you!

JMA Mascot Character ‘Hare-run’
‘Hare’ means sunny weather in Japanese
‘Hare-ru’ means ‘it becomes sunny’.
‘Run-run’ means happiness feeling.

JMA's Seasonal Numerical Ensemble Prediction for Winter 2012/2013

Above-normal SSTs are expected in the central part of the equatorial Pacific and the tropical Indian Ocean.

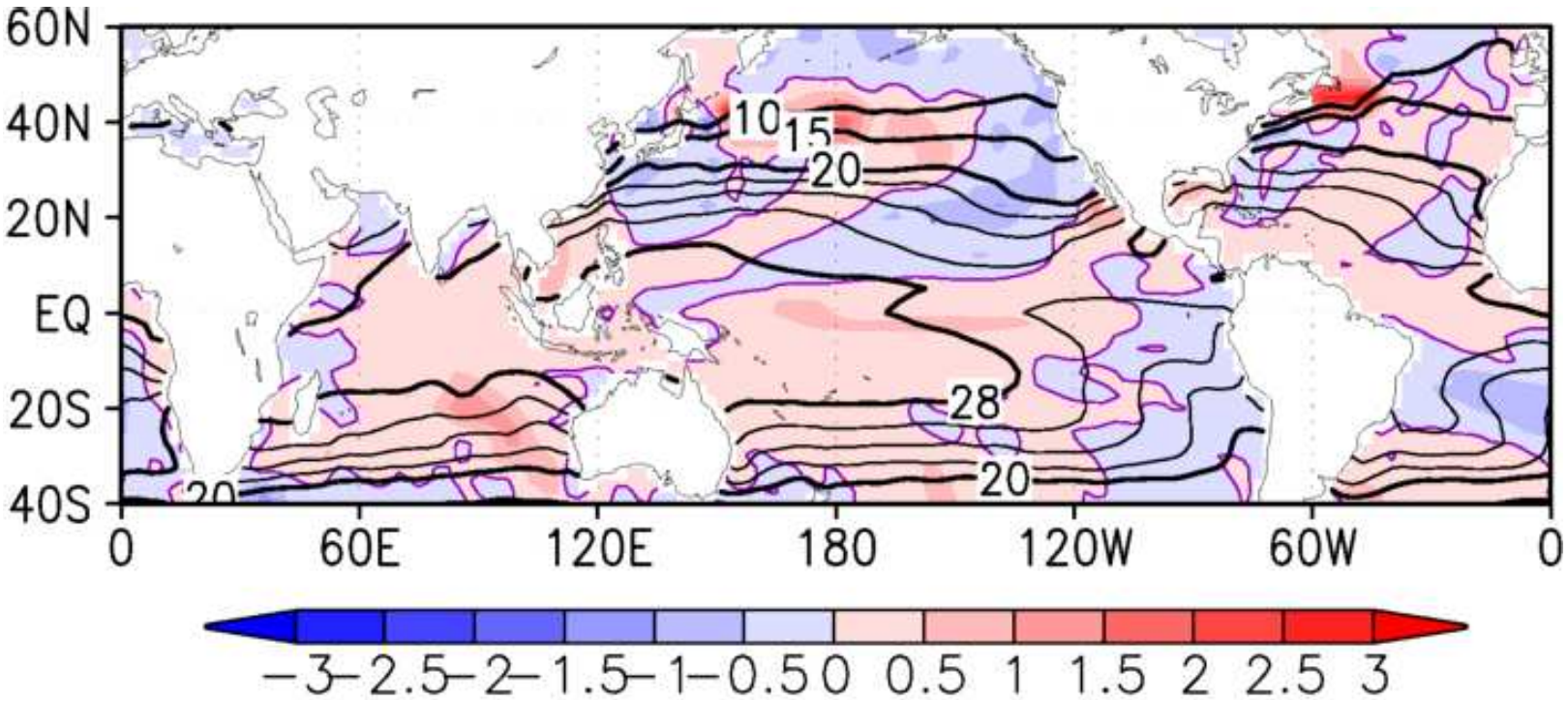


Figure 1 Predicted SSTs (contours) and SST anomalies (shading) for December 2012 – February 2013 (ensemble mean of 51 members)

JMA's Seasonal Numerical Ensemble Prediction for Winter 2012/2013

In association with SST anomaly pattern over the equatorial Pacific, above-normal precipitation is expected in the central equatorial Pacific, while below-normal around the maritime continent and east of the Philippines. From the tropical Indian Ocean to Southeast Asia, above-normal precipitation is expected. However, hindcast experiment indicates that prediction skill for precipitation around Southeast Asia is relatively low. Therefore, above-normal precipitation over the Southeast and its response to atmospheric large-scale circulation as shown later should be interpreted with caution.

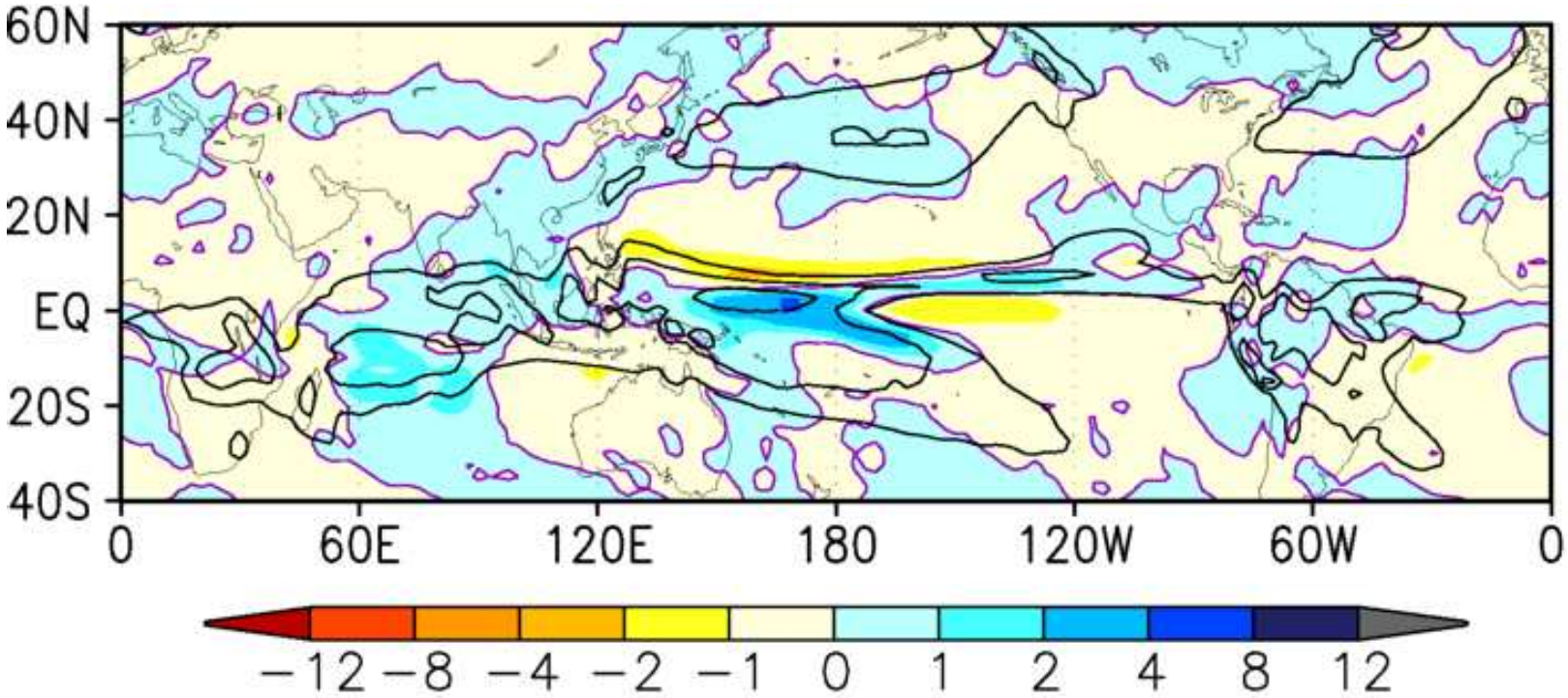


Figure 2 (a) Predicted precipitation (contours) and its anomaly (shading) for December 2012 – February 2013 (ensemble mean of 51 members).The contour interval is 2 mm/day.

JMA's Seasonal Numerical Ensemble Prediction for Winter 2012/2013

Velocity potential in the upper troposphere (200 hPa) is expected to be negative (i.e., more divergent) over the tropical Indian Ocean and the central equatorial Pacific, reflecting active convection at those regions. Around the maritime continent, relatively positive (i.e., more convergent) anomalies are predicted, reflecting inactive convection.

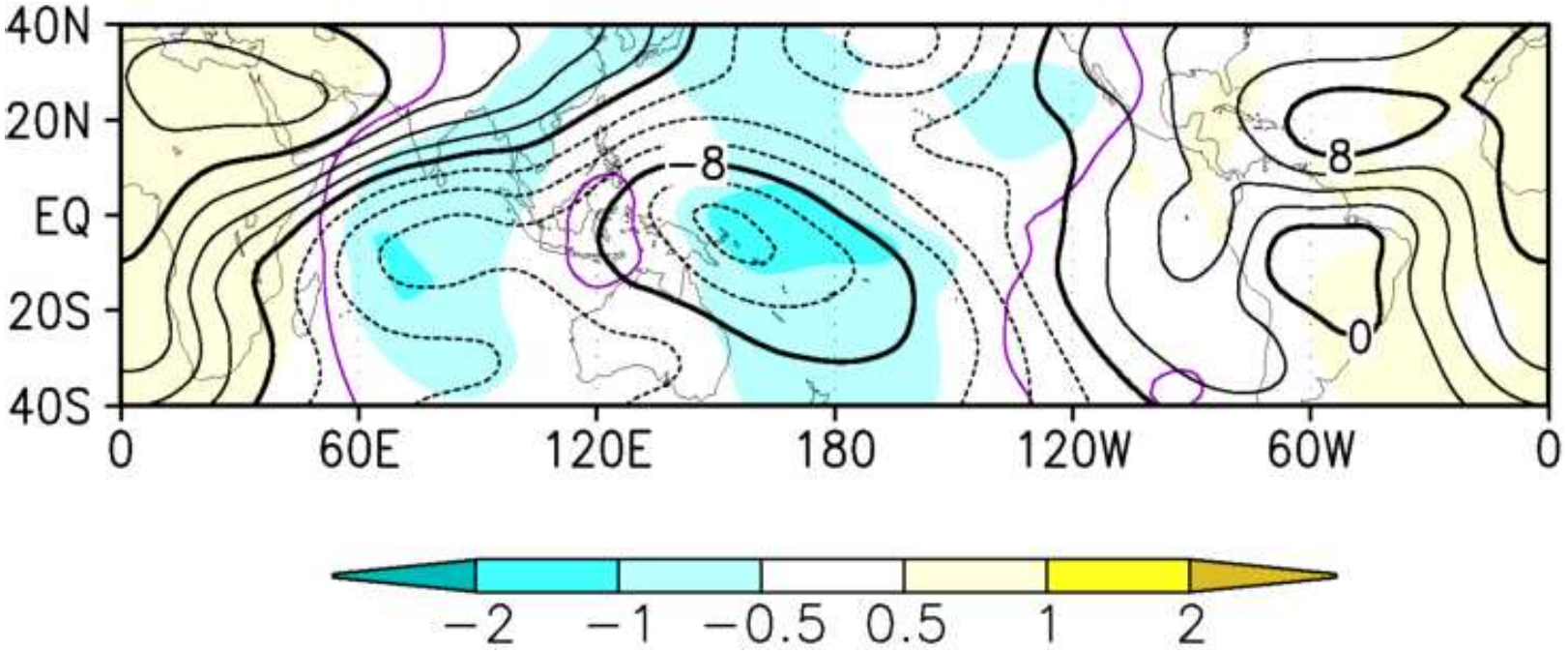


Figure 2 (b) Predicted velocity potential at 200 hPa (contours) and its anomaly (shading) for December 2012 – February 2013 (ensemble mean of 51 members). The contour interval is 2 × 10^6 m^2/s.

JMA's Seasonal Numerical Ensemble Prediction for Winter 2012/2013

The stream function at 200 hPa is generally expected to be negative (i.e., cyclonic) in the mid-latitudes of the Northern Hemisphere, reflecting the zonal pattern of precipitation (i.e., active near the equator and inactive in the subtropics of the Northern Hemisphere). From South to Southeast Asia, positive (i.e., anti-cyclonic) anomalies are expected, reflecting with active convection from the tropical Indian ocean to Southeast Asia. In association with this, sub-tropical jet stream is expected to be shifted northwardly over the western part of the Eurasian Continent and above-normal air temperature around South Asia is expected (not shown). However, these anomalies around Southeast Asia should be interpreted with caution, because those may be affected by unreliable active convection over Southeast Asia.

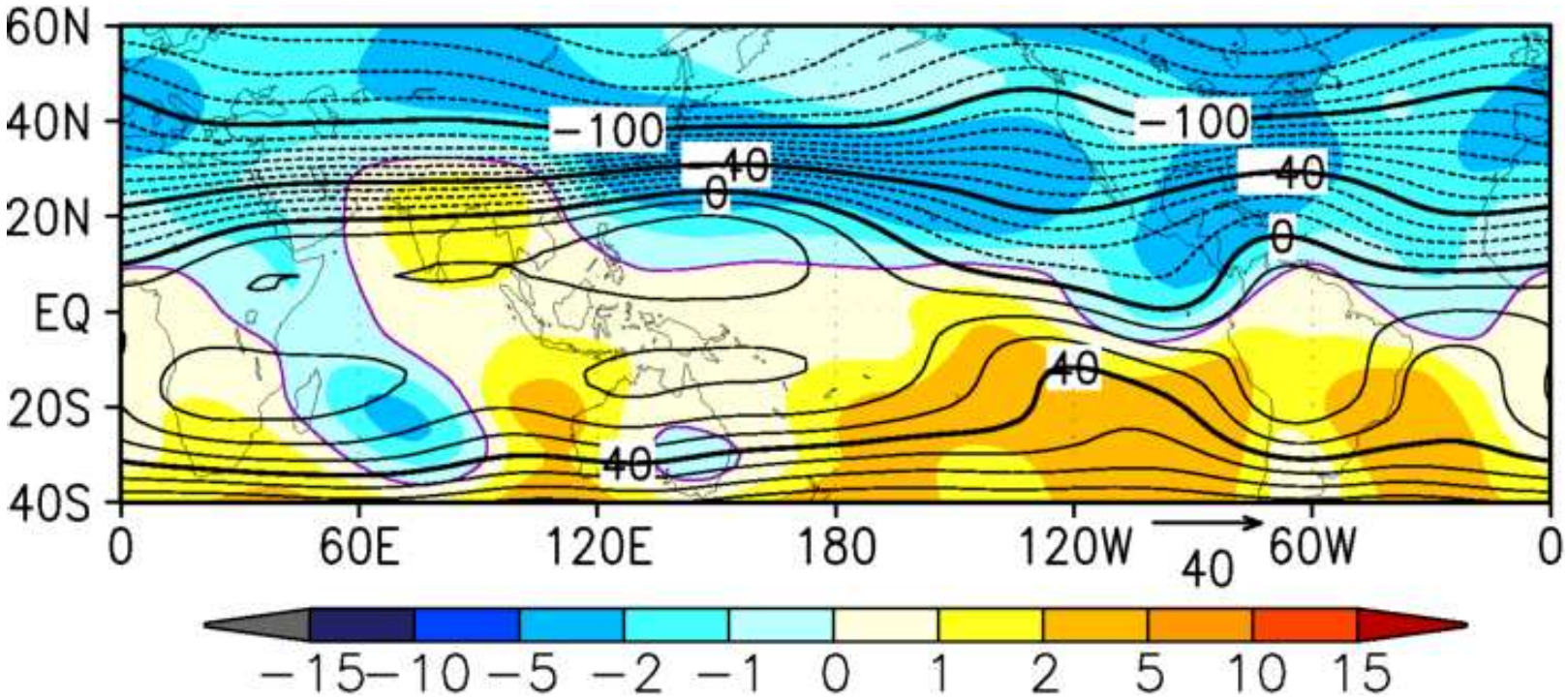


Figure 2 (c) Predicted stream function at 200 hPa (contours) and its anomaly (shading) for December 2012 – February 2013 (ensemble mean of 51 members). The contour interval is 16 × 10^6 m^2/s.

JMA's Seasonal Numerical Ensemble Prediction for Winter 2012/2013

Stream function anomalies at 850 hPa are expected to be negative over the northern Indian Ocean in association with active convection over the Indian Ocean. Positive anomalies are predicted over the western tropical Pacific in association with inactive convection around the maritime continent and east of the Philippines.

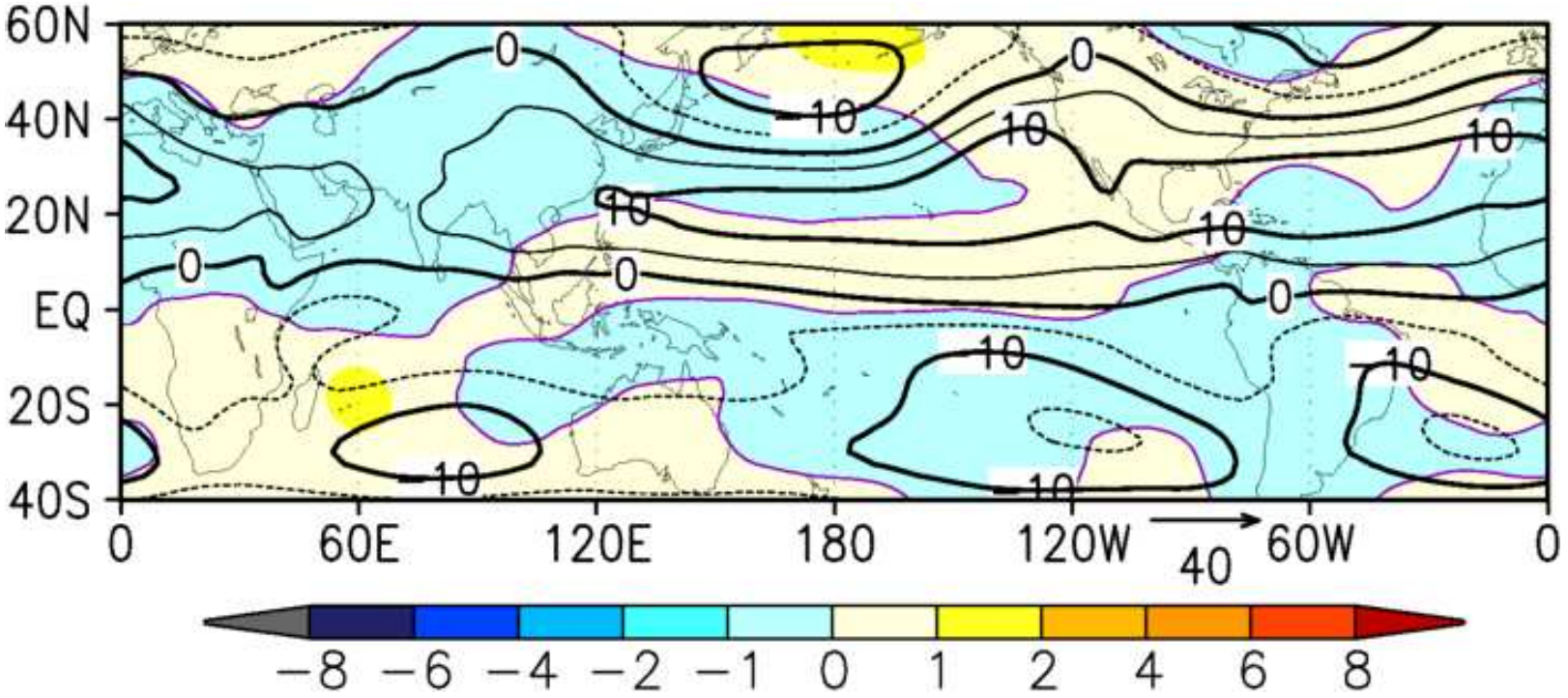


Figure 2 (d) Predicted stream function at 850 hPa (contours) and its anomaly (shading) for December 2012 – February 2013 (ensemble mean of 51 members). The contour interval is 5 × 10^6 m^2/s.

JMA's Seasonal Numerical Ensemble Prediction for Winter 2012/2013

Around the Aleutian Low region, sea level pressure (SLP) anomalies are expected to be positive in the north side, while negative in the south side, suggesting that the Aleutian Low would be shifted southwardly.

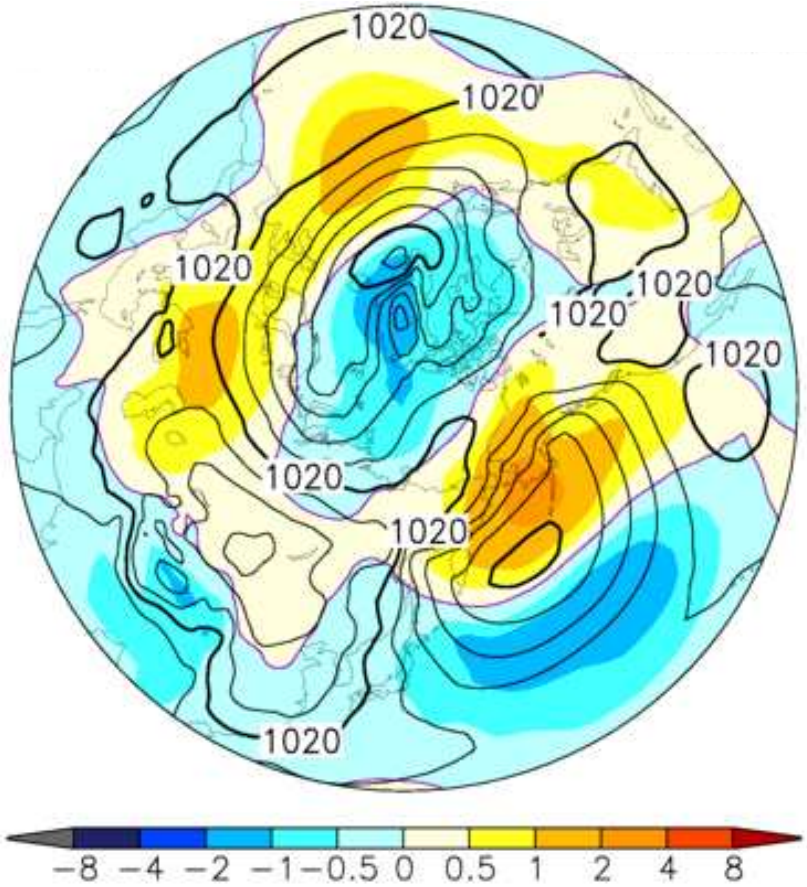


Figure 3 (a) Predicted Sea level pressure (contours) and its anomaly (shaded) from 20° N – 90° N for December 2012 – February 2013 (ensemble mean of 51 members). The contour interval is 4 hPa.

JMA's Seasonal Numerical Ensemble Prediction for Winter 2012/2013

Negative anomalies of 500-hPa geopotential height are widely expected over the southern part of the Eurasian Continent, and this might be attributable to active convection from the tropical Indian Pacific to Southeast Asia.

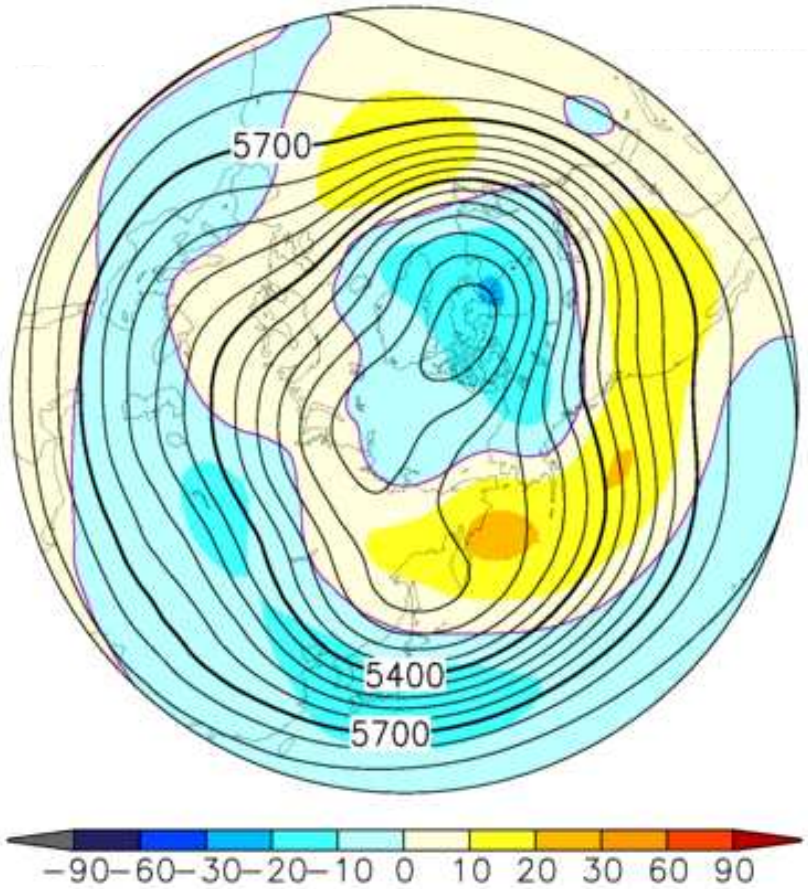


Figure 3 (b) Predicted 500-hPa height (contours) and its anomaly (shaded) from 20° N – 90° N for December 2012 – February 2013 (ensemble mean of 51 members). The contour interval is 60 m.

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Accordingly, lower atmospheric temperature would be below-normal over the mid-latitudes of the Eurasian continent. However, negative anomalies around East Asia should be undervalued, because those may be affected by unreliable active convection over Southeast Asia.

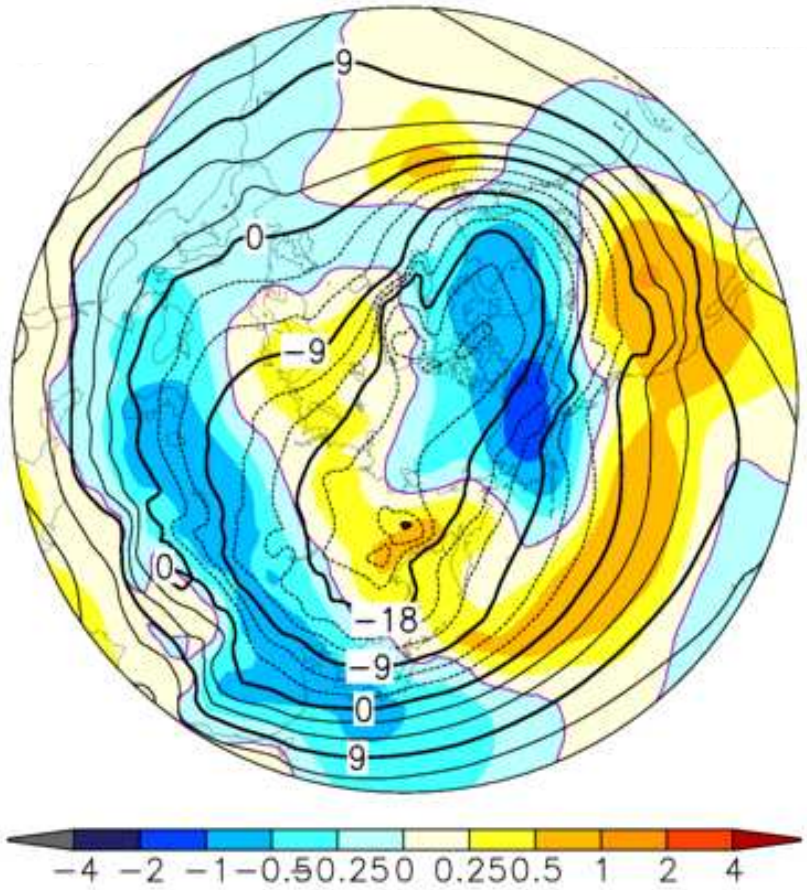

Figure 3 (c) Predicted 850-hPa temperature (contours) and its anomaly (shaded) from 20° N – 90° N for December 2012 – February 2013 (ensemble mean of 51 members). The contour interval is 3℃.