An overview of 2012 summer climate over Japan

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Contents

Characteristics of Asian summer monsoon during June-August 2012

8月登陆我国台风个数与频次历史罕见

来源：中国气象报社　　发布时间：2012年09月01日

中国气象报记者刘成成报道 8月31日，记者从中国气象局新闻发布会上获悉，今年8月登陆我国的台风共5个，较常年同期的平均2个明显偏多，与1994年和1995年并列为历史同期最多。其中，双台风"苏拉""达维"在24小时内接连登陆我国，时间间隔不到10个小时，为有气象记录以来首次；双台风风雨影响尚未结束，台风"海葵"又在浙江登陆，7天内3个台风接连正面袭击我国，登陆频次创近17年来新高，而今年台风登陆时间之密集也为历史罕见。

"截至目前，今年西北太平洋和南海海域共有15个台风生成，比历史同期的14.3个多0.7个。其中，有7个台风在我国登陆，比历史同期的4.3个偏多2.7个。8月有'苏拉''达维''海葵''启德'和'天秤'5个台风登陆我国。"中国气象局台风与海洋气象预报中心高级工程师高拴柱介绍。

8月份以来，登陆我国的台风不仅个数多，登陆时间集中，而且还具有强度较强、影响范围广、雨量大和风力强的特点。"8月份登陆我国的台风登陆时风力均达到12级以上，平均登陆强度为40.4米每秒，而常年同期平均为33.6米每秒，为1949年来历史同期罕见。"高拴柱说。

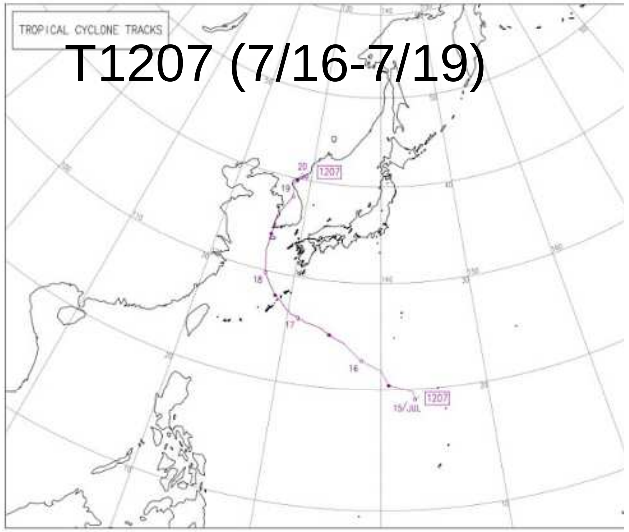
在8月登陆的5个台风中，"苏拉""海葵""天秤"以强台风强度登陆，风力达14级，为42至45米每秒；其中"达维"是1949年以来登陆我国长江以北地区的最强台风，也是近10年来影响北方地区最严重的一个台风。登陆的台风相继影响了吉林、河北、山东、江苏、安徽、上海、浙江、福建、江西、广东、广西、海南和云南等18个省（区、市），辽宁、河北东北部、浙江、上海、苏皖南部、江西东北部、广东和广西南部等地出现区域性大暴雨。其中，辽宁本溪、浙江北仑和江苏金坛局地日降水量为213.3毫米、257.1毫米和316.5毫米，均突破历史极值。

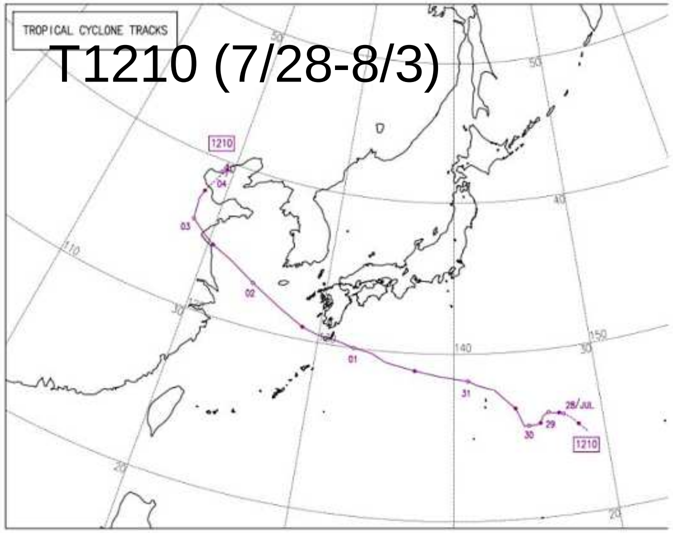
（责任编辑：赖敏）

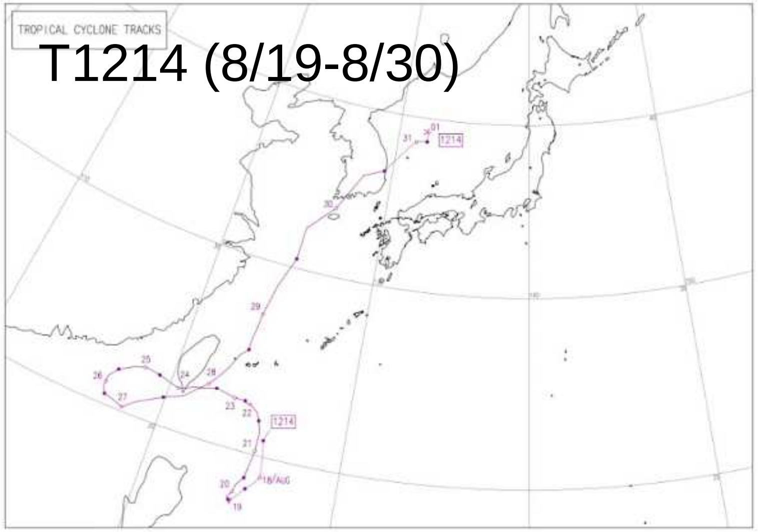
http://www.cma.gov.cn/2011xwzx/2011xqxxw/2011xqxyw/201209/t20120901_183990.html

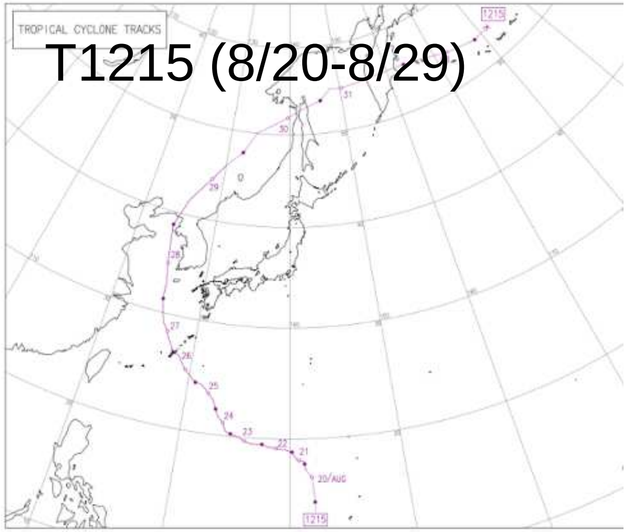
According to the CMA, the number of tropical cyclone landfall on China in August 2012 was 5, which is the greatest number for August on record along with 1994 and 1995.

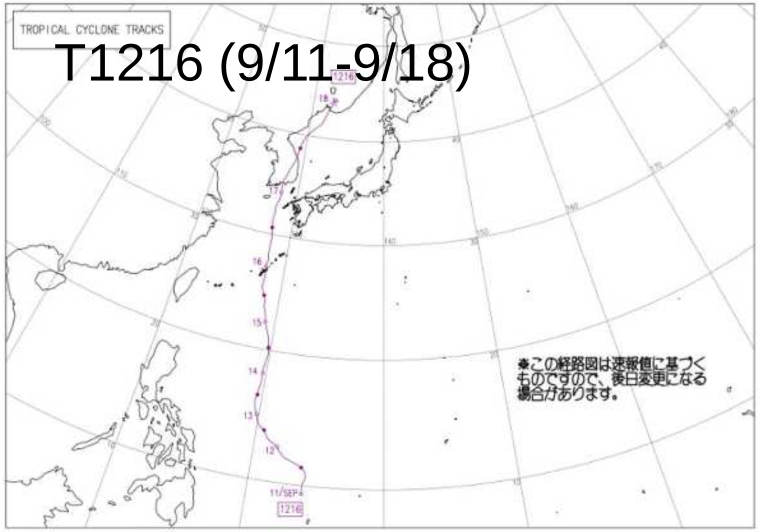
Four-time landfall and one time approach on the Korean Peninsula of tropical cyclones in 2012





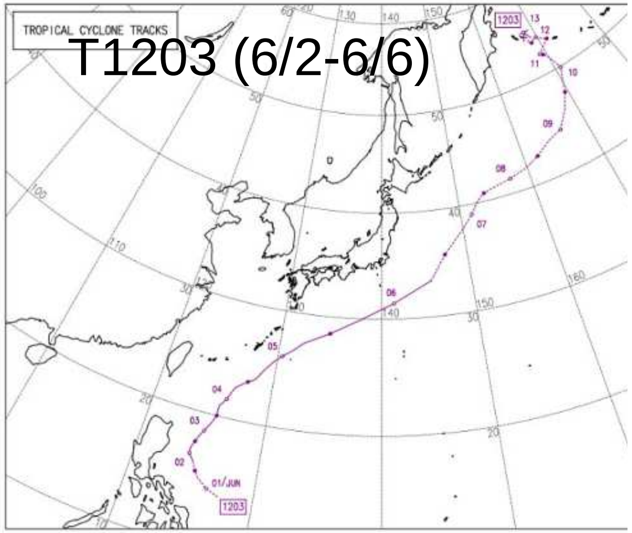


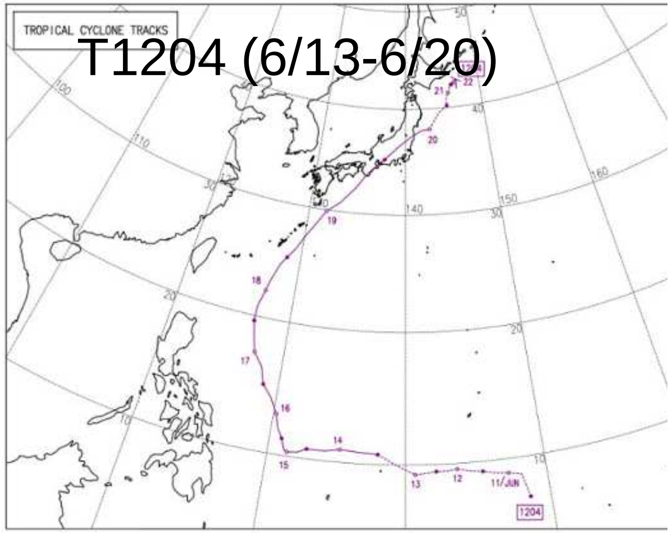


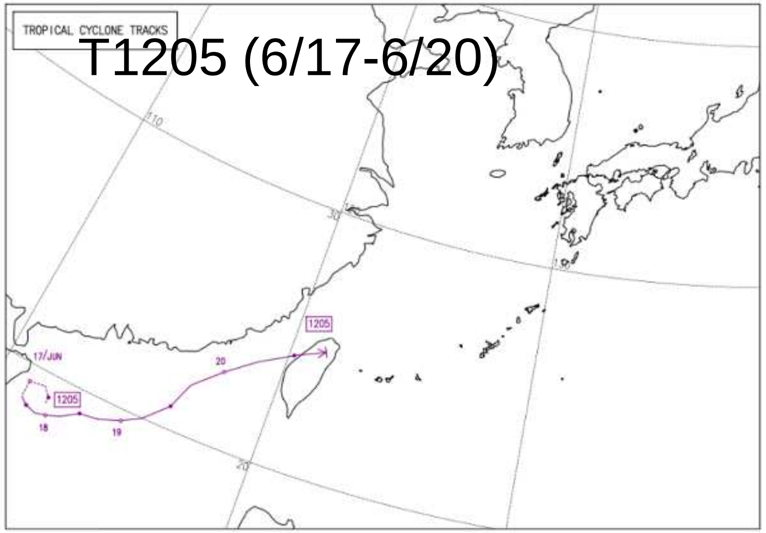


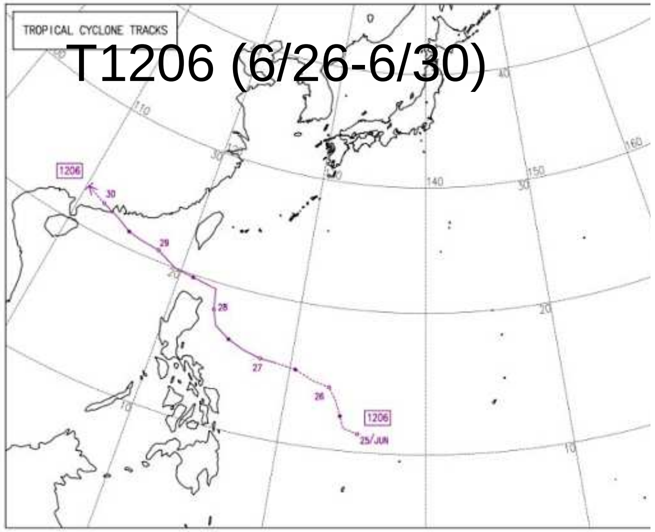
According to the Korean mass media, it is the first time in 50 years that four typhoons has made landfall on the peninsula in a single year.

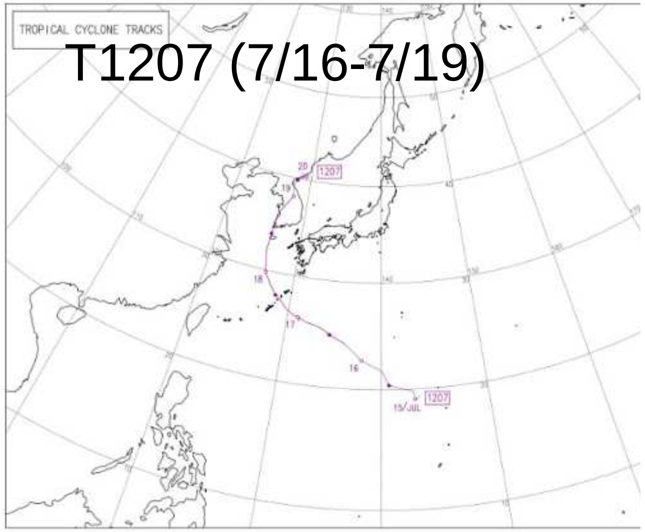
Frequent approach on Okinawa and Amami of tropical cyclones during summer 2012

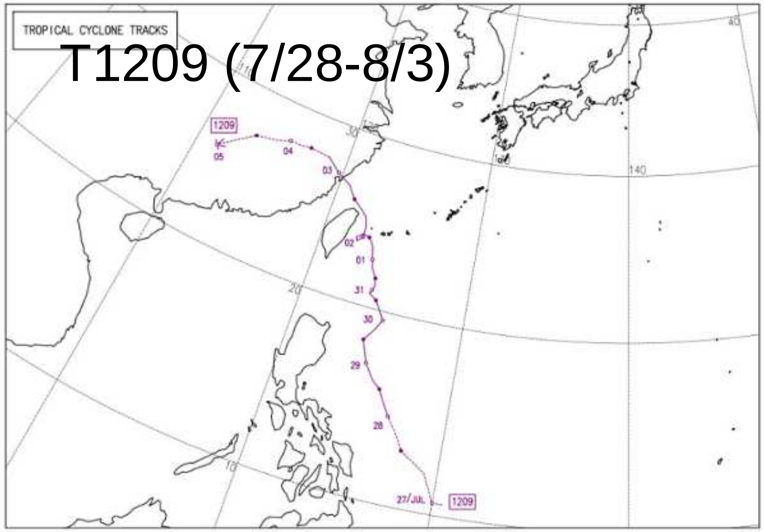






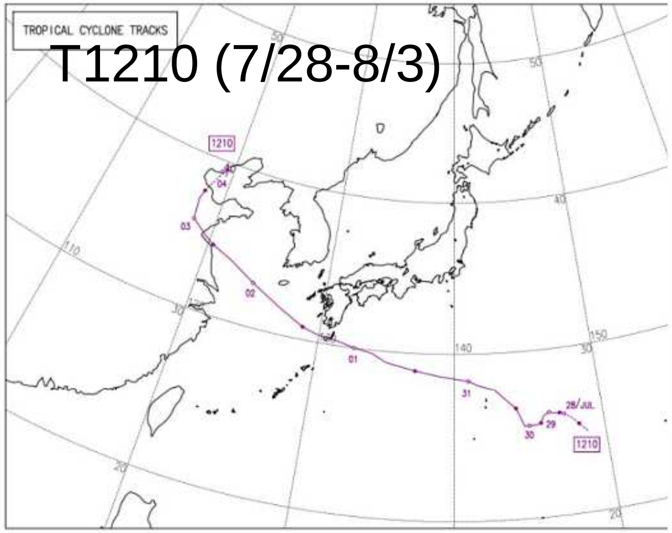


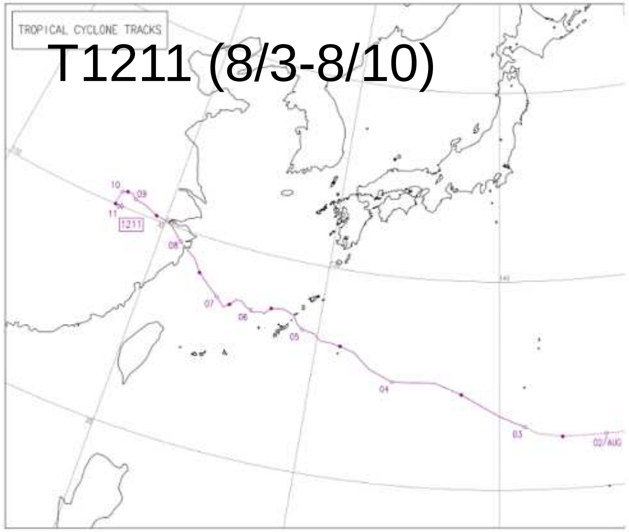


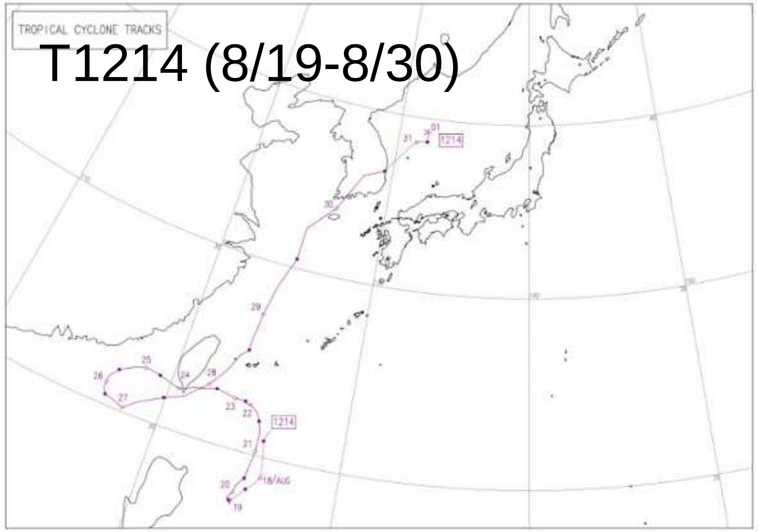


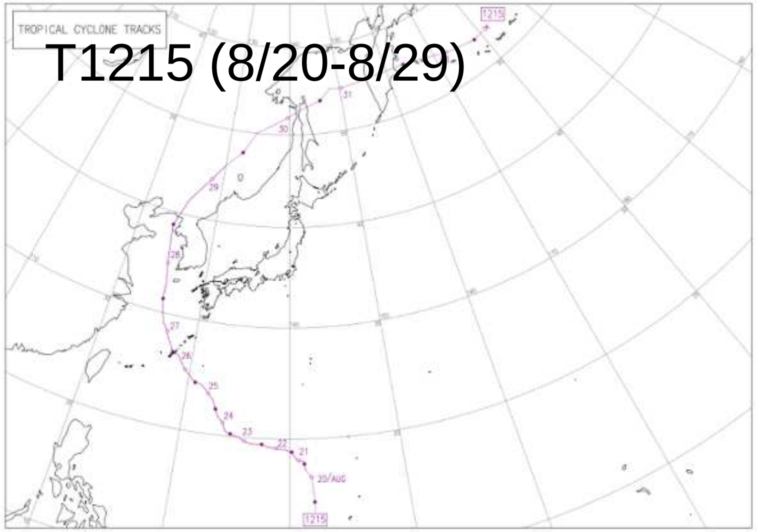
http://www.jma.go.jp/jma/jma-eng/jma-center/rsmc-hp-pub-eg/bstve_2012_m.html

Frequent approach on Okinawa and Amami of tropical cyclones during summer 2012









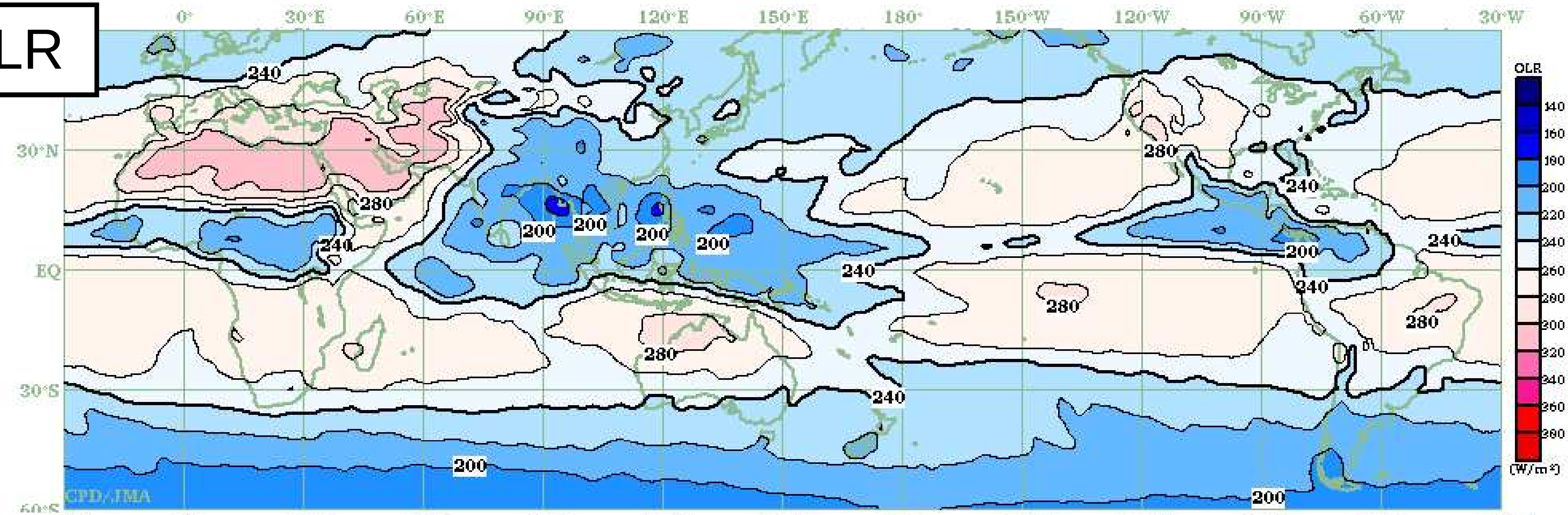
The number of approach on Okinawa and Amami of tropical cyclones with maximum winds of 17.2m/s or higher was 10 this summer (June-August 2012), which is the greatest number for summer on record since 1951.

http://www.jma.go.jp/jma/jma-eng/jma-center/rsmc-hp-pub-eg/bstve_2012_m.html

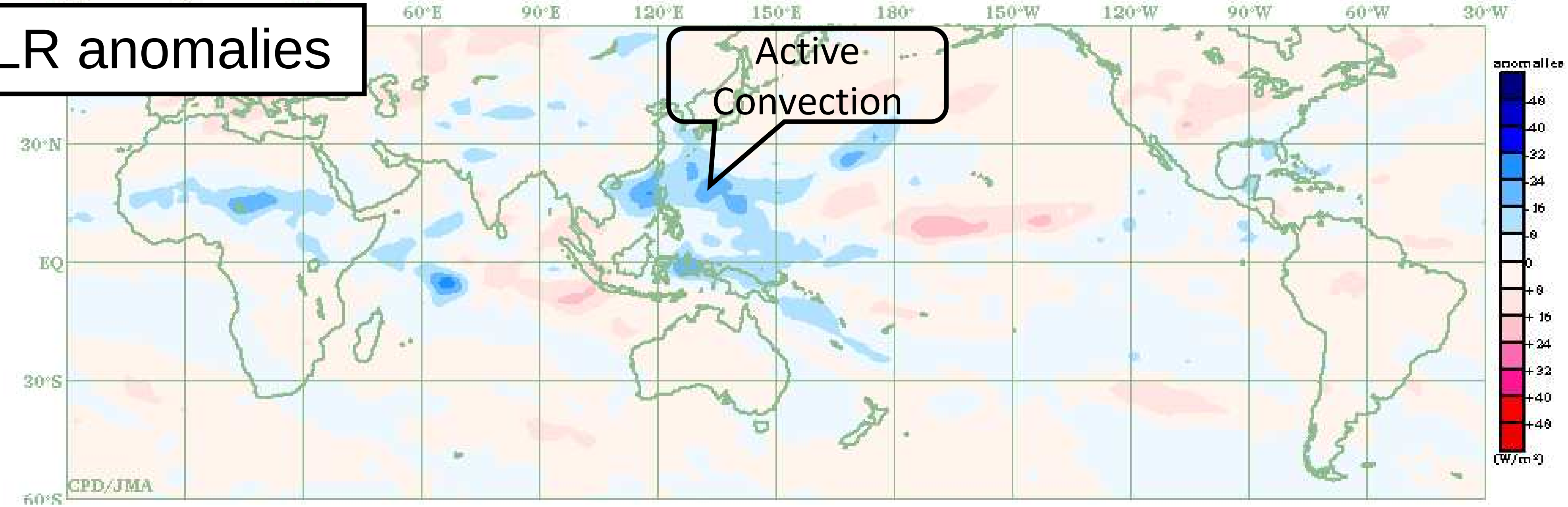
OLR（Outgoing Long-wave Radiation）averaged over the summer 2012

Convection was more active than normal in the seas east and north of the Philippines.

OLR

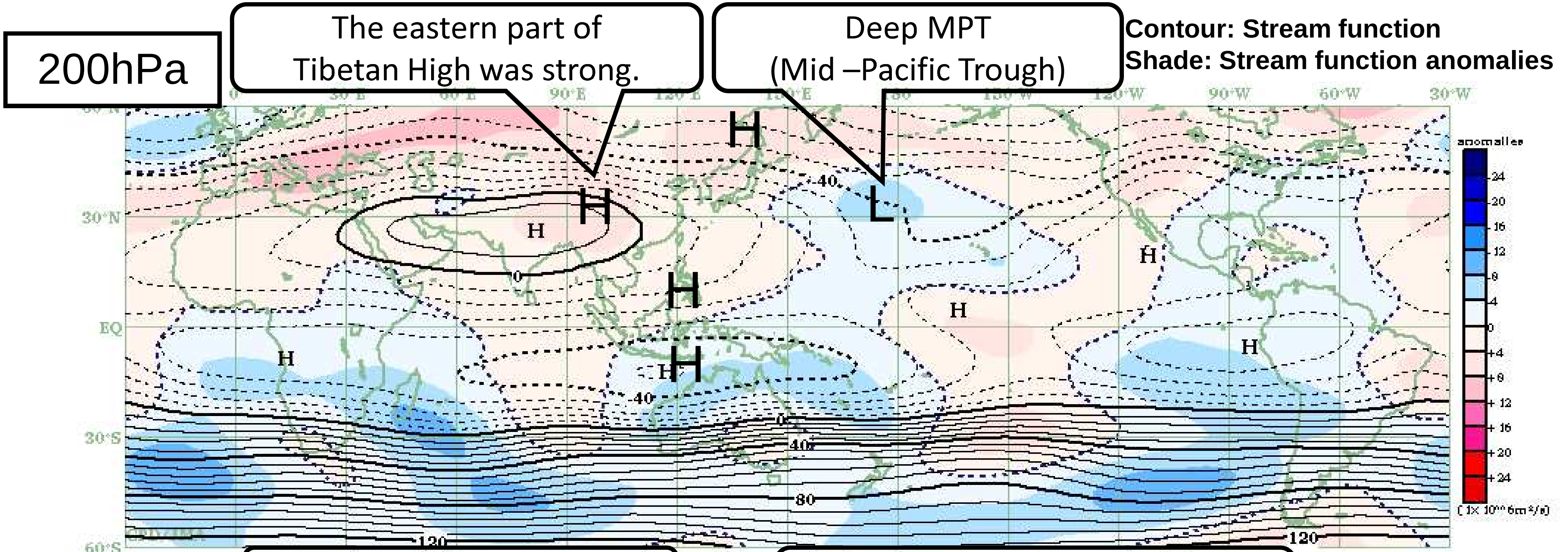


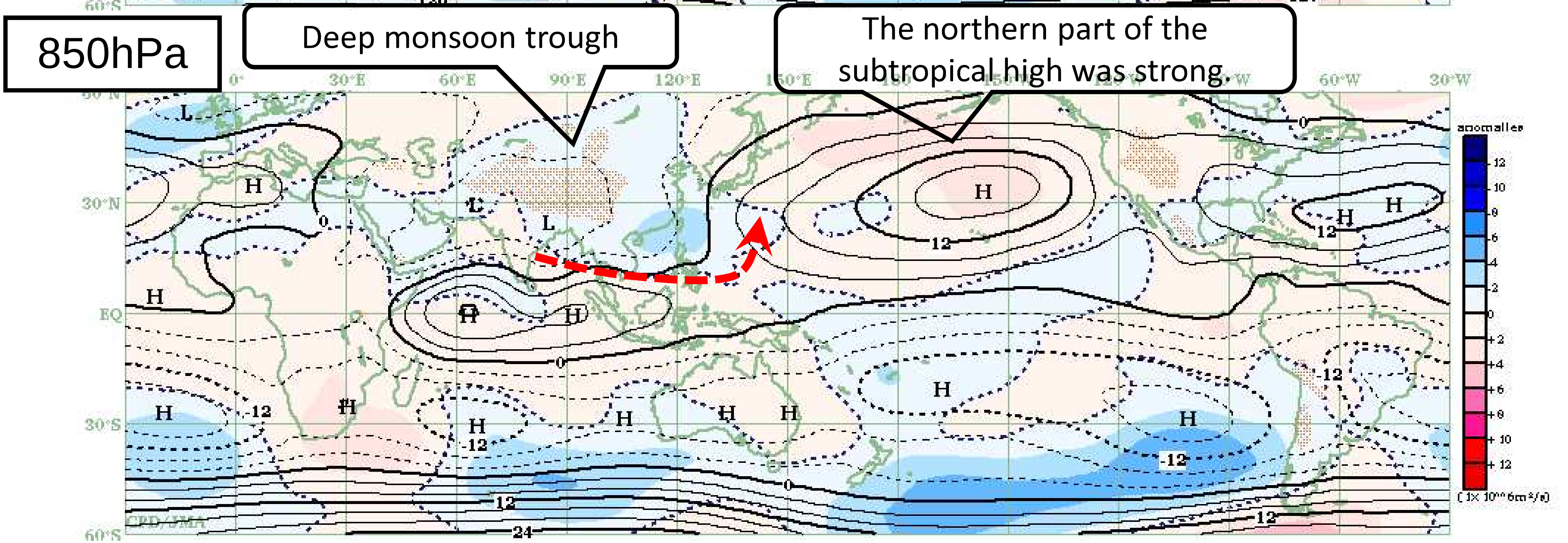
OLR anomalies



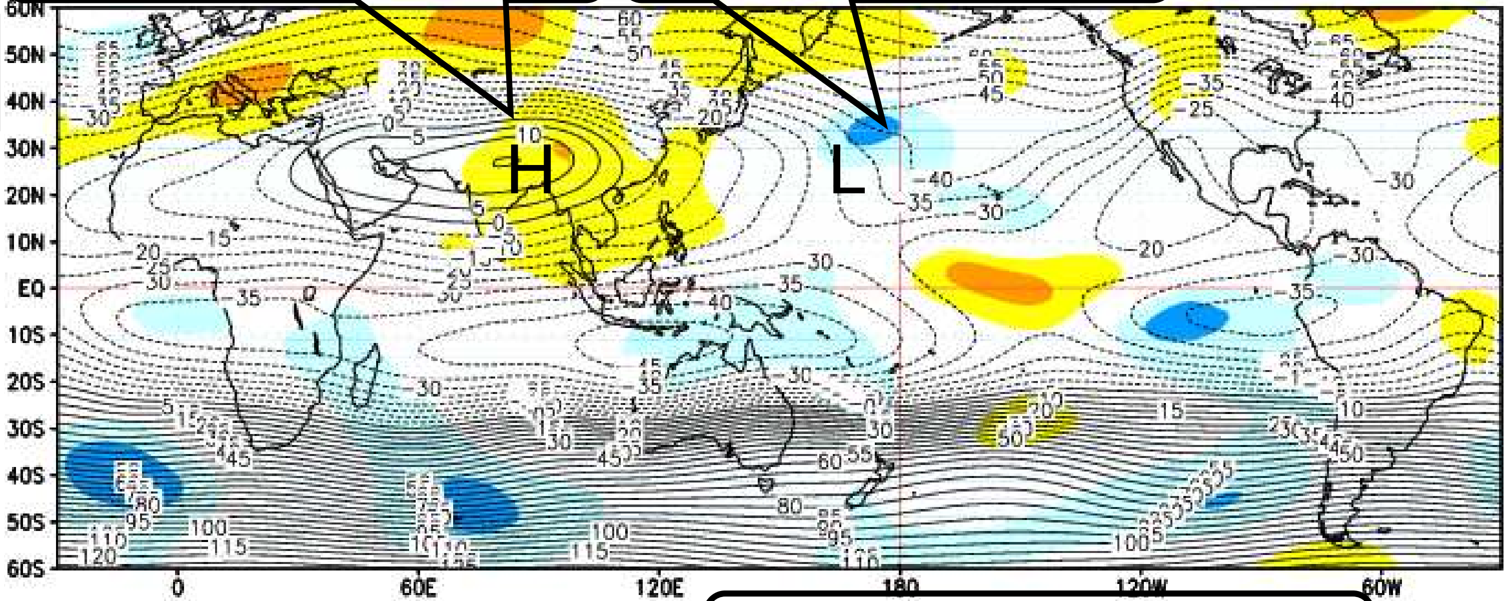
Stream function averaged over the summer 2012

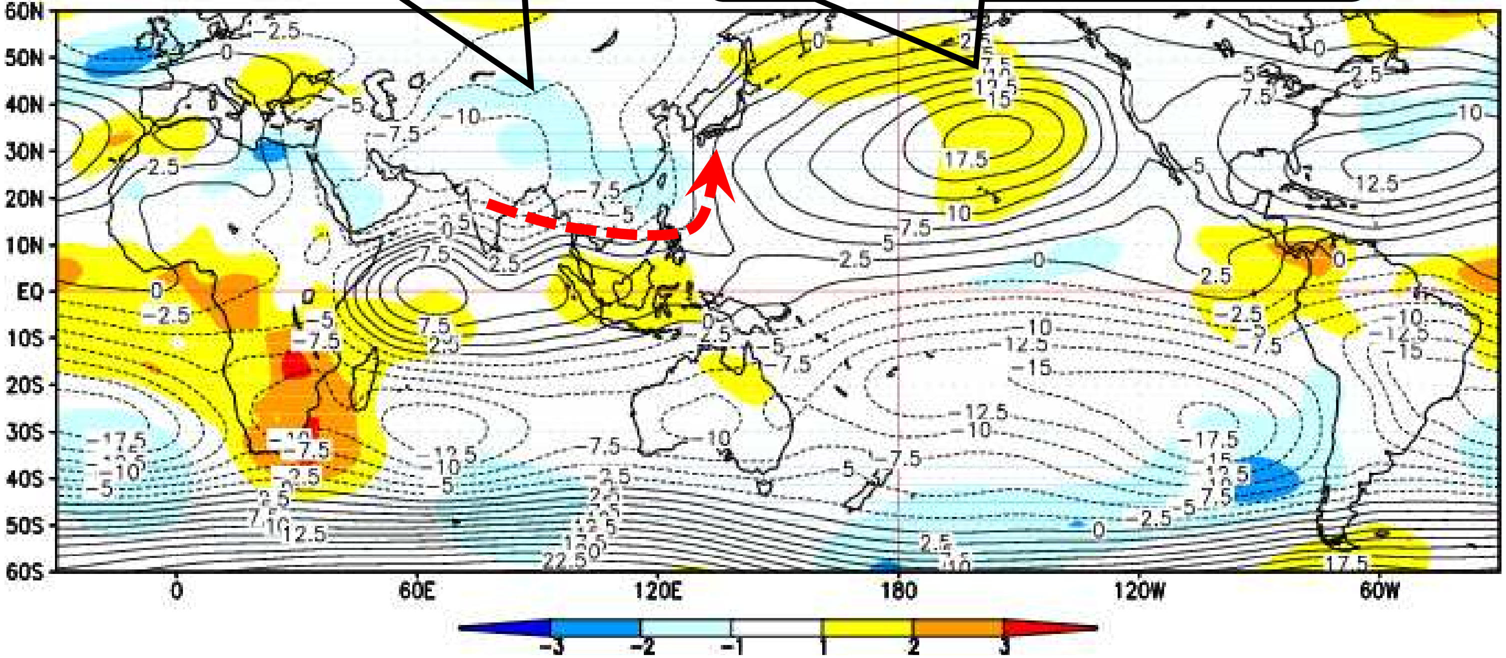
Contour: Stream function
Shade: Stream function anomalies





Normalized anomalies of Stream function averaged over the summer 2012

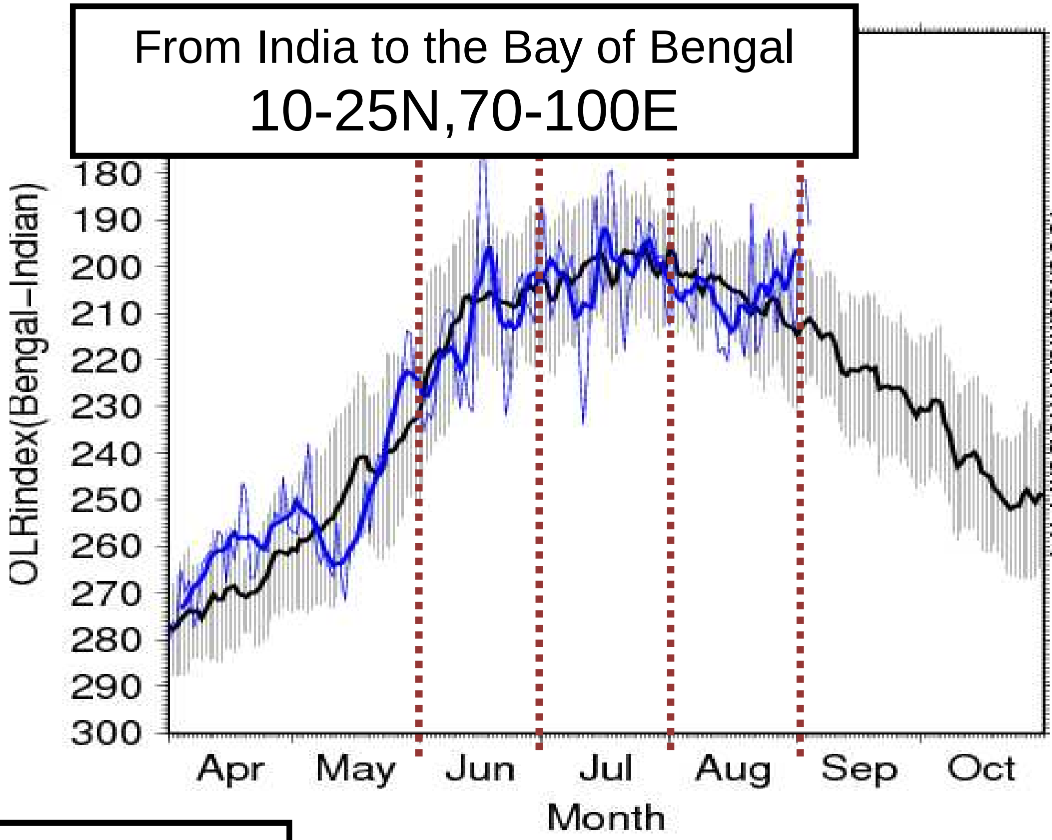


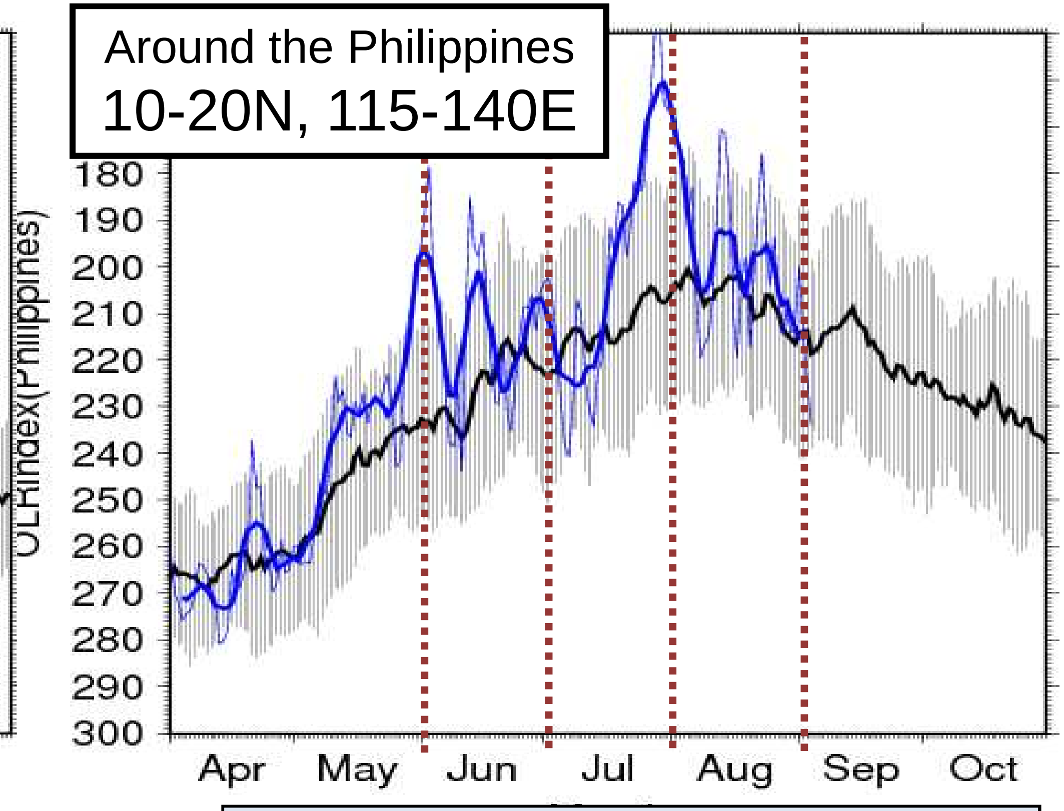


Activity of Asian summer monsoon (convective activity)

Area averaged OLR

Black line: daily normals
Gray area: daily standard deviations
Blue bold line: seven daily averages
Blue thin line: daily values





SAMOI

	(A)	(N)	(W)
Jun	+0.7	+1.2	-1.5
Jul	+1.0	+0.3	-1.4
Aug	-0.1	+1.4	-0.9

The activity of Asian summer monsoon was near normal around India and above normal around the Philippines.

There was a tendency of northeastward shift of Asian summer monsoon.

Three monthly average of SAMOI(N) was the third highest and the one of SAMOI (W) was the first lowest on record since 1979.

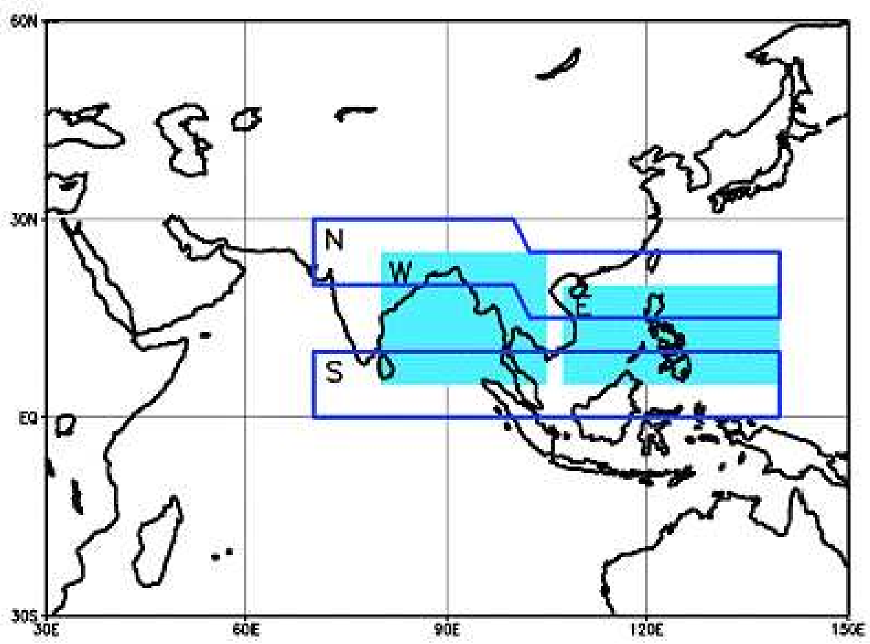


Fig. 1.4.1 Asian Summer Monsoon OLR Index (SAMOI) areas

Asian summer monsoon OLR indices (SAMOI) are derived from OLR anomalies. SAMOI (A), (N) and (W) indicate the overall activity of the Asian summer monsoon, its northward shift and its westward shift, respectively. SAMOI definitions are as follows:

SAMOI (A) = (–1) × (W + E)

SAMOI (N) = S – N,

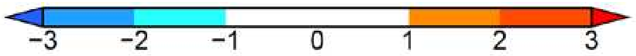
SAMOI (W) = E – W

W, E, N and S indicate area-averaged OLR anomalies for the respective regions shown in Fig. 1.4.1 normalized by their standard deviations.

Annual Report on the Climate System (JMA)
http://ds.data.jma.go.jp/tcc/tcc/products/clisys/arcs.html

Potential Vorticity (PV) on the 340 K isentropic surface

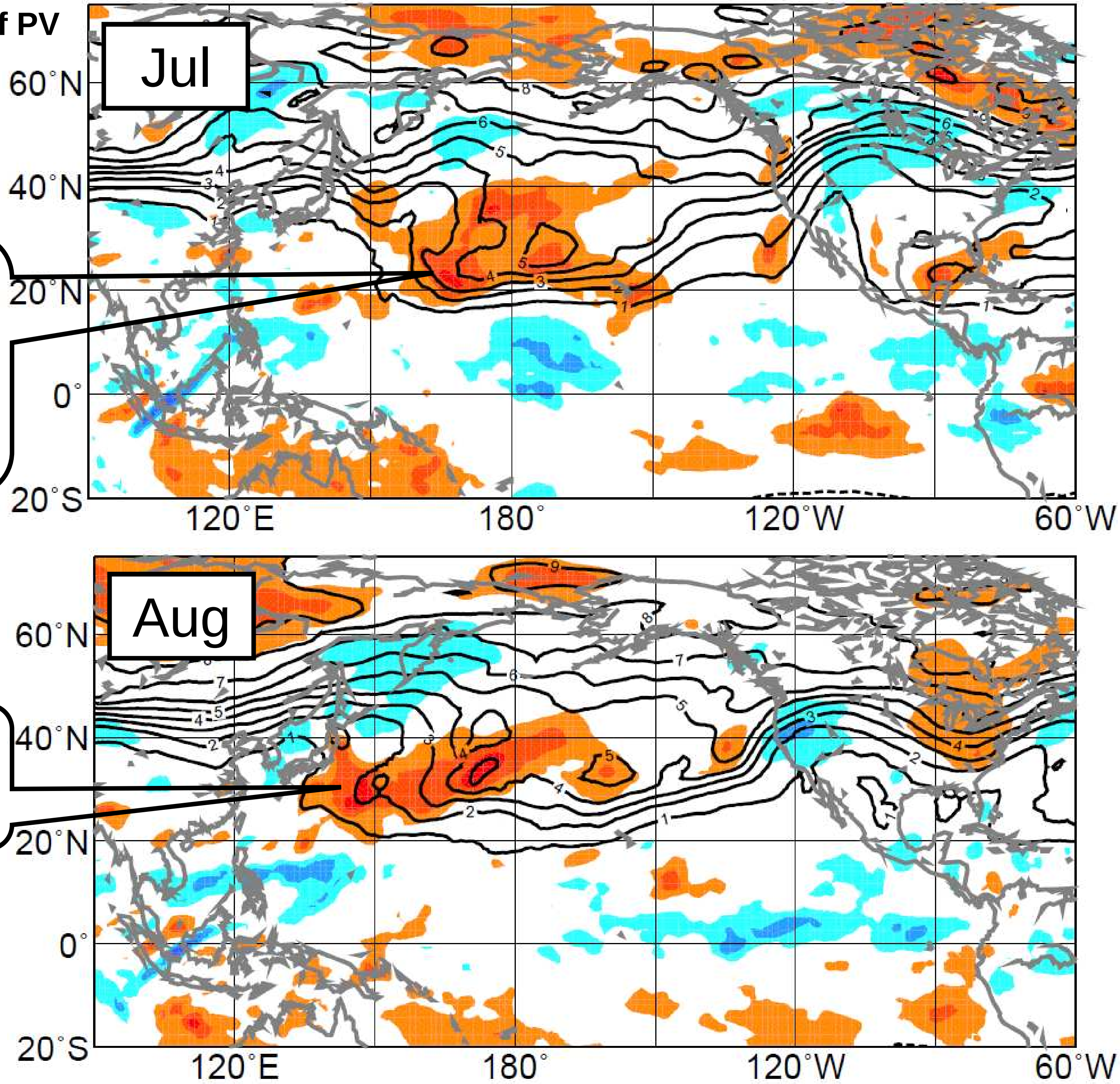
Shade: Normalized anomalies of PV
Bold line: PV



Inflow into the region over the central North Pacific of high PV in association with the deep MPT

Inflow into the region south of Japan of high PV

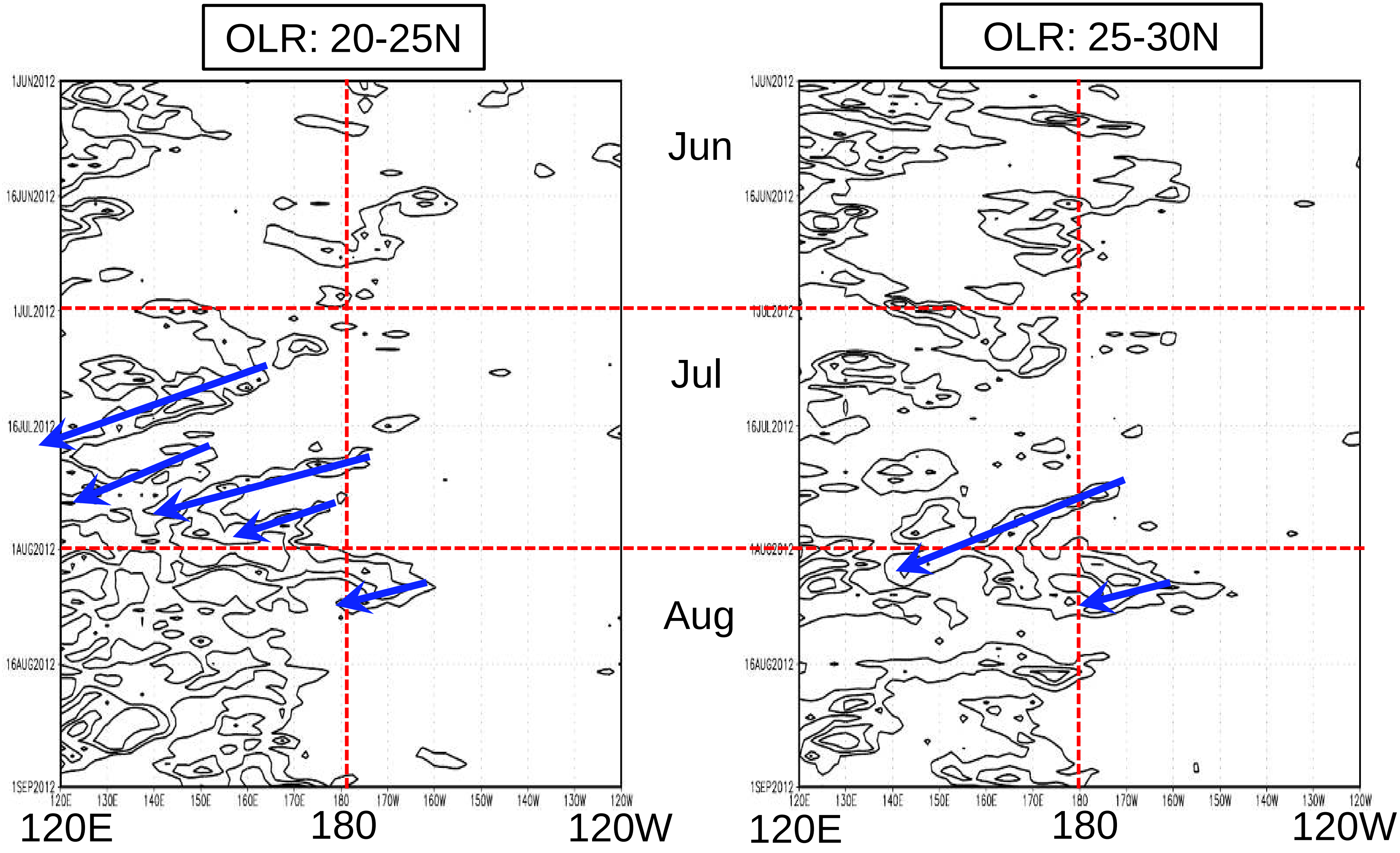
Significant Inflow into the northern parts of the active convection region north and east of the Philippines



High PV and active convection

Time-Longitude sections of OLR

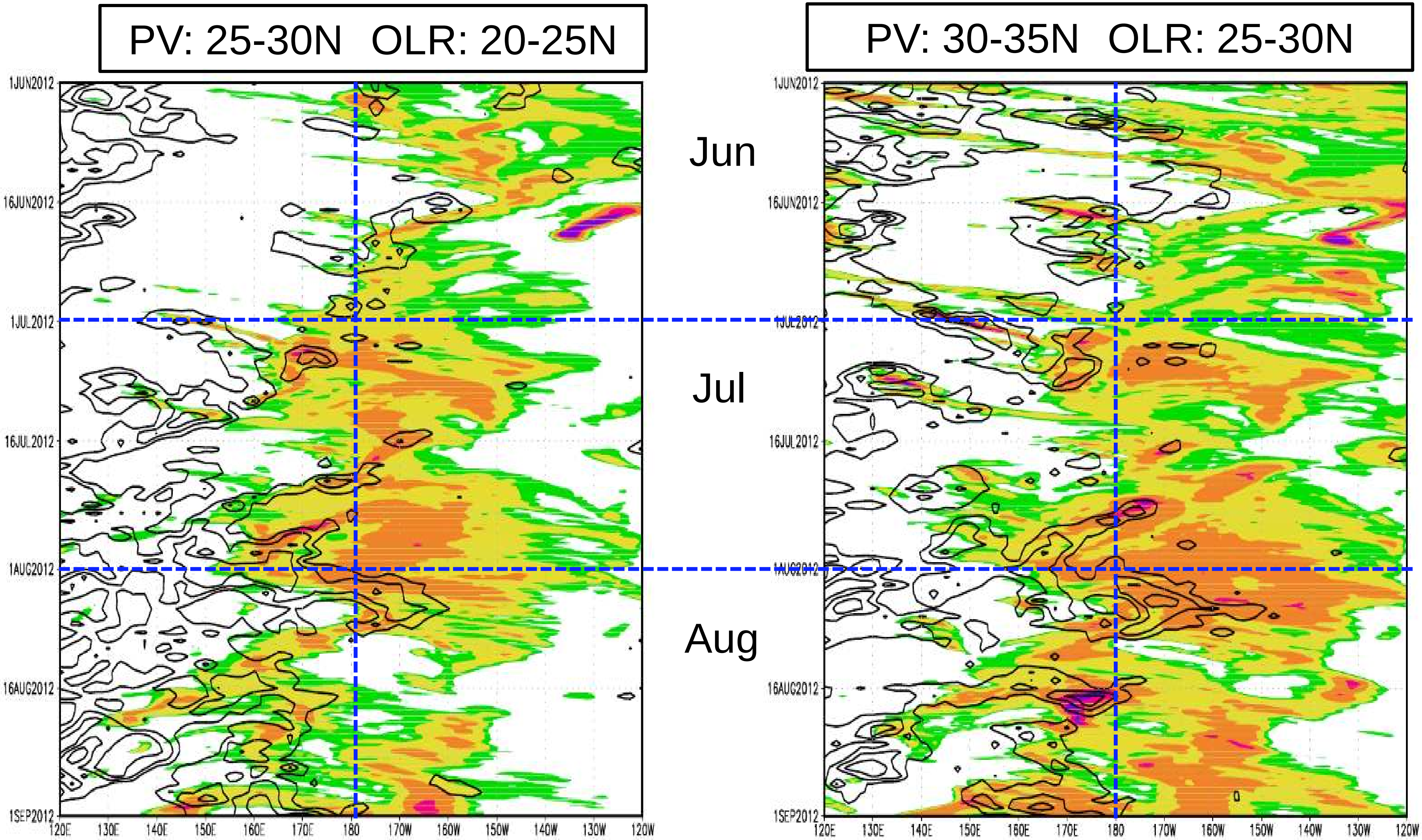
Contours: 160, 200, 240W/m^2



High PV and active convection

Time-Longitude sections of 350K PV and OLR

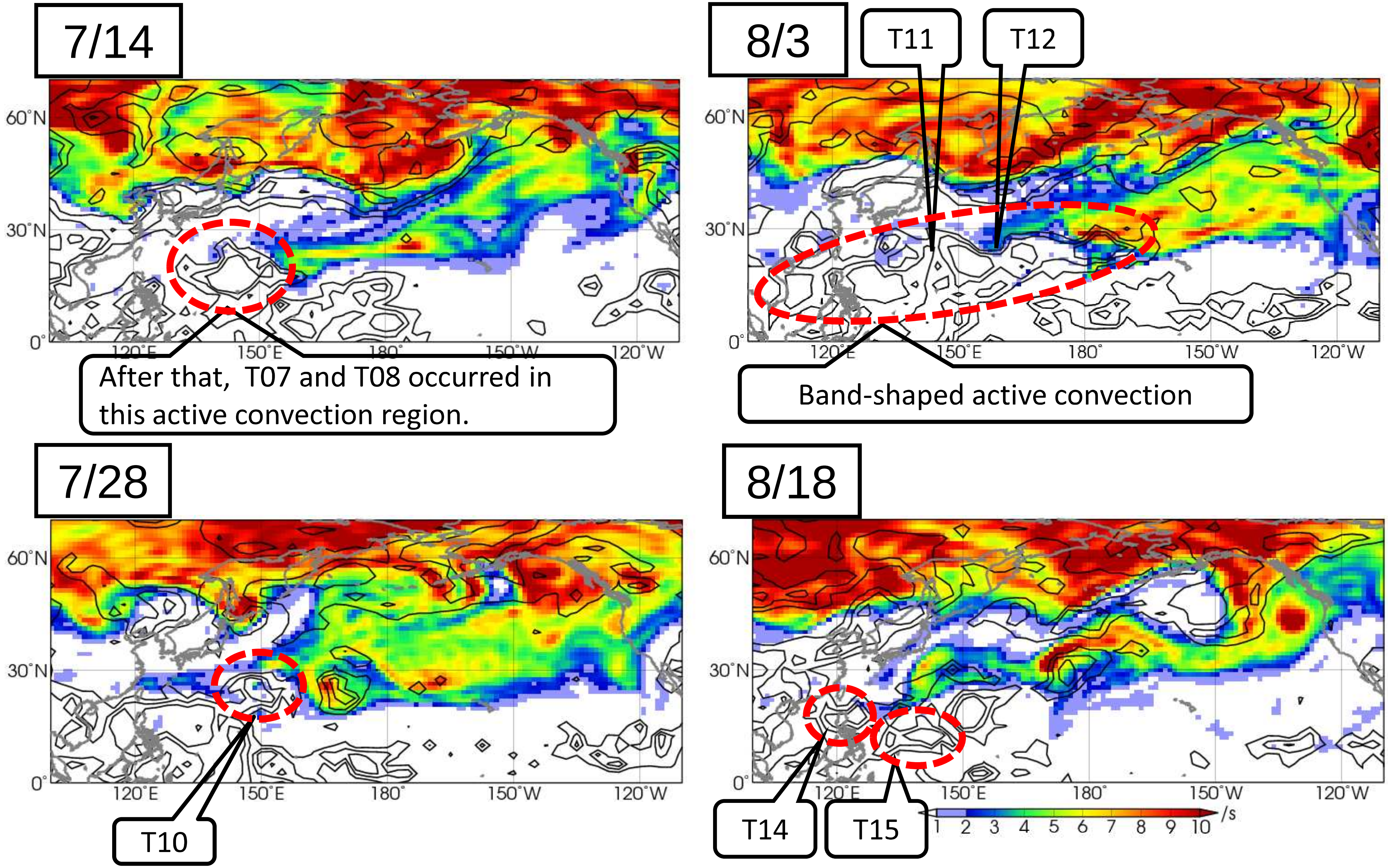
Shade : PV (≥ 2PVU)
Contours : OLR (160, 200, 240W/m²)



Active convection frequently occurred west of the date line when high PV flew into the region over the central North Pacific.

High PV and tropical cyclones

Shade: 350K PV (≥ 1PVU)
Black line: OLR (≤ 240W/m^2)



Surface conditions in Japan during June-August 2012

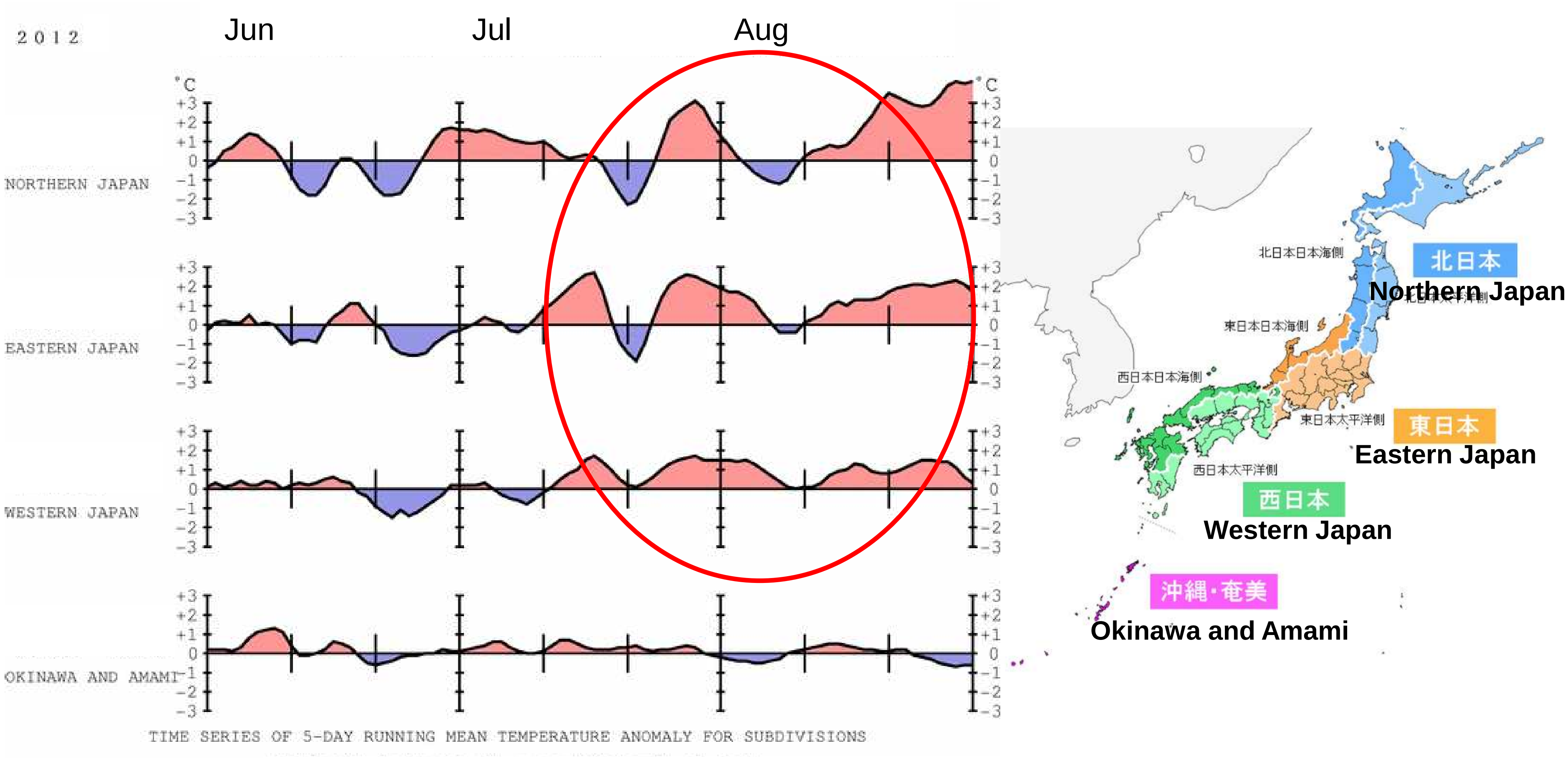
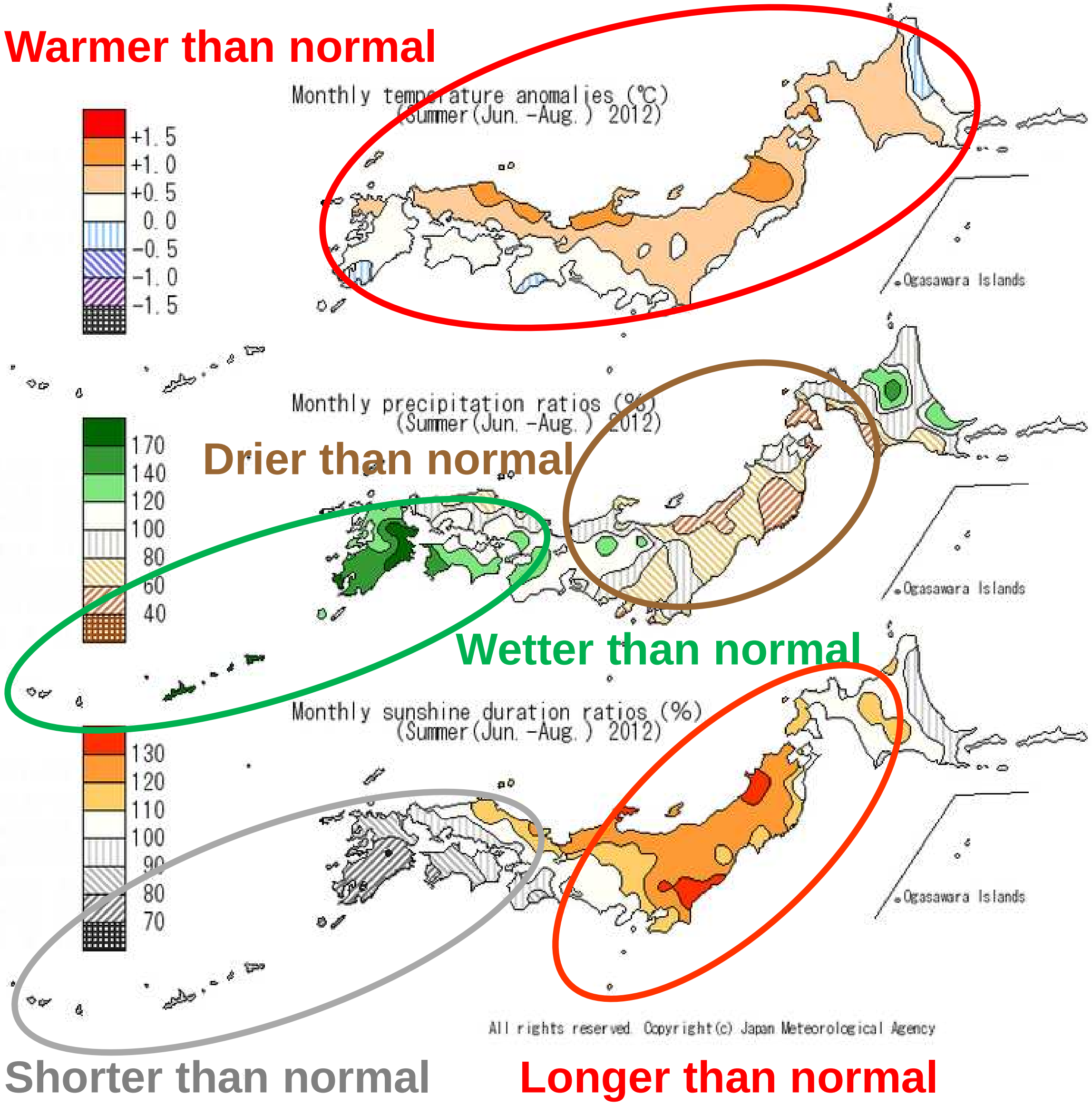


Figure 1 Time series of five-day running mean temperature anomalies (unit: °C) for four divisions of Japan from 1 June to 31 August 2012

Anomalies indicate deviations from the 1981 – 2010 average.

Generally speaking, temperatures were much higher than normal in northern, eastern, and western Japan from the mid of July to the end of August.



	TEMPERATURE ANOMALY ℃ (RANK)	PRECIPITATION RATIO % (RANK)	SUNSHINE DURATION RATIO % (RANK)
NORTHERN JAPAN	0.7 (+)	79 (−) (J) 90 (0) (P) 69 (−)*	111 (+) (J) 114 (+) (P) 109 (0)
EASTERN JAPAN	0.6 (+)	85 (−) (J) 79 (−) (P) 87 (−)	116 (+) (J) 128 (+)* (P) 113 (+)
WESTERN JAPAN	0.4 (+)	123 (+) (J) 113 (+) (P) 132 (+)*	93 (−) (J) 98 (0) (P) 89 (−)
OKINAWA AND AMAMI	0.1 (0)	167 (+)*	87 (−)*

Rank Representation (−):below normal (0):near normal (+):above normal
()*:significantly below normal or significantly above normal

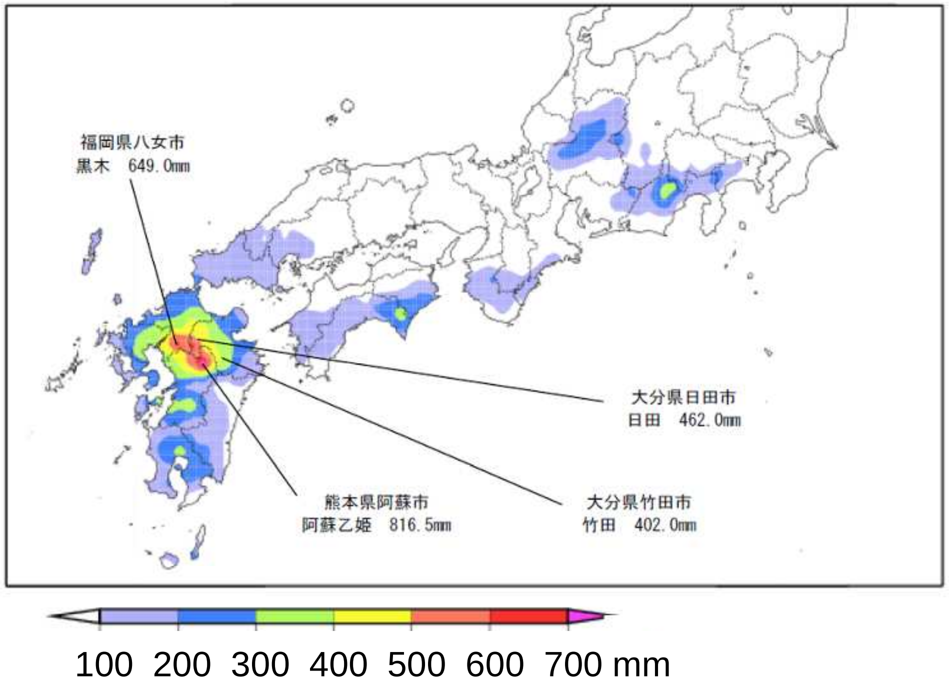
Region Representation
(J): Sea of Japan side (I): San-in (K):Kyushu island
(O):Sea of Okhotsk side (Y):San-yo (A):Amami islands
(P):Pacific side

-Temperatures were above normal in northern, eastern, and western Japan this summer, because the Pacific High was strong east of Japan and extended westward around the main land of Japan.

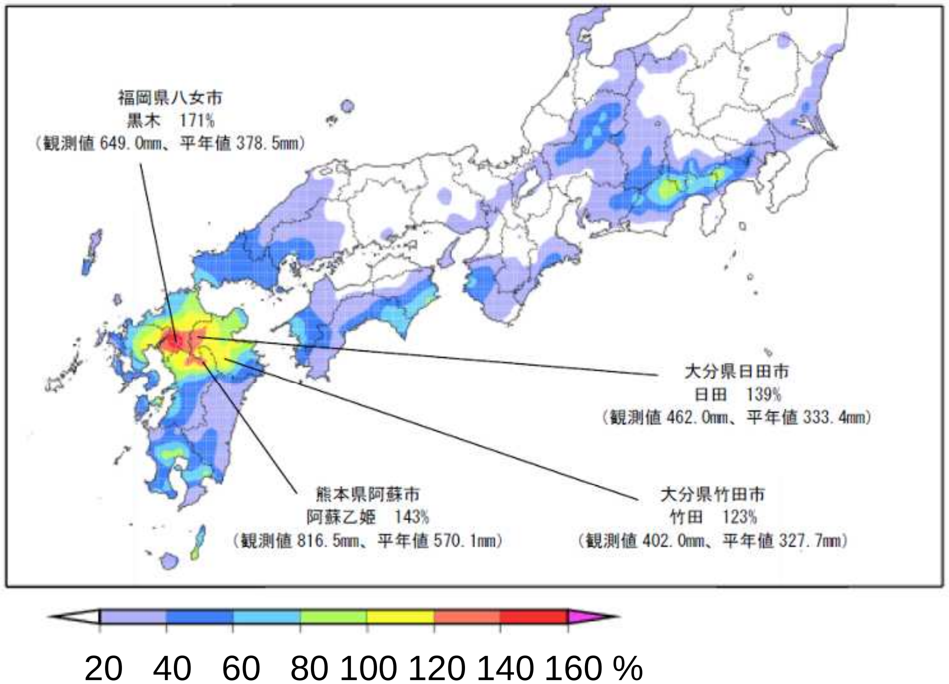
- Precipitation amounts were above normal and sunshine durations were below normal in western Japan and Okinawa and Amami this summer due to frequent approach of tropical cyclones, the active Baiu-front, and frequent warm and moist southerly flow.

Heavy rainfall on Kyushu Island at the end of the Baiu period (the first half of July 2012)

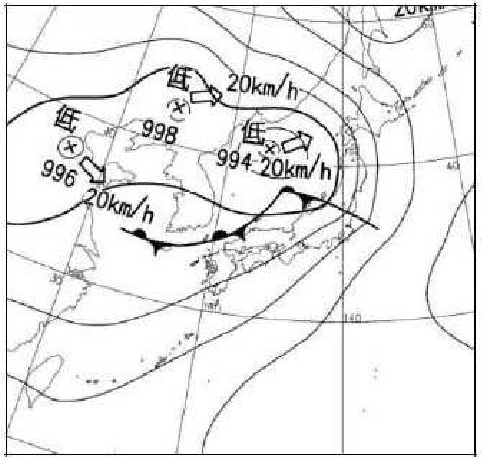
Precipitation amounts (11 – 14 July 2012, JST)



Ratio of precipitation amounts (11 – 14 July 2012, JST) compared with normals for July



09JST 12 July 2012



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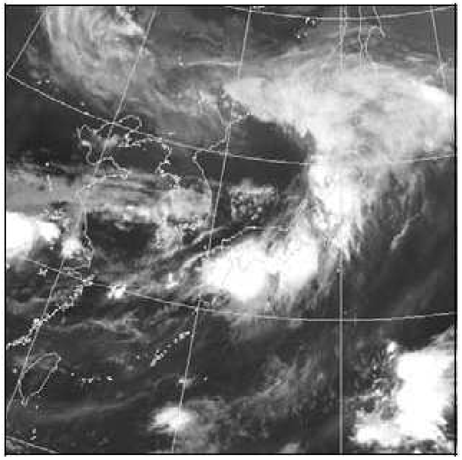
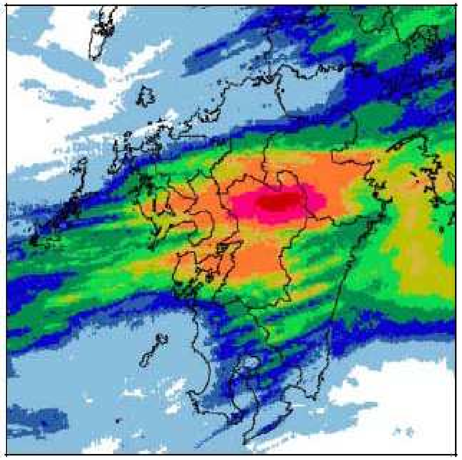


21JST 11 – 09JST 12 July 2012



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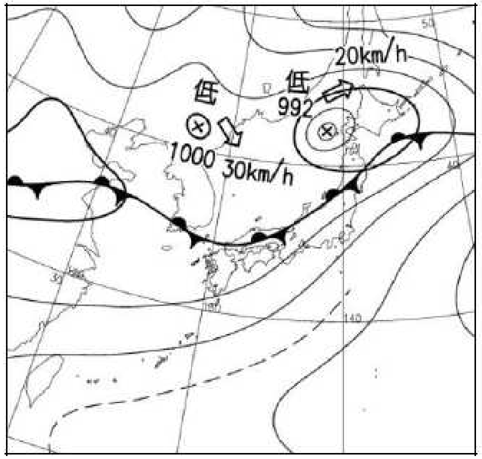

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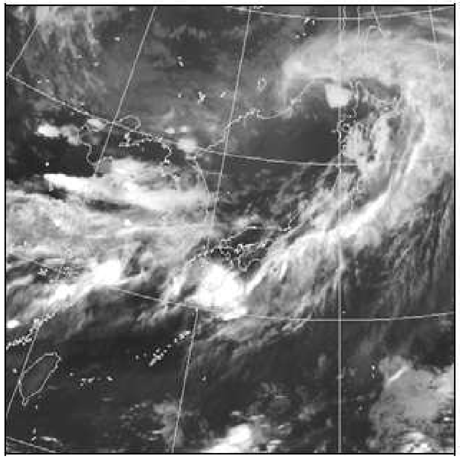

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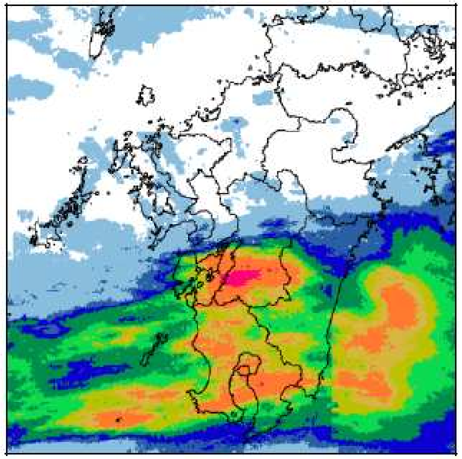

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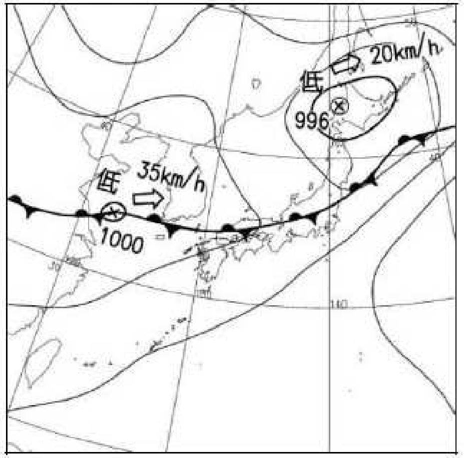

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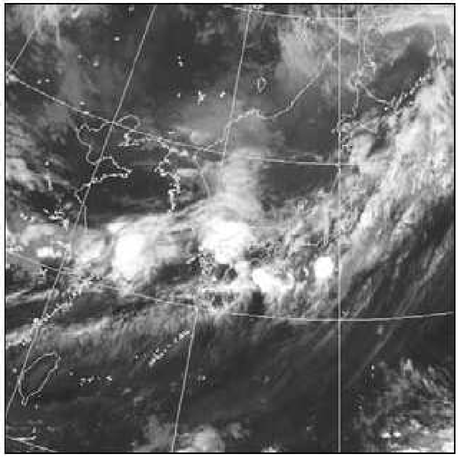

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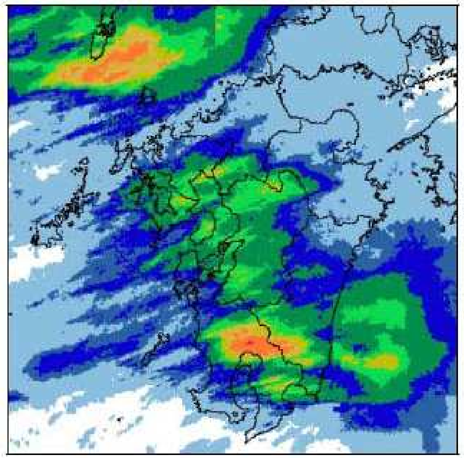
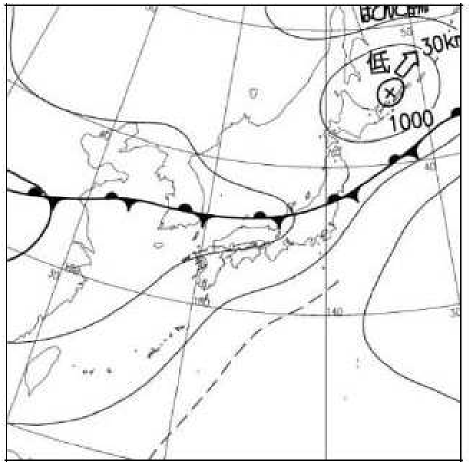


left:
weather chart
middle:
satellite infrared image
right:
6 hourly precipitation amounts

Unit: mm

	<	0.0
0.0 <	<	5.0
5.0 ≦	<	10.0
10.0 ≦	<	20.0
20.0 ≦	<	40.0
40.0 ≦	<	60.0
60.0 ≦	<	80.0
80.0 ≦	<	100.0
100.0 ≦	<	200.0
200.0 ≦	<	400.0
400.0 ≦		

21JST 13 July 2012



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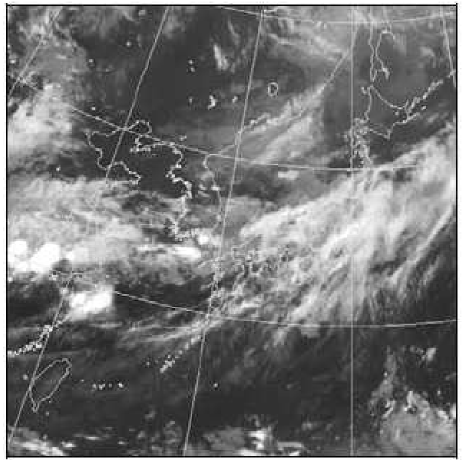

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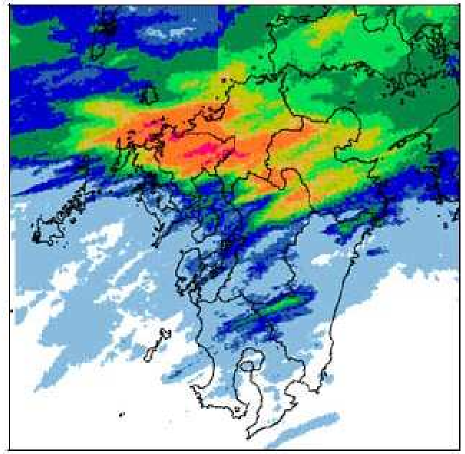

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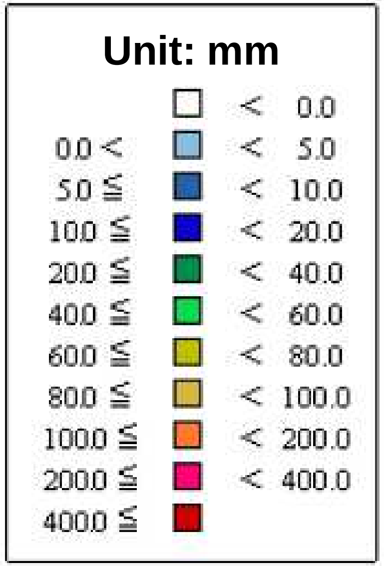

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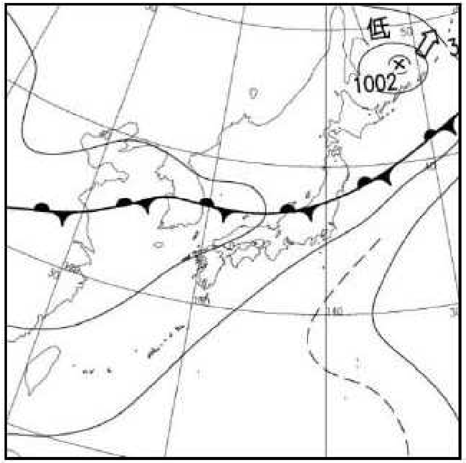

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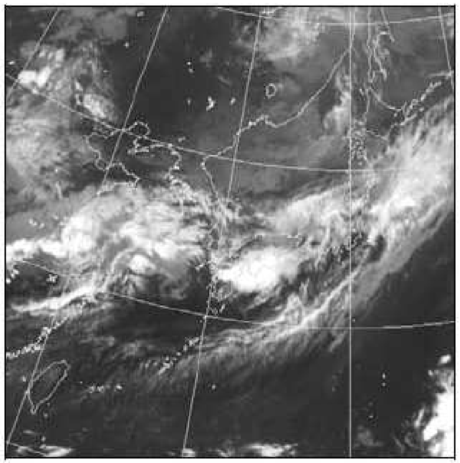

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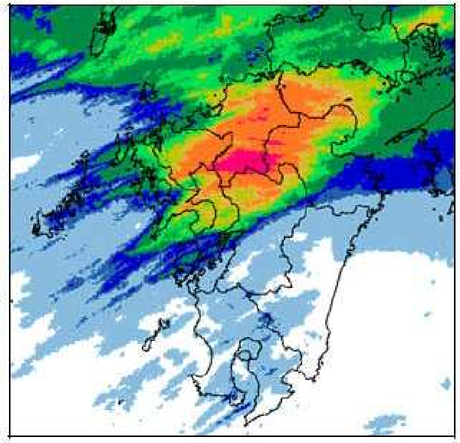
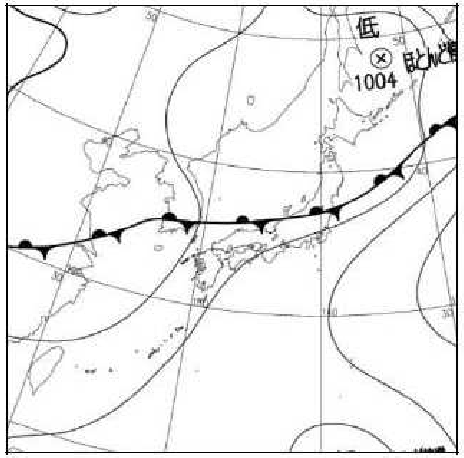
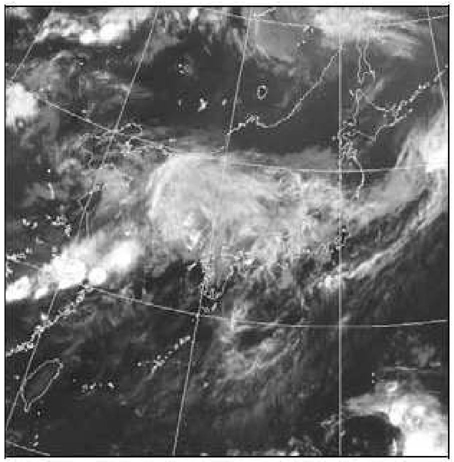


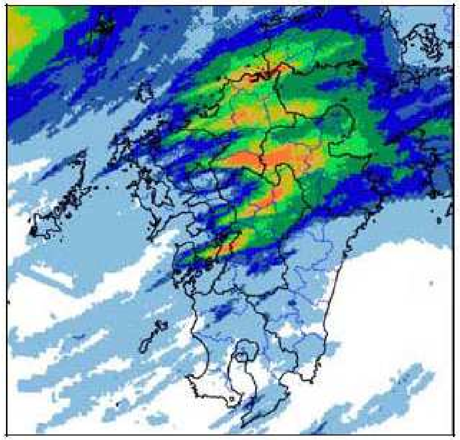
21JST 14 July 2012



21JST 14 July 2012



09JST 14 – 21JST 14 July 2012



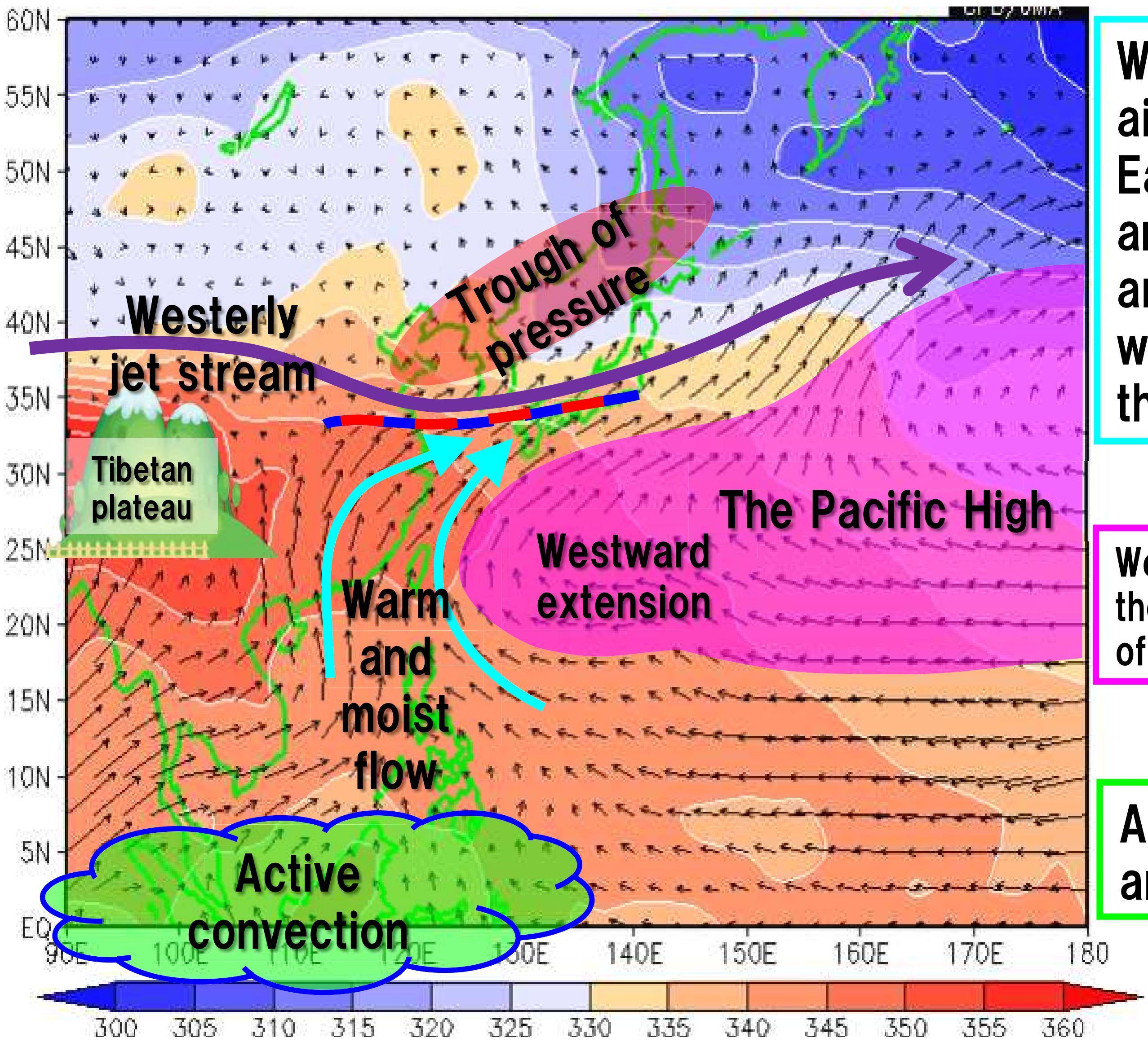
The Baiu-front was almost stationary and active.

Characteristic atmospheric circulation at the end of the Baiu period (the first half of July 2012)

-Trough of pressure around the Yellow Sea due to the meander of the jet stream
- Almost stationary jet stream

-Upward flow in front of the trough
-Almost stationary Baiu-front

The Baiu-front continued to be active in and around Kyushu Island.



Warm and moist air flew into the East China Sea and Kyushu Island around the western edge of the Pacific High.

Westward extension of the Pacific High south of Japan

Active convection around Indonesia

Arrows: Water vapor flux at the level of 925hPa
Shade: Equivalent potential temperature at the level of 925hPa

Severe lingering summer heat of 2012 in northern and eastern Japan

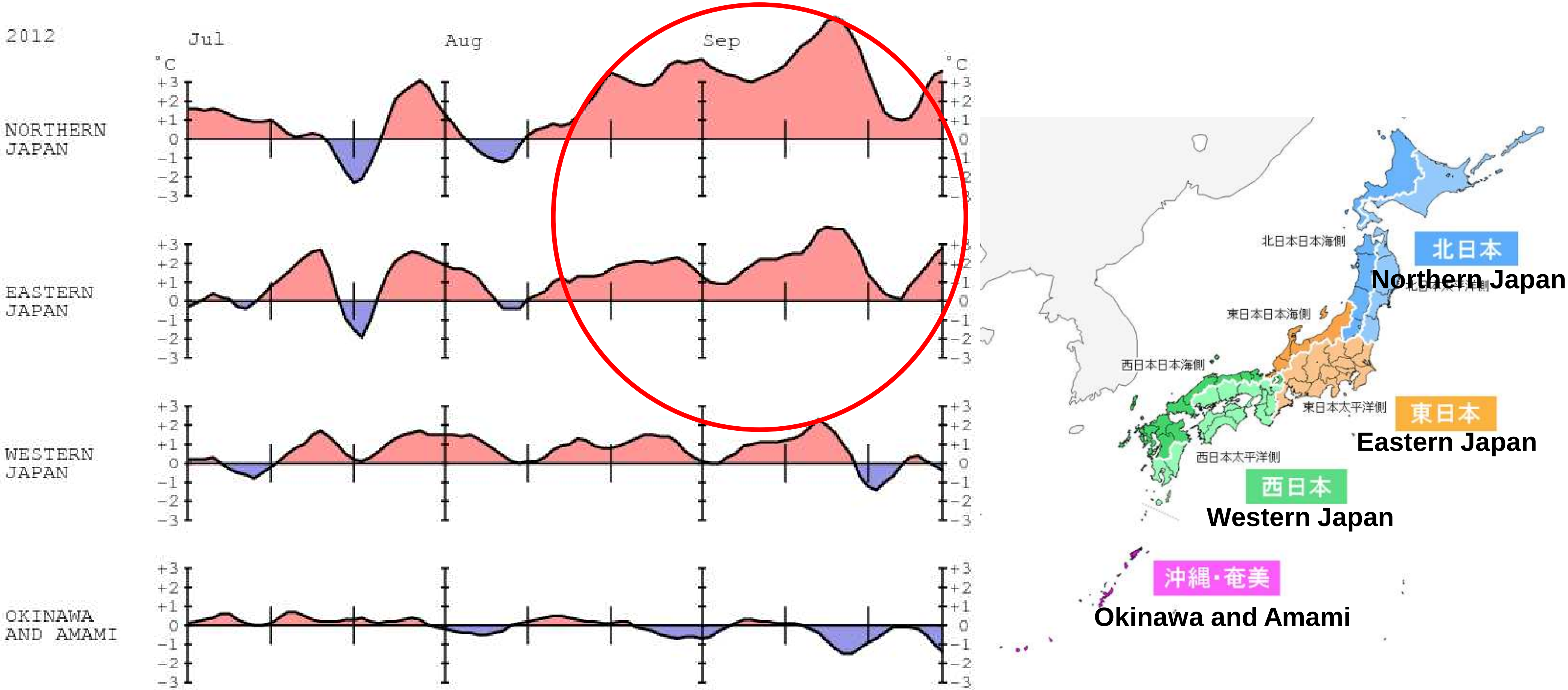


Figure 1 Time series of five-day running mean temperature anomalies (unit: °C) for four divisions of Japan from 1 July to 30 September 2012

Anomalies indicate deviations from the 1981 – 2010 average.

In northern and eastern Japan, sunny, hot weather prevailed from the middle of August to the middle of September 2012, and temperatures remained significantly above-normal for the time period.

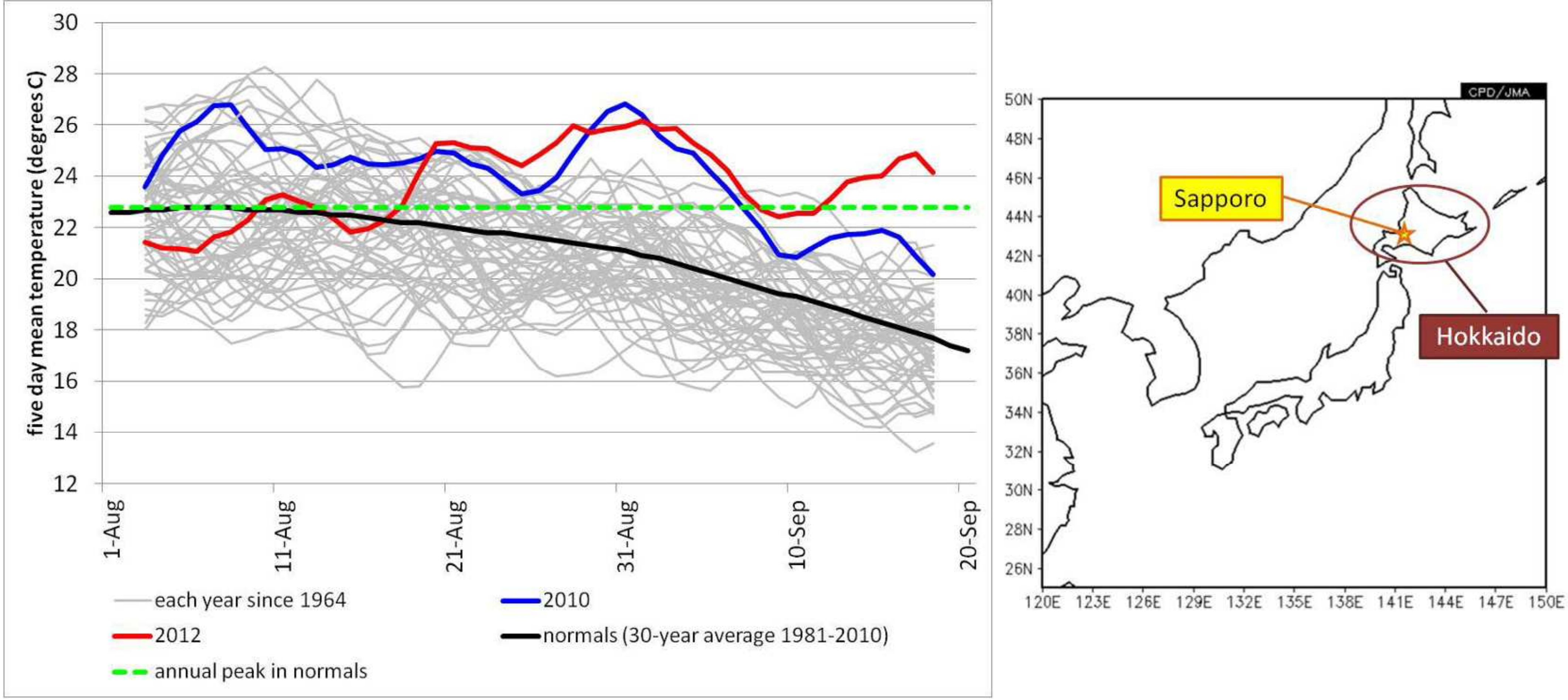


Figure 2 Time series of five-day running mean temperatures at the Sapporo meteorological observatory from 3 August to 18 September between 1961 and 2012

Red and blue lines indicate 2012 and 2010 (previous record-high hot late summer), respectively. Green denotes indicate the highest value among daily mean temperatures in the climatological normal (i.e., the 1981 – 2010 average) at the Sapporo observatory.

For example, Sapporo City, located in Hokkaido of northern Japan, experienced very hot weather everyday from late August to mid-September, and daily mean temperatures persisted above the annual highest level of the climatological normal.

Table 1 Top three records of 10-day mean temperature anomalies (unit: ˚C) averaged over northern Japan from late August to mid-September

Statistical records began in 1961. Anomalies indicate deviations from the 1981 – 2010 average. Red figures denote records of 2012.

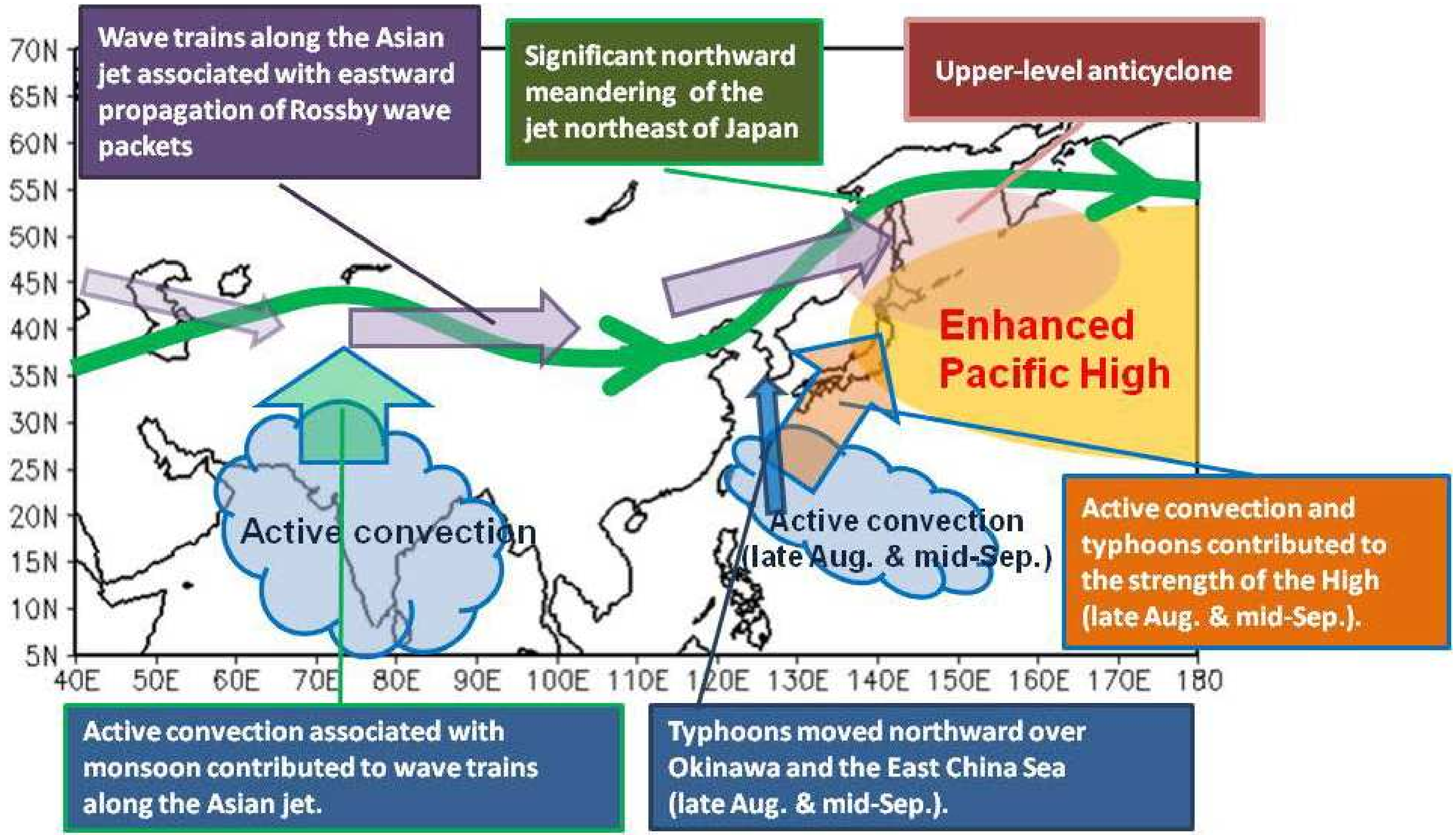
Northern Japan	Highest	2nd highest	3rd highest
21 – 31 August	+3.5 (2012)	+3.1 (2010)	+1.9 (2000)
1 – 10 September	+3.3 (2012)	+3.1 (2010)	+2.5 (2011)
11 – 20 September	+5.5 (2012)	+2.0 (2000)	+1.8 (2007)

Table 2 Top three records of 10-day mean temperature anomalies (unit: ˚C) averaged over eastern Japan from late August to mid-September

Statistical records began in 1961. Anomalies indicate deviations from the 1981 – 2010 average. Red figures denote records of 2012.

Eastern Japan	Highest	2nd highest	3rd highest
21 – 31 August	+2.7 (2010)	+2.1 (2012)	+1.7 (2000)
1 – 10 September	+2.9 (2010)	+1.5 (2012)	+1.5 (1961)
11 – 20 September	+3.1 (2012)	+3.1 (2011)	+2.3 (2003)

Primary factors contributing to the severe lingering summer heat of 2012 in northern and eastern Japan



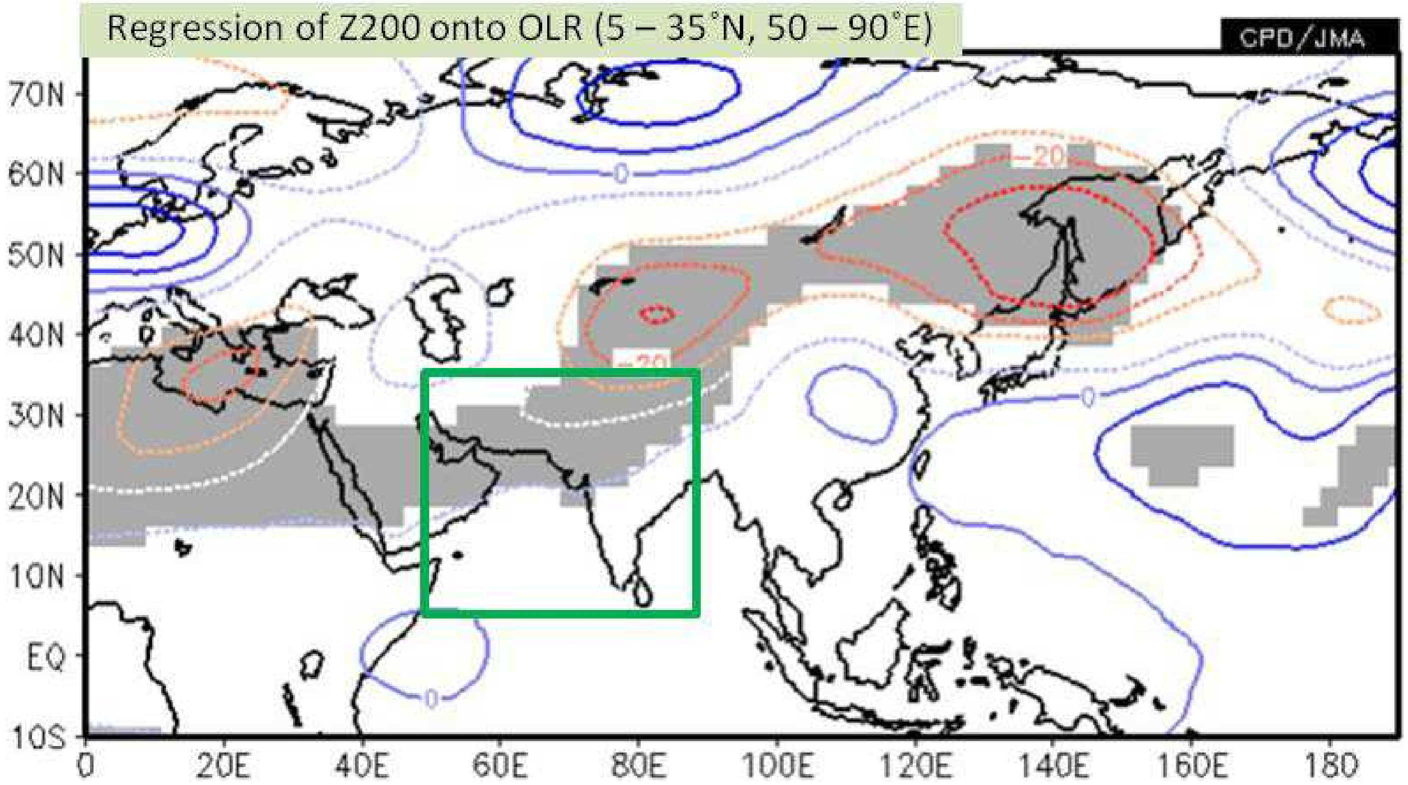


Figure 3 200-hPa geopotential height (contours; unit: m) regressed onto a time series of area-averaged OLR in and around South Asia (green rectangle: 5˚N – 35˚N, 50˚E – 90˚E) for the time period from 21 August to 20 September
The contour interval is 5 m. The gray shading indicates a 95% confidence level. The base period for the statistical analysis is 1979 – 2011.

According to statistical analysis, when convective activity is enhanced over these areas in and around South Asia for the time period from late August to mid-September, wave trains with anticyclonic circulation anomalies north of Japan tend to appear along the Asian jet stream, which is similar to those seen in 2012. Such wave trains along the Asian jet are similar to the Silk Road pattern named by T. Enomoto (Enomoto et al. 2003; Enomoto 2004).

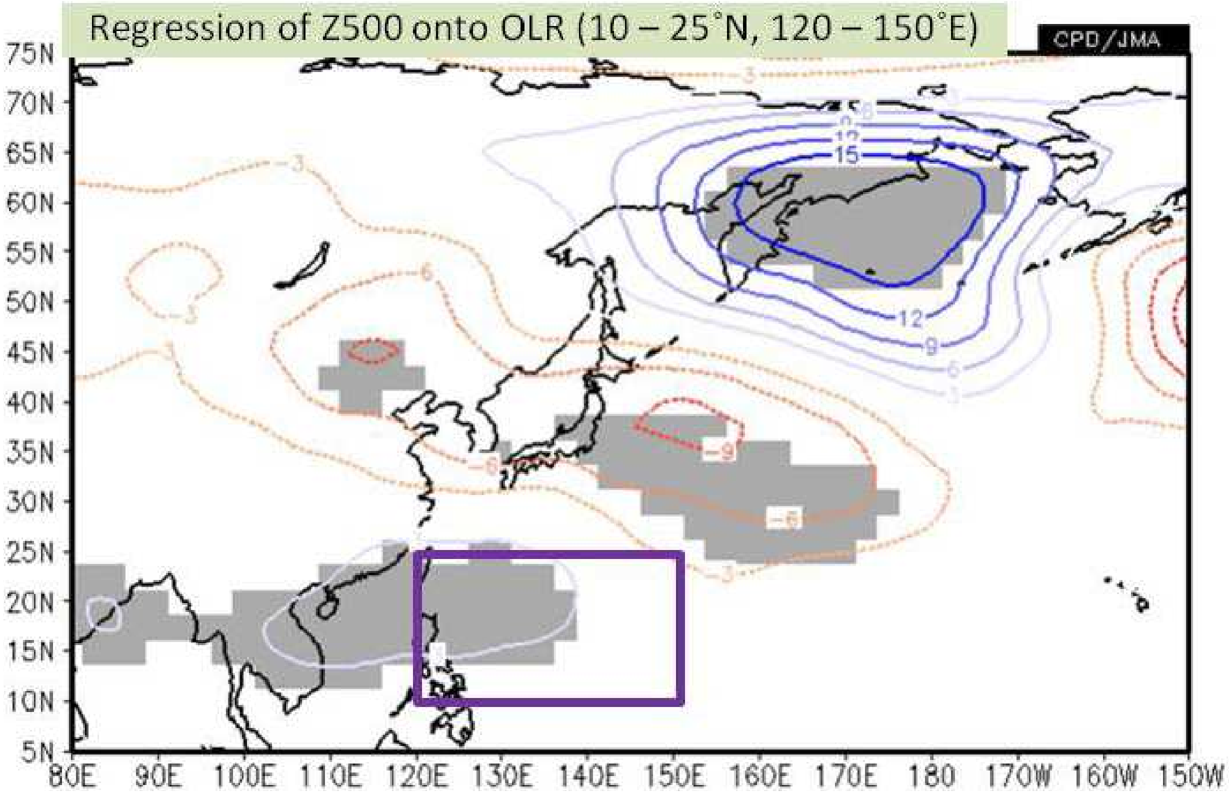


Figure 4 500-hPa geopotential height (contours; unit: m) regressed onto a time series of area-averaged OLR northeast of the Philippines (purple rectangle: 10˚N – 25˚N, 120˚E – 150˚E) for the time period from 21 August to 20 September

The contour interval is 3 m. The gray shading indicates a 95% confidence level. The base period for the statistical analysis is 1979 – 2011.

According to statistical analysis, wave trains tend to appear from the Philippines to Japan and the northern Pacific in association with the variability of convective activity northeast of the Philippines for the time period from late August to mid-September. Such a teleconnection pattern is called Pacific-Japan (PJ) pattern (Nitta 1986; 1987).

Summary

1. There was a tendency of northeastward shift of Asian summer monsoon during June-August 2012. Convection was more active than normal around the Philippines partly due to deeper than normal MPT.

2. The northern part of the Pacific High was stronger than normal primarily due to the northward meander of the subtropical jet stream and the active convection around the Philippines.

3. Temperatures were above normal in northern, eastern, and western Japan this summer, because the Pacific High was strong east of Japan and extended westward around the main land of Japan.

4. Precipitation amounts were above normal and sunshine durations were below normal in western Japan and Okinawa and Amami this summer due to frequent approach of tropical cyclones, the active Baiu-front, and frequent warm and moist southerly flow.

Thank you!

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