

Characteristics of 2017 summer monsoon in East Asia

Hiroki TOGAWA

Tokyo Climate Center (TCC)
Japan Meteorological Agency (JMA)

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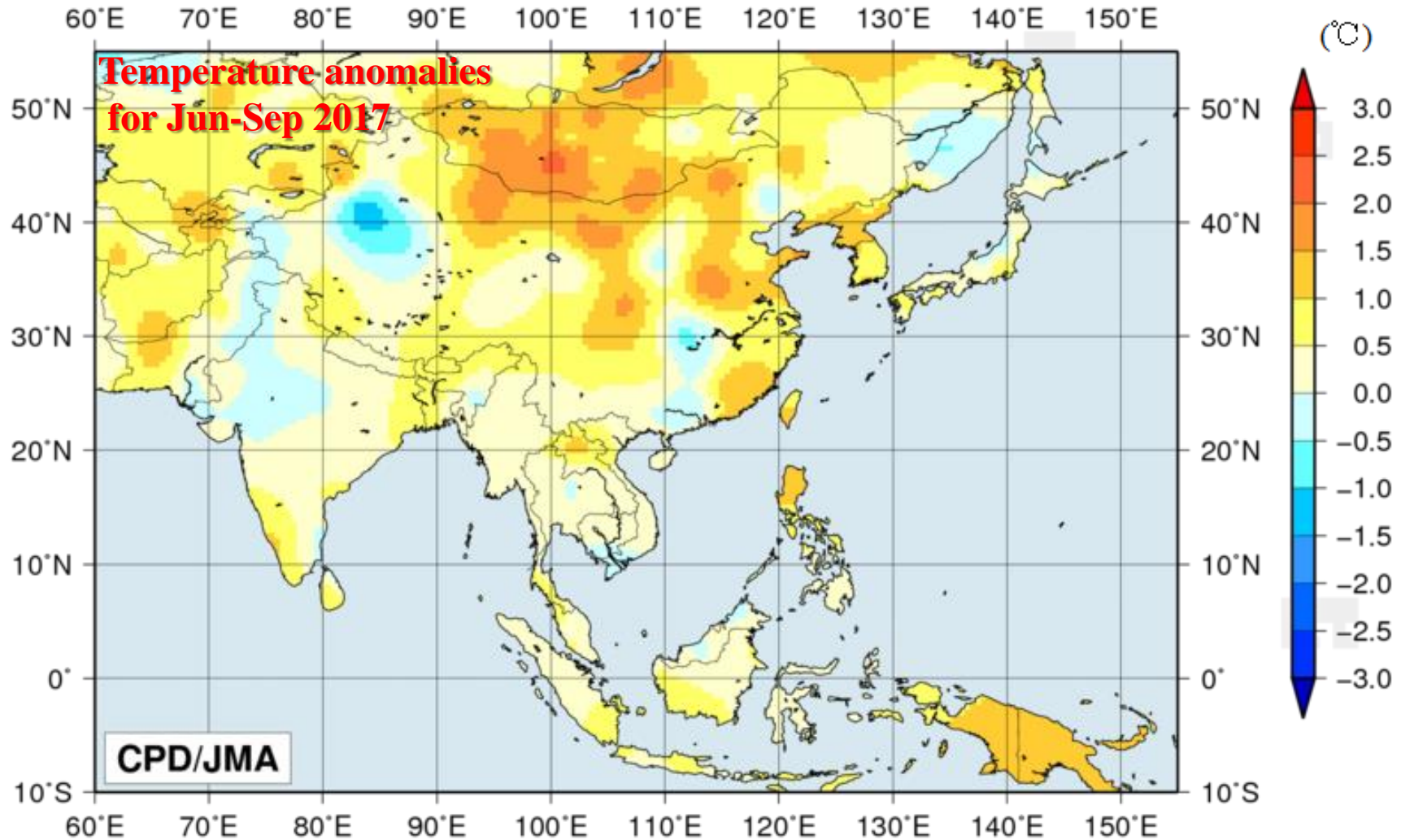
Part I

**Overview of 2017 summer monsoon
in East Asia and associated
atmospheric conditions**

4-month mean surface temperatures for Jun-Sep 2017

Warmer than normal: eastern China, Okinawa/Amami of southwestern Japan, in and around Mongolia

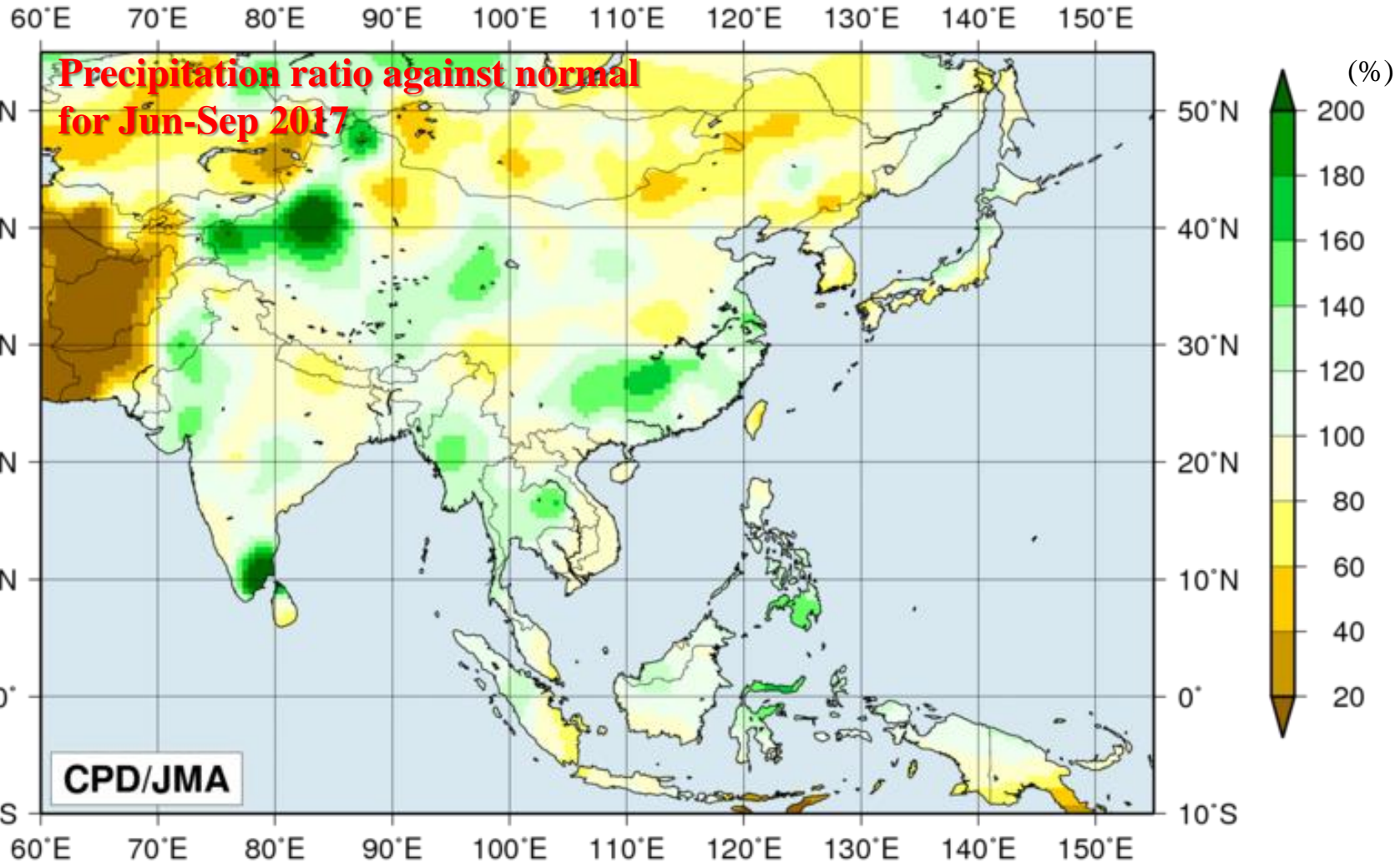
Cooler than normal: western China



4-month precipitation amounts for Jun-Sep 2017

Wetter than normal: southeastern China, western China, the Sea of Japan side of Japan, Myanmar and northwestern India

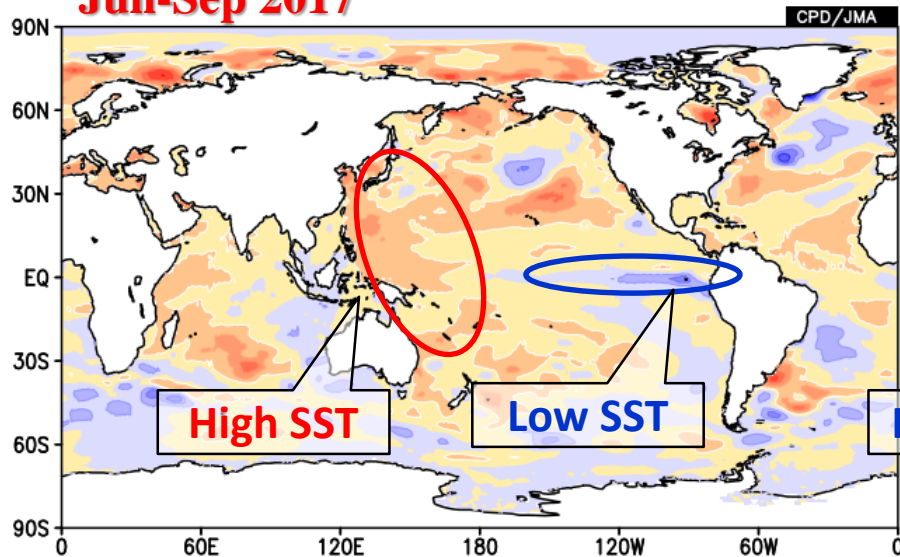
Drier than normal: Mongolia to northeastern China and over the Korean Peninsula



SST and Convective activity(OLR) for Jun-Sep 2017

- Positive SST anomalies were observed in the western Pacific and Negative SST anomalies were observed in the eastern equatorial Pacific.
- Convective activity was enhanced around the Maritime Continent and suppressed over the tropical Indian Ocean.

SST
Jun-Sep 2017

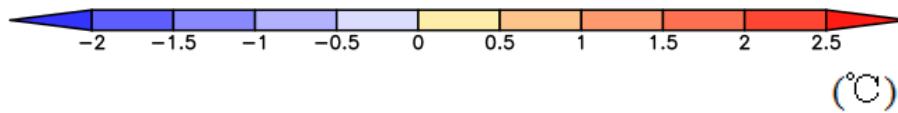


High SST

Low SST

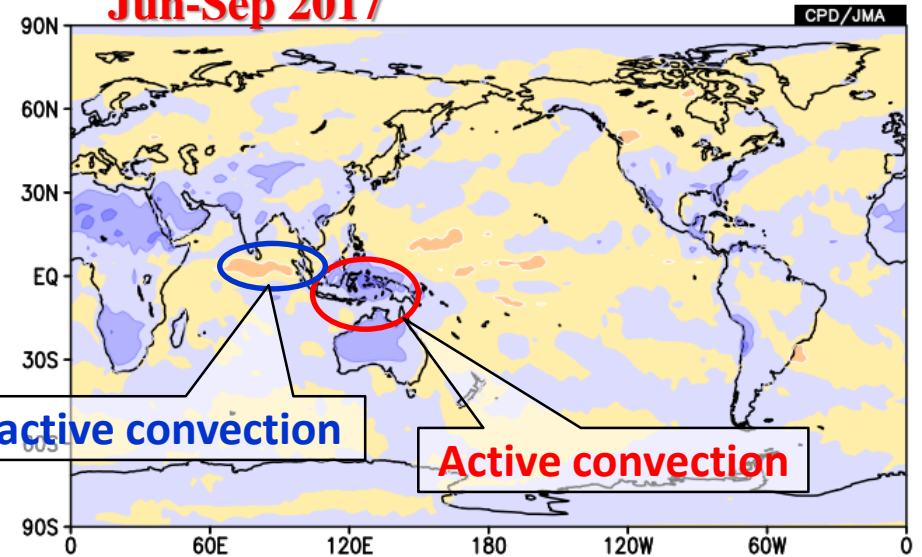
Inactive convection

Active convection

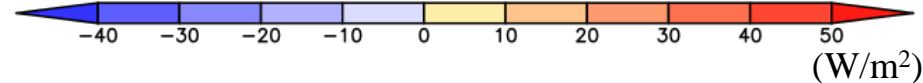


SST anomalies for the four months of
Jun-Sep 2017

OLR
Jun-Sep 2017



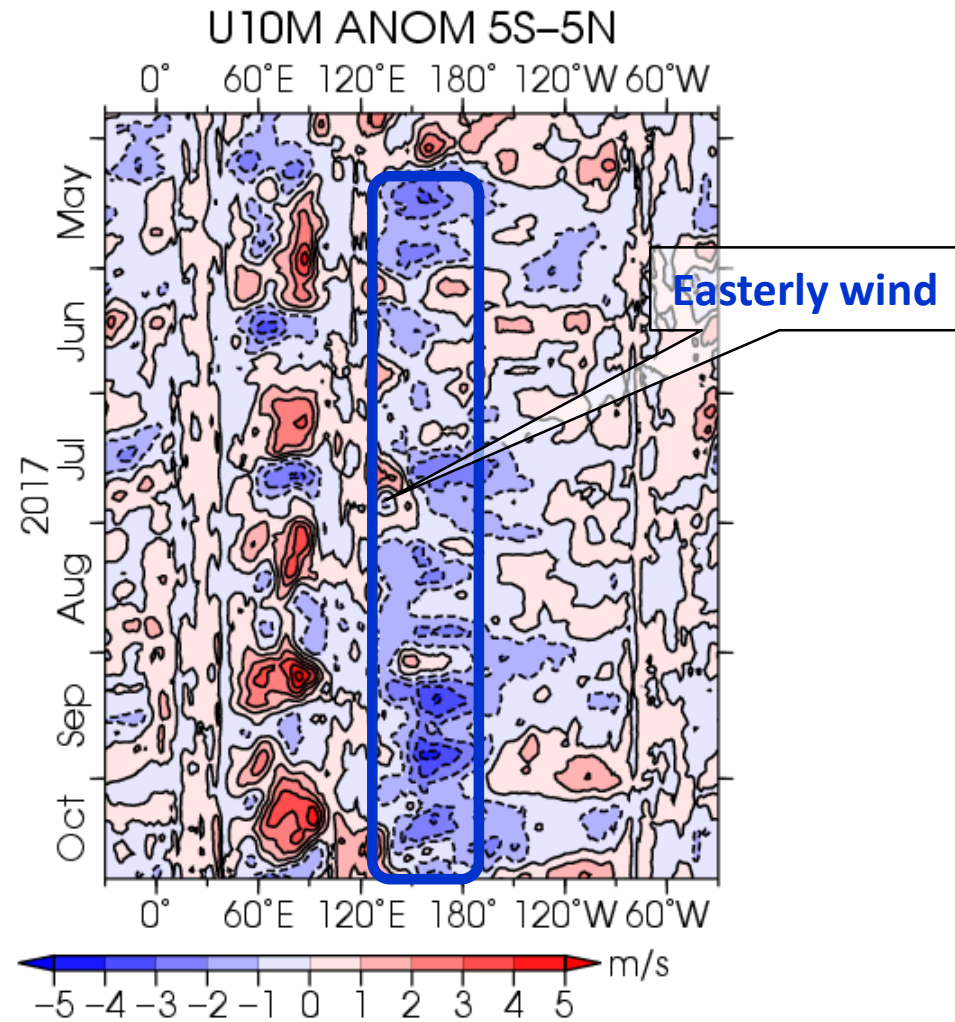
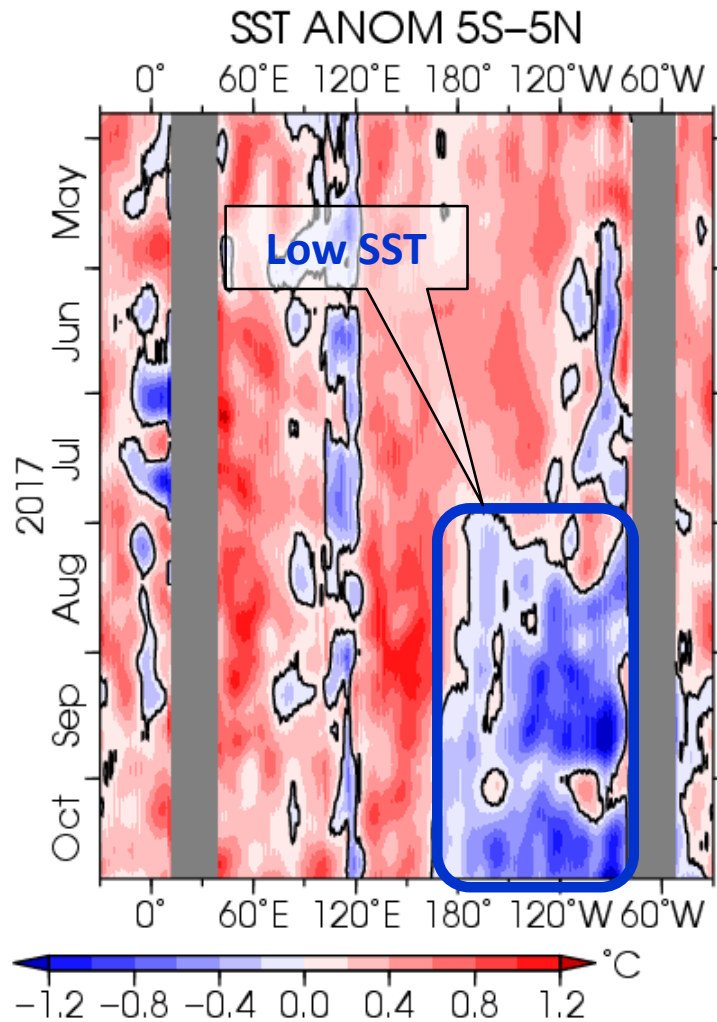
OLR (contour) and anomaly (shade)
for the four months of Jun-Sep 2017



Time-Longitude Cross Section (Tropics)

SST: Positive anomaly continued in the western Pacific and negative anomaly was seen in the eastern Pacific since August.

10m Zonal Wind: Easterly wind anomaly continued in the western Pacific.

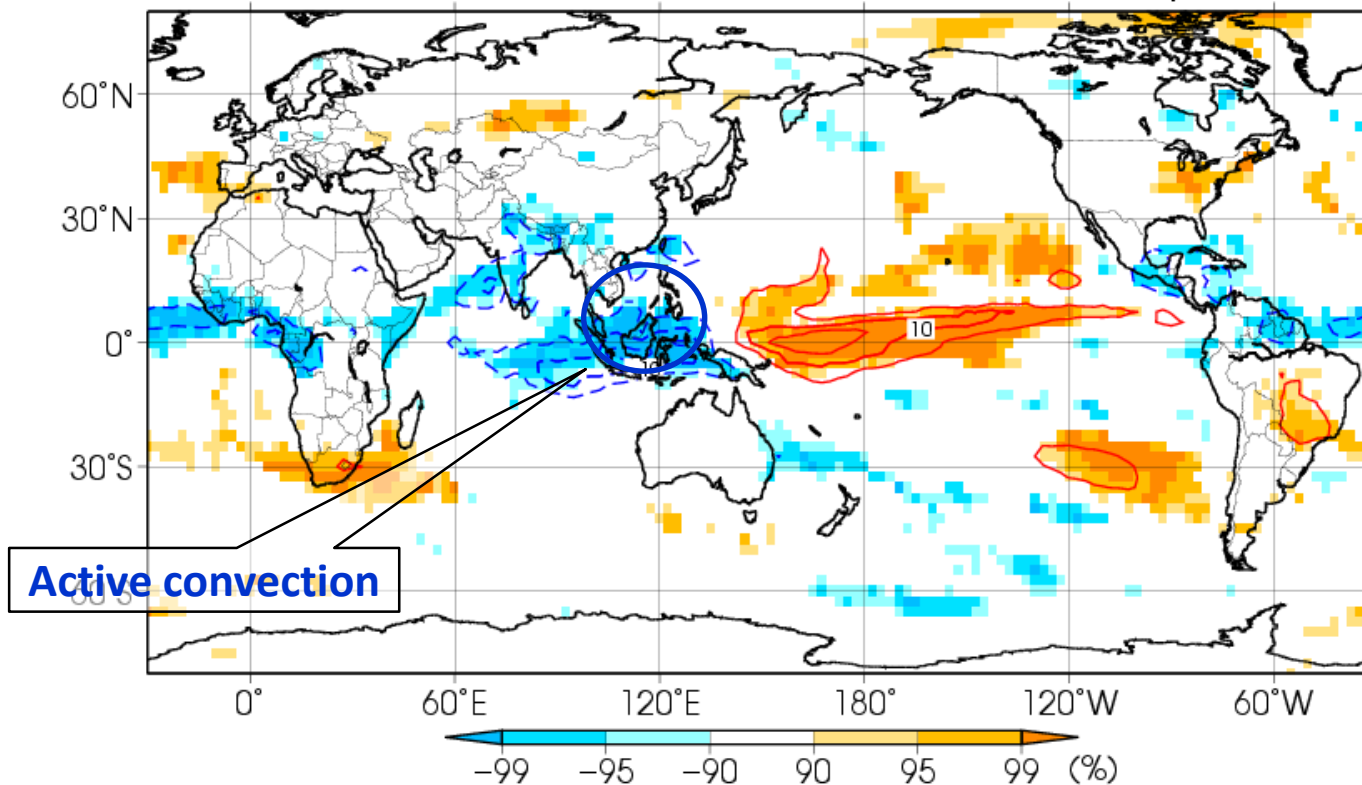


ENSO composite for convective activity (OLR)

- Over the Maritime Continent, positive OLR anomalies were shown in composite over the three-month periods (Jul. to Sep.) of La Niña years, as well as years followed by La Niña events.

NINO.3 (cold event) composite for OLR

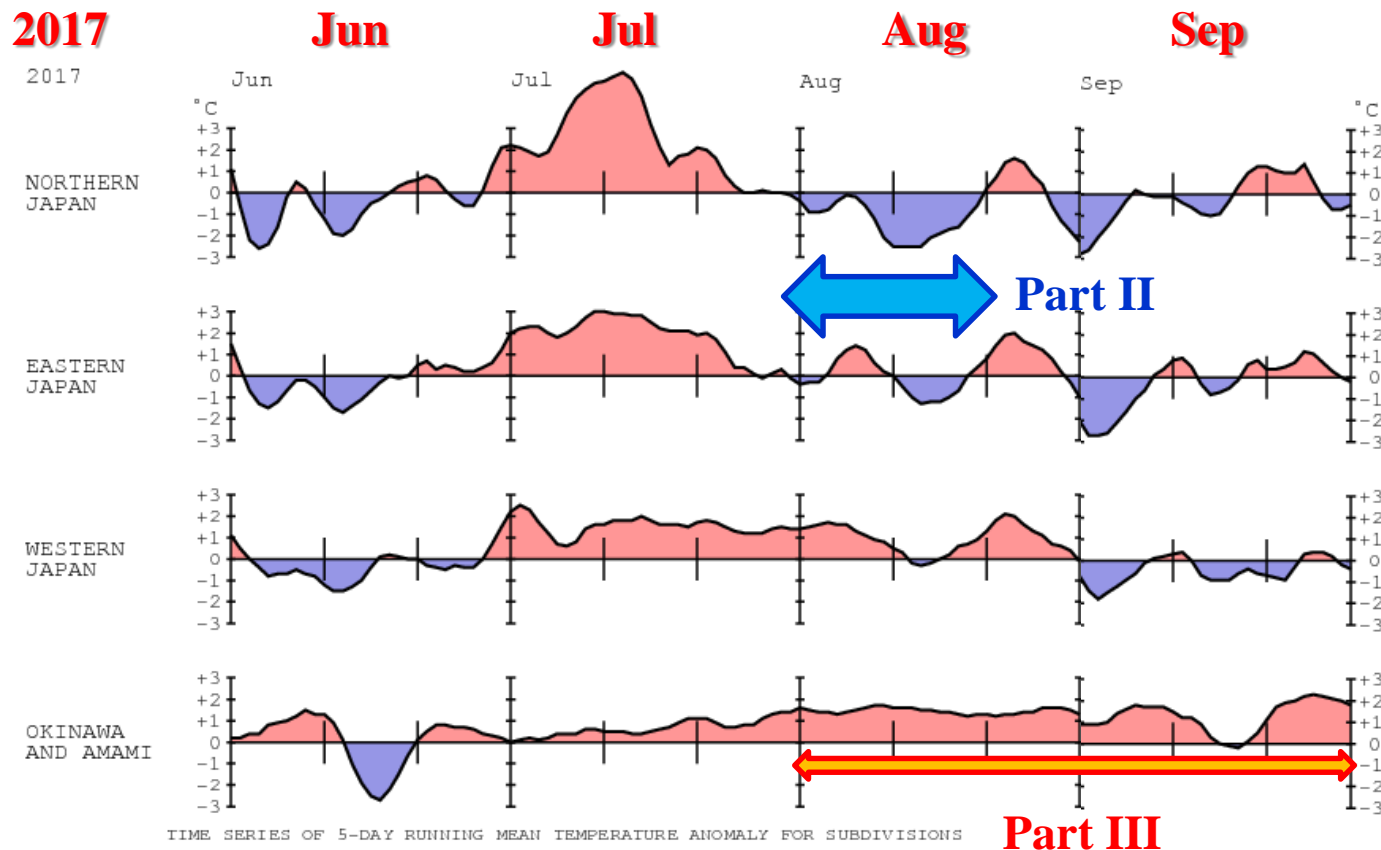
Element:olr Index:NINO.3(Cold) Period:Jul-Sep



OLR anomaly (contour) and reliability level (shade)
composite for the three months of Jul-Sep

Climate in Japan

- In and around northern Japan, below-normal temperature appeared from the early to mid-August.
- In August and September, each monthly mean temperature were significantly above normal in Okinawa/Amami of southwestern Japan.



Time series of temperature anomaly in Japan

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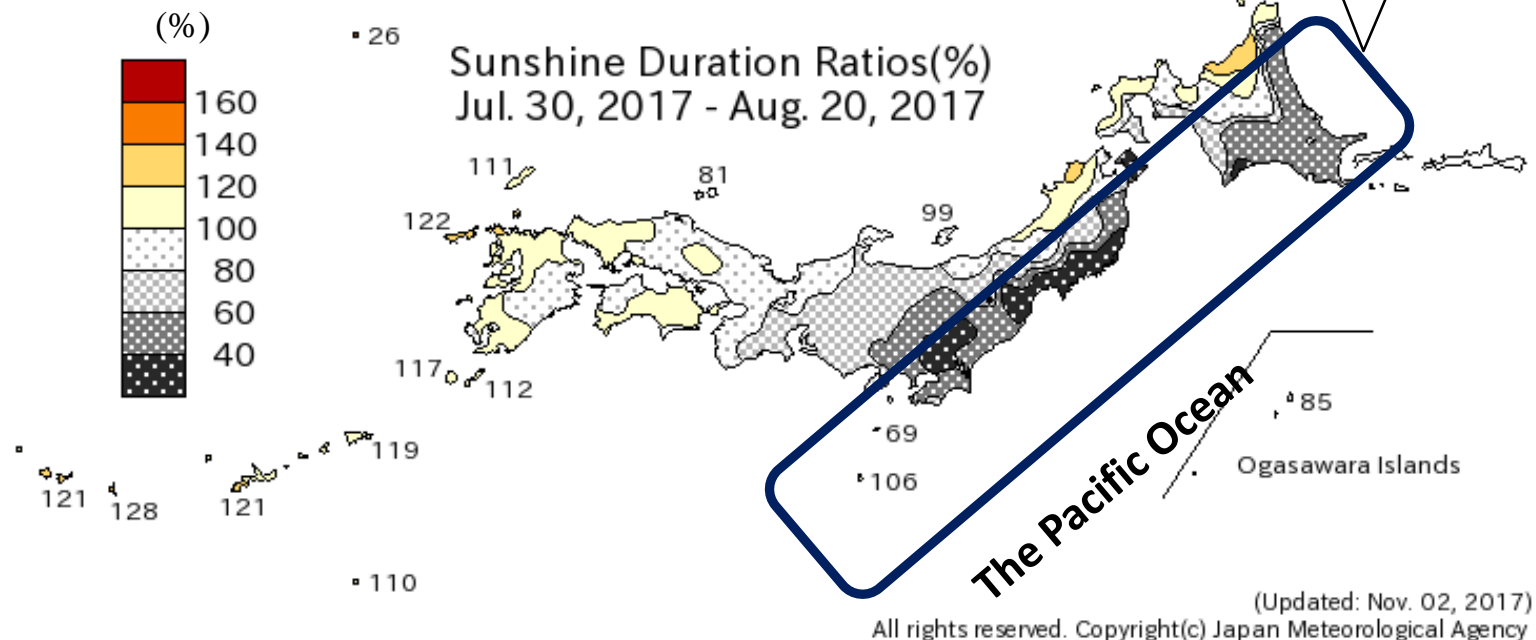
Part II

**Below-normal sunshine durations on the
Pacific side of northern and eastern Japan**

Below-normal sunshine durations

- On the Pacific side of northern and eastern Japan, below-normal sunshine durations appeared from the end of July to mid-August.
- In addition, there was a place where the rainy days continued.

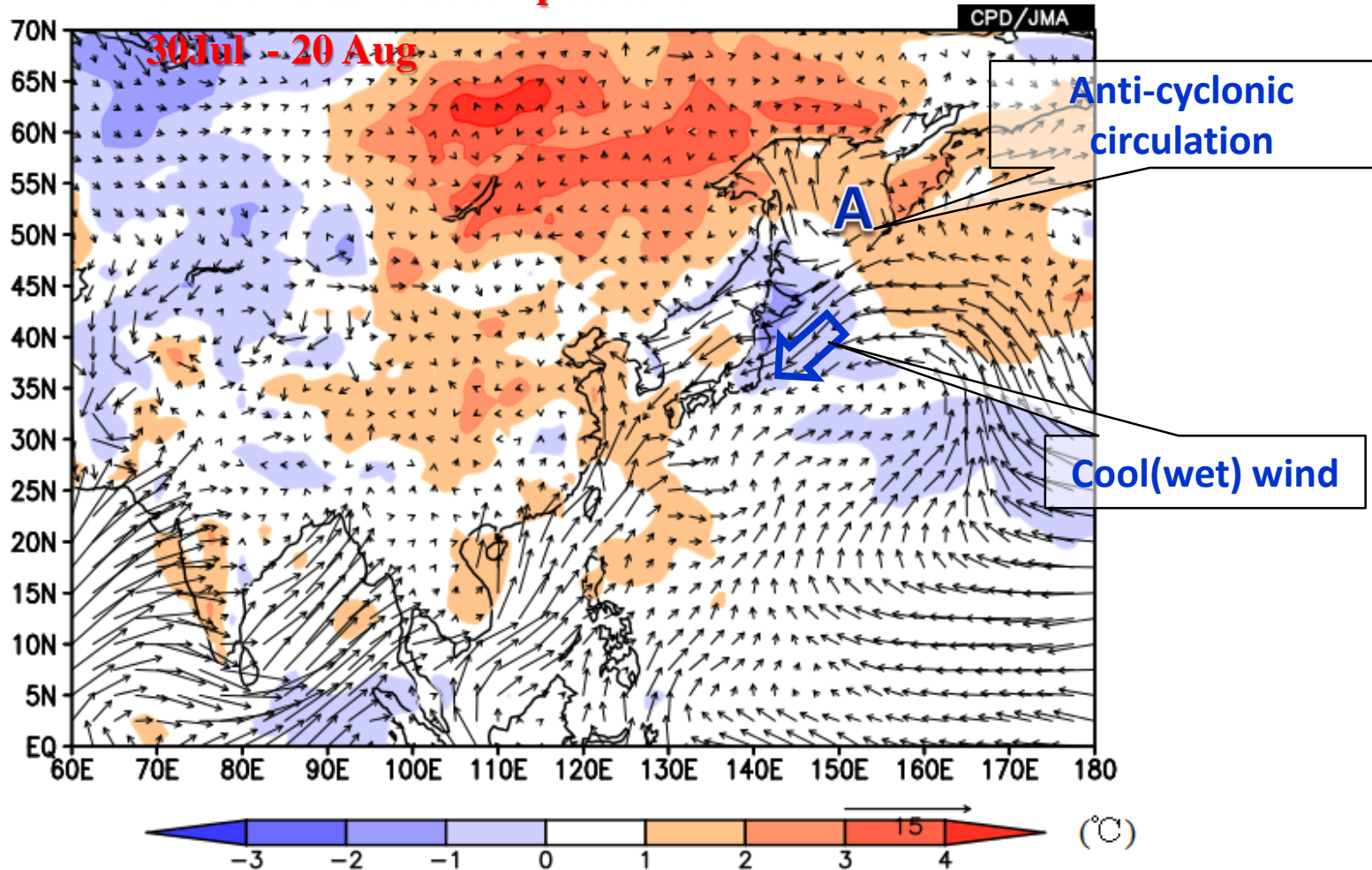
Sunshine duration ratios Jul 30 – Aug 20



Northeasterly wind

Cool and wet northeasterly airflow brought cloudy and rainy weather on the Pacific side of northern and eastern Japan.

Wind and surface temperature



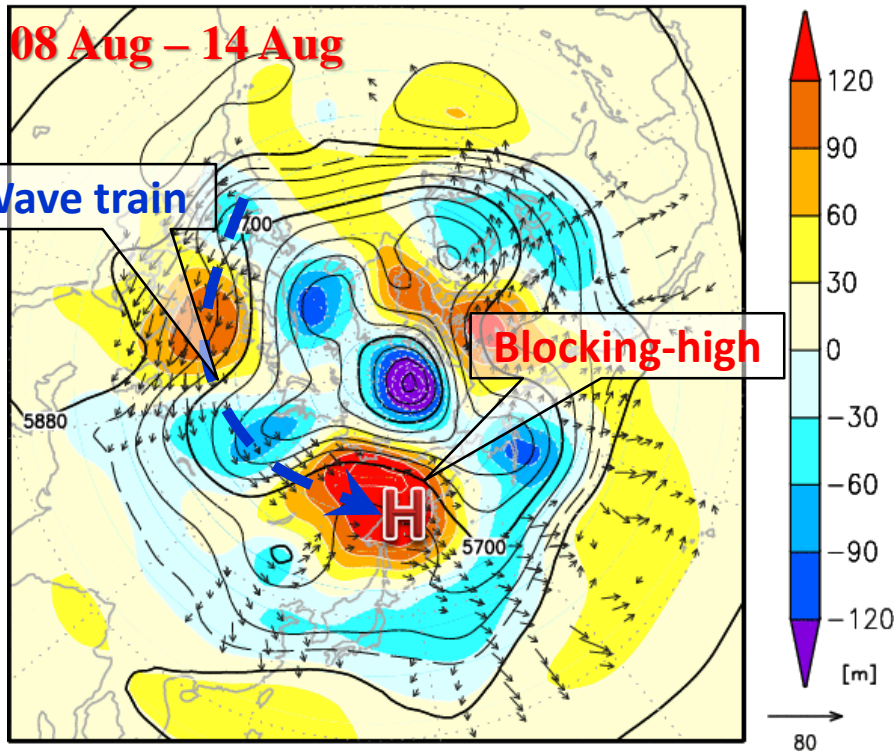
Surface temperature anomaly (shade) and surface wind (vector)

Blocking-high and the Okhotsk High

500hPa height: From the end of July to mid-August, upper level blocking-high developed over eastern Siberia. Wave train along the westerly jet stream over northern Eurasia contributed to maintenance of the blocking.

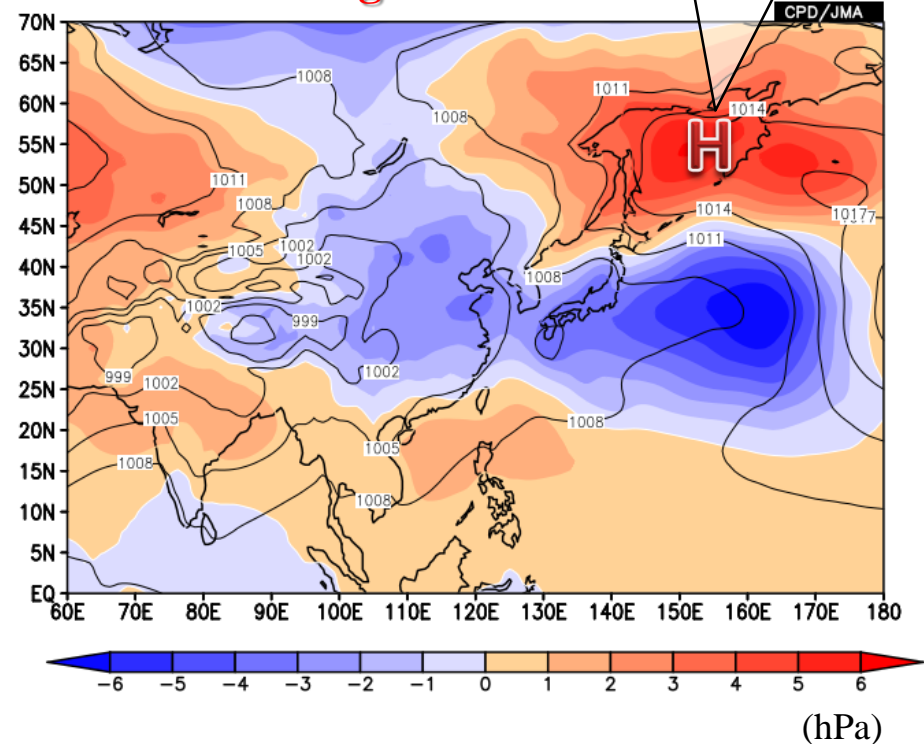
Sea level pressure: In the same period, the Okhotsk High persisted.

Geopotential height at 500hPa and WAF



Geopotential height (contour) and anomaly (shade) at 500hPa and wave activity flux (WAF; vector) at 200hPa

SLP 30 Jul – 20 Aug



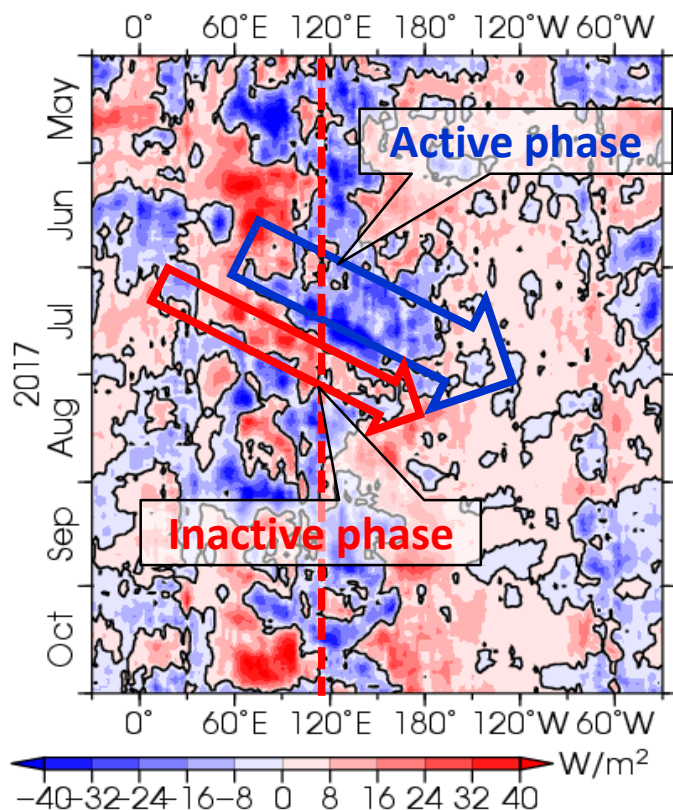
Sea level pressure (contour) and anomaly (shade)

Convective activity and negative PJ pattern

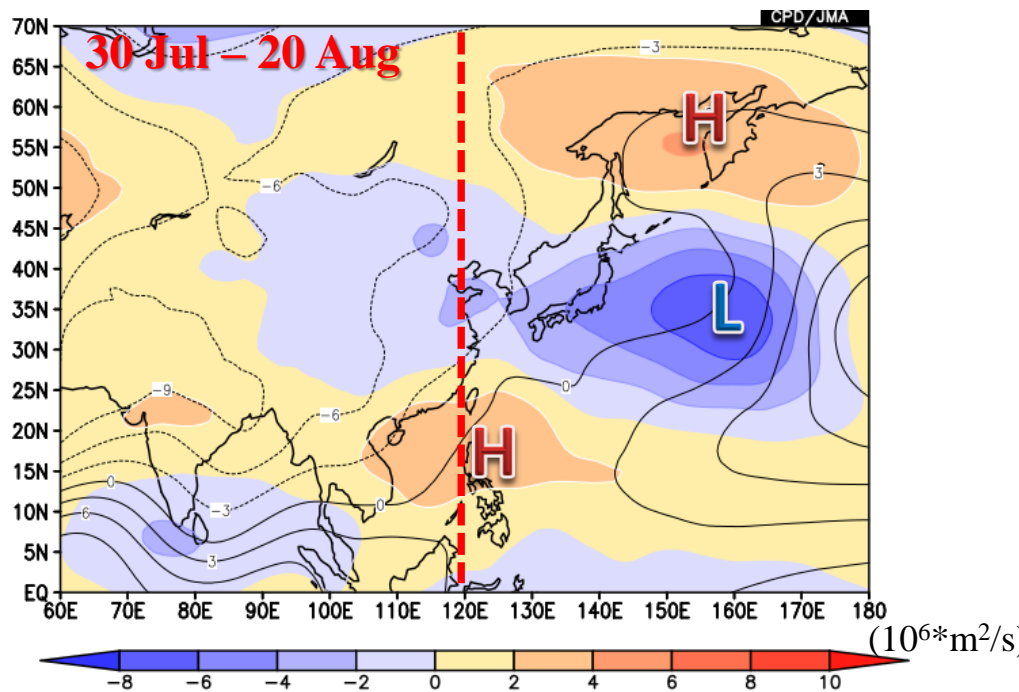
Convective activity: Inactive phase of MJO propagated eastward over the Maritime Continent during from the end of July to early August. Convective activity was suppressed over and around the Philippines from early to mid-August.

Stream function at 850hPa: Cyclonic circulation anomalies were observed to the east of Japan and anti-cyclonic circulation anomalies observed the Okhotsk Sea, corresponding to the negative PJ (Pacific – Japan) pattern.

5S-5N average OLR anomaly



Stream function at 850hPa



Stream function (contour) and anomaly (shade) at 850hPa

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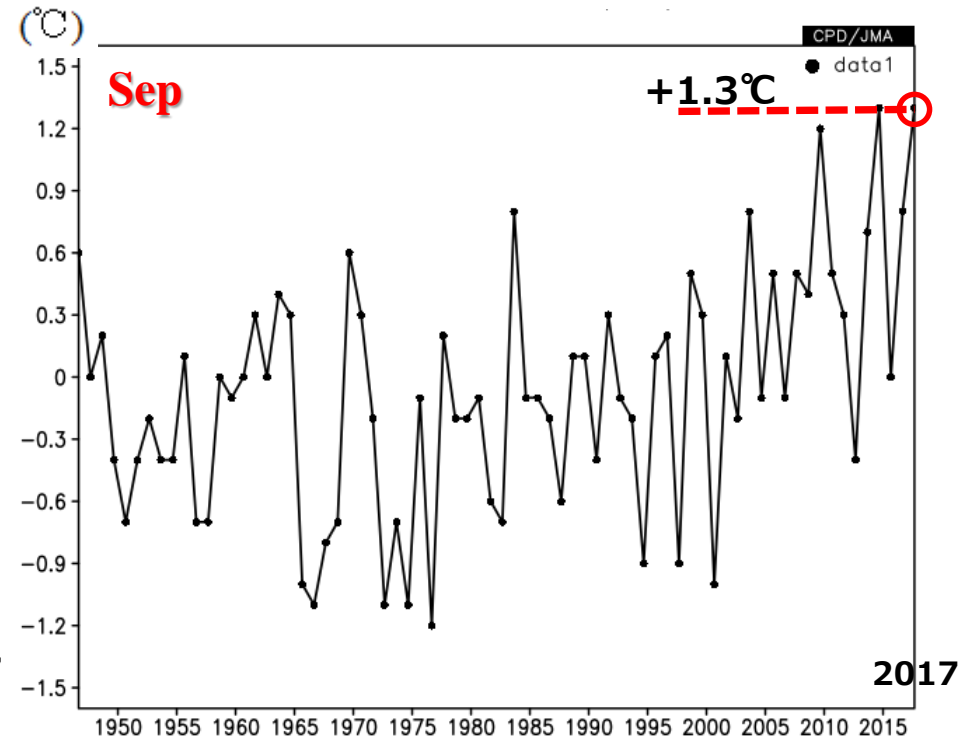
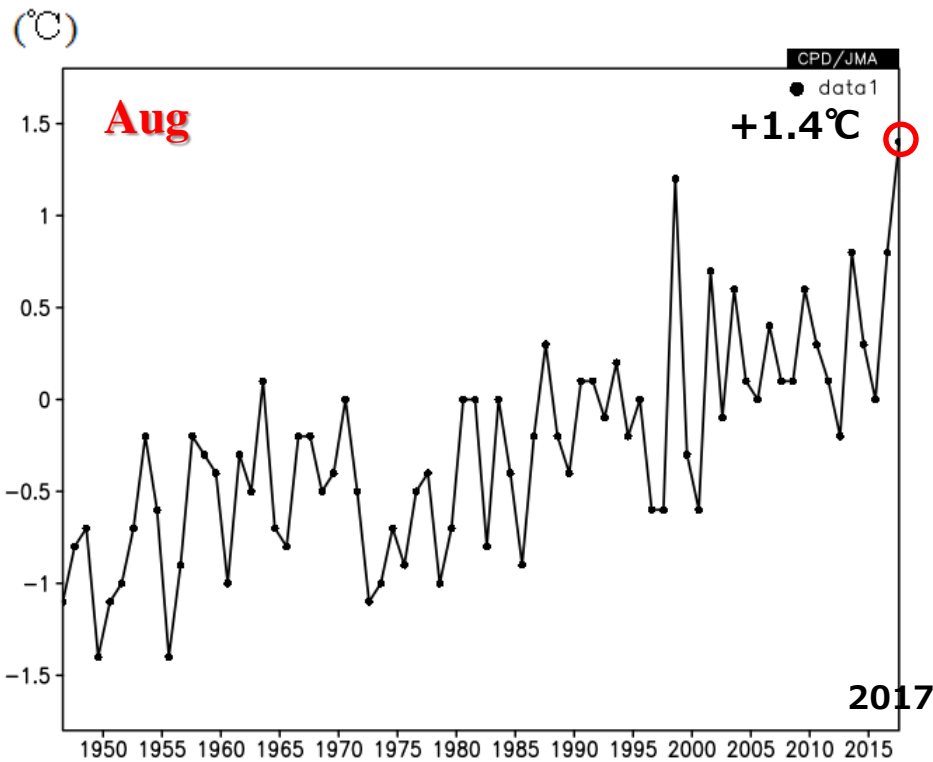
Part III

Unusual high temperature in Okinawa/Amami of southwestern Japan

Monthly mean temperature in Okinawa/Amami

In Okinawa/Amami of southwestern Japan, monthly mean temperature was the highest on record for August and tied with 2014 as the highest on record of September since 1946.

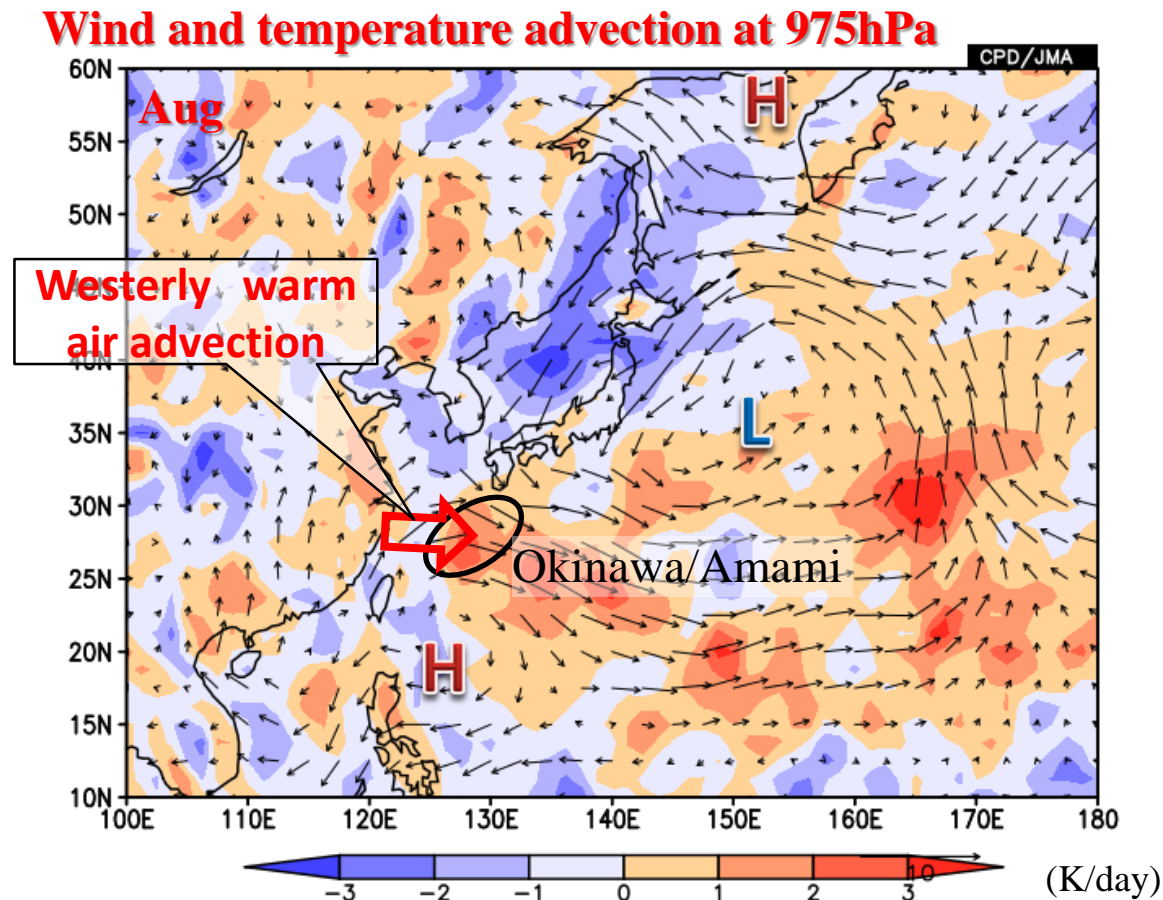
Time series of temperature



Monthly mean temperature anomaly for 1946-2017 in Okinawa/Amami

Wind and temperature advection

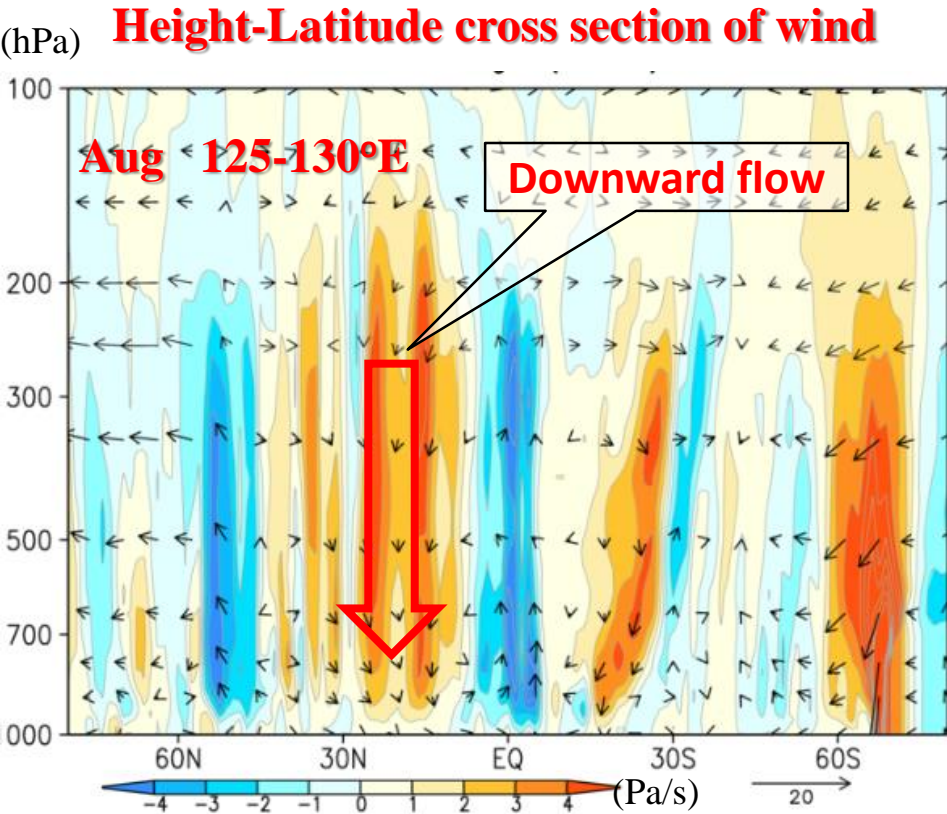
- In August, the Pacific High extended to the south of Japan. Westerly wind anomaly and warm air advection was observed in Okinawa/Amami.
- In September, southwesterly wind anomaly and warm air advection appeared due to the Pacific High extended to the south of Japan.



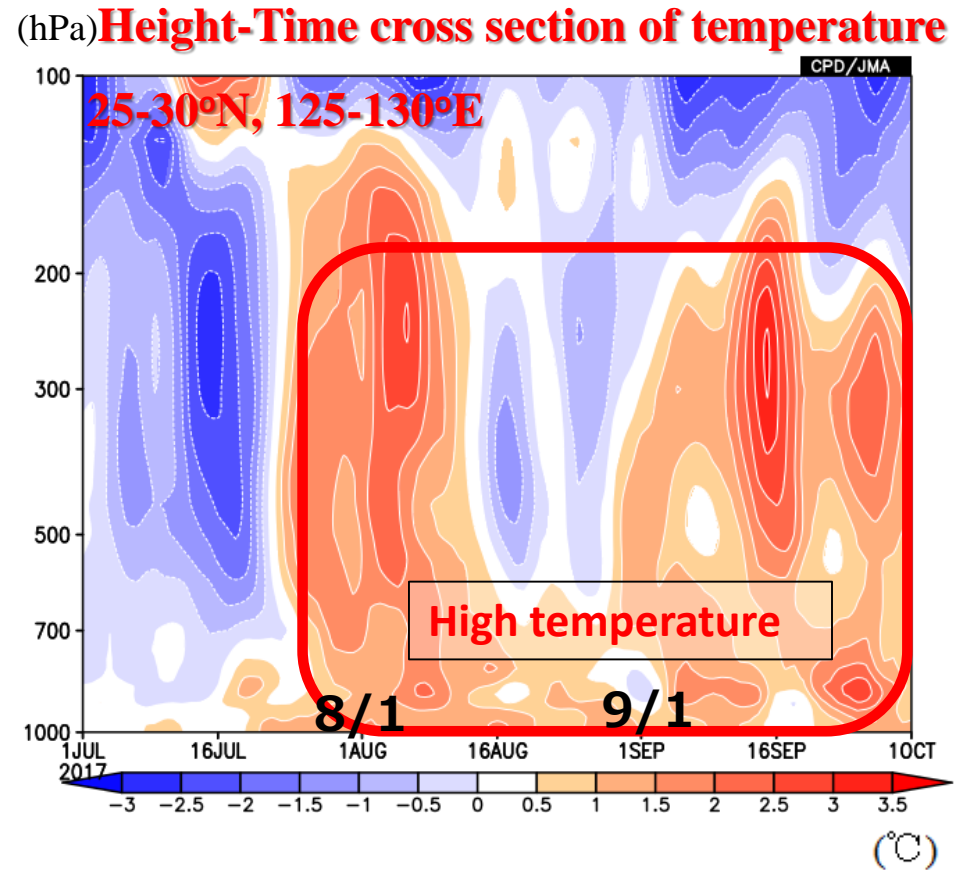
Wind anomaly (vector) and temperature advection anomaly (shade) at 975hPa

Vertical velocity and temperature

- Downward flow anomaly was observed over Okinawa/Amami especially in August.
- In this region, higher-than-normal temperature almost continued over the troposphere.



Zonal-vertical wind (vector) and pressure vertical velocity (shade) anomaly averaged 125-130°E

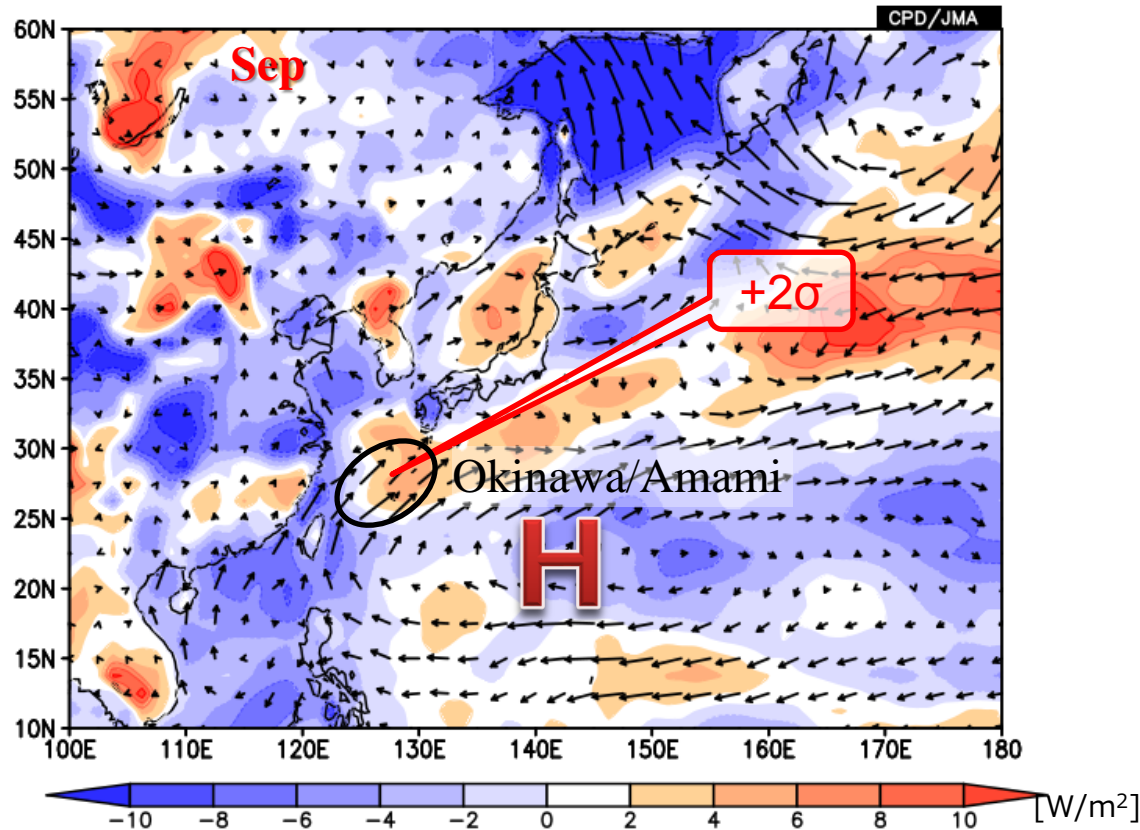


Temperature anomaly averaged 25-30°N, 125-130°E

Sensible heat flux

- Around Okinawa/Amami, remarkably positive SST anomalies were observed from July to September.
- Positive sensible heat flux anomaly seems to have contributed to the high temperature of Okinawa/Amami in September.

Sensible heat flux



Sensible heat flux anomaly (shade) and surface wind anomaly (vector)

Contents

(Conclusion)

Conclusion

- ❑ SSTs were above normal in the western equatorial Pacific in this summer and below normal on the central and eastern parts after August. The convective activity over the Maritime Continent was enhanced through the summer monsoon season.
- ❑ From early to mid-August, convective activity was particularly inactive over and around the Philippines. During the same period, the Pacific High did not extend to mainland Japan as usual, corresponding to the negative PJ pattern. In addition, the Okhotsk High has persisted since the end of July to mid-August. They caused below-normal sunshine duration on the Pacific side of northern and eastern Japan.
- ❑ In August and September, monthly mean temperature were significantly above normal in Okinawa/Amami of southwestern Japan. Such extremely high temperature was considered to be caused by warm air advection in the lower troposphere, adiabatic heating by downward flow, and high SST.

Thank you very much