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Characteristics and Factors about the Heavy Rain Event of July 2018 and the Subsequent Heatwave in Japan in boreal summer 2018

Minako SHIOTA

Tokyo Climate Center

Japan Meteorological Agency

Outline

1. Introduction

2. The Heavy Rain Event of July 2018

   2.1 Characteristics of the heavy rain
   2.2 Factors

3. The Heatwave in Japan in boreal summer 2018

   3.1 Characteristics of the Heatwave
   3.2 Factors

4. JMA's press conference against the Heatwave events

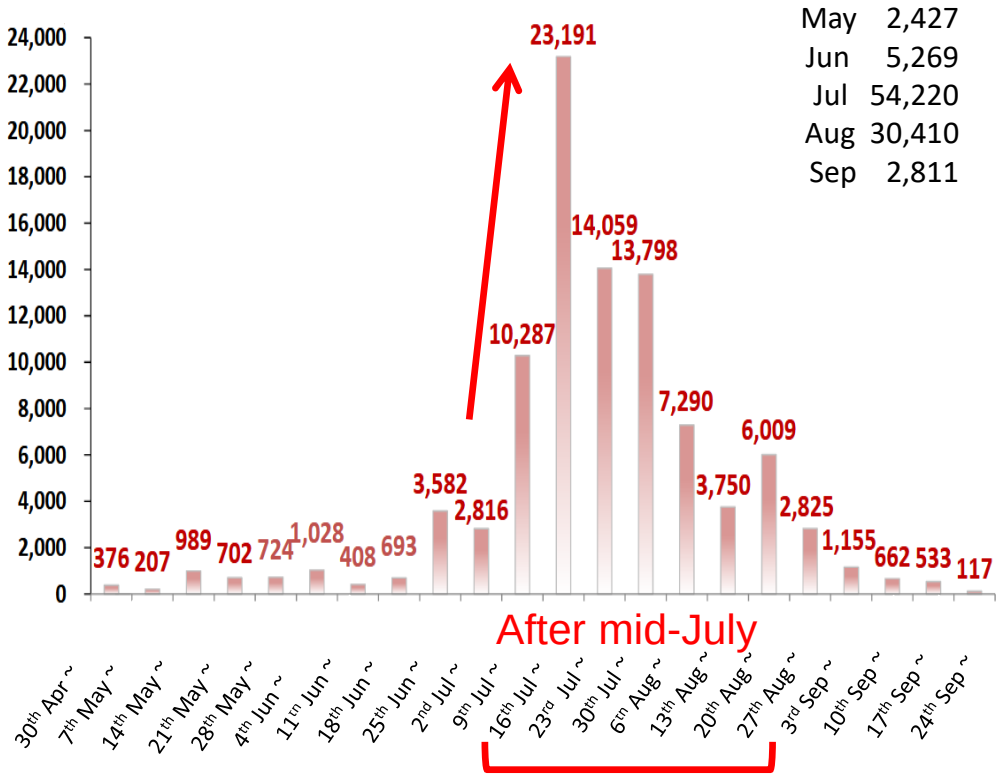
1. Introduction

This summer, especially in July, two recordable phenomena occurred in Japan.

- Early July : Unprecedented heavy rain in recent decades occurred.
- After mid-July : High temperature events persisted throughout most of Japan.

Damage due to heavy rain.

Source: "Document 5, About the Heavy Rain Event of July 2018" (Ministry of Land, Infrastructure,Transport and Tourism) (http://www.mlit.go.jp/river/shinngikai_blog/shaseishin/kasenbunkakai/shouiinkai/r-jigyouhyouka/dai11kai/pdf/5-1.shiryou.pdf), "Sediment disaster outline doe to the Heavy Rain Event of July 2018" (preliminary report version) (Ministry of Land, Infrastructure,Transport and Tourism) (http://www.mlit.go.jp/river/sabo/jirei/h30dosha/H30_07gouu_gaiyou1807311800.pdf) (Used on 22 October 2018)
These figure is made by processing the above data



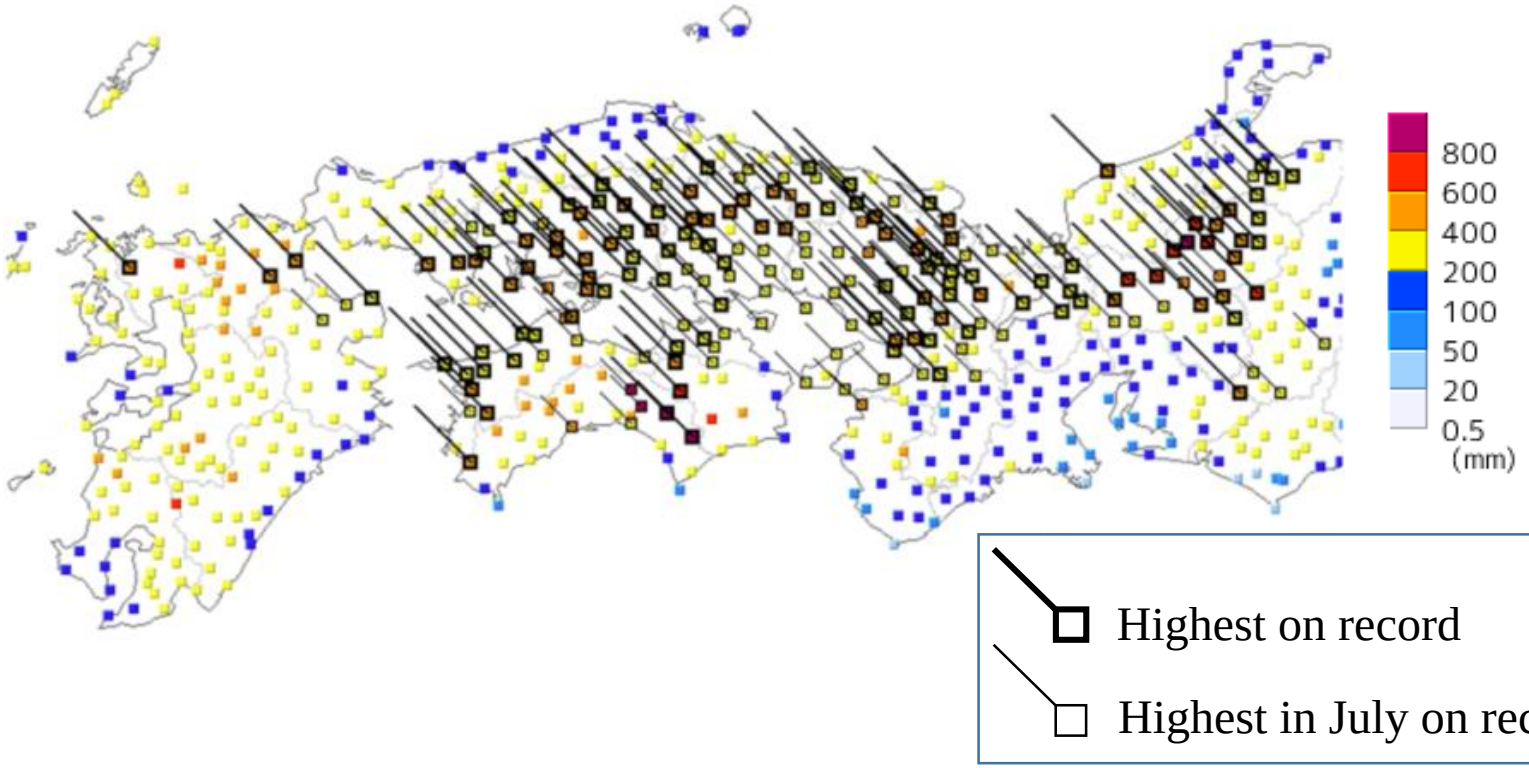
Number of emergency transport due to heatstroke.

Source: "Number of emergency transport personnel due to heat stroke in 2018 (From May to September)" (Fire and disaster Management Agency) (http://www.fdma.go.jp/neuter/topics/houdou/h30/10/301025_houdou_3.pdf) (Used on 30 October 2018)
This figure is made by processing the above data.

2. The Heavy Rain Event of July 2018

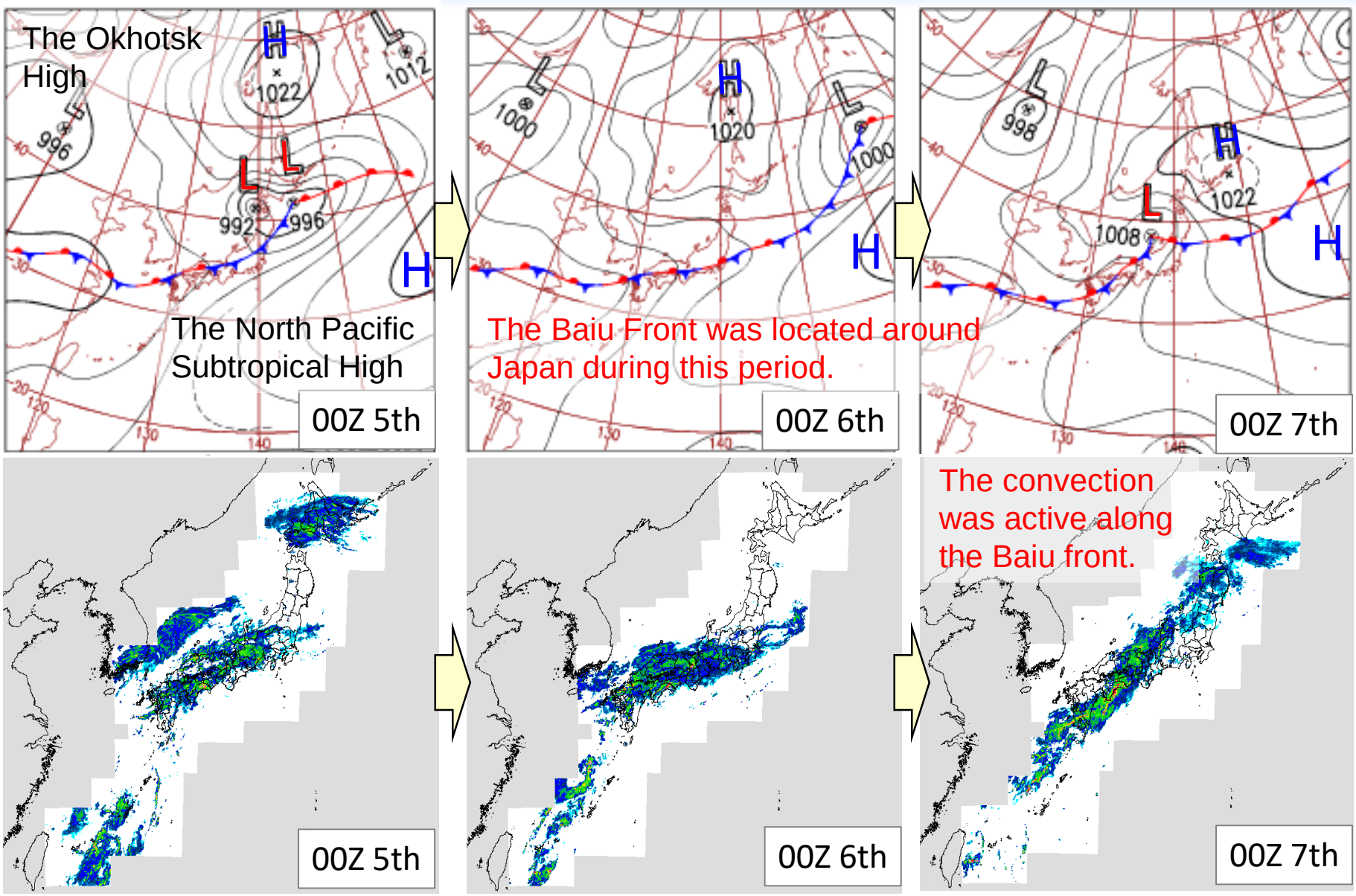
2.1 Characteristics of the heavy rain

Some observation stations recorded more than 1,800 mm during heavy rain event (28th June – 8th July, 2018). And some areas experienced 2 to 4 times the precipitation of the monthly normal for July.
A prominent characteristic is that areas with record precipitation, particularly within 48 to 72 hours, were widely observed in western Japan.



Maximum 72-hour precipitation amounts during the event (from 28th June to 8th July) from western Japan to the Tokai region.

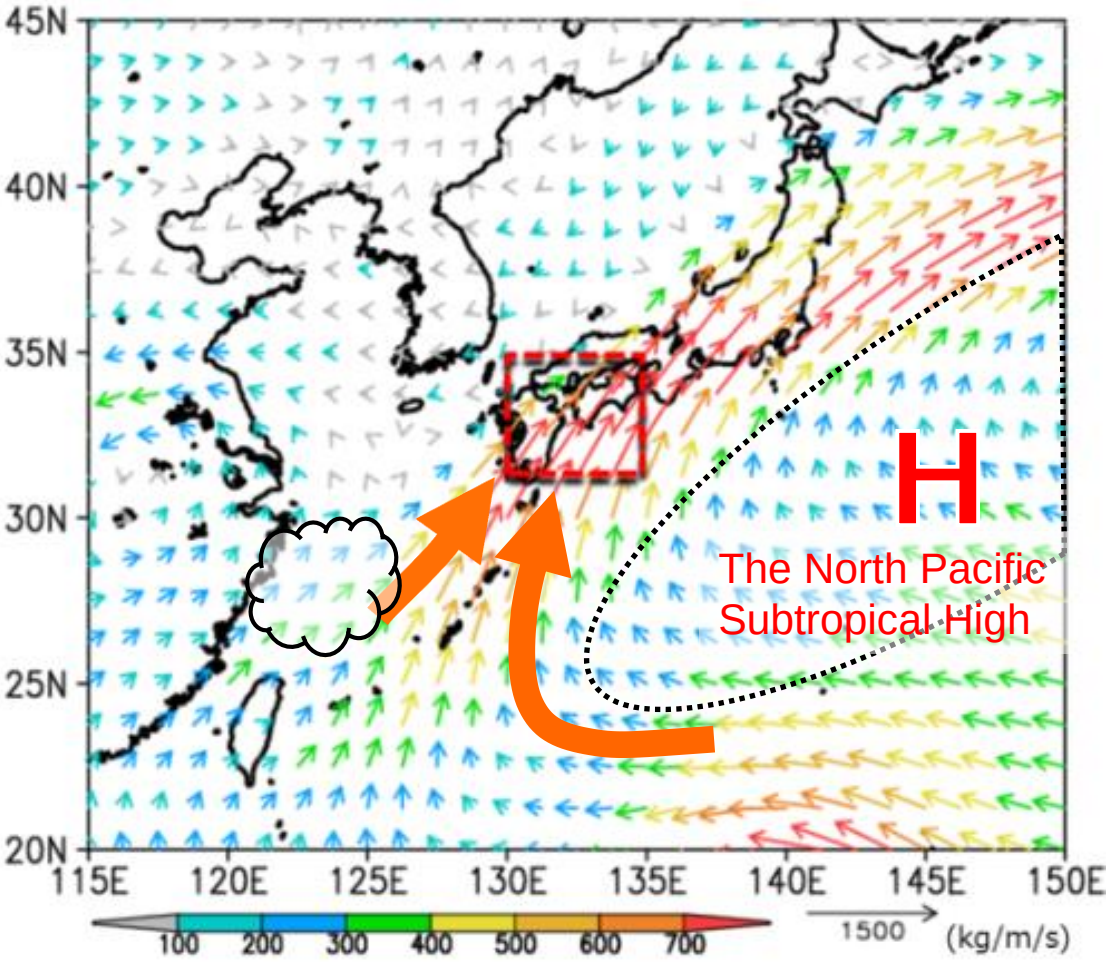
2.2 Factors (Baiu front that stagnated in the vicinity of Japan)

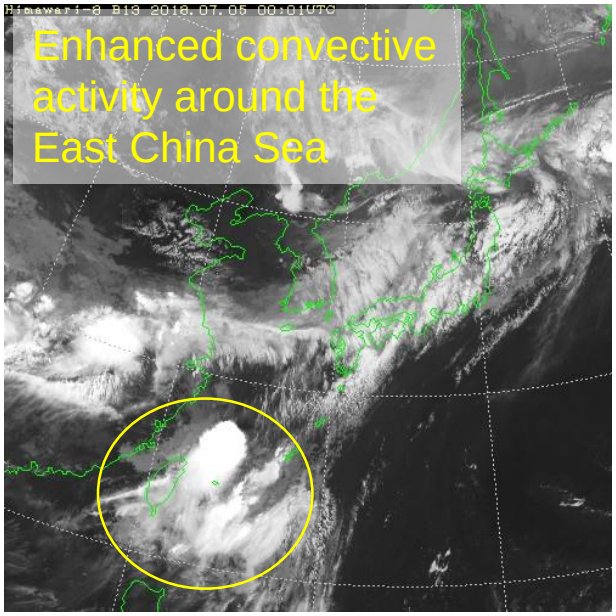


Weather charts and precipitation intensities observed by Radar from 5th July to 7th July 2018

2.2 Factors (moist air flow at the middle and lower level)

There were two moist air streams over western Japan. From 5th to 7th July, unprecedented large amounts of water vapor was concentrated.



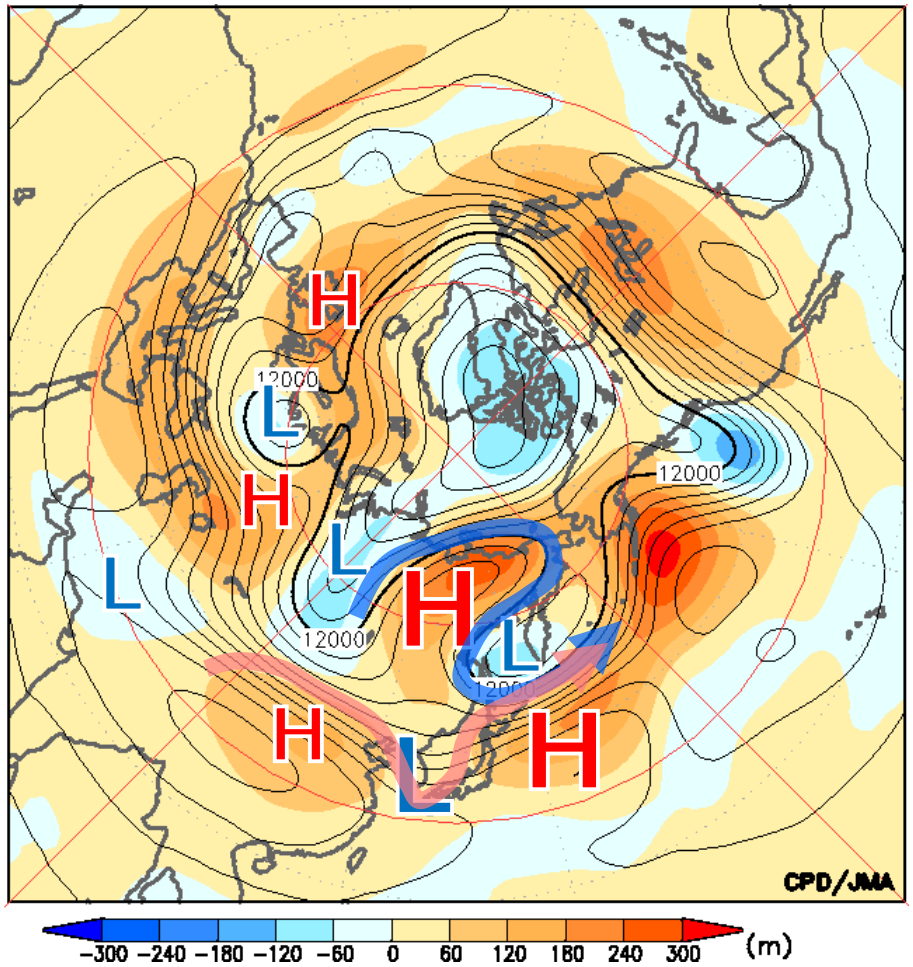


Infrared image at 5th July

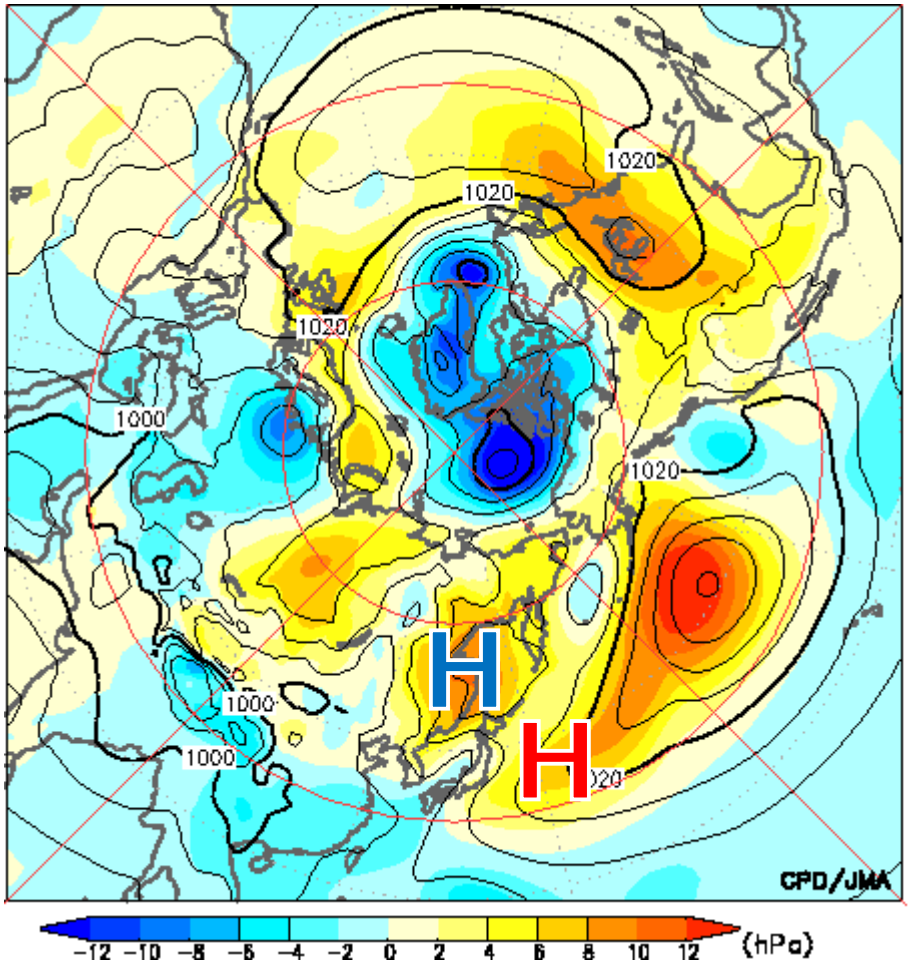
Vertically integrated horizontal water vapor flux averaged over the period from 5th July to 7th July 2018 [kg/m/s]. Vertical integration here represents integration from the surface to 300 hPa.

2.2 Factors (large scale atmospheric circulation)

The anticyclonic circulation anomaly of eastern Siberia is related to the development of the Okhotsk High. The anticyclonic circulation anomaly over the east of Japan is considered to have contributed to the expansion of the Subtropical High.

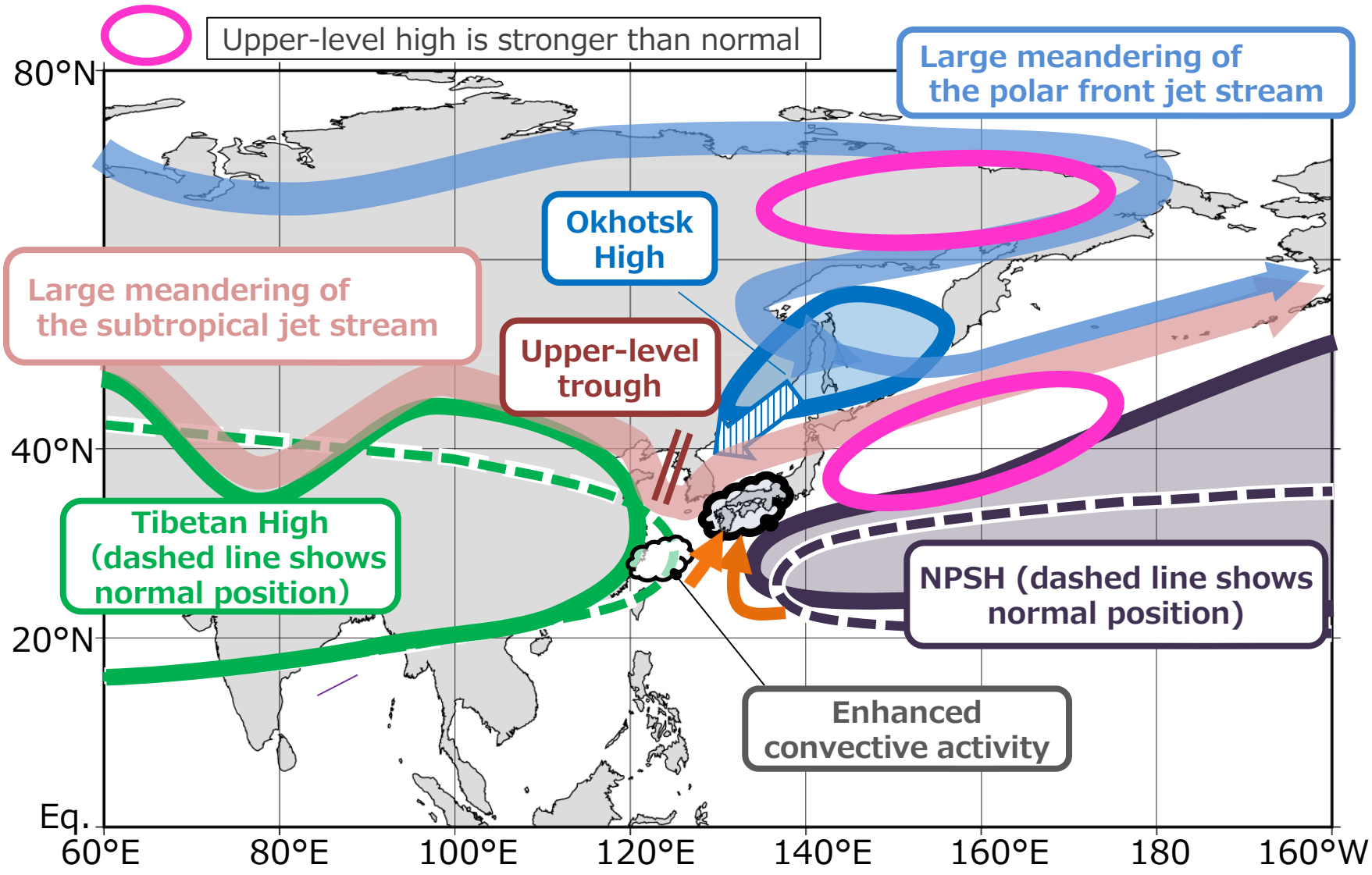


5-days (from 4th July to 8th July) mean 200-hPa height (contour) and anomalies (shade) [m].



5-days (from 4th July to 8th July) mean sea level pressure (contour) and anomalies (shade) [hPa].

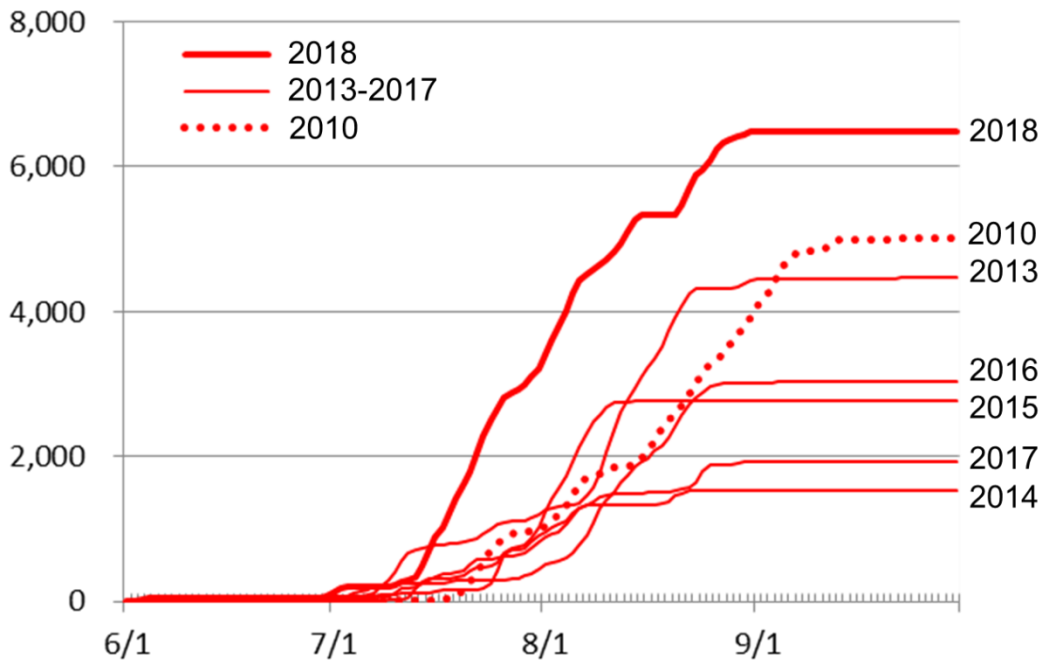
2.2 Factors (Summary)



NPSH: the North Pacific Subtropical High

3. The Heatwave in Japan in boreal summer 2018

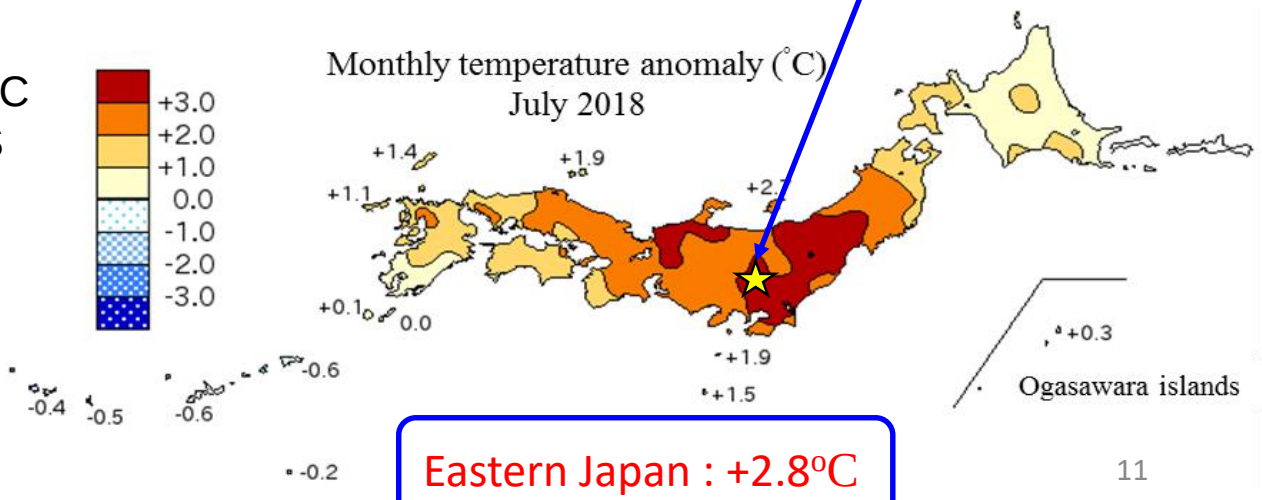
3.1 Characteristics of the Heatwave



↑ Cumulative numbers of AMeDAS stations with daily maximum temperatures of 35°C or more. Numbers of AMeDAS stations vary by year.

6,483 stations up to 30th September (about 129% of 5,014 stations for 2010) recorded hot temperature.

A new national record maximum temperature of 41.1°C was recorded in the Saitama Prefecture city of Kumagaya on 23rd July.

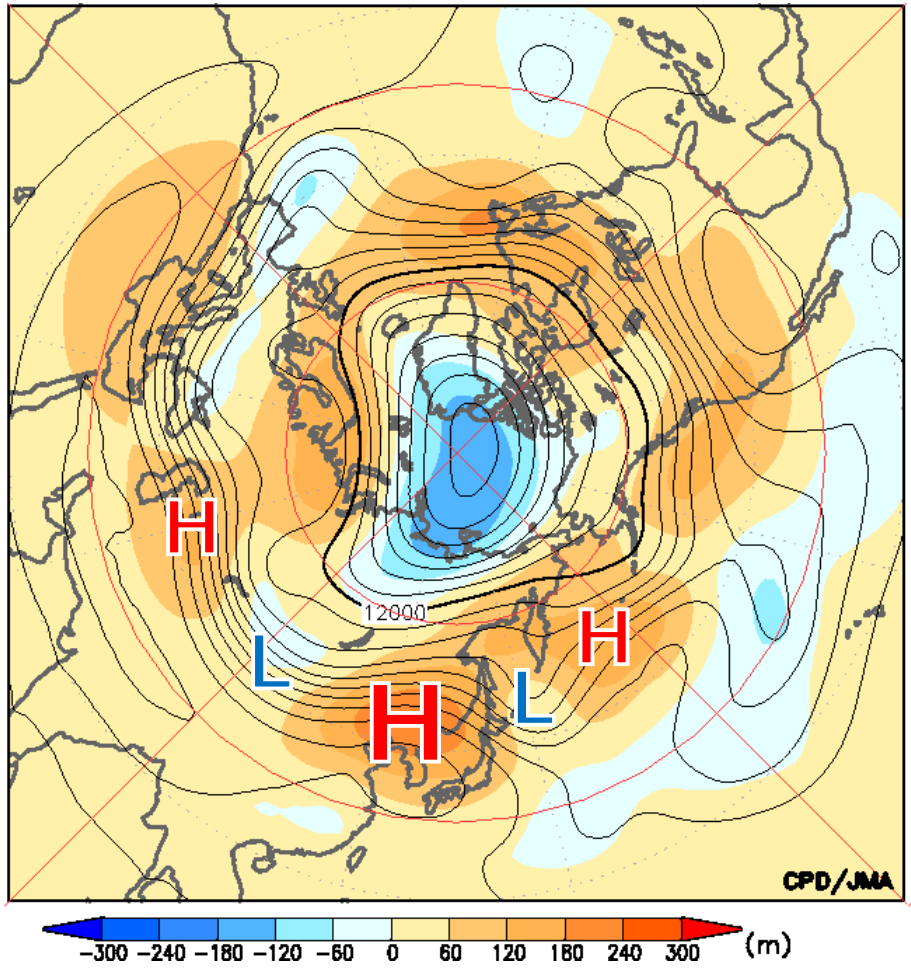


→ Monthly mean temperature anomalies for July 2018.

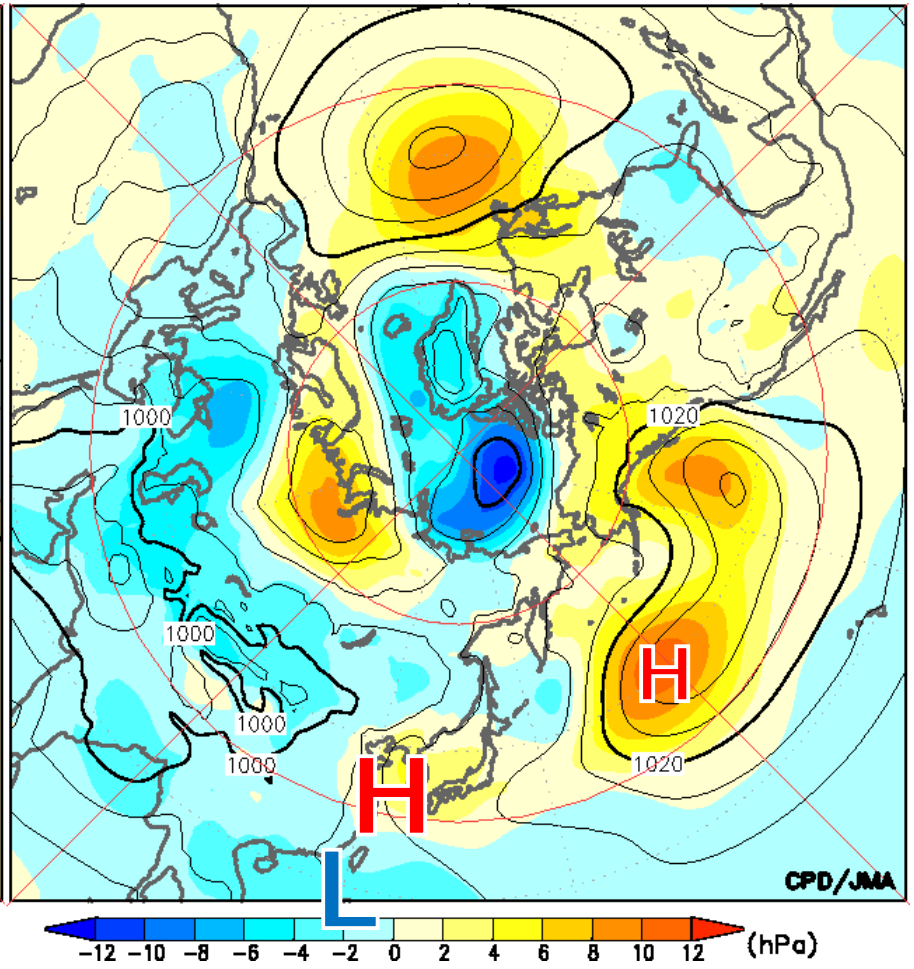
Eastern Japan : +2.8°C

3.2 Factors (large scale atmospheric circulation)

In the upper troposphere, the Tibetan high expanded over East Asia.
In the lower troposphere, the Subtropical High expanded around Japan.



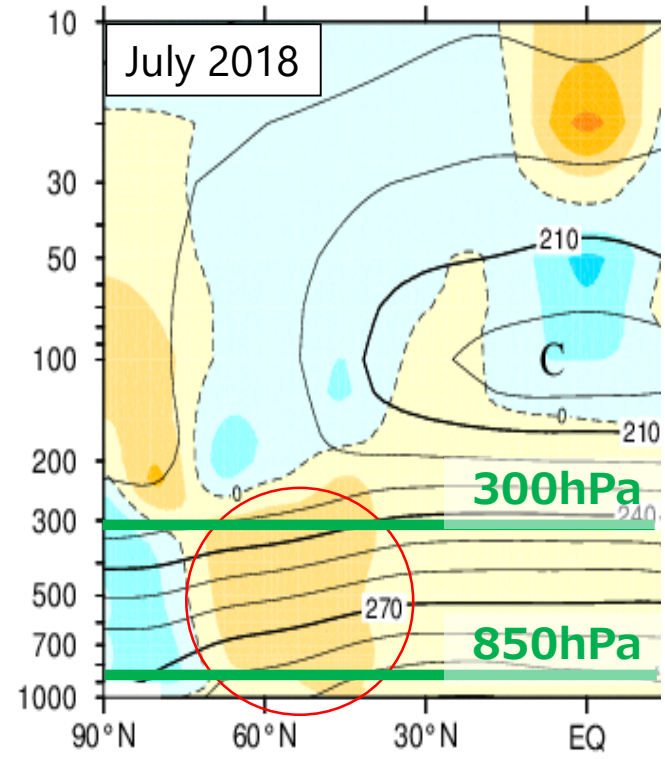
14-days (from 11th July to 24th July) mean 200-hPa height (contour) and anomalies (shade) [m].



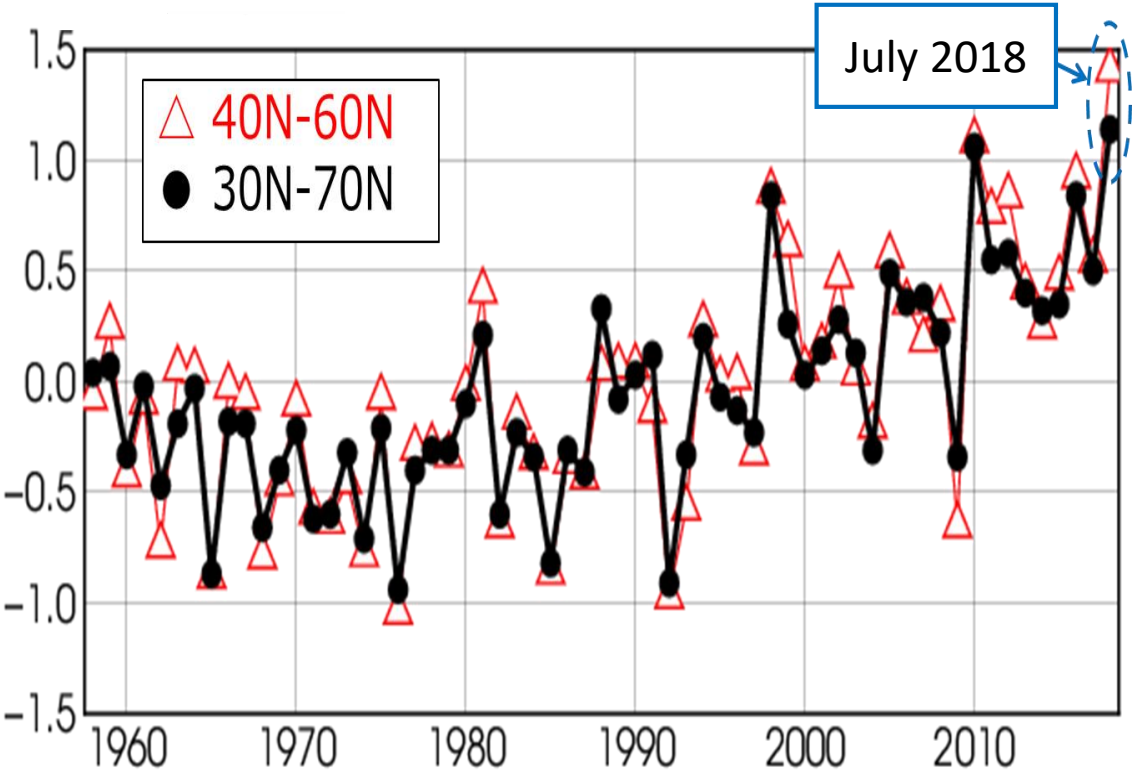
14-days (from 11th July to 24th July) mean sea level pressure (contour) and anomalies (shade) [hPa].

Zonally averaged tropospheric air temperature in the mid-latitudes of the Northern hemisphere

The zonal mean temperature in the middle latitude of the Northern hemisphere was high.

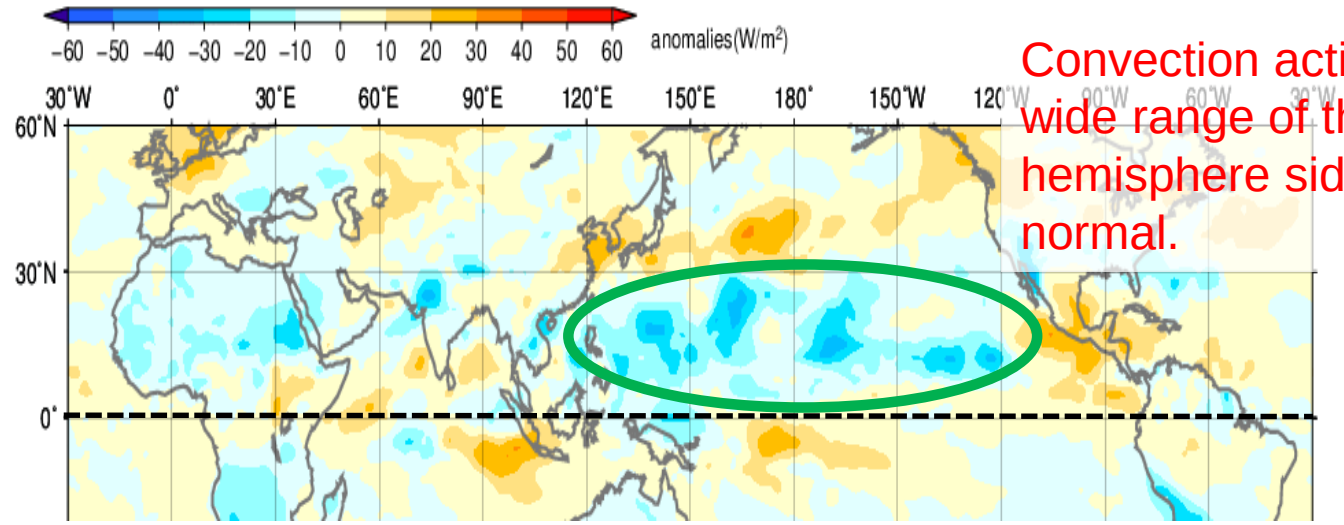


Latitude-altitude cross section of zonal mean temperature (contour) and anomalies (shade) [K].



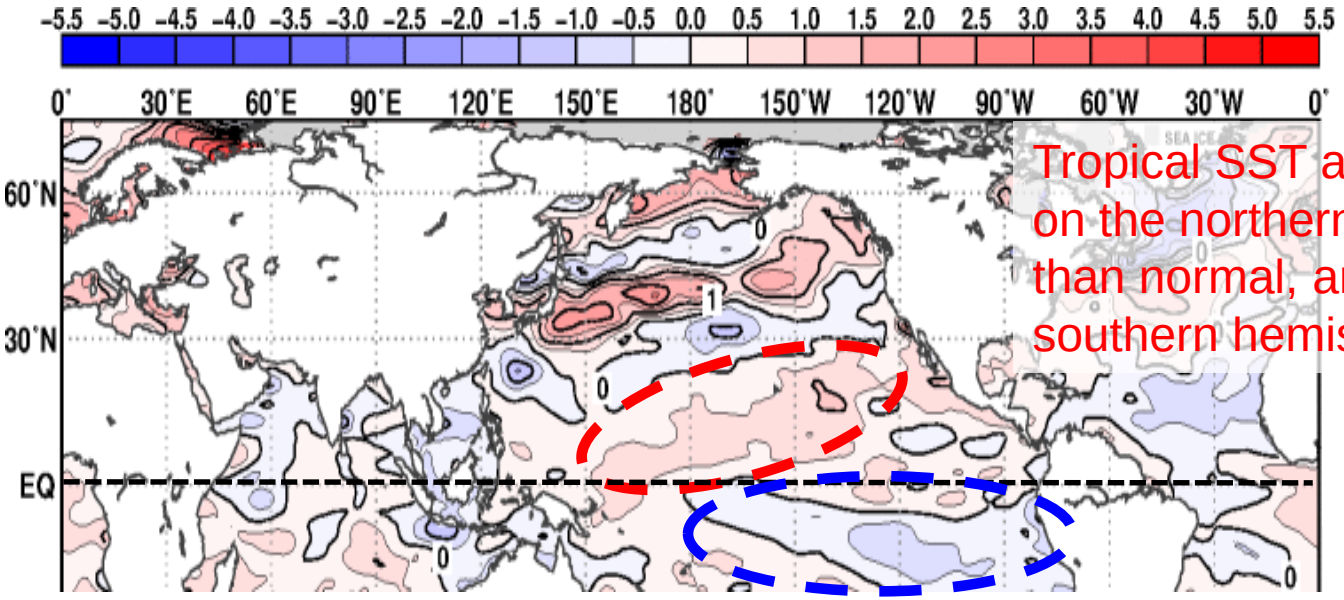
Interannual variations in zonally averaged thickness temperature anomalies in the troposphere for July [K].
(Thickness temperature is estimated between 300hPa and 850hPa.)

One of the factors of higher-than-normal zonally averaged tropospheric air temperatures in mid-latitudes



Convection activity was active in the wide range of the northern hemisphere side compared to the normal.

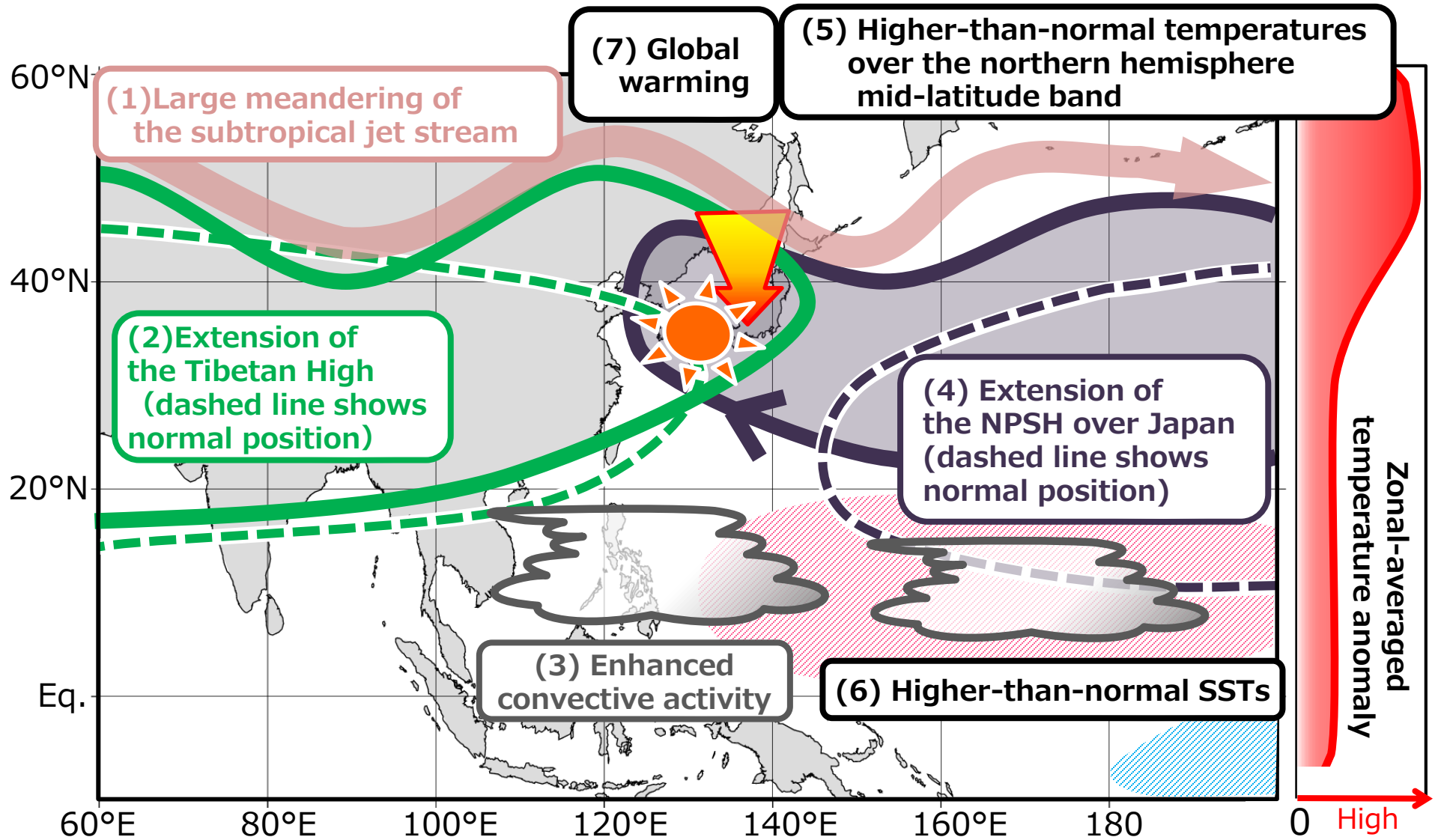
Monthly mean OLR anomalies for July 2018 [W/m^2]



Tropical SST anomalies were higher on the northern hemisphere side than normal, and lower on the southern hemisphere side.

Monthly mean SST anomalies for July 2018 [K]

3.2 Factors (Summary)



Thank you for your attention.