2018 Summer in East Asia: Rapid transition from extreme flood to extreme heat wave

Jin-Ho Yoon, GIST

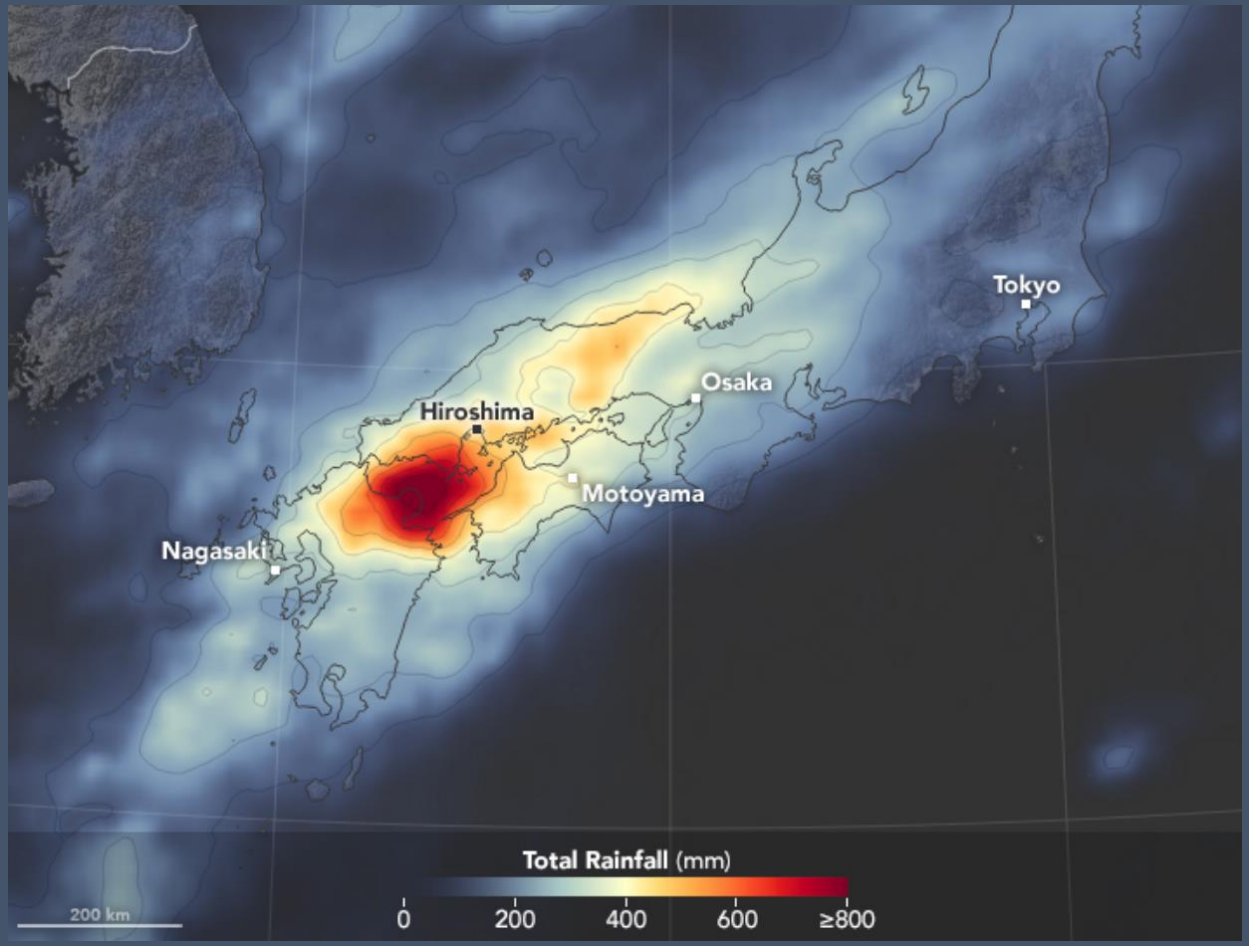
Thanks to

- My coauthors:
- Prof. Shih-Yu (Simon) Wang at USU, USA
- Prof. Hyungjun Kim at the University of Tokyo, Japan
- Dr. Lin Zhao at CAS, China

- Colleagues: Prof. J.-H. Jeong, Prof. S.-W. Son, Prof., B.-M. Kim and many others

We started to work on this issue almost right after Japan flood.

July 2-9, 2018


Tokyo
Osaka
Hiroshima
Motoyama
Nagasaki
Total Rainfall (mm)
0
200
400
600
≥800
200 km

Most conditions conducive to heavy Baiu rains as depicted by Sampe and Xie (2009)

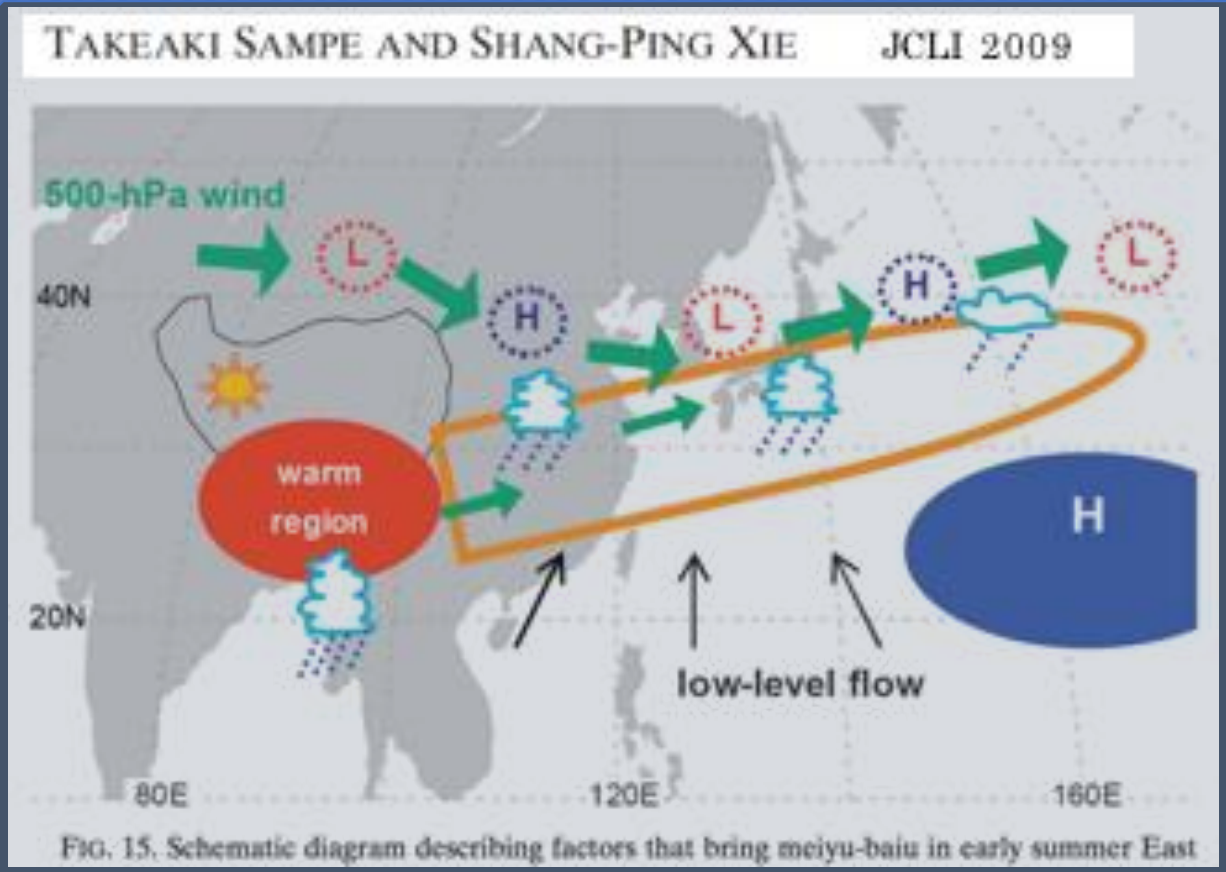


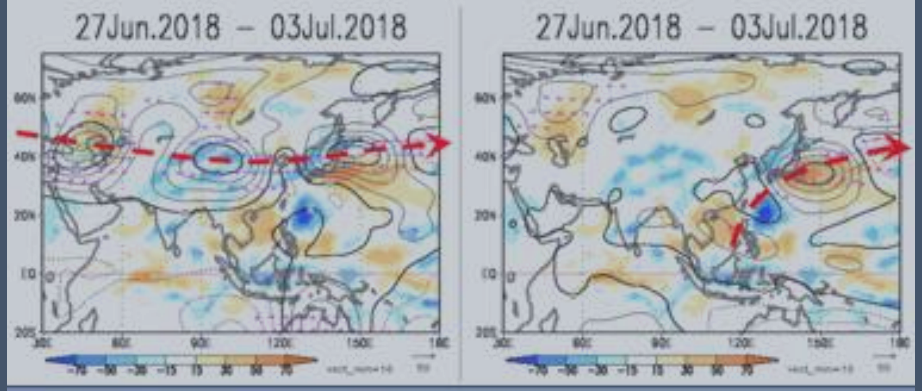
FIG. 15. Schematic diagram describing factors that bring meiyu-baiu in early summer East

Those include strong subtropical high and standing short-wave trains, compounded by a typhoon.

Two prominent circulation trends that could contribute to the extremeness of this heavy-rain event:

- Increased waviness of midlatitude summer jet
- Strengthened subtropical high extension

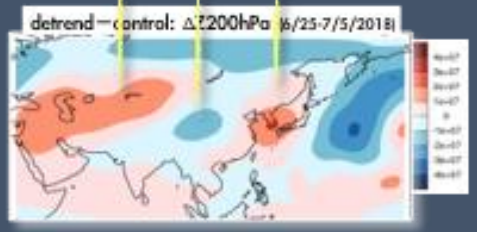
Hypothesis: Stationary short waves vs. WNP teleconnection

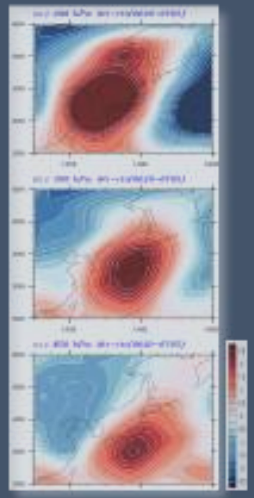


Tokyo Climate Center

Post-1985 trend in ψ850hPa (6/15-7/15)

Strengthened subtropical high is a known response to global warming and universally depicted by observation and climate models





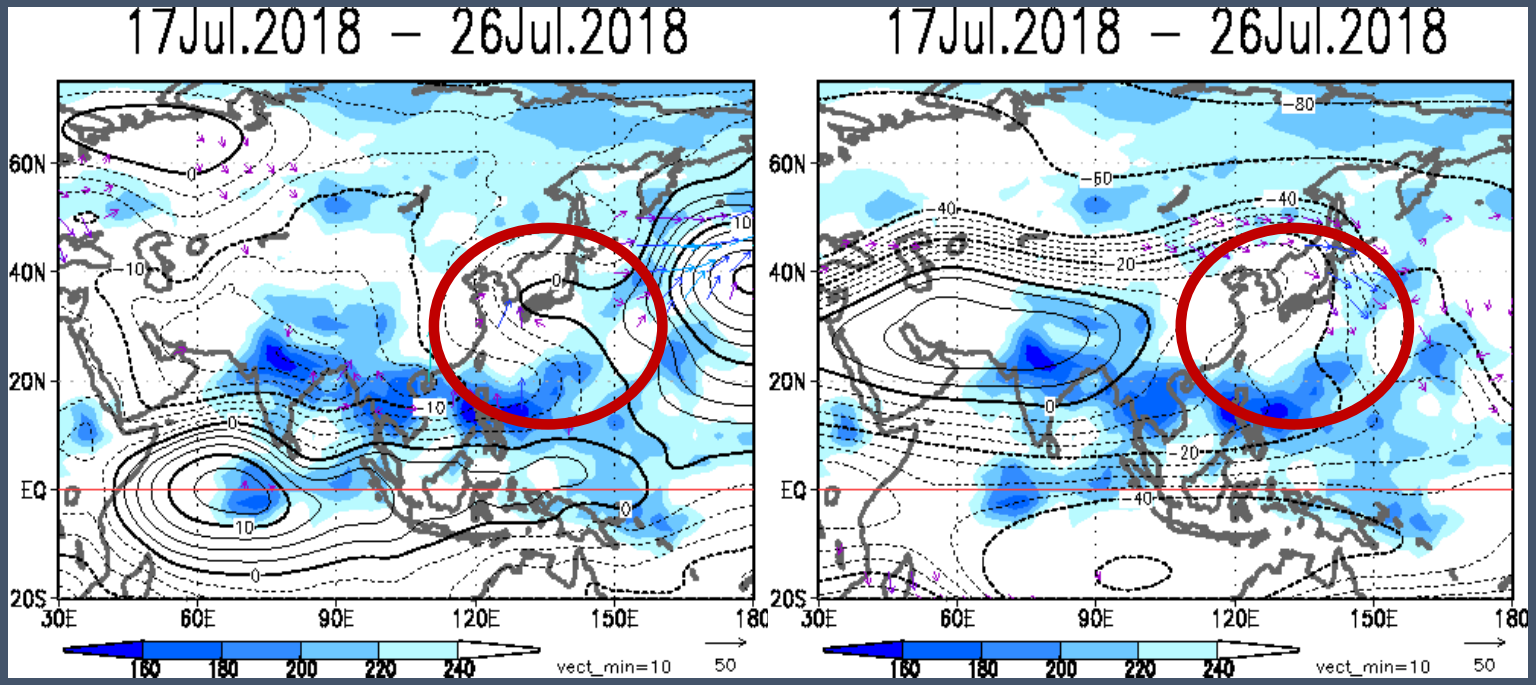
Right after this historical heavy rain event, heat wave began over Korea and Japan.

한겨레신문

KBC 뉴스

- Several points over 40C
- More than 2000 heat wave related patient and 27 death
- Economic damage

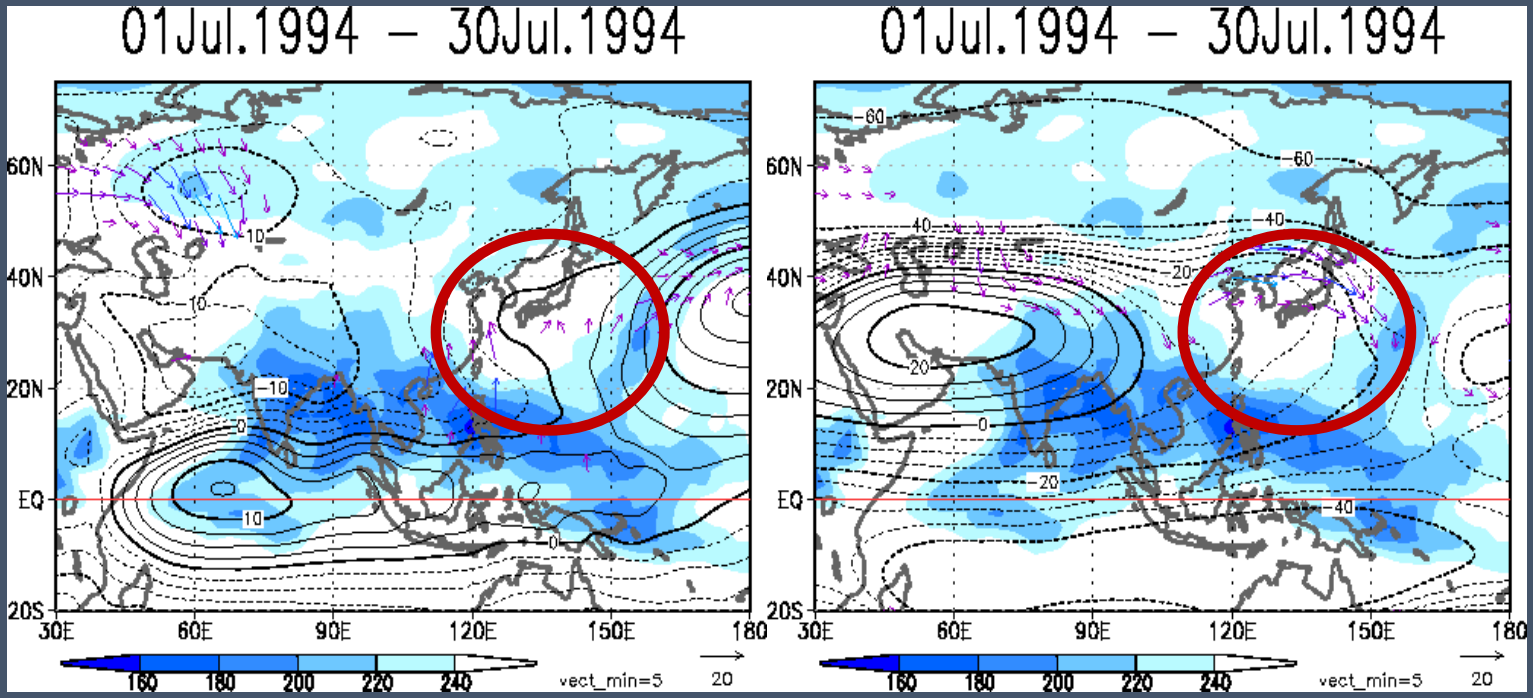
2018 Heatwave: Very strong NP High and Tibetan High



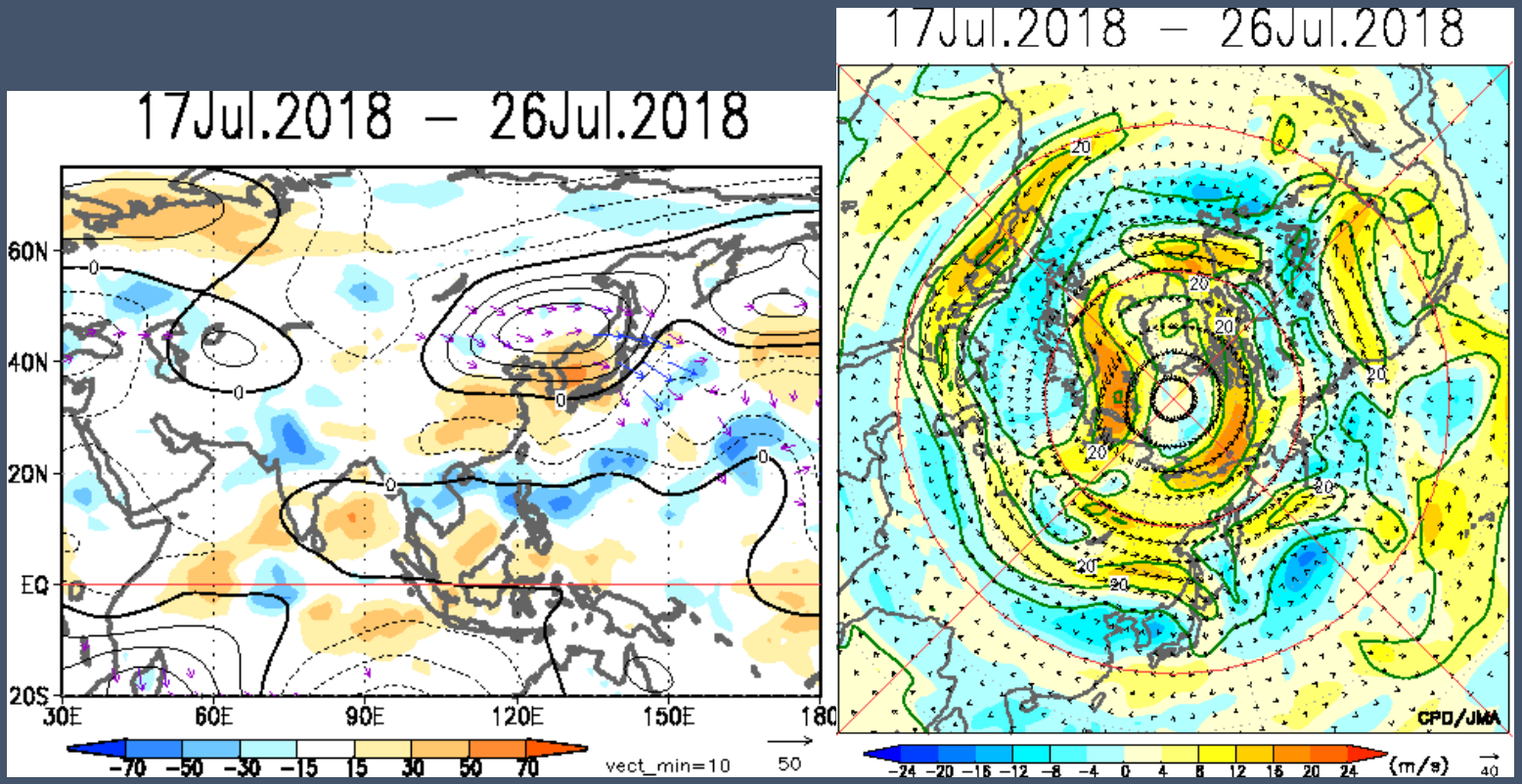
850hPa streamfunction

200hPa streamfunction

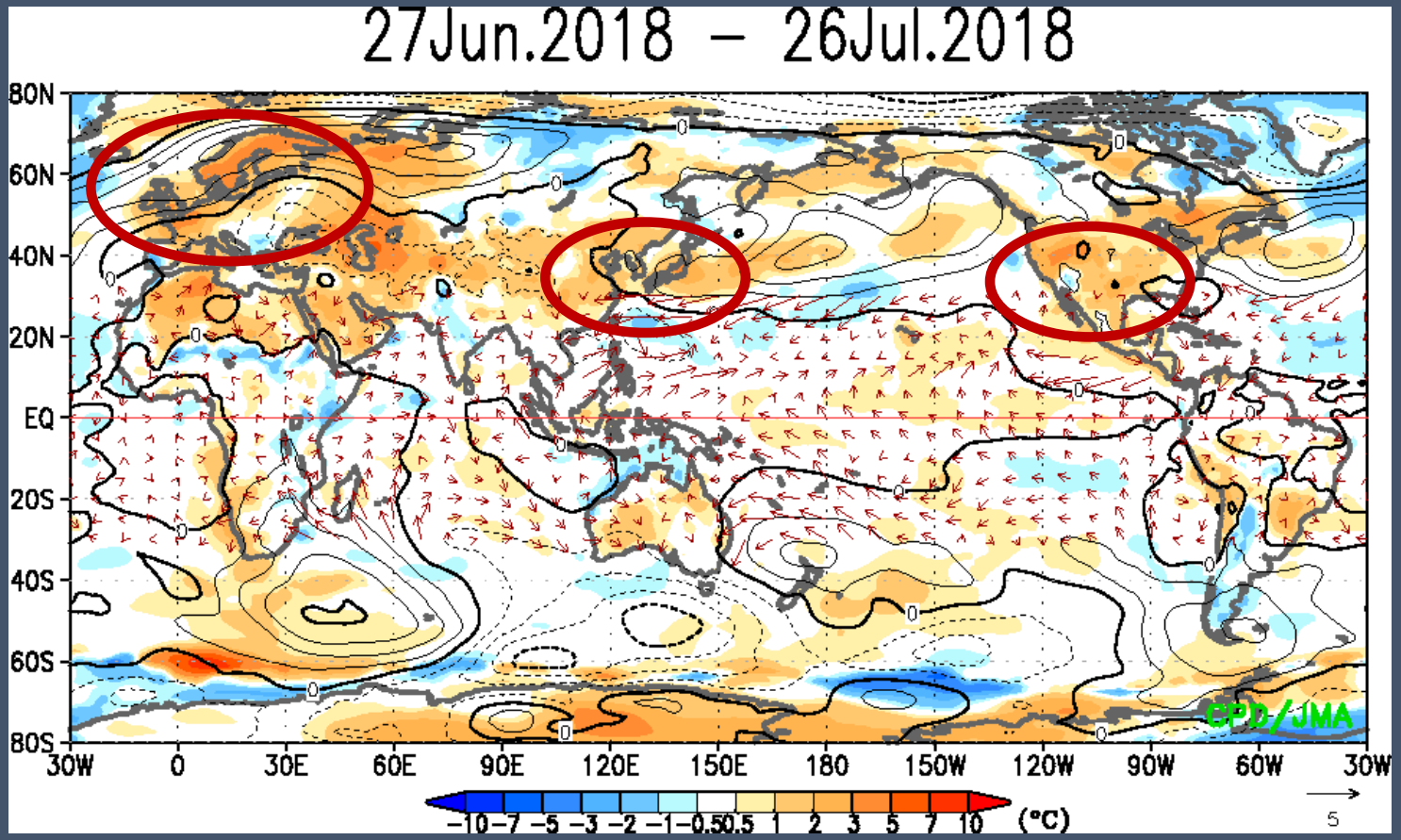
This is similar to what happened in the past.



It is still an open question why?



2018 Summer: anomalously warm over the entire NH



The July 2018 Japan flood: a Compound Event with global warming

Simon S-Y Wang, Utah State University
Jin-Ho Yoon, Gwangju Ins. Sci. Tech.
Lin Zhao, CCCAR, Chinese Academy of Sciences
Hyungjun Kim, University of Tokyo

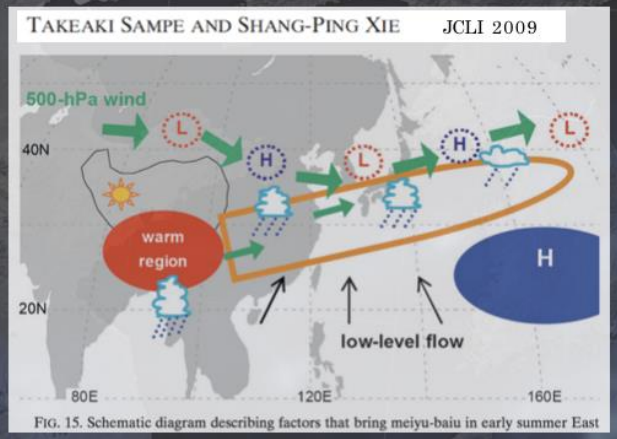


FIG. 15. Schematic diagram describing factors that bring meiyu-baiu in early summer East

(1) Most conditions conducive to heavy Baiu rains as depicted by Sampe and Xie (2009 ⬅) were observed

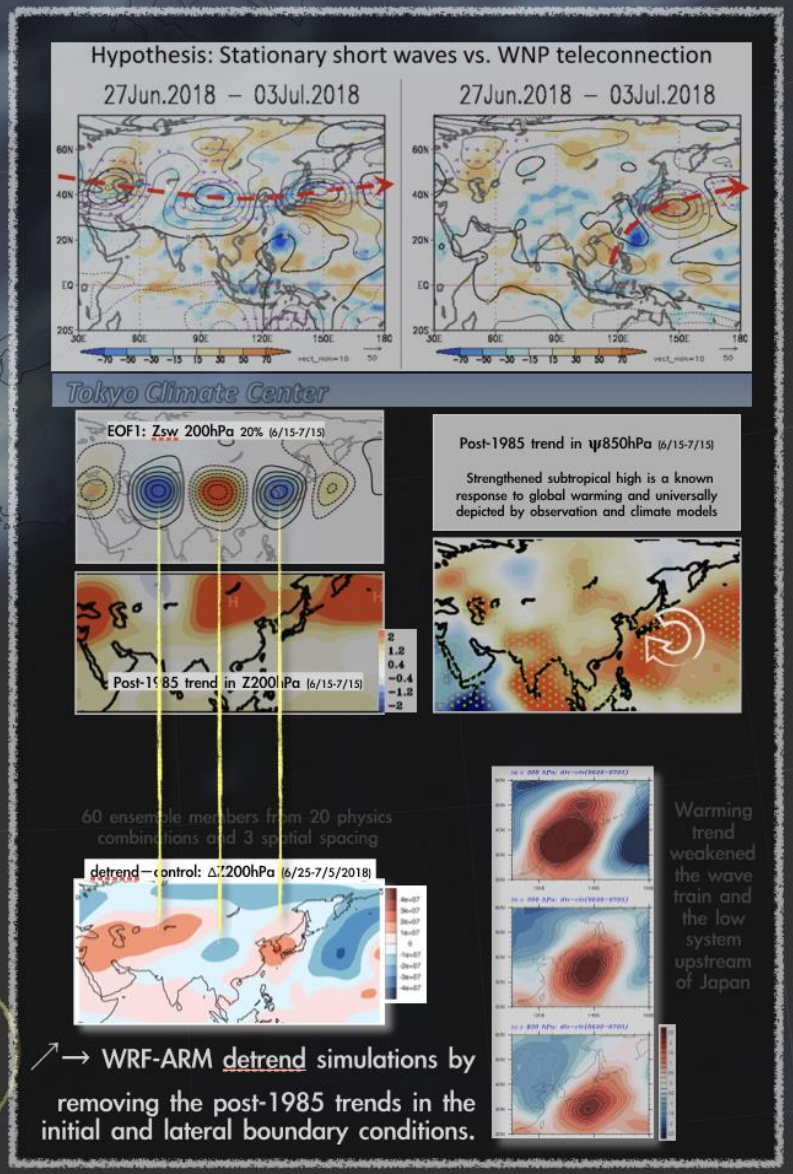
(2) Those include strong subtropical high and standing short-wave trains, compounded by a typhoon

Weather processes ↗

↘ *Climate trend impacts*

(3) We found two prominent circulation trends that could contribute to the extremeness of this heavy-rain event:

- increased waviness of midlatitude summer jet
- strengthened subtropical high extension



- Song et al. (2018 GRL): enhanced land–sea thermal contrast under global warming strengthens the NPSH
- Coumou et al. (2018 NCOMM): Arctic amplification increases waviness of the Eurasian summer jet stream

Thank you very much!!