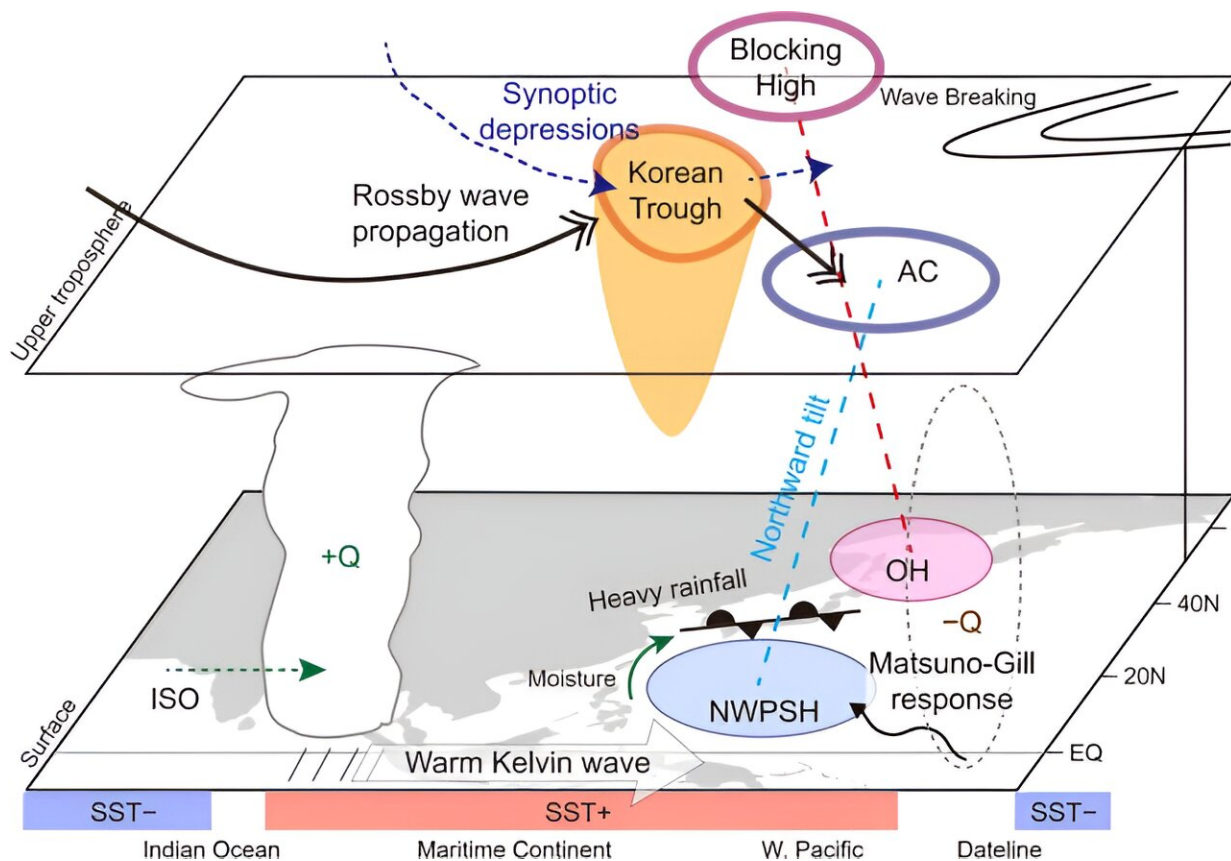


# Co-amplification in atmospheric fluctuations caused heavy rainfall over Japan in August 2021, finds study

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Credit: *Progress in Earth and Planetary Science* (2023). DOI: 10.1186/s40645-023-00598-4

In Japan, the summer season is characterized by stagnant rain fronts, causing persistent heavy rainfall. This phenomenon is reportedly associated with global-scale atmospheric and oceanic anomalies. Remote influences from the tropical and extratropical regions have been identified as the main causes, respectively. However, the link between the two causes remains unclear.

Researchers from University of Tsukuba elucidated the mechanism of the heavy rainfall in August 2021, which caused record-breaking [natural disasters](#) over a wide area extending from the western to eastern part of Japan, through [computer simulations](#) and other methods. [The study](#) is published in *Progress in Earth and Planetary Science*.

During the heavy rainfall, three high/low-pressure systems, namely the Okhotsk high, trough over the Korean Peninsula, and northwestern Pacific subtropical high, were aligned in a north–south direction and were intense. The researchers analyzed the observation data, reanalysis data, cutoff low index, and numerical simulation results.

The results revealed that the three systems were linked by a process through which a small cutoff low was concentrated near the Korean Peninsula due to an upper-tropospheric blocking high and a near-surface [atmospheric flow](#) induced by an upper-tropospheric anticyclone. In addition, cumulus convection within the tropics enhanced the northwestern Pacific subtropical high.

The researchers concluded that the joint action of these tropical and extratropical variations led to a concentration of water vapor and updrafts around Japan, resulting in persistent [heavy rainfall](#).

The study elucidated the formation and maintenance mechanisms of the northwestern Pacific subtropical high, which played an important role in water-vapor transport, with a focus on wave dynamics in the tropics and

quasigeostrophic dynamics in the extratropics.

These results herald the dawn of subtropical climate dynamics. Deep investigations into the factors that lead to such large-scale atmospheric flows may contribute to a better understanding of extreme weather events and improve the accuracy of seasonal forecasts.

**More information:** Masaya Kuramochi et al, Coherent amplification of the Okhotsk high, Korean trough, and northwestern Pacific subtropical high during heavy rainfall over Japan in August 2021, *Progress in Earth and Planetary Science* (2023). [DOI: 10.1186/s40645-023-00598-4](https://doi.org/10.1186/s40645-023-00598-4)

Provided by University of Tsukuba

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