

Fickle winters in East Asia caused by major shift in regional atmospheric circulation, suggests study

February 27 2023



Credit: AI-generated image ([disclaimer](#))

Sometimes it seems like winter just can't make up its mind—is it going to be harsh or mild? A little bit of both? New research from the University of Tsukuba shows how a better understanding of large-scale weather patterns can help meteorologists improve seasonal forecasts and

prepare us for dramatic shifts in weather conditions.

In a new study published in the *Journal of the Meteorological Society of Japan*, researchers at the University of Tsukuba investigated the weather patterns associated with a significant shift in the winter of 2020/2021 in East Asia, which was colder than normal for the first half of the season but warmer than normal in the second half. This study focused in particular on how convection in various tropical regions can drive [weather patterns](#) that influence different regions of East Asia.

"The winter climate over East Asia is influenced by two teleconnection patterns, one called the western Pacific pattern, and another that we have named the Southeast Asia-Japan pattern," explains the study's first author, Ph.D. student Masaya Kuramochi. "These two patterns played a major role in the turnabout of East Asian air temperatures between first and second halves of the 2020/2021 winter season."

The goal of the new study was to investigate the structure and dynamics of these two distinct patterns. The researchers used meteorological data for winters from 1974 to 2021 to establish the baseline climate and analyzed anomalous departures from that baseline. The different circulation patterns were reproduced using the linear baroclinic model.

In the first half of the 2020/2021 winter season, an anticyclonic circulation anomaly appeared over the southeastern Tibetan Plateau, and a corresponding cyclonic anomaly occurred over northern Japan. This pattern was associated with enhanced convection over the South China Sea toward the Indian Ocean. But in the second half of this winter season, the anticyclonic anomaly shifted to southern Japan.

"The resulting changes in the flow of cold air brought warmer-than-normal conditions to East Asia, and the enhanced convection also moved east toward the Philippine Sea," says senior author Professor Hiroaki

Ueda. "These shifting patterns also caused changes in the East Asian winter monsoon."

The authors of the study expect that in the future, closer analysis of interactions of air circulation between the tropics and higher-latitude regions will further improve understanding of these teleconnection patterns and lead to better seasonal forecasting.

More information: Masaya KURAMOCHI et al, Two Types of Wintertime Teleconnection Patterns over the Western North Pacific Associated with Regionally Different Heating Anomalies, *Journal of the Meteorological Society of Japan. Ser. II* (2022). [DOI: 10.2151/jmsj.2023-002](https://doi.org/10.2151/jmsj.2023-002)

Provided by University of Tsukuba

Citation: Fickle winters in East Asia caused by major shift in regional atmospheric circulation, suggests study (2023, February 27) retrieved 26 April 2024 from <https://phys.org/news/2023-02-fickle-winters-east-asia-major.html>

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