

# Could the background circulation of the record-breaking rainfall in July 2021 in East-central China have been predicted?

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In July 2021, unprecedented heavy rainfall occurred in Zhengzhou (east-central China) against a background of a northward shift in the western

Pacific subtropical high (WPSH), which is a key atmospheric circulation system affecting the East Asian summer climate.

Due to complex air–sea–land interactions, the WPSH exhibits significant interannual to interdecadal variability, which poses a [grand challenge](#) to skillfully predicting the climate. In this context, the predictability of the anomalous WPSH in July 2021 remains unknown and deserves careful study.

Recently, in a paper published in *Advances in Atmospheric Sciences*, scientists from the State Key Laboratory of Numerical Modeling for Atmospheric Sciences and Geophysical Fluid Dynamics (LASG), Institute of Atmospheric Physics (IAP), Chinese Academy of Sciences, have revealed both the predictable and unpredictable components of the anomalous WPSH in July 2021 based on large ensemble hindcast experiments using the IAP/LASG ocean–atmosphere coupled model.

"The observed northward shift of the WPSH in July 2021 exhibits a meridional dipole pattern in the 850-hPa geopotential height over the eastern China sea, and the amplitude of geopotential height was the strongest since 1979," explains Dr. Shuai Hu, the lead author of the study. "This meridional dipole pattern corresponds to the two nodes of the so-called Pacific–Japan pattern."

To reveal the predictability of the anomalous WPSH, Hu and colleagues conducted a 21-member ensemble of seasonal predictions initiated from the end of June 2021. Both the predictable and the unpredictable components of the meridional dipole pattern were identified from the ensemble simulations.

The predictable component was driven by positive precipitation anomalies over the tropical western Pacific, which were caused by a positive horizontal advection of the mean moist enthalpy associated with

southwesterly anomalies to the northwestern flank of anticyclonic anomalies, which was excited by the La Niña.

The unpredictable component was associated with the atmospheric internal intraseasonal oscillations, which were not initialized in the predictions. The [relative contributions](#) of the predictable and unpredictable components to the observed northward shift of the WPSH at 850 hPa were 28.0% and 72.0%, respectively.

"Our study calls for attention to be paid to the intraseasonal variability of the WPSH in seasonal predictions. An accurate prediction of the intraseasonal variability is of high priority in efforts devoted to improving the prediction skill for the East Asian summer climate," says Prof. Tianjun Zhou, corresponding author of the study.

**More information:** Shuai Hu et al, Seasonal Prediction of the Record-Breaking Northward Shift of the Western Pacific Subtropical High in July 2021, *Advances in Atmospheric Sciences* (2023). [DOI: 10.1007/s00376-022-2151-x](#)

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