The dynamics behind the exceptional summer 2020 Yangtze River rainfall projections

June 29 2021

While not located in the Yangtze River basin, Beijing, home of the study's lead author, received unusual severe meiyu rainfall, taken July 2nd, 2020. Credit: Lyu Jiawei

During summer 2020, the Yangtze River basin experienced persistent, record-breaking meiyu rainfall. Likewise, the region suffered from severe flooding and water damage as accumulated rainfall broke records dating back to 1954. Regions outside the meiyu rain belt received significant summer rainfall as well, including Beijing, located in northeastern China.

Typically, an above average meiyu rainfall season follows a strong El Niño during the previous winter. However, summer 2020 followed a neutral El Niño-Southern Oscillation (ENSO) event. Therefore, scientists are working to explore the many dynamic components of this outlying season, and why some predictability signals, like the phase of ENSO, did not verify well for summer 2020 rainfall forecasts across the Yangtze River basin.

As part of the Climate Science for Service Partnership (CSSP) China project, a group of scientists from Institute of Atmospheric Physics, Chinese Academy of Sciences and the UK Met Office Hadley Centre collaborated, finding clues as to why the 2020 summer meiyu season was so unique. They just published their research, data, discussion, and conclusions in *Advances in Atmospheric Sciences*.

Despite the poor ENSO signal, archived model data and observations agree that the Met Office GloSea5 operational forecast system provided an accurate above average summer 2020 rainfall projection. Researchers attribute the reliable forecast to a good reproduction of the notably anomalous western North Pacific subtropical high (WNPSH) pressure system. The model uses local and tropical Indian Ocean sea surface temperature (SST) data to predict the size and placement of the WNPSH throughout the summer season.

"These results support that the anomalous WNPSH change and associated local air-sea interactions could exist without the impact of ENSO," said Dr. Chaofan Li, the lead author of the study.

Collaborators also explored which extratropical dynamics may have driven extreme heavy rainfall. They found that the East Asian westerly jet (EAJ) was significantly accelerated in observed data, but not nearly as intense in model simulations. While this scenario may favor more meiyu rainfall, accurately predicting the placement and speed of the EAJ

through the summer season is more difficult. That said, the EAJ likely boosted seasonal Yangtze River rainfall against weaker model projections, hindering precision forecasting and disaster mitigation.

"Unfortunately, the forecast Yangtze River rainfall anomaly was weaker compared to that observed," added Dr. Li, "But the forecast members are useful to identify predictability and dynamical causes for this exceptional rainfall."

More information: Chaofan Li et al, The Seasonal Prediction of the Exceptional Yangtze River Rainfall in Summer 2020, *Advances in Atmospheric Sciences* (2021). DOI: 10.1007/s00376-021-1092-0

Provided by Chinese Academy of Sciences