Looking for the key to predict heatwaves over the Yangtze River basin 20 days in advance

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Children playing and lingering in the water to keep away from the heat of the Nanjing summer. Credit: Pang-ning Hsu

Under global warming, the frequent occurrence of summer heatwaves has exerted an increasing impact on human health and public infrastructure. For example, Europe experienced a severe heatwave in 2003 with more than 70,000 heat-related casualties. Western Russia was struck by its hottest summer on record in 2010, leading to the deaths of

around 55,000 people. Record-breaking heatwaves have also been frequently reported in populous countries of East Asia, such as the Northeast Asian heatwave in 2018 and the heatwave in Japan this summer. In China, the Yangtze River basin is one of the most densely populated and economically important regions in China, and a region where heatwaves have a high probability to occur. Summertime heatwaves in this region have caused tremendous economic losses in recent years. Therefore, extending the forecast lead times and increasing the prediction skill for heatwaves over the Yangtze River basin is key for disaster prevention and mitigation.

In a recently published study in *Advances in Atmospheric Sciences*, Prof. Pang-Chi Hsu and her team from Nanjing University of Information Science & Technology evaluate the subseasonal prediction skill of heatwaves in the Yangtze River basin and identify the crucial processes influencing the prediction skill using the long-term hindcast data from three operational models.

"We compare three models developed respectively by the China Meteorological Administration, the U.S. National Centers for Environmental Prediction, and the European Centre for Medium-Range Weather Forecasts," explains Prof. Hsu. "These models all participated in the Subseasonal to Seasonal Prediction project."

Her team found that the superior skill of these operational models in predicting the occurrence, intensity and duration of heatwaves can be attributed to their fidelity in capturing the phase evolution and amplitude of high-pressure anomalies associated with the intraseasonal oscillation and the dryness of soil moisture induced by less precipitation via the land-atmosphere coupling.

Furthermore, the team found that the capability of the models in predicting heatwave occurrence at a longer lead time (15-20 days in

advance) is closely related to their fidelity in capturing the evolution and amplitude of 30-90-day intraseasonal circulation rather than the 10-30-day intraseasonal circulation. The biases of intraseasonal circulation anomalies further affect precipitation anomalies and thus soil moisture conditions, affecting the prediction skill for heatwave intensity and duration.

"In the future, we will further diagnose the key factors influencing the activity of intraseasonal oscillation and related land-air interactions to gain a more comprehensive and in-depth understanding of the potential sources of subseasonal predictability," says Prof Hsu. She and her team will continue to work toward improving the subseasonal prediction skill of high-impact weather events.

More information: Jiehong Xie et al, Sources of Subseasonal Prediction Skill for Heatwaves over the Yangtze River Basin Revealed from Three S2S Models, *Advances in Atmospheric Sciences* (2020). DOI: 10.1007/s00376-020-0144-1

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