

Arctic and tropical Pacific synergistic effects cause extremely cold winter in China

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China is just one of many countries in the Northern Hemisphere experiencing an extremely cold winter due in part to both the tropical Pacific and the Arctic, according to an analysis of temperatures from

Dec. 1, 2020 to mid-January of 2021.

A country-specific case study potentially has far-reaching implications for predictions and early warnings to protect against harmful impacts, according to the study published online in *Advances in Atmospheric Sciences* on Feb. 12.

"We are trying to explain why the countries in the Northern Hemisphere more frequently encounter the extremely cold events against a global warming background, and we chose the 2020-21 extremely [cold winter](#) in China as a [case study](#)," said co-first author Prof. Zheng Fei, International Center for Climate and Environment Science (ICCES), the Institute of Atmospheric Physics (IAP) of the Chinese Academy of Sciences (CAS).

According to Zheng, two events are responsible: warming in the Arctic and cooling in the tropical Pacific. Arctic warming results in melting ice, disrupting surface and ocean temperatures. La Niña, the cool phase of the tropical Pacific's extreme climate cycles, drops ocean temperatures to -5 degrees Celsius and displaces atmospheric and global wind circulation.

"The synergistic effect of the warm Arctic, mostly induced by global warming, and the cold tropical Pacific, caused by La Niña, intensified the intrusions of cold air from [polar regions](#) into mid-[high latitudes](#), which further influenced the cold conditions in China during the first half of winter 2020-21," ZHENG said. "This synergistic effect can be regarded as a necessary background for triggering the cold surges invading most countries in East Asia and North America."

To forecast the evolution of La Niña in particular, the researchers used the ensemble prediction system developed at IAP, CAS. The system assesses the last 20 years of a selected climate event and offers a

prediction of up to a year on how that event might evolve.

"The most recent ensemble forecast suggests that there is at least a 95% chance that La Niña will persist through the 2020-21 winter, with a potential transition to a neutral standing during the spring," Zheng said, noting that there is still some uncertainty when it comes to winter predictions. "We still need to pay attention to the possible large temperature fluctuations and increased snow and rainfall in China during the late winter."

Researchers plan to further study the synergistic effect of extreme climate events through observation, climate simulation and data assimilation with the ultimate goal of improving seasonal predictions for countries in the Northern Hemisphere.

More information: Fei Zheng et al. The 2020/21 Extremely Cold Winter in China Influenced by the Synergistic Effect of La Niña and Warm Arctic, *Advances in Atmospheric Sciences* (2021). [DOI: 10.1007/s00376-021-1033-y](https://doi.org/10.1007/s00376-021-1033-y)

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