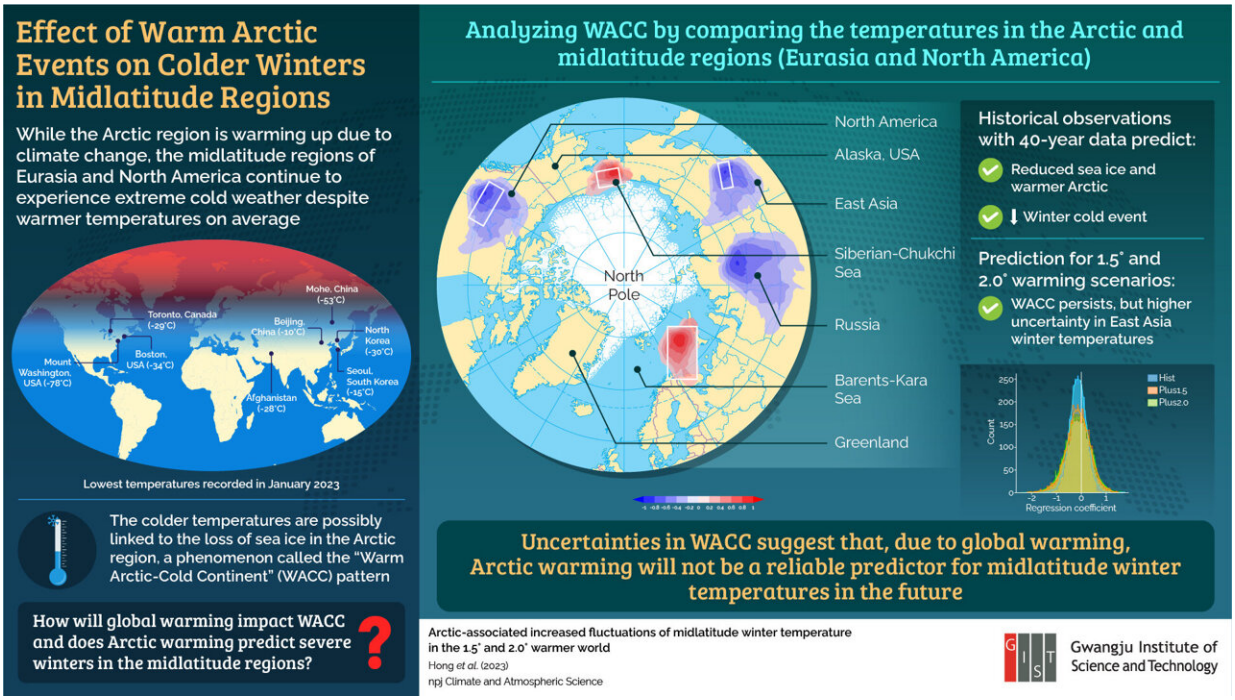
Researchers correlate Arctic warming to extreme winter weather in midlatitude and extrapolate its future

April 5 2023



The midlatitude regions are experiencing colder and more severe winters as the Arctic region continues to warm. As global temperatures keep rising, the link between extreme winter events in the midlatitude and Arctic warming may become more unstable, challenging the forecast of future extreme winter weather events. Credit: Prof. Jin-Ho Yoon from Gwangju Institute of Science and Technology (GIST), Korea

Pictures of melting glaciers and stranded polar bears on shrinking sea ice in the Arctic are perhaps the most striking images that have been used to highlights the effects of global warming. However, they do not convey the full extent of the consequences of warmer Arctic. In recent years, there has been growing recognition of the Arctic's role in driving extreme weather events in other parts of the world.

While the Arctic has been warming at a rate twice as fast as the global average, winters in the midlatitude regions have experienced colder and more severe weather events. For instance, the winter of 2022-2023 saw record-breaking cold temperatures and snowfall in Japan, China, and Korea. Similarly, many parts of Eurasia and North America have experienced severe cold snaps, with heavy snowfall and prolonged periods of sub-zero temperatures.

While there are multiple theories for this climate phenomenon, an international team of researchers led by Professor Jin-Ho Yoon from Gwangju Institute of Science and Technology (GIST), Korea set out to examine the relationship between the severe winters in the Northern Hemisphere and the melting sea ice in the Arctic region, a phenomenon referred to as the "Warm Arctic-Cold Continent" (WACC), and how this relationship changed with the warming climate.

In their study published in *npj Climate and Atmospheric Science*, the researchers looked at historic climate data and turned to climate projection models to explore the potential connection and assess how this phenomenon might be influenced by different global warming scenarios.

Based on the climate data from the European Center for Medium-Range Weather Forecasting (ECMWF) going back almost 40 years, the researchers correlated winter temperatures in East Asia and North America to the temperatures of the Barents-Kara Sea and the East

Siberian-Chukchi Sea in the Arctic region.

They observed that lower winter temperatures in East Asia and North America are usually accompanied by warmer Arctic Sea temperatures. However, they also found that in some winters, such as the 2017/18 winter in East Asia, this pattern did not hold, suggesting that this linkage include uncertainty likely due to factors other than Arctic Sea temperatures were at play.

Nonetheless, using climate projections from the Half degree Additional warming, Prognosis and Projected Impacts (HAPPI) experiments which were targeted to project future climate under 1.5°C to 2°C warming scenarios, the researchers found the WACC pattern to persist even when global temperatures rose.

However, they found that the correlation between the Arctic Sea temperature and the East Asia temperatures became more uncertain with the intensification of global warming.

"We found that the relationship between Arctic warming and cold weather events in midlatitude would become more uncertain under warmer climates, challenging the forecast of winter temperature in the future," says Mr. Yungi Hong, a Ph.D. student at GIST and a member of the research team.

"Our study shows that while one can expect the Arctic warming-triggered cold waves in the midlatitudes to persist in a warmer future, they will become more difficult to predict," adds Prof. Jin-Ho Yoon.

The results of this study highlight the importance of the continued efforts to better understand the interactions between Arctic warming and the midlatitude climate as a means to finding alternate predictors for extreme winter weather events that are to come.

More information: Yungi Hong et al, Arctic-associated increased fluctuations of midlatitude winter temperature in the 1.5° and 2.0° warmer world, *npj Climate and Atmospheric Science* (2023). DOI: 10.1038/s41612-023-00345-y

Provided by GIST (Gwangju Institute of Science and Technology)