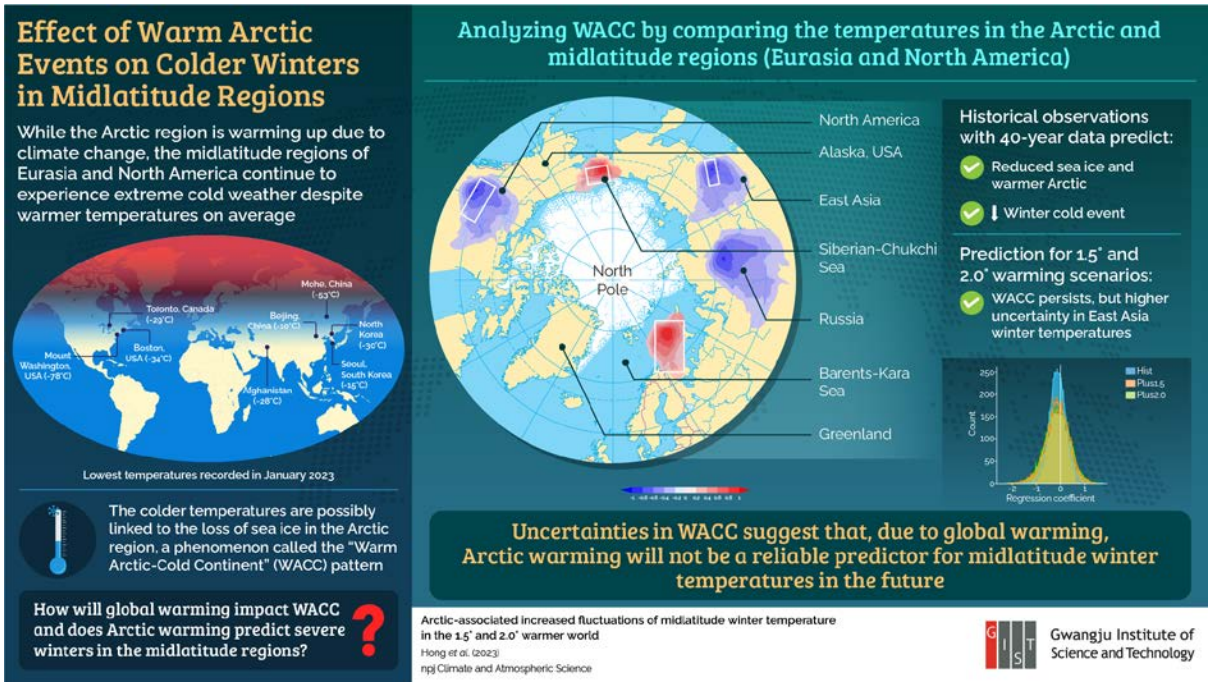
PRESS RELEASE

Gwangju Institute of Science and Technology Researchers Correlate Arctic Warming to Extreme Winter Weather in Midlatitude and Its Future

Study shows that Melting Arctic Ice May Lead to Unpredictable Winter Weather Across the Globe

A warmer Arctic has been linked to extreme winter weather in the midlatitude regions. But, it is not clear how global warming affects this link. In a new study, researchers from Korea and the United States used weather data and climate models to show that while the "Warm Arctic-Cold Continent" pattern will continue as the climate continues to warm, Arctic warming will become a less reliable predictor of extreme winter weather in the future.



Title: Effect of warm Arctic events on colder winters in midlatitude regions.

Caption: 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 the Gwangju Institute of Science and Technology (GIST), Korea

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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 a 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 the Gwangju Institute of Science and Technology (GIST) in 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 online on 27 March 2023 in the journal *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 has uncertainty likely due to factors other than Arctic Sea temperatures that 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.

Reference

Authors:	Yungi Hong[1,*], S.-Y. Simon Wang[2], Seok-Woo Son[3], Jee-Hoon Jeong[4], Sang-Woo Kim[3], Baekmin Kim[5], Hyungjun Kim[6], and Jin-Ho Yoon[1,*]
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About the Gwangju Institute of Science and Technology (GIST)

The Gwangju Institute of Science and Technology (GIST) is a research-oriented university situated in Gwangju, South Korea. Founded in 1993, GIST has become one of the most prestigious schools in South Korea. The university aims to create a strong research environment to spur advancements in science and technology and to promote collaboration between international and domestic research programs. With its motto of "A Proud Creator of Future Science and Technology," GIST has consistently received one of the highest university rankings in Korea.

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About the authors

Jin-Ho Yoon is a Professor of Earth Sciences and Environmental Engineering at GIST, Korea. He received his Ph.D. in Atmospheric Sciences from Iowa State University, USA in 2004. His group at GIST focuses on understanding and predicting weather-climate extremes under climate change. Prof. Yoon's group is also analyzing aerosol-cloud-precipitation interactions to understand the distribution and characteristics of clouds. Before coming to GIST, he was a scientist at Pacific Northwest National Laboratory, USA.

Yungi Hong is an Ph.D. student at GIST, Korea. He belongs to the Climate Analysis and Modeling (CAM) Laboratory. His research aims to understand how the Earth Climate System works and is going to change in the coming years.