

## Did an Arctic sea-ice hole cause hemispheric extreme cold winter in 2017/18?

\*Keisuke Ota<sup>1</sup>, Yoshihiro Tachibana<sup>1</sup>, Kensuke K. Komatsu<sup>1</sup>, Alexeev A. Vladimirov<sup>2</sup>, Cai Lei<sup>2</sup>, Yuta Ando<sup>1</sup>

1. Graduate School of Bioresources, Mie University, 2. International Arctic Research Center, University of Alaska Fairbanks

While unprecedented cold weather characterized the American and Asian winter of 2017/18, the Pacific side of the Arctic experienced largely ice-free ocean, referred to as a “sea-ice hole.” The jet stream dividing cold Arctic air from warm persistently meandered northward with intrusion into the sea-ice hole. Large southward streams over Asia and America were also persistent, allowing cold air to spread there. We hypothesize that the sea-ice hole and Pacific atmospheric rivers were responsible for the cold winter, using data analyses and numerical experiments. We argue that the presence of the sea-ice hole resulted in formation of atmospheric rivers that penetrated into the Arctic with anomalous south winds toward the sea-ice hole, which led to more warm water injected into the sea-ice hole by the wind-driven current through Bering Strait. Poleward propagation of the atmospheric rivers made upper air warm, leading to their upgliding, which further heated the overlying air, causing poleward jet meanders. As a part of the response the jet meandered southward over Asia and North America, resulting in cold intrusions. This winter may be the first year when the sea-ice hole shifted the dynamics of hemispheric climate to the new state, with potential for self-sustainability.

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term1 hgt500hPa yr30 re

