Arctic sea ice loss and recent extreme cold winter in Eurasia

Masato Mori (1), Masahiro Watanabe (1), Masayoshi Ishii (2), and Masahide Kimoto (1)

(1) Atmosphere and Ocean Research Institute, The University of Tokyo, Kashiwa-shi, Japan (masato@aori.u-tokyo.ac.jp), (2) Meteorological Research Institute, Japan Meteorological Agency, Tsukuba-city, Japan

Extreme cold winter over the Eurasia has occurred more frequently in recent years. Observational evidence in recent studies shows that the wintertime cold anomalies over the Eurasia are associated with decline of Arctic sea ice in preceding autumn to winter season. However, the tropical and/or mid-latitude sea surface temperature (SST) anomalies have great influence on the mid- and high-latitude atmospheric variability, it is difficult to isolate completely the impacts of sea ice change from observational data.

In this study, we examine possible linkage between the Arctic sea ice loss and the extreme cold winter over the Eurasia using a state-of-the-art MIROC4 (T106L56) atmospheric general circulation model (AGCM) to assess the pure atmospheric responses to sea ice reduction. We perform two sets of experiments with different realistic sea ice boundary conditions calculated by composite of observed sea ice concentration; one is reduced sea ice extent case (referred to as LICE run) and another is enhanced case (HICE run). In both experiments, the model is integrated 6-month from September to February with 100-member ensemble under the climatological SST boundary condition. The difference in ensemble mean of each experiment (LICE minus HICE) shows cold anomalies over the Eurasia in winter and its spatial pattern is very similar to corresponding observation, though the magnitude is smaller than observation. This result indicates that a part of observed cold anomaly can be attributed to the Arctic sea ice loss. We would like to introduce more important results and mechanisms in detail in my presentation.