The associations of winter Atlantic SST, Arctic sea ice, and East Asian surface temperature

Muyuan Li\textsuperscript{1,2,3}, Dehai Luo\textsuperscript{2,3}, Ian Simmonds\textsuperscript{1}, Aiguo Dai\textsuperscript{4}, Linhao Zhong\textsuperscript{2} and Yao Yao\textsuperscript{2}

\textsuperscript{1} School of Earth Sciences, The University of Melbourne, Victoria, Australia
simmonds@unimelb.edu.au
\textsuperscript{2} CAS Key Laboratory of Regional Climate-Environment for Temperate East Asia, Institute of Atmospheric Physics, Chinese Academy of Sciences, Beijing, China
\textsuperscript{3} University of Chinese Academy of Sciences, Beijing, China
\textsuperscript{4} Department of Atmospheric and Environmental Sciences, University at Albany, SUNY, Albany, NY, USA

We are investigating the physical processes underlying recent winter cold anomalies over East Asia (EA). The Arctic region has experienced a rapid loss of sea ice in winter since the 1990s (Simmonds 2015), whereas EA has shown a large cooling trend during the winter months (Yao et al. 2017; Luo et al. 2017). Considerable research has been devoted to determining if there is a direct connection between these two occurrences, and what mediating factors might be present (Screen and Simmonds 2013; Luo et al. 2019a, b), such as high-latitude blocking (Luo et al. 2017, 2018). In addition, there is some evidence to indicate that anomalies in the North Atlantic Ocean can initiate teleconnection wave trains that can influence both Arctic sea ice and Eurasian climate (Simmonds and Govekar 2014; Luo et al. 2016, 2017).

Our analysis is aimed at determining which specific aspects of Atlantic SST variability might be linked to Arctic ice loss. We have undertaken this by decomposing winter SST variability into its first four EOF modes (Fig. 1) and exploring the ‘downstream’ impacts of each of these separately. Each mode induces a different large-scale circulation response. It is shown that the extent to which temperature over EA is impacted, in turn strongly depends on whether the sea ice anomalies are able to set up a persistent anticyclonic structure (or ‘block’) over the Ural Mountains region of western Russia (at about 60°E). Full details of the investigation are presented in Li et al. (2020).

References


Luo, D. et al., 2019: Weakened potential vorticity barrier linked to recent winter Arctic sea ice loss and midlatitude cold extremes. *J. Climate*, 32, 4235-4261.


---

![Fig. 1: First four EOFs of detrended and normalized winter (DJF) SST anomalies (for the period 1958–2016).](image-url)