Sea ice variability associated with nearshore-offshore water change in the Arctic marginal seas

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In the context of climate change, the Arctic Ocean has lost its perennial sea ice in the past decades. As a result, the majority of sea ice covering the Arctic marginal seas has become first-year ice, which presents the large interannual variability in terms of its annual minimum extent in summer. Previous studies attributed most of the interannual variability of Arctic-wide sea ice extent in summer to atmospheric internal variability. However, in the marginal seas, the water exchange between the Arctic marginal seas and offshore deep waters is likely important to the interannual variability of marginal sea ice, yet its impact is not well understood. Arctic coastal environments are exposed to emerging changes, such as wave environments and associated coastal erosion, and use as shipping routes. Better understanding of the sea ice variability over the Arctic marginal seas is desired for managing adaptation to the changes. In this study, we present the results from a high-resolution coupled ice-ocean model covering the Laptev, East Siberian, and Chukchi Seas and evaluate quantitative contributions of atmospheric forcings (e.g. downward longwave radiation) and oceanic forcings (i.e. heat transport from the offshore deep water) to the thermal variability over the marginal seas, as well as to the variability of summer sea ice extent in these regions. We also discuss how amomalously low sea ice extent in these marginal seas influence the circulation, and resulting impacts on nearshore-offshore water exchange.

Keywords: sea ice, Arctic marginal seas, numerical modeling

