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Memory effects of Eurasian land processes cause enhanced cooling in response to sea ice loss

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Amplified Arctic warming and its relevance to mid-latitude cooling in winter have been intensively studied. Observational evidence has shown strong connections between decreasing sea ice and cooling over the Siberian/East Asian regions. However, the robustness of such connections remains a matter of discussion because modeling studies have shown divergent and controversial results. Here, we report a set of general circulation model experiments specifically designed to extract memory effects of land processes that can amplify sea ice–climate impacts. The results show that sea ice–induced cooling anomalies over the Eurasian continent are memorized in the snow amount and soil temperature fields, and they reemerge in the following winters to enhance negative Arctic Oscillation-like anomalies. The contribution from this memory effect is similar in magnitude to the direct effect of sea ice loss. The results emphasize the essential role of land processes in understanding and evaluating the Arctic–mid-latitude climate linkage.