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European weather sensitivity to Barents-Kara sea-ice variability

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The rapid decline of sea-ice cover in the Arctic has recently instilled great interest in the atmospheric dynamics community, who has been trying to understand the links between this region and the extra-tropical circulation. One of the aspects that has attracted attention has been the so-called Arctic Amplification mechanism linked to the sea ice variability over the Barents and Kara seas (B-K). In this work, we investigate this link and show that changes in the tropospheric circulation over the Euro-Atlantic sector can be associated with sea ice variability in B-K.
The links between the local response in the surroundings of the B-K seas, expressed in terms of temperature and pressure anomalies, and atmospheric regimes in the North Atlantic, identified with a low-level jet index and a blocking index, are investigated looking at 16 years of winter weather reanalyses. It is found that cooling over Western Europe can be caused, or at least enhanced, by the atmosphere dynamics response to low B-K sea ice conditions. Reanalyses of the 100 hPa heat flux and of the intensity of the stratospheric polar vortex suggest that a two-way coupling troposphere-stratosphere is one of the key physical mechanisms linking the B-K seas and the Euro-Atlantic variability. Years with low ice cover are found to be associated with enhanced high-latitude blocking activity in the North Atlantic, with increased occurrence of low-latitude jet events that induce cold-air advection over Europe. In this framework, blocking events can be interpreted both as the cause and the consequence of the intense coupling between the lower and the upper atmosphere by means of vertical propagation of planetary waves. The impact of B-K sea ice variability over Europe thus appears to be associated with a positive feedback between high latitude blocking and changes in the stratospheric circulation. Although the variability of early winter B-K sea ice is probably only one of factors driving the coupling, we speculate that it has a potential role in the predictability of a class of severe events in Europe.