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Sea ice in the Barents Sea: variability and climate feedbacks in a global coupled model

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Sea ice variability in the Barents Sea and its impact on climate are analyzed using a 465-year control integration of the global coupled atmosphere-ocean-sea ice model ECHAM5/MPI-OM. Sensitivity simulations are performed to investigate the response to an isolated sea ice anomaly in the Barents Sea.

The interannual variability of sea ice volume in the Barents Sea is mainly determined by variations in sea ice import into Barents Sea from the Central Arctic. This import is primarily driven by the local wind field. Horizontal oceanic heat transport into the Barents Sea is of minor importance for interannual sea ice variations but is important on longer time scales. Events with strong positive sea ice anomalies in the Barents Sea are due to accumulation of sea ice by enhanced sea ice imports and related NAO-like pressure conditions in the years before the event. Sea ice volume and concentration stay above normal in the Barents Sea for about two years after an event. This strongly increases the albedo and reduces the ocean heat release to the atmosphere. Consequently, air temperature is much colder than usual in the Barents Sea and surrounding areas. The cooling is largest in the lower troposphere, which leads to enhanced vertical stability in the atmosphere. A cold high pressure system forms over the Barents Sea and precipitation is decreased. The large-scale atmospheric response is limited with the main impact being a reduced pressure over Scandinavia in the year after a large ice volume occurs in the Barents Sea. Furthermore, high sea ice volume in the Barents Sea leads to increased sea ice melting and hence reduced surface salinity. Generally, the climate response is smallest in summer and largest in winter and spring.