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Atmospheric winter response to Arctic sea ice changes in reanalysis data and model simulations

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In recent years, Arctic regions showcased the most pronounced signals of a changing climate: Sea ice is reduced by more the ten percent per decade. At the same time, global warming trends have their maximum in Arctic latitudes often labled Arctic Amplification. There is strong evidence that amplified Arctic changes feed back into mid-latitudes in winter. We identified mechanisms that link recent Arctic changes through vertically propagating planetary waves to events of a weakened stratospheric polar vortex. Related anomalies propagate downward and lead to negative AO-like situations in the troposphere. European winter climate is sensitive to negative AO situations in terms of cold air outbreaks that are likely to occur more often in that case. These results based on ERA-Interim reanalysis data do not allow to dismiss other potential forcing factors leading to observed mid-latitude climate changes. Nevertheless, properly designed Atmospheric General Circulation Model (AGCM) experiments with AFES and ECHAM6 are able to reproduce observed atmospheric circulation changes if only observed sea ice changes in the Arctic are prescribed. This allows to deduce mechanisms that explain how Arctic Amplification can lead to a negative AO response via a stratospheric pathway. Further investigation of these mechanisms may feed into improved prediction systems.