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Impact of Arctic sea ice variations on winter temperature anomalies in northern hemisphere land areas in multi-model ensemble simulations

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This study investigates if the recent Arctic sea-ice loss has contributed to temperature trends in 10 mid and high latitude land areas of the northern hemisphere and if Arctic sea ice variations are important for the temperature variations in these land areas. Numerical ensemble experiments with five different state-of-the-art atmospheric models, performed in the NordForsk funded project GREENICE, have been used to quantify the impact of the observed sea ice variations versus the total effect of observed ice and sea surface temperature variations.
We find that the observed trends in sea ice are only of minor importance for the temperature trends in almost all land areas, except for north-eastern Canada where the sea ice reduction trend dominates the temperature trend. Our multi-model experiments do not indicate any relation between observed sea ice trends and a cooling in mid or high northern latitude land areas in winter. Despite a small impact on temperature trends, sea ice seems to be an important factor for the temperature variations over the European and Asian land areas. Winter temperature in experiments using sea ice variations and climatological SST as lower boundary forcing and temperature in experiments using full SST and ice variations, are correlated with 0.78 in northern Europe. Northern Europe is also the region, which shows the highest correlation between the multi-model ensemble mean and the observed winter temperature.
We further analyzed if the cold winters in 2009/ 2010 and 2010/ 2011 in Northern Europe could be reproduced by our models. The results indicate that winter 2009/ 2010 is not well reproduced in the models while winter 2010/ 2011 is much better reproduced. However, the spread among models and particular between single ensemble members is extremely large, indicating a huge natural variability.