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High-impact winter weather in EURO-CORDEX climate models and their links to large-scale atmospheric circulation

Eva Plavcová[1], Ondřej Lhotka[1,2], and Jan Stryhal[1]
[1]Institute of Atmospheric Physics of the Czech Academy of Sciences, Prague, Czech Republic (plavcova@ufa.cas.cz)
[2]Global Change Research Institute of the Czech Academy of Sciences, Brno, Czech Republic

Regional Climate Models (RCMs) are powerful tools to study changes in the climate system on the regional scale. However, the reliability of their simulations has been considerably limited by the longstanding issue that climate models often fail to reproduce various aspects of the historical climate. In our study, we analyse how RCMs from the EURO-CORDEX project are able to reproduce high-impact winter weather. We analyse temporal and spatial characteristics of snowfalls, wind gust, extreme temperatures, late spring frosts, total precipitation, and winter storms. Model outputs are validated against observed data from the gridded European database (EOBS) and the novel ERA5 reanalysis. We focus on the Central European domain (defined roughly between 48–52°N and 10–20°E) over the 1979 – 2017 period. We investigate a set of 12 simulations of 4 different RCMs driven by 3 different global climate models which allow us to analyse the influence of driving data on the RCM's performance. Since local climate elements are relatively tightly linked to a large-scale atmospheric circulation over Europe in winter, we also evaluate the ability of RCMs to reproduce the atmospheric circulation and its links to selected high-impact winter weather in detail. Investigation of these links can lead to better physical understanding of the climate and to the identification of inadequacies in simulated characteristics of the studied events. All of this is an important step forward in further improving the models and enhancing the credibility of climate change scenarios based on climate model simulations.