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Impact of snow cover on European climate in high- and standard-resolution simulations with EC-Earth3

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In the past few decades, a significant reduction of snow cover extent in the North Hemisphere has been observed, particularly a noticeable decrease in spring since the late 1980s. Changing snow conditions can have wide-ranging direct and indirect effects on the climate. Snow cover variability exhibits strong influence on the atmospheric large-scale circulations and associated changes in patterns and variability of land surface conditions. Over Eurasia, a concurrent surface warming has been observed. With the motivation to better understand the impact of Siberian snow changes on European climate, we run the latest EC-Earth3 model in atmosphere-only mode (AMIP) to investigate this issue as part of the EU-H2020 PRIMAVERA project. One set of control simulations and one set with reduced snow albedo have been performed. Reducing the snow albedo leads to a substantial reduction of the snow cover all year-around. The experiments were done with two different horizontal resolutions, T511(∼40km) and T255 (∼80km) over the period 1980-2015. The high and standard resolution simulations comprise 5 and 11 ensemble members, respectively. All experiments start from initial conditions in 1980 that were taken from a previous spin-up simulation, and are forced with daily SST and SIC datasets that have been prepared for the PRIMAVERA project. The preliminary results show that reduced snow albedo induces anomalous anticyclonic circulation over mid- and high-latitude regions, which contributes to surface warming, particularly in winter and spring. In addition, since some physical processes are strongly sensitive to horizontal resolution, climate response links with horizontal resolution changing are more robust for such processes-related variables , e.g. for precipitation. More detailed analyses of the impacts of a snow cover reduction will be presented in this study.