The effect of 3 °C global warming on hail in Europe

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Hail is a severe weather phenomenon in the Alpine region causing extensive damage to life and infrastructure. However, it is still unclear how hail events change in a future warmer climate. In the scClim project, we conducted convection-permitting regional climate simulations over Europe using the model COSMO with a $\sim$ 2.2 km horizontal resolution. The simulations encompass both present-day climate conditions for 2011 – 2021 and a climate scenario with a 3 °C global warming using a pseudo-global-warming approach. ERA5 reanalyses were used as boundary conditions and a CMIP6 simulation (MPI-ESM1-2-HR) for the large-scale climate-change signal. The simulations, with integrated online diagnostics for hail and lightning, provide total precipitation and maximum hail size estimates every 5 minutes, together with the maximum hourly lightning potential. This detailed model output allows for hail cell tracking in the climate simulations and the analysis of hail events in a warmer climate. The present-day simulation has been validated against observations of temperature, precipitation, hail and lightning. For hail in particular, the model validation with radar-based, station-based and crowd-sourced observations shows an overall good model performance in simulating hail on spatial, diurnal and seasonal scales. This allows further study of the climate signal of hail as simulated with the pseudo-global-warming approach. We plan to show first results of the simulation with a 3 °C global warming, namely, the changes in the spatial distribution and seasonal cycle of hail in Europe as well as the lifetime, storm area and location of hail cells.