



Future of severe thunderstorm environments in Europe: simulated changes and uncertainties

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Changes in conditions that support severe convective storms during the 21st century were studied using an ensemble of 14 regional EURO-CORDEX climate models at 0.44° resolution. The model ensemble represents a spectrum of local climate models run by different climate research institutes across Europe using boundary conditions provided by a range of global climate models. The present environment of (severe) thunderstorms is characterized by a historical control period spanning the years 1971 – 2000. Future changes were addressed by comparing two 30-year periods, 2021 – 2050 and 2071 – 2100 to the historical period. RCP4.5 and RCP8.5 scenarios were chosen to represent the scenarios of moderate climate change risk mitigation and no climate change risk mitigation.

The ensemble simulates an increase of latent instability over all of Europe until the end of the century. The increase is the largest, and most consistent among the ensemble models, over the south-central and north-eastern parts of the continent in the rcp8.5 scenario and the 2071 – 2100 period. This increase, caused by an increase of absolute moisture in the lower troposphere, suggests that environments supportive of thunderstorms will become more frequent. Over southern Europe, however, the number of precipitation events in the presence of instability was found to decrease. Deep-layer vertical wind shear will almost nowhere change significantly. An increase in the number of situations featuring pronounced instability, strong vertical wind shear and modelled precipitation is predicted, which indicates an increase of number of environments conducive to severe thunderstorms.

However, the increase is not uniform across Europe, with areas such as southwestern Europe showing less agreement in model projections than e.g. central Europe. Regional differences in the robustness of model simulations is discussed, as well as the sources of uncertainty in the model simulations. With a large difference in the number of severe thunderstorm environments among the individual models for the control period, final discussion point is the ability of ensemble to represent the occurrence of such environments in present climate. This is done by a comparison of EURO-CORDEX ensemble to ERA-Interim reanalysis.