



Future changes of severe thunderstorm frequency over Europe

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An ensemble of 15 EURO-CORDEX model runs was used to investigate the changes in the frequency of severe thunderstorm phenomena (large hail, severe wind gusts and tornadoes) over Europe. For each time frame and grid point, a probability of occurrence was calculated based on the degree of instability, vertical wind shear and the occurrence of precipitation. We show that the local annual probabilities of occurrence are very different for the three investigated phenomena. Future changes were addressed by comparing the RCP4.5 and RCP8.5 simulations to historical (control) runs. Historical runs span the 1971–2000 period, while the future studied periods are 2021–2050 and 2071–2100.

The frequencies of all studied phenomena are forecast to increase in the future due to the climate change, especially across south-central Europe. In the RCP8.5 scenario and the 2071–2100 period significant increases are forecast across large parts of Europe. In this case, the frequency of the phenomena increases by 20–70%. Regional differences in the increase are discussed and further analysed by considering the individual ingredients of severe thunderstorms. We show that instability is forecast to increase across all of Europe due to the increase in the absolute moisture content in the lower troposphere. On the other hand, no significant changes in the degree of vertical wind shear are forecast. For some regions in Europe (e.g. Iberian peninsula), drying of the atmosphere may result in the reduced potential for thunderstorm formation.