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Trends of rain, wind-, snow- and thunderstorm events during the 21st Century according to regional climate models

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Within the European Project Risk Analysis of Extreme Weather Impacts on Critical Infrastructure (RAIN), climate researchers have evaluated the evolution of severe weather probability during the 21st Century across Europe. The spatial distributions of the probabilities in the present climate were mapped and projections of changes according to the RCP 4.5 and RCP 8.5 climate scenarios were developed. The investigations by the European Severe Storms Laboratory, the Freie Universität Berlin, the Finnish Meteorological Institute focused on thunderstorm-related phenomena, windstorms and heavy precipitation, winter weather and forest fires, respectively. The analyses are primarily based on regional climate models covering the European domain in the World Climate Research Program Coordinated Regional Downscaling Experiment (EURO-CORDEX). Information to infer the probability of hazard occurrence was extracted from those datasets in several novel ways.

The projections for the 21st century indicate that a number of changes are to be expected across Europe. First, the windstorm hazard may become more relevant across continental Europe, while a slight decrease is expected across the Mediterranean region and the North Atlantic Ocean. Extreme precipitation, of both short (3 hour) and medium (24 hours) time ranges are forecast to increase across most of Europe. The increase will be most pronounced in North-Western Europe, especially over Scandinavia and across the British Isles. The numbers of sub-daily, high-intensity events are predicted to increase at a higher rate than the number of long-duration events characterised by high accumulated rain amounts. Lightning will become more common, in particular across northern and central Europe. Conditions supportive of severe thunderstorms with large hail, tornadoes and severe wind gusts become more likely as well, especially in south-central Europe. Heavy snowfall, blizzards and snow load should become less likely across much of Europe, with the exception of central and northern Fennoscandinavia and northern Russia, where increases are predicted for heavy snowfall and snow load. The occurrence of freezing rain is expected to undergo a northward shift, with slight decrease in probability in central Europe but intensification in Fennoscandinavia and Northern Russia.