



Future projections of freezing rain climatology in Europe

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Freezing rain is a rare but potentially high impact weather phenomenon affecting Europe. Major events cause substantial damage to critical infrastructure and forestry. As part of the EU FP7 RAIN and SAFIR2018 EXWE projects, future estimations of freezing rain occurrence were calculated based on an ensemble of six EURO-CORDEX regional climate models with medium (RCP4.5) and strong (RCP8.5) emission scenarios on 0.44° spatial and 6-hourly time resolutions. A precipitation typing algorithm was applied to modelled time series to detect the freezing rain events. The occurrence of freezing rain events above two impact thresholds, 5 mm/day and 25 mm/day – defined based on the impact of freezing rain events on critical infrastructure – were then evaluated from the sub-daily results. Finally annual probabilities of freezing rain, and their changes between the baseline (1971-2000) and future (2021-2050 and 2071-2100) periods, were calculated.

Freezing rain occurs mostly in central and eastern Europe in the present-day climate. Mountainsides are also prone to experience the phenomenon. Inter-model differences dominate the quantitative result for the 5 mm/day impact threshold, but generally the models agree qualitatively that towards future, freezing rain decreases in central and south-eastern Europe, and increases in northern and north-eastern parts of the continent. Annual probabilities of 25 mm/day freezing rain events are so rare and spatially inconsistent in present-day and future climates that climate change projections for this threshold are not possible.