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An additive regression convective hazard model (ARCHaMo) for detecting past and future trends in severe weather events

Anja T. Rädler (1,2,3), Pieter Groenemeijer (3), Tomáš Púčik (3), Robert Sausen (4,2), and Eberhard Faust (1)

(1) Munich Re, Geo Risks Research, Munich, Germany, (3) European Severe Storms Laboratory e.V. (ESSL), Wessling, Germany, (4) Deutsches Zentrum für Luft- und Raumfahrt, Institut für Physik der Atmosphäre, Oberpfaffenhofen, Germany, (2) Meteorological Institute, Ludwig-Maximilians-University (LMU), Munich, Germany

We developed an additive regression convective hazard model (ARCHaMo) for severe weather events such as large hail and severe wind gusts taking a range of atmospheric parameters into account.

First, a model for the probability of thunderstorm occurrence P(storm) was developed as a function of several predictors derived from the ERA-Interim global atmospheric reanalysis. Lightning data served as evidence for thunderstorm occurrence. Second, the probably for hail exceeding 2 cm in diameter and severe wind gusts exceeding 25 m s^{-1} given that a convective storm occurred in the first place P(hazard|storm) for both hazards hail and wind were modeled. Third, the final hazard probability P(hazard) was defined as the product of P(storm) and P(hazard|storm).

The method was evaluated within the time period 2008 and 2013 for Central Europe. It will be shown that the annual cycles and spatial distribution of lightning, and of the hail and wind hazards are reproduced reasonably well by ARCHaMo.

To detect changes in lightning, hail and wind occurrence during the last decades, the statistical models have been applied to the period between 1979 and 2013. We have detected an increase in 6 hourly periods with thunderstorm occurrence of 19% across Germany and the Alps and 10% across Central and Western Europe. The occurrence of hail (wind) has increased by 78% (54%) across Germany and the Alps and by 28% (15%) across Central and Western Europe.

The frequency of severe weather in future climate scenarios was calculated by applying the models to an ensemble of EuroCORDEX regional climate simulations. We will present the modeled trends and changes in severe weather variability for future climates.