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Probabilistic modeling of European severe convective storm risk – from research to insurance application

Michèle Lai (1), Alison Dobbin (2), Philip Haines (2), Marc Hill (2), and Juergen Grieser (2)
(1) Risk Management Solutions, Zurich, Switzerland, (2) Risk Management Solutions, London, United Kingdom

Severe convective storms are an inherent part of the European climate risk landscape. They are the third largest natural peril in Europe by average annual insured loss and have caused more than € 20 billion economic loss in the last 10 years.

Severe convective storm risk is often managed using historical experience alone. However, recent events such as Hailstorm Andreas in 2013 or Hailstorm Ela in 2014 challenged (re)insurers in Europe to understand their risk and exposure against hail and other thunderstorm-related perils.

We develop a severe convective storm risk model for the (re)insurance industry. The model simulates thousands of years of convective storm activity across Europe, to capture the spatial and cross-peril correlation between hail, straight-line winds and tornadoes. For this, we use a combination of observations from the European Severe Weather Database, OPERA radar data and reanalysis data in a hybrid model that combines the benefits of both statistical modeling and parametrization of the meteorological processes driving these events.

The output of the hazard model is then fed into a vulnerability model, which converts hailstone size, wind gusts and tornado intensity into a loss damage, using an engineering model and results from hail impact tests on building component materials.

We validate results from our probabilistic model against industry loss data.