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Assessment of the hail hazard from a combination of radar and insurance data

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Over the last decades, loss due to severe hailstorms increased significantly in Central Europe. In the federal state of Baden-Württemberg, for example, most of the damage to buildings is caused by large hailstorms (1986-2008). Examples of severe hailstorms include the local-scale Villingen-Schwenningen hailstorm on 28 June 2006 or the hail streak on 26 May 2009 with a full track length of more than 500 km. Due to the high damage potential, quantifications of the hail hazard and risk as accurate as possible are essential for the economy, especially for the insurance industry. Within the frame of the project HARIS-CC (Hail Risk and Climate Change) it is aimed at quantifying the hail hazard for Germany in a high spatial resolution as well as estimating trends for the future (see abstract Mohr and Kunz, 2011).

Due to the local-scale impacts of a few hundred meters to some kilometres only, hailstorms and their intensities are not captured accurately and uniquely by a single observation system. Therefore, several appropriate meteorological data sets (3D / 2D radar, lightning, and radiosounding data) are used and combined to identify tracks of single hailstorms in the past. In order to exclude events without any loss-relevant hail, additional loss data from insurance companies, complemented by web-based information, are included in the analysis. The hailstorm tracks are projected on an equidistant grid (e.g., 10×10 km^2) to quantify their local density. In order to ensure a sufficient number of samples for the application of statistical methods, synthetic hailstorm tracks will be generated using stochastic modelling by taking into account predominant meteorological boundary conditions. The application of extreme value theory (peaks-over-threshold method and generalized Pareto distribution function) then allows estimating the intensity as a function of the probability or return period. The results reveal a high spatial variability of the intensity and probability of hail tracks that can be (partly) explained by orographic flow modifications. Furthermore, it will be discussed to what extent the radar data (radar reflectivity) match with hail-impacted areas as recorded by an insurance company.

In the future, a hail loss model will be created to convert measured and modelled intensities (e.g., radar reflectivity or hail kinetic energy) into monetary parameters like mean loss or maximum loss. From that, it is will be possible to quantify the local-scale hail risk for certain return periods.