



Overshooting cloud tops as a proxy for hail hazard and its application in a catastrophe risk model

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The 'overshooting' of cloud tops above the equilibrium level into the lower stratosphere indicates the presence of very strong convection. These overshooting tops (OTs) are often associated to severe weather conditions at the ground, including strong wind, heavy precipitation and hail. In particular, OTs have been identified as a suitable proxy for hailstorms. In combination with hail reports from the ESWD, the OT data set is used to build a climatology of hail events in Europe and to derive a stochastic risk model that is applied in the insurance industry.

We use OTs detected in an infra-red window (IRW) brightness temperature product of the Meteosat Second Generation (MSG) SEVIRI instrument covering most parts of Europe (30N-65N, 12W-40E) over the period 2004-2011. The atmospheric conditions close to OT detections are derived from ERA-INTERIM data and compared to those close to ESWD reports, and to the mean conditions during the study period. E.g., elevated CAPE and southerly wind component are identified as typical for hail days in most parts of Europe, while elevated surface minimum or 850hPa temperatures indicate higher hail risk only in the northern half of Europe.

For the development of a risk model, the quarter-hourly OT detections are grouped to 'OT events' representing the evolution of thunderstorms during the day, forming areas where hail fall is likely. The geometric properties and intensity of these events are used to construct a stochastic event catalogue. Minimum OT temperature is used as an indicator for hail size, the distribution of which is derived from ESWD. The resulting hail event catalogue is the first for Europe with a spatial distribution derived from a single homogeneous observation source. Key hail occurrence areas in central and southern Europe are represented, and high frequencies occur in regions neighbouring the Alps and the Pyrenees. A further maximum occurs in central Eastern Europe; hail events can however occur everywhere in Europe. Hail events are also often found to concern several countries. Consequences for further research and adaptation strategies are discussed.