Hail frequency in Europe based on overshooting cloud top detections filtered for hail-specific atmospheric conditions

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Hailfall is generally the most damage intensive phenomenon associated to convective storms and concerns most parts of Europe. Besides orographic features, the climatological frequency and intensity of hailstorms is expected to depend on climatic properties of the atmosphere. However, due to the poor climatological knowledge on hail, the relative roles of these aspects are barely understood.

We propose a continental scale, medium resolution climatology of hail risk based on the detection of cold overshooting cloud tops (OTs) from the MSG operational weather satellites, in combination with a hail-specific filter derived from the ERA-INTERIM reanalysis. This filter has been designed based on the atmospheric properties in the vicinity of hail reports registered in the European Severe Weather Database (ESWD). Selected properties include freezing level height, tropopause height or total column water vapor, evaluated on the nearest time step and interpolated from the reanalysis grid to the location of the hail report.

The major hail risk areas from most national scale hail climatologies are retained. The largest hail risk in Europe is found in Northern Italy, followed by Styria in Austria and Catalonia in Spain. Pronounced hail risk is also found in most continental medium mountain ranges, but not in the inner Alps.

This climatology is currently applied for risk modelling in the insurance sector and can serve as a reference for climate model studies on hailstorm frequency and variability.