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A Hail Storm Climatology for Switzerland

Cornelia Schwierz, Katharina Schrooer, Simona Trefalt, Urs Germann, Alessandro Hering, and Luca Nisi
MeteoSchweiz, Klima APK, Zurich, Switzerland (cornelia.schwierz@meteoswiss.ch)

Hail storms often cause severe damage, e.g. to cars, infrastructure and agriculture. With annual costs of several hundred millions of Euros, hail is among the costliest natural hazards in Switzerland. The localized and chaotic nature of hail storms poses a significant challenge to forecasters, insurers,
and risk managers. In the Alpine region, the complex topography and diverse climates make research on severe convective storms particularly challenging. Climatological analyses and event categorization studies on hail storms are still hampered by a lack of long-term and spatially coherent data.

The recently established public-private partnership project “National Hail Climatology Switzerland” between MeteoSwiss and stakeholders from the affected sectors (buildings, insurance, agriculture) aims at creating a novel, coherent, spatio-temporally differentiated hail climatology for Switzerland. It will advance our climatological understanding of highly heterogeneous hail storm occurrence as well as provide stakeholders with ready-to-use hail risk maps and data. These will then potentially feed into stakeholder applications, such as risk assessment, pricing or prevention tools.

The project makes use of a range of modern data sources that have become available in the past years. A new generation of observations at high spatio-temporal resolution (1 km2, 5 min) from the weather radar network operated by MeteoSwiss offers a high-quality, area-covering database to assess the frequency and intensity of hail events in Switzerland. Crowd-sourced data from the MeteoSwiss App and a new automatic ground sensor network aids in improving the radar algorithms with respect to hail observations at the ground.

Building on Nisi et al. (2016) and Nisi et al. (2018), this study presents an extended and updated climatology of the characteristics and distribution of hail storms in Switzerland for the period 2002 - 2018. Empirical radar-derived parameters of Probability of Hail (POH) and Maximum Expected Severe Hail Size (MESHS) are used to identify hotspots of hail activity as well as to estimate the risk of large hail stone occurrence. Furthermore, data from a radar-based storm tracking algorithm (Thunderstorm Radar Tracking TRT) allows estimation of the size, lifetime, and trajectories of individual hail storms. The climatology of these events provides valuable information on the regional-to-local scale peculiarities of hail.