

Hail in Switzerland – Modeled trends, decadal variability, and large-scale drivers

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There is still the need for a better understanding of what drives the inter- and intra-annual variability of hailstorms in Switzerland. We currently lack long-term, consistent information about the occurrence of Swiss hailstorms. To address this gap, we developed statistical models that reconstruct past hail days in the Swiss radar domain from 1959 to 2022 from environmental information from ERA5 trained on radar-based hail observations. Two regions north and south of the Alps are analyzed separately. The time series show a strong significant positive trend in yearly haildays in both the southern and northern domain, driven mainly by increased atmospheric instability and moisture in ERA5 in recent decades. We also see an increase in hail days at the beginning of the convective season but no systematic changes in the seasonal cycle over the last six decades. There is substantial natural variability in both regions. We investigate the large-scale mechanisms that influence this variability and the seasonal cycle of Swiss hail activity through analyzing synoptic composites, distinguishing between months and seasons with few and many hail days. Potential drivers and precursors include soil moisture conditions, sea surface temperature anomalies, large-scale variability patterns (Piper and Kunz, 2017), central European weather types (e.g. Rohrer et al., 2018), and cold fronts (Schemm et al., 2015, 2016). Together the results of this study shed new light on long-term trends, decadal variability and its drivers of Swiss hailstorms.