From observation to climatology: preparing 17-year radar- and NWP-based hail data series for climatological studies

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Hail is among the costliest natural hazards in Switzerland, close to the European Alps. It occurs on a yearly basis ruining harvests, and damaging cars and infrastructure. The localized and often short-lived nature of hail storms, along with the difficulty in measuring hail, pose challenges to weather forecasters, risk managers, and atmospheric researchers alike.

Hail occurrence can be estimated with algorithms such as e.g. Probability of Hail (POH) and Maximum Expected Severe Hail Size (MESHS), based on EchoTop heights (ET) from radar and environmental freezing level heights from numerical weather prediction (NWP) models. These two algorithms have been operationally running at MeteoSwiss since 2002 for observational purposes, as well as for nowcasting and warning activities. Such algorithms inherently include real-time radar measurement errors, which are often easily identifiable by eye by the forecasters, and do therefore not cause any major problem to warning activities. However, when data fields are averaged or summed up over extended periods of time, as is done when aiming to compile a 17-year long climatology of hail, radar artifacts or localized residual ground clutter may show up and suggest hail incidence where it does in reality not occur.

On this poster we show the many steps that we adopted in order to make the POH and MESHS data series originally used for observation, nowcasting and warning purposes better suited for climatological studies. The improvement of the POH and MESHS products included employing numerical weather prediction (NWP) analyses instead of forecasts, homogenizing between different NWP model versions, smoothing the NWP output to remove the effect of storm cells on the environmental freezing level height field, revisiting EchoTop computation, identifying and deleting residual ground clutter pixels, and eliminating other radar artefacts. We will comment on the possibility of making these adjustments automatic in the future.

The presented work is part of the project “National Hail Climatology Switzerland”, within which scientists and stakeholders work together to generate a novel, consistent, spatially and temporally differentiated hail climatology for Switzerland. The aim is to advance our climatological understanding of highly heterogeneous hail storm occurrence as well as to create and provide ready-to-use maps and data for various applications in risk management and damage prevention.

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