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An empirical relation between Swiss hail occurrence and monthly environmental parameters

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Hail can develop in mid-latitude thunderstorms and cause serious damages to cars, buildings, crops and injure livestock or people, making it one of the most costly natural disasters in Switzerland.
The prediction of thunderstorms, and in particular hail, is a challenging task for operational weather forecast models, due to often short temporal scale, the small spatial scale and the complexity of the involved processes. Moreover, most of the time, only short-term forecasts are possible. Due to the high risk potential associated with large hail and in perspective of a changing climate, the local probability and intensity of hail has gained interest, in particular for loss prevention and risk management purposes.

The aim of this study is to provide an empirical relationship between monthly environmental parameters and hail frequency over Switzerland, provide a framework for extended range forecasts of hail and study its long-term variability.
First, hail-producing thunderstorms are detected combining weather radar imagery and information from numerical weather prediction models for the months April to September 2002-2014. The number of hail events is then summed for each month.
For the same period, monthly averaged environmental parameters, which have been identified as important for hail formation in previous studies, are computed at 1° resolution from the ERA-Interim ECMWF reanalysis.
The monthly environmental parameters are linked to the number of hail events through a Poisson regression model, similar to the method used in Allen et al. 2015.
Using the model outcome, the occurrence of hail is computed for a period prior 2002 and the results are compared to hail reports from an insurance company.
Potentially, the model can be applied to regional climate models to forecast the future monthly hail occurrence.

References:

Allen, J. T., M. K. Tippett, and A. H. Sobel (2015), An empirical model relating U.S. monthly hail occurrence to large-scale meteorological environment, J. Adv. Model. Earth Syst., 7, 226–243