



Modelling the economic losses of historic and present-day high-impact winter storms in Switzerland

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Severe winter storms such as “Vivian” in February 1990 and “Lothar” in December 1999 are among the most destructive meteorological hazards in Switzerland. Disaster severity resulting from such windstorms is attributable, on the one hand, to hazardous weather conditions such as high wind gust speeds; and on the other hand to socio-economic factors such as population density, distribution of values at risk, and damage susceptibility. For present-day winter storms, the data basis is generally good to describe the meteorological development and wind forces as well as the associated socio-economic impacts. In contrast, the information on historic windstorms is overall sparse and the available historic weather and loss reports mostly do not provide quantitative information. This study illustrates a promising technique to simulate the economic impacts of both historic and present winter storms in Switzerland since end of the 19th century.

Our approach makes use of the novel Twentieth Century Reanalysis (20CR) spanning 1871-present. The 2-degree spatial resolution of the global 20CR dataset is relatively coarse. Thus, the complex orography of Switzerland is not realistically represented, which has considerable ramifications for the representation of wind systems that are strongly influenced by the local orography, such as Föhn winds. Therefore, a dynamical downscaling of the 20CR to 3 km resolution using the Weather Research and Forecasting (WRF) model was performed, for in total 40 high-impact winter storms in Switzerland since 1871. Based on the downscaled wind gust speeds and the climada loss model, the estimated economic losses were calculated at municipality level for current economic and social conditions.

With this approach, we find an answer to the question what would be the economic losses of e.g. a hazardous Föhn storm – which occurred in northern Switzerland in February 1925 – today, i.e. under current socio-economic conditions. Encouragingly, the pattern of simulated losses for this specific storm is very similar to historic loss reports. A comparison of wind gust speeds with simulated storm losses for all highly damaging winter storms in Switzerland since the late 19th century considered in this study shows that storm losses have been related primarily to population density (and distribution of values at risk, respectively) rather than hazardous wind speed.