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Impacts of winter storms on residential building damage - Modeling claim ratio considering parameters of vulnerability and exposure

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Severe winter storms are one of the most damaging natural hazards for European residential buildings. Previous studies mainly focused on the loss ratio (loss value/total insured sum) as a monetary value for damages (e.g. Prah1 et al. 2012; Pardowitz et al. 2016). In this study the focus is on the claim ratio (number of insured claims/number of contracts), which is derived from a storm loss dataset provided by the German Insurance Association. In a first step, loss ratios and claim ratios in German administrative districts are compared to investigate differences and similarities between the two variables. While there is no significant change in the ratio between claim ratio and loss ratio with increasing wind speeds, a tendency for lower loss ratios in urban areas can be confirmed. In a second step, a generalized linear model for daily claim ratios is developed using daily maximum wind gust (ERA5) and different non-meteorological indicators for vulnerability and exposure as predictor variables. The non-meteorological predictors are derived from the Census 2011. They include information about the district-average construction years, the number of apartments per buildings and others to get a better understanding of these factors concerning the number of buildings affected by windstorms. The modeling procedure is divided into two steps. First, a logistic regression model is used to model the probability of storm damage occurrence. Second, generalized linear models with different link functions are compared regarding their ability to predict claim ratios in case a storm damage occurred. In a cross-validation setting a criteria for model selection is implemented and the models of both steps are verified. Both steps show an improvement over the climatological forecast.