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Meteorological and hydrological conditions triggering rockfall events in Germany

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In this study we present the results of a logistic regression model aimed at describing changes in probabilities for rockfall events in Germany in response to changes in meteorological and hydrological conditions.

The rockfall events for this study are taken from the landslide database for Germany (Damm and Klose, 2015). The meteorological variables we tested as predictors for the logistic regression model are daily precipitation from the REGNIE data set (Rauthe et al. 2013), hourly precipitation from the RADKLIM radar climatology (Winterrath et al., 2018) and temperature from the E-OBS data set (Cornes et al., 2018). As there is no observational soil moisture data set covering the entire country, we used soil moisture modelled with the state-of-the-art hydrological model mHM (Samaniego et al. 2010), which was calibrated using gauge measurements.

In order to select the best statistical model we tested a large number of physically plausible combinations of meteorological and hydrological predictors. Each model was checked using cross-validation. The decision on the final model was based on the value of the logarithmic skill score and on expert judgement.

The final statistical model includes the local percentile of daily precipitation, total relative soil moisture and freeze-thawing cycles in the previous weeks as predictors. It was found that daily precipitation is the most important parameter in the model. An increase of daily precipitation from its median to its 80th percentile approximately doubles the probability for a rockfall event. Higher soil moisture and the occurrence of freeze-thaw cycles also increase the probability for rockfall events.

Cornes, R. C. et al., 2018: An ensemble version of the E□OBS temperature and precipitation data sets. Journal of Geophysical Research: Atmospheres, 123, 9391– 9409.

Damm, B., Klose, M., 2015. The landslide database for Germany: Closing the gap at national level. Geomorphology 249, 82–93

Rauthe, M. et al., 2013: A Central European precipitation climatology – Part I: Generation and validation of a high-reso-lution gridded daily data set (HYRAS), Vol. 22(3), p 235–256.

Samaniego, L. et al., 2010: Multiscale parameter regionalization of a grid-based hydrologic model at the mesoscale. Water Resour. Res., 46,W05523

Winterrath, T. et al., 2018: RADKLIM Version 2017.002: Reprocessed gauge-adjusted radar data, one-hour precipitation sums (RW), DOI: 10.5676/DWD/RADKLIM_RW_V2017.002.