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Estimating rockfall release scenarios based on a straightforward rockfall frequency model

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A realistic quantification of rockfall risk is crucial for an effective and efficient prevention of damages. The estimation of realistic block and event volumes as well as their release frequencies remain a major challenge and are often based on mere expert estimation. Based on the analysis of the rockfall frequency and volume of a wide range of rock cliffs, Hantz et al. (2020) proposed a power law based model for the determination of rockfall magnitude-frequency aiming at a more objective approach for practitioners. It assumes that both, the released masses of rockfall events as well as the individual blocks of a rockfall event follow a power law distribution. The parameters of these distributions are determined using a simple classification of rock structure in combination with field measurements of blocks. In this study, we applied and tested the proposed rockfall frequency model (RFM) at 8 different sites at 7 locations in the Swiss Alps. The calculated frequencies of rockfall events and the derived block volumes were compared to release scenarios of official hazard assessments as well as inventory data. Block volume distributions of all sites could be well fitted by power law distributions (fitted b values between 0.69 to 1.69). The rockfall event and block volumes are in a comparable range as the scenarios of the official hazard assessments, but generally slightly larger. The differences increase with the return period. For all sites, the parameter sensitivity of the RFM is relatively large, in particular for return periods of 100-300 years. Nevertheless, the method proposed in this study allows for a more objective and consistent estimation of rockfall scenarios and thus has the potential to substantially improve the mostly opaque determination of rockfall scenarios. The results further show that the block volume scenarios for pre-defined return periods strongly depend on the considered cliff size, which does not appear to be consistently taken into account in current hazard assessments. However, the study should be extended to additional sites and the parameter estimation has to be optimised to come up with a consistent and transparent method to estimate rockfall frequencies in practice.