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# Topographic Avalanche Risk: DEM Sensitivity Analysis

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GIS-based models are frequently used to assess the risk and trigger probabilities of (snow) avalanche releases, based on parameters and geomorphometric derivatives like elevation, exposure, slope, proximity to ridges and local relief energy. Numerous models, and model-based specific applications and project results have been published based on a variety of approaches and parametrizations as well as calibrations. Digital Elevation Models (DEM) come with many different resolution (scale) and quality (accuracy) properties, some of these resulting from sensor characteristics and DEM generation algorithms, others from different DEM processing workflows and analysis strategies. This paper explores the impact of using different types and characteristics of DEMs for avalanche risk modeling approaches, and aims at establishing a framework for assessing the uncertainty of results. The research question is derived from simply demonstrating the differences in release risk areas and intensities by applying identical models to DEMs with different properties, and then extending this into a broader sensitivity analysis. For the quantification and calibration of uncertainty parameters different metrics are established, based on simple value ranges, probabilities, as well as fuzzy expressions and fractal metrics. As a specific approach the work on DEM resolution-dependent 'slope spectra' is being considered and linked with the specific application of geomorphometry-base risk assessment. For the purpose of this study focusing on DEM characteristics, factors like land cover, meteorological recordings and snowpack structure and transformation are kept constant, i.e. not considered explicitly. Key aims of the research presented here are the development of a multi-resolution and multi-scale framework supporting the consistent combination of large area basic risk assessment with local mitigation-oriented studies, and the transferability of the latter into areas without availability of higher resolution elevation modes. Worked examples are provided from different DEMs for Alpine as well as Central Asian study areas (including an avalanche cadaster of a mountain road in the Kyrgyz Republic), exploring the transfer of uncertainty parameters into regions where only lower resolution DEMs are available.