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A regional analysis of elements at risk exposed to mountain hazards in the Eastern European Alps

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We present a method to quantify the number and value of buildings exposed to torrents and snow avalanches in the Austrian Alps, as well as the number of exposed people. Based on a unique population and building register dataset, a relational SQL database was developed that allows in combination with GIS data a rule-based nation-wide automated analysis. Furthermore, possibilities and challenges are discussed with respect to the use of such data in vulnerability assessment and with respect to resilience measures. We comprehensively address the challenge of data accuracy, scale and uncertainties.

From the total of approximately 2.4 million buildings with a clearly attributable geographical location, around 120,000 are exposed to torrent processes (5 %) and snow avalanches (0.4 %); exposition was defined here as located within the digitally available hazard maps of the Austrian Torrent and Avalanche Control Service. Around 5 % of the population (360,000 out of 8.5 million inhabitants), based on those people being compulsory listed in the population register, are located in these areas.

The analysis according to the building category resulted in 2.05 million residential buildings in Austria (85 %), 93,000 of which (4.5 %) are exposed to these hazards. In contrast, 37,300 buildings (1.6 %) throughout the country belong to the category of accommodation facilities, 5,600 of which are exposed (15 %). Out of the 140,500 commercial buildings, 8,000 (5 %) are exposed.

A considerable spatial variation was detectable within the communities and Federal States. In general, an above-average exposition of buildings to torrent process and snow avalanches was detectable in communities located in the Federal State of Salzburg, Styria and Vorarlberg (torrents), and Tyrol and Vorarlberg (snow avalanches). In the alpine part of Austria, the share of exposed accommodation buildings was two times (Salzburg) and three times (Vorarlberg) higher than the regional average of exposed buildings, and the share of agricultural buildings was around 50 % lower than on the national level. A significantly higher share of people is exposed in Salzburg (torrents) and Tyrol and Vorarlberg (snow avalanches); nevertheless, there is a need for a further in-depth local analysis.

The results clearly indicate that an assessment using nation-wide data on buildings and population has advantages in vulnerability assessment compared to traditional approaches. However, the data has some limits if information on the large scale of individual catchments is needed, which restricts the application when an increase in resilience towards mountain hazards is targeted.