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Evaluation of the protective capacity of forests against snow avalanches in the Chilean Andes

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Abstract

Mountain forests play an important role as a protective measure against snow avalanches. Forests can prevent avalanche release as well as decelerate running avalanches. Yet, this important function of forests needs to be locally assessed and quantified, as it varies according to different parameters such as topography, terrain roughness, forest type, as well as crown closure, vertical structure and stage of development of the trees. In addition, regional weather conditions determine the type of avalanches that can occur, including powder avalanches, flowing avalanches, or a combination of both. Much research on forest-avalanche interactions has been conducted in the Alps and in other mountain chains where the forest has an important biological functions against natural hazards. In other regions like the Southern Andes, this value of mountain forests has been practically neglected and thus underutilized. Two-dimensional avalanche simulation models, such as AVAL-1D and RAMMS, are widely used for hazard mapping and engineering to predict runout distances and impact pressures of snow avalanches. Recently, the function of mountain forest in decelerating snow avalanches has been implemented in RAMMS. The main goal of our investigation is to apply and locally calibrate avalanche simulation models at selected locations of the Chilean Andes in order to provide tools for hazard mapping and disaster risk reduction. Given the scarcity of records of past avalanche events, dendrochronological methods are used in combination with remote sensing data to reconstruct spatio-temporal patterns of avalanches on slopes adjacent to populated areas. Preliminary results from recent avalanche events resulting in casualties and damage to infrastructure near Las Trancas, Biobío Region, demonstrate that mountain forests can play an important role in protecting local communities against natural hazards but that it can be very challenging to improve this protection effect. In collaboration with local authorities we are evaluating possibilities to better account for the value of ecosystems and to introduce hazard maps, which are at the moment inexistent for the study area.