# Submitted Abstract

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## Abstract

Snow avalanches are gravitative phenomena of snow masses that pose a potential hazard to populations living in cold mountainous regions. The classical techniques to mitigate the snow-avalanche hazard consists in constructing snow bridges or other types of snow supporting structures in the release area. Although these anti-avalanche structures effectively reduce the probability to release a snow mass, they cannot be built in potential release areas falling into protected natural sites due to constructive regulation constraints. In these cases, an alternative way to mitigate the snow-avalanche hazard corresponds to construct suitable naturalistic engineering structures in the runout zones.
In this work, we, firstly, identify some possible engineering works for a specific avalanche site belonging to the “Natura 2000” European network and, secondly, study how these engineering works can affect the snow-avalanche dynamics. For these purposes, we consider the “Val de Roseal” avalanche site (Trentino-Alto Adige, Italy) that was hit, in 1986, by an avalanche that partially destroyed some of the houses in its alluvial fan. As a preliminary step, we back-calculate the 1986 event using the numerical model TRENT2D# to calibrate the model parameters and highlight some interesting aspects of the avalanche site. The numerical results and a careful site inspection show how the presence in the alluvial fan of suitable vegetation and flat areas might affect the flow of a snow avalanche either by deviating or even by stopping it. To verify the capability of the vegetation and the flat areas to reduce the snow-avalanche hazard, we perform a series of simulations by modifying the topography of the alluvial fan of the study area and by considering different configurations and extent of the flat areas, different densities of the protection forests and different combinations of planes and vegetated areas. The results show that the planes act in reducing the runout distance and the dynamic pressure of the avalanche, while the vegetated areas act in deviating the avalanche flow. As regards the combination of planes and vegetated areas, this proposal overlaps the two previous effects. The planes are able to maintain the dynamic pressure in the runout zone lower than the literature limits above which the vegetated areas can be destroyed. In this way, the vegetated areas are allowed to apply their deviating effect, thus making the combination of planes and vegetated areas an effective engineering work against snow avalanches for the alluvial fan of the Val de Roseal site.