Dense avalanche friction coefficients influence of nivological parameters

High altitudes, heavy snow, and sharp mountainous relief of Mont Blanc massif make the upper part of the Arve valley (Chamonix, France) one of the most threatened areas by snow avalanches. 115 paths from this area were included in the avalanches national observatory, 26 of them have experienced between 20 and 100 events over a period of almost 100 years, among these avalanches 729 are posterior to 1958. Recently, Meteo France reconstructed, for all the French massifs, the daily evolution of the snowpack properties since 1958 producing a consistent data set with available measurements, advanced meteorological models and snow physics. These two data sources were combined to calibrate an avalanche dynamics model including sub models for friction, erosion, entrainment and deposition. First topographic profiles of the 26 well documented paths were built using an accurate laser scan model. Then, the snow conditions were determined from the reconstructed snow packs for each of the 729 avalanches. Finally the full range of friction coefficients was scanned and a numerical simulation was performed for each pair of friction parameters and thus the corresponding run-out altitude determined. Only the pairs of parameters, for which the run out altitude is found close enough to the observed one (+/-5m), was retained. Statistical methods such as CPA and stepwise were used to investigate correlations between the obtained friction coefficients and the snow properties. Concerning the static friction coefficient, an increasing tendency with the temperature and the density was evidenced as well as a decreasing tendency with the liquid water content and the snow depth.

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