



Influence of snow properties on dense avalanche friction parameters

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The values of the Voellmy friction parameters of 735 historical avalanches that occurred along 26 paths in the Chamonix valley since 1958 are back-analysed with a depth-averaged hydraulic model including sub models for erosion, entrainment and deposition. For each path, the longitudinal and crosswise topographic profiles were derived from a high resolution digital elevation model acquired by laser scanning. The initial snow depth and snow cohesion, as well as various physical properties of snow, were computed from numerical simulations of the detailed snowpack model Crocus fed by the SAFRAN meteorological analysis. For each event, the full ranges of the two friction parameters were scanned and the pairs of friction parameters for which the run-out altitude is found close enough to the observed one (with an uncertainty of 5m), were retained. Statistical class analysis was used to investigate the correlation between the obtained friction coefficients and the snow physical properties. Concerning the inertial friction coefficient, no evident trend with the snow parameters was found. For the static friction coefficient, an increasing trend with the temperature and the density was observed, as well as a decreasing trend with the liquid water content and the initial snow depth.