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A regional approach for the simulation of extreme snow avalanches: a case study in the Italian Alps

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A regional method for simulation of extreme avalanches is developed and applied in Italian Alps. Data from some historical avalanche sites are used to evaluate regionally valid features of avalanche release probability, geometry and runout. A more than decadal series of daily snow fall data, is used to calibrate a statistical model able to simulate point daily snow fall, resulting into three day snowfall, used as the avalanche release depth. These findings are then used to set up a site specific model for long term simulation of avalanches occurrence. One particular site is considered, the Vallecetta mountain, of interest in view of the considerable avalanche events observed therein. Long term simulation of daily snow fall is performed, to be fed into a model of snow avalanche occurrence. Snow avalanches simulation for a period of 300 years is carried out, resulting in synthetic statistics of avalanche geometry, volume and end mark, well fitting the historical series. Then, a 1D dynamics model is used to evaluate hazard maps according to the Swiss Procedure, also adopted in Italy with slight changes. The proposed regional approach profits from increased sample dimensionality for model estimation and allows more accurate assessment of high frequency avalanches with respect to the derived approach based on three-day snow fall depth frequency analysis, so aiding in hazard mapping procedure and evaluation of countermeasures.