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A high resolution approach to define extreme spatial snow heights in avalanche release zones

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Over the last 80 years, avalanche-dynamic models have been increasingly used in land-use planning and for the design of protection measures. One of the important input parameters of such models is the mass of snow that is released within the avalanche starting zone. The variability of the snow pack depth in mountainous terrain and the lack of measurements of snow heights when extreme avalanche events occur make it difficult to define the releasing mass of snow. We present a high resolution approach containing of spatial snow depth measurements using terrestrial laser scanning that we extrapolate to approximate the volume of the slab. We compare this approach to extreme value statistics of snow depths of regional automatic stations such as the generalized extreme value distribution, the GUMBEL method and the modified PRO GUMBEL method. A horizontal resolution of 0.5 m and a vertical of 0.05 m was obtained by spatial snow depth measurements using terrestrial laser scanning using RIEGL LPM-321 laser devices. The measured snow depths were extrapolated according to extreme value statistics. The presented methodology was applied to case studies. We used the different results for snow depth as input for dynamic avalanche modeling carried out using the models ELBA, SAMOS and Aval-1D. According to the difference in input the results of the dynamic avalanche models such as run out length and pressure varied. The results are presented and their reliability for hazard mapping is discussed.