Critical length derived from weak layer shear strength spatial variability

Johan Gaume (1), Jürg Schweizer (1), Alec van Herwijnen (1), Benjamin Reuter (1), and Guillaume Chambon (2)

(1) WSL Institute for Snow and Avalanche Research, Davos, Switzerland (johan.gaume@gmail.com), (2) IRSTEA, UR ETGR, Grenoble, France

The primary process required for dry-snow slab avalanche release is failure initiation in a weak snow layer underlying a cohesive snow slab. The initiation is assumed to occur by damage accumulation followed by failure localization in a very weak zone of the weak layer so that a crack forms. If the crack further grows and reaches a certain (critical) size, it suddenly becomes self-propagating which may lead to catastrophic failure, i.e. avalanche release. For a 2-D snow cover on a slope, using the finite element method, we compute this critical length as a function of the properties of the snow slab and the spatially varying properties of the underlying weak layer. The simulation results suggest that the critical length increases with increasing slab stiffness and with increasing spatial variability (coefficient of variation and correlation length). Finally, we compare our results with field data of critical lengths obtained with either propagation saw tests (PSTs) or derived from snow micro-penetrometer (SMP) measurements.