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# Dry-snow slab avalanche release: recent measurements and observations

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Dry-snow slab avalanches can be viewed as the non-linear response to perturbations of the layered, spatially variable snow cover. The processes leading to dry-snow slab avalanche release occur over multiple scales and are of immense complexity. Dry-snow slab avalanches involve the release of a cohesive slab over an extended plane of weakness. As shear fracture below the slab spreads along the plane of weakness, high tensile stress develops upslope, leading to tensile fracture. It is accepted that the primary failure is between the slab and the substratum. The primary failure is commonly in slope-parallel shear, but occasionally compressive failure leads to the loss of shear support. The slab avalanche is the result of a failure and fracture process that covers a wide range of scales. According to a conceptual model, slab release starts with a damage process at the scale of the bonds between snow crystals. The damage will accumulate to a localized failure which will grow along the plane of weakness. When reaching a critical size, the fracture will eventually rapidly propagate below the slab. After tensile fracture the slab will fully detach and release, ending the process at the slope scale. We review the conceptual model from the point of recent measurements and observations. In doing so, we first present an overview of recent results of relevance for avalanche formation, including a) in-situ observations of sintering after slope collapse, b) spatial variability at different scales, and c) measurements of fracture toughness in the laboratory and in the field. We then discuss a recent theory proposing that weak layer collapse provides the fracture energy needed for fracture propagation. Finally, the importance of scale issues in modelling slab avalanche release, in particular when taking into account the spatially varying properties of the snow cover, will be reviewed, as some of the shortcomings of modelling snow avalanches with complex system methodologies (e.g. cellular automata) seem to be due to scale issues. Based

on these recent results we conclude that the previously proposed conceptual model is still a valid summary of our understanding but that substantial progress is under way.