

The Cryosphere Discuss., community comment CC1
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Comment on tc-2022-140

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Community comment on "A closed-form model for layered snow slabs" by Philipp Weißgraeber and Philipp L. Rosendahl, The Cryosphere Discuss.,
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This study develops an analytical model for the investigation of mechanical behavior of a stratified snow cover over a weak layer. The snow cover is considered as an arbitrarily layered beam solved by laminate mechanics, while the weak layer is modeled as a set of springs attached to the bottom of the snow cover. The model is firstly verified with the experimental data and the numerical results from finite element modeling, and then adopted to investigate the factors affecting slab release, including layering, bridging and slope angle. The key novelty of this study to the reviewer is the consideration of the layered snow, compared to the previous study conducted by the authors. The outcomes from this study could offer useful information for understanding the failure behavior of stratified snow over a weak layer, and thus give relevant information on slab avalanche release. However, there are some concerns to be clarified as detailed below.

1) Consideration of the crack: As described in the methodology, the model considers the weak layer as springs with normal and shear stiffnesses, and can handle different scenarios such as the ones with partially collapsed weak layer in Fig. 4. But it is not clear how the crack in the weak layer is considered and whether the scenarios in Fig. 4 are predefined. If the scenarios are predefined, how to determine these different initial conditions in practice? If not, please clarify the triggering of the crack. For example, what is the criteria to trigger the crack? Do the springs have certain shear and normal strength, above which they break? Please also discuss the propagation of the crack with time.

2) Comparison with the results from a homogeneous equivalent layer: In the results 4.1, the current model has been compared with the homogeneous model by Monti et al. (2015). It is stated that "Both concepts are benchmarked against the stiffnesses computed using finite element analyses", please clarify whether "both concepts" are the current model and the model by Monti et al. (2015). If yes, as they have been benchmarked already, why the model by Monti et al. (2015) does not have consistent stiffness with the FEA in Fig. 10? In addition, please clarify that if the correct equivalent stiffnesses are implemented to a homogeneous model such as that by Monti et al. (2015) or the previous model by the authors (Rosendahl and Weißgraeber, 2020a), will the homogeneous models give good prediction on the mechanical behavior of the slab?