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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Assessing fragility of a reinforced concrete element to snow avalanches using a non-linear mass-spring model" *by* Philomène Favier et al.

Anonymous Referee #3

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The paper 'Assessing fragility of a reinforced concrete element to snow avalanches using a non-linear mass-spring model' aimed to establish a bridge between civil engineering and the snow avalanche community. The authors proposed an efficient Single-Degree-of-Freedom (SDOF) model to account for the behavior of an Reinforced Concrete (RC) wall under snow avalanche pressures. The validity of the proposed approach was validated by using finite element and yield line theory analyses. Afterwards several reliability models were incorporated to obtain the so-called fragility curves for the different RC elements suffering from avalanche pressures. The authors also pointed out that their methods would be potentially applicable for the other natural hazards assessment such as rockfall or landslide engineering. It is found that

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Discussion paper

the paper was very well written, the mathematical analyses were sound, and most importantly, the perspective to develop a practical model for analyzing fragility of snow avalanche defense structures was particularly interesting. However, it is worth pointing out that in the paper the practical prospective of the proposed SDOF model in snow avalanches is yet less convincing. The critical point is that the model is based on the assumption that the load is only quasi-static and the inertial effects are not involved. It is thus suggested that the authors consider the following points: (1) In the introduction part the authors mentioned that 'Until now, very few fragility curves have been established for snow avalanches. ... Using such numerical approaches, snow avalanche fragility curves have recently been proposed (Favier et al., 2014; Ousset et al., 2016)'. How are these researches exactly handling non-uniform load in their models? (2) Is the proposed model more suitable for structural fragility assessment in a snow pack condition? Here the inertial effects are less important compared to snow avalanches. But even in this situation the load would not be uniform. (3) At the last paragraph of conclusions, the authors have stated that a further development of model considering typical time evolutions of the pressure signal is important. It would be great if the authors can already address a bit how one can extend their models to those non-uniform load cases. Small corrections: (1) In the caption of Figure 11, it should be 'mixed deterministic-statistical with sets (1,α,a) and (3,α,a)'. (2) In Figure 13c, the position of the label 'Pressure (kPa)' is not correct.

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