Natural Hazards
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Interactive comment on "Determining the drivers for snow gliding" *by* Reinhard Fromm et al.

Reinhard Fromm et al.

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We thank the reviewer for the comments and we address the various concerns below. In this answer we mainly consider questions and remarks from the general comments as well as major specific comments. However, we would include answers to all specific comments in a revised version of the manuscript. Reviewer comments are highlighted (R), with our response below (A) in each case.

R: [The story of the manuscript should be focused more towards answering the three research questions and towards the main conclusions (which are not yet so clear for me). Two of the three research questions are dealing with vegetation effects on snow gliding. So, this topic should be introduced and discussed better in the light of previous work and implications for land-use management.]

A: We agree that the research questions raised at the end of the introduction are not

adequately answered in the conclusion section. We will integrate more aspects of previous studies concerning vegetation and snow gliding. Especially, we will look more closely at the differences in vegetation (reported among others by Newesely et al. (2000) and Meusburger et al. (2014). Former investigations have shown that the vulnerability of alpine ecosystems to snow gliding increases with the reduction of agricultural use. High snow gliding rates were observed on low but soft dwarf shrub canopies which is an early stage in the secondary succession after abandonement. Referring to these findings, we will improve our 'introduction' as well as 'discussion' section.

R: [Some methodological aspects should be clarified (see also specific comments). Generally, the methods used in this work have been conducted carefully, but they partly fail at disentangling potentially confounding variables. Surprisingly significant results (e.g. effects of lichens and mosses on snow gliding) should thus be better checked for interactions with other variables or at least carefully discussed before publishing.]

A: Some variable names are not used consistently throughout. This leads to confusion in some parts of the manuscript and makes the manuscript difficult to comprehend. We will eliminate these flaws in a revised version of the manuscript. There are collinearities between some variables. This results from statistical analyses which are described and applied. To allow better interpretation of confounding effects as well as correlations, a correlation matrix for all used independent variables will be provided as supplemental material. Moreover, we will improve discussion on most valuable confounding effects in the revised version of the manuscript.

R: [The form and presentation of the manuscript could be improved in different ways (see also specific comments). Some parts of the text is not yet nicely structured in topical paragraphs. Some sections could be shortened without a loss of relevant information towards the main conclusions. Some captions to figures and tables are not 100% clear. The English language would deserve an additional check.]

A: The sections 'methods', 'results' and 'discussion' will be reorganized. The para-

graphs describing the test site and the snow gliding conditions will be assigned to the methods section. The section 'results' will then only contain results and we will take care to ensure that there are no new terms/results are shown in the discussion section. We will revise figure and table captions following your specific comments.

R: [Specific comments]

R: [P2, l. 11-16 – The paragraph on the role of vegetation is important for the understanding of the manuscript (2 of 3 research questions are dealing with vegetation effects). The paragraph would deserve thus some more attention in the introduction. In the current form the topic is just introduced by the statement that not much is known about vegetation effects (ignoring thus various publications on snow-glide vegetation effects) before the topic is again abruptly changed to LWC in the same paragraph.]

A: We will integrate more aspects of previous studies concerning vegetation and snow gliding and better represent this main topic of our study in the 'introduction' section (as already indicated in our answer to your general comments).

R: [P2, l 20-25, research questions: the two first research questions make sense, but the 2nd research question is not really introduced in the preceding introduction. The 3rd question is also relevant, but is in my eyes not really answered here. The manuscript provides some information on the association between snow gliding with different plant types (eg. mosses or lichens), but I can't find information about the effect of different land-use types (e.g. pasture, abandoned land).]

A: Throughout revision we will slightly adapt our research questions to the improved introductory part regarding snow gliding and vegetation impact. We will also add available information about different land-use types associated with variations of plant types.

R: [Section 2.1: the test-site section is quite long and partly redundant with Fig. 1. Please avoid where possible paragraphs with only 1 sentence (in the whole manuscript). I would also reduce the number of listed plant species (because most

readers of NHSS are probably not be familiar with them) and focus on the most characteristic and for snow gliding most relevant dwarf shrub and grass species (or vegetation types). It is not clear from the description of the study area if we have 2 or 3 treatments (is abandoned and unusable the same treatment or not). And are slope angles and other topographical variables the same for the different categories? Section 2.2.1 : The description of the design of the distribution of the glide shoes is rather vague. How many glide shoes were distributed in pastures vs abandoned land and which other criteria were used to distribute them?]

A: We will thoroughly revise figures and tables following your valuable comments. Information on spatial distribution of snow glide shoes as well as numbers will be added to Figure 1.

R: [p5, line 12-14. I'm a bit confused by the statement that about 0.5% of the data entries contain snowgliding and the data set was reduced to have an equal number of snow gliding vs. no snow gliding. I agree that the numbers of 0 and 1 in a logistic model should be similar or at least in the same range, so the approach seems ok for me. But this would means that c. 90% of the data entries without gliding have been thrown away. Could you provide here numbers of data entries with and without snow gliding and the criteria used for this categorization.]

A: We have used a random sample of '0' values to be in accordance with case numbers of '1' values. Also requested from Reviewer #1, we will determine the magnitude of variations by choosing several sets of randomly selected data records for the analysis (i.e. statistical bootstrapping). This will demonstrate the quality of the fit. Table 2 will be extended with the range of the values of exp(ß). We did some tests with several random samples in advance and based on these results we expect small variations with the main correlations/results staying the same. However, the interpretation of variables with exp(ß) close to 1 will be revised based on the new results.

R:[p. 7, line 18-19. It is for me a bit surprising that the phytomass of mosses has an

influence on snow gliding. While I'm not surprised that you received a significant relationship, I expect mainly a confounding effect between phytomass of mosses and other variables which may have a more direct effect on snow gliding (also indicated on p. 8, line 10, relationship with canopy height). Such potentially confounding relationships are not easy to disentangle with multivariate logistic models alone. I would suggest to check additionally for such relationships or at least to discuss such a result (which is also repeated in the abstract) and potential confounding effects with other variables p8, l8: snow gliding or snow sliding?]

A: Thank you for emphasizing the importance of better explanation/interpretation of confounding variables. Although potential confounding relationships are not easily to detect, we will provide a correlation matrix of all involved variables as supplement as well as a more comprehensive discussion of the main confounding effects in the discussion section in the revised version of our manuscript.

Please also note the supplement to this comment:
https://www.nat-hazards-earth-syst-sci-discuss.net/nhess-2018-3/nhess-2018-3-AC2-supplement.pdf

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