Determining the drivers for snow gliding by Fromm et al. - REVIEW

The authors present the analyses made on data gathered in an experimental test site for snow gliding, in order to find the most significant drivers for such phenomenon. What is interesting is that, beside the more classical snow and weather variables, they consider as drivers also soil and vegetation.

The topic can be of interest for the readers of NHESS. The paper is worth to be published but only after, I think, major revisions.

In particular, my main concern is about the chosen method for selecting the data to be used for the statistical analyses. The choice might imply some uncertainty in the results which is not discussed in the manuscript. Due to this, at the moment I would like to highlight this fact, without entering too much into other details. Therefore, in the following I report my general comments to the authors and not an exhaustive list of specific comments. I am willing to hear the response of the authors, in order to make a fruitful discussion about this interesting topic and hopefully be helpful in publishing their manuscript.

General comments to the authors:

The manuscript is well written and introduces clearly the argument. The Introduction is very well written.

My main concern is related to the choice of the data used for the analyses and the possible consequences of this choice on the results. You state that "*In about 0.5 % of the data entries snow gliding was recorded. The data set was reduced by randomly selecting data entries without displacements. This satisfies that equal amount of 0 and 1 for snow gliding which are used for the multiple logistic regression.*" (pag. 5, lines 12-14). As in the period of "no gliding" the other parameters (used as independent variables) were very variable (Fig. 2), I think that the results of your analyses might be very different if another random subsample of "no gliding" data was chosen. I think you should try to address this fact, discussing the uncertainty related to the results. Did you try with different subsets?

You should also indicate the number of data in your dataset: 0.5% corresponds to N = ?

Something unclear is also what is the "snow glide rate" that you used as dependent variable? It seems that it takes the value 1 or 0 if there was or not displacement. If this is the case, I would not call it glide rate which includes something related to time (30 min, hourly, daily ?).

Specific comments:

In the Introduction, I think that lines 14-16 (pag. 2) are not needed. Without these lines the section naturally flows to the goal of the manuscript (pag. 2, lines 17-25), where the importance of vegetation appears and is introduced just before (lines 11-13). Lines 14-16 could be little modified and moved to section 2.2.2 (pag. 4).

Table 1 already presents some results. I would move it in section 3. Moreover, in the caption of Table 1 you write "*… For each land-use type the glide distance and all…*", but no glide distance is given.

At the end of section 2.2.3 (pag. 4, line 30) there is a part that should belong to the result section. I would move this part in a new subsection of section 3 related to topography and vegetation. Also Table 1 and the figure of the Appendix should be moved in this new section. I would also make this figure distinguishing between abandoned and pasture areas. Though it is not the main goal of the manuscript, showing the

difference of the vegetation types in the two different plots would anyhow provide useful information for discussion.

Still in section 2.2.3 you write "*The stagnation depth was below 0.5 m, except in one case, indicating a smooth location of that glide shoe.*" (pag. 4, line 32). Apart from this statement, concerning the roughness of the site, you show in Table 1 values for "vegetation roughness" in the pasture and abandoned areas… how did you determine these values? Is this parameter related to stagnation depth? Please describe this or refer to literature.

Pag. 5, lines 23-24. Was the division in period I and II done according to a general rule or to the registered data in your study site? Dreier et al. (2016) and Ceaglio et al. (2017) explicitly write that their choices were based on the specific snow and weather conditions of their study sites. Please, give a reason for your choice, even if kind of expert-based.

In section 3. Results, I would eliminate the first subsection "Time series" and just begin the section with "*The time series…*", then make the more specific subsections 3.2 and 3.3 after the new subsection on topography and vegetation.

In section 3.2 (pag. 6, line 9) you give values for the overall mean glide distance which I cannot find in Fig. 2. What are the values 185.9 and 361.8 mm? In Fig. 2 the black lines should represent the same values at the end of the period, right? Do I miss something? Please, check and explain well this… I would also write somewhere what a "click" in the measuring device for glide distance corresponds to. In Leitinger et al. (2008), which you refer to in section 2.2.1, it seems that it corresponds to 2.6 mm. Is this right?

At pag. 6, lines 1-3 you write something that is not represented in Fig. 2. The soil moisture at 10 cm (green line) in the abandoned area is around 15 %, not zero as you write here. Please check this.

Caption of Fig. 2 is incomplete. You show also snow glide distance… for which it is needed to write what it is the black line and the grey area around that line.

In the boxplot of Fig. 3, did you use the whole dataset or again only the subset which were used in the logistic regression? This is not clear.

And again it is not clear to me how you chose the parameters for the box plots and the Whitney–Mann U-test. In the caption of Table 2 your write "… (*bold = most relevant variables, indicated by a large difference from 1).*", but then some of the values are not much far from 1 (for ex. soil moisture at 1.5 cm) !?!?

At pag. 8 the discussion on snow gliding and vegetation properties is very interesting, but it is strange that some *p* values appear here for the first time without being presented before… did you do some correlation analyses? Why don't you present all the results of the correlation analyses in the results section and then discuss them here?