Hydrol. Earth Syst. Sci. Discuss., 10, C5205–C5209, 2013
www.hydrol-earth-syst-sci-discuss.net/10/C5205/2013/

Hydrology and Earth System Sciences
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Discussions

Interactive comment on "Impact of snow gliding on soil redistribution for a sub-alpine area in Switzerland" *by* K. Meusburger et al.

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Received and published: 26 September 2013

We would like to thank Reviewer 3 for his/her interest in the topic and for valuable comments to improve the manuscript. Generally we fully agree with all three reviewers who highlight, that the fact that the difference between the two methods in determining soil erosion correlates with the measured process rates of snow gliding is not a proof that there is actually a causal relationship. In theory, this could be random correlation. However, the 137Cs based erosion rate includes all erosion processes including as well winter processes, while the USLE modelling does not account for these, we think that our results are really noteworthy. But we will be more explicit in the revised discussion about uncertainties and of course we will improve discussing errors of used methods.

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We would also like to answer more specifically on the following points raised by the Reviewer 3:

1) Yes as mentioned by the other reviewers, the site description and data availability for each site need to be more documented. We will follow the suggestion of the reviewer and include the modelled snow glide distance in Table 1. For Table 2 it is not clear what the reviewer meant. We guess that he/she advises us to show the measured data for each individual site of the south facing slope. If so this could be presented in our updated manuscript.

2) The Reviewer 3 is right, in facts the minimum value resulting from the equations 2 and 3 is 0.0047. We apologize since we did not provide the information that for Alnus viridis sites we used the literature value provided in the "Procedure for computing sheet and rill erosion on project areas" (US Department of Agriculture, 1977) of 0.003. This value assumes a fall height of 0.5 m and a ground cover of 95-100

3) We sincerely acknowledge the reviewer for this comment! Effectively, we forgot to multiply the initial force (measured with the spring balance) with the standard gravity in our excel sheet. Thus, the presented static friction coefficients in Figure 2 were approximately by a factor 10 smaller as the ones of Leitinger et al. (2008). The corrected static friction coefficients are now 0.2-0.87 and within the range of values (0.22-1.18) given by Leitinger et al. (2008). The relations presented in Figure 2 are not affected. For the model application the correct static friction coefficients were used.

4) This is another very good remark. Yes, we observed at some locations little undergrowth at the Alnus viridis sites on the north facing slope. However, at the time and location of the snow glide shoe installation the percentage of undergrowth was 100

5) Probably the reviewer refers to Figure 6, which presents the mean modelled snow glide distances as mean for the entire catchment. There are two reasons for the high modelled snow glide distances. First Alnus viridis stand predominantly occur on very steep slopes with a high natural susceptibility for snow gliding. And second the Alnus

viridis does not block the snow movement like a forest. Instead the Alnus viridis will be bend downslope by the snow (see photo 2), hardly slowing down the movement in times of heavy snow load at high snow depths. This fact is taken into account in the modelling process by setting the variable ‘forest stand’ as ‘1’ together with the low static friction of the undergrowth. Hence, given the special site- and vegetation characteristics of Alnus stands, potential snow glide distances are high. Similar (and transferable) conditions are assigned to Rhododendron stands which are represented in the original SSGM study from Leitinger et al. (2008).

References

Leitinger, G., Holler, P., Tasser, E., Walde, J., and Tappeiner, U.: Development and validation of a spatial snow-glide model, Ecological modelling, 211, 363-374, 10.1016/j.ecolmodel.2007.09.015, 2008. US Department of Agriculture, S. C. S.: Procedure for computing sheet and rill erosion on project areas, Soil Conservation Service, Technical Release No. 51 (Rev. 2), 1977.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 10, 9505, 2013.

Fig. 1.

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Fig. 2.

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