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The interaction of soil, vegetation and snow - results of a case study in the Central Swiss Alps

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In mountainous areas snow movements can yield enormous erosive forces that are responsible for major soil loss. In this presentation we aim to assess and highlight the importance of snow-gliding as soil erosion agent. Since snow-gliding is dependent of surface roughness, four land use/land cover types in a sub-alpine area in Switzerland were investigated. We used two different approaches to estimate soil erosion rates: the fallout radionuclide ^{137}Cs and the Revised Universal Soil Loss Equation (RUSLE). The RUSLE model is suitable to estimate soil loss by water erosion, while the ^{137}Cs method integrates soil loss due to all erosion agents involved. Thus, we hypothesised that the soil erosion rates determined with the ^{137}Cs method are higher and that the observed discrepancy between the erosion rate of RUSLE and the ^{137}Cs method can be largely explained by snow-gliding. Cumulative snow-glide distance was measured for the sites in the winter 2009/2010 and modelled for the surrounding area with the Spatial Snow Glide Model (SSGM). Measured snow glide distances range from 0 to 189 cm with lower values for the north facing slopes. Further, with increasing surface roughness of the vegetation a reduced snow-glide distance was observed. The latter relationship is of crucial importance in the light of conservation planning and the observed land use changes in the Alps. Our hypothesis was confirmed, as the difference of RUSLE and ^{137}Cs derived erosion rates was correlated to the measured snow-glide distances ($R2 = 0.73$; $p<0.005$). The SSGM reproduced the relative difference of the measured values between different land use/land cover types and the resulting map highlights the relevance of snow-gliding for large parts of the investigated Alpine valley.