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On the measurement of alpine subscale erosion

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Data on quantification of sheet erosion rates in alpine grasslands and their dependency on land use remain scarce but are urgently needed to estimate soil degradation and soil conservation strategies. We determined soil erosion rates based on the Cs-137 method with in-situ measurements and with sediment traps. The Cs-137 method integrates the erosion over the last 22 years (time after the Chernobyl accident), whereas sediment traps provide information on erosion rates over single weeks and months during the vegetation period. Sediment traps can not be applied during winter time in alpine regions because snow amounts flatten and destroy the sediment traps. Three different land use types were investigated: hayfields, pasture with dwarf shrubs and pasture without dwarf shrubs. Our test plots are situated in the Urseren Valley (Central Switzerland) with a mean slope steepness of 37°. Monthly erosion rates measured with sediment traps during the vegetation periods 2007 and 2008 are about 0.01 t ha-1 for hayfields, 0.005 t ha-1 for pastures with dwarf shrubs and 0.05 t ha-1 for pastures without dwarf shrubs. Mean annual soil erosion rates determined with Cs-137 of the investigated sites ranged between 4.7 t ha-1 a-1 for pastures with dwarf shrubs to >15 t ha-1 a-1 at hayfields and pastures without dwarf shrubs and are thus exceedingly high compared to measurements with sediment traps. Cs-137 measurements integrated over the last 22 years, including extreme rainfall events as well as winter processes; whereas sediment traps provide erosion rates based on summer time rainfall events. Our results lead to the assumption that the triggering processes of alpine erosion are due to snow gliding processes during winter time whereas erosion rates due to overland flow and splash effects play a minor role on the entire erosion amount. These different amounts on erosion rates for the vegetation periods in comparison to long term erosion rates that are also including erosion during winter time can also be confirmed be the WEPP model that was applied in the Urseren Valley for the time period 1986 till 2007.