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Short term soil erosion dynamics in alpine grasslands – Results from a Fallout Radionuclide repeated-sampling approach

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Improper land management and climate change has resulted in accelerated soil erosion rates in Alpine grasslands. To efficiently mitigate and control soil erosion and reduce its environmental impact in Alpine grasslands, reliable and validated methods for comprehensive data generation on its magnitude and spatial extent are mandatory. The use of conventional techniques (e.g. sediment traps, erosion pins or rainfall simulations) may be hindered by the extreme topographic and climatic conditions of the Alps. However, the application of the Fallout Radionuclides (FRNs) as soil tracers has already showed promising results in these specific agro-ecosystems. Once deposited on the ground, FRNs strongly bind to fine particles at the surface soil and move across the landscape primarily through physical processes. As such, they provide an effective track of soil and sediment redistribution. So far, applications of FRN in the Alps include 137Cs (half-life: 30.2 years) and 239+240Pu (239Pu [half-life = 24110 years] and 240Pu [half-life = 6561 years]).

To investigate short term (4-5 years) erosion dynamics in the Swiss Alps, the authors applied a FRNs repeated sampling approach. Two study areas in the central Swiss Alps have been investigated: the Urseren Valley (Canton Uri), where significant land use changes occurred in the last centuries, and the Piora Valley (Canton Ticino), where land use change plays a minor role. Soil samples have been collected at potentially erosive sites along the valleys over a period of 4-5 years and measured for 137Cs and 239+240Pu activity.

The inventory change between the sampling years indicates high erosion and deposition dynamics at both valleys. High spatial variability of 137Cs activities at all sites has been observed, reflecting the heterogeneous distribution of 137Cs fallout after the Chernobyl power plant accident in 1986. Finally, a new modelling technique to convert the inventory changes to quantitative estimates of soil erosion has been tested.