Universität Basel

Research Project

Improving soil erosion assessment in Swiss mountainous areas using radionuclides (137Cs, 239+240Pu)

Third-party funded project

Project title Improving soil erosion assessment in Swiss mountainous areas using radionuclides (137Cs, 239+240Pu)
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Organisation / Research unit
Departement Umweltwissenschaften / Umweltgeowissenschaften (Alewell)
Department
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The combined pressure of land use and climate change has resulted in accelerated soil erosion rates in Alpine grasslands. To efficiently mitigate and control soil losses by erosion and reduce their environmental impacts in Alpine grasslands, reliable and validated methods for comprehensive data generation on the magnitude and spatial extent of soil erosion are needed. Sheet erosion, which is one of the main forms of erosion affecting Swiss Alpine grasslands, is particularly difficult to investigate with conventional methods. While the use of the fallout radionuclide ^{137}Cs has been successfully used to determine sheet erosion rates in lowland arable areas, the method was found to produce relatively large uncertainties in Alpine grasslands. The latter difficulties were most likely caused by a combination of (i) the general heterogeneous distribution of atmospheric ^{137}Cs Chernobyl fallout, (ii) the partly snow covered ground in Alpine areas during the fallout event in April 1986, which results in inhomogeneous ^{137}Cs distribution during snow melt and (iii) uncertainties in finding undisturbed references sites in the geomorphological and anthropogenic highly active slopes of the Swiss central Alps. We will implement an innovative combined use of radionuclide soil tracers (the ^{137}Cs re-sampling approach and $^{239+240}$Pu based erosion rates) in the alpine valleys of Ursern (Canton Uri, northern central Alps) and Piora (Canton Ticino, southern central Alps) to overcome these difficulties. We will replace the classical ^{137}Cs approach, where an undisturbed reference site is compared to erosional sites, with a re-sampling approach, where previous measurements from 2007 will be compared to 2013 sampling, thus using temporal instead of spatial reference. Using $^{239+240}$Pu which originates from nuclear bomb testing during the 1950's and 1960's as an erosional tracer is an approach only recently suggested to the soil science community. With the proposed concepts of combining $^{239+240}$Pu based erosion rates (averaging over the last 50 – 60 years, more homogeneous fallout distribution) with the ^{137}Cs re-sampling approach (which allows short term erosion assessment integrating the last 6 years erosive events with no dependence on undisturbed reference sites) we are confident to overcome the above discussed limitation already encountered with the classical ^{137}Cs approach in the Swiss Alps. Assessing soil erosion magnitude in Swiss mountainous areas through radionuclide methods is not only a first step towards an efficient resource management policy to target a successful implementation of agricultural soil conservation practices but also to validate existing soil erosion models which is in urgent need to up-scale and regionalize soil erosion rates in mountain areas.

Keywords soil erosion, fallout radionuclides, radiogenic isotopes, 239+240Plutonium, 137Caesium, alpine grasslands

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Add publication

Published results

3641300, Arata, L.; Meusburger, K.; Frenkel, E.; A'Campo-Neuen, A.; Iurian, A. -R.; Ketterer, M. E.; Mabit, L.; Alewell, C., Modelling Deposition and Erosion rates with RadioNuclides (MODERN) – Part 1: A new conversion model to derive soil redistribution rates from inventories of fallout radionuclides., 0265-931X ; 1879-1700, Journal of Environmental Radioactivity, Publication: JournalArticle (Originalarbeit in einer wissenschaftlichen Zeitschrift)

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Add documents

Specify cooperation partners

ID	Kreditinhaber	Kooperationspartner	Institution	Laufzeit - von	Laufzeit - bis
2365905	Alewell, Christine	Dr. Lionel Mabit	International Atomic Energy Agency, Vienna	20.12.2006	31.12.2018
983672	Alewell, Christine	Egli, Markus, Prof. Dr.	University of Zürich	31.10.2010	31.12.2013
983626	Alewell, Christine	Ketterer, Michael, Prof. Dr.	Metropolitan State University of Denver	01.11.2011	31.12.2015