Universität Basel

Research Project

Nuclear Techniques for a Better Understanding of the Impact of Climate Change on Soil Erosion in Upland Agro-ecosystems

Project funded by own resources

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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, 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, is particularly difficult to investigate with conventional methods. The fallout radionuclide 137Cs proved to be successful to determine sheet erosion rates but the application of the method in alpine areas is constrained (a) by the general heterogeneous distribution of atmospheric 137Cs Chernobyl fallout and the general difficulties in finding undisturbed references sites in the geomorphological and anthropogenic highly active terrain (b) in providing information on short term erosion rates and (c) sediment source areas.

A suitable alternative to tackle issue (a) are the two major Plutonium isotopes (i.e. 239Pu [half-life = 24110 years] and 240Pu [half-life = 6561 years]) which have been suggested and tested as soil erosion tracers in the Alps. The second issue (b) can be addressed by replacing the classical 137Cs 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 a 2014 sampling, thus using temporal instead of spatial reference. Finally, a promising new technique to solve issue (c) is the compound specific isotope analysis (CSIA). Compound specific stable isotope (CSSI) signatures of inherent organic biomarkers in the soil, can discriminate and apportion the source soil contribution from different land-uses in order to reinforce the effectiveness of soil conservation measures.

With the proposed concepts of combining 239+240Pu based erosion rates (averaging over the last 50 – 60 years, more homogeneous fallout distribution) with the re-sampling approach (which allows short term erosion assessment integrating the last 6 years erosive events with no dependence on undisturbed reference sites) and CSIA we are confident to overcome the above discussed limitations. Furthermore, having erosion assessments for different temporal scales will indicate impacts of climate change. Within the he frame of this CRP we aim to share knowledge and ideas, support knowledge transfer and teach on the mentioned topics.

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Add publication

Add documents

Specify cooperation partners