Geophysical Research Abstracts
Vol. 19, EGU2017-18799, 2017
EGU General Assembly 2017

Rainfall simulation experiments to study sediment redistribution using rare earth element oxides as tracers under conventional and conservation agricultural practices

Adrienn Tóth (1), Gergely Jakab (1), Péter Sipos (2), Máté Karlik (2), Balázs Madarász (1), Dóra Zacháry (1), Judit Szabó (1), and Zoltán Szalai (1)

(1) Geographical Institute, Research Centre for Astronomy and Earth Sciences Hungarian Academy of Sciences (toth.adrienn@csfk.mta.hu), (2) Institute for Geological and Geochemical Research, Research Centre for Astronomy and Earth Sciences Hungarian Academy of Sciences

Rare earth elements (REE) have very favourable characteristics for being ideal sediment tracers as they are characterised by strong binding to soil particles, low mobility, low background concentration in soils, environmental benignity, high analytical sensitivity and they can be detected relatively easily and inexpensively in soils. The group of REEs consist of 16 elements with similar chemical properties, but at the same time, they are clearly distinguishable enabling multiple tracking of sediment deriving from different parts of the studied area, as well as mapping redistribution processes by appropriate designing of subareas marked by different REEs.
In this study, rainfall simulation experiments were carried out to compare the loss and redistribution of soil sediments in two plots under conventional and conservation agricultural practices. Five different rainfall intensities (up to 80 mm/h) were applied to both plots. Sources and pathways of sediments within the two plots were studied using REE-oxides as tracers. Approximately 1,000 mg/kg of $Er2O_3$, $Ho2O_3$ and $Sm2O_3$ (calculated to the upper 1 cm of the soil) were dispersed to the soil surface with banded distribution; each transversal band covered the third of the surface are of the plots. Concentration of the REE-oxides in the sediment leaving the plots, and that of the surface soil before and after the experiment were analysed by X-Ray fluorescence spectrometry.
Significant sediment losses were found for both plots after the experiments, with slightly different characteristics between the conventional and conservation ones. Highest difference in loss of added REEs was found in the upper third of the plots with $81 \pm 19\%$ in the conventional and $71 \pm 21\%$ in the conservation ones. These values have been equalized downwards with almost complete losses in the lower third of the plots ($99 \pm 2\%$ and $97 \pm 4\%$, respectively). Only very small part of the removed sediment has been accumulated in the lower parts of the plots, they rather mostly leaved the study area. These accumulation zones showed patchy distribution and could be characterized by slightly higher REE concentrations in the conservation plot. Also, large variances in the REE amounts removed from the study plots were found during the experiment with slight differences between the two plots.
Thanks to the use of the REE tracers, information was received not only on the sediment amounts leaving the area due to the individual rainfall events but also on the source of them within the plot. Our data also suggest that differences between the conventional and conservation plots can be observed even in the short term.
The authors are grateful to the support of the National Research, Development and Innovation Office (OTKA PD 112729). A. Tóth also thanks for the support of the János Bolyai Research Scholarship of the Hungarian Academy of Sciences.