Rare earth oxide tracking and soil surface modelling – opportunity to study small scale soil redistribution

Judit Alexandra Szabó (1,2), Csilla Király (1), Máté Karlik (3), Adrienn Tóth (1), Zoltán Szalai (1,2), Gergely Jakab (1,4)

(1) Research Centre for Astronomy and Earth Sciences, Hungarian Academy of Sciences, Budapest, Hungary (szabo.judit@csfk.mta.hu), (2) Department of Environmental and Landscape Geography, Eötvös Loránd University, Budapest, Hungary, (3) IInstitute for Nuclear Research, Hungarian Academy of Sciences, Debrecen, Hungary, (4) Institute of Geography and Geoinformatics, University of Miskolc, Miskolc, Hungary

Plot scale rainfall simulators are useful tools to study the redistribution of soil during the initial phase of sheet erosion. Usually, we assume, the runoff at the sample collector transports sediment from the total area of the flume. To investigate the origin of the sediment in the runoff and track the relocation of the soil in the surface, rare earth oxides (REO) were used. Four different REO (Pr_6O_{11} Sm_2O_3, Ho_2O_3, Yb_2O_3) were spilling on the soil surface dividing the plot to four sub-parcel (two back and two front). Altogether four simulations were run on a 9 % slope under 40 mm h-1 rain intensity and 96 runoff and 8 crust sample were collected. The REO concentration of the runoff were measured by XRF. Assuming that the REOs from the back sub-parcels could not reached the plot outlet, soil crust samples were also taken. A surface part was marked out for sampling if it fulfilled two criteria: it laid in the flow route within a front sub-parcel and crust formation was evident, such as in microdepressions. The REO appearance in the crust was detected and measured by scanning electron microscope. In order to track the morphological changes of the surface and locate possible runoff barriers, high-resolution DEMs were created by photogrammetric (SfM) method. After averagely 4 L of runoff during 43 minutes, REO were measured from both front and the back sub-parcels. At the same time, the concentration of the REO in soil loss from the back sub-parcels were low or they appeared in the late phase of the runoff because of the micromorphology. Crust samples also contained REO from both front and back sub-parcel. In accordance with the detected decreased surface roughness, the preliminary results suggest the calculation of the contribution area even in small scale is necessary to predict soil erosion.