Geophysical Research Abstracts
Vol. 13, EGU2011-9135, 2011
EGU General Assembly 2011

Tracing sediment by enhancing soil magnetic properties

Alona Armstrong (2), John Quinton (1), and Barbara Maher (1)

(1) Lancaster University, Lancaster Environment Centre, , Lancaster, United Kingdom (j.quinton@lancaster.ac.uk), (2) Department of Geography, Glasgow University, Glasgow, UK and CEH Lancaster, Lancaster UK

AB: The last decades has seen the increasing development of new technologies for tracing the movement of sediment across landscapes, including rare earth element oxides, fluorescent particles and DNA tags. These new tracers allow us to tag soil particles using a chemical marker or introduce particles to the soil that mimic its behaviour. Once applied to the soil the particles can be recovered from the landscape or fluvial system and the concentration of tagged particles present quantified. Therefore there is the potential to use different tracers or different 'species' of the same tracer to collect data on temporal and spatial patterns of soil redistribution on hillsides and sediment delivery to fluvial systems, with a better resolving power than existing tracers, such as Cs137. Such data could help us in many ways, for example: improving our process understanding of soil erosion processes; understanding rates deposition and their links to biogeochemical cycling; providing spatial data for the validation of erosion models; and getting a better understanding of sediment residence times in catchments. However, there are problems with some of the new generation of tracers which include: different properties to the soil which is being tagged; difficulties with analytical methods; analysis costs; and poor recovery from hillslope scale experiments. In this paper we present initial findings on the use of soil with an enhanced ferrimagnetic content, but with the same physical characteristics as the parent soil, as a sediment tracer. To enhance the soil's ferromagnetic content the soil was heated under reducing conditions. High and low field susceptibility, anhysteretic remanent magnetization, alternating frequency demagnetisation (10, 20, 30, 40, 60, and 80 mT), and isothermal remanent magnetization (10, 20, 50 100, 200, 300 and 1000 mT) of the bulk soil and the <2, 2-8, 8-16, 16-32, 32-64, 64-125, 125-250, 250-500, and 500-1000 micron size fractions were found to differ by at least one order of magnitude before and after heating. Furthermore, the different size fractions were discernable from two measures, thus illustrating potential for the technique to provide information on size specific erosion. Soil box experiments using rainfall simulation demonstrated the 2, 2-8, 8-16, 16-32, 32-64, 64-125, 125-250, 250-500, and 500-1000 micron size fractions were found to differ by at least one order of magnitude before and after heating. Furthermore, the different size fractions were discernable from two measures, thus illustrating potential for the technique to provide information on size specific erosion. Soil box experiments using rainfall simulation demonstrated the potential for both in situ measurement of magnetic susceptibility and measurement of the magnetic properties of eroded sediment to trace sediment and measure soil erosion.