EGU2020-2199
https://doi.org/10.5194/egusphere-egu2020-2199
EGU General Assembly 2020

Evaluation of the magnetite as a magnetic tracer of eroded sediment from ephemeral gullies: conditioning factors of magnetic susceptibility

Elena Zubieta[1], Juan Larrasoaña[2], **Rafael Giménez**[1], Alaitz Aldaz[1], and Javier Casalí[1]
[1]Public University of Navarre, Engineering, Pamplona, Spain (rafael.gimenez@unavarra.es)
[2]Spanish Geological and Mining Institute, Zaragoza, Spain

In gully erosion, the soil detached by the action of the erosive flow can be transported over long distances along the drainage network of the watershed. In this long way, the eroded material can be redistributed and/or deposited on the soil surface, and then eventually buried by eroded material from subsequent erosion events. Likewise, the variability of the soil (i.e., in texture and moisture content) over which this material moves can be considerable. The presence of the eroded material could be detected through magnetic tracers attached/mixed with the eroded soil. In this experiment, the degree to which the magnetic signal of the magnetite is conditioned by (i) the burying tracer depth, (ii) the texture and moisture content of the soil covering the tracer and (iii) the tracer concentration was evaluated.

The study was carried out in the lab in different containers (0.5 x 0.5 x 0.3 m^3). Each container was filled with a given soil. In the filling process, a 0.5-cm layer of a soil-magnetite mixture of a certain concentration was interspersed in the soil profile at a certain depth. Overall, 3 different soil:tracer concentrations (1000:1, 200:1, 100:1), 4 tracer burying depths (0 cm, 3 cm, 5 cm and 10 cm from soil surface), and 2 contrasting soils (silty clay and sandy clay loam) were used. In each case, the magnetic susceptibility was measured with a magnetometer (MS3 by Bartington Instruments). Experiments were repeated with different soil moisture contents (from field capacity to dry soil).

If the tracer is located under the soil surface a minimum soil:tracer concentration of 200:1 is required for its correct detection from the surface using a magnetometer. The intensity of the magnetic signal decreases dramatically with the vertical distance of the tracer from the soil surface (burying depth). The maximum detection depth of the tracer magnetic signal is strongly dependent on the natural magnetic susceptibility of the soil which hides the own tracer signal. Variation in soil moisture content does not significantly affect the magnetic signal. For extensive field studies the soil-tracer volume to be handled would be very high. Therefore, it is necessary to explore new tracer application techniques.