Assessing soil redistribution in a complex karstic catchment using fallout $^{137}$Cs and GIS

A. Navas, M. López-Vicente, L. Gaspar, J. Machín

Department of Soil and Water, Estación Experimental de Aula Dei, CSIC. Apartado 13034, 50080 Zaragoza, Spain. anavas@eead.csic.es

Caesium-137 derived from nuclear testing in the past century has been widely used as a sediment tracer of soil movement providing information on medium term (40–50 years) erosion rates. To date most of studies focused on individual fields but estimates of rates and patterns of soil redistribution requires upscaling to catchment scales. An attempt to assess soil redistribution processes on complex terrain with strong geomorphic control such as in karstic areas which has not been explored yet is presented in this work. A comprehensive geomorphological survey of the study catchment permitted to identify the main geomorphic elements at a grid resolution of 5 x 5 m which was the base for the terrain analyses. A detailed DEM together with field identification of the drainage system and 237 point measures in gentle slopes with TTE allowed identification of 15 endorheic subcatchments. A grid sampling scheme 100 x 100 m was established to derive point data of $^{137}$Cs inventories across the catchment. Geoestatistical interpolation of point samples of $^{137}$Cs inventories in soil was done to assess the areas of gain and loss of sediment by comparing with $^{137}$Cs reference inventories in the area. Mass balance models were used to calibrate $^{137}$Cs data and to derive estimates of soil redistribution. GIS was used to provide spatially distributed erosion and deposition rates in the landscape for the whole catchment and for each of the individual subcatchments. The spatial analyses of the results outline the importance of considering the geomorphological features that in karstic catchments are main factors in controlling the active processes of soil movement. Results of this study are of interest for a comprehensive approach of the global cycle of particle generation at erosion sites, sediment transfer and storage at deposition sites. Fallout $^{137}$Cs in combination with GIS are powerful cost-efficient techniques to assess soil redistribution at catchment scale in complex karstic landscapes.