Geophysical Research Abstracts
Vol. 18, EGU2016-10156, 2016
EGU General Assembly 2016


# Plot-scale testing and sensitivity analysis of Be7 based soil erosion conversion models

Alex Taylor (1), Wahid Abdelli (2), Bashar Al Barri (3), Andra Iurian (1), Leticia Gaspar (4), Lionel Mabit (5), Geoff Millward (6), Nick Ryken (3), and Will Blake (1)

(1) School of Geography, Earth and Environmental Sciences, Plymouth University, UK, (2) Centre National des Sciences et Technologies Nucléaires (CNSTN), Sidi Thabet, 2020, Tunisia, (3) Department of Soil Management, Ghent University, Gent, Belgium, (4) Soil and Water Department, Estación Experimental de Aula Dei (EEAD-CSIC), Spain, (5) Soil and Water Management & Crop Nutrition Laboratory, Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture, International Atomic Energy Agency, Vienna, Austria, (6) Consolidated Radioisotope Facility, Plymouth University, UK

Over the past 2 decades, a growing number of studies have recognised the potential for short-lived cosmogenic Be-7 (half-life 53 days) to be used as a tracer to evaluate soil erosion from short-term inter-rill erosion to hillslope sediment budgets. While conversion modelling approaches are now established for event-scale and extended-time-series applications, there is a lack of validation and sensitivity analysis to underpin confidence in their use across a full range of agro-climatic zones.

This contribution aims to close this gap in the context of the maritime temperate climate of southwest UK. Two plots of 4 x 35 m were ploughed and tilled at the beginning of winter 2013/2014 in southwest UK to create (1) a bare, sloped soil surface and (2) a bare flat reference site. The bounded lower edge of the plot fed into a collection bin for overland flow and associated sediment. The tilled surface had a low bulk density and high permeability at the start of the experiment (ksat > 100 mm/hr). Hence, despite high rainfall in December (200 mm), notable overland flow was observed only after intense rain storms during late 2013 and early January 2014 when the soil profile was saturated i.e. driven by Saturation Overland Flow (SOF). At the time of SOF initiation, ca. 70% of the final Be-7 inventory had been delivered to the site. Subsequent to a series SOF events across a 1 month period, the plot soil surface was intensively sampled to quantify Be-7 inventory patterns and develop a tracer budget. Captured eroded sediment was dried, weighed and analysed for Be-7. All samples were analysed for particle size by laser granulometry.

Be-7 inventory data were converted to soil erosion estimates using (1) standard profile distribution model, (2) the extended time series distribution model and (3) a new ‘antecedent rainfall’ extended time series model to account for lack of soil erosion prior to soil saturation. Results were scaled up to deliver a plot-scale sediment budget to include an estimated amount of sediment delivered from the plot for comparison with the true mass captured. Sensitivity analysis was undertaken to evaluate the influence of (1) variability in Be-7 depth distribution, (2) selection of particle size correction factors and (3) potential loss of Be-7 in overland flow after SOF initiation on model output. Order of magnitude differences in sediment export estimates across the tested scenarios underpins the critical need for adequately addressing sources of uncertainty in experimental design and sampling programmes. Recommendations are made to improve methodological accuracy and confidence in model outputs.