Pb-210(xs.) is a viable alternative to Cs-137 for tracing soil redistribution in mountain pastures affected by heterogeneous Chernobyl fallout

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Soil mobilization has been investigated by means of fallout radionuclides (FRN) in a first-order catchment of the Eastern Alps. Caesium-137, Pb-210(xs.) (Pb-210 excess or unsupported fraction), and Am-241 have been measured in soil samples collected from a pasture at about 2150 m above sea level. Combining pedological and radioactivity data, including mineral-related radionuclides (primordial K-40 and nuclides belonging to the Th-232 and U-238 decay chains), the distribution of FRNs, their spatial variability, vertical distribution, and relationships with pedological and topographical variables were assessed. Because of low activity concentration, it was not possible to use artificial long-lived Am-241 as a soil tracer, but preliminary results are encouraging. Inventories of Pb-210(xs.) and Cs-137 have been converted into soil mobilization rates applying the MODERN model. Despite the gentle steepness and the absence of evident signs of erosion, the slopes of the considered catchment are affected by erosion at a rate up to 6 t ha(-1) yr(-1), likely related to grazing. A comparison between Pb-210(xs.) and Cs-137 has revealed that at this site Cs-137, the most used FRN for estimating soil redistribution, is not suitable for this purpose, probably due to its irregular spatial distribution on snow-covered ground after the Chernobyl accident. Conversely, Pb-210(xs.), owing to its continuous input, has provided reliable estimates of soil redistribution rates, in accordance with local morphology. The latter has in fact been related to morphometric variables in a regression model to provide an overview of soil erosion/sedimentation across the entire catchment, confirming that Pb-210(xs.) is a viable alternative to trace soil erosion and deposition where the Chernobyl fallout occurred on snow-covered ground.
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