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Baseline Caesium-137 and Plutonium-239+240 inventory assessment for Central Europe

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Artificial fallout radionuclides (FRNs) such as Caesium-137 and Plutonium-239+240 released as products of the thermonuclear weapons testing that took place from the mid-1950s to the early 1980s and from nuclear power plant accidents (e.g. Chernobyl) are useful tools to quantify soil redistribution. In combination with geostatistics, FRNs may have the potential to bridge the gap between small scale process oriented studies and modelling that simplifies processes and effects over large spatial scales.

An essential requirement for the application of FRNs as soil erosion tracers is the establishment of the baseline fallout at undisturbed sites before its comparison to those inventories found at sites undergoing erosion/accumulation. For this purpose, undisturbed topsoil (0-20cm) samples collected in 2009 within the framework of the Land Use/Cover Area frame Survey (LUCAS) have been measured by gamma-spectrometry and ICP-MS to determine ^{137}Cs ($n=145$) and $^{239+240}\text{Pu}$ ($n=108$) activities. To restrict the analysis to undisturbed reference sites a geospatial database query selecting only sites having a slope angle <2 degree, outside riparian zones (to avoid depositional sites) and under permanent grassland cover (according to CORINE Land Cover and Landsat) was applied.

This study reports preliminary results on the feasibility of establishing a ^{137}Cs and $^{239+240}\text{Pu}$ baseline inventory map for Central Europe. The $^{137}\text{Cs}/^{239+240}\text{Pu}$ activity ratios will further allow assessing the rate and the spatial variability of ^{137}Cs Chernobyl fallout. The establishment of such baseline inventory map will provide a unique opportunity to assess soil redistribution for a comparable time-frame (1953–2009) following a harmonised methodological protocol across national boundaries.