

# Application of Chernobyl-derived $^{137}\text{Cs}$ fallout for sediment redistribution studies: Lessons from European Russia

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## Abstract

Vast areas of Europe were contaminated by the radioactive isotope  $^{137}\text{Cs}$  after the explosion at the Chernobyl nuclear power plant in April 1986. More than twodecades have since passed and Chernobyl-derived  $^{137}\text{Cs}$  has proved to be useful a tracer for quantitative assessment of erosion and deposition rates. This paper firstly summarizes the results of detailed studies of the spatial variability of its initial fallout in different landscape zones of European Russia. From 4 to 28 bulk soil samples were taken at each of the reference locations to characterize local variability of the isotope inventories in topsoil. In addition, one section with depth-incremental sampling at 2- to 3-cm intervals to a depth of 30-40cm was taken at the uncultivated sites for determination of the  $^{137}\text{Cs}$  vertical distribution. Local spatial variability of  $^{137}\text{Cs}$  fallout inventories did not exceed 20% in areas with high to moderate levels of Chernobyl contamination. However, it is necessary to sample several reference locations for each study site to document possible larger-scale spatial trends in the initial Chernobyl-derived  $^{137}\text{Cs}$  fallout, which should be taken into account in calculations of erosion/deposition rates. The second part of the paper considers several examples of the application of Chernobyl-derived  $^{137}\text{Cs}$  in sediment redistribution studies within European Russia. These include evaluation of erosion and deposition rates along individual slope transects, assessment of sediment redistribution within small catchments, and determination of recent floodplain sedimentation rates. It has been shown that the main advantages of the Chernobyl-derived  $^{137}\text{Cs}$  are the short period of fallout, which means it can be treated as a single event, and the existence of a detailed map of the initial fallout for the majority of European countries. The latter facilitates collection of reliable initial fallout data for input into calibration models. © 2012 John Wiley & Sons, Ltd.

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## Keywords

Chernobyl-derived  $^{137}\text{Cs}$ , Deposition, Floodplain accumulation; European Russia, Sediment redistribution, Soil erosion rate