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Modelling the extent of Cs-137 soil contamination patterns at the Kostica River basin (Bryansk Region, Russia)

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Digital terrain analysis may be a useful tool for modeling the extent of Cs-137 soil contamination patterns after the Chernobyl disaster. The test area of the Kostica River basin (Bryansk Region, Russia) covers an area of 19,4x11,6 km and is characterized by relatively low levels of ^{137}Cs contamination after the Chernobyl accident in the range of 2.4 to 33 kBq/m^2. It is just 4-18 times higher than the global fallout which was equal to 1,75 kBq/m^2 in 1986.

The purpose of the research was to obtain estimates of the transformation of initial ^{137}Cs patterns as influenced by different landscape factors (DEM attributes) with a grid resolution of 100, 50 and 25 m. Different kinds of DEM curvatures calculations may be done by using SAGA, Whitebox GAT and Grass for each grid size model.

In the case under study two informational layers were made use of to evaluate processes of ^{137}Cs redistribution in the River Kostica basin. These are: 1) SRTM layer with a resolution of 90 m and 2) the data of air-gamma survey with a resolution of 100 m. The total watershed area of the Kostica River occupies 225 km^2. SRTM data were resampled in a coordinates and georeference system of AG (air-gamma survey was represented in the Gauss-Kruger coordinate system) lay with a resolution of 100 m.

The results of the air gamma survey conducted in the summer of 1993, give clear evidence that the processes of ^{137}Cs lateral migration took place due to nearly a fourfold increase of ^{137}Cs in the lower slope as compared to the surface of the watershed during a seven-year period after the Chernobyl accident.

We examine the effect of grid size of the digital elevation model (DEM) on the erosion simulations. For resampled grid data with a resolution of 50 and 25 m we apply SAGA-GIS Module "Resampling" and compare the results with those of the original method of simplicity versus fitting (SvF). The method SvF is devoted to finding a compromise between simplicity of the model and precision of replication of experimental data. The integral in the range of squared second derivatives was used as a measure of simplicity, with usual standard deviation being applied as a

measure for replication of experimental data.

The study is based on the concept of sediment and hydrological connectivity. We apply GIS-based models considering lateral soil migration to analyze sediment cascade systems. Soil erosion was evaluated based on an analysis of Cs-137 migration determined using the LS factor implemented by GRASS GIS.

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