Estimation of Cs-137 hillslope patterns of Polesje landscapes using geo-information modeling techniques (on example of the Bryansk region)

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In the result of Chernobyl disaster on 26 April 1986 many regions of Ukraine, Belarus and Russia were contaminated by radionuclides. Vast areas of farmlands and woodlands were contaminated in Russia. The deposited radionuclides continue to cause concern about the possible contamination of food (in particular, mushrooms and berries). But the radioactive materials are also an ideal marker for understanding of hillslope processes in natural and seminatural landscapes.

Model area chosen for the research (Opolje landscapes located in the central part of the Bryansk region) is characterized by relatively low levels of Cs-137 contamination. It just 4-33 times higher than global fallout which was equal 1,75 kBq/m2 in 1986 . According the results of air gamma survey (grid size: 100 m x100 m), which was done in 1993, it was explicitly to identify that the processes of Cs-137 lateral migration took place due to nearly fourfold increase of Cs-137 in the lower slope in comparison with the surface of the watershed during a seven-year period after Chernobyl accident.

Erosion processes which define Cs-137 pattern in the lowest part of hillslope depend upon such parameters as slope, hillslope forms, vegetation, land use and the roads, which intersect a streamline.

GIS-modeling of Cs-137 was carried out in SAGA software. The spatial modeling resolution was equal 100x100 m according the air-gamma data. SRTM data was resampled to a grid 100x100 m.

Erosion rates were the highest on the slope of southern exposure. There the processes of lateral migration are more intensive and observed within the entire slope. The main contribution in receipt of Cs-137 to floodplain on the northern slopes comes only from the lower part of the slope and gullies and ravines network.

We have used geo-information modeling techniques and some kind of interpolation and statistical models to predict or understand forming of Cs-137 spatial patterns and trends in soil erosion. To study the role of some geomorphological parameters in the Cs-137 redistribution we apply different mathematical models. We have identified the main trend (dependence on the X, Y coordinate) and contribution of such geomorphological parameters as concave and convex profiles, slope and others.

Thus, the use of fallout radionuclides, measured with air-gamma survey, can complement our concept about Cs-137 secondary redistribution due the erosion processes which controlled by numerous of landscape factors.