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The effect of Cs-137 short-range spatial variability on soil after the Chernobyl disaster

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After the Chernobyl accident of 1986, large areas of Russia were contaminated by 137Cs. Post-depositional redistribution of 137Cs fallout across the land surface resulting from mechanical, physical, chemical, and biological processes operating in the soil system and the grain size selectivity associated with soil erosion and sediment transport processes. Therefore of uppermost importance are data on evaluating 137Cs variability at short distances, obtained at the early period after the accident.
Measurements of 137Cs deposit at the territory of Russia exposed to radioactive contamination were mainly conducted with the help of air-gamma survey, and were verified by soil sampling on test plots with size 10x10 m with control soil sampling using “envelope” method of fivefold soil sampling (1 sampling at the centre and 4 along the edges of the plot under study). Presented here are evaluation data of 137Cs contamination, obtained in the Bryansk, Yaroslav and Rostov regions in 1991. Test plots were selected at the distance of 50-100 m away from a road on matted areas with undisturbed soil structure. Test routes of sampling were made perpendicularly to directions crossing basic traces of radioactive contamination.
Sampling measurements were carried out at Canberra and Ortec gamma spectrometers. Each of the 5 samples of the “envelope” was measured separately, soil mixing was not applied.
137Cs value for the Bryansk Region varied from 2,6 kBq/m2 to 2294 kBq/m2, at the territories of the Yaroslav and Rostov regions 137Cs value varied from 0,44 kBq/m2 to 5,1 kBq/m2 and 0,56 kBq/m2 to 22,2 kBq/m2, respectively. Statistical analysis of 137Cs deposit at different plots is a solid argumentation in favour of nonuniform distribution in various landscapes and at a different distance from the Chernobyl NPP. Such nonuniformity of 137Cs soil contamination in the limits of 10 m of the plot is most likely to be related to initial aerosol contamination nonuniformity at the moment of deposition.