Geophysical Research Abstracts
Vol. 20, EGU2018-620, 2018
EGU General Assembly 2018

The character of Cs-137 distribution in moss and soil cover of undisturbed elementary landscape geochemical systems

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Long-term monitoring of Cs-137 distribution in the soil and moss cover of the test site located in pine forest in the Chernobyl exclusion zone (Bryansk region, Russian Federation) revealed that even 30 years after the accident, the main inventory of radiocaesium is stored in the upper 10 cm layer of the soil, while the maximum activity have moved to a depth of 2-8 cm. This may be explained by the weak vertical water migration of the radioisotope and the burial of the contaminated layer under the annual fall.

A peculiar character of Cs-137 distribution in toposequence of conjugated elementary-geochemical systems has been confirmed since 2005 that exhibited itself in cyclic variation of radiocaesium activity in both soils and mosses, which does not correspond to the standard scheme of unidirectional migration of pollutant down the slope. As it has been shown earlier in two-dimensional space the Cs-137 contamination field in soils and mosses has a stable regular structure of the polycentric type (Korobova, Romanov, 2011). Our studies of 2015-2016 confirmed stability of the structure.

Surface activity of Cs-137 measured by field spectrometer correlated, to the greatest extent, with Cs-137 content in the upper 0-2 cm soil samples($r = 0.643$, $n = 15$). A high correlation was established between the Cs-137 in the lower and upper parts of the moss ($r = 0.718$, $n = 60$), and between the activity of Cs-137 in the green part of mosses and in the soil 4-6 cm layer ($r = 0.626$, $n = 15$).

It is suggested that the Cs-137 may be used as a tracer of secondary transformation of anthropogenic contamination in natural systems with water. This means that it marks the character of pollutants' migration in any toposequence that is also reflected in vegetation cover. However, contamination fields in soil and vegetation although rather similar differ in configuration owing to variation in uptake of Cs-137 by plants. Such statement of problem opens new possibilities for spatially adequate effective monitoring and fertilizers application at different scale.

Reference

E. Korobova and S. Romanov. Experience of mapping spatial structure of Cs-137 in natural landscape and patterns of its distribution in soil toposequence. Journal of Geochemical Exploration, 2011, 107, 179-191.