Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

MAG38-16 会場:501 時間:5 月 2 日 14:30-14:45

福島原発事故後の様々な土地利用からの土壌侵食による放射性セシウムの流出
Radiocesium wash-off associated with soil erosion from various land uses after the Fukushima Dai-ichi NPP accident

脇山 義史 [1*] ; 恩田 裕一 [1] ; 吉村 和也 [2] ; 加藤 弘亮 [1]
WAKIYAMA, Yoshifumi[1*] ; ONDA, Yuichi[1] ; YOSHIMURA, Kazuya[2] ; KATO, Hiroaki[1]

[1] 筑波大学アイソトープ環境動態研究センター, [2] 日本原子力研究開発機構福島技術本部
[1]Center for Research in Isotopes and Environmental Dynamics, University of Tsukuba, [2]Headquaters of Fukushima Partnership Operations, IAEA

Soil erosion is the initial process which drives radiocesium into the aquatic systems and therefore the quantification of radiocesium wash-off associated with soil erosion is indispensable for mitigating the risks. This study presents two year ' s observation of soil erosion and radiocesium wash-off to quantify differences in radiocesium behavior in various land uses. Seven runoff plots were established in four landscapes; uncultivated farmland (Farmland A1, Farmland B1), cultivated farmland (Farmland A2, Farmland B2), grassland (Grassland A, Grassland B) and Japanese cedar forest (Forest) in Kawamata town, an area affected by the Fukushima Dai-ichi Nuclear Power Plant accident. The discharged sediments were collected approximately every two weeks. In laboratories, collected sediments were dried and weighed for calculating soil erosion rates (kg m^{-2}) and served for measurements of radiocesium concentration (Bq kg^{-1}) with HPGe detectors. The erosivity factor of the Universal Soil Loss Equation (R-factor: MJ mm ha^{-1} hr^{-1} yr^{-1}) was calculated based on the data of precipitation. Standardized soil erosion rates (kg m^{-2} MJ^{-1} mm^{-1} ha hr yr), observed soil erosion rates divided by R-factor, was 1.8 $\times$ 10^{-4} in Farmland A1, 6.0 $\times$ 10^{-4} in Farmland A2, 1.5 $\times$ 10^{-3} in Farmland B1, 8.3 $\times$ 10^{-4} in Farmland B2, 9.6 $\times$ 10^{-6} in Grassland A, 5.9 $\times$ 10-6 in Grassland B and 2.3 $\times$ 10^{-6} in Forest. These erosion rates were basically proportional to their vegetation cover of soil surfaces except for cultivated farmlands. Concentrations of Cs-137 in eroded sediments basically depended on the local deposition of Cs-137 and varied enormously with ranging several orders of magnitude in all the landscapes. For the observation period of time decreasing trends in concentrations of Cs-137 in eroded sediments were not obvious. To compare these results with those of Chernobyl, we calculated normalized solid wash-off coefficient (m^2 g^{-1}) with dividing the mean total concentration of Cs-137 in sediments by local deposition of Cs-137 (Konoplev et al., 1992). The coefficient was 4.4 $\times$ 10-5 in Farmland A1, 1.3 $\times$ 10^{-5} in Farmland A2, 6.4 $\times$ 10^{-5} in Farmland B1, 1.0 $\times$ 10^{-5} in Farmland B2, 2.2 $\times$ 10^{-5} in Grassland A, 1.0 $\times$ 10^{-5} in Grassland B and 8.2 $\times$ 10^{-5} in Forest. High erodibilities and relatively low values of normalized wash-off coefficients in cultivated farmlands can be attributed to the mixing of surface soil by ploughing. These values almost corresponded to those of Chernobyl. It was found that the total solid wash-off coefficient of radiocesium from farmlands is high and for 2 years period of time after the accident reaches 10%. Generally high precipitation in the region and steep slopes promote higher wash-off of radiocesium as compared to the Chernobyl case. Also, normalized wash-off coefficients exhibited relatively less volatility than erodibilities in the landscapes. These results suggest that soil erosion management is crucial for mitigating risks of radiocesium.

キーワード: 土壌侵食, 侵食プロット, Cs-137
Keywords: soil erosion, erosion plot, Cs-137