Erosion and transport processes of earth surface materials in a reservoir-catchment system inferred from atmospheric radionuclides ^{7}Be and ^{210}Pb

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Erosion and transport processes of earth surface materials are related to landform development in river catchment area and material discharge from the land area to the ocean. It is necessary to understand erosion and transport processes of earth surface materials to achieve proper management and prediction of river watershed and coastal area. However, since discharge behavior of earth surface materials in a large-scale river system is complicated by various processes, it is difficult to trace individual processes. On the other hand, earth surface materials eroded from catchment is transported and accumulated in reservoir. Therefore, discharge behavior of earth surface materials from catchment can be observed by monitoring of reservoir sediment. In this study, erosion and transport processes of earth surface materials in catchment were investigated based on atmospheric deposition flux to the catchment and sedimentation flux in the reservoir of ^{7}Be (half-life: 53 days) and ^{210}Pb (half-life: 22.3 years). From July 2016, rain water sample was collected every month with a collecting pan installed on the roof of Noto Atmospheric Observatory in Suzu City. ^{7}Be and ^{210}Pb in rain water were collected on ion exchange resins and measured with a Ge semiconductor detector to obtain atmospheric deposition fluxes. Sediment samples were collected with two sediment traps installed on the bottom of the reservoir (Shin-ike Reservoir) near the Noto Atmospheric Observatory at the same interval with rain sampling. Another trap was also set up in the middle layer (1.5 m above the bottom) since May 2018. Sediment samples were freeze-dried and measured with a Ge semiconductor detector to obtain sedimentation fluxes of ^{7}Be and ^{210}Pb. The atmospheric deposition fluxes of ^{7}Be and ^{210}Pb ranged 1.06-30.7 and 0.334-7.68 Bq/m^{2}/day, respectively. It shows clear seasonal fluctuation with high deposition in winter. The sedimentation fluxes of ^{7}Be in the bottom and middle layers were same level with the deposition flux. This result indicates that the contribution of ^{7}Be from the catchment is small. On the other hand, the sedimentation flux of ^{210}Pb in the middle layer was about 1.7-7.3 times higher than the atmospheric deposition flux of ^{210}Pb. This result suggests that sedimentation flux of ^{210}Pb in the middle layer reflects the contribution of ^{210}Pb from the catchment. The sedimentation flux of ^{210}Pb in the bottom layer was much higher than the atmospheric deposition flux, implying that sedimentation flux in the bottom was largely affected by resuspension in addition to the contribution of ^{210}Pb from the catchment. Residence time of these radionuclides in the reservoir-catchment system was estimated from the ^{7}Be/^{210}Pb$_{ex}$ ratios of rain water and sediment samples. The average residence times of the bottom layer samples and middle layer sample were estimated at 278 days and 141 days, respectively. This difference in the residence time may result from resuspension effect in the reservoir bottom.

Keywords: sediment, reservoir-catchment system, Be-7, Pb-210

