EGU21-14891, updated on 18 Jan 2022
https://doi.org/10.5194/egusphere-egu21-14891
EGU General Assembly 2021

Influence of the decontamination work on suspended sediment dynamics and ^{137}Cs migration after the Fukushima nuclear accident

Bin Feng, Yuichi Onda, Yuki Yamanaka, and Keisuke Taniguchi
University of Tsukuba, Center for Research in Isotopes and Environmental Dynamics, Japan (binfjf@outlook.com)

The FDNPP-derived ^{137}Cs triggers significant concern due to its potential health risk and on-going environmental pollution. Approximately 27% of ^{137}Cs are deposited in the terrestrial environment, and most of them remain in catchment until now. This severe radioactive contamination situation has driven government-led decontamination efforts to be implemented since 2012. Earlier studies reveal the influence of decontamination on local soil erosion, thereby changing the fluvial sediment supply and ^{137}Cs concentration. However, the dynamic transport process of suspended sediments (SS) and particulate ^{137}Cs remains unknown and the resulting variation of particulate ^{137}Cs fluxes into the ocean hasn't been totally evaluated because of the unavailable decontamination relevant materials and long-term monitoring data. Moreover, the shortcomings in the present SS load estimation method limited the possibility for further qualifying the impact of anthropogenic perturbation on SS load and their relative contribution by anthropogenic perturbations.

Here, combining the GIS and aerial photography, we report government-scheduled decontamination dataset for the Nidda river basin and exhibit the significant difference in their land covers in spatiotemporal scales, revealing the existence of different soil erosivity therein. Through a long-term monitoring campaign spanning decontamination and post-decontamination stages, we systematically explore the dynamic influence of decontamination on SS and particulate ^{137}Cs transport. Our results show SS load (normalized by precipitation factor) gradually increased but particulate ^{137}Cs concentration dropped sharply with the processing of decontamination, which probably is attributable to the increasing supply of ^{137}Cs-depleted eroded soil particulate from decontaminated land. We estimate the range of ^{137}Cs fluxes within 122 to 588 GBq·a^{-1} in 2013-2018 and find a continuous declination tendency in ^{137}Cs load after 2015, suggesting that decontamination restraining fluvial ^{137}Cs into the ocean. Based on the normalized difference vegetation index (NDVI), we evaluate the land cover changes in the decontaminated regions and applied them in the universal soil loss equation (ULSE) for estimating the fluvial load of SS during the study period. In comparison with the total SS flux in the study region, about 32%~71% of fluvial SS were thought from decontaminated land, highlighting the important role of decontamination in SS supply.

Scientifically, our findings not only fill the knowledge gap in the influence of decontamination but also respond to the global concern about yearly variations of ^{137}Cs fluxes into the ocean under the

influence of decontamination. More importantly, we propose and validate an approach for evaluating the input of SS and particulate ^{137}Cs to the ocean, which is extendable to apply in other interested catchment and forest.