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Source contributions to radiocesium contaminated particulate matter deposited in a reservoir after the Fukushima accident

J. Patrick Laceby (1), Sylvain Huon (2), Seiji Hayashi (3), Yuichi Onda (4), and Olivier Evrard (1)

(1) CNRS-LSCE, Gif-sur-Yvette, France (placeby@lsce.ipsl.fr), (2) Sorbonne Universités UPMC Univ Paris 06, Institut d'Ecologie et des Sciences de l'environnement de Paris (iEES), Paris, France, (3) National Institute for Environmental Science, Fukushima Branch, Miharu, Fukushima, Japan , (4) Center for Research in Isotopes and Environmental Dynamics, University of Tsukuba, Tsukuba, Japan

The Fukushima nuclear accident resulted in the deposition of radiocesium over forested and rural landscapes northwest of the power plant. Although there have been several investigations into the dynamics of contaminated river sediment, less attention has been paid to the sources of deposited particulate matter in dams and reservoirs. In the Fukushima Prefecture, there are 10 significant dams and over a 1,000 reservoirs for both agricultural and surface water management. These reservoirs may have trapped a significant volume of radiocesium contaminated sediment, and understanding the sources of this material is important for the ongoing management of contamination in the region.

Accordingly, the source of contaminated particulate matter (i.e. cultivated, forest and subsoils) deposited in the Mano Dam reservoir, Japan, was investigated with the analyses and modelling of carbon and nitrogen stable isotope ratios, total organic carbon and total nitrogen concentrations. Four sediment cores with lengths ranging from 29-41 cm were sampled in the Mano Dam, approximately 40 km northwest of the FDNPP. Source samples were taken from 46 forest soils, 28 cultivated soils and 25 subsoils in the region. Carbon-nitrogen parameters were analysed on all samples and a concentration-dependent distribution modelling approach was used to apportion source contributions.

Three of the four cores sampled in the Mano Dam reservoir had distinct radiocesium peaks representative of the initial post-accident wash-off phase. Cultivated sources were responsible for 48% (SD 7%) of the deposited fine particulate matter in the three cores with the radiocesium peaks, whereas forests were modelled to contribute 27% (SD 6%) and subsoil sources 25% (SD 4%). Ongoing decontamination of cultivated sources in the Fukushima region should result in a decrease of contaminated matter deposited in reservoirs. More research is required to understand the potential ongoing source contributions from forested landscapes in this post-fallout environment.