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Employment of the generalized adsorption model for the prediction of the solid-water distribution of radiocesium in the river-estuary-ocean system

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Abstract: Since last century, a large amount of radiocesium (RCs) released from atomic weapon tests and nuclear accidents, such as in Chernobyl and Fukushima, was directly introduced into the environment through atmospheric transportation and deposition on land surface soil, discharged into river systems by erosion effects during rainfall, and finally released into the ocean. In this study, a generalized adsorption model (GAM) for Cs^+ was employed to estimate the solid-water distribution of Cs^+ in the river-estuary-ocean system. The results confirmed that the capacity of each adsorption site of river sediments, i.e., interlayer site, type II site, and planar site, can be precisely optimized through the adsorption isotherm of Cs^+ on the river sediments combined with the radiocesium interception potential (*RIP*) and cation exchange capacity (*CEC*).

According to the GAM, the main contributor for Cs^+ adsorption is the frayed edge site rather than others due to the very low concentration of Cs^+ in the river-estuary-ocean system. The different solid-water distribution of Cs^+ in the river-estuary-ocean system was dominantly controlled by the salinity in the aqueous phase. Therefore, Cs^+ should be highly reactive with strong adsorptive character to particulate matter in the river system, whereas a conservative distribution must be dominant in ocean with much weaker affinity to particulate matter because of the high salinity.