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MODELING RADIOCESIUM FLUX TO THE OCEAN FROM RIVERS IN FUKUSHIMA AND SENSITIVITY ANALYSIS ON INPUT DATA RESOLUTION

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A large amount of radiocesium was released from The Fukushima Dai-Ichi Nuclear Power Plant (FDNPP) accident and deposited in the catchment of east coast rivers in Fukushima Prefecture. In the previous study, a compartment model has been developed and used for estimating the flux of radiocesium from Abukuma River. Since it gave a satisfactory result, the reliability of the model was evaluated by applying it on the east coast rivers in Fukushima Prefecture. We attempted to estimate the radiocesium flux into the Pacific Ocean from 16 rivers located in east coast of Fukushima Prefecture. Moreover, the future projection of the flux for 100 years has been estimated. The model relies on wash off process by which the values are provided on the various previous studies. Numerical technique was used to solve the established equations. During the first year after the accident, the rivers in the east coast released about 17 Tbq of radiocesium. By adding the flux from Abukuma River (10.1 Tbq), the total radiocesium flux from these rivers is higher than the direct discharge from FDNPP (17 Tbq). Based on the 100 years projection, it was estimated that the rivers will discharge about 125 Tbq of radiocesium. Summing up with the discharge from Abukuma River, the total discharge was estimated about 258 Tbq. The estimated data resulting from the model shows an spatial agreement with the observed data by achieving R^2 of 0.95. The accuracy of the model was evaluated by calculating Nash Efficiency Coefficient in which achieved by value of 0.9.This achievement was obtained by using fall out data as the radiocesium input based on the survey by MEXT on more than 200,000 sampling points. Thus, the sensitivity analysis on fall out data resolution was required in order to assess the accuracy of the model in a condition where the fall out data is limited. To create such condition, 3 scenarios were established. Scenario A uses 1000 sampling points as the radiocesium input which were randomly selected for 100 times from 200,000 sampling points. Scenario B and C uses 500 and 100 sampling points respectively. Then, the estimated radiocesium flux to the ocean as the results was compared to the observed data. The value of R^2 from scenario A,B and C are in the range of 0.81-0.85 indicating that even by using 100 sampling points, the trend of the observed data is still in agreement with the estimated data. Moreover, 100% and 99% of the Nash Coefficient values from scenario A and B are over 0.7 and only 7% of Nash Coefficient values from scenario C is below 0.65. This results show that during the condition where the fall out data is limited, the fall out data based on 100 sampling points could be used as the radiocesium input for the model and could produce a good estimation for the radiocesium flux from rivers to the ocean.

キーワード: radiocesium, compartment model, river, east coast of fukushima, sensitivity analysis, resolution of fall out data
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