Simulations of Radiocesium Discharge from Abukuma River with Improved Cesium Wash-off Model

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Abstract

The present work aims to improve the Soil and Cesium Transport (SACT) model, which has been developed for simulating radiocesium redistribution after the Fukushima accident. Two mechanisms, namely, vertical migration, and long-term fixation of radiocesium in soil have been newly implemented. Without parameter tuning, the new SACT model shows improved agreement with measurement results.

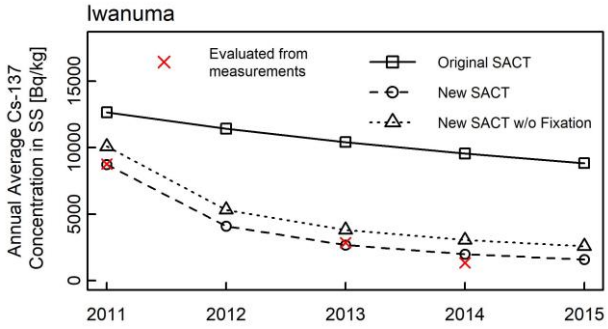
Keywords: Fukushima Accident, Radiocesium, Migration, Depth Profile, Fixation, USLE

1. Introduction

In previous works [1], Soil and Cesium Transport (SACT) model has been developed to simulate the long-term migration of radiocesium after the Fukushima Accident. Although the SACT model has been successfully applied to simulate the radiocesium discharge in 2011, it fails to capture the sharp decrease of radiocesium flux in subsequent years, especially in the case of Abukuma River.

2. Method and Results

The present work aims to improve the SACT model by implementing a new sub-model for cesium wash-off, in which the vertical migration, and long-term fixation of radiocesium in soil are taken in to account. To understand the vertical migration process, depth profile measurement results between 2011 and 2016 have been fitted by different distribution functions, with model selection made by Akaike information criterion (AIC). To simulate the long-term fixation of radiocesium in soil particles, a semi-empirical model has been developed to describe the findings in sorption experiments [2]. For validation, the annual average radiocesium concentration in sediments discharged from Abukuma river has been evaluated from measurement. The comparison is shown in the figure below.



3. Conclusion

Without parameter tuning, the new SACT model shows improved agreement with the measurements. Vertical migration and long-term fixation could be the key to understand the long-term behavior of radiocesium.

References

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