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# Stochastic modeling of the migration of Cs-137 in the soil considering a power law tailing in space

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We develop a theoretical model to reproduce the measured data of Cs-137 in the soil due to the Fukushima Daiichi NPP accident. In our past study, we derived the analytic solution under the generalized Robin boundary condition (Oka-Yamamoto solution). This is a generalization of the He-Walling solution (1996). We compared our solution with the Fukushima soil data of for 3 years after the accident and found that the concentration of Cs-137 has a discrepancy from our solution, specifically in a deep part because the depth profiles have a power law tailing. Therefore, we improved our model in the following aspect. When Cs particle (or Cs solution) migrate in the soil, the diffusion coefficient should be the results of many processes in the soil. These processes include the effect of various materials which constitute the soil (clay, litter, sand), or the variations of pore size in the soil. Hence we regard the diffusion coefficient as the stochastic variable, we derive the model. Specifically, we consider the solution of ADE to be the conditional probability C(x,t|D) in terms of the diffusion coefficient D and calculate $C(x,t)=\int_{(0\sim\infty)} C(x,t|D)*f(D)*dD$, where f(D) is the probability density function of D. This model has a power law tailing in space like the space-fractional ADE.