Novel hypothesis for Fukushima re-suspension: Biological processes

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In this presentation we would like to introduce novel hypothesis that the bioaerosol processes could be involved in the radioCs resuspension to the atmosphere for the case of the Fukushima radiological contamination. The authors have studied for the re-suspension of the radioCs emitted by the Fukushima Dai-ichi Nuclear Power Plant (F1NPP) accident in contaminated area to assess the effect of the accident (Ishizuka et al., 2016; Kita et al., 2016; Kinase et al., 2016). Consequently, the authors found that 1) during summer radioCs concentration increases in such typical Japanese village-vicinity mountain area and that 2) radioCs hosting particles in summer seem to be dust from its appearance, their optical micrograph and our experiences (Igarashi et al., 2015; Ishizuka et al., 2016). However, we recognized that most particles collected on the filter had biological origin from electron-microscopic view. Considering the fact that true fungi concentrate Cs due to misidentifying Cs as potassium, we can reasonably assume that the fungal spore as the major contributing host for radioCs resuspension.

So we had carried out ball park calculation. Supposed that only fungal spore can carry ^{137}Cs, estimating the ^{137}Cs amount per spore under various assumptions; the value would be ranging 5×10^{-10}-3×10^{-7} Bq/fungal spore particle, in that case, the spore needs to be released at a rate of 9×10^{3}-5×10^{5} particle/m^2/sec from forests to support the present ^{137}Cs in the air. This value is surprisingly 1-3 digits larger than the forest maximum value (387 particle/m^2/sec) of the fungal spore emission rate described in Table 2, Sesartic & Dallafior (2011), suggesting a potentially large environmental impacts of the spore. Actually, number concentration of bio-aerosol would be reaching 5-8$\times10^{5}$ particle/m^3 in our preliminary observation during past summer in 2015 in a forest in Fukushima prefecture, revealing that more bio-aerosol release could be occurring from Japanese forests than our expectation. Further, based on this postulation that fungal spore would be a major source of atmospheric radioCs especially during summer, ^{137}Cs concentration would be ranging 2.5×10^{-4}-0.15 Bq/m^3 air in the forest, which almost fits to the actual ^{137}Cs concentration level observed in the air of the site in Fukushima prefecture.

Therefore, we have carried out preliminary observations at the Namie site during summer and winter for the possible bioaerosol detections by using the fluoresence microscopy and DNA analysis. In this presentation, we will show the results for the bioaerosol number concentrations by fluoresence microscopic counting and predominant species by the DNA analysis.

The radioCs could be recycling through the terrestrial ecosystem and emitted to the atmosphere, for instance, in the case of cedar pollen. However, “bio-resuspension” related to the fungal spore is a quite novel hypothesis. The hypothesis is under tests by observations as well as model simulations (Kajino et al., 2016), which could contribute better understanding of anthropogenic Cs behaviour in the terrestrial environment.

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