

Dear anonymous referee #2,

We very much appreciate your constructive comments, useful information and your time for RC1. Especially, the intimate investigations, grammar corrections, and introduction of Evrard et al. (2015) were really helpful. Thanks to your review, our manuscript was substantially improved. Point-by-point responses to your comments are written in blue in this letter.

Best regards,
Mizuo Kajino

General comments:

This manuscript quantifies radiocesium resuspension in 2013 in Northeastern Japan following Fukushima accident, based on field observations/experiment and numerical simulations. Overall, the results are well presented (in Tables and Figures) and described in the text. Detailed comments/suggestions are provided in the attached annotated pdf file. Only general comments are provided here:

Thank you for your evaluation. I improved the manuscript according to your general as well as specified comments. Point-by-point responses to your comments in the PDF file are embedded in this letter.

[1] The title does not fully reflect the content of the study, the study period should be provided (rather than mentioning that it is a 'long-term study', which is misleading);

This is a full-year assessment in fact, but the outcomes obtained from the study can have long-term perspectives: Less than 0.1%/y of re-suspension rate will have negligible impacts on reducing the ground radioactivity for a long-term, say ten to several ten years, for example. To avoid the misleading, we defined it in Abstract as "In order to assess the long-term effect, the full year of 2013 was selected to study...". Thank you for your understanding.

[2] Materials and methods section is very clear, and necessary supporting information is provided as Supplementary Material;

Thank you.

[3] In the discussion section (and in the perspectives), hypotheses could usefully be proposed by the authors regarding the mechanisms that may drive the observed/simulated resuspension (in my opinion, it is not sufficient to mention that 'future work should investigate this'. . . The structure/style in which perspectives and conclusions are written could be improved to avoid providing a list of ideas/items;

I modified Sect. 5.4 (Sect. 5.3 in the previous manuscript) excluding the list of items.

[4] It is not clear to me why the so-called 'land surface processes' were removed from the main text and detailed in Appendix C; in my opinion, this could be integrated in the main text.

According to you as well as Referee 3's suggestions, Appendix C has been moved to the main text as Sect. 5.3. Thank you for your suggestion.

Specific comments (embedded in the pdf manuscript):

(P.1) ← page number of your supplement pdf

the accident happened in 2011... I don't know whether we can refer to a long-term study...

As replied to the general comment #1.

why 'ecosystems'?

As discussed in Sect. 2.3, from the previous studies, it is likely that Cs emission exists from forest but the mechanism is totally unknown, whether it is from vegetation, fungi, soil, or litters. That's why we used the word ecosystems to cover everything in the forest.

is it relevant?

Please refer to the reply of the general comment #1.

this statement confirms that it is not a 'long-term' study...

We rephrased the sentence as follows: "In order to assess the long-term effect, the full year of 2013 was selected to study just after the start of the field experiments."

mainly due to the difference in initial contamination levels at both sites, what do you think?

Basically yes, but the surrounding regions of the sites also affect. Sect. 5.1 together with

Fig. 12 partially answers to your question. For example, 10% of radiocesium concentration at Namie was coming from regions outside the contaminated area ($< 300 \text{ kBq/m}^2$) (please see Figure 4a) and 10 – 40 % of radiocesium concentration at Tsukuba was coming from regions inside the contaminated area.

(P2)

what do you mean?

I modified the phrase as “migration in the soil and biota”. The phrase, migration in the soil, includes migration with soil water and with soil particles (as summarized in Evrard et al., 2015) in the soil.

in negligible proportions?

Referee #1 (RC3) also suggested grammar correction here. The both should work but I took the Referee #1's suggestion just because it is simpler. Thank you for your understanding.

= reproduce?

I changed it.

= could explain?

I changed it.

within?

This is re-suspension “from” forest.

please rephrase this sentence

>> suggestion: future research should investigate the processes/mechanisms governing this resuspension over the long term?

to avoid repetition, could be as follows:

>> this could be achieved through conducting additional field experiments and numerical simulations

Referee #1 (RC3) also suggested correction of the sentence. I modified the sentence combining the above two of your comments and his comments as “Additional research activities should investigate the processes/mechanisms governing the re-suspension over the long term. This could be achieved through conducting additional field experiments and numerical simulations”

maybe add 'Japan'?

I added it.

the ocean

I changed it.

that occurred

I added it.

replace with 'soil' only

I changed it.

during the months and the first years that followed the accident

Here I meant March 2011 so I modified the sentence as “during the months that followed the accident”.

what type of field observations?

I modified the sentences as “field observations (ground aerosol sampling: Masson et al., 2011, 2013; Kaneyasu et al., 2012; Adachi et al., 2013; Tsuruta et al., 2014; Igarashi et al., 2015; Oura et al., 2015, aircraft measurements: NRA, 2012, and afoot measurements: Hososhima and Kaneyasu, 2015)”.

to simulate emissions....?

I added “of transport and depositions”.

GENERAL REMARK HERE:

I would only provide 3 representative references for each item

I would like to show the significant differences in numbers for the study of air concentrations, during the crisis phase (March 2011) and post-accidental phase (this study select 2013 as an example).

(P.3)

replace 'but' with 'and'

I changed it.

I would make two sentences here, and start the second one with 'However,...'

I changed it.

replace with: 'for unmonitored locations'

I changed it.

(P.4)

Although

I changed it.

remains possible

I changed it.

use 'activities' to avoid repetition of 'concentration'?

I changed it.

please rephrase

I rephrase it to "They found substantial amounts of bioaerosols upon scanning electron microscopy samples collected in the summer, "

You could stress the fact that with 'Fukushima', you mean 'Fukushima Prefecture' to avoid confusion for the readers

I changed it to "(Namie town, Fukushima prefecture)" and to be consistent changed "(Tsukuba, Ibaraki)" to "(Tsukuba city, Ibaraki prefecture)". I changed them in the abstract accordingly.

collected?

I changed it to "conducted", instead.

please rephrase

The current sentence has been deleted according to the Referee #1's comment (RC3).

these?

The current sentence has been deleted according to the Referee #1's comment (RC3).

please avoid repetitions with the text above (LL. 18-20)

I changed the sentence to "By utilizing the observational data both inside and outside together with the transport model,".

>> a robust analysis?

I changed it.

>> the

I added it.

(P.5)

crucial to understand?

I remained the sentence as it was.

low to moderately?

I changed it.

low/large?

I added "large".

(P.6)

level?

I meant "schoolyard" here. I changed it.

(P.7)

do you mean runoff/erosion?

Yes, runoff, erosion, percolation and all the processes resulting in radiocesium migration in the soil and biota.

Furthermore?

I changed it.

where are they mentioned? I missed this...

I added the phrase as "into the four above-mentioned four categories (i.e., sand, loamy sand, sandy loam, and silt loam)".

(P.8)

>> an analogue

I remained the word as it was.

= bare ground?

According to the referee #1's comment (RC3), I have deleted the sentence.

it would be useful to add in 1-2 lines how they explain this resuspension in forests?

They didn't explain the mechanisms and just stated the fact. Anyway, according to the referee #1's comment (RC3), I have deleted the sentence.

(P.9)

> the previous versions

I changed it.

However

I changed it.

(P.10)

I changed it.

please provide the max period

I found the max period is 2 days for the analysis period (year 2013), and so the phrase in the parenthesis was removed.

this is rather confusing!

In the revised manuscript, the Tsushima site is referred to as Namie (sometimes as Namie (Tsushima)) and the Omaru site is referred to as Omaru (sometimes as Namie (Omaru)) throughout the manuscript.

remained

I changed it.

(P.11)

aerosols carrying...?

I changed it.

to

I added it.

(P. 12)

in agreement...?

I changed it.

valid?

I changed it.

please rephrase

I changed it to "rather give simulation results consistent with the available observations".

please rephrase >> you mean that it was simulated but not observed?

I rephrased it.

(P. 13)

used?

I added it.

in order to adjust?

I changed it.

unclear to me, please rephrase

I rephrased it to "in order to adjust".

facilitated?

I changed it.

unclear what you mean here

If the tuning parameter varies in time and space, the source of variation in the simulated concentration is hardly identified, whether it is coming from the varying tuning parameters or from the model variation itself (i.e., emission and meteorology). I rephrased it from "by keeping the simulated variation as it was" to "by keeping the simulated variation solely originating from the variation of boundary conditions (i.e., emission and meteorology)".

remove 'in'

I removed it.

or soil erosion?

Yes, and runoff, percolation and all the processes resulting in radiocesium migration in the soil and biota. The definition of land surface processes are additionally written in the beginning part of the revised manuscript, in Sect. 2.2.

AFTER decontamination, as DURING decontamination works, this flux should increase

Thank you for your suggestion. This is a very important implication and I added the following sentence in the Introduction section: "Although the decontamination-related work could be a potential source of re-suspension, it is not considered in the current simulation as the re-suspension flux has been hardly quantified." The similar statement was added to Sect 5.4 (previously Sect. 5.3) as "The decontamination may reduce resuspension afterward, whereas the resuspension may occur during decontamination-related work. This effect should be evaluated in the future."

(P.14)

unclear what you mean here

I changed it to "continuously presenting emissions, such as natural emissions, and not accidental ones."

unclear what you mean here

I changed it to "from the highly contaminated areas such as within the premises of FDNPP (e.g. debris removal operations) or very close to FDNPP on these days, as indicated later in Sect. 5.2)

please rephrase

I changed it to "inside and outside".

where to? The Pacific Ocean? Other Japanese regions?

I changed it from "out of the region" to "out of the model domain". We cannot tell exactly where to but anyway toward out of the model domain, which only covers a part of Japan.

(P.15)

??

It meant “The discrepancy between the observed peak and the dust simulation could be due to underestimation of the simulation but it is less likely because the simulated dust peak reached an intensity of 4 – 5 mBq/m³ in other days in the winter, which is of the same order of magnitude as that of the observed peak.” But I deleted the sentences because I judged it is not necessary here.

(P.16)

??

In winter in Japan, northwesterly wind prevails due to Siberian high, which is called winter monsoon. On the other hand, southerly wind prevails due to Pacific high, which is called summer monsoon, in Japan.

(P.17)

this is unclear, please rephrase

“around Tsukuba” is added at the end of sentence.

a line of explanation would be welcome here

“due to higher surface wind speed in the cold season” is added at the end of sentence.

> constant emission sources?

I changed it from “constant emission” to “continuous emission sources”.

(P.19)

Not sure whether the journal recommends to structure the perspectives section as a list of 'bullet points'

I modified the section by excluding list of items.

>> could be rephrased and could usefully include suggestions/hypotheses of potential mechanisms driving the observed processes

Based on the approaches used in the study, the authors cannot hypothesize the mechanisms of the emissions. This should be done by other studies on experimental or theoretical basis.

what do you mean exactly here?

I meant “improved”. I modified the sentence as follows “The module needs to be

improved to be applicable to various land use and soil texture conditions”.

this

I changed it.

(P.20)

during?

I changed it.

(P.25)

why it is separated from the main text?

I moved the Appendix C in the main text as Sect. 5.3. Thank you for your suggestion.

why

This is just a rule of data sampling. Other rules can be applied for example to pick up stations showing median dose rate at 0:00 a.m., January 1, 2014. No matter how data were sampled, a conclusion we extract here would not be changed: Decreasing rate in gamma dose rates due to re-suspension was two to three orders of magnitude smaller than the gross decreasing rate including radioactive decay, decontamination, and the land surface processes.

(P.27)

Cs might be transported with soil as well, see for instance Evrard et al. (2015); J . Env. Rad; for a review on these processes

Thank you for introducing the very important work. I modified the last paragraph of Sect. 5.3 (previously Appendix C) referring their work as “Evrard et al. (2015) summarized that significant transfer of particulate-bound radiocesium occurs during major rainfall and runoff events (typhoons and spring snowmelt) ...”.

(P.44) Figure 8.

a ratio is not a %...

I changed from “ratios” to “fractions”.