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Interactive comment on “Depth distribution of radiocesium in Fukushima paddy fields and implications for ongoing decontamination works”

by H. Lepage et al.

Anonymous Referee #2

Received and published: 11 November 2014

General comments

The Introduction does not conclude with a clear statement of the aims of the study that are justified by the preceding text. By the end of the Introduction the reader understands that you intend to investigate the depth distribution of caesium-137 in the area of fallout, but it is not clear how you will draw more broad conclusions on the processes governing migration and cycling that would have significance for other studies beyond your own. Although the Fukushima Dai-Ichi Nuclear Power Plant accident is clearly significant the findings that caesium-137 cycles within the upper layer of the soil is not

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novel – this was shown previously in relation to Chernobyl fallout (in the UK) based on models of caesium dynamics (Absalom et al 2001). The introduction needs to consider earlier work on Cs-137 turnover at other sites of radioactive contamination that pre-date Fukushima Dai-Ichi.

In the study you apply equations to determine the inventory of caesium-137 but this is not referred to specifically in the introduction - who has applied these equations previously to which sites (beyond the current study) and what are there advantages and disadvantages?

The study needs a more comprehensive consideration of the relative importance of mineral versus organic matter related adsorption/interception of caesium-137. For example, you need to consider the work undertaken by Gil Garcia et al (2009). This work and others have suggested that mineralogy is likely to be the dominant influence on RIP, not organic matter concentrations or interactions between OM and minerals. Do you have any information on the mineralogy of these soils (which may determine RIP more than organic matter content) that could be included in the analysis (e.g. illite content is important for RIP). If not, why was mineralogical analysis undertaken as part of the study. For example, Absalom et al (1995) showed that mineral dominated soils adsorbed more caesium than organic soils.

There are numerous small grammatical errors which requires a native speaker to correct before the paper can be accepted.

Specific comments

Abstract

Line 16 - replace maintenance with grass cutting and tilling with tillage

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Line 19- over what area are you recommending removal and what are you suggesting authorities do with this soil material to minimise human exposure to radiation?

SOIL

Line 24 - what does 'on river channels' mean - by river channels?

1, C181–C185, 2014

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Line 13 - what is the exposure pathway - direct exposure to gamma radiation from the soil or consumption of contaminated foodstuffs? Later in the text you make gamma exposure measurements but you need to make it clear in the introduction that this is the exposure pathway you are considering.

Line 22 - affected to a limited extent is better.

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line 2 large concentrations of organic matter.

line 9- Why should depth migration be specifically investigated in these soils – this statement needs to be justified. It is not self evident.

line 10-12 Would a large proportion of amorphous minerals result in a low RIP if there was a large proportion of other mineral phases that had large RIP values?

line 14 - you make it clear here that soil to plant transfer is important of a RIP for understanding exposure, but you do not suggest undertaking any assessment of RIP values in relation to previous work - why did you not consider measuring RIP as a means of understanding the processes governing the fate of Cs137 in these soils?

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It is not clear how many sections of soil this procedure yields: 'The soil cores were subsectioned into 1 cm increment layers for the uppermost 5 cm, and into a 5cm interval to a depth of 10 cm.'

Figure 6 - is this cumulative rainfall? It appears to show rainfall for each rainfall event, but not accumulated?

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line 22-25 - this needs redrafting as it currently too long and loses its meaning

lines 3-7 - these are not conclusions from your study, they are suggestions based on your inference that bare soil will erode more easily. You have not shown that soil is more erodible when decontamination works are underway so this should be left in the discussion and not repeated here.

References ABSALOM, J.P., YOUNG, S.D. and CROUT, N.M.J. (1995), Radio-caesium fixation dynamics: measurement in six Cumbrian soils. European Journal of Soil Science, 46: 461–469. doi: 10.1111/j.1365-2389.1995.tb01342.x

Absalom JP, Young SD, Crout NMJ, Sanchez AL, Wright SM, Smolders E, Nisbet A, Gillett AG. (2001) Predicting the transfer of radio caesium from organic soils to plants using soil characteristics. Journal of Environmental Radioactivity 52:31-43

Gil-García C, Rigol A, Vidal M. 2009. New best estimates for radionuclide solid–liquid distribution coefficients, Part 1: Radiostrontium and radio caesium. Journal of Environmental Radioactivity 100: 690–696.

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