

Interactive comment on “Global risk from the atmospheric dispersion of radionuclides by nuclear power plant accidents in the coming decades” by T. Christoudias et al.

Anonymous Referee #1

Received and published: 30 December 2013

The paper addresses risks from radioactivity exposures in the following 2 decades from hypothetical accidents in the operational, under construction and planned NPPs. In general, I am very positive about publishing this work in ACP due to the very attractive presentation of the results and the interpretation given by the authors. However, I would like to state some comments that, in my opinion, would make the manuscript stronger and more comprehensible to the reader.

-Abstract, line 13: Correct "dosages" to "doses".

-Abstract, line 14: Correct "from the inhalation and the exposure to ground deposited

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radionuclides" to "from inhalation and ground-deposition exposures of radionuclides".

-Abstract, line 15: One of your main conclusions (also in the conclusions section of the manuscript) is that inhalation doses are the highest during boreal winter. However, I cannot see any evidence for this in the manuscript or in the supplements. Please add a graph or something to support it.

-Page 2, line 28: Correct "dosages" to "doses".

-Page 2, line 29: There is one more pathway that should be taken into account (air-submersion). Please write a comment on its low contribution to the total dose or provide a reason why it is not included in the computations.

-Page 2, line 31: I think this paragraph is not useful and should be removed. We easily see the different sections of the manuscript.

-Page 2, line 104 (last sentence of the page): Please remove "and irradiation". You probably mean air-submersion, which is an external pathway that exists while fallout passes near human and non-human biota. Irradiation is the result of all these exposure pathways.

-Page 3, line 5: Please correct "life-time" to "half-life".

-Page 3, line 56: I would like to see a graph of the daily emissions of these hypothetical releases in the supplementary information because I do not understand how the temporal release takes place. For example, if you claim that emissions take place throughout a year, this cannot be realistic, as in the two INES 7 accidents, atmospheric emissions occurred for 10 days (Chernobyl) and for 42 days (Fukushima). Moreover, it is not clear if you emit 1 PBq per year or 1 PBq in total. Please correct.

-Page 5, line 5: I do not understand how exactly you define the RISK. Please add a chapter in the supplementary information of the manuscript. Do you define it in relation to the burden at the lowest level, or the committed effective dose and for which period (20 years average???)? Is it a really dangerous exposure? As I see, the dose you get

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is below 1 mSv, which is the maximum annual effective dose for the population from all artificial radionuclides according to the IAEA. Please explain.

-Page 6, line 85: The definition of the risk as given here seems a bit speculative and meaningless. In radiation protection, when we discuss about population risk from radioactive releases, we usually mean how many people will get sick (morbidity risk) or die (mortality risk) from "all solid cancers" or from thyroid cancer (when we calculate exposures from ¹³¹I). The function for these calculations are given in detail by Ten Hoeve and Jacobson (2013) or Evangeliou et al. (2014) *Env. International*. I would recommend you to calculate such risks. You can use future population density gridded data from NASA. The risk you mean here (but you don't calculate) is just a risk of a population to be exposed in a certain amount of radiation. If this risk is dangerous or not can be quantified using the cancer risk to the population exposed. You have to pay attention on that because exposure to radiation occurs continuously in human life. The question is how dangerous this risk is.

-Page 7, line 26: Please correct "lifetime" to "half-life".

Interactive comment on *Atmos. Chem. Phys. Discuss.*, 13, 30287, 2013.

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