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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Modelling the global atmospheric transport and deposition of radionuclides from the Fukushima Dai-ichi nuclear accident" *by* T. Christoudias and J. Lelieveld

Anonymous Referee #2

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The manuscript presents the global atmospheric transport and deposition of Xe-133, I-131 and Cs-137 released into the atmosphere from the Fukushima Dai-ichi nuclear power plant (FD-NPP) in Japan by the global transport model. Also, the manuscript discusses the total deposition of I-131 and Cs-137 in the Western Pacific and Japan. At the present time, the multi-scale and multi-media environmental pollution caused by the massive release of radioactivity to the atmosphere from the FD-NPP is very severe natural and social issues, while the available information related to the emissions and pollution is very limited so far. In this situation, the author's work brings very valuable and timely information to the international society. However, the author's work is fundamentally based on the transport model of global scale, which has large uncertainty in

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the regional scale. Hence the conclusions should be discussed carefully based on the observed data especially in Japan. In particular, the results related to the Japanese situation give the large impacts to the Japanese society and will affect to the current works in progress and future planning for countermeasures for the reduction of radioactivity in Japan. Therefore, it is very important to draw a conclusion by careful discussion and consideration from objective and scientific evidences. The reviewer recommends publishing this paper with major revisions in response to the following questions and comments.

< Major comments >

1. Model results in Japan: The horizontal resolution of the author's global model (T255 resolution) is approximately 0.5 by 0.5 degrees. The resolution is too coarse to resolve the complex topography around the FD-NPP. As a result, the modeled spatial distribution of deposition of the sum of Cs-137 and I-131 may be different from the actual situation. The authors need to evaluate the modeled results in Japan based on the observation data. For example, the deposition map of Cs-137 based on the aircraft measurement released by MEXT (Ministry of Education, Culture, Sports, Science and Technology) of Japan (http://radioactivity.mext.go.jp/en/contents/4000/3179/24/1270_1216.pdf) is now available. It is strongly recommended that the authors compare the modeled deposition with the measurements (e.g. http://radioactivity.mext.go.jp/en/). And then, the section 3.2 (4-13 lines of page 24542) and section 3.3 should be revised.

2. Chemical characteristics and wet deposition of I-131: Are there any proofs or references of "iodine largely remains in the gas phase" (Page 24533, lines 2-3) and "I-131 in not removed by wet deposition"(Page 24540, line 9)? In the previous studies, it is usually assumed that iodine is either bound to particle or in gaseous phase (Sportisse, 2007; Kristiansen et al., 2012). Actually, the measurements at the sites around FD-NPP after the accident shows that the I-131 consists of gas and particulate phase though the gaseous fraction has a big temporal and spatial variation (private commu-

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nication with Japanese scientists). Additionally, for the wet deposition of I-131, the deposition rate for gaseous I-131 is reported in the previous study (Sportisse, 2007). If the wet depositions of particulate I-131 are considered in the global simulation, the author's modeled results may change drastically.

(Ref.) Sportisse: A review of parameterizations for modelling dry deposition and scavenging of radionuclides, Atmospheric Environment, 41, 2683-2698, 2007. Kristiansen et al.: Atmospheric removal times of the aerosol-bound radionuclides 137Cs and 131I during the months after the Fukushima Dai-ichi nuclear power plant accident – a constraint for air quality and climate models, ACPD, 12, 12331-12356, 2012.

< Individual comments >

1) Page 24532, line 24: "Stohl et al., 2012" and "Chino et al., 2011" should be reversed in order.

2) Introduction As a previous work in the global simulation of radionuclides from the FDNPP, the following reference which is a first publication in the global simulation should be added.

(Ref.) Takemura et al.: A Numerical Simulation of Global Transport of Atmospheric Particles Emitted from the Fukushima Daiichi Nuclear Power Plant, SOLA, 7, 101-104, 2011. https://www.jstage.jst.go.jp/article/sola/7/0/7_0_101/_pdf

3) Page 24535, line 9: Are there any proofs or references of "mean radius 0.25um"?

4) Page 24535, line 18: Recently, the Chino's group revised the emission data (Terada et al., 2012). Some comments are needed.

(Ref.) Terada, H., G. Katata, M. Chino, and H. Nagai: Atmospheric discharge and dispersion of radionuclides during the Fukushima Dai-ichi Nuclear Power Plant accident. Part II: verification of the source term and analysis of regional-scale atmospheric dispersion, J. Environ. Radioact., 141-154, 112, 2012.

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5) Page 24540, lines 3-4: The modeled results based on the emission inventory by Chino et al. should be shown in Figure and/or Table.

6) Figs. 2(b), 2(c), 3(b) and 3(c): The size of each figure is too small. They need to be improved.

7) Fig. 6 (bottom) The location of "Tokyo Metropolitan Area" is a small mistake. The rectangle should be shifted to the Northeast.

8) Fig. 7, line 1 of the legend "Eastern Pacific" should be changed to "Western Pacific".

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 24531, 2012.