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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Application of linear minimum variance estimation to the multi-model ensemble of atmospheric radioactive Cs-137 with observations" *by* Daisuke Goto et al.

Anonymous Referee #1

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(Part A) [General comments] This paper presents a novel method that can significantly improve airborne Cs-137 predictions for ensembles of limited size and moderate performance. The authors use a linear minimum variance estimation and the data of approximately 100 sites covering eastern Japan, to combine CMAQ and NICAM model results for enhanced predictions. Numerical experiments with different data and various sensitivity studies have also been performed to demonstrate the behavior of this method, including the spatial interpolation, time window, and the ensemble size. With the optimism parameters, the proposed method shows very promising results and remarkable metrics. The ensemble simulation method could provide a more precise estimation of the nuclide dispersion, thus helping us better understand the impacts of inhalation

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exposure on residents in Japan. The paper is definitely worth publishing. However, it is suggested that the authors address the following issues, to make the paper better presented. (Part B) [Specific comments] In section 2.2, the weight ai seems to be calculated for data from each monitoring site. However, Figure 11 indicates that the weights are applied to the whole calculation domain. In section 4.1, the author studied the interpolation method of variance, which may seem to be used for weight calculation beyond site positions. However, this explanation may not be easily found by the readers. It is suggested that the authors add some explanations on how to apply the weights to the whole domain in section 2.2. In section 2.3, it would be helpful if the authors added the lattices of representative sites to Figure 1. These lattices may help the reader to understand the representativeness of these sites. Besides, it is suggested that the authors give some explanations on how to choose the representative site in these lattices. For example, it is possible to present the data set of each experiment in an individual subplot of Figure 1. In section 3.2, Figure 5 shows that SEN3 does not reproduce the observations at Shinchi and Sugitsumacho. But there is a learning site (the red one in Figure 1) which is close to Shinchi, which should provide some information. Would the authors add some explanations for the phenomenon? In section 4.2 Are all the observations used by the ensemble methods in the sensitivity tests of ensemble size and time windows? In section 3.2, Figure 6, what's the difference between the knots on the all sites line (black line)? Are these knots the metrics calculated from a part of the all-site ensemble results (those predictions at the sites used by SEN1, SEN2, and SEN3)? In section 4.2, why the GMB, RMSE, PCC remain stable while the FAC2 drop apparently due to the weakening of the peak by using the longer time window. Is it possible to discuss the deposition predictions of the proposed method? It could be interesting to see whether the air concentration correction can improve the deposition prediction as well. (Part C) [Technical corrections] Some description can be simplified to be concise and clear. 1 Introduction P1 L9 "great efforts have been carried out to simulate atmospheric pollutants" could be better. P3 L10 "limiting" should be "limited" P3 L33 "the available results were increased via the use of six members"

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could be "The available results were increased to six members" 2 Method P4 L20 "the basic experimental design in this study is common, such as in Morino et al." could be "the basic experimental design in this study is widely used in this field . . ." P6 L7 "discussed in section 4.2" should be "discussed in section 4.1" 3 Results P9 L12 "in figure 5(a) and 5(c)" should be "in figure 5(a) and 5(b)" 5 Conclusion P13 L26 "when Cs-137 simulated by some members is overestimated compared to the observations" could be " when Cs-137 is overestimated by some members"

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