

Geosci. Model Dev. Discuss., referee comment RC2
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Comment on gmd-2022-168

Anonymous Referee #2

Referee comment on "Bayesian transdimensional inverse reconstruction of the Fukushima Daiichi caesium 137 release" by Joffrey Dumont Le Brazidec et al., Geosci. Model Dev. Discuss., <https://doi.org/10.5194/gmd-2022-168-RC2>, 2022

Review of gmd-2022-168: Bayesian transdimensional inverse reconstruction of the ^{137}Cs Fukushima-Daiichi release, authored by Joffrey Dumont Le Brazidec, Marc Bocquet, Olivier Saunier, and Yelva Roustan

Summary:

In this work, the authors investigated a transdimensional sampling method to reconstruct highly fluctuating radionuclide atmospheric sources and applied it to assess the ^{137}Cs Fukushima-Daiichi release. The authors apply a reversible-jump Markov chain Monte Carlo sampling algorithm for use in Bayesian inverse problems for source reconstruction. The authors tried various methods in hopes of gaining accuracy and reducing uncertainty in the estimates, such as the inclusion of two observational sources of information (air concentration observations and deposition measurements). The authors found that the total released reconstructed activity is estimated to be between 10 and 20 PBq, which matches previous literature, although this estimate increases when considering the deposition measurements.

While the authors do a good job in explaining the methods and the results in the paper, I think there are small points that need to be addressed, mostly grammatical or in the figures.

Main comments:

This is just my opinion, but I believe that parts of the introduction that describe the Bayesian inverse modelling approach (e.g. Section 1.2) can be moved to the methods section, and parts of Section 2 describing previous literature on the topic (e.g. Section

2.1) can be moved to the introduction.

In general, the metric used to describe the goodness of fit (FAC scores) is hardly described in the text with very little background information. This makes it hard for a reader to judge the accuracy of the results. The authors can do a better job at providing some of this information for clarity. What decides if a given FAC score is considered 'good' or not?

The figures seem to have some mistakes or an issue with the processing. Numbers and labels drop off for many of the figures, please fix this. Also, the main text does not refer to some figures, and in some locations the reference is done with a capital letter (e.g. Figure 1) and in other locations not (e.g. figure 1). Please choose one way and keep consistent.

Figures 3-5: Is the uncertainty derived as a multiple of the standard deviation? Why not use the information from the posterior samples to apply the uncertainty, can the authors comment?

Minor Comments:

Line 7: Is MCMC defined before using here?

Line 10: Is ^{137}Cs defined before using here?

Line 80: Take out the word 'Here'

Lines 113-120: Various assumptions are mentioned here, but it is not clear if the impact of these assumptions on the results is discussed later in the text. It would be great if the authors can provide some comments on how these assumptions can have an influence on the results.

Line 175: A main assumption is that the average wind speed is representative of the temporally varying wind speed used in the simulations. Is this an average of the whole period? What effect does this have on the error/uncertainty of the results, compared to using a time-variable input vector for wind speed that is derived directly from observations? Again, some comments from the authors would be appreciated.

Line 204: take out the word 'for'

Line 271: "Figure 3 shows ...? " There is a grammatical mistake here, please fix.

Line 275-285: The authors describe a 'good match' and 'similar in magnitude', but how can the reader quantify if this is true? Are the FAC scores supposed to represent this? If that is the case, the current information on the FAC score is not sufficient for the reader to make these conclusions. More information on the FAC score is needed.

Line 345: "Both the" instead of "the both"

Line 346-347: The authors state that "an adaptive grid allows to reconstruct the source term with higher accuracy and to reduce the corresponding uncertainties". Was the higher accuracy and reduced uncertainty actually achieved? Where does the reader get this information from?