

## ***Interactive comment on “On the model uncertainties in Bayesian source reconstruction using the emission inverse modelling system FREARtool v1.0 and the Lagrangian transport and dispersion model Flexpart v9.0.2” by Pieter De Meutter et al.***

### **Anonymous Referee #3**

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The authors studied the model error estimations and their impact on the inverse modeling using ensemble simulations of 2017  $Ru^{106}$  detections from several CTBT stations. Several interesting findings are presented. The paper is pretty well written.

General comments: While the paper relies on a set of ensemble simulations to quantify the model uncertainties for the emission inverse modeling study, it is helpful to include ensemble in the title.

C1

This paper emphasizes on the spatial patterns of the reconstructed sources. Since the sources also possess the temporal patterns, it is better to describe briefly what the reconstructed sources appear in time. How do the release start time and end time vary with the different approaches in this paper?

Specifics:

Title: FREARtool in the title is never mentioned in text. In the Code and data availability part, it is stated that the “Bayesian inference tool will be made available upon request”. If this tool is not mature enough to be available publicly, it is better not to appear in the title.

Line 5: It is not clear what the authors mean by “credible intervals”. Is “interval” used to represent the range of emission rates in magnitude? Please clarify this.

Line 103: It is not accurate to say “model output frequency was three hours”. In addition, the output can be instantaneous or time-averaged quantities. This needs to be clarified.

Line 105: The emission grid and the concentration grid can be different. Please specify which “grid box” is referred here.

Lines 105-6: Again, it is not accurate to refer the averaging time period as “the output frequency” here.

Lines 107-110: Please specify the resolutions of the meteorological data inputs for FLEXPART.

Lines 138-9, “Since this spans many orders of magnitude, we take  $\log_{10}(Q)$  as source parameter in our implementation and simply impose a uniform prior between 10 and 16”: Does that mean the accumulated release  $Q$  is assumed as  $10^{13}$  Bq?

Lines 197-200: These steps are quite important. Brief descriptions of them are suggested here.

C2

Section 5.2: In this section, the use of “time” (e.g. lines 318, 320, and 321) is confusing. I believe it is used to refer the chosen 3-hr release time intervals. Please clarify.

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