# Discussion: Quantification of uncertainties in the assessment of atmospheric release source with application to the autumn 2017 $^{106}$Ru event

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# Report 4

We thank the reviewer for his/her technical comments and general advices to improve the manuscript.

This paper does exactly what it says it will do: source term estimation for an emission of Ruthenium using observations, an atmospheric model, and Bayesian inversion. It excels at explaining the concepts involved, making it especially accessible to someone who has not done this exact type of problem before. However, many corrections are needed to the wording, particularly in section 2, and the organization, particularly in section 3.

Lines or references were missing in the report, so not every comment could be taken in account in the manuscript.

Comments:

- In the climate modeling community we would refer to an initial conditions ensemble of the same atmospheric model as a "single-model ensemble" rather than a "multi-model ensemble."

  We have changed the sentence according to this comment. Thank you.

- Missing "a"

  We did not find where the "a" was missing.

- 60-63. Comment: I like this concise explanation of how a model, source, observations, and likelihood fit together.

  Thank you for your kind words.

- Suggested "These three sources of uncertainty are explored in an application of source term estimation for the 106Ru release..."

  We have changed the sentence.

– state of the art of

We did not understand this comment.

– 89-94. Can you rephrase this so that it flows monotonically, i.e. reference section 2 before section 3?

Reference to section 2 is simply used as a reminder. But the topic of section 2 is already described before the topic of section 3.

– Missing a word here, which obscures the meaning of the sentence.

We do not know where to find the missing word.

– It may be helpful for the reader if you reference the section in which the threshold is discussed.

We removed the passage « and will be discussed later on » as the threshold discussion is two paragraphs after.

– If the observation sorting algorithm is the division into r and rnd, then you should not start a new paragraph for sentence 191.

Thank you, we have modified this part.

– 268, 274. "22nd"

Thank you, we have modified this part.

– This summary section should be clarified if possible. For uniformity, I recommend starting each bullet point with a section number, e.g.

Section 3.3.2 is an application of the observation sorting algorithm...; Section 3.3.3 is an application of the different likelihood functions and spatial clustering ...; Section 3.3.4 is an application of the perturbed dispersion parameters and enhanced ensemble...

Indeed, this part gains to be clarified. Thank you.

– Secondly, the section heading "Summary" section seems out of place, especially since you have a summary section later. I would suggest renaming 3.3 "Results" and renaming 3.3.1 "Overview."

This seems indeed necessary. Thank you.

– "Probable sources"

This has been corrected.

– "which is not justifiable.

This has been corrected.

- "Explain when and where this accident took place, and maybe ad some thoughts about how this might compare to what you just did.

  We are again very sorry, but we were not able to find what the comment was referring to.

- 436-440. I think more discussion would be helpful for the reader. Remember, many readers skim the paper until they get to the conclusions.

  This has been added. Thank you a lot.

- The math is correct but the wording is not quite right. I think you mean that r is a positive coefficient and R (and rI) is a positive diagonal matrix; r itself is not a "positive diagonal coefficient."

  This has been corrected.

- 111-112. Suggest something like...choosing Gaussian likelihood penalizes the largest errors to an extent that smaller errors are negligible.

  Thank you, this has been corrected.

- Rephrase. Consecutive sentences starting with "in other words."

  We have deleted this sentence.

- I think you should delete the sentence starting with "Every " as the wording is confusing. Your example (100,120) vs (10,12) has already made this point.

  Indeed, we have also deleted this sentence. Thank you

- Bracket typo.

  We did not find where was the typo.

- What do you mean by mitigated here? I think you can say "should be 1" or "should be close to 1."

  We remove "mitigated".

Thank you for these technical comments.