

Dear Editor,

Please find below the revisions we did to comply with the Reviewers' comments:

** Reviewer 2:*

Still, I suggest that the properties of the task (i.e. the CTBTO context with quite sparse measuring network; the assumption of knowledge of release rate boundaries of both, temporal and absolute/day) should be stated (defined) in the Introduction as the definition of your source reconstruction problem since it is quite specific.

Reply:

We have added to the introduction:

L 69: "In this study, the Bayesian source reconstruction tool ~~FREARtool~~ (FREAR stands for Forensic Radionuclide Event Analysis and Reconstruction) described in De Meutter and Hoffman (2020) will be used. **FREAR was designed to determine the properties of a single point release (such as the release location, release amount and release start and release stop times) based on observations from one or more sparse measuring networks. Expert information can be taken into account through the prior distribution.**"

However, we disagree that our source reconstruction problem relies on "*the assumption of knowledge of release rate boundaries of both, temporal and absolute/day*": knowledge of the release rate boundaries is not necessary to use the FREAR tool, since the tool can be run with wide priors. However, if expert information is available, it is clearly recommended to incorporate such information through the prior distribution.

** Reviewer 3:*

There are two more specific comments I have for this revision.

Line 5, "The Bayesian approach has the advantage of providing credible intervals on the inferred source parameters in a natural way."

Although the authors explained in their responses to my previous comments, "credible intervals" is still too arbitrary to be meaningful. In addition, what can be defined as "a natural way" is questionable as well. This sentence is really too ambiguous to be included in the succinct abstract.

Reply:

We have rewritten the original sentence as follows:

L 5: "The Bayesian approach has the advantage of providing ~~credible intervals~~ **an uncertainty quantification** on the inferred source parameters ~~in a natural way~~."

Line 167, "... a uniform prior between 10 and 16"

Based on what the authors stated in their responses to my previous comments ("the prior distribution from which initial samples are drawn is a uniform distribution between 10 and 16), it is mistaken to call it "a uniform prior". Please correct this.

Reply:

We have rewritten that sentence as:

L 150: "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~~ use a uniform distribution between 10 and 16 as uninformative prior."

Furthermore, we have added in the beginning of that paragraph:

L 146: "Uninformative bounded uniform priors are used for the source parameters. The prior is designed to allow for all plausible scenarios given the sparse measurement network and under the assumption the detected radionuclides are from the same release. For the current study, the source longitude is assumed to be between 20° and 80° and the source latitude is assumed to be between 40° and 70° (see Fig. 1 for a map showing the search domain)."

Yours faithfully,
The authors