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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Bayesian inverse modeling and source location of an unintended I-131 release in Europe in the fall of 2011" *by* Ondřej Tichý et al.

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We would like to thank you for providing us with detailed reviews of our paper. We have considered all the comments and notes and we are glad that we can submit a revised version of our paper. In the following text, we will respond to all comments.

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Discussion paper

1 Specific Comments:

As pointed out in my initial review, there is one issue not fully discussed in the paper. The total amount released was well reconstructed. The time dependency not at all – assuming that most was released during only two days. The models, however, proposed significant releases much earlier. The question that should be discussed further is the reason for this. Is it an artefact? Is the meteorological data together with the limitation of these models the reason for this? The timing of the source term is even more important of the total amount released as this determines the areas affected and the countermeasures needed.

The new approach can only be evaluated if such a discussion is performed, otherwise the results might be just achieved by chance

- It is not clear from the official report how were the released amounts obtained and what are their uncertainty bounds. Unfortunately, on the reported days of the main release, the released activity was monitored only by the Budapest station (see Figure 6 middle in the new manuscript). We have now added a Figure with measured concentrations in Budapest and Prague in the analyzed period. Note that the concentrations in Budapest indicate that the release in September was not negligible and there is not evidence for abnormal release in early October.
- The temporal profile reconstructed by the Variational Bayes may be misleading since it finds only local approximation of the posterior distribution. We have added another approximation of the posterior distribution based on Gibbs sampling. This approximation evaluates global approximation of the posterior and thus it provides more realistic representation of uncertainty in the timing. The conclusion is that the available data can provide only rather wide bounds on the release profile.

Changes made in the paper

1. A figure with measured concentrations from Budapest and Prague has been added. Predicted concentrations on October 14 are now reported in Fig. 6.
2. Reconstructions of the temporal profiles were also done by the Gibbs sampling which provides more accurate approximation of the true posterior.
3. Discussion on the influence of the weather conditions on the results has been added.

2 Initial Review

The paper discusses one of the most important issues in emergency management and response, the source term. As the source term in a progressing accident is typically not known, source term reconstruction capabilities as essential for a good response. Even long time later, the source term might be not fully known and retrospective analysis is important. This paper address an event from 2011 where iodine was released into the atmosphere. The approach presented is well described and a promising method to estimate the source term based modelling and monitoring records.

The paper is well structured and describes the results very well. There are some issues to be considered in a possible revision of the paper.

Comment 1: Figure 1 is hard to read with the dark background.

- Colormap of the maps has been changed.

Comment 2: Figure 3 is presented in the backward modelling section but it refers to the forward modelling. Please clarify

- Thanks for suggestion, this typo is now corrected.

Comment 3: In the section of dose, the maximum dose is presented. I would not recommend to publish this as the cess size with about 45x55 km is too large to get the maximum dose captured which may happen close to the source point

- In the figure, we present maximum average dose. Certainly the maximum dose can be different than the average. However, since the dose is summed over the period of three months, the difference between the average and the maximum should be minimal even on such a large cell.

Comment 4: There is one issue not fully discussed in the paper. The total amount released was well reconstructed. The time dependency not at all – assuming that most was released during only two days. The models, however, proposed significant releases much earlier. The question that should be discussed further is the reason for this. Is it an artefact? Is the meteorological data together with the limitation of these models the reason for this? The timing of the source term is even more important of the total amount released as this determines the areas affected and the countermeasures needed.

- This has been addressed by the use of Monte Carlo evaluation via Gibbs sampling. See discussion of the Specific Comment 1.

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