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Atmospheric Chemistry and Physics Discussions

Interactive comment on "A refinement of the emission data for Kola Peninsula based on inverse dispersion modelling" *by* M. Prank et al.

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Response to the Anonymous Referee #3 comments

Thank you for the attention to the paper although we were surprised by the style of the report. Below is the response, with the comments themselves bracketed by »» «« marks.

Marje Prank Mikhail Sofiev on behalf of co-authors

»» The authors presented results from their collective work on an important issue concerning the validity of available emission inventories. However, the authors did not present any new methodology that could be extended to correct other sources. ««

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This is not correct. Indeed, no part of the methodology is new but there is no study we are aware of when they are applied in a complementary way. Secondly, the methodology is universal and was developed as a generic tool for the source apportionment and analysis of modelling results. No part of the exercise is tight to Kola Peninsula.

»» It appears the presented paper is really a collage of several reports prepared for funding agencies mentioned in the Acknowledgements. ««

Herewith we confirm that no part of the paper is presented in any of the project reports.

»» The purpose of this paper is not clear. ««

In fact, it is stated in the paper: p.15967, lines 11-15. It is extended in the revised version to highlight the methodological aspects.

»» Also, it is not clear what the impact should be of the presented findings. ««

In fact, it is in the paper: p.15967, line 25, Figure 11, and the section 4.2. The Kola region and Nikel plant in particular are the most powerful sources in Northern Europe, second only to Norilsk if the whole Northern Eurasia is considered. Therefore, its correction is of utmost importance for this part of the globe.

»» One would think that if a source location was identified as wrong a simple correction of its coordinates (on the modelling domain) is required and the case is closed. ««

Not correct. The Nikel source was mixed up with other ones – differently in different inventories, as demonstrated in the section 2 of the paper.

»» The strength of a source is a different story that belongs to the past and it will never be established with the available data. I am afraid we have to live with the uncertainty of our past. ««

Not correct. As shown in the paper, all the emission estimates available for assessment of present-day air quality are erroneous. Our analysis also showed that the past-time estimates are closer to reality today. It is also not correct that the past-time data can-

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not be restored: as shown in the paper, the observational information, combined with modeling assessments, is sufficient for at least a considerable improvement.

»» The authors did not strongly emphasise the importance of the missing source, its relative strength (emission flux, stack height, plume rise) in comparison to other sources (i.e. Vale-Inco) at present and in the past. ««

We did: p.15967, line 25.

»» Also, are there any satellite observations that could be used in the analysis process? ««

Satellites see the SO2 plumes only if they come from extremely powerful sources, such as volcanoes. The Kola plumes are currently below the detection limit.

»» The missing (underestimated) DMS source is mentioned several times. I would suggest adding the source to the SILAM European domain and to the domain used in this study. ««

We have the DMS emission as it is included into EMEP inventory. The missing part is only from the area of the Arctic Seas outside the modelling domain – and the DMS emission in the Arctic is small. Since the analysis was focused on concentration peaks, its impact cannot affect the results. Further clarification is added to the paper.

»» What is the (potential) impact of the missing/misplaced Nikel source on the Artic environment? Is it outside the SILAM domain and thus cannot be assessed in this study? ««

See Figure 11 and the discussion in pp.15981-15982: the deposition can be redistributed up to a factor of 15, depending on the distance from the plant. To highlight the issue, we will add the third panel with total deposition map to the figure.

»» Also, I would take issue with the frivolous use of “ensemble modelling”. What is presented in the paper are scenarios – good old scenarios – nothing else. An elegant

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and rigorous mathematical formulation of an ensemble approach is being used to give credibility to a rather limited set of scenario runs using models and input meteorological data readily available to the authors. ««

Not correct. Scenarios imply different assumptions about the external parameters of the simulations – for example, climate scenarios are built around different scenarios of emission development. Nothing of this kind is in the current study: we were solving the same problem with different methods, which is the classical multi-model ensemble widely used in air quality. Corresponding references are available from the paper. Already the small-size ensemble was enough to demonstrate the uncertainty of the problem by providing a sufficient spread between the simulations and thus reducing the chances for conclusions based on coincidences.

»» Furthermore, the following examples of a colloquial use of the English language should be changed ««

Wording of the specific sentences is reconsidered in the revised paper

»» Do we need a paper for each emission source wrongly placed by the EMEP experts? ««

We showed that none of the existing inventories reflects the Kola emission correctly, not only EMEP. Secondly, as stated above, the paper addresses the major SOx source in Northern Eurasia and it is not only its place that has been mistaken – it was mixed with other sources and the absolute rates were incorrect. These all have strong implications for the EMEP source-receptor matrices and, consequently, significant practical outcome. And absolute levels of so powerful sources are important for the whole Arctic.

»» How many sources are wrongly identified in the official emission inventories? Is there a universal and practical methodology to correct all the mistakes introduced by the emission experts? ««

Some data assimilation methods like 4D-var do allow emission treatment, but universal

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methodology allowing the correction of all emission errors in one shot does not exist, first of all due to limited information available from observations. However, we demonstrated that the model-measurement comparison can be used to locate the problematic regions and to correct the major errors. The methodology is valid for analyzing any case of significant discrepancy between measurements and model results – and for tracing them down to emission sources if they are the root cause of the problem. Its value is further highlighted in the revised paper.

»» I note that over a third of the references are from the 'grey literature domain' – including internal reports, web sites, and even newsletters. This observation could be very important, as it gives an insight into the 'life of emission modelling' done by arbitrary decisions often without rigorous and open review. ««

Not correct. The paper contains 67 references with only 11 grey items. There are 13 reports from EMEP but they are reviewed by experts of all European countries and pass the official approval every year at EMEP Steering Body Meeting. They are all available online and from the corresponding national authorities and thus fully satisfy the "white" literature definition. Regarding the 11 grey-literature sources, we have tried to include all information about the region into consideration – but insist that no significant omissions of the "white" literature were made.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 15963, 2010.