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Interactive comment on "Prediction of source contributions to urban background PM10 concentrations in European cities: a case study for an episode in December 2016 – Part.1 The country contributions" *by* Matthieu Pommier et al.

Anonymous Referee #1

The study by Pommier et al., demonstrates the ability of two modelling setups to identify source contributions of particulate matter from different countries to multiple capital cities in Europe during a pollution episode. Overall, the paper does indeed demonstrate this and after some major revisions it should be suitable for publication in GMD.

The main concerns I have with the manuscript is its lack of clarity in places. Firstly, the description of the source-receptor calculations needs to be more clearly discussed as it is not easy to follow to non-experts of this methodology. Secondly, the manuscript is compiled of lots of short sentences which lead to a stop-start flow with makes the

manuscript more difficult to read. Thirdly, the comparisons between the models and the observed PM concentrations are satisfactory at best. For instance, many of the correlation statistics between the models and observations are below 0.5 and the mean biases (magnitude) are sizable. Therefore, I feel the authors really need to stress that the model comparisons are "satisfactory" and clearly state whether the metrics presented (e.g. P11) show the models are doing well or badly when compared to the observations. Finally, some of the figures are too busy and need to be made clearer. For instance, Figure 6 is overly complicated and takes a long time to fully digest. Also, the "agreement in the dominant contributor" in figure 8 between the models is not clear. How is this agreement determined? What statistical metrics are used? If this is already stated, then please make it clearer!

Minor Comments: P3 L71-73: Provide reference for the WHO health metric stated. P3 L84: Space between "VOCs).The". P4 L99-101: Please explain in detail how "source" and "receptor" are related in this work to make it clear for readers not familiar with this method. P5 L158: What is the new land-cover dataset used? P6 L168-169: Make it clear whether or not other BVOC emissions are used in the model other than iso-prene and monoterpenes. P6 L170: The definition of the "remainder" is unclear. P7 L212-213: What do the authors mean by "we have harmonized the used of different parameters"? Do you mean that the setup and input/outputs of the model are been made as consistent as possible? P8 L 222: Worth saying that the ECMWF operational system does not archive 3D precipitation fields when this is first discussed on P6. P8 L 247: Can the authors please elaborate on what they mean by "medium intensity". P9 L256: What quantifies as "large concentrations"? P10 L277: I suggest the authors change the word "enormous" to something more scientific. P11: L307-312: I suggest the authors re-write this paragraph as it is unclear and difficult to follow. P11: The discussion of the different metrics is a bit over-kill here. If all this discussion is to be kept in the manuscript, can the authors at least specify what the numbers mean in terms of model performance (e.g. R=0.72 is reasonable and R=0.25 is poor). P13 L365-371: As mentioned above, I think the authors need to discuss in more detail the

source-receptor methodology to make it clear to non-experts of this approach. P14 L415: "For the positive correlation, a clear feature appears" is an example of these short sentences which break the flow of the text. P15 Section 5.2: If the LOTUS model is using a different approach to that of EMEP, how are the emissions perturbed? This is not overly clear from the text as it stands. P16 L458: What do the authors mean by "each at the end of the EMEP model"? P16 L459-462: The term "Rest" appears to represent the difference between the total PM and the sum of all its components. Is this the metric used to explain the "non-linearity in the chemistry? If so or if not, I think this sentence need to be rewritten to clear emphasis the definition of "Rest". P16 L467-8: Is this true? In section 3 I got the impression there was substantial disagreement between the models. Figure 2: Could the country outlines be more clearly plotted. Figure 6: There is a lot of stuff is this plot, so could be good to make it simpler or bigger at least so easier to see everything. The calculation of non-linearity need to be explained more clearly in the manuscript.