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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Impact of the vertical emission profiles on ground-level gas-phase pollution simulated from the EMEP emissions over Europe" *by* S. Mailler et al.

Anonymous Referee #2

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The paper "Impact of the vertical emission profiles on ground-level gas-phase pollution simulated from the EMEP emissions over Europe" by S. Mailler et al. aims to compare the results of five different simulations with WRF-CHIMERE model over Europe at a resolution of 0.5° when the vertical distribution of emissions is modified, using EMEP vertical layering profiles, some modified profiles and the information of Bieser et al., 2011.

The paper addresses an interesting topic related to air quality simulations; however in the last years a number of papers on this topic have been published, so I do not feel to have learnt anything new by reading this manuscript. The authors have to clarify what's new in this contribution and why the paper deserved publication in Atmospheric Chemistry and Physics.

Although the paper is well organised and detailed, there are some aspects of the paper that require revision before publication. My main objections for the publication of the paper in its present form are detailed below.

Major comments:

One of my major concerns is about the resolution of WRF-CHIMERE simulations. The resolution used is 0.5x0.5° (about 50 km at the latitude of simulations); so I guess that the results presented here are only valid for background concentration of pollutants, because, as stated by the authors, this resolution does not allow an assessment over urban or industrial areas. However, the most important emissions of the analysed pollutants (sulphur dioxide and nitrogen dioxide) come from these activities. So the assessment presented here is only valid for background areas, and this has to be clarified both in the title and in the discussion of results.

In this very sense, the authors state that " [. . .] but the coarse resolution of these simulations does not allow the model to simulate correctly the impact of a highway, factory or urban area, therefore the simulated SO2 concentrations are not comparable to observations for stations that are not "rural background" type". Then, why not focus the statistical comparison just in this type of stations?

Moreover, after reading the design of the experimental setup and the vertical profiles used, I would have expected a much more realistic approach to the vertical dissagregation and layering. Here, the authors do not trust realistic information on vertical profiles (but the work of Bieser et al., 2011) but perform a sensitivity analysis. That could lead to right results because of wrong reasons. What if the model systematically underestimates ground-level concentration of pollutants? Then, decreasing the vertical layering would increase the ground levels of the air pollutants, but it does not necessarily mean

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that this profile is more correct than EMEP recommendations. So, the authors should be careful about that and elaborate a little bit more on this topic.

Section 3.2.2. deals with the analysis of the simulations in two stations: DENW081 and PL0243. I personally find this analysis very biased. The authors have used the AirBase database to validate their results, but their analysis focuses just in these two stations. These two stations are located in Germany and Poland, then in the northern-central part of the domain? Why have these stations been selected? Is there any reason for that? Why not selecting stations in other areas (southern Europe Mediterranean areas)? I guess the analysis by individual stations should be replaced by a more detailed analysis where all stations have been considered, probably grouped by latitude, or station type, in order to have a more complete scope of the results.

Last, no analysis on O3 concentrations is done in the manuscript, despite in the abstract the authors say they are going to do so (also, the analysis of NO2 is very limited in the manuscript).

Minor comments: Line 5, Pag 1 (and several other lines of the manuscript): Please correct “recommandations” by “recommendations”.

Introduction: First two paragraphs must be supported by corresponding references

Line 18, Page 5: I know the authors wanted to cover a full annual cycle, but I do not know the point of starting precisely on Feb 20, 2008. Is there any reason for that?

Line 21, Page 6: Since this article is still in press, some information on this topic should be included in this manuscript, either in this section or as supplementary material. I guess this information is essential to understand how temporal and spatial dissagregation is done in this work.

Line 2 and 11, Page 13: Is the code of this station DEN081 or DENW081? Please correct.

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