

Interactive comment on “Air quality trends in Europe over the past decade: a first multi-model assessment” by A. Colette et al.

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Answer to both anonymous referees, Colette et al. 2011: “Air quality trends in Europe over the past decade: a first multi-model assessment.”

PM2.5

Rev #1: Section 2.1: Why was PM2.5 not chosen as it is a more relevant human health metric. If there was a valid reason for this, you might want to include/mention this here.

Authors: Unfortunately, the data coverage for PM2.5 is not satisfactory to investigate trends as being done in this paper (i.e. relying on a large dataset to minimize uncertainties). A sentence has been added in Section 2.1.

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Emission inventories

Rev #1: P19040 L5-6: It might be useful to list a few examples of the well-documented limitations of the emission inventories here, as they may or may not be relevant to the results of this assessment. Rev #2 : Also the chapter is not at all in relation to the discussion about the emission inventory which was discussed within three small paragraphs. As one of the most important input for modeling exercises a deeper discussion on the emission inventory is necessary, including a discussion about the inhomogeneity across national levels.

Authors: Both of these comments have been taken into account by adding a paragraph on the main uncertainties in anthropogenic emission inventories to section 3.1.

Rev #1: Section 3.1 paragraph2: Wouldn't this affect the trend – using the same emissions at the beginning of the time series, such that up to the first 3 years are all the same emissions in some areas?

Authors: Indeed, however we could not find a better gap-filling approach. A sentence has been added to highlight this assumption in the paper.

Rev #2 : Emissions from ships have been discussed during several occasions. The increase of pollutants on ship tracks is quite evident as we can see in the figures. The question is, if this increase is based on the increase the numbers of ships or just because of the increase of the knowledge and awareness of ship emissions in the recent past. In section 5.1 this is discussed but the explanation is far too weak. Some investigations on ship numbers and emissions might be very helpful.

Authors: According to the literature (Eyring et al., 2010; Endresen et al., 2007), whereas the lack of knowledge about these emission was a major issue in understanding trends of the 20th century, the increase of emissions that we found for 1998-2007 can be attributed to an actual increase of the activity. A sentence has been added in the paper in Section 3.1 devoted to the emission inventories.

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Station type

Rev #1: P19043 L14-15: Why were suburban background stations chosen over urban background stations?

Authors: There is no specific reason for that choice besides the fact that suburban background stations represent a good trade-off between urban and rural sites.

VOC/NOx trends

Rev #1: P19056, last P: is it really that VOC reductions were not aggressive enough? Or could it also be due to less titration of O₃ from NO_x emission reductions? Although you cite one paper that mentions this, this is also a modelling paper, are there any other papers that address VOC reductions for Europe in observations?

Authors: It is a combination of both depending on the photochemical regime. A more complete sentence has been added to the conclusion and in Section 2.3. Also a reference to a recent paper on VOC trends in Europe has been added to section 5.2 (von Schneidmesser et al. 2010).

Model strength/weaknesses summary

Rev #1: Was there a reason for not giving a final assessment of the models in the conclusion that would sum up the strengths/weaknesses of the models, as a whole, or as a group, global/regional with respect to their utility for air pollution trend modelling?

Rev #2: The discussion of the models is adequate and all necessary references have been made. Also the behavior of the models in relation to measurement data was discussed sufficiently. At the end of the paper the discussion found a short end. The readers expectations was not fulfilled in the way, that there was no discussion about “the capability of the models”, which was addressed in the beginning. What are the main advantages/disadvantages of the models. Why did one model perform well and the other not? What are the physical and chemical parameterizations behind, etc. Actually there was one short comment about the performance of the models on page

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19055, line 8 about the “degree of photochemical activity”.

Authors: As stated in the manuscript, the purpose of this study was not to perform a model intercomparison but to discuss the envelope of modelled AQ trends. The respective skill of the models at capturing air pollution concentrations of given constituents are discussed in other projects where a stronger emphasis is put on using an identical model setup to investigate the strength and weaknesses of the representation of physical and chemical processes in each model (AQMEII, EURO-DELTA, HTAP). Our approach resembles that of Climate Model Intercomparison Projects where the scope is to propose an envelope of likely trends rather than comparing the models. So that the main goal of the validation was to check whether the participating models could enter the ensemble of air quality trends. That is why we devoted section 4 to the validation where the photochemical activity but also hints for the explanation of biases in NO_x and PM (including their speciation) are given. This discussion is summarized in the conclusion but in more general terms (e.g. comparing the behaviour of regional and global models) to avoid pointing one model or the other.

Data analysis

Rev #2: The paper opens with a clear statement to “. . .discuss the capability of current state-of-the-art chemistry and transport models to reproduce air quality trends. . .”. But in the first chapter the emphasis was on an extensive discussion of the quality and quantity of available air quality station data. This is an important issue, but not in such an extensive discussion in the frame of this paper. Already this chapter might be worth to write a single paper out of it. It is not clear why such emphasis was put on the data analysis.

Authors: From the perspective of the authors, this paper is more a model assessment than an intercomparison. As such, we deemed essential to discuss observed trends. Because of the scarcity of previous work on trend detected by air quality monitoring network over the past decade, we found relevant and necessary to include this dis-

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cussion here. However we agree there was probably enough material to devote a full length paper to this topic.

Technical Corrections:

Authors: All these comments were accounted for except the suggestion to rewrite the article in past tense and to split the figures for urban/suburban/and rural stations in order to avoid multiplying the number of illustrations. We hope the editor will support this choice.

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 19029, 2011.

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