Atmospheric
Chemistry
and Physics
Discussions

Interactive comment on "Mid-21st century air quality at the urban scale under the influence of changed climate and emissions: case studies for Paris and Stockholm" *by* K. Markakis et al.

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The authors evaluate the impact of climate change and emission mitigation strategies on air pollution in two European cities. They find that influences of climate change are regionally driven and have a modest benefit for both O3 and PM in Paris and Stockholm. However, when emission mitigation strategies are taken into account, O3 is potentially worsened in Paris. Lastly, the authors highlight the importance of high-resolution urban-scale versus regional modeling in simulating air quality.

A novel feature of the manuscript is the linking of global and urban-scale atmospheric models, in investigating the impacts of climate change on air quality in Europe. The scientific approach is well documented, though I have some questions related to the

rationale for why different chains of models were used for each case study (see below). Overall, the manuscript is well written and figures are clear. With some revision that address the comments raised, I believe this paper can be considered for publication in Atmospheric Chemistry & Physics.

General Comments

1. Why are different chains of models used for Paris and Stockholm for the climate and air quality simulations (Table 1)? More importantly, by utilizing different models for the two regions, how are cross-city comparisons affected. Have the authors performed any sensitivity runs with respect to different model configurations? Some discussion of why different chains of models were employed in this analysis is needed somewhere in Section 2.1.

2. Why is the urban-scale modeling performed at 1 km resolution for Stockholm, but at 4 km resolution for Paris? If the emissions are available for Paris at 1 km resolution (Page 27049, Line 6), it seems odd not to model Paris at the same urban-scale resolution as for Stockholm. I would expect the higher resolution to be more important for Paris, since Stockholm has a stronger regional influence on air quality (Page 27058, Line 6). Some rationale is needed for why the horizontal resolutions are different between the two cities, and how this might affect modeling results.

3. Section 2.1 (Page 27048, Line 7). Does the CHIMERE model include SOA chemistry like the MATCH model (Line 13)? If SOA chemistry is not included for Paris, how would this affect modeling PM under present and future climate scenarios?

Specific Comments

4. Section 2.3 (Page 27051). A figure of sectoral emissions for Stockholm, similar to Paris (Figure 2), would be useful. To an unfamiliar reader, it is not clear how different the two cities are in their emission sources, and how this might affect future mitigation scenarios. For example, is it realistic for Stockholm to adopt the more aggressive local

emissions mitigation strategy of Paris (Page 27051, Lines 16-19), beyond reducing traffic-related emissions only?

5. Section 3 (Page 27052, Line 4). How is PM measured from the urban stations? I'm guessing by filter samples. If so, could there be sampling artifacts in the measurements that affect the model evaluation for PM (Page 27052, Lines 18-26)? For example, sampling artifacts for OC can be large and dependent on measurement techniques.

Chow, J.C., et al., Quantification of PM2.5 organic carbon sampling artifacts in US networks. Atmospheric Chemistry and Physics, 2010. 10: p. 5223-5239. DOI: 10.5194/acp-10-5223-2010.

Turpin, B.J., P. Saxena, and E. Andrews, Measuring and simulating particulate organics in the atmosphere: problems and prospects. Atmospheric Environment, 2000. 34: p. 2983-3013. DOI: 10.1016/S1352-2310(99)00501-4.

6. Section 3 (Page 27052, Line 29). Can the Norr Malma (rural) site be identified in Figure 1? Also, is the prevailing wind pattern such that this site is upwind or downwind of Stockholm?

7. Section 5.6 (Page 27063, Lines 4-6). Not sure what is meant by this sentence. If Paris does not undergo a regime shift by 2050, shouldn't stronger NMVOC controls be emphasized?

8. Figure 3. To improve robustness of model evaluation, these plots would benefit from the addition of error bars that show the variability of the mean for the model and observations. Also, correlation coefficients of the model against observations should be reported somewhere.

9. Figures 4 and 5. Can a consistent color scale be applied between Figure 4 (Paris) and Figure 5 (Stockholm)? It is hard to interpret the color scales easily between the two cities otherwise.

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