Atmos. Chem. Phys. Discuss., 8, S2463–S2466, 2008
www.atmos-chem-phys-discuss.net/8/S2463/2008/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "The role of climate and emission changes in future air quality over southern Canada and northern Mexico" *by* E. Tagaris et al.

E. Tagaris et al.

Received and published: 9 May 2008

Reply to Referee #1 comments

Comment: This manuscript presents model simulations over a large North American domain similar to those discussed in Tagaris et al., JGR, 2007, and focuses in on Mexico and Canada. While a cataloguing of model differences is presented, no evaluation of the modeling results over Canada and Mexico is presented. In order to have any confidence in the model results, evaluation of the air quality and meteorology predictions is warranted. These areas have higher uncertainty due to the close proximity to the domain boundaries and emission estimates.

Response: The reviewer's concern is understandable. In the revised version of the

Full Screen / Esc
Printer-friendly Version
Interactive Discussion
Discussion Paper

manuscript a new paragraph and a table have been added evaluating air quality model's performance for both Canadian sub-regions using observational data from the National Air Pollution Surveillance (NAPS) Network (about 150 monitoring stations for ozone and 50 for PM2.5 belongs to the domain of our interest). Moreover, in the revised manuscript we compare concentrations derived from our analysis with concentrations from other works. Comparison is done for average summer ozone concentrations from GCMs (Wu et al., JGR 2007, 2008; Zeng et al., ACP 2008); the spatial patterns are similar. Due to the lack of data from monitoring stations over northern Mexico, model performance could not be evaluated in as much details. We believe that the evaluation we perform in our previous work and here is sufficient for model's performance. The meteorological fields used here have been published by Leung and Gustafson (2005, GRL), and that work (and, presumably the peer-review as well) included extensive analysis. In this work we focus on future air quality under climate and emissions changes. However, in order to have a better understanding for the variables used in air quality modeling the changes in meteorology and emissions for the projections used in this study are briefly presented. For that reason although we have extended the air quality evaluation we believe that extending the evaluation for meteorological fields is out of the scope of this work.

Comment: This study uses updated emission scenarios for Canada and Northern Mexico. However, no direct comparison is provided to show how much the updates changed the future emission scenario, whether they resulted in model improvements, and whether they lead to different results or conclusions.

Response: There is a slight misunderstanding here. None of the results presented here for Canada and Mexico have been presented elsewhere so no comparison is possible. This is a good suggestion for future work to compare how further updates impact model performance and whether they lead to different results or conclusions.

Comment: The general conclusions for the Canadian and Mexican areas are generally similar to those shown from the U.S. in Tagaris et al., 2007. The authors have some

ACPD

8, S2463–S2466, 2008

nice illustrations of these results, but what conclusions from here progress beyond what has already been suggestions for regional air quality changes under future climate? Are there any differences in these results from other results reported in the literature over Canada and Mexico?No direct comparisons are made to other literature where air quality under future climate has been studied. Are these findings consistent with the global scale modeling results published (e.g., Stevenson et al., JGR 2006; Huang et al., JAMC 2007; Wu et al., JGR 2007, 2008; Zeng et al., ACP 2008; Racherla and Adams, ACP 2008)? What about other regional simulations referred to in the introduction?

Response: It is not surprising that some results concerning the impact of climate and emissions changes on air quality might be similar to the ones presented by Tagaris et al., 2007 for the US. For example the fact that climate change alone has less significant effect compared to the combined effect of climate and emission changes. However, there are important outputs from this study such as: (1) while future emissions over northern Mexico are projected higher, pollutant concentrations are simulated to be lower due to the US emissions reductions; (2) climate change alone is estimated to increase PM2.5 concentrations over both Canadian sub-regions in contrast to PM2.5 levels over northern Mexico and the US sub-regions. We have found no results in the literature focused on the effect of climate and emissions changes over Canada and Mexico using regional climate models. Comparing the historic summer ozone concentrations derived from our analysis with ozone concentrations from GCMs (e.g., Wu et al., JGR 2007, 2008; Zeng et al., ACP 2008) a similar trend is observed (it has been added in the manuscript). No direct comparison could be done for the future since Wu et al. (2007, 2008) doesn't provide future simulations, Zeng et al. (2008) examine the year 2100, Stevenson et al. (2006) the year 2030, while Huang et al. (2007) and Racherla and Adams (2008) are for the US domain. However, we are in agreement with Stevenson et al. (2006) that ''The effect of climate change on ozone, as discussed above, is rather uncertain, and may introduce either a small negative or positive feedback." The regional simulations referred to in the introduction examine the US domain, which was the focus of Tagaris et al. 2007 JGR paper.

ACPD

8, S2463–S2466, 2008

Interactive Comment

Comment: The authors mention that the boundary conditions do not change. When only climate changes in the 2050 simulations, very little difference is noted in the Canadian and Mexican areas. Since they are so close to the model boundaries, the constant boundary changes have to play some role in this. Going in 5 grids is not sufficient to remove this influence for PM2.5 or O3.

Response: The reviewer's concern is understandable. However, in both historic and future periods, boundary conditions are kept the same, as there is scant information as to how we might alter them and keeping the boundary conditions constant makes the impact of regional climate change on pollutant concentrations more transparent. Given the simulated small sensitivity of air quality to climate change, imposing varying boundary conditions would add significant noise to our ability to isolate how climate change impacts compare to emissions changes. Moreover, we believe that going 5 grids (180Km) (usually many more) is sufficient as the in-flow boundary is over the Pacific Ocean, and concentrations of ozone and PM2.5 precursors are quite low. Of interest, recent results from MILAGRO campaign (e.g. DeCarlo et al., ACPD 2007) show that the influence of Mexico City emissions is about 200Km from the city basin.

Comment: The manuscript should have a substantial amount of revision before being deemed acceptable for publication.

Response: We believe that thanks to all reviewers' comments a substantial revision has been made.

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 3405, 2008.

ACPD

8, S2463–S2466, 2008