**Atmospheric
Chemistry
and Physics
Discussions**

Interactive comment on "Influence of air quality model resolution on uncertainty associated with health impacts" *by* T. M. Thompson and N. E. Selin

Anonymous Referee #2

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General comments

The authors aim to characterize the influence of air quality modeling resolution on estimates of human health impacts of tropospheric ozone. This research question is certainly one worth exploring. Given the time and resource intensity of finer-scale photochemical modeling, it would be useful to understand better the relationship between model resolution and health impact estimates.

I'm concerned that their approach suffers from significant limitations that affect the interpretability of the findings and the extent to which the results may be generalized to other pollutants or geographic areas. I also found the documentation of the health impact assessment to be incomplete. There was also no discussion regarding the role of baseline incidence rates, which tend to be spatially heterogeneous, in affecting the

size of impact estimates. Finally, there is no discussion regarding the appropriateness of applying effect coefficients to a spatial scale that is finer than that considered in the epidemiological study. If, for example, an epidemiological study uses a central site monitor to characterize population exposure in an urban area, it may not be appropriate to assign an effect coefficient from that study down to a 4km or even 12km grid cell; at the very least this approach introduces uncertainty which should be acknowledged in the paper.

Specific comments

Abstract

–How well has the analysis characterized the temporal variability in ozone concentrations by modeling for 60 days rather than the full ozone season?

–In what year were the impacts modeled?

–Need to be clear that the sensitivity of the estimated impacts are constrained by the model specification, and that this inherently limits your ability to apply these results to other contexts.

–I appreciate the authors sense to only include the parts of the coarser domains that cover the area of the finest domain in this analysis. That makes comparison between grid resolution much easier to interpret.

Introduction

–14527/11: Can you provide a citation to support this claim?

–14528/17: the characterization of impacts with and without the Clean Air Act was the central policy question they were trying to answer, rather than an uncertainty analysis.

–14529: It's not immediately obvious how the discussion on this page regrading the downscaling of climate modeling relates to cross-scale comparisons. What does this tell us about the sensitivity of model predictions of concentration and health impacts to

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the use of alternate grid resolutions?

Methods

–14531: Which version of CAMx did you use?

–14531: Additional contextual information regarding the emissions inventories would be helpful. In particular, additional information about: (1) the sources affected; (2) whether link-level emissions were modeled; (3) the spatial distribution of emissions. These are each factors that would tend to affect the influence of spatial resolution on model predictions, and would also help the reader determine how generalizable this episode might be.

–14531-2: Missing here is a discussion of the role of the meteorological model in specifying fine-scale input data. How readily available are these data, and are there any special challenges or uncertainties associated with generating these estimates?

–14531/16: The author incorrectly states that US EPA has published criteria for ozone performance in the 2007 modeling guidance document as being +- 15% for mean normalized bias and mean normalized error. There are not criteria published in the modeling guidance document and in fact it states quite clearly that there is not specific bright-line performance criteria. This incorrect statement is made in multiple sections of this paper.

–14532: How did you project the population size and distribution?

–14532: It's not clear why population-weighted air quality changes were calculated only at cells containing monitors. This approach would bias-low your estimates of health impacts.

–14533: There's no discussion here of what rationale the authors used to select either these endpoints or studies.

* What was the source of the baseline morbidity rates? These vary spatially and could

have an important influence on your results across scales. * When applying effect coefficients from Bell et al. (2004) and Zanobetti and Schwartz (2008), which estimates did you use? The national estimate, or the city-specific estimate?

–14536/26: It's not clear how the effect coefficient used to quantify impacts would be sensitive to the model resolution. The underlying population projections and baseline incidence rates might be–but not the effect coefficient used in the health impact function.

–14537/5: The negative tail is likely due to weak statistical power in the study.

–14537: I am not clear why this is an "error analysis". It seems that the process analysis is used to understand which processes contributed most to changes in ozone between the baseline simulation and the "control" scenario. More information about the process analysis setup is needed. How many grid cells were included in the process analysis box and how many vertical layers?

Conclusions

–It is important to note that if 36 km results tend to overestimate health impacts then simulations greater than 36 km could suffer from a similar tendency. This is critical to note as many researchers take output from global models such as GEOS-CHEM and estimate health benefits using much coarser grid resolution than even 36 km.

Technical corrections

–The cost/benefit requirements you refer to are stipulated by Executive Order 12866 and not the Clean Air Act

–The use of the term "improve uncertainty" in the abstract is a little awkward.

–14527/7: suggest rephrasing "Many elements of ozone concentration and impacts are uncertain..." to "Predicting ozone concentrations and health impacts is subject to a number of sources of uncertainty, including..."

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–14538/24: This sentence is unclear.

–14539/8: This sentence is unclear.

–14539/17: This sentence is unclear. The confidence intervals around the mean estimates reflect the standard error reported in the epidemiological study–and are entirely unrelated to model resolution.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 14525, 2012.

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