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Atmospheric Chemistry and Physics Discussions

# *Interactive comment on* "Air quality resolution for health impacts assessment: influence of regional characteristics" *by* T. M. Thompson et al.

**Anonymous Referee #1**

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The authors estimate health impacts using the BenMAP model for nine regions in the eastern United States using CAMx photochemical model output of ozone and PM2.5 at difference grid resolutions: 36, 12, and 4 km. The authors find the largest differences in health impacts between 36 and the finer grid resolutions, but little difference between 12 and 4 km. Characterizing air pollutant and health impacts in urban areas is important for estimating the benefits of emissions control programs. The authors select grid resolution as the factor being studied for influence on health impact estimation. It seems intuitive that improving spatial resolution of a grid model application would lead to better representation of health impacts since area-specific differences in the spatial heterogeneity of emissions and population would be better characterized. That seems to be evident as the authors find a notable difference in health impact estimation when



using 36 km model estimates compared to 12 or 4. However, little difference is seen between 12 and 4 km.

It is not clear from the methodology described in the manuscript that the authors generated 4 km emissions and meteorology similarly to what was done for the 36 and 12 km domains. The authors are fairly clear in that 4 km meteorology was not developed, but interpolated from the 12 km domain using CAMx. If the authors used a similar process to interpolate the gridded emissions from 12 to 4 km with CAMx then it is not surprising that no differences in health impacts are seen between 12 and 4 km because they have not improved the spatial representation of large near-surface emissions such as mobile and area sources with respect to the 4 km spatial representation of population. This is a critical issue with this manuscript.

The authors do not provide any operational or diagnostic model performance comparing the different grid resolution predictions for these areas. The authors incorrectly reference an EPA technical support document for a description of all the model inputs and for model performance evaluation. An inspection of the EPA document reveals that no 4 km inputs were developed as part of the modeling for the CSAPR rule. Since the focus of this paper is showing the impact of grid resolution on health impacts the authors need to provide much more detail about how the 4 km inputs were developed and provide an evaluation of those domains. Also, in order to make conclusions about how 4 km health impacts differ from impacts estimated using coarser grid resolution, the authors need to develop emissions at 4 km rather than interpolating the 12 km emissions to 4 km. Without 4 km spatial surrogates underlying the emissions the authors are effectively using the same emissions at 4 and 12 km and it is not at all surprising they see no difference in estimated health impacts.

The authors appropriately chose to include the health effects using a variety of epidemiological functions in the results. However, similar to needing appropriate data to support a 4 km photochemical modeling assessment, the authors should discuss what aspects of the BenMAP health benefits model need more detailed information for

urban-specific 4 km applications compared to national scale assessments. Is population the only BenMAP input that changes at 4 km? Are the health impact functions appropriate at 4 km and for all urban areas?

There are not very many Figures or Tables supporting this assessment. Since variable grid resolution is the focus of this paper some spatial plots showing ozone and PM2.5 (and primary and secondary since it is discussed in detail) at different grid resolutions would be useful.

Specific comments:

Page 14143 lines 15-20. I am not convinced anything was presented that addresses the influence of varying meteorological patterns on optimal grid resolution. I don't see any subsequent discussion detailing different weather patterns and how different health impacts were across various mesoscale and micro scale meteorological patterns.

Page 14146 Methods section. Much more detail on the development of the 4 km emissions and meteorology is needed. Also, more detail is needed regarding the CAMx application. For instance, are the 4 km domains run with 1 or 2-way grid nesting from the 12 km domain? It would be useful to know what feedback choice was made for the readers interpreting the results. The version of CAMx used for this study needs to be included in the manuscript.

Page 14152 Discussion section. The authors speculate about how primary and secondary PM2.5 have different and sometimes possibly compensating impacts on total PM2.5 in an urban area. It would be much more effective if the authors did a controlled experiment where primary PM2.5 and separately secondary PM2.5 precursors are systematically adjusted to quantify the impacts of both on human health benefits estimates.

Page 14154 lines 14-17. This is a very useful and important conclusion that 36 km grid resolution overestimates health benefits. Since global models such as GEOS-CHEM



and MOZART are commonly applied with grid resolution much greater than 36 km this suggests that these models should not be coupled with health effects models like BenMAP to make conclusions about health impacts, or at a minimum those projects should recognize that their impacts are overstated. The authors should point out the implications for global modeling in the conclusions as well.

Figure 3. It is very interesting to see that there is more variability in health impact estimates due to the epidemiological function used compared to grid resolution. The authors should include that as an important conclusion for this study.

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Interactive comment on Atmos. Chem. Phys. Discuss., 13, 14141, 2013.