Atmos. Chem. Phys. Discuss.,
https://doi.org/10.5194/acp-2017-1074-RC1, 2017

Atmospheric Chemistry and Physics Discussions

Interactive comment on "The influence of model spatial resolution on simulated ozone and fine particulate matter: implications for health impact assessments" *by* Sara Fenech et al.

Anonymous Referee #1

Received and published: 13 December 2017

This study compares health impacts estimated for ozone and PM2.5 simulated at global versus regional chemical transport model resolutions, and analyzes the factors contributing to resulting differences in the health estimates. While several other studies have conducted similar analyses for air pollution health impacts in the US, at a range of spatial scales from 4km to ∼250 km, it hasn't been done for Europe. There is reason to believe that results from the US wouldn't directly apply to Europe due to differences in emissions magnitudes of pollution components and chemical processing in the atmosphere. Thus, while this paper is a relatively straightforward corollary to the US studies, it is interesting and a useful contribution to the literature. It also presents some interesting new results on seasonality of and factors contributing to the resolution ef-

fect.

Below are some comments for the authors to consider: - In reality, differences in disease rates in urban centers versus broader areas would also come into play in addition to model spatial resolution and population/pollution colocation. Please discuss this limitation in your approach and how its omission should affect interpretation of your results.

- The paper made me wonder why so many papers have been written on spatial resolution issues, but not as much attention has been given to vertical resolution. Is the use of the first model layer (which is noted as 40m high) as ground concentrations adequate for capturing concentrations at the "nose level"? Should this be explored? Please provide guidance on this issue.

- Line 160-167: The original PM2.5 epi study should be cited here, rather than simply referring to the HRAPIE recommendations. Please check whether all the health impact assessments referenced (Anenberg 2009, Punger and West 2013, and Thompson et al. 2014) actually used HRAPIE recommended effect estimates since some of these were published before HRAPIE.

- Many health impact assessments are now employing non-linear concentration-response curves which flatten out considerably at higher concentrations, particularly for cardiovascular diseases. Please comment on how using such non-linear concentration-response functions would influence your results (e.g if the higher spatial resolution leads to higher PM concentrations, would those concentrations then fall on the flatter end of the CRF, leading to lower health impact estimates?)

- Same comment as above, but for low-concentration thresholds. We don't know whether PM health effects go down to zero, though some epi studies are showing relationships to very clean levels (2-5 ug/m3). It's useful to the reader to provide some guidance on how your results would be different if you did apply a low-concentration threshold for PM2.5, perhaps set at the theoretical minimum risk level used in the GBD

studies.

- Also, the most recent American Cancer Society study update gives ozone-mortality relationships for annual average concentrations (Turner et al. Long-term ozone exposure and mortality in a large prospective study, American Journal of Respiratory and Critical Care Medicine, 193, 10, 1142, 2015). These relationships were used by Malley et al. to updated the ozone burden of disease values (Malley et al. Updated global estimates of respiratory mortality in adults >30 years of age attributable to long-term ozone exposure, Environmental Health Perspectives, 087021-1, 2017). Please comment on how your results would be different if you were to use these annual average ozone effect estimates, given the seasonality of the resolution effect on simulated concentrations.

- Line 183: GPW data are at a much finer resolution. Were these regridded to 0.5x0.5 degrees?

- Lines 426-433: should compare results also to Thompson et al. 2014, and also compare results for ozone from these studies.

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