

# ***Interactive comment on “Assessment and economic valuation of air pollution impacts on human health over Europe and the United States as calculated by a multi-model ensemble in the frame work of AQMEII3” by Ulas Im et al.***

## **Anonymous Referee #1**

Received and published: 22 November 2017

This paper uses an ensemble of multiple chemical transport models and health impact functions to estimate the health impacts of air pollution in US and Europe and the impacts of long-range transport of pollution between the two regions. The idea for the paper is interesting and if conducted well it would be a nice contribution to the literature. Unfortunately the implementation is lacking, particularly for the health impact assessment methods and data sources. The authors have generated health impact numbers, it is not clear how they were generated, whether they are supported by the epidemiological evidence, and how they should be interpreted. The analysis of the

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model ensemble and different averaging techniques is much stronger. Below are some suggestions mainly for how the health methodology might be improved.

Lines 84-96 should be updated with the most recent GBD 2016 numbers

Lines 118-153 could use some organization. This section is basically just listing results from individual studies without synthesizing them or connecting them to the present study. It's not clear as written by this section is there.

Line 188-190 states that this is the first study to use a common approach for health impact assessment across US and Europe, but the HTAP ozone and PM2.5 health impact assessments referenced earlier used a similar approach. Perhaps the authors are referring only to the economic valuation portion? If so, I'm still not sure this is the first study to do that since there are now several (perhaps many) global health impact and valuation studies that use a common approach for all countries/regions, including US and Europe.

Lines 296-298: given that this paper's focus is on the health impacts, and not the modeling, there should be much more detail given here about the health impact methods in addition to, or instead of, the modeling detail, which can be found in other places and referenced. The health methods quickly summarized here diverge from the methods used by the Global Burden of Disease, U.S. EPA, and many recently published papers. So this needs to be explained, expanded, and justified quite a bit more. As stated, summing ozone deaths with PM2.5 YOLL doesn't make logical sense, as one is cases and one is years, and what is being divided by 10.6 and why? The CAFÉ reference is 12 years old, and air pollution epidemiology and health impact assessment has advanced quite a bit since then. For ozone, there are now studies showing effects of long-term exposure on mortality, just like for PM, so why are only short-term ozone impacts calculated?

Lines 299-302: The ERFs listed in Table 2 are quite a bit out of date, particularly for the U.S. studies. Most of these are 20 years old. There have been many studies now

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reporting updated ozone and PM<sub>2.5</sub> risk estimates for the American Cancer Society cohort which can be used. And these are not necessarily consistent magnitudes compared with the old studies.

Table 2 needs concentration metrics to which each ERF applies. Section 2.2 should state which concentration metrics were drawn from the models (annual average, annual average of 8-hr daily max, etc.) used which each ERF. I see now these are indicated starting in line 376, but not explained, and should be in section 2.2.

Section 2.2 should also give some equations used to calculate health impacts. It's difficult to understand what was done and impossible to judge whether it's technically sound.

Section 2.2 were the exposure response functions applied in a linear equation or some other functional form (e.g. log-linear)? This is important for the perturbation simulations because you are reducing pollution at the high end, where the shape of the curve can have a big impact on the magnitude of health benefits estimated.

Section 2.2 should also indicate the source of baseline disease rates to calculate health impacts.

Section 2.2 did you first estimate health impacts from each individual model and then average, or first average the concentrations across models and then estimate health impacts?

Section 2.2 what spatial resolution was used to estimate health impacts? Part of the problem with previous studies of PM long-range transport is that the grid resolution was too coarse to adequately capture health benefits from reducing local PM. Spatial scale is important.

Section 3.2 are the plus/minus numbers given with all the results the range of health impacts calculated with individual models? How was uncertainty in the exposure-response function accounted for?

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Line 413 appears to be missing a 0 in the HTAP2 result

Line 421 what is meant by “by construction”?

There are many references to the Liang (in preparation) study, but since this study is not yet available the usefulness of these comparisons is limited. It is often used as justification that the present study was done right, since the numbers match up. But there is not currently enough information from either study to judge that.

There are many tables with numbers for health impacts that are difficult to digest. Suggest replacing some of these with figures to highlight the most salient points.

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Interactive comment on Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2017-751>, 2017.

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