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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Source contributions and potential reductions to health effects of particulate matter in India" *by* Hao Guo et al.

Anonymous Referee #1

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Review for Atmospheric Chemistry and Physics Discussions

Title: Source contributions and potential reductions to health effects of particulate matter in India

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General comments

This manuscript estimates the contributions of different sources to ambient PM2.5 concentrations in India and the associated disease burden. The study calculates potential reductions in the health impacts if PM2.5 concentrations were reduced to different standards. The topic of Indian air quality is important as exposure to air pollution

causes a substantial disease burden in India and it is relevant to the scope of ACP. The author's use a regional chemical transport model at high-resolution to estimate the health impacts from ambient PM2.5 exposure with a methodology that is consistent with the literature, although they use outdated health functions and old baseline mortality data. The tagging methodology, using tracers to estimate the source contributions, is a strength of this study. The results are sufficient to support the conclusions that residential emissions dominate the source contributions, that the disease burden is primarily across northern India, and that large emission reductions are required to reduce the substantial disease burden from ambient PM2.5 exposure in India.

The major issue is the novelty of the manuscript. The authors state on line 76 and 77 that "no studies have attributed the health effects to different sources of PM2.5 in India till date". This is not true. The impacts of different sources to ambient PM2.5 concentrations and the associated disease burden in India were studied in detail in Lelieveld et al., (2015), Silva et al., (2016), Lelieveld (2017), Conibear et al., (2018a), GBD MAPS Working Group (2018), and Venkataraman et al., (2018). Only one out of six of these studies (Lelieveld et al., 2015) was discussed in this manuscript, and the results of this manuscript have largely been found in the other previous studies. Many studies have focused on reducing PM2.5 concentrations in India, for example, Giannadaki et al., (2016) studied the health impacts from applying different air quality standards to PM2.5 and Conibear et al., (2018b) explored the non-linear response of health impacts to PM2.5. The GBD MAPS Working Group (2018) and Venkataraman et al., (2018) directly addressed the research question of this manuscript studying source contributions and potential reductions of PM2.5 pollution in India in the present day and the future in comprehensive papers, one of which was recently published in ACP.

In summary, this manuscript focuses on an important topic using standard methods, though it neglects many previous studies that have already addressed this research question, and the current version of the manuscript is not novel. To develop the novelty of this manuscript, the author's could focus on the insights brought by the tagging

methodology relative to a zero-out approach and on the chemical speciation of PM2.5 health impacts seeing that SOA has a large impact in this work.

Specific comments

1. The author's should discuss the important work done on these research questions by Venkataraman et al., (2018), GBD MAPS Working Group (2018), Conibear et al., (2018a, 2018b), Lelieveld (2017), Silva et al., (2016), Giannadaki et al., (2016), GBD2016 (2017), Cohen et al., (2017), Chafe et al., (2014), and Butt et al., (2016).

2. Lines 46-49: Estimates that are more recent exist. In the GBD2016 (2017), India accounted for 1.034 million of 4.093 million global premature mortalities from ambient PM2.5 exposure, and ambient PM2.5 exposure was the second largest risk for health in India in 2016.

3. Line 54: "Few studies estimate the health effects using regional and global models, and satellite data". This is not true. More than 15 studies estimate the health effects using models and observations in India, where some are summarised in Figure 4a of Conibear et al., (2018).

4. Lines 61-65: The estimate of the disease burden from ambient PM2.5 exposure for the United States using a different health function is unrelated to this manuscript focusing on India.

5. The baseline mortality rates are for 2000. Large differences have occurred in these values relative to the year of study (2015).

6. The integrated exposure-response (IER) function used to calculate the health impacts uses coefficients from the GBD2010 (2012) study documented in Burnett et al., (2014). The IER has been updated multiple times (in 2013, 2015, and 2016). Estimates of the disease burden are very sensitive to the exposure-response function used and recent updates of the IER provide estimates that are more accurate.

7. Section 3.3: It is not clear how the reductions in PM2.5 and disease burden were

calculated.

8. The quality of the plots could be improved, e.g. increasing the resolution, not using a rainbow colour bar, adding units, and fixing typos (Figure 6).

9. The model evaluation should at least be summarised in this manuscript.

10. Line 191-192: Why does the approach to calculating YLL in Ghude et al., (2016) introduce uncertainties?

Technical corrections

1. The wording is sometimes unclear. Examples are Lines 58-61, 157, 189-192, 196-199, though this is not an exhaustive list.

2. Equations 3 and 4 could be consistent e.g., both include mortality.

3. Line 275: Typo "Utter Pradesh".

References

Burnett, R. T. et al. An integrated risk function for estimating the global burden of disease attributable to ambient fine particulate matter exposure. Environ. Health Perspect. 122, 397–403 (2014).

Butt, E. W. et al. The impact of emissions from residential combustion on atmospheric aerosol, human health and climate. Atmos. Chem. Phys. 16, 873–905 (2016).

Chafe, Z. A. et al. Household Cooking with Solid Fuels Contributes to Ambient PM2.5 Air Pollution and the Burden of Disease. Environ. Health Perspect. 122, 1314–1320 (2014).

Cohen, A. J. et al. Estimates and 25-year trends of the global burden of disease attributable to ambient air pollution: An analysis of data from the Global Burden of Diseases Study 2015. Lancet 389, 1907–1918 (2017).

Conibear, L., Butt, E. W., Knote, C., Arnold, S. R. & Spracklen, D. V. Residential energy

use emissions dominate health impacts from exposure to ambient particulate matter in India. Nat. Commun. 9, 9 (2018a).

Conibear, L., Butt, E. W., Knote, C., Arnold, S. R. & Spracklen, D. V. Stringent emission control policies can provide large improvements in air quality and public health in India. GeoHealth 2, (2018b).

GBD 2010 Risk Factors Collaborators. A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990-2010: a systematic analysis for the Global Burden of Disease Study 2010. Lancet 380, 2224–60 (2012).

GBD 2016 Risk Factors Collaborators. Global, regional, and national comparative risk assessment of 84 behavioural, environmental and occupational, and metabolic risks or clusters of risks, 1990–2016: a systematic analysis for the Global Burden of Disease Study 2016. Lancet 390, 1345–1422 (2017).

GBD MAPS Working Group. Burden of Disease Attributable to Major Air Pollution Sources in India. Special Report 21. Boston, MA:Health Effects Institute. (2018).

Ghude, S. D. et al. Premature mortality in India due to PM2.5 and ozone exposure. Geophys. Res. Lett. 43, 1–9 (2016).

Giannadaki, D. et al. Implementing the US air quality standard for PM2.5 worldwide can prevent millions of premature deaths per year. Environ. Heal. 15, 1–11 (2016).

Lelieveld, J., Evans, J. S., Fnais, M., Giannadaki, D. & Pozzer, A. The contribution of outdoor air pollution sources to premature mortality on a global scale. Nature 525, 367–371 (2015).

Lelieveld, J. Clean air in the Anthropocene. Faraday Discuss. 200, 693–703 (2017).

Silva, R. A., Adelman, Z., Fry, M. M. & West, J. J. The Impact of Individual Anthropogenic Emissions Sectors on the Global Burden of Human Mortality due to Ambient

Air Pollution. Environ. Health Perspect. 124, 1776–1784 (2016).

Venkataraman, C. et al. Source influence on emission pathways and ambient PM2.5 pollution over India (2015–2050). Atmos. Chem. Phys. 18, 8017–8039 (2018).

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