Review of paper by Chandra Venkataraman et al. titled: **Source influence on emission pathways and ambient PM2.5 pollution over India (2015-2050)**

General comments

The work of Venkataraman et al. deals with the investigation of PM sources in India which experiences severe air pollution problems, under current emissions and future emission scenarios which assume cleaner and more energy efficient technologies. This work wants to address two scientific questions strongly related with HTAP, such as the identification of regional PM2.5 pollution levels and their sources and the changes in PM2.5 levels as a result of air pollution and climate change abatement efforts. The paper is overall well written and fits with the purposes of the HTAP special issue; therefore I recommend it for publication after developing the following comments.

Specific comments

-page 2 line 5: please provide a reference for the population statistics

-page 2 line 21: in the text you mention that air pollution is a critical issue in particular in certain cities and states of India. It would be interesting to have in the supplementary material a map with the Indian states indicating with markers the most polluted cities.

-page 3 line 10 and page 8 line 27: the HTAP inventory documented by Janssens-Maenhout et al. (2015) is named HTAP_v2, so please correct it.

-page 3 line 27: can you shortly describe the "engineering model approach" on which your emission estimates are based, although documented in other publications. This will help in understanding the source of data for the technology penetrations and air pollution control measures (refer to page 4 line 5).

-page 3 line 8: I guess residential emissions do not only include water and space heating but also all the other domestic activities like cooking. Please correct this sentence.

-page 4 line 20: the authors should clarify why their database does not include emission estimates of CO, NH3 and PM10? Later in the manuscript the authors say that NH3 is indeed taken from MIX. Why was not it possible to calculate them with your methodology? How is the consistency among all pollutants (in terms of activity data, technologies, abatement and spatial distribution) is guaranteed? NH3 is a crucial compound for the formation of secondary PM, so consistency with other SOA precursors is needed. Moreover, you refer to the paper by Li et al., 2017 for the MIX inventory, however, this inventory is only till 2010. How did you obtain emissions for 2015?

-page 5 line 21: The authors mention the "shift to non-fossil generation". Can the authors clarify towards what type of energy source India will move? In addition, as general comment on the

future scenarios, the authors should mention how much realistic/feasible are they. Why Indian emissions cannot increase even at a higher speed compared to 2015 since quite some time is required before future policies to reduce the emissions in India will become effective?

-The authors should compare their scenarios assumptions (including references therein) and results with the recent work by Li et al. (2017).

-page 8 lines 24-43: as supplementary information, it would be interesting to look at some additional emission inventory comparisons for the common years (e.g. 2008 and 2010): e.g. HTAP_v2, REAS, ECLIPSE and your inventory. This can be shown both as total/sector-specific emissions comparison and gridmaps.

-page 11 line 25: why meteorological data are not available beyond 2012?

-page 13 line 14: why do we observe higher concentrations in northern India? Is it only due to the fact that most of the sources are located in that area or are there other reasons?

-page 16 line 13: PM2.5 concentration from road transport seems to be rather low (below 2 ug/m3). Are emissions from re-suspension included?

-page 17 lines 22-24: the authors should clarify why district level urban population is used to distribute on-road gasoline emissions. Transport emissions should be distributed over roads (with different type of weights) and not over population proxies. The authors could provide in a supplementary table the proxies used to grid emissions from different sectors.

-Table1: please clarify what you mean with “emissions of anthropogenic dust removed”. If the dust is collected/removed it does not contribute to atmospheric emissions.

-Figure 7 reports PM2.5 concentrations by state, however, it is not clear how this is calculated. Do the authors estimate emissions for each Indian state using statistics of each state and then they evaluate PM2.5 concentrations by state? Please clarify.

-Table S1: it is not clear why NH3 (and possibly also PM10 and CO) emissions by state are not reported here.

-Table S2: it would be good to report a short description in how the uncertainty bands have been calculated using the cited studies.

-Table S4: it would be interesting to know more details about the technologies applied on the private vehicles. The authors could report the share of two/three wheelers and passenger cars as well as the corresponding emission standards (share and emission levels) applied on these vehicles. Is gasoline the most used fuel for private vehicles?

Technical corrections

-You should use in the text and in the graphs the “Mt” units instead of “MT”

-page 1 line 30: please rephrase as following: “… and a very large shift (80-85%) to non-fossil electricity generation, an overall reduction in PM2.5 concentrations below 2015 levels was achieved”.

-page 2 line 15: please reformulate as following: (particulate matter in a size fraction with diameter smaller than 2.5 μm)

-page 4 line 20: please replace “reside” with “residues”.

-page 11 line 21: please correct as following: “mass to organic”

-page 11 line 22: please change to Philip et al. (2014b)

-page 14 line 26: “The simulated change in sectoral contribution to population-weighted PM2.5 concentrations, is evaluated” please remove the “comma”

-page 18 line 15: “The present findings imply that desirable levels of air quality, may not be widespread” please remove the “comma”

-Figure S3 should not be in black and white but with colors.

References

Li, C., McLinden, C., Fioletov, V., Krotkov, N., Carn, S., Joiner, J., Streets, D., He, H., Ren, X., Li, Z., and Dickerson, R. R.: India Is Overtaking China as the World’s Largest Emitter of Anthropogenic Sulfur Dioxide, Scientific Reports, 7, 14304, 10.1038/s41598-017-14639-8, 2017.