

## ***Interactive comment on “Impacts of Household Sources on Air Pollution at Village and Regional Scales in India” by Brigitte Rooney et al.***

### **Anonymous Referee #1**

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General comments: The residential source is a major source sector for air pollution in India. Studying the impact of household source to air pollution is important for policy-making. The topic of this study is suitable for the ACP. However, major revisions are needed to further improve the study. The contents need to be re-organized, and the model performance should be evaluated cautiously before analyzing the results and drawing the conclusions. A discussion on the uncertainty and limitation of this study is also needed. Specific comments: 1 Line 10-15 on Page 6: “Thus, daily emission rates are generated for all species and sectors, except for the residential sector. All emissions are assumed to occur at Earth’s surface. How do the authors derive the daily and hourly emission rates of different emission sectors for the CMAQ model? It seems limited information is available for the temporal profiles of most of the sectors other than

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residential. And assuming all the emissions occur at Earth surface will overestimate the impact of high-stack emission sources to the ground-level concentrations, such as power and some industrial sectors. 2 Line 25-30 on page 10: why not directly run the GEOS-Chem model in 2015 and 2016 for the exact corresponding dates of CMAQ simulation? 3 Page 14-Page 15: One and a half pages are spent to review the previous studies on ozone simulation in India. The review is too long, which distracted the reader's attention. It's better to first present the author's results, and then have proper discussion with information from previous studies. Please re-organize the contents. 4 Line 20-25 on page 9: why do the authors choose Sep. 2015, Dec. 2015 and Sep 2016? Do the three periods has some relevance? What's the intention to choose three discrete periods? 5 Page 41: The comparison between simulation and observation shows that the model always underestimates the ozone concentration during night, close to zero. What is the reason? Is this reasonable? 6 Line 25-28 on page 15: "This overall comparison of predictions and observations would appear to be driven by the accuracy of the meteorological fields generated by the model. "Indeed, the performance of air pollutant predictions can be largely affected by the meteorological conditions simulated by WRF. It's necessary to evaluate the model performance of WRF prior to CMAQ evaluation, which may provide hints for the inconsistency between the observation and simulation. 7 Line 27-28: "In general, the degree of agreement between predicted and observed O3 levels in New Delhi over these periods should be considered as reasonable. "The conclusion here is not convincing. Please first do the statistics for the model evaluation, and then compare with previous studies to see whether it's reasonable or not. 8 Line 15-28 on page 15: please explain the reasons of underestimation and over estimation of ozone for different monitoring sites. 9 Page 16-Page 17: Somehow, the model performance for PM2.5 is also not satisfactory: large underestimation occurred in SOMAARTH HQ in Sep. 2015, Bajada Pahari in Dec. 2015, whereas over estimation occurred in Bajada Pahari in Sep. 2016, and New Delhi in Sep 2015 and Sep 2016. Before moving further, the authors should evaluate the model performance in details, analyze the reasons for the underestimation and

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overestimation, and compare the model performance with other studies. 10 Line 2-4 on Page 18: “September 2015 and 2016, household energy-use activities account for up to 33% of ambient PM<sub>2.5</sub> at SOMAARTH HQ and up to 28% at Bajada Pahari in September 2016.”With current model performance, it’s hard to trust the reliability of the results. Since a large proportion of PM<sub>2.5</sub> mass concentration is missing compared with the observation. 11 Now that the study also analyzed the household contribution to SOA, a model evaluation for SOA is also needed. 12 A discussion on the uncertainty and limitation of this study is missing.

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