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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Using satellite measurements and mesoscale modelling to understand the contribution to an extreme air pollution event in India" *by* Ashique Vellalassery et al.

Anonymous Referee #1

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Review

Atmospheric Chemistry and Physics

Title

Using satellite measurements and mesoscale modelling to understand the contribution to an extreme air pollution event in India

Authors

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Summary

This paper analyses the contribution of biomass burning emissions, anthropogenic emissions, and meteorology to carbon monoxide (CO) concentrations across the Indo−Gangetic Plain (IGP) in India. A case study focuses on an air pollution episode during November 2018, coincident with large agricultural biomass burning across the states of Punjab and Haryana. This study quantifies these contributions using chemical transport model simulations with tracers and evaluates the model using uses high spatial−resolution satellite measurements. Air pollution exposure is an important public health problem in India, and acute episodes can be particularly severe in winter. The topic of this paper is relevant to the scope of Atmospheric Chemistry and Physics.

My main criticisms are to increase the model description, discuss specific anthropogenic sources, and consider particulate air quality.

A substantial portion of the paper is dedicated to evaluating the model skill in simulating CO concentrations. However, the paper does not mention which physics, chemistry, aerosol, and dynamics schemes were used. A discussion of the gas−phase chemistry mechanism would be especially relevant. The authors find a larger contribution from anthropogenic emissions than from biomass burning emissions to CO concentrations across the IGP, except within the Punjab for a short period of time during the episode. Examples of these anthropogenic emissions are given (e.g. residential air conditioning systems). However, alternatives to these may be expected to be more likely (e.g. residential solid fuel use for cooking and heating, coal−fired brick kilns). Hence, the chosen examples need explaining.

Air quality in India is mainly important in terms of fine particulate matter (PM2.5) exposure and these biomass burning events also contribute significantly to ambient PM2.5 concentrations (India State-Level Disease Burden Initiative Air Pollution Collaborators

2019, Cusworth et al 2018, Jethva et al 2019). It would be useful to see a discussion of how these episodic emissions contributed to PM2.5 exposures and the associated acute health impacts.

Overall, this paper provides an interesting analysis of how biomass burning contributes to CO concentrations during a winter air pollution episode in India. The paper would be improved by adding model details and further discussing its implications.

Comments

- 1. Title: The contribution of what? Also, is mesoscale modelling the most accurate term here?

- 2. This paper has many acronyms. Are all these necessary?

- 3. The paper aims to address 5 questions. It would be useful to have a concise summary of the answers to these questions in the conclusion.

- 4. Page 2 line 10, page 3 lines 3 and 10, page 4 lines 21 and 40, page 5 lines 13, 14, and 30, page 6 lines 1, 9, 10, and 23, page 7 lines 10, 19, and 28, and page 12 line 34: Define acronyms at first use.

- 5. Lines 8−13: Why is the fire−radiative power (FRP) approach more accurate than inventory approaches? In the second half of this sentence, the authors mention inaccuracies in these derived approaches. If by derived the authors imply FRP, then this would be useful to clarify for the reader.

- 6. Page 4 line 36, page 5 line 22, page 7 line 27, and page 14 lines 17 and 18: Acronyms already defined.

- 7. Page 5 lines 9−19: This is a very long sentence, which requires shortening. Also, this comparison to previous work may be better suited to the Discussion.

- 8. Page 5 line 40, and page 6 line 12: Typo: WFM−DOAS.

- 9. Page 13 line 36: Typo: PBL.

- 10. Page 15 line 31: Typo: November.

- 11. Page 16 line 10: The authors emphasise residential and commercial emissions. This needs to be more specific i.e. are they implying residential solid fuel use emissions from cooking and heating?

- 12. Table 2, Figure 2, Figure 3, Figure 4, and Figure 5: Define acronyms in captions.

- 13. Figure 2a: Unit mismatch between caption (mg/m2/month) and y−axis label (g/month/region).

References

Cusworth D H, Mickley L J, Sulprizio M P, Liu T, Marlier M E, DeFries R S, Guttikunda S K and Gupta P 2018 Quantifying the influence of agricultural fires in northwest India on urban air pollution in Delhi, India Environ. Res. Lett. 13

India State-Level Disease Burden Initiative Air Pollution Collaborators 2019 The impact of air pollution on deaths, disease burden, and life expectancy across the states of India: the Global Burden of Disease Study 2017 Lancet Planet. Heal. 3 e26–39

Jethva H, Torres O, Field R D, Lyapustin A, Gautam R and Kayetha V 2019 Connecting Crop Productivity, Residue Fires, and Air Quality over Northern India Sci. Rep. 9 16594 Online: http://www.nature.com/articles/s41598-019-52799-x

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