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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Exposure-plant response of ambient ozone over the tropical Indian region" *by* S. Roy et al.

Anonymous Referee #2

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1) General comments

This paper presents an assessment of seasonal ground-level ozone and respective AOT40 index calculations for an Indian subcontinent region using the Regional Chemistry-Transport Model REMO-CTM. The CTM was tested with station data for the year 2003 from Pune-India. The work is within the scope of Atmospheric Chemistry and Physics; and presents a relevant contribution to the research field by quantifying the magnitude and distribution of areas where there are risks of ozone damage to human health and vegetation. Results reinforce the need for increasing research efforts to quantify ground-level ozone (both by in situ measurements and modeling) in critical regions such as the Indo-Gangetic plains where a large human population and vast cropping areas are subjected to high ozone levels. This type of study helps to minimize

the scarcity of data and research in developing countries, in comparison with USA and Europe, for this area of atmospheric sciences. Two strong points of the paper are the use of a recent emissions inventory for India and the use of a regional CTM able to reproduce the AOT40 seasonality in India. This paper highlights the importance of further assessments in Asia where crop types were shown to be as sensitive to ozone as in the USA and Europe (Emberson et al. 2009) and estimated losses are significant at global level (Van Dingenen 2009). As a general suggestion to improve this manuscript, the authors could give a better explanation of the possible elements that limited model performance (e.g. emission inventory, climate data, model structure)by discussing their relative importance and uncertainty (see item 2; specific comments).

2) Specific comments:

There are some specific points that may require further clarification and/or development:

(i) How site-specific the authors believe the results of the CTM-testing are? For instance, the model was tested for the Pune site - which is quite far south from the Indo-Gangetic plain where the 'hot-spots' of AOT40 were identified. How confident could one be that results of model performance can be extrapolated to other sites with different emissions and environment? Please, consider that for discussion.

(ii) Please, discuss the possible reasons that could cause the observed systematic underestimation in AOT40 (roughly 35%, Figure 1) during the periods of highest ozone concentration (December to March). How important is the model limited ability to capture ozone peaks in this context (Fig 2c)? Similar to the question in item 2i, how would these limitations affect assessments in the other sites?

(iii) Suggestion: Figure 3 shows three individual months around monsoon but is currently not showing periods with the highest AOT40 sums. Would it not be more illustrative to show maps with selected 3-month AOT40 sums (as used for yield-damage assessment)including months between December to March?

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3) Technical corrections/suggestions:

(i) In Figure 3 please consider using an identical color palette to all graphs (same color and scale) to facilitate comparison among months.

(ii) Please, include lat/long coordinates when first referring to the site used for model testing. You may also include it as a point in Figure 3.

(iii) When referring to Rabi (line 13; pg 4146) and Kharif (line 6; pg 4148) growing seasons please briefly clarify the meaning (period of the year, e.g. from month x to month y and the type of crops). This short explanation will help the reader to understand the context and importance of referring to these periods.

(iv) Figure labels: Change ppb*h for ppb h

(v) In y-axes labels of figures, specify the period for variable calculation, as for example (please check if units are correct): - Fig 1. Monthly AOT40 sum (ppb h) - Fig 2a: Daily AOT40 sum (ppb h) - Fig 2b: Daily average ozone (ppb) - Fig 2c: Daily maximum ozone (ppb) This will help the reader compare graphs with different calculation time steps.

(vi) Horizontal lines marking thresholds in graph 2 could also include the 40 ppb h for vegetation protection as it was frequently referred in the text.

References cited in this comment: Emberson, L. D., P. Büker, M. R. Ashmore, G. Mills, L. Jackson, M. Agrawal, M. D. Atikuzzaman, S. Cinderby, M. Engardt, C. Jamir, K. Kobayashi, K. Oanh, Q. F. Quadir and A. Wahid (2009). "A comparison of North American and Asian exposure-response data for ozone effects on crop yields." Atmospheric Environment doi:10.1016/j.atmosenv.2009.01.005

Van Dingenen, R. (2009). "The global impact of O3 on agricultural crop yields under current and future air quality legislation." Atmospheric Environment 43(3): 604-618.

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 4141, 2009.