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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Variations in surface ozone and carbon monoxide in the Kathmandu Valley and surrounding broader regions during SusKat-ABC field campaign: Role of local and regional sources" *by* Piyush Bhardwaj et al.

Anonymous Referee #2

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The paper presents data collected during the winter and spring of 202-2013 in the Kathmandu valley region of Nepal of O3 and CO and contemporaneous measurements of these two gases from Nainital and Pantanagar in India. Hydrocarbon data was collected for a few weeks in December and January during the same period in Bode, Nepal. Extensive analysis of this data is presented contrasting O3 and CO for the winter and spring and episode resulting from biomass burning over western parts of India on the air masses observed over the three sites is presented. The dataset is unique and certainly worthy of discussion in a paper. One serious short coming of the paper is

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Discussion paper

an absence of model calculations supporting numerous statements in the manuscript. I can't see how this will make sense without supporting model simulations. I will detail some of them below. A second un answered question is what connects these three sites besides them being in approximately near and in the Himalayan foothills? Kathmandu is in a valley and that makes it meteorology fairly unique and extensively influenced by drainage flows, flow through mountain passes and other complex flow situations. Naintal site is at the edge of the mountain ranges and high enough that it can be considered a background site. Pantnagar being lower elevation and in the IGP and is potentially not directly connected to Kathmandu (in terms of transport). I would like to see some discussion why these three sites make a good case for comparing with each other. Finally, the use of HYSPLIT for boundary layer flow reaching Bode in the central of the Kathmandu valley with a 1 degree x 1 degree GDAS fields is probably not a good idea. It would be reasonable to use this method for trajectories reaching mid troposphere. Due to the complex flow conditions here you need much higher resolution flow fields and may be trajectories that reach the top of PBL at Bode rather than the surface. I recommend they try using higher resolution (0.5 degree?) flow fields or better (generated with WRF simulations for example) to increase the confidence in these trajectories.

Specific Comments:

Page 14, Line 1: photo-dissociation of NO3 and NO5 at sunrise Q: Have you measured, No3, N2O5, HNO3 or NOy ever during this experiment. Are there model caluclations that show how much N2O5 can be produced during nighttime? Are there any estimates of PAN produced using models or observations? It is really hard to tell this complicated story using CO and O3. You will need lot more measurements to constrain your story and these are basic measurements for any airuqality study.

Page 14, Line 5 to 10: discussion on ozone mix down Q: Are there any measurements of ozone profiles at Bode? Ozone sondes etc? In its absence running a model may help evaluate these claims. As it stands this is pure speculation and unsupported by

any facts and the discussion is very qualitative.

Page 15, line 5 to 10: Decrease of CO from morning to evening Q: This is again a fairly qualitative description with no supporting data. Later in the discussion it seems like the photochemistry is active during the early morning hours. What are the OH levels at Bode during early morning and late afternoon time periods? A model will help distinguish between chemical and meteorological phenomena.

Page 17, Line 1 to 5: Seasonal variability of CO, decrease from winter to Spring Q: Again, I am not sure how much role chemical loss of CO is important here. Having an idea of OH concentration changes between winter and spring in the valley would be useful. This being a valley the CO emitted could stay trapper for much longer times than other places and hence photochemistry plays a bigger role in CO lifetime.

Page 18, Line 1:10: ozone variation from winter to spring Q: What happens to NO emissions from Winter to Spring? If CO emissions are said to be decreasing will it also not lower NO emissions? Does a decrease in fresh NO at evening hours keep more of the ozone from losses during the night? This would make the ozone issue mostly local.

Page 18, Line 11 – 15: negative correlations between CO and ozone Q: what is the explanation for this negative correlation?

Page 18, Line 20:24: measurements from Nainital and Pantanagar Q: How are these sites connected meteorologically?

Page 20: Line 2-5: No titration discussion Q: This probably is the explanation for the ratios of CO and ozone

Page 21, Line 6: Bode are likely Q: do you mean ‘unlikely’?

Figure 11: ozone, co time series Q: what about the CO and ozone peaks in April? Are they also from biomass burning?

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