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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Observations of high rates of NO_2 – HONO conversion in the nocturnal atmospheric boundary layer in Kathmandu, Nepal" *by* Y. Yu et al.

Y. Yu et al.

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We appreciate the referee's comments and suggestion. We made some changes (i.e. clarified the contributions of HONO formation in various sources according to the referee's suggestions) in the revised paper, and clarify some questions raised by the referee here.

Comment 1: Perhaps the best example of this is given by the juxtaposition of sections 3.3 and 3.4. In the first section attention is focused on relatively fast variations in HONO/NO2, perhaps linked to even shorter spikes in aerosol mass (measured in-situ as PM10) presumed to reflect increasing S/V of aerosol (Figure 5). In the final paragraph of 3.3 it is suggested that soot in the nocturnal aerosol plumes may be an

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important HONO source. Then the discussion of Figure 6 largely ignores similar linked variations in HONO/NO2 and S/V aerosol (estimated from the DOAS retrievals) on short time scales, focusing instead on the correlation between HONO/NO2 and S/V ground, which is driven by larger changes occurring over several hours.

Response 1: The referee thinks section 3.3 contradicts 3.4. We discussed the HONO formation in section 3.3 as ADDITIONAL HONO formation! This HONO formation might be a small amount of HONO compared to other sources. The de-active soot doesn't have any contribution to HONO formation. We don't see any contradiction between your opinion and our data. In our paper, we wrote " This calculation indicates that soot may play a role in NO2-HONO conversion in Kathmandu. However, it should be noted that there is inadequate information about aerosol chemical composition." Thus, we declared the possibility of HONO formation due to soot aerosol.

Comment 2: And section 3.4.1. ends by suggesting that production on ground surfaces "was a major source of HONO in Kathmandu atmosphere." While not clearly stated, the implication appears to be that the ground source overwhelms any contribution from the aerosol plumes discussed in the previous section. However, the next section takes up the effect of RH and focuses on aerosol reactions as much, if not more, than ground surfaces.

Response 2: The purpose of discussion of effect of RH on aerosol reactions is to apply the same uptake coefficients to ground surface production (the major source of HONO as we declared in the paper). Here are the words we wrote in our paper "Based on their results of particles and an assumption of similar uptake coefficients on the ground reactive surface and entire conversion of NO2 to HONO on the surface, the..." and "The water uptake processes can take place on the ground surface in addition to the aerosol surface in Kathmandu atmosphere." We should make it clear in the revised paper.

Comment 3: At the very least, a paragraph or two discussing the possible combination of multiple sources would tie the different subsections together. I realize that reviewer

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1 discounts any significant production of HONO on aerosols (apparently globally), but the fine scale variations in Figures 5 and 6 are intriguing. It should be noted that the particulate loading in Kathmandu is extremely high, and is quite likely to have qualitatively different composition than aerosol in European cities. In addition to the brick kilns mentioned in the manuscript, the vehicle fleet in Kathmandu has a large number of old and poorly maintained diesels. Adding these local sources onto the regional "brown cloud" makes for impressively poor air quality in the valley.

Response 3: We appreciate the referee's comments. It is good to recognize that there are huge environmental difference in South Asian countries (like Nepal) compared to European and North American countries. The mechanism of HONO formation is complicated. It might be different due to various conditions, which is a major motivating factor for conducting HONO research at different sites besides North America and Europe cities.

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 183, 2009.