Atmos. Chem. Phys. Discuss., 9, S1787–S1789, 2009
www.atmos-chem-phys-discuss.net/9/S1787/2009/

Atmospheric Chemistry and Physics Discussions

ACPD

9, S1787–S1789, 2009

Interactive Comment

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.

Received and published: 28 April 2009

We appreciate Dr. Steeneveld's comments.

Dr. Steeneveld makes several points. Here are our responses.

Comment 1: The reviewer points out that the paper does not provide sufficient overview of the strength of the nocturnal boundary layer. The reviewer suggests making a rough estimate of the stable boundary layer depth using methods from Steeneveld et al (2007) or Zilitinkevich (2002).

Response 1: The references suggested by Steeneveld provide ways of estimating the nocturnal stable boundary layer depth based upon several different typically observed values. The most promising estimates are based upon the magnitude of the frictional velocity or the buoyancy flux. Calculation of the frictional velocity requires knowing the perturbation velocities in three directions, u', v', and w'. If we had a sonic anemometer, that would have been easy to obtain. However our weather station only provided one-minute average values of u and v. Similarly, calculating the buoyancy flux also requires knowing the perturbation vertical velocity w', as well as perturbation potential temperature, theta-prime. We lacked the observations to calculate the buoyancy flux.

Comment 2: Dr. Steeneveld asks whether we trust our observations of extremely low wind speeds and constant wind direction in the night of February 4 presented in Figure 3, and asks how we define the nocturnal boundary layer depth.

Response 2: The weather station we used (Portlog from Rainwise, Inc, Maine, USA) had an accuracy of 1 m/s. To within that accuracy we do trust its observation of low wind speeds at night. The displayed constant wind direction, however, is a consequence of the wind speed being below a threshold such that the vane would not turn even if there was non-zero wind speed and changing wind directions. Our figure should be corrected to show no wind direction at times when the wind speed was zero (or make a statement of meaningless wind direction at times when the wind speed was zero).

In the analysis so far, the nocturnal boundary layer depth was assumed to be a constant 120 meters based upon an average of inaccurate night-time measurements by the sodar. This boundary layer depth actually is in good agreement with other researchers8217; observation in Kathmandu valley (Kondo et al., 2002).

Comment 3: Dr. Steeneveld asks if we can suggest sources of the plumes shown in Figure 5, and suggests that they may be due to intermittent turbulence.

Response 3: There are two possible point sources for nocturnal pollution plumes in the Kathmandu Valley: Brick kilns (the nearest ones were 5-6 km away from our DOAS light path), and garbage fires. The brick kilns operate throughout the night and are a big source of both PM10 and soot in the valley, while the garbage fires are more

ACPD

9, S1787–S1789, 2009

Interactive Comment

ephemeral. Given that the plumes were seen after midnight, we think it is more likely that we saw plumes from brick kilns. Even more likely though, is the possibility (suggested by other reviewers) that changes in vertical mixing within the stable boundary layer (some sort of wave-like behavior) brought layers of more polluted air (from nearer to the surface) into the DOAS light path as well as to the location of the PM10 sensor. However, it is interesting that NO2 loss and HONO formation after PM10 plume, which indicates the chemical processes during such PM plume events.

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

ACPD

9, S1787–S1789, 2009

Interactive Comment