Atmos. Chem. Phys. Discuss.,
doi:10.5194/acp-2016-1002-AC1, 2017

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Investigation of the mixing layer height derived from ceilometer measurements in the Kathmandu Valley and implications for local air quality" *by* Andrea Mues et al.

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Received and published: 12 April 2017

Below we reply to the short comment by Dr. Tang on our ACPD manuscript "Investigation of the mixing layer height derived from ceilometer measurements in the Kathmandu Valley and implications for local air quality". We would like to thank Dr. Tang for his interest in our work and for the constructive comments helping us to improve the paper. We have listed Dr. Tang's comments below and answers are provided in blue. All page and line numbers refer to the "track changes" version of the revised manuscript provided as a supplement.

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Discussion paper

Short comment by G. Tang

The authors analyzed the seasonal changes of mixing layer height in the Kathmandu Valley, calculated the black carbon emission fluxes, and presented some interesting results. Since our team also conducted some ceilometer observations, I feel very interested in your study, and there are some tiny questions that I want to discuss with the authors:

a. As for the estimation of mixing layer with a ceilometer, some extreme weather conditions should not be ignored, such as the windy and sand storm days. Under these circumstances, the ceilometer retrivals may exist big errors [Tang et al., 2016]. Could the authors made some evaluations of the ceilometer measurements about this?

We checked our wind and precipitation data but could not find anything that stands out as unusual weather events. By excluding data from the ceilometer measurements if low clouds, precipitation or fog was observed (within the mixing layer) and by also excluding whole days with a precipitation sum of $>$ 0.5 mm/day the impact of precipitation on the mixing layer height was considered and discussed in the study (especially for the monsoon season). Wind speed was found to be less than 6 m s^{-1} most of the time and no data on dust were available. We therefore could not assess what difference it would make if severe weather days would be filtered out.

b. Since the black carbon is nonreactive, the black carbon column concentration in the mixing layer could represent the emission and transport contributions [Zhu et al., 2016]. If we ignore the transport effect, the diurnal variation in black carbon column concentration is consistent with the emission variations, thus can reveal the emission diurnal characteristics.

We agree with this point and added some more discussion to the manuscript on the assumption that horizontal and vertical transport can be neglected at night in order to determine top-down emissions (p. 16, l. 20-30). However, since transport can only be neglected during nighttime, when the boundary layer is very stable (little vertical mixing) and the horizontal wind speed is low (little horizontal mixing), but not during the daytime (when turbulent vertical entrainment and transport in and out of the valley passes occurs), the information is unfortunately insufficient to determine the diurnal variation in emissions. As shown in Berkes et al. (2016) the entrainment fluxes at the capping inversion can become substantial particularly if clouds are involved.

Reference:

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Tang, G., et al. (2016), Mixing layer height and its implications for air pollution over Beijing, China, Atmospheric Chemistry and Physics, 16(4), 2459-2475, doi:10.5194/acp-16-2459-2016.

Zhu, X., G. Tang, B. Hu, L. Wang, J. Xin, J. Zhang, Z. Liu, C. Münkel, and Y. Wang (2016), Regional pollution and its formation mechanism over North China Plain: A case study with ceilometer observations and model simulations, Journal of Geophysical Research: Atmospheres, 2016JD025730, doi:10.1002/2016JD025730.