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Atmospheric Measurement Techniques Discussions

Interactive comment on "Analysis of spatial and temporal patterns of on-road NO_2 concentrations in Hong Kong" *by* Ying Zhu et al.

Anonymous Referee #2

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In this manuscript, Zhu et al. report on measurements of boundary layer NO2 in Hong Kong using different techniques. In two campaigns, car-based measurements with a CE-DOAS instrument were performed for several days at different times of the day, covering both rush-hour and normal conditions. These measurements are complemented by data from the in-situ measurement network, a long path DOAS instrument operating during and in between campaigns, and OMI satellite data. Data were analysed for their temporal trend, the diurnal profile, the week-end effect, their spatial distribution and the NO2 / NOx ratio.

The paper reports interesting measurement results from a highly polluted city enforcing strict emission controls and highlights some nice local effects such as changes in pollution levels around metro stations. The manuscript is overall well written but fo-

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cuses on reporting measurement results and a qualitative interpretation. It therefore does not fit well into the scope of AMT ("The main subject areas comprise the development, intercomparison, and validation of measurement instruments and techniques of data processing and information retrieval for gases, aerosols, and clouds.") but should rather have been submitted to ACP in my opinion. It would also benefit from a more quantitative discussion including error bars.

Nevertheless, I recommend it for publication after the following points have been fully addressed.

1. Was any correction applied to the in-situ chemiluminescence NOx analysers for cross-sensitivities?

2. I'm not yet convinced by the discussion of the NO2 to NOx ratios. While I can understand that the ratio is driven by the fraction of NOx emitted as NO close to the source, and therefore a change in technology used in the car fleet can have an impact on NO2 to NOx ratios at roadside stations, I'm surprised to see that this is also the case at ambient stations. Is this because of the increase in ozone concentrations, and if so, does this match quantitatively with model results / stationary state estimates?

   The values given in Fig. 9 are also not in good agreement with the number of 0.7 given for the NO2/NOx ratio in section 2.3. Clearly, this ratio is not constant over the measurement period and varies strongly within the area. How will that impact on the results?

3. I do not see what I can learn from Fig. 7 which is not already shown in Fig. 6.

4. In section 3.2.1, a filtering of the data for congestion situations is described, and I can see the reason why the authors apply this filter. On the other hand, isn't there a risk of introducing a low bias, as the most busy (and thus most polluted)

parts of the roads which have the highest risk of congestion will be removed from the data?

5. If I understood the diurnal normalisation discussed in section 3.2.2 right, not the actual diurnal profile from the LP DOAS is used but rather the mean profile for that day of week, scaled to the actual LP DOAS measurements. As can be seen in Figure 5, the match is not very good between these two curves, and I'm wondering what that implies for the validity of the correction and the remaining bias from non-coincidence of measurements.

6. In Figure 8 and the discussion in the text, the measurements taken in March 2017 and December 2010 are used to characterise the long-term evolution of NO2 in Hong Kong. While the differences are large enough to be convincing, I still think that some discussion is needed here to exclude and quantify other effects such as weather, season or sampling.

7. In section 3.4, the differences between the magnitude of the NO2 concentrations measured by EPD ambient stations and on-road CE-DOAS is discussed in the context of Figure 11. However, already in Fig. 6 it can be seen that CE-DOAS values are on average clearly (much) higher than the station data, although measured within 100 m. I assume that this is mainly due to the different measurement altitudes and the steep vertical profile of NO2 in this urban environment (see also the earlier paper on the LP-DOAS measurements by Chan et al., 2012). In my opinion, this asks for some discussion with respect to the representativity of the CE-DOAS measurements and the station data, for example for human health and compliance with environmental legislation.

8. In order to put Figure 12 to use in other studies, it is important to know if this is a snapshot or an average over many observations. If the latter is true, the number of individual measurements that go into these averages and also the RMS are

relevant so that the reader can get an idea of how representative the mean value is.

9. I'm missing a statement on the availability of data – as the high resolution NO2 map is one of the main outcomes of the study, readers should know how to access it.

10. The text is overall well written and clear, but there are several shorter sections which need careful proof reading for grammar.

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