

The manuscript "Spectroscopic real-time monitoring of NO₂ for city scale modelling" by Hundt et al. describes the set-up of a new NO₂ instrument and its use in the city of Zürich onboard a tram. The observational data gathered during 6 month of operation are compared to the results of nearby Air Quality Monitoring stations showing good overall performance of the instrument. Additionally, the data set is used in a statistical analysis together with spatial information of traffic intensity. Although the data set itself and the general approach seems to be promising I cannot recommend the current paper for publication due to logical deficiencies in the model analysis.

It is my opinion that the paper would be better-off if only the instrument, the general features of the observational data set (with DTV050 etc., see below), and the comparison to the AQM station data would have been presented. This in itself would be valuable information. The paper contains on the one hand a lot of detailed information, on the other hand significant information for the basic understanding of relationships is missing. Due to this imbalance the text of the paper is not simple to read and it is hard to stay tuned to gain conclusions from it.

The major gap in the statistical model analysis is the misunderstanding between the connection between NO₂ concentration and traffic intensity. Car traffic primarily emits NO with a small addition of NO₂ depending on the type of motor (petrol or diesel). The NO₂ contribution to the NO_x emission of a car is on the order of 10-25%. At low traffic intensity, the NO from the car exhaust is oxidized to NO₂ from ambient O₃. This lays the ground for an almost linear relation between NO₂ and traffic intensity at low NO_x concentrations. In a main street, the traffic intensity is so large that all of the ambient O₃ is titrated away by the NO emissions of the cars. In that region, the NO₂ concentration is almost saturated at the level of the undisturbed ambient O₃ concentration. This titration effect can clearly be seen in figure 6. As a consequence, the link between NO₂ and traffic intensity is strongly non-linear at large NO_x concentrations. In these cases, O₃ goes to zero, NO₂ goes to the concentration of O₃ expected without traffic emissions, and NO can reach large concentrations, sometimes 10 times larger than NO₂. As a consequence, a statistical analysis based on a linear relation between traffic intensity and NO₂ will fail and will give apparent parameters very much depending on the range of NO₂ concentrations included in the analysis. This effect is demonstrated in figure 10 of the current paper which shows the results of the model approach. In panel a, low and high traffic stations from the AQM network are used in combination with traffic intensity data. The streets are clearly visible in this map, but also nearby regions of the city. In panel b, the result of the tram observations following the relative large traffic in main-streets is used. As a consequence of the above mentioned NO₂ saturation effect, the contrast between streets and residential areas is very large and the calculated NO₂ in the streets totally dominates this map. In panel c, when the AQM (containing small and large NO₂ regions) and the tram data-sets are combined, something between panel a and panel b is calculated. Which one is better? There is no measure to decide. If one would want to follow such an approach, the NO_x concentration would be needed. And this is not possible to do with the current NO₂-instrument used in the tram.

The mentioned imbalance between detailed information presented and information which is missing can be shown when looking at the instrument performance. Figure 1 to 7 show a lot of detailed information of the instrument and its comparison to the data of the AQM station. I am convinced that the instrument gives reliable data for NO₂. The basic information used in the model analysis like

DTV050, DTM, SVF is not presented at all. Figure 8 (and 6) would have been an appropriate place to show the average traffic intensity and sky view factor alongside the track of the tram. Especially since figure 8 shows a very important result: the average NO₂ concentration along the track of the tram is almost constant with a small variability of +/-10%. This is somehow unexpected. One would expect larger variability due to traffic density patterns. And where is the imprint of the sky view factor meaning where is the imprint of building density? This is the kind of missing information from which the reader really would benefit.

Minor comments:

Figure 3: The colors for the data series Zero-Air and Dark-Noise seem to be interchanged in the legend inside the figure. If I read the text above it correctly, the Dark-noise should be linear while the Zero-air levels off.

Figure 2 supplement: I do not see any difference to figure 6 of the main paper. Both figures contain dotted lines for the O₃ concentrations at two AQM stations.

In page 19, several figure numbers are missing in the text.

In page 19, the difference between model scenarios V and W is not clear. What is scenario W_B?