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Atmospheric Chemistry and Physics Discussions



# *Interactive comment on* "Spatial and temporal representativeness of point measurements for nitrogen dioxide pollution levels in cities" *by* Ying Zhu et al.

**Ying Zhu et al.**

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We sincerely thank the reviewer for providing her/his very helpful suggestions, which helped us to improve our paper a lot. Below please find our responses:

1) The mobile data set is interesting. However other mobile data sets examining spatial variability in cities exist and it is not clear if any of the observations here are surprising because they are not placed in the context of the prior related literature. I recommend adding a deeper and more comprehensive discussion of the theoretical and observational understanding we have of emissions from roadways and the length scales of decay of those emissions in cities. For example, papers by Choi et al. including



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Discussion paper

https://doi.org/10.1016/j.atmosenv.2012.07.084 and Atmos. Chem. Phys., 14, 6925–6940, 2014 and by Apte et al. Environ. Sci. Technol. 2017, 51, 12, 6999–7008 show a characteristic decay length scale of 500-1000m (1/e) that would be approximately consistent with the measurements reported herein. The Choi et al papers also provide a theoretical basis for discussion of the decay. It is also important to note that the time scale for conversion of NO to NO2 is not instantaneous. Thus on-road measurements of NO2 may have a systematic bias. The measurements in Apte, et al. show the consequences of NO to NO2 conversion as different timescales/lengthscales for decay from urban roadway sources.

Thanks very much for reviewer's suggestions. All publications above have been added as references in Section 3.2 line 15-20. These are valuable information to support our research.

2) I find the discussion of the remote sensing measurements confusing. The logic connecting them to the mobile measurements is unclear. It is well-known that OMI measurements with a 2 degree a priori will have a large bias compared to urban measurements. The large context of the long path measurements connects both emissions and loss, while the mobile measurements are so near to the source that they only reflect emissions. I recommend these sections be removed or the connection to the mobile observations made substantially clearer. Also, to help with the readability of the paper, I recommend moving all descriptions of the instruments to the supplement.

According to the reviewer's suggestion, we decided to remove the whole section of OMI comparison from the paper and move it to the supplement.

The description of the instruments is kept in the paper, because we think it is important to describe the different measurement techniques for providing a better understanding for the combination of point and path averaging measurements.

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