

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

### **Anonymous Referee #3**

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This paper has two themes. First it analyses spatial variation in urban NO<sub>2</sub> based on mobile and stationary point measurements. Then it describes remote sensing observations. I recommend a major revision prior to publication.

Taking each in turn.

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

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of decay of those emissions in cities. For example, papers by Choi et al. including <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 NO<sub>2</sub> is not instantaneous. Thus on-road measurements of NO<sub>2</sub> may have a systematic bias. The measurements in Apte, et al. show the consequences of NO to NO<sub>2</sub> conversion as different timescales/lengthscales for decay from urban roadway sources.

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.

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Interactive comment on *Atmos. Chem. Phys. Discuss.*, <https://doi.org/10.5194/acp-2019-1198>, 2020.

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