Atmos. Chem. Phys. Discuss.,
https://doi.org/10.5194/acp-2020-1169-SC1, 2021

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Mobile monitoring of urban air quality at high spatial resolution by low-cost sensors: Impacts of COVID-19 pandemic lockdown" *by* Shibao Wang et al.

D. Westerdahl

danewest03@gmail.com

Received and published: 20 January 2021

General comments This paper reports on the findings of a year of monitoring conducted using a sensor pack on two taxis while they drove the streets of Nanjing, China. Based on the data reported the investigators developed concentration information plotted on the many roadways where data were collected. The opportunity to capture the impacts of major activity patterns associated with Covid-related restrictions is an interesting application of the results.

I concur with RC1 and will only add a few most concerning points beyond those in that review. The basic problem presented by this paper is that crucial methodolog-

ical/protocol descriptions regarding data collection activities are totally absent. I was unable to determine the nature of the sensor pack from the paper and a look at the Chinese company web site was not useful or clear-beyond the weight and size. There is no clear description of data adjustment which is mentioned. One this is very clear–the outcome of the monitoring data both before and after adjustment is startlingly good, beyond what most other users of sensors have reported. This enforces need to describe the process in detail. Overall, the uncertainty in monitoring and calibration practices makes it quite possible that the overall data set and interpretations might be impacted.

Specific comments Since the sensors are not described and data handling is also only somewhat described it appears possible that the data came from some sort of electrochemical cells. If this is true, it is quite possible that important Ozone/NO2 interactions occurred in, for example in the ozone data. This could have important implications on data observations and would show variable degrees of impacts depending on the mix of pollutants. The findings of fixed site calibration would differ from those made on road since the sensor experience a differing relative mix of NO2 and ozone.

Sensors seem perhaps only to be calibrated as study started and then once a month by comparison with an outdoor monitoring site (whether the sensors were tested in outdoor air or in some facility is unclear). Text in the first sentence of section 2.2 appears to state that sensor packs were placed at the campus supersite monthly for "at least seven days." No data are presented regarding the nature of the data at these monthly calibrations. Maintenance or data review are not described, however line 85 states "if the data deviated substantially from the nearest national network stations (shown as red stars in Figure 1), the instrument is also taken offline and re-calibrated." This statement indicates that there was some attention to reviewing the quality of data. This topic should be expanded and data on these calibration events should be included. The use of fixed site data should also be expanded. What was meant by the use of the "nearest" station in data review?

There is mention of a data calibration mentionedâĂŤ"A supervised machine learning

methodology based on the Gradient Boost Decision Tree (GBDT) is used for data calibration" with a reference. But this should be fully described.

Line 187âĂŤconsideration of observations vs. "life times" of each pollutant is incomplete and it is not clear how it applies to a near roadway urban environments where there is an impact of complex emissions/conversion and new emissions are present. This especially the case for the pollutant "NOx" mentioned on line 190âĂŤa pollutant that is not reported on in this studyâĂŤthe pollutant reported is NO2. The authors should provide a complete and careful consideration of these issues and they should be careful in the use of "NOx" vs the pollutant they measured. It seems to be used interchangeably in several places.

Figure 2âĂŤconfidence In NO2 is not high seeing the good agreement with the fixed site dropped to R2=0.67. The authors suggest that this may be due to humidity impacts. NO2 and NO are probably the most important gaseous pollutant today in many urban near-roadway locations, but the authors have failed to follow up on the observations of possible poor model performance by repeating the calibration procedures. Further, for this pollutant, in this situation, it might be beneficial to see how the two sensor packs performed at each calibration. Current text only says they were in 'good agreement'. Authors should discuss the contributors to the mis match between agreement at cal vs validation for NO2. Is it clear that this fitting is successful as the sensors aged over the year?

What was the data capture completeness in this study? Were there any sensor replacements? Pollution observation examples would be helpfulâĂŤprovide specific time series examples.

Para beginning on line 205âĂŤwhere attribution of sources to observations is made. The actual basis for these is only general and not closely linked to the study. It appears to be conjecture.

Line 245âĂŤstates that VOC control is necessary to control ozone at this site. This

may be true but is not studied or established by the investigators. It should be rewritten to reflect the basis for this statement.

The statement that lack of sunlight in the tunnel is the reason for low ozone may or may not be correct. A more complete consideration of emissions, ambient air ozone and reactions is called for here.

Conclusions Line 348âĂŤit is unclear that the following is established in this studyâĂŤ"We find that higher spatial resolutions are useful to identify hotspots that are mainly affected by five types of air pollution source emissions, namely, traffic, industrial, dust, and cooking fumes. It also provides hints for air quality management and emission source control." What assessments were made in this study to consider industrial dust, industrial fumes. . .."?

Interactive comment on Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2020-1169, 2020.