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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Long-path measurements of pollutants and micrometeorology over Highway 401 in Toronto" *by* Yuan You et al.

Anonymous Referee #1

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This paper provides a significant contribution to the study of air quality within urban environments. The combination of open-path FTIR measurements with in-situ measurements and scintillometer measurements is interesting and novel. The paper is well written, clear and scientifically sound. I enjoyed reading it! In my opinion it should be accepted for publication after some minor comments are addressed as outlined below:

1. Line 113-line 116: this needs slight elaboration – the stray light problem should be very minor and only from internal reflections (since the light is modulated before being sent across the open-path. This means ambient scattered radiation will not be modulated and thus not detected by the instrument).

2. The MALT program (which you say that your analysis is based on) can calculate the

reference spectra directly from the HITRAN database using the ambient temperature measured at the same time as the spectra were recorded. Does the Bruker software really not allow this? This may only introduce uncertainties of 10% but it is an unnecessary added uncertainty, since you have accurate temperature measurements available.

3. There are other uncertainties inherent to open-path FTIR measurements (like those that come from the HITRAN database and fitting errors). These are not mentioned in the text but should at least be referred to as existing even if a full uncertainty analyses is not given.

4. Section 2.2 – at what time resolution are these calculations made?

5. Line 212 – Isn't an estimate using WindTrax and CO mole fractions a "top-down" estimate? You then compare it to one based on traffic volumes – isn't this one "bottom-up"?

6. Line 247: do they generally agree? The level of agreement is not quantified. From looking at the time-series the variations certainly seem to be well captured, but it would be good to give a correlation coefficient for this.

7. In fact some basic statistics for the model's skill level would improve the manuscript. The authors have used the "open-air" package and this has some great tools for quick evaluation of a model's performance against observations.

8. Page 10: reading this discussion about model to measurement spatial differences begs the question as to why a comparison of model to open-path FTIR is not shown. This will suffer similar problems but should be much less than the in-situ observations.

9. Line 297. Are the traffic volumes similar on the weekends? This is surprising and you have not actually stated that clearly before. Can you clarify?

10. Line 323: is it worth showing the correlation plot at least in the supplementary data?

11. Line 332: Are you also assuming that traffic is the only source of CO emissions above background?

12. Line 438: Why only 3 days? I assume that these are the best steady wind conditions? Whatever the reason for the choice of these days, it should be stated briefly in the text.

13. Line 529: “reasonable” correlations observed. . .You need to provide some actual statistics to back this up somewhere in the manuscript.

Other minor points

1. Consider changing “mixing ratio” to “mole fraction” throughout, as I believe this is now the preferred terminology.

2. Line110: the “fraction” of the path is not actually a fraction but a distance, consider rephrasing.

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