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comment**

Interactive comment on "Estimation of the Paris NO$_x$ Emissions from mobile MAX-DOAS observations and CHIMERE model simulations using the closed integral method" *by* Reza Shaiganfar et al.

Anonymous Referee #2

Received and published: 18 January 2017

In this paper, Shaiganfar et al. Report on a series of car-based DOAS measurements of NO2 around Paris which they use to estimate NOx emissions of that city. The manuscript describes the measurements and approach to emission estimation and discusses the different contributions to the overall uncertainties of the derived NOx fluxes. It then applies the same flux estimation method to simulations of the CHIMERE model using the sampling of the measurements and compares the results to the integrated emission flux used in the model. Finally, emissions are derived from the measurements on 18 days and compared to the emissions from the TNO / AirParif inventory.

The paper is clearly structured, well written, reports on an interesting type of measurements and provides relevant emission estimates for Paris. The detailed error discussion provided is important for the application of similar measurements in other regions and will be useful for future measurements. My only major concern with this paper is that it mainly discusses the method used and its uncertainties and spends little time on the results and their implications. A journal such as AMT would therefore have been a better place for this manuscript. I therefore recommend publication of this paper only after strengthening the results and discussions part.

Major point

The paper reports measurements of NOx emission fluxes for Paris on 18 days and compares them to the TNO / AirParif emissions. The results as shown in Fig. 17 indicate good agreement between the two quantities on many days, but also large differences on other days. In particular in January / February, the car-DOAS based estimates show large day-to-day variations and much larger values than the emission inventory. This raises two questions:

1. Is it plausible that NOx emissions in Paris change by a factor of two between January 19 and February 11? The emission inventory suggests the same value for both days, and considering the fact that traffic is the dominant NOx source in Paris, what could be the origin of all the additional NOx? Or is this a problem of the measurements / method? The latter is not suggested by the results of the application of CIM to the model data, so this is a bit of a mystery.

2. Is it realistic that the TNO / AirParif NOx emission inventory is off by a factor of three as it appears from the last 4 days of measurements shown?

I think these two points deserve more discussion and analysis.

Minor points

- Section 3, line 9: The Figure in the Appendix referenced to does not exist

- Section 4.1, line 19: Wrong Figure number in Appendix

- Section 4.1, line 25: Wrong Figure number in Appendix

- Section 4.3, line 26: Is it expected that the emission flux depends on the largest values? And isn't that maybe a problem indicating that the car DOAS measurements are affected by close-by local sources more than they should?

- Section 4.3: Please mention and briefly discuss somewhere that you apply partitioning (and life time correction) to columns although strictly speaking this is something to be done on height levels.

- Section 4.6.1., line 19: simply => simple

- Section 4.6.3., line 19: Last sentence of paragraph is unclear, please reformulate

- Section 5: The definition of times for CIM application to the CHIMERE data is unclear to me – why did you not just use the times of the measurements? Using the time of the maximum measurement appears arbitrary to me but I may be missing the important point here. Please explain.

- Section 5 last paragraph: I find the discussion of weekend effects confusing – in Fig. 17. We can clearly see the weekend effect in the emissions but not in the CHIMERE.CIM values. Therefore, this is not a result of changes in domestic heating but just random uncertainties introduced by the method and sampling. Please re-consider.

- Section 5, last lines: What is the logic of only showing data with small differences between TNO and CIM values here? I could understand if only data without obvious problems were used, but the other values should appear in this figure in my opinion. Please re-consider.

C3

- Section 6, last paragraph: It is noted twice that a similar ratio is found between CHIMERE VCs and observed VCs on the one hand and the emissions on the other hand. I think this is to be expected considering the way the emissions are determined from the columns which assumes a nearly linear relationship (excluding life time and partitioning corrections).

- Conclusions and perspectives: This section is mainly a summary and in parts identical to the abstract. As mentioned in the major comment, I think more focus should be on the results.

- Conclusions and perspectives: I do not agree with the statement, that the large number of measurements was used to test the applicability of CIM under various atmospheric conditions. Actually, all the tests were performed on the model data which could have been done without measurements by just assuming certain measurement routes and patterns. The data themselves are only used for emission estimates which is of course very interesting.

- Figure 2: I'm surprised that I cannot see the effect of daylight saving time in the diurnal emission pattern

- Figure 2: Are the emission values in the map given per 3 x 3 km2 pixel? In the caption, it is said that they are averaged over this area but I assume they are summed up?