

Interactive comment on “Mobile mini-DOAS measurement of the emission of NO₂ and HCHO from Mexico City” by M. Johansson et al.

Anonymous Referee #1

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General comments

In this manuscript, the result of one measurement of the differential column density of two gases (NO₂ and HCHO) along a route in Mexico City is presented. From this one measurement, the authors attempt to estimate the total outflow of the entire metropolitan area during the measurement period. The paper is concise, straightforward and the technical aspects of the employed experimental techniques are well described and argued. However, the true objective of this study is not clearly stated. It is not evident how the results could contribute to the general knowledge or specifically to the MILAGRO project. In order to explore which the main contribution could be, the different possibilities are addressed individually:

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1) Methodology. If the purpose of the authors is to show how the mobile DOAS instrument can be used to estimate the total outflow of pollutants from a mega city under very unique conditions, then the text should be structured in this direction. Although the methodology is not new and has been deployed to estimate the emissions from more localized sources, the example shown in this work could be used to demonstrate that it is also feasible for such a large and dispersed source as Mexico City.

2) Comparison with model. The measurement of the differential column along a route can be used to compare with the output of air quality models such as CAMx along this same route. This can be done to evaluate the performance of the model and if necessarily adjust it to the observation. In this case the authors should focus in the interpretation of Figures 3 & 4, as was shortly attempted at the end of the Results section (lines 23-29, p.871), instead of centering their attention in comparing the flux calculations. It is evident that the spatial distribution and magnitudes of the emissions considered by the CAMx model presents several problems. The flux calculation incorporates an additional uncertainty, and has no significant relevance (see point 3). Once "validated" with the observation, the constrained model could be used to assess typical outflow values along the different pathways.

3) Reporting a typical outflow value for NO₂ and HCHO. The way the flux results are presented can be misleading as the obtained flux corresponds to one instantaneous measurement and should not be thought as a typical outflow value for Mexico City. For that, and if that would be the purpose of this study, a proper assessment of the flow patterns, frequencies and magnitudes from the WRF mesoscale meteorological model would be required.

From the arguments presented in points 1-3, it seems that either direction the authors chose to take, the manuscript would need to be restructured accordingly. Probably a combination of 1 and 2 is the most feasible since the shown measurement has potential to be presented as an example, and from which the CAMx model could be evaluated and improved. The conclusions are poor and scarce and should be improved following

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the above recommendations.

Specific comments

- The term "emission" in the title should be exchanged with "outflow" as justified in point 2 of the general comments.

- The authors make different assumptions for the two gases when converting the simulated columns by CAMx to differential columns (lines 1-3 and 16-21, p.871). For NO₂ they "subtract the lowest modeled column value from all other modeled values", whereas for HCHO they decide not to subtract the lowest modeled value, but rather a "column upwind Mexico City" value. This procedure, attempting to match the flux obtained from the measurement as good as possible, seems ambiguous and is not properly justified.

- Although this study also reports results on NO₂, the Introduction section only contains arguments as to why it is important to measure HCHO, while NO₂ is not mentioned.

- The error range reported for the calculated flux (line 12, p.871 and Tables) does not contain the source of error in the wind velocity, which is probably significant and varying considerably during the measurement time. Please consider.

- In the Experimental section (line 10, p 868) it is written that a Fraunhofer reference spectrum has been chosen. Please specify if it is a measured or simulated spectrum and what criteria were used in the choice.

Technical corrections

line 3-4, p.868 move the word "led" after light is

line 7, p.868 replace "ratioed" with a more appropriate term, like "fitted" or "scaled"

line 22, p. 869 should probably read NOAA

line 1, p. 871 insert the word "done" after been

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