

***Interactive comment on “Weekly patterns of
México City’s surface concentrations of CO,NO_x,
PM₁₀ and O₃ during 1986–2007” by S. Stephens
et al.***

S. Stephens et al.

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Reply to comments by Referee 1
by S. Madronich et al.

We thank the reviewer for the useful comments, particularly with respect to the uncertainties inherent our analysis.

[Referee 1] General comments:

This paper presents an analysis of day-of-week patterns of major pollutants in Mexico City, with the goal of assessing the sensitivity of ozone formation.

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The paper is very well written, and the results are clearly presented. One novel contribution of the work is the analysis of the fraction of radical loss due to NOx chemistry, L_N/Q , in the context of evaluating the weekend effect. A few minor revisions, suggested below, will help strengthen the paper.

Specific Comments:

1. (p. 8360, line 22) The use of CO as a proxy for VOCs, while necessary, may be a significant source of uncertainty in the work. CO and VOC emissions from mobile sources tend to be correlated over time, but vehicles' contribution to emissions of each differs. In Mexico City, mobile sources are thought to be responsible for 99% of CO emissions but less than half of VOC emissions. Therefore, a reduction in CO and VOC emissions from mobile sources only would result in an increase in the VOC/CO ratio if other sources (point, area, biogenic) did not change. A long-term trend in the VOC/CO ratio may exist, and further documentation of VOC/CO ratios in Mexico City should be presented, if available.

[Reply] We agree and already had discussed at some length the uncertainties in using CO rather than VOCs, and we have now also added the sentence:

Mexico City's mobile sources account for 98% of CO emissions, but only 40% of VOC emissions with the balance mostly from area sources such as solvent use and painting (Molina et al., 2002a). Whether the emissions from these area sources decrease on weekends by a similar fraction as mobile sources is uncertain.

An evaluation of historical VOC/CO trends is outside the scope of this work.

2. (p. 8362, lines 22-23) The authors note a secondary maximum from the evening rush hours in CO, NOx, and PM₁₀. The magnitude of the secondary

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maximum relative to the morning rush hour maximum is much higher for PM₁₀ than for CO or NO_x. Why might this be?

This is an interesting question, so although evening concentrations are not the focus of this paper, we have added the following text:

The relatively large evening PM₁₀ peak occurs 1-2 hours earlier than the CO and NO_x secondary peaks, and may be due to temporal overlap between evening rush hour emissions and remaining secondary aerosols produced during the daytime, wind-related dust in the late afternoon (de Foy et al., 2008) or biomass burning plumes advected into the basin from surrounding areas late in the day (Moffet et al., 2007).

3. (p. 8364, line 2) A great deal of land development on the outskirts of Mexico City has probably taken place between 1986 and 2007. Mention of such change and its impacts on emissions and chemistry is warranted in the discussion of long-term trends in day-of-week concentration patterns.

We agree and have added the following sentence:

We note also that urban and regional development has increased greatly in the past two decades (Lezama et al., 2002), so that the monitoring stations may have been sampling a more urban chemical regime in recent years.

4. (p. 8364, line 2) Following up on the previous comment, the authors should address in Section 2 the completeness of the data record and whether the addition or removal of monitoring sites could bias the results.

We have added a new table giving the number of points used, and the following text:

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The availability of the data is summarized in Table 1, which gives the number of valid days summed over the stations of each sector, for each year. The data record is clearly more complete in the recent years, particularly for PM₁₀ and NO_x.

Detailed analysis of addition or removal of any number of stations is outside the scope of this paper. Note however Figs 3 and 4 give result by sector, and show that in recent years, different sectors are more similar to one another. We also added some text regarding the behavior of the SW sector in the early years (see response to review by Sillman).

5. (p. 8364, line 23) Figures 6-7 show seasonal behavior over 2001-2007. Are the results similar over the other blocks of years?

Yes. We have added the following text:

For 1986-1992 and 1993-2000 (not shown), the general seasonal patterns were similar with concentrations of CO and NO_x peaking in January and February, O₃ peaking in May, and no clear seasonal trend of the relative weekend changes.

6. (p. 8363, line 24) The words, "...either on...", " appear to be transposed.

Deleted "on".

7. (p. 8366, line 19) "...consistently... " should be "...consistent..."

Corrected.

8. (pp. 8367-8368) The formatting, or lack thereof, of the equations makes them harder to read than necessary.

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Equations have been reformatted.

References:

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Lezama, J. L., Favela, R., Galindo, L. M., Ibarra, M. E., Sanches, S., Molina, L. T., Molina, M. J., Connors, S. R., and Fernandez Bremauntz, A., Chapter 3 Forces driving pollutant emissions in the MCMA, in *Air Quality in the México Megacity: An Integrated Assessment*, Molina, L. T. and Molina, M. J. (eds.), Kluwer, Boston, pp. 384, 2002.

Molina, M. J., Molina, L. T., West, J., Sosa, G., Sheinbaum Pardo, C., San Martini, F., Zavala, M. A., and McRae, G., Chapter 5 Air pollution science in the MCMA: Understanding source-receptor relationships through emissions inventories, measurements, and modeling, in *Air Quality in the México Megacity: An Integrated Assessment*, Molina, L. T. and Molina, M. J. (eds.), Kluwer, Boston, pp. 384, 2002a.

Moffet, R. C., de Foy, B., Molina, L. T., Molina, M. J., and Prather, K., Measurement of ambient aerosols in northern Mexico City by single particle mass spectrometry, *Atmos. Chem. Phys. Discuss.*, 7, 6413-6457, 2007.

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