

***Interactive comment on “Hit from both sides: tracking industrial and volcanic plumes in Mexico City with surface measurements and OMI SO<sub>2</sub> retrievals during the MILAGRO field campaign” by B. de Foy et al.***

**Anonymous Referee #2**

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This paper has presented analyses of surface SO<sub>2</sub> concentration measurements and other relevant data in the MCMA during the MILAGRO field campaign to identify sources and transport processes that affect urban-scale atmospheric composition. The authors have illustrated both anthropogenic and volcanic SO<sub>2</sub> emissions can reach the MCMA within a short period of time, even on the same day, despite that the two different point-like sources are located on the opposite sides of the MCMA and at a different altitudes. The pathway of pollutant transport is an important aspect in air quality study. The main result of this paper is quite interesting and relevant to ACP. Publication is

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recommended after improvements on the manuscript by addressing comments below.

General comments:

The main issue of this paper is that the qualitative nature of the analyses and conclusions is incommensurate with the use of quantitative measurements and numerical simulations done with a chemistry-transport model (CTM). Specifically, the authors have pooled together a large amount useful data, including the time series of meteorological parameters and SO<sub>2</sub> concentration measurements at various sites, radar vertical wind profiles, satellite SO<sub>2</sub> column maps, and SO<sub>2</sub> emissions from the known (Tula industrial complex and Popocatepetl volcano) sources. For the analyses, they have employed a CTM named CAMx, to run in tracer mode for simulation of SO<sub>2</sub> dispersion and transport in fine-spatial resolution. Yet detailed quantitative comparisons between simulations and measurements are not emphasized in the paper. Based on Figs. 2-4 of this paper, one not only sees similar features but also significant discrepancies in the time series and spatial maps from simulations and observations. The authors should consider direct quantitative comparisons between SO<sub>2</sub> surface concentrations and columns between observations and model simulations to identify factors (such as emissions, meteorological fields, etc) that may have contributed to the discrepancies, and attempt to improve agreements by adjusting these factors. Doing so would be helpful to the readers of this paper to better understand and appreciate this work.

Specific comments:

1. On page 16566, line 19, the distance of Tula from the MCMA is clearly spelled out. The distance of Popo should be included as well.
2. It is not clear why Fig. 2a and 2b are shown together. The measurement and simulation curves cannot be compared directly, since Fig. 2a has two curves labeled 'south' and 'north', while Fig. 2b has three curves labeled 'Urban', 'Tula', and 'Popo'. Clarifications are needed. Please consider showing the observation and simulation (including

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all sources) for the same locations in the same plot, and the model contributions from difference sources in another.

3. Though Figs. 3 and 4 show similarity in SO<sub>2</sub> spatial distributions between OMI observations and model simulations, they also reveal striking differences, particularly the relative SO<sub>2</sub> columns associated with Tula and Popo. The authors should examine these differences to see if they can be explained by the height (from model) of the SO<sub>2</sub> plume, because satellite observations are more sensitive to high plume, while the model should not have such sensitivity difference.

4. In Figs. 6, 9, and 13, the SO<sub>2</sub> concentration and the wind vectors are quite different between the simulations and the surface measurements. This is evident when comparing the patterns in the upper and lower panels in each figure. These discrepancies raise the questions about the usefulness of these figures and the interpretations based on them. Clearly the meteorological data fields in the model may not match the surface measurements at any moment in time, therefore showing averages over time may result in better agreements. Also displaying the maps of surface concentrations from interpolation among sparse sites is probably not the right way to compare the spatial patterns between measurements and simulations. Minor point: same contour levels should be drawn in both upper and lower panels of these figures.

5. The description of the legends in Figs. 12, 14, and 16 is incomplete. Labels 'MEX' and 'T1R' are not mentioned in the paper, and they cannot be found in Fig. 1.

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Interactive comment on Atmos. Chem. Phys. Discuss., 9, 16563, 2009.