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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Tula industrial complex (Mexico) emissions of SO_2 and NO_2 during the MCMA 2006 field campaign using a Mini-DOAS system" *by* C. Rivera et al.

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The authors would like to thank R. Ramos, an anonymous referee, A. García and M. Melamed for their reviews and short comments which have greatly improved the quality of this work. Please find below specific responses and modifications for the manuscript.

R. Ramos (Referee)

Specific Comments

a) It was made clear in the text that the emission information comes from the Federal Environmental Authority.

b) Additional explanation on how the traverses were made was added. A second panel, showing an example about how and where the traverses were made, was added to Figure 3.

c) The acronym of IMP was changed for Mexican Petroleum Institute.

d) The word refinery was replaced by MHR.

e) SO2 and NO2 concentration data from monitoring sites in the MCMA were consulted online from the RAMA website. A new paragraph was added to the conclusions addressing whether emissions from the Tula industrial complex during the period of this study had any influence on the MCMA air quality.

f) The reason for the large standard deviations in our observations was explained in more detail in the conclusions (rather than in Table 1), and it was attributed mainly to the shifting of plumes over short periods of time, which could lead to either overestimation or underestimation of the emissions and therefore to large standard deviation of emissions calculated during consecutive measurements.

g) In order to address the differences in wind speed and wind direction between soundings, pilot balloons and the WRF model, a comparison between them was performed. In general, we found good correlation between measurements and the WRF simulation wind speed (see Figure 1).

With regard to the wind direction comparison, the WRF model predicted reasonably well the measured results (see Figure 2). Except for the 18 hr, the wind direction frequency is in good agreement between WRF model and measurements.

Once we corroborated statistically the good agreement between measurements and model results, we decided to use pilot balloons wind data set for flux calculations because those were launched more frequently than radiosondes during 24-26 March.

With this regard, Figure 2 in the paper was substituted for a new one that includes all wind direction and wind speed vertical profiles for pilot balloons and soundings.

Anonymous Referee # 2

General comments:

The fact that our measurements are in good agreement with the reported values in recent inventories was stressed in the abstract and conclusions. In the latter it was also stressed the adequacy of using emission factors together with reliable energy consumption and power generation data in order to calculate emissions.

Specific comments:

a) The use of the term mini-DOAS is well established among the scientific community, as well as in the literature, when referring to the use of this instrument. For this reason the usage of mini DOAS was kept and instead other recommendations given by the Referee were followed, in this case the instrument was referred to as Mobile mini-DOAS.

b) The usage of tons per day in the abstract, observed emission factors, conclusions, Table 1 and Figure 4 was adopted as suggested. Emissions from an example of an individual measurement were reported in kg per hour since it was thought to be more convenient for the short timescale that conducting a measurement takes. Comparison of our measurements with inventories was made in tons per year, as suggested by the Referee, using the average of the daily average measurements and the standard deviation of the daily average measurements.

c) The clarification was made.

d) Please see the response to R. Ramos at g) bullet. Figure 2 in the paper was complemented by including results of other days and times when coincident information was available. A detailed answer to the comment about effective plume height is available in the response to the short comment made by A. García.

Technical corrections The manuscript was modified taking into consideration all suggested technical corrections.

A. García Comment

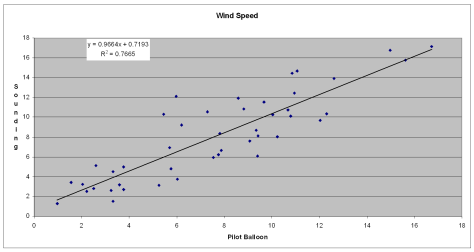
The plume rise calculations were redone and values similar to those quoted by A. García were obtained. Plume rise was calculated using the algorithm in CAMx (Environ, 2009) for every hour. There was in fact very little difference between the original simulations and the new ones, suggesting that for these cases there was little wind shear in the vertical, and relatively homogeneous conditions in the boundary layer.

ENVIRON: CAMx, Comprehensive Air Quality Model with extensions, User's Guide, Tech. Rep. Version 5.40, ENVIRON International Corporation, 2009.

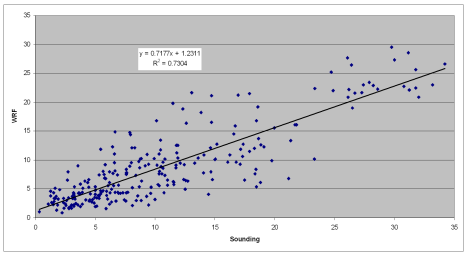
M. Melamed Comment

The presented measurements in this paper are not slant columns but rather differential vertical columns. M. Melamed is correct in pointing out that "the retrieval process described in this paper does not result in the total column of the gas of interest" and this has been corrected in the manuscript in section 2.1 by more clearly stating the evaluation procedure. However the retrieval does not result in a differential slant column density as the measurements are collected in the zenith position, therefore no Air Mass Factor is necessary to calculate the emission fluxes. Furthermore any clouds present at the time of the measurements were clearly located at a higher altitude than the probed gas plumes; therefore any multiple scattering within the clouds will not affect the retrieved differential vertical column densities.

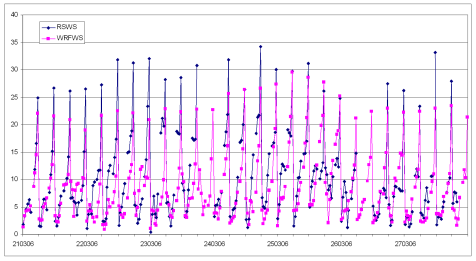
Interactive comment on Atmos. Chem. Phys. Discuss., 9, 5153, 2009.



Wind speed correlation between soundings and pilot balloons



Wind speed correlation between Soundings and WRF model simulations



Wind speed vertical profiles for Soundings and WRF model simulations

Fig. 1. Wind speed comparison between WRF model and measurements

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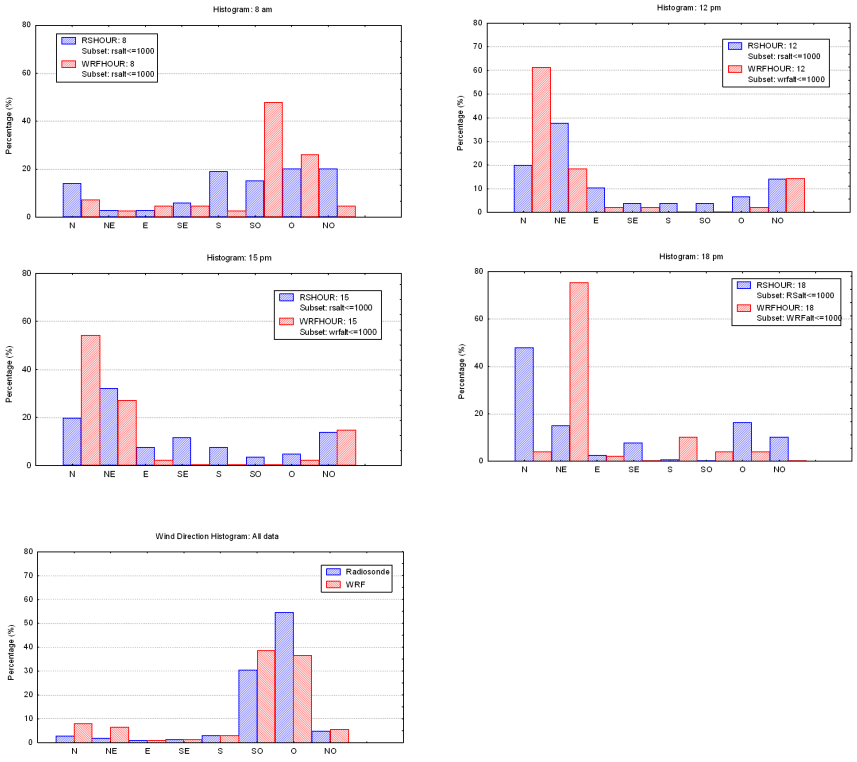

Fig. 2. Wind direction comparison between WRF model and measurements

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