Author's response to reviews

Title: Modelling NO2 dispersion for a health impact study in the city of Sao Paulo, Brazil

Authors:

Agnes A. Soares da Silva (a.soares@iras.uu.nl)
Maria Regina M.R. Cardoso (rcardoso@usp.br)
Bert B. Brunekreef (b.brunekreef@iras.uu.nl)
Kees K. C. Meliefste (c.meliefste@iras.uu.nl)

Version: 2 Date: 7 April 2006

Author's response to reviews: see over
Dear Dr Grandjean,

Thank you for giving us the opportunity to revise our MS 1527554270912099

Based on the reviewers’ suggestions, we decided to change the title of the manuscript to: “Use of passive diffusion sampling method for defining NO\textsubscript{2} concentrations gradient in São Paulo, Brazil” which better reflects what was actually done.

We thank the editor for the remarks on the text. We have revised the manuscript according to the instructions given to the authors and we have made spelling and terminology checks.

Additional information to Dr Ole Hertel:

We have now better addressed the assumptions, problems and limitations of using NO\textsubscript{2} as a marker for traffic related air pollution, by adding discussions about the complex mixtures in the urban air environment, more information about the sites and about the characteristics of São Paulo in the ‘Background’, ‘Methods’ and in the ‘Results’ of the manuscript.

We have now included two of the suggested references (Palmgren, 1996; Raaschou-Nielsen, 2000) and added another reference from a study made in Copenhagen (Raaschou-Nielsen, 1997). There are a few recent publications that use NO\textsubscript{2} as a marker for traffic exposure as well, but we did not mean to be comprehensive in the literature review.

Regarding the profile of the pollutants and the seasonal variation of air pollutants, please see figures 1 and 2 below that show a daily profile of NO\textsubscript{2}, NO\textsubscript{x} and NO for the sampling periods based on continuous monitoring and also the average concentrations of NO\textsubscript{2} obtained by the diffusion tubes in the same periods. The values of the diffusion tubes (average for the period) indicate that this method works well in Sao Paulo, reflecting the variation in both periods.

About the ozone levels, it has been established that in São Paulo, in the winter, high concentrations of aerosols could affect the actinic flux, leading to a reduction in UV radiation, and thus high O\textsubscript{3} levels are not reached within the city (see figures 3 and 4 below). However, studies indicate the presence of high O\textsubscript{3} levels 50-200Km downwind from São Paulo - to the Northwest (see Molina LT, Molina MJ, Slott RS, Kolb CE, Gbo PK, Meng F, Singh RB, Galvez O, Sloan JJ, Anderson WP et al: Online Version of the 2004 Critical Review on Megacities and Atmospheric Pollution -- Air Quality in Selected Megacities. Journal of the Air & Waste Management Association 2004, 54; 12)

In conclusion, in São Paulo’s case, considering the places where the tubes were located and considering that we worked during winter, the NO\textsubscript{2} concentration can be regarded as a good indicator of traffic-related air pollution.

Additional information to Dr Ubiratan Santos:

We have corrected the numbers in the text (fleet and population) in the ‘Background’ of the manuscript.
Differences between heavy and local traffic in the 1st and 2nd periods are already presented in the manuscript in Table 1. Figure 2 show differences between the two periods, important for short-term exposure. Figure 3 shows differences between sites with local (low) and heavy traffic densities, important for long-term exposure. Figure 4 (in previous version of the manuscript Figure 3b) shows regression analysis of NO2 concentration levels and log of the traffic counts controlling for period. (r = 0.6 for both periods; r = 0.69 for the first period and r = 0.65 for the second period; p < 0.001)

Complementing the information given in the Figure 6 of the manuscript (Figure 4 in the previous version), we have added the Figures 5 and 7 to this letter (see below) showing that in fact the wind speed in July is lower than in August and this could explain the higher levels of NO₂ in July, which supports our findings. We did look at the relative humidity for both exposure periods (see Figures 6 and 8 below) but during this period of the year humidity plays a minor role in the formation of photo-oxidants due to scarce UV radiation. The highest frequency of high ozone episodes occurs with maximum temperatures between 25 and 30°C and relative humidity less than 60%, which did not occur in the two studied one-week periods.

We hope to have answered the concerns of editor and reviewers adequately and look forward to receiving your decision in due time.

Yours sincerely,

Agnes Soares
Corresponding author
Figure 1 - Distribution of the NO2, NOx and NO concentrations in the period 17th to 27th July 2000
Figure 2 - Distribution of the NO2, NOx and NO concentrations in the period 10th to 18th August 2000
Figure 3: Distribution of the O3 concentrations by hour in the period 17th to 27th July 2000.
Figure 4 – Distribution of the O₃ concentrations by hour in the period 10th to 18th August 2000.
Figure 7 - Wind speed (km/h) in the period 10th to 18th August 2000

Figure 8 - Temperature (°C) and relative humidity in the period 10th to 18th August 2000