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## ***Interactive comment on “The effects of vehicle emissions and nucleation events on vertical particle concentration profiles around urban office buildings” by T. N. Quang et al.***

**Anonymous Referee #2**

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This study presented and discussed the measured particle number size distributions and PM<sub>2.5</sub> concentrations and their vertical profiles nearby a street at three different buildings in Brisbane, Australia. All locations were considered with urban characteristics. The topic itself is of great interest and the main finding in the article is that “vertical profile of fine aerosols around buildings in the urban areas does not follow a systematic characteristic, instead each building have its own vertical profile.” This finding is very important and the authors emphasized that their study will help to better define fine aerosols behavior and their variability around building envelopes, which has implications for studies of both human exposure and fins particle dynamics.

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I recommend publication of this study after major changes. The acceptance in the ACPD journal shall be subject to meeting the critical comments listed here in my report.

General comments: - The title is not suitable for this study because there was not enough evidence how traffic emissions or new particle formation would influence in the vertical profiles. In my point of view, the title is better written in the form “Vertical profiles of fine particle number size distributions and PM<sub>2.5</sub> concentration around three buildings in the urban area of Brisbane, Australia”

- The introduction and the literature review should contain most of the relevant studies regarding vertical profiles of fine aerosols in urban areas. In that sense, the references list should be longer and more extensive.

- While I emphasize it here as “fine particles”, authors did not. I believe that they should in the first place consider this fact because their instrumentation provided a certain fraction of fine particles (size distribution between 8.5 – 400 nm) in addition to the PM<sub>2.5</sub>. Although, the authors have to discuss the validity of their size distribution for the whole fine particle size range (say 3-1000 nm).

- Another important terminology error in this article is that authors mentioned in several places the term “PNSD concentrations” denoting for Particle Number Size Distribution concentration. The correct term should be “particle number size distribution”. [Please mind this typo]

- While trying to make evidence of traffic emissions influence, the authors has to present traffic activities data and make real statistical analysis for it with respect to the aerosol data. Otherwise, the presentation of the results would be like hand waving and without real support. Another important point here regarding traffic is to consider workdays versus weekends.

- To make a good presentation for then nucleation events, I strongly recommend quantifications of the nucleation and growth rates of the events. Furthermore, when the

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authors presented the differences in the vertical profiles during nucleation events and compared it with the daily ones, did they consider all the data in the daily averages or just removed the time periods of nucleation events? Please specify what does “daily” state for specifically.

- It is very interesting to compare the vertical profiles found in this study to those found in open lands nearby traffic. there are couple of interesting studies in the literature dealing with this topic.

- Please consider specific size fractions as well in addition to the total number concentration and PM<sub>2.5</sub>.

Specific comments: - Section “2.1. Setting”: I suggest making a map showing the locations of the three sites within the urban Brisbane. This is to give a better insight into the distribution of sources around each building. It is not enough to have the closest sources, but also further ones as well.

- Section “2.2. Instrumentation”: a detailed description of the sampling lines, losses, and calibration. This might explain why the nucleation events were observed only at the rooftop and street levels at Building C.

- Section “2.5. Identification of nucleation events”: I strongly recommend the differentiation between local events and regional events in the urban atmosphere. For example, the original criteria by Dal Maso (2005) and the modified one by Hussein et al. (2008) described the regional events. However, Hussein et al. (Atmos. Chem. Phys., 9, 4699-4716, 2009) presented how to distinguish local events from regional ones. The main key factor is the time-span of the event.

- Section “3.3. Vertical profiles of particle concentrations”: how come the nucleation events were observed at the street level and on rooftop of building C only and they were not observed at the middle levels?!

- Page 1630, lines 21-22: Unclear statement “This suggests a more pronounced influ-

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ence from vehicle emissions and new particle formation on PN and PM<sub>2.5</sub> concentrations at each level during these periods.”

- Page 1631, lines 14-15: unclear statement “In general, vertical profiles of PM<sub>2.5</sub> concentrations around the building envelopes were 15 markedly higher with decreasing distance to nearby streets.”

- Figure 4: It is more interesting to plot longer time periods. Also the same comment for similar figures in the supplementary files.

- Figure 6: plot other levels in addition to the rooftop and street level. The same apply for similar figures.

- Figure 10: you should merge subfigures a and b together. also merge subfigure c and d. Please do the same for other similar figures.

- Figure 13: This figure is very interesting and it is the main finding of the study. Please make extensive discussion about it. Also do the same discussion regarding the different particle size fractions.

- When plotting the size distribution spectra, please use logarithmic color scale instead of linear. That would make better visibility of other interesting events in the size distributions.

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Interactive comment on Atmos. Chem. Phys. Discuss., 12, 1613, 2012.

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