

Interactive comment on “Measurements in a highly polluted Asian mega city: observations of aerosol number size distribution, modal parameters and nucleation events” by P. Mönkkönen et al.

Anonymous Referee #2

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General comments: The authors report the ambient particle number size distributions and the number concentrations (3-800 nm) in a highly polluted city, New Delhi India. Measurement of this kind is very rare in the developing countries, in particular south Asian countries. Therefore, authors' endeavor is highly appreciable. This study would be useful for those who are interested in health effects and climatic effects of atmospheric aerosols, as well as those involved in air quality management. The authors used valid scientific techniques for experiments, produced high quality data and the data analysis methods are sound. This paper depicts the situation of air quality in New Delhi, in particular, and for the broader scientific community it provides the evidence

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that the new particle formation occurs in this region, a highly polluted urban site.

Major comments: 1. The authors mention that the measurement period was from 28 October to 9 November 2002. However, main conclusion on diurnal pattern has been drawn from a period of 4 days (28-31 October 2002). The authors describe in detail the diurnal variations in 1-2 days that constitute isolated events rather than general feature. The time interval is too short to capture any diurnal patterns. It is more appropriate to use the data from the entire campaign, if data collection was uninterrupted. To be specific, Figure 2 should be reproduced as follows: a. Plot the box and whisker graph of diurnal variations of the total number concentrations for the entire campaign (15 days). This would better illustrate diurnal pattern of number concentrations, if any, and the influence of the traffic emissions and/or any other emissions, for example peaks in evening hours. b. The top panel of Figure 2 should be a composite of the diurnal size distributions for the whole campaign, i.e. X-axis: time of the day (1:00, 2:00 and so on), Y-axis: Diameter in log space, and Z-axis: $dN/d\log D_p$. This plot will complement the plot in (a), and the variation of the number size distribution would be better captured, if there is any general pattern. 2. Due to the limitations of gaseous measurements, and probably meteorological measurements too, authors back up the suspected nucleation events with some analytical techniques. Solar radiation and total surface area of the pre-existing particles play major role, besides condensable vapor, temperature, relative humidity etc. Including the time series of solar variation and surface area (in Figure 6 and 7) would shed more light on those alleged nucleation events. Authors did not discuss the possibility of changing boundary layer and its influence on particle number concentrations. It is possible that the particles trapped in the nocturnal boundary layers might have reached the sampling inlet (15 m from the ground) after nighttime boundary layer break up due to solar heating. This could be checked with PM₁₀ or PM_{2.5} mass concentration (if there is any hourly measurements) or gas phase species such as CO, NO. Any other possible sources of particles should be systematically and categorically discarded, in order to confirm the nucleation events.

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Minor comments: 1.Remove Figure 1.

2.Use different date format, e.g. 28 Oct 2003 and time format e.g. 1:00, 2:00 etc. that is easily understandable, rather than day number such as 301, 302, and time of day such 0, 0.25, 0.5, 1 etc.

3.Don't repeat the same description in the figure caption that is already mentioned in the text.

4.Some of the sentences are repeated in abstract and conclusion, for example lines 12-15 in conclusion. Either rephrase them or remove from the conclusion.

5.Is Table 2 a summary for the entire campaign? If so, mention it in the text. Nothing is mentioned about the duration for which Figure 4 was produced. Is it for the entire campaign?

6.Plot the number concentrations in linear scales so that the changes are clearly seen.

7.Cooking has been suspected as another source of particle in the evening. Why does not the effect of cooking is seen in the morning hours? Clarify it.

8.5413/12: Rewrite the sentence "A clear increase... ". For instance, an increase of Aitken mode particle number concentration starts around 4:00 am and continues through to about 7:30 am.

9.5414/24-27: Rather than saying slight changes, mention briefly what changes were observed during weekend versus weekdays.

10.5415/9-12: Describe briefly the terminology used, e.g. event class, CS. 11.5415/26: Rephrase the sentence :This shows ...". The sentence as such does clearly state what is meant.

12. Add a column in Table 3 to include the total number concentrations at the start of the events.

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Typing errors:

1.5409/5: Krishna et al., 1997 and Krishna et al., 2000, could be Krishnamoorthy et al., 1997 and Krishnamoorthy et al., 2000 (Check it out).

2.5409/24: "dunk-cake" should read "dung-cake".

3.5411/17-18: Makela et. al., 2000 (a or b or both?).

4.5412/4: "present" instead of "presents".

5.5412/16-17: use thousand separator i.e. 20,000 not 20000.

6.5413/13, 17-18: use thousand separator.

7.5414/21: "can not neglect" should read "cannot be neglected".

8.5415/3: to better explain, add "particle nucleation" in front of "event" 9.5415/4: replace "is" with "are".

10.5415/10-12: Remove: "see" and also remove two "Kulmala et al., 2001" that appear right after growth rate and condensation sink and keep the very last one. 11.5416/7: Remove "see".

12.5417/10: "Baumgartner" should read "Baumgardner".

13.5418/1: "nvironmental" should be "environmental".

14.5419/25: "Nucle" should read "nuclei" and "proramme" should read "programme".

15. In the reference list: Woo et al.: Change the title of the article to Sentence Case, to be consistent with others.

16.5424, Title of the table 3: 25 October or 26 October?

17. In Figure captions of Fig. 5 and Fig. 6, replace "of" right after distribution by "and".

Interactive comment on Atmos. Chem. Phys. Discuss., 4, 5407, 2004.