

Interactive comment on “Particle number concentrations and size distribution in a polluted megacity: The Delhi Aerosol Supersite study” by Shahzad Gani et al.

Anonymous Referee #1

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Delhi is well recognised as one of the world’s most polluted megacities and is a city for which there are relatively few data available for highly resolved particle size distributions. This paper reports on around 15 months of continuous measurements of submicrometer particle size distributions and provides an interpretation which gives valuable insights into the processes which determine the size distribution. The length of the dataset also allows segregation according to seasons which is valuable. Calculations of the condensation and coagulation sink are a valuable complement to the data analysis process.

The work is of good quality but there are a number of points which, if addressed, would

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significantly enhance the value of the paper. These are as follows:

(a) Sampling took place on the campus of the Indian Institute of Technology in Delhi, but rather little detail is given of the sampling site apart from very local characteristics. The IIT Delhi campus is close to the southern perimeter of Delhi and some comment would be valuable on the degree to which this site could be considered as representative of Delhi more widely. Could we expect to see similar data from a site in the city centre or in Old Delhi? Were the prevailing winds from the city or from the less populated areas to the south?

(b) There are a number of questions concerning the instrumentation. Measurements were made with a TSI Scanning Mobility Particle Sizer. These are generally recommended to be used with an online dryer. Was any conditioning of the inlet air carried out, or do the measurements refer to ambient temperatures and relative humidity? Were the conditions inside the building where the instrument was located the same as those outdoors? Details are given of corrections applied for sampling losses. The TSI instrument software normally calculates sampling losses on the basis of detail of the instrument setup, and if this were carried out, there is a risk of applying two sets of corrections. Was the TSI correction turned off? Which version of the AIM software was used?

(c) The condensation sink was calculated using the properties of sulphur dioxide. Condensation sinks are more often calculated for sulphuric acid vapour and it is not at all clear why SO₂ was assumed as the condensing vapour. Table 2 lists condensation and coagulation sinks from the literature referring to studies by Laakso et al. (2006) and Hussein et al. (2004). A search of these papers for the condensing molecule revealed no data for condensation sink or coagulation sink in either paper. This requires further explanation.

(d) The discussion of particle number and mass concentrations and of size-resolved particle concentrations on pages 5-7 does not appear to account for restrictions apply-

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ing in Delhi for the access of heavy duty vehicles which can only enter certain areas at nighttime. This seems likely to affect the particle number concentrations and size distributions and should be discussed. A further point which is wholly lacking from this part of the discussion is the relative contributions of locally-generated and advected particles. Many workers have highlighted the significance of biomass burning in the rural areas outside of Delhi and there are also highly polluting brick kilns. Can the contributions of such sources be identified? Does the airport (which is quite close) influence the measured data?

(e) On page 7 there is some discussion of comparison of concentrations with other cities but the literature cited is at least 10 years old. Particle number concentrations can change quite massively, as they have done in western Europe as a result of controls on the sulphur content of fuels. Hence, a comparison with such old data is probably of little value and this needs to be updated.

(f) The section on multi-modal PSD fitting draws conclusions based upon assumed patterns of traffic. This would be strengthened by inclusion of a graph showing traffic volumes as a function of time of day, preferably for different vehicle classes.

(g) The comparator used for particle number concentrations in the conclusions section is the review of Kumar et al. (2014). It should be noted that many of the studies included in that review are now very old, and in line with the comment above, it would be more appropriate to compare with more recently collected data.

The manuscript is well written and pleasingly clear of minor typographic errors. However, in Table 1 the units for PM_{0.56} are incorrect.

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