

Interactive comment on “Source apportionment of ambient particle number concentrations in central Los Angeles using positive matrix factorization (PMF)” by M. H. Sowlat et al.

Anonymous Referee #1

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SOURCE APPORTIONMENT OF PARTICLE NUMBERS IN LOS ANGELES There is very widespread interest currently in particle number concentrations in the atmosphere, and the determinants of those concentrations. Much of the recent research has focused on the global atmosphere, with particular attention being paid to nucleation processes. While such research is important in the context of global climate, there is also a very important research area associated with particulate matter in the urban atmosphere. While a huge number of source apportionment studies of particle mass have been carried out in urban environments around the world, there has been a relative scarcity of source apportionment of particle number concentrations. The latter requires data sets which are not available from many locations, and the rather challeng-

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ing application of source apportionment programs. Consequently, there are few high quality studies in the literature and this paper presents a valuable addition for a major city with a well characterised air pollution climate. It can be very challenging to extract meaningful factors from PMF, but the authors appear to have succeeded in doing so, and have provided convincing associations with the sources to which they attribute the factors. In summary, the data interpretation appears to be sound, and consequently the paper offers excellent quantitative insights into the sources contributing to the particle number count as a function of particle size within Los Angeles. There are some relatively minor points which need to be addressed, relating to both the methodology and the data interpretation. These are as follows: A. At no point is it clearly stated how the particle size distribution data are sub-divided for uploading to the PMF. Were the size bins from the SMPS used without subsequent combination into larger size fractions and what size ranges were used from the OPC? There is also a question as to how the errors in the SMPS and OPC data were quantified in order to populate the error matrix of the PMF. These are points of interest which should be included in the paper.

B. The PMF does not appear to have separated the factors wholly cleanly (which is not unusual). Thus, the nucleation factor (Factor 1) appears to show some influence of morning rush hour traffic seen in Figures 7 and 8. A comment on the magnitude of this overlap would be useful. The nucleation factor has significant magnitude, even in the depths of the night, which require some explanation. Is this a reflection that nucleation continues through the night, or is it an artefact of the PMF?

C. The Traffic 2 factor shows a rather odd diurnal variation, which differs substantially between the cold phase and the warm phase and between weekday and weekend data. The diurnal profiles seem to suggest a substantial contribution of semi-volatile materials, especially during the cold phase, as reflected in the substantial increase at night time.

D. The huge difference between the cold phase and the warm phase seen in Figure 7

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for the soil/road dust factor is rather surprising. Are the weather conditions really that different between the cold phase and the warm phase, such that they can explain such a huge seasonality?

E. Some recent papers have attributed a significant proportion of particulate matter mass in California to emissions from cooking. Such attribution usually comes from AMS data, largely on the basis of diurnal profiles. Is there any indication of such a source within this data set? One might expect it to be more prominent at the weekend than on weekdays, especially if related to outdoor barbequing.

Minor points which require attention are as follows: F. Page 3, line 6. This implies that regulations on PM number emissions from road vehicles in Europe have been set on the basis of health studies of UFPs. This is not the case. The PMP number limits, which have been introduced as part of recent European vehicle emission standards, arose because of the difficulty encountered in achieving repeatable measurements of very low mass concentrations of PM in diluted engine exhaust, whereas particle number could be measured very repeatedly after removal of the semi-volatile fraction. Hence a test procedure, based upon solid particle number, was considered a more practicable option than determination of mass.

G. Page 5, line 34. Last word should read 'factor' rather than 'actor'.

H. Page 6, line 30. 'Ration' should read 'ratio'.

I. It would be good to quote the OC/EC gradient determined through equation 1, as there is still considerable interest in applications of the EC Tracer Method to source apportionment of organic carbon.

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