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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Ultrafine particle sources and in-situ formation in a European megacity" *by* M. Pikridas et al.

Anonymous Referee #2

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This work details new particle formation events (NPF) measured during two field campaigns under the MEGAPOLI umbrella. The campaigns took place in July 2009 and January/February 2010 to capture summer and wintertime conditions in Paris. In this particular experiment, data was gathered from three ground sites, two mobile sites and one aircraft. Aerosol number and size distributions were measured, alongside trace gas measurements made on board the aircraft. NPF event days were characterized if nucleation mode particles (<10nm) were observed over the course of several hours growing to larger particle sizes. NPF event days were only witnessed in summer, on about 50% of the campaign days. However agreement between all three ground sites was not always present.

The paper was an enjoyable read to start with, and well written. However it became

evident that the sources of the NPF events were not going to be identified, as the paper title suggested. The authors identified whether the source was "Paris' or 'Not Paris', but this explanation doesn't go far enough for me and I'm left with far more questions than answers.

The Paris plume itself was identified by concentrations of black carbon and increased particle numbers. I wonder whether non-Paris contributions of black carbon might affect this assumption – i.e. smoke from rural grass/forest fires in summer, or suburban/rural woodburning in winter? Perhaps associated wind directions and speeds could be combined in a polar plot of number concentrations might also assist this analysis?

The paper explained when new particle formation takes place and whether agreeable measurements were made at other sites but does not explain the process of formation nor what the particles are composed of. I would expect that an experiment designed to investigate ultrafine particle sources would have had an aerosol speciation instrument, such as an Aerosol Mass Spectrometer or an Aerosol Chemical Speciation Monitor available.

From the list of instrumentation used in table 1, the only coincident trace gas measurements were taken on board the aircraft at approx 600m in height. None of these trace gases correlated with particle number. Why were there no ground measurements of trace gases? A brief look at papers within the MEGAPOLI special issue suggests there are more measurements available, indeed the section describing the MEGAPOLI field campaign in the introduction discusses other work done to identify sources of particulate matter, but then these same measurements don't seem to be used later on to help identify the sources of these ultrafine particles.

Was any modeling done across the MEGAPOLI participants to try and answer these questions? The CHIMERE model is mentioned in the introduction section as being used to decide the routes of the mobile and aircraft platforms, but could have been used to model the Paris Plume. This would then have pointed to certain emission

source groups being likely candidates for the different NPF events. Even better, a model incorporating aerosol number, size and composition would aid the story.

Please explain the comment ”during winter the higher condensation sink. . .prevented particles from growing to sizes larger than 10nm”. I would expect that high condensation would lead to an increase in the particle size either directly or via coagulation. The only other explanation is that there was a high surface area already present which caused a plateau in the particle growth, but as there were no nucleation events in winter I don’t understand where this high surface area originated from.

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 5663, 2015.