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Atmospheric Chemistry and Physics Discussions

Interactive comment on "On the spatial distribution and evolution of ultrafine aerosols in urban air" *by* M. Dall'Osto et al.

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This paper presents aerosol number and black carbon concentration data at several sites in Barcelona as part of the SAPUSS project. The authors identify three sources of ultrafine particles: traffic-related emissions, regional nucleation, and urban nucleation. Diurnal trends in N and BC were investigated and the nucleation events were explored in detail. N-BC correlations were presented to elucidate the contributing sources of ultrafine particles at each of the sites in and around Barcelona.

The authors have done a decent job at synthesizing a difficult and complex set of data, although I believe a few things should be clarified so that the overall "story" is more convincing. I recommend this paper to be published in ACP as soon as the changes are made.

Technical comments:

P16604 L27-28: Secondary particles from the city center make up 61-71% of the total particle concentrations. But it only nucleated twice, and only one was urban. Is this 61% just for that nucleation day or averaged over the whole campaign?

P16605 L20-24: Some nomenclature confusion. For the second case of particles formed in the atmosphere after tailpipe emission, are you calling these primary? The description makes them sound like secondary particles, but then the next paragraph begins the secondary particle introduction. I wonder if you are referring to them as primary here because the vapors are low enough volatility and nucleate quickly enough to basically be treated as primary. Please clarify.

P16612 L2: This is not quite the same order in N as it is for BC. UB and TM seemed to be flipped, although within the uncertainty ranges.

Section 3.2.1 (Regional nuc): The authors mention the possibility of wrongly assigned nucleation events and go over the Dal Maso et al. (2005) criteria. Yet, in my opinion they are being somewhat loose with nucleation event assignment themselves for the regional event. It is possible that the events at UB, TC, or TM may not pass the Dal Maso criteria. Specifically, the appearance of 3-7nm particles satisfies the "nucleation burst" aspect but doesn't say much about their growth and survival outside of that range. I understand that the SMPSs were down at the other sites, which is unfortunate.

Section 3.2.2 (Urban nuc): I am not totally convinced that this is an urban event and not another (partially) regional event. First, if the winds blow from RS to UB to TC to RB, why does the mean particle diameter appear to be smaller at UB than RS (Fig 5)? Second, also looking at Fig. 5, the particles measured at RS could plausibly be emitted (20-40nm) and not secondary in nature. Finally, why does the mode continue to grow at TC until the end of the day and not at RB?

P16617 L3: I am not sure it is correct to call this the growth rate.

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P16621 L12: Coagulational scavenging is referred to CS here, but earlier condensation sink was. CS is usually used for condensation sink. It is mentioned a few times that the low condensation sink above the city is partially responsible for the elevated number concentrations there (via nucleation). Could this be quantitatively shown and/or plotted?

Grammar and writing style:

The whole manuscript could use several good proofreads before publishing. I found a few typos:

P16605 L9: "...UF, the main component of ambient particles by number..." is a superfluous line since the same thing is said one sentence prior ("UF...make a dominant contribution to urban total particle number concentrations.")

P16607 L2: "NFP"

P16608 L15 "UCT"

P16613 L9: "air masses scenarios"

This is probably not an exhaustive list.

Presentation style:

The figures could use a little editing:

Throughout: use superscripts, not "cm-3"

Fig 1: Is the BC really in nanograms per cubic centimeter? Everywhere else is per cubic meter.

Fig 2: Is there a lower error bar on these? If so, they are blending in with the value bars themselves

Fig 3: It is odd to start with (a) at the bottom of the figure. Please fix.

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Fig 5: Text looks stretched

Fig 6: In print, this figure is very difficult to decipher. The colored points appear as almost all black because of their small size and black outline. Enhancing the PDF by a few hundred percent helps, but this is not ideal. I would suggest breaking up into separate figures or putting some in the supplement.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 16603, 2012.