Atmos. Chem. Phys. Discuss., 11, C1127–C1132, 2011
www.atmos-chem-phys-discuss.net/11/C1127/2011/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "

On the sub-micron aerosol size distribution in a coastal-rural site at El Arenosillo Station (SW-Spain)" *by* M. Sorribas et al.

Anonymous Referee #3

Received and published: 24 March 2011

Review of "On the sub-micron aerosol size distribution in a coastal-rural site at El Arenosillo Station (SW-Spain) by M. Sorribas et al.

General Comments: The paper presents two years of continuous DMPS measurements from the El Arenosillo GAW Station in Spain. The measurements seem to be carefully conducted and the calibration of the instrument has been performed at the IfT. The paper therefore presents data which is quality assured and very useful to the aerosol community. The paper contains a detailed analysis of the data, and being a GAW station I assume that the data have also been (or will be) submitted to the joint

data bank.

What the paper is lacking is a coherent presentation of the data. It took several times to read the article before getting a clear picture of the message that the authors are trying to relay; a fast reader will be left confused. This can be fixed by moving a couple of paragraphs here and there (suggestions will follow in the detailed comments), and by carefully segregating the sections where different data are addressed. In the current form of the paper, it is sometimes difficult to understand which numbers relate to which pieces of data. In addition, the English language will need to be improved considerably. I recommend having the article proof read by a native English speaking person, or using a proof reading service. Upon correcting these issues, I can recommend the paper to be published in ACP.

Detailed comments:

Abstract:

- Instead of speaking about modes, here could be the size limits for “nucleation”, “Aitken” and “accumulation mode”. This would remove the mismatch with the next sentence, which mentions 4 different modes.

- There is talk about 60 % of nucleation events falling under certain conditions. If I understood the paper correctly, this is valid only for events N1?

- I would not draw the conclusion “1cm3 increase of the nucleation mode equals 0.5cm3 decrease in accumulation mode” from the monthly averages, but from the concentration relations directly. I will come back to this later.

Chapter 2.1 Sampling station site

- The authors divide the air mass back trajectories into coastal marine conditions (44%), continental air masses (38%) and desert dust (18%). Could this segregation be utilized later in the chapter 3.1 Mean levels? Chapter 2.3 Dataset

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- The authors report one longer gap in the measurements for about 2 months. Do you think having this gap increases or decreases the reported average concentrations? If so, would the difference be notable?

- Rather than talking about the number of size distribution spectra per month, I would talk about data coverage in percentages. This relates to figure 3 too.

Chapter 3.1 Mean levels

- I'm not sure if I like the comparison against data from arbitrary stations in the world. From the stations listed here, I would say Ispra is the only relevant comparison point, also located in Southern Europe. Like the earlier referees have suggested, it might be useful to check what global models suggest the concentrations are.

- Discussion and related Table 1. Do the "Entire period study" statistics contain the "mixed event" occurred on 27.7.-4.8.2004 or are they calculated without the mixed event? Chapter 3.2 Monthly and seasonal total and modal concentrations

- I would not begin this chapter by presenting data from individual case days. Consider removing this paragraph completely, or presenting it at the end of the chapter as a sub chapter with some figures similar to Fig 10.

- Talking about monthly increase or decrease of different modes deserves a more rigorous examination; were there more nucleation events or just more often? How do these data relate to the different air masses mentioned in chapter 2.1?

- Page 3823, line 12: how did you deduct that 60 % of the particles in nucleation mode grew to Aitken mode? I'm not sure looking at monthly averages is the proper way to do this. If nucleation occurred, this should rather be looked at case by case. After looking at the data you wouldn't need to say:"This behavior may be related to new particle formation"; this claim is easy to check.

- The conclusion "1cm3 increase of the nucleation mode equals 0.5cm3 decrease in accumulation mode" is now here. I really don't think such a conclusion can be drawn

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on basis of a timeline data. Rather just plot monthly Nnuc versus Nacc and look at the slope of that dataset. This would be much more quantitative.

- Consider showing the trajectory information in this chapter. I would suggest the following structure for the chapter: begin with the timeline, then present the data in light of the air mass types. After that discuss the data, and whether the air mass occurrence evolved during the measurement period. There might (or not) emerge patterns that can explain the overall trends of the data, i.e. the apparent increasing trend in the Nait. I leave the decision how to further develop the chapter to the authors.

Chapter 3.3 Diurnal evolution of the modal size ranges

- Perhaps the heading should be changed slightly, as the size ranges of the modes are not the ones that are changing.

- Page 3825, line19:"The maximum for Nnuc were reached at 11:00 GMT and 10:00 GMT. . . Then, during summer time there was a delay of 1-h. . ." Please consider clarifying these sentences; I'm not sure I understand what the authors are trying to tell.

- Paragraph beginning on page 3825, line 23: except for the last sentence, I would move this paragraph somewhere in the nucleation event chapter. The paragraph breaks the flow of the current chapter somewhat.

- The authors discuss an evening maximum observed in the nucleation and Aitken mode during summer evening/night. How do the DMPS plots look like? Are there additional nucleation events in the evening?

- The authors discuss the height of the boundary layer to be the reason behind lower night time concentrations during winter. This might not be the reason, colder temperature should lead to a shallower boundary layer, opposite to what the authors suggest.

- Paragraph beginning on page 3826, line 18: This paragraph feels again out of place. Consider moving parts of it in other chapters. It's interesting how the different timescales affect the correlations, this conclusion should appear somewhere in the

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manuscript. The authors may think where would be the best place for this.

Chapter 3.4 Study of representative episodes

- It may be more relevant to have this chapter as a sub-chapter in the Methods. I leave this choice to the authors.

- How do the air mass types correspond to the episodes with re-circulation?

Chapter 3.4.1 New particle formation events (N1 and N2)

- I had some troubles going through this chapter due to structure of the chapter. I would suggest making a clear division of the figures between events N1 and N2. Especially in figure 10 there should be clear indication which figure corresponds to N1, which to N2. There is even a figure (10d) corresponding to a N-PB day. Maybe this should be a separate figure not to be mixed in the nucleation event analysis?

- Instead of case studies, it may be worthwhile to give average numbers for formation and growth rates; however, given the frequency of nucleation events, a separate paper with a longer time series might be opted as a follow-up study.

- Figure 12 feels a bit out of place in this chapter again – do the authors want to present correlations of the whole measurement period here, or is the focus only in nucleation events?. The discussion in the text is mostly about N1 events (red dots in the figure). Maybe the black dots could be left out – at least there should be commented if differences are seen between red and black dots. Make clear in the figure caption 12 that these are related to N1 events, also explanation for marker colors is missing.

Chapter 3.4.2 Sea-land breeze days

- Figure 14 and the corresponding discussion: There seems to be a considerable increase of the nucleation mode in both pure-breeze and non-pure breeze days during mid-day. What makes these days so different that they are not considered to be nucleation event days?

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After changes made in the paper, the conclusions should be changed accordingly.

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 3813, 2011.