**Atmospheric
Chemistry
and Physics
Discussions**

Interactive comment on "Behavior of CCN to CN fraction during aging and mixing processes of atmospheric particles" *by* S. Rojas et al.

Anonymous Referee #1

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This paper by Rojas et al. studies the behaviour of CCN/CN fraction during aging and mixing processes of particles based on campaign measurements of 10 days. The paper includes measurements of particle size distributions and CCN concentrations with different supersaturations. The sample is collected through a switching inlet having a "normal" mode and a thermo-desorber mode to get into the particle coating properties. The paper classifies the air mass types with trajectories and presents their different properties. The main objective is to determine the hygroscopic behavior of ambient aerosols during aging processes taking place during their atmospheric transport. The scientific aspects of the paper are well within the scope of ACP. Despite some interesting results, some points of the paper need to be improved and/or clarified before publication. I am slightly worried about the relatively small amount of data, but espe-

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cially the classification of the air masses, of which many other results in the paper are depending on.

General comments:

1. Because the results are based on a small data set, I would be careful with using wording like "typical range" for something "was determined" or other heavy statements due to low statistics and would emphasize more clearly that the results are more or less from case studies. Since only a day or two per air mass is available.

2. The way of defining the different air masses remained bit unclear to me. In the "Experimental section" is said that the selection was done "according to their aerosol mass content and back trajectories". No word or number of aerosol mass concentrations is presented later on in the paper. Please add what was measured and with which instrument, and how the results were used.

3. In the paper, I get the feeling that trajectories are calculated only once per day (at 00:00) and the air mass is assumed to be similar until 23:59 on the same day, which is certainly not the case in real atmosphere. Then a new trajectory is calculated again at 00:00. If this is true, the classification should be totally renewed. Since 5 min data is available (CN and CCN), I would suggest calculating trajectories for every hour (or minimum every three hours). Then it is possible to pick up the "correct" air masses and leave out the transition periods or classify those for example as mixed air masses. Now, no transition periods or mixed air masses are experienced at all? I also strongly recommend calculating the back trajectories for the last five days instead of the three days now used.

4. I would imagine more distinct relation/differences in CCN/CN ratio might occur if trajectories would be used to calculate the time the air masses have travelled over the land prior arriving to the measuring site. One would expect seeing: more time over the land, more coating, more different CCN/CN ratios between the inlets. This way one would get a discrete value of the air mass "age" over the continent instead of subjective

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air mass classification. Could you comment on this?

5. The text had some unclear sentences and was partly hard to follow. It would improve the quality of the paper if a native English speaking person could check the spelling and grammar. Due to this, later on I leave the grammatical corrections on less notice.

6. Since we are talking about sub micrometre particles, I would prefer using nanometre throughout the text as main diameter unit instead of micrometre. Now both are used and mixed.

Specific comments:

Abstract

- Lines 11-13: "For each air mass type, the aerosol bulk chemical composition used was that previously determined from cascade impactor samples by Sellegri et al. (2003)". Where is this information used? Please, explain more in the text or delete if not used. Is Sellegri 2003a or 2003b meant here?

Experimental

- Line 4: Please present the coordinates of the site more precisely (i.e. with degrees and minutes or degree with two decimals)

- Line 7: "are monitored all year long", suggest changing to "are monitored continuously".

- Line 10: "cloudiness", suggest changing to "cloudy".

- Page 9549, line 16: What is meant by "the DMA was operated at ambient humidity"? The sample air was not dried? The sheath air is also in ambient humidity? Please also report the sample and sheath air flows instead of the ratio.

- Page 9549, lines 17-19: Why CN concentrations are only used from the size range of 15-300 nm? This needs an explanation. Particles larger than 300 nm will certainly

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activate as cloud droplets. This might be one reason why in some cases more CCN is observed than CN (i.e. 1 April). On the other hand, in atmospheric conditions, particles of 15 nm in diameter will most probably not activate as cloud droplets. Comment?

- Page 9549, lines 27-29: "Pollution events provide the most frequent aerosol type at the measuring site." Does this just mean that the air masses have travelled over the land for some time or is it something more specific? For example which cases of the measurement data could be "pollution events"?

Results and discussion

- As I mentioned earlier, I would think about the trajectory classification once more since it is the basis for the whole study. Please renew it and make it more precise. This reflects to most of the results and therefore I find them partly bit difficult to comment.

- Here you have four air mass types, but in Figure 2 there is five types and with different names. Please use consistent types throughout the paper.

- A comment could be added about what the authors would expect how the seasonal differences/variations affect on their results.

- Most parts of section 3.2 should belong to experimental section. Basically no results or relating discussion are presented under section 3.2.

- A table of the results for different air masses would be useful to the reader. In the table (or in the text) authors could also include the number of cases (or hours) that each air mass was experienced.

- Page 9550, lines 25-26: "Thus, the CCN/CN computed values which are statistically different (at the 99% confidence level) for each of the air mass types, appear to vary significantly with the air mass origin." This sentence is somewhat confusing to me. Is the same thing said here twice or is something else meant to be said? How many data points there are in each class? Is this enough for the statistical conclusions presented?

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- Page 9553, lines 5-9: Here is said that the continental case (27 March) has "short time over the continent or is coming from rather clear environment". On which facts is this statement based? The trajectory path is over the continent for more than three days and the particle concentration is the highest of all cases. I would delete this case from the specific conclusion since also some difference in CCN/CN ratio is seen on this day, contributing to the other arguments.

Figures

Figure 1:

- Since colour figures are accepted, I recommend plotting the trajectories in colour to make the figure easier to read.

- I recommend plotting five day trajectories and the authors have to think how to plot the trajectories when they are available for every hour. Probably the trajectories could be plotted at noon or using clusterizing (or averages of one day).

- I would try plotting the lower graph with time on x-axis and including colours. Current figure is somewhat unclear.

- Please add units: deg N, deg E, deg W.

- Is the trajectory time local time or UTC? Please mention (also in the text).

Figure 2:

- This figure will change after re-analysing the trajectories.

- Set the y-axis limits so that all values fit in to the figure (i.e. CN in continental case).

- Background colour is missing in the beginning of 28 March.

- It seems that some CCN/CN values are missing on 2 April and on 4 April.

- Caption: "with sigma bars", probably means "standard deviation".

Figures 3-6:

- I would use same y-axis limits in all four cases, if possible, to make the comparison easier. At least to some extent this can be done without losing information.

- Use same x-axis tickmarks in all Figures. Now some are in six hour interval and some in three hour interval.

- Use the same unit in e) plots. Now some are dN and some dN/dloD.

- Add unit for e) plot x-axis, Dp (nm).

- The x-label for plots a-c should probably be "Time" instead of "Date".

- In Figure 5 some x-axis tickmarks are missing in plot b and c.

- In Figure 5e), the size distribution is plotted up to 700 nm while in the other cases it is plotted up to 300 nm. Please make consistent.

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