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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Physical properties of the sub-micrometer aerosol over the Amazon rainforest during the wet-to-dry season transition – comparison of modeled and measured CCN concentrations" *by* J. Rissler et al.

J. Rissler et al.

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GENERAL COMMENTS

After reading and reflecting on the comments from Referee 1 the manuscript was proofread (again) and most comments taken as a good guideline when changing the manuscript. We have tried to reformulate and simplify complicated sentences. We have also tried to be consistent with verb tense, choosing the verb tense we think are most appropriate. For actions taken during the actual field campaign, in the data evaluation and in the calculations we use past tense, but in some cases for theory, and also certain instrumental issues that are still valid, we use present tense.

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OUR ANSWER TO SPECIFIC COMMENTS FOLLOWS BELOW:

1. Introduction

Lines 9-10, page 3161: deleted word: "particles" - changes made according to comment.

Lines 13 and 25-26, page 3161: We agree with the referee that some words might be value judgments. This was however not obvious for a non-native speaker. We have changed the sentences with the "most striking examples".

2. The experiment

Lines 22-23, page 3166: Unfortunately this is a fact we cannot change. In the last sentence "at" is changed to "of" - as suggested.

Line 5 of page 3167: "was" changed to "were" - as suggested.

Lines 5 and 12, page 3167: We replaced the expression "quality assure" by slightly changing the sentences to "and the quality assured off-line" (line 5) and "later used to assure the quality of the data" (line 12).

3. CCN calculation model

Line 16, page 3169: As suggested by the referee, we change this section in order to make it more clear that the model is developed with data from the H-TDMA in mind.

Lines 10-11, page 3170: We describe e as the equilibrium partial pressure over the droplet and es(T) might as the equilibrium over a flat surface - as suggested.

Line 10, page 3172: ds is described as the dry particle size - as suggested.

Line 14 of page 3172: In the text we removed the word "non-ideal" to avoid confusion. Still, the reason for using a model salt is that the hygroscopic growth for most compounds slightly deviates from the ideal behavior predicted with Raoult's law - i.e. has a non-ideal behavior. If the hygroscopic growth is mostly due to the dominating inorganic

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salt, this salt should be the best to use in our model. The sensitivity of the non-ideal behavior of the model salt is investigated later in the article.

Lines 14-17, page 3172: We agree this might not be obvious and therefore include the suggested equation.

Lines 17-18, page 3172: "Needless to say" is removed - as suggested.

4. Submicron physical properties

Lines 8-10, page 3175: We specified the time periods more - as suggested.

Lines 21-22, page 3176: The parentheses was removed - as suggested.

Line 26, page 3179- line 3, page 3180: The bars in figure 3 indicates the standard deviation of each measured size with the DMPS and not the instrumental error. We do not argue that there are significant differences, nor do we seek to find such differences. We merely wish to describe the size distributions (and their variability) observed during each defined time period.

Page 3180: So far we did not find any good reference on size distributions of particles from small grass fires measured in the region with a DMPS. One reference was found from flights measurements over southern Africa (SAFARI) during biomass burning (Jim Haywood, Pete Francis, Oleg Dubovik, Martin Glew and Brent Holben, Comparison of aerosol size distributions, radiative properties, and optical depths determined by aircraft observations and Sun photometers during SAFARI 2000, J. of Geophys. Res., Vol 108, No. D13, 8471, doi:10.1029/2002JD002250, 2003). In this area the source is known to be dominated by grass fires. The size distribution was measured with a PCASP (Passive Cavity Aerosol Spectrometer Probe). Comparing the size distributions measured during SAFARI and CLAIRE, during the small grass fires, the distributions were alike, with a slightly wider peak and a small shift towards lower size for CLAIRE 2001. Number concentration depends strongly on the source strength and since the extent of this fire as limited the number concentration is lower.

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Another reference (Christensen et al., The formation of submicron aerosol particles HCl and SO2 in straw-fired boilers, J. Aerosol Sci., Vol 29, No. 4, 421-444, 1998) was found from straw-fired boilers, but the number size distributions are very much dependent on burning conditions. In this reference the size distribution is shifted towards higher diameters with munch higher concentrations, and we don't think it is relevant to compare.

Lines 3-5, page 3181: We remove "probable".

Line 12, page 3183: We removed the reference to Figure 2c.

Lines 5-6, page 3184: The parenthesis was removed and instead a sentence was added in the first section, chapter 4.2.3.

5. CCN prediction

Lines 14-15, page 3188: A reference to table 4 was added - as suggested.

Lines 15-17, page 3188: We are not sure what the referee means with this comment. The uncertainty in supersaturation is discussed in section 2.2.3. In the Nenes et al. reference there is also a short discussion about sedimentation rates and other uncertainties. In the CCN counter used, the number is measured directly using a video camera and not estimated from light scattering. Another reason for the large uncertainty is the small detection volume in the CCN counter. We think the article is extensive as it is and we don't want to go into this discussion. Interested readers can look up the reference. We therefore so we put in the reference to Nenes et al.

Line 3, page 3189: The word should be "reduced" and not "reducted". The CCN counter had a short interruption during the clean period. The comparison was made only for the periods when all three instruments were running in parallel. In the final version of the manuscript this sentence was removed and a comment instead added in section 2, chapter 5.1.

Line 15, page 3189: Several times in the section we before mentioned the "hygro-

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scopic" group without specifying it. We changed it to "less hygroscopic" to make it clear.

Line 19, page, 3190: Ni was changed to ni.

Tables and Figures

Table 4: The recent biomass period is split into two time periods because the "CCN concentrations were slightly over predicted during some periods (e.g., 25 July 15:00 - 26 July 12:00 UTC), while under predicted during others (e.g., 26 July 12:00 - 28 July 04:00 UTC)" (written in section 3, chapter 5.1). These two periods are separated in table 4 to show this trend. To clarify this, a comment is added in the text to table 4.

The terminology was changed during writing from "young biomass burning" to "recent biomass burning". We forgot to change this in the tables. This is done in a new version of the article.

The reason for not including S=0.12% in table 4 is because at this low supersaturation we have extremely few activated droplets and a very small detection volume in the CCN counter. Therefore the number is not behaving linear but rather as a "step function". The average is still interesting, but calculating correlation does not give relevant information. This information is added in chapter 5.1, paragraph 3.

Figure 2: The original figure was planned to be one full A4-page. To make the figure more clear figure 2c is removed. The final size is decided by the editor and publisher, not by us.

Figure 3: The right axes were corrected. However, we do think that it is relevant to plot the size distributions and the size/supersaturation in the same figure since this illustrates the connection between the size distribution and the activation diameter applied integrating the size distribution at different supersaturations.

Figure 4: The plots for different supersaturations look very similar and we don't think it is necessary to show more time series. The article contains many figures as it is. The

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intercomparison at the various supersaturations can be found in table 4.

Figure 7: We agree with the referee comment that the different groups of curves, corresponding to the different time periods, should be labeled.

More changes have and will be made to a newer version of the article.

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