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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Biomass burning aerosol emissions from vegetation fires: particle number and mass emission factors and size distributions" *by* S. Janhäll et al.

Anonymous Referee #2

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This manuscript deals with a very important and timely subject of atmospheric aerosols, particle emissions from biomass burning. The authors have collected published data from a very large set of publications and present parameterizations that will very probably be used in various models and also in interpreting experimental data. It is for sure a paper that should be published. There are some points that I didn't understand and wish to be changed or modified to make the paper more readable.

1) I find it very good that you have also used the bivariate regression methods for data where both variables have uncertainties. These methods obviously yield the uncertainties of both slope and offset, as in Eqs. 3 – 5. But since I (and many other amospheric

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scientists) am not familiar with the bivariate method, I don't really understand what the uncertainties mean and I didn't find an explanation in the text either. So, what do the uncertainties mean? Is it some probability range?

2) You write that you use the standard regression method to get the relationship between EF and MCE. However, then you also seem to get some uncertainties for the resulting regression lines, Eqs. 6 – 10. When I use the standard linear regression in Excel or Matlab, I don't get any uncertainties as in the above equations, just a correlation coefficient or a squared correlation coefficient. So, what are these uncertainties and where and how do you get them?

3) One more thing I am not quite sure of concerning Eqs. 6 – 10: you present the formulas this way EF = (A – B*MCE) $\pm$ E where E is the uncertainty in all the above formulas. I am not quite sure what this means. I suppose it means simply this: EF = (A – B*MCE) $\pm$ E = – B*MCE + A $\pm$ E Have I understood right? If I have, why are there the parentheses? It confuses at least me a bit.

4) P10L22-25: "All analyses shown here have been repeated on a dataset including also PM3.5, PM4 and PM0.5 data to show the limited effect resulting from adding data with slightly different particle size limits (Tab S2 and S3 in Supplement)." In tables S2 and S3 I did not find any information regarding PM3.5, PM4 and PM0.5, just PM0.5-4. So I don't understand how you draw the conclusion of the sentence above.

5) P11L5-6. "F-statistics analysis shows that EFPM is MCE dependent, while the PM/CO emission ratio has no MCE dependence (Table 3)." It is hard to draw any such conclusions like this based on Table 3. There are only four lines. MCE values vary very little: 0.91, 0.93, 0.93, 0.92, when EFPM has values 11, 6, 5, 7 and PM/CO values 0.13, 0.08, 0.07, 0.09. I see here just as good or bad a correlation between EFPM and MCE as between PM/CO and MCE (actually, EFPM and PM/CO correlate very well) so please give a bit stronger explanation for your statement which may probably be true.

6) P11L6-8 "In some studies, the CO emission factor is not given and the PM/CO emis-

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sion ratio is based on the CO emission factor calculated from MCE and an estimated CO2 emission factor" According to the definition of MCE there has to be both CO and CO2 data to calculate MCE. Now you say you have to calculate CO from MCE and CO2 because there is no CO. How can there be MCE without CO? There is something I don't understand here.

7) P11L12-13 "the overall data set (Eq. 10) are shown as lines in Figure 3, with the standard error of the overall data fit shown as a shaded area" I don't see any shaded area in Figure 3. And regarding figures: please go through all of them to see that there is a clear and unambiguous explanation for each line and symbol in the captions.

8)P12L11-12 "particle number emission factors calculated using EFPM, Eqs. 7 - 10, combined with different assumptions, mainly Eqs. 2 and 3 for size distribution" You write much simpler equations as numbered formulas and now this most difficult one is left for the reader to be derived. I have an intuitive feeling of what has been done but I want to be sure. Please write the exact formulas as numbered equations to show how you get from EFPM to EFPN. That would make it much easier to follow the rest of the section. For instance section 6.2 is very difficult to understand without seeing exact formulas – at least I don't really understand section 6.2. After writing the formulas, rewrite also 6.2 with references to the formulas.

9) P12L12-13 "The particle density is assumed not to vary with MCE, and is set to 1300 g m-3". This is too low density, must be a typing error. Water density is 1 kg/L = 1000 kg m-3. Just add a "k".

10) Supplement, Eqs. S3 – S5. The parentheses are probably in a wrong place. For example the formula" Dg / nm= (260 – 82)* σg $\pm$ 11 " should most probably be "Dg / nm= (260 – 82* σg) $\pm$ 11". Otherwise it is a very odd formula.

9) Supplement, table S2. There is not an explanation for each column – what is dEFPM0.5-4?

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