

# ***Interactive comment on “Evaluation of the impact of wood combustion on benzo(a)pyrene concentrations, using ambient air measurements and dispersion modelling in Helsinki, Finland” by Heidi Hellén et al.***

**Heidi Hellén et al.**

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Thank you for the very good comments. We have carefully considered all the comments and improved our manuscript according to them. Please, find below our answers to the general and specific comments:

The largest problem with the manuscript is the inadequate treatment of uncertainty/variation in the presentation. Averages should be presented together with the uncertainty/variation related to the data, in both text and figures. Typically the standard deviation should be given.

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-We have added standard deviations and uncertainties whenever possible (please see also our answers to referee no 1 and for the specific comments below).

Furthermore the text should be checked by a native English-speaking person to correct grammatical errors. I have noted a few here, but not all.

-Native English-speaking person did now the language editing for the manuscript

Specific comments:

Abstract: Explain all abbreviations the first time they occur.

-we did this

Page 2 line 8-9: "This could be related to the ongoing and not decreasing sources." This is an unspecific and unclear statement. Please clarify.

-this unclear sentence was deleted

P2 line 15: Change to: If we consider the reference level... -We changed this

P2 line 20: Add relevant references to the first sentence. The first sentence of this paragraph is on PAH, while the rest of the paragraph presents the study of Butt et al. on PM, not PAHs. I suggest to gather the discussion of previous studies according to the components. It would also be useful to present information on emission inventories, especially for Finland.

-this paragraph was changed. The first sentence was combined with discussion on previous studies and part on PM was removed. There are no emission inventories for BaP and wood combustion available for Finland.

P3 L9: Please consider the effect of improved stoves leading to lower emissions per kg wood combusted.

-based on the recommendations other referee and our reconsideration, this paragraph was removed since it was discussing PM and not BaP.

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P3 L11: Unclear sentence which needs revision.

-based on the recommendations other referee and our reconsideration, this paragraph was removed since it was discussing PM and not BaP.

P3 L24-25: Please indicate here how this is overcome in the present work.

-we added a sentence 'In this study we combined all ambient air data from 8 years of measurements with a recent emission inventory and dispersion modelling to better characterize wood combustion as a BaP source.'

P4 site descriptions: It would be useful to provide more information on the distance between measurement sites in non-urban areas and nearby houses with wood stoves.

-distance between measurement sites is shown in Fig. 1.

-better description of suburban measurement sites was added. In these 8 areas, the measurement sites were surrounded by detached houses. Wood combustion appliances are used in 90% of the detached houses in the HMA. Fig. 1 shows the number of houses per hectare. The nearest detached houses were located about 10-25 m distance from the measurement sites.

P5 Section 2.2: Please provide more information on the measurement methods, especially the analysis methods for both PAH and levoglucosan (columns, temperature program, standards and so on).

-better descriptions on measurement methods were added

Line18: Did you really use deionized water and not MilliQ water?

- word 'deionized' water was changed to 'MilliQ' water.

P6 L5: the amount of the wood combusted -> the amount of wood combusted...

-corrected

P6 L19-22: Please provide the standard deviations for these averages.

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-we added standard deviations

P8 L19: have been -> are

-corrected

P9 L5-6: Is this data shown?

-This is shown by the box whisker plots in Fig. 2. Reference to this figure was added into the text

P10 L1-4: Please clarify this paragraph.

-more discussion on ratio between BaP and levoglucosan was added

P11 L19: Please discuss the uncertainty associated with this approach.

-Discussion on possible variation of background value has been added into text

P11 L30: Is there previous studies that show this effect?

-we were not able to find any previous studies showing this effect.

P11L31: In general -> Furthermore. Since this is a different problem you discuss.

-this was corrected

P11 L34. Please cite relevant literature here.

-references were added

P12 : Please discuss your results compared to other previous studies.

-discussion on concentration levels were added in the section 3.1.1.

P13 L7-8: Please improve this sentence.

-this sentence was changed

Table 1 and figures: Please provide standard deviations when possible. The points

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in Figures 2 and 3 are annual values and the variation should be clearly stated (even though it might not be feasible to make box and whisker plots). Bars in Fig. 5 also lacks indication of the associated variation.

-we added standard deviations between the years into the table 1 and error bars showing the measurement uncertainty into figure 5.

-Seasonal variation is much higher than inter-annual variation. Therefore we think that showing the standard deviation calculated from the monthly variations for single points in figure 2 and 3 would make them unclear. In these figures annual values are compared with each other and with reference values and therefore we wish to keep box and whisker plots describing the inter-annual variation. Seasonal variations are shown in figure 5 and in supplement figures S1 and S2.

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[Interactive comment on Atmos. Chem. Phys. Discuss., doi:10.5194/acp-2016-780, 2016.](#)

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