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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Ambient aromatic hydrocarbon measurements at Welgegund, South Africa" *by* K. Jaars et al.

Anonymous Referee #1

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The paper by Jaars et al. presents extremely valuable results from ambient aromatic VOC measurements in South Africa. Such papers are particularly needed since VOC data for Africa, in particular on the atmospheric abundance of aromatic compounds, are essentially unavailable. Furthermore, the measurements of aromatic VOCs seem particularly relevant for many African regions which suffer from significant pollution, where no national thresholds for aromatic hazardous VOCs exist with a single exception for benzene.

Not only do the authors report long-term measurements of gas-phase aromatic compounds but they also further analyze polluted air masses in terms of their source origin by using HYSPLIT back-trajectories. They also examine the correlations and ratios between different aromatics in an attempt to recognize the source characteristics (e.g.

the use of solvents) and age of air masses. Three distinct source-area categories were constructed based on the back-trajectories which seemed to work well for providing interesting insights into different regional anthropogenic influences and the characteristics of a more diluted regional background. Finally the authors also look at the effect of these aromatic compounds on ozone formation potential.

The methodology and data analyses seem appropriate. Overall, it is an interesting paper relevant for publication in ACP, if the following comments/suggestions are addressed.

General:

1) The samples were taken twice a week, always on the same days of the week (Tuesday and Saturday) and the same hours of day. Despite certain limitations of such a sampling schedule, it is still impressive to have all year's worth of data for aromatic VOCs from South Africa. However, these limitations at least should be mentioned in the text.

a) Could there be a strong source that occurred regularly outside the sampling periods (e.g. a potential fugitive emission that is released by an industrial facility regularly on Thursdays)? It might be useful to add just a short clarification about data interpretation and the possibility of missed emissions.

b) Would there be expected any consequences from sampling outside of the traffic rush hours? I am also curious if there were any differences between the Tuesday data and Saturday data?

c) It could be interesting to see the diurnal variations if such data even for the short period are available or this could be an idea for future measurements.

2) There seems to be a small inconsistency in using mean and median in the manuscript. For example, the annual NAAQS standard for benzene is expressed as average but it is compared to the measured median value. If the pollution events are

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episodic it might be that the mean is much larger than the median. However, I like the box plots in Fig. 2 which contain both, and I find particularly interesting very high monthly mean values of benzene concentration in May and November which could be worth discussing further (e.g. for specific pollution episodes). Generally, the mean and maximum values are mostly not discussed but might serve an additional interesting information potentially worth discussion.

3) Conclusions seem to have a potential for improvement. The current version contains some unnecessary repeated material that perhaps does not need to be highlighted, while the most interesting points and take-home messages could probably be stronger emphasized. See also comment #18 for some example specific changes that could be considered.

Specific:

4) Page 4190, Line 21: Consider providing the range also for mean values (e.g. in parentheses).

5) P4190 L22 Insert the value of the local air quality standard and over what time range it corresponds to.

6) P4190 L23 Consider adding also annual mean concentration value (e.g. in parentheses).

7) P4190 L25 “proved” should probably be “indicated”

8) P4192 L3 “consist” should be “consists”

9) P4191 L16 Replace “pollutant species” with “pollutants”. In general the use of the word “species” seems excessive and sometimes can be confused with biological species. Consider replacing some of them with “compound”, “chemical”, etc.

10) P4194 L21-24 How was the metal part of the inlet joined with the Teflon inlet part? What was the temperature of the Teflon section?

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11) P4196 L19 Spell out the acronym HYSPLIT.

12) P4199 L5 you probably meant aromatic hydrocarbons, not “aromatic carbons”.

13) P4201 L22 consider replacing “will” with “can”

14) P4201 L25 “Aromatic hydrocarbons measured in air masses from the Regional Background . . . may also be associated with natural emissions (e.g. Heiden et al., 1999).” These emissions would be very interesting and novel, in particular that you do see smaller number of aromatics intercorrelated over the regional background while there toluene seems anticorrelated with CO and NOx (Fig. 7c). Although it might probably be still difficult to separate those from anthropogenic influences, I wonder, if you can see correlations or coincidences with elevated temperatures? Would it be possible to add the temperature trace to Fig 8?

15) P4202 L2 “each other” should be “one another”

16) P4202 L28 Please revise this sentence as to what was related and what unrelated “Therefore, it seems that the sources of benzene and toluene were related, while the sources of the other aromatic hydrocarbons were related.”

17) P4204 Sect. 3.5

a) Regarding the inter-compound ratios, it should be stated in the text whether the medians or means were used to derive them.

b) The ratios between different aromatics (e.g. shown in Table 1) are the annual ratios. Was there any variation in those ratios on the weekly, monthly basis? If so this might be very interesting to show, for instance, on a graph for each source region, as this could provide an indication of how the specific source contributions varied within each source region.

18) P4206-4207 The conclusions could be expanded to encourage more such measurements, and perhaps could suggest incorporation of national thresholds for toluene

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and other hazardous pollutants which showed the highest concentrations in the region. On the other hand, there are potentially redundant sentences which might not be necessary and could be removed for achieving more coherent message. One example of an unclear sentence which may be distracting is “For air masses that had passed over the Regional Background, benzene and toluene were again linked, but the sources of the other aromatic hydrocarbon species were not necessarily linked.” It is unclear what you mean by “linked benzene and toluene”. As correlation does not imply causation, it might be better to refer just to the correlations. In any case, there is no need to summarize the entire paper, but it would definitely be worth including the most interesting key findings and take-home messages. Finally it would be nice to see some recommendations for the future studies.

19) Fonts in some figures could be enlarged, in particular, I could hardly read Fig 6.

20) Figure 7a-c. These are nice figures! If possible enlarging the numbers on the color scale could be helpful.

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 4189, 2014.