Atmospheric
Chemistry
and Physics
Discussions

Interactive comment on "Airborne observations of IEPOX-derived isoprene SOA in the Amazon during SAMBBA" *by* J. D. Allan et al.

Anonymous Referee #2

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General Comments:

This manuscript presents airborne measurements of the AMS m/z 82 isoprene SOA marker compound, attributed to methylfuran, above the Amazon during the SAMBBA campaign. The flights took place after the onset of the transition to the wet season, hence, under conditions where some biomass pollution is to be expected. Interesting observations include that the AMS m/z 82 compound shows a vertical profile with the highest concentrations at the top of the boundary layer and that evidence is obtained for the organic aerosol containing N-containing compounds. The authors have done considerable efforts to provide explanations for the boundary layer profile of the AMS m/z 82 compound. The explanation that this profile results from repartitioning of semivolatile material, i.e., IEPOX, into the particle phase due to the reduced tempera-

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ture and increased particulate water content appears the most reasonable one.

Specific Comments:

1) Page 12637 – lines 9-12: it would be relevant to mention here other major marker compounds for low-NOx isoprene SOA; these do not only include the 2-methyltetrols but also the C5-alkene triols and IEPOX-derived organosulfates. Suitable references would be Surratt et al. (2006) and (2010), of which the last one is already cited in the manuscript. The cited reference, Pye et al., 2013, is not so appropriate here. However, it could be cited in the context of acidity playing a major role in the formation of isoprene SOA through the IEPOX route.

Ref.: Surratt, J.D., et al., Chemical composition of secondary organic aerosol formed from the photooxidation of isoprene, J. Phys. Chem. A 110, 9665-9690, 2006.

2) I would like to draw attention that an isoprene SOA marker data set is available for a field campaign conducted in the Amazon, namely the 2002 LBA-SMOCC campaign, which spanned part of the dry, the transition and part of the wet season (Claeys et al., 2010); hence, it would be worthwhile to evaluate whether the results obtained in the current study can be related to results obtained for the 2002 LBA-SMOCC campaign. The low-NOx isoprene SOA markers, i.e., the 2-methyltetrols and the C5-alkene triols, were measured in PM2.5 filter samples, and it could be shown that their levels were the highest in the dry season, where the aerosol was most acidic. More specifically, isoprene SOA marker compounds showed an average concentration of 250 ng/m3 during the dry period versus 157 ng/m3 during the transition period and 52 ng/m3 during the wet period. These data are consistent with acidity playing a major role in the formation of isoprene SOA.

Ref.: Claeys, M., et al., Polar organic marker compounds in atmospheric aerosols during the LBA-SMOCC 2002 biomass burning experiment in Rondônia, Brazil: sources and source processes, time series, diel variations and size distributions, Atmos. Chem. Phys. 10, 9319–9331, 2010.

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3) Page 12642 – lines 11-12 and page 12648 – lines 4-19: the authors write: "none of the flights were completely free of influence of combustion sources, as evidenced by the presence of rBC". Based on this observation one can thus expect that the organic aerosol will also contain organics originating from biomass burning, such as N-containing nitro-aromatic compounds, which are specific secondary organic marker compounds for biomass burning (Iinuma et al., 2010; Kitanovski et al., 2012). Nitro-aromatic compounds such as methylnitrocatechols could contribute to the AMS m/z 30 signal, a proxy for organic nitrogen. It is thus well possible that the AMS m/z 30 signal is not only related to isoprene SOA nitrooxy organosulfates but also to nitro-aromatic compounds.

Refs.:

Iinuma, Y., et al., Methyl-nitrocatechols: Atmospheric tracer compounds for biomass burning secondary organic aerosols, Environ. Sci. Technol. 44, 8453–8459, 2010.

Kitanovski, Z., et al., Liquid chromatography tandem mass spectrometry method for characterization of monoaromatic nitro-compounds in atmospheric particulate matter, J. Chromatogr. A 1268, 35-43, 2012.

4) Page 12648 – Boundary layer profile: comment, no action necessary; a very relevant result is that there is a doubling of the m/z 82 AMS marker compound concentration from 20 to 40 ng m-3, although this concentration appears quite high considering that the precursors of this compound, 3-methyltetrahydrofuran-3,4-diols, are not major isoprene SOA marker compounds (Lin et al., 2012). The authors have done a considerable effort to come up with a reasonable explanation for this phenomenon. Among the different hypotheses the first one appears most likely but the last one, although somewhat speculative and impossible to test, also seems reasonable.

5) Page 12653 – Conclusions; lines 15-17: the authors mention that the rBC and NOx concentrations were consistently low but exhibited some residual pollution, indicating that conditions do not have to be pristine for this mechanism to take place. I can concur

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with this conclusion; in fact, it is consistent with earlier field results from the 2002 LBA-SMOCC campaign showing that the highest isoprene SOA marker concentrations were found during the dry period, where the impact of biomass burning pollution was the highest. It therefore would be worthwhile to conduct future airborne experiments in the Amazon and monitor the m/z 82 AMS signal during the dry season.

6) I am aware of a paper reporting high isoprene SOA levels at the top of a Chinese mountain based on filter measurements and wonder whether these observations could be related to the observations of the current study (Fu et al., 2010).

Ref.: Fu, P., et al., Contributions of biogenic volatile organic compounds to the formation of secondary organic aerosols over Mt Tai, Central East China, Atmos. Environ. 44, 4817-4826, 2010.

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 12635, 2014.

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