Atmos. Chem. Phys. Discuss., 14, C5705–C5707, 2014
www.atmos-chem-phys-discuss.net/14/C5705/2014/

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 #3

Received and published: 8 August 2014

Overall Comment and Recommendation:

This study presents novel aircraft AMS measurements of a marker ion at m/z 82 that is ascribed to isoprene epoxydiol (IEPOX)-derived SOA over the Amazon during the transition to the wet season. The m/z 82 ion signals observed in AMS/ACSM data sets have been clearly shown in prior work to be associated with IEPOX-derived SOA products (such as the isomeric 3-methyltetrahydrofuran-3,4-diols) (Robinson et al., 2011, ACP; Lin et al., 2012, ES&T; Budisulistiorini et al., 2013, ES&T); I disagree with one of the other reviewers about their concerns with this ion, especially when PMF is involved. This work seems to support prior lab (Surratt et al., 2010, PNAS; Lin et al., 2012, ES&T; Nguyen et al., 2014, ACP), field (Froyd et al., 2010, PNAS; Lin et al., 2012, ES&T; Lin et al., 2013, ACP; Budisulistiorini et al., 2013, ES&T) and modeling

(Pye et al., 2013, ES&T; Karambelas et al., 2014, ES&T Letters) studies that indicate the importance of acidic sulfate aerosol in promoting IEPOX-derived SOA formation. The measurements presented here are very unique and lacking in the literature and will likely provide a lot of future discussions on how to think about IEPOX-derived SOA formation throughout the boundary layer and free troposphere. I highly recommend this manuscript for publication in ACP, but I kindly request that the authors seriously consider my specific comments/suggestions below before publication as well as the other two reviewer's comments.

Specific Comments/Suggestions:

1.) Page 12636, Abstract, Lines 6-7:

I would say it "mostly occurs" under the low-NO route, but recently Matt Elrod's group (Jacobs et al., 2014, ACPD) showed that OH radical-initiated oxidation of synthetic isoprene hydroxynitrates can yield IEPOX in lower yields ($\sim$13%) compared to the OH radical-initiated oxidation of ISOPOOH (which is about 50-75% yield).

2.) Page 12637, Introduction, Lines 4-7:

Insert appropriate citations for the NOx dependence. These include Kroll et al. (2006, ES&T), Surratt et al. (2006, JPCA), and Surratt et al. (2010, PNAS).

3.) Page 12638, Introduction, Lines 9-13:

If you are going to be specific about sites, I would also say the ground-based Canadian observations by Slowik et al. (2011, ACP) and ground-based measurements in downtown Atlanta, GA by Budisulistiorini et al. (2013, ES&T).

4.) Page 12647, Results, Lines 26-29:

Not necessarily true if hydroxynitrates are being formed from RO2 + NO. As recently shown by Elrod's group (Jacobs et al., 2014, ACPD), synthetic isoprene-derived hydroxynitrates will yield IEPOX once they are further oxidized by OH radicals.

ACPD
14, C5705–C5707, 2014

5.) Page 12653, Discussions, Lines 1-4:

I think the arguements about IEPOX-OA factor (or m/z 82 ion) shifting from that factor to more LV-OOA is spectulative at this time and should be more stated as so. The reason for this is there is a lot more data from the recent SOAS 2013 study that shows from multiple sites that this IEPOX-OA factor is present, is incredibly low volatility, and likely has an atmospheric lifetime of 2 weeks. This data hasn't been published yet, but the authors should be aware of this and be careful in making this conclusion with such a limited data set.

6.) Page 12653, Conclusions, Lines 18-27:

The authors need to be careful here with this conclusion. Although the m/z 82 appears to not be conserved, PMF analyses which is typically used to evaluate AMS organic mass spectral data could still resolve a factor related to IEPOX chemistry. My group has consistently found this in the SE USA, especially from the recent SOAS 2013 field study. Comparison of off-line filter tracer data with this hypothesized IEPOX-OA PMF Factor (which typically has a m/z 82 characteristic ion for its associated mass spectrum) is highly correlated (R2 >0.8). These IEPOX-derived SOA tracers are only highly correlated with this PMF factor and NOT LV-OOA (or any other PMF factor). The question is would the IEPOX-OA factor be more fresh IEPOX-derived SOA at the ground? This seems to remain an unanswered question in the present study with this limited data set.

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