

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

### **Anonymous Referee #3**

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#### 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

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(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 (~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 NO<sub>x</sub> 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 RO<sub>2</sub> + 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.

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

I think the arguments about IEPOX-OA factor (or m/z 82 ion) shifting from that factor to more LV-OOA is speculative 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 ( $R^2 > 0.8$ ). 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.

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