Review on “Characterization of a real-time tracer for IEPOX-SOA from aerosol mass spectrometer measurements” by Hu et al.

General comments

This manuscript presents a relatively comprehensive study using a variety of field and lab results to investigate the strength and limitation of using AMS data to represent ambient SOA formed from IEPOX. This study shows a positive relationship between AMS IEPOX-SOA and GEOS-Chem modeled gas phase IEPOX at many locations globally w and w/o isoprene emission. This study also estimates the interference in C_5H_6O signal from monoterpene and other sources (e.g urban, biomass burning). The authors found that IEPOX-SOA mass loading derived from AMS data is comparable to the measured molecular tracers concentrations in SOAS. The authors also provide a new method to estimate IEPOX-SOA w/o PMF, which may be useful when PMF is not available. This study brings the aerosol community a better understanding of IEPOX SOA derived from AMS measurements, which have been used in many studies of SOA formed from IEPOX. In general, the authors interpret their data carefully. However, there are a few places not clear in the manuscript. I think this manuscript is suitable for publishing in ACP after the authors address my comments below.

Specific comments

The manuscript uses both PMF IEPOX-SOA factor and f_{C5H6O+} to evaluate if AMS data can well represent SOA from IEPOX. I think the PMF IEPOX-SOA factor is the one that most people in the AMS community use to represent IEPOX SOA mass loadings. The authors checked the background values of f_{C5H6O+} in many non-isoprene dominant environments. Could the authors be clear about how those interferences would be reflected in the IEPOX-SOA factor (ug/m^3) ? Also, it is often not clear when the f_{C5H6O+} values in the manuscript are C5H6O+/OA from IEPOX-SOA factor mass spectra only, from all data or from non-IEPOX-SOA factor data. I think it is important to keep them consistent. I suggest using “$f_{C5H6O+.all}$” or other symbol to represent from all data and using “$f_{C5H6O+.IEPOX-SOA}$” or other different symbol to represent from IEPOX-SOA factor data only. I was misled at the beginning when I read the manuscript. For example, in the abstract, *f*C5H6O in IEPOX-SOA of (12–40 ‰) looks much higher than that influenced by monoterpene (3.1 ‰). These values are actually apples and oranges.

Page 11226 line 24-25:

Please state clearly if “the low *f*C5H6O (< 3 ‰) observed in non IEPOX-derived isoprene-SOA” is the result in the lab or in the ambient. Also I think the abstract should be clearer if this result is from part of this study or derived from previous published results.

Figure 2(b)

What about the correlation between IEPOX-SOA and C5-alkene triols and IEPOX-derived organosulfates and dimers?

Page 11232:

"No IEPOX-SOA factor found in areas strongly influenced by urban emissions (e.g. Hayes et al., 2013)" does not give us information whether IEPOX pathway is suppressed by high NO unless you measured high isoprene levels there.

Page 11244:

"Given the spread of values of *f*C5H6O $_{\text{IEPOX-SOA}}$ (12–40 ‰) in different studies, if no additional local IEPOX-SOA spectrum is available for a given site, the estimation from this method should be within a factor of 2 of the actual concentration."

Considering that the interference from monoterpene oxidation is important (e.g. *f*C5H6O in rocky mountain comparable to SE aircraft data: Figure 4) and that estimation from monoterpene interference is derived from only one site (rocky mountain), I think more data are needed to testify the method and the above conclusion is a little bit too strong.

Page 11245

Paragraph 2

"Low tracer values (*f*C5H6O < 3 ‰) are observed in non IEPOX-derived isoprene-SOA, indicating that the tracer ion is specifically enhanced from IEPOX-SOA, and is not a tracer for all SOA from isoprene." Please also state if this is lab or ambient result because the paragraph starts with " In ambient OA …" and this sentence is somehow misleading when I read.

Figure 2 and Figure 7:

Could the authors give more information about how to get IEPOX-SOA in ug/m^3 ? The mass spectrum of IEPOX-SOA factor in Figure 2 (b) shows many other peaks besides 82 m/z. Is IEPOX-SOA in ug/m^3 a function of f_{C5H6O} in IEPOX-SOA factor and the "weighing" of IEPOX-SOA factor compared to other OA factors? I think this is important to help non AMS people better understand AMS IEPOX-SOA data. The results in Figure 7 and the statement in abstract "During the SOAS study, 78% of IEPOX-SOA is accounted for the measured molecular tracers" rely heavily on this.

In addition, could the authors provide the uncertainties (or error bars) of the data shown in Figure 7? The statement of "During the SOAS study, 78% of IEPOX-SOA is accounted for the measured molecular tracers, making it the highest level of molecular identification of an ambient SOA component to our knowledge." in the abstract also points to the importance to know the uncertainty.

Technical correction:

Page 11226 Line 9: please define “SOAS”

Figure 3: red curves in (a) are hard to distinguish. So are the green ones in (b). Please state clearly what the small dots are in (d).

Figure 3 and 5: the legends are way too small and won’t show up readable in print version.

Check the references to make sure they are recently updated.