Referee comment on

"Examining the effects of anthropogenic emissions on isoprene-derived secondary organic aerosol formation during the 2013 Southern Oxidant and Aerosol Study (SOAS) at the Look Rock, Tennessee, ground site"

by Budisulistiorini et al., Atmos. Chem. Phys. Discuss., 15, 7365-7417, 2015.

Anonymous referee #3

This manuscript describes results obtained at the ground site of Look Rock, TN, during the 2013 Southern Oxidant and Aerosol Study (SOAS). A large set of instruments was deployed to measure the particle chemical composition (with on-line and off-line techniques) and gas-phase compounds. Results reported in this manuscript concern mainly non-refractory submicron particles (NR-PM_1) with an Aerodyne aerosol chemical speciation monitor (ACSM), isoprene-derived secondary organic aerosol (SOA) tracers from filter samplings, and gaseous compounds with a high-resolution time-of-flight chemical ionization mass spectrometer (HR-ToF-CIMS) and a proton transfer reaction time-of-flight mass spectrometer (PTR-ToF-MS).

The authors showed that isoprene-derived SOA contributed significantly to the total organic mass, and that almost all the tracers quantified with off-line techniques were isoprene epoxydiol (IEPOX)-derived compounds. Results obtained suggest that IEPOX-derived SOA was not formed locally but rather during long-range transport, during which anthropogenic and biogenic emissions mix and interact.

This manuscript is well written, fits the scope of the journal, and provides interesting information on the complex mechanisms leading to the formation of isoprene-derived SOA. I recommend its publication in Atmospheric Chemistry and Physics after minor revisions.

Specific comments:

1) Section 2.1: A better description of the sampling site is needed to fully understand the rest of the manuscript. If the authors include just one figure with a map of the region and a wind rose plot for the entire campaign, it will help a lot to better understand the different air masses, where the anthropogenic influences come from, etc. Without this information, even the back-trajectories given in the supplementary material (Figures S12 and S13) are impossible to understand, because we have no idea on the locations of biogenic or anthropogenic sources.

2) Section 2.2: According to results shown later (section 3.4.1, Figure 6a), particles seem rather acidic. In these conditions, the use of a constant collection efficiency (CE) of 0.5 for the ACSM is not appropriate. I suggest that the authors introduce a time-dependant CE using equation 4 in Middlebrook et al. (2012).

3) Section 3.2: Additional information is needed in the supplementary material to support the choice of the 3-factor solution. In particular, it would be important to show mass spectra of the PMF factors for the 2-, 4-, and eventually 5-factor solution, in order to see how the OOA split into different factors. In addition to that, it would be useful to show a few diagnostic plots, such as the correlation among the PMF factors based on time series and mass spectra (so the same graph as Figure S3, panel d) for the 2-, 4-, and eventually 5-factor solution.

   Moreover, can the authors confirm that they do not resolve a hydrocarbon-like organic aerosol (HOA) factor, even if they go up to 10 factors? This is a bit surprising for a site which is supposed

to have anthropogenic influences. This result, coupled to the low concentration of primary pollutants (BC, NO_x, CO), suggests that anthropogenic influences were quite limited at the sampling site.

4) Section 3.3: It seems there is a mistake in the percentages of isoprene-derived SOA tracers reported in this section. Thus, the contribution of IEPOX- (96.8%) and MAE- (8.8%) derived tracers to the total isoprene-derived SOA mass is higher than 100% (page 7389, line 5). Moreover, the sum of all the tracers given in Table 1 reaches 101.6%.

Technical corrections:

1) Page 7368, line 1: "methacrylic acid epoxide (MAE)". Actually, MAE appears for the first time 2 lines earlier (page 7367, line 27), so the abbreviation should be defined already there.

2) Page 7384, line 28: "but higher than ~~that~~ those".

3) Page 7393, line 3: "decrease in the ~~in~~ predicted IEPOX SOA".

4) Supplementary material, page 13, line 5: "organic ~~aerosol~~ mass (OM)"

5) Supplementary material, page 15, line 2: "the ~~2014~~ 2013 SOAS field study".

6) Supplementary material, page 16, line 1: "24-hr model during_the first".

Reference:

Middlebrook, A. M., Bahreini, R., Jimenez, J. L., and Canagaratna, M. R.: Evaluation of Composition-Dependent Collection Efficiencies for the Aerodyne Aerosol Mass Spectrometer using Field Data, Aerosol Sci. Technol., 46, 258-271, 10.1080/02786826.2011.620041, 2012.