

Atmos. Chem. Phys. Discuss., referee comment RC2
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Comment on acp-2021-416

Anonymous Referee #2

Referee comment on "Measurement report: Variability in the composition of biogenic volatile organic compounds in a Southeastern US forest and their role in atmospheric reactivity" by Deborah F. McGlynn et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2021-416-RC2>, 2021

General Comments:

The paper by McGlynn et al. presents a 1-year dataset (Sep-2019 to Sep-2020) of selected biogenic volatile organic compounds (VOCs) from a mixed forest in Central Virginia, S.E. USA. The measurements were performed using an automated gas chromatograph-flame ionization detector (GC-FID). The mixing ratios of isoprene, isoprene oxidation products, monoterpenes and sesquiterpenes were reported and analyzed for their impact on hydroxy radical (OH), ozone, and nitrate reactivity contributions. Summertime average values of isoprene were as high as 6 ppb and had distinct summer max -winter min seasonality, whereas for monoterpenes the mixing ratios generally ranged from few hundred ppt to 1 ppb, throughout the year. A major objective was speciation of monoterpenes to improve model descriptions and non-isomer-resolved measurements of this chemical class to aid tropospheric chemistry studies.

This is an interesting and valuable study which would be a great addition to the literature, also because of the description of the analytical system since BVOCs can be challenging to quantify on hourly temporal scale continuously for a full year. I recommend publication in ACP after the authors have addressed the comments below.

Comments:

Figure 3 and 4 and elsewhere in the text ppb is referred to as concentration. Concentration is always amount of a substance (moles /kg etc..) per unit volume. ppb is nmol per mol and a molar mixing ratio. This should be corrected everywhere in the text and the Figures (e.g. 2 and 3).

Figure quality can be improved, please see suggestions below.

Abstract:

L14: I suggest replacing isoprene reaction products with isoprene oxidation products here and throughout the manuscript because reaction is more generic.

Introduction:

L52- mitigating inaccuracies? Perhaps reducing inaccuracies is better choice?

Methods and location:

It is mentioned that the site received air masses with anthropogenic influence and also that the year was classified simply into two seasons namely growing and non-growing season. As the forest is mixed and has both isoprene and monoterpene emitters, it would be useful to some quantitative information on the tree species composition of the forest. Also here and later while interpreting the data, the authors should highlight the known isoprene and monoterpene emitters.

Further there is no information provided on the meteorological conditions such a temperature and rainfall and solar radiation in different months of the year. As biogenic emissions are driven by environmental conditions the authors need to do a better job in describing these and also using it for interpreting the ambient data.

L95: Please add details concerning the inlet residence time, rain events during deployment and efficiency of ozone scrubber.

L105: how often over the full year was there a need to replace columns, parts and troubleshoot? This would be helpful for readers those who may be interested in using such

system.

L124-125: 0.0 ppt is so highly significant. Here and in the Table 2 (0.00??) the authors may wish to correct such unrealistic values by below detection limit etc..

please mention how many such instances and values also (what fraction of the dataset?)

L133: please elaborate what is meant by cosine similarity of 0.85 as these are not routine

L139 please clarify whether the rate constants were corrected for temperature?

Figure 3 : Monoterpenes should be sum of monoterpenes in caption?

Between Jan 2020 and April 2020 almost all are close to zero! Some explanation and additional details are required in terms of LAI and environmental conditions.

Also please clarify: Are gaps due to species being below detection limit or instrument issues? Periods when calibration experiments were carried out should be either provided in a separate Table or highlighted in the Figure. Also please mention whether the sensitivity of the compounds changed during the year-long deployment.

Figure 3: Why are isoprene oxidation products 0.6 ppb in Sep-Oct 2019 for isoprene of 4 ppb and also 0.6 ppb for isoprene of 10 ppb in July 2020? This needs to be clarified.

Figure 3 and Figure 4: Please add the compounds names in the panel for easy readability.

L155-160: Are the trees without leaves.. discuss which trees are known to be high isoprene emitters..which are MT emitters? discuss the leaf phenology at the site during the year.

L157: 0.27 ± 0.28 ..here and in other instances please state interquartile range instead of instead of std dev to indicate ambient variability

The Results and Discussion can further benefit through comparison to previous studies at similar latitudes. For example L175 -183 the discussion could benefit from temperature and radiation regimes in which emissions are lower or higher.. see for example an analyses in the growing season. Detailed analyses of temperature and radiation regimes associated with highest isoprene emission and formation of photochemically formed compounds (see for e.g. Mishra et al. Emission drivers and variability of ambient isoprene, formaldehyde and acetaldehyde in north-west India during monsoon season, Environmental Pollution, Vol. 267, 115538, 2020) would also provide further mechanistic insights.

L186-187: OH oxidation and boundary layer dynamics ... radiation and temperature measurements would be helpful also for these and whatever information is available should be provided in this context

Figure 4: mention compound labels inside panels and seasons inside the panels

L202-205: also speciation is different... many abundant OVOCs such as methanol, acetaldehyde and acetone are missing from the present study? Please add discussion

Figure 8: Please label the oxidants in main figure

L247: account instead of accounts