Atmospheric Measurement Techniques Discussions

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Comment on amt-2021-265

Anonymous Referee #1

Referee comment on "Design and characterization of a semi-open dynamic chamber for measuring biogenic volatile organic compound (BVOC) emissions from plants" by Jianqiang Zeng et al., Atmos. Meas. Tech. Discuss., https://doi.org/10.5194/amt-2021-265-RC1, 2021

General comments:

The manuscript gives a good example on an evaluation of a semi open dynamic BVOC chamber. While technical in my opinion nothing significant new was introduced, the throughout characterization (e.g. transport efficency) and behavior of different BVOC types in such chamber systems is quite helpful for further developments and corrects of such chamber setups. Currently the manuscript lacks at some parts detailed information and two major issues regarding measurement of the flow rate and background concentration C_0 arises. Length and language wise the manuscript is good. Also it would be nice if the author would show some estimated emission rates from the field test.

Abstract: Concise with enough information

Highlights: Make sense.

1 Introduction: The introduction shows the general issues and importance of testing / characterizing BVOC chamber systems in order to generate correct emission inventory data or to perform BVOC related plant experiments. Length of the introduction is sufficient. Most actual literature is covered.

2.1 The description of the chamber system lacks some details and some questions is arising regarding the measured flow of the chamber, since it is not clear if both analyzers and the automatic sampler add up to the total flow. Also I am missing a leaf temperature sensor, since air and leaf / branch temperature can slightly differ from the ambient air temperature due to heat up from the incoming radiation. Did you consider to add such as sensor or why is it not installed?

Also a real photograph of the chamber should be included into the manuscript (e.g. as Fig 1 B or to the supplement) to see the construction.

2.2. Logical and sound description Some details are missing.

2.3. Okay

2.4 Nice and interesting test. It is not clear if the holes of the inlet were closed. Please describe the sample setup a bit better.

2.5. Overall ok. Some info's are missing. How is the inlet concentration C_0 measured or did you use a second empty chamber for this? How long are the tubing in these field tests, since the chamber were in 20m and 12m height? Does length of the tubes play a role in terms of compound loss / adsorption and in case of the automatic sample add a dead unflushed volume?

3. Should this section not be 3.1 with a header? How is C_0 measured? This was not stated in section 2 and is crucial for all calculations. Also this part might be also fitting more into the method section.

3.1. Maybe add that these results are based on the lab test, it is a bit unclear in the beginning.

3.2.2 Could you please implement a statistical test to verify your result are differing between the humidity ranges.

3.2.3 Interesting idea. Should be somehow tested in future studies in the field.

3.3 Overall nice insights on the chamber performance. I am somehow missing the report of any emission rates derived from the field tests.

3.3.1 Okay, sound reasonable and should be expected, since heat is transported out of the chamber.

4. Conclusion Please specify future research a bit more detailed.

References Nothing found.

Figures: In general, the figures (in MS / supplement) are mostly good und need only small adjustments. However, the current quality seems like a bit compressed or scanned.

Specific comments:

L.130: specify the pump; is the flow controlled with a mass flow controller? If I interpret Fig 1 correctly the pump is connected to outlet 3 or? So in case you use the automatic sampler another pump is sucking the air the cartridges. Is this also mass flow controlled?

L.131: specify the fan

L.138: is the sensor housing also made from an inert material?

L.143: what diameter do the tubes have? Are the connectors / fittings also made of Teflon.

L.144. please specify the flowmeter and mass flow controller. The PTRMS and CO2 / H2O analyzer is connected to outlet 3. Do both analyzers have their own pump and mass flow controllers. Does this add up to overall flow? If so, the flowmeter should be placed before the outlet to the analyzers. Other calculations of the emission would be wrong, since you have slight higher flowrate than measured.

L.150 Do the air temperature sensors have a radiation protection?

L.159: How long is tube to the sampler. Is outlet 2 also constantly flushed by the outlet air? Otherwise you would measure a relative old dead volume of air (depending of the tube length) which does not represent the actual concentration and composition in the chamber.

L.164-166. How do you deal with humidity in the cartridges? Is there some pre flush of the tube to extract humidity before it goes into the analyzer?

L.166. What trap material was used?

L.170 maybe add to the supplement what M/Z were selected.

L.206 Since you test this with pure nitrogen. Does humidity affect the filter performance?

L.208 Is 10.05% a typo?

L.239 How did you dry the leaves? Was this done for both tree species?

L.240 Temperature outside or inside of the chamber?

L.402 Is there any compound, you would suggest to use which probably does not interact with the plant?

L.408 it should be tissue temperature

L.430-432 Redundant, was already mentioned in 2.5

L.437 How was this measured?

L.455 Such high flow rates might however affect may be transpiration rates of the leaf and thus affect the plant physiology.

L.744-L746 Please add more details to Fig. 1 Were is C0 measured? If you use abbreviation such as MFC, please write it out in the description. A photo of the real chamber would really nice to see.

L.747-750 Fig. 2 Make the arrows a big bigger