

Interactive comment on “Simultaneous leaf-level measurement of trace gas emissions and photosynthesis with a portable photosynthesis system” by Mj Riches et al.

Anonymous Referee #1

Received and published: 11 April 2020

Summary and Recommendation

Riches et al. present a method characterization technique that combines established methods in plant physiology for measuring photosynthesis with established off-line and on-line trace gas measurements. They couple a Licor, Inc. portable photosynthesis system (LI-6800) with two different approaches for measuring plant volatile emissions: adsorbent cartridge sampling followed by off-line thermodesorption GC-MS analysis and on-line trace gas monitoring with a ToF-CIMS using iodide ionization. The paper outlines the approach they used to couple these measurements, characterizes the chemical background of the measurement approach, and present a couple exam-

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ple “case studies” investigating plant volatile emissions as a function of temperature. They also validate the method by comparing CO₂ assimilation measured with the LI-6800 directly with CO₂ assimilation measured with an external CO₂ gas analyzer. The measurement approach and characterization are novel and would help the community address important questions about changing volatile emissions in a changing climate. The paper could be drastically improved with a few moderate revisions focusing on 1) better placing their results in context with other published results and 2) a more thorough analysis of the speciated monoterpene emissions which is data they have but was not presented. These concerns are described in more detail below. If these items are addressed, the paper would more adequately showcase the viability and utility of the measurement approach for addressing some of the major challenges in the field, including a better understanding of climate change effects on emission rates of different monoterpene isomers. I recommend publication after these moderate revisions.

MAJOR COMMENTS

Authors should indicate somewhere what the rationale was for selecting the plants they used in this study. This discussion should also include information on what is already known about their emissions, and how representative/relevant these plants might be overall. This will help place their results in context with the scientific literature on plant volatile emissions.

L. 245-251: results showing persistent signal of some compounds and not others are interesting and worthy of presentation in a results section rather than a methods section, particularly since this is a measurement technique development/characterization paper. I would like to see a more detailed presentation of the results from the carryover testing.

Section 5.1: Please place the CO₂ assimilation rates and volatile emission measurements in context with previous studies. Are these high values for plants overall? Low values? Typical for this type of plant in particular?

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Section 5.3: It is unclear why the authors only present data on two of the monoterpenes they observed. Did all the monoterpene emissions have large variation between leaves and between trees? They have the data, and a more comprehensive analysis of that data is necessary to demonstrate the capability of this measurement approach for conducting the type of comprehensive, speciated terpenoid analysis that the community needs to better understand factors regulating VOC emission rates from plants. Just showing results for two monoterpenes does not accomplish this.

MINOR COMMENTS

Regarding emission rate calculation (equation 5, L. 205): how are they estimating leaf surface area? There are a number of different approaches that often vary depending on type of plant. This should be clarified.

L. 364-365: “though sample collection and analysis is timely.” Timely means “opportune” or “prompt”. I think the author intends to say something more like time-intensive or labor-intensive.

L. 411: “Temperature response curves can be used”. Temperature “response” of what variable? Assimilation? trace gas exchange? All of the above? Unclear what is being referred to.

L. 412-413: “For example, this study suggests that basil has a higher photosynthetic thermotolerance than mint despite the fact that basil had a lower CO₂ assimilation rate.” How so? Can you please elaborate on this referring to specific data in the plots that supports this conclusion?

L. 414: “to that of formic acid or monoterpenes can better inform of the impact and deciding factors”. 2 comments. There is a typo or grammatical error around “can better inform of the impact”. Also, “deciding” doesn’t appear to be an appropriate word choice here. Perhaps “regulating”?

L. 437: “These case study data support that leaf emissions”. Typo or grammatical

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error?

Figure 8: decanal emissions, markers and error bars. If you don't have duplicates to define error bars as standard deviation, I suggest using your analytical error for the error bars. There should be some indication of error, even if it's the small error introduced from the instrumental analysis.

Interactive comment on Atmos. Meas. Tech. Discuss., doi:10.5194/amt-2020-45, 2020.

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