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Biogeosciences Discussions

Interactive comment on "Short term changes in methanol emission and pectin methylesterase activity are not directly affected by light in *Lycopersicon esculentum*" *by* P. Y. Oikawa et al.

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This short submission attempts to resolve the question of whether leaf MeOH production is directly affected by incident light, an issue left somewhat ambiguous in previous studies because light and stomatal conductance covary.

As indicated by other reviewers, the authors carried out three sets of experiments to elucidate this question. In the first set of experiments, the response of both MeOH emission and stomatal conductance to varying light were obtained (although for reasons unclear to me, no data were collected in darkness). Although both MeOH emissions and stomatal conductance increased with increasing light, when emissions were

normalized (i.e., divided by) the rate of conductance, the light effect disappeared. This is taken by the authors as evidence 'that light did not have a direct effect of MeOH emissions.' I question this conclusion. If light were to affect both MeOH production and conductance similarly, the effect on production could well be masked by normalizing the data. Simply consider what a light response curve of net photosynthesis would look like if the data were normalized to stomatal conductance. The light effect on photosynthesis would certainly be greatly obscured, if not apparently eliminated.

In contrast, the other two sets of experiments provide fairly convincing evidence that MeOH production is largely independent of light. In the second set, stomatal conductance was maintained more or less constant through manipulation of the CO2 concentration in the leaf cuvette, while incident light was again reduced from 1150 to 50 umol/m2/s. In this case, MeOH emissions did not vary significantly with light, demonstrating unambiguously that reductions in emissions in the first set of experiments was the result of varying stomatal conductance (although to me the results would be more compelling if MeOH emissions per se, rather than normalized MeOH emissions, were shown in Fig. 2). Nor is it clear whether the statistics given for this experiment represent normalized or non-normalized emissions. The idea suggested by Sharkey in his review of measuring MeOH emissions while forcing stomatal closure using ABA while maintaining constant light and temperature would clearly provide another unambiguous way of teasing apart stomatal vs. direct light effects on emissions. Wish I'd thought of it.

Finally, the third set of experiments investigate whether pectin methylesterase (PME) activity changes in the short-term with variation in light. Although the authors recognize that a potential light effect on MeOH production could arise from other factors such as a substrate limitation, demonstrating the enzyme activity shows no light response would be a useful addition to our understanding of regulation of MeOH emissions. Although, as expected, immature leaves had higher levels of PME activity than did fully expanded leaves, within each age class, light had no significant affect, consistent with the results

discussed above.

In short, although I question the interpretation of the results from the first set of experiments, this contribution accomplishes exactly what it set out to do, and in a straightforward and clearly presented manner. Eliminating light effects on MeOH production in the short-term will simplify future attempts to model MeOH emissions, although no new suggestions for those modeling efforts are presented here. As the authors indicate, the key to modeling MeOH over longer time scales is a better understanding of MeOH release during cell wall expansion/repair, for which indirect light effects cannot be excluded. From the point of view of the atmospheric science community, short-term regulation of MeOH emissions via temperature, solubility or stomatal effects are probably of less interest than longer-term changes in maximal daily emissions as affected by leaf age, leaf growth rates or plant species.

p. 416, l. 20 suggest ". . . and the remainder coming from . . ."

p. 419, l. 17 by "mature leaves" do you mean "fully expanded leaves" or do you consider the terms synonymous? I.e., when is a leaf fully "mature"?

p. 420, l. 1 I am just curious why a data point in the dark was not included

p. 418, l. 15 Actually, the model used assumed that MeOH production increased exponentially with temperature, but did not include a direct light effect.

p. 423, l. 26 Do these statistics apply to MeOH emissions, as implied in the sentence, or to normalized MeOH emissions, as shown in the accompanying figure?

Interactive comment on Biogeosciences Discuss., 8, 415, 2011.