Biogeosciences Discuss.,
doi:10.5194/bg-2017-32-RC1, 2017

Biogeosciences Discussions

Interactive comment on "Isoprene emission and photosynthesis during heat waves and drought in black locust" *by* Ines Bamberger et al.

Anonymous Referee #1

Received and published: 24 February 2017

Isoprene emissions in relationship to plant carbon cycling during drought and high temperature stress is an important and active area of research with numerous papers on this subject in recent years. Isoprene production protects carbon assimilation processes including stabilizing photosynthetic membranes during high temperature stress through numerous potential mechanisms including excess photosynthetic energy consumption, direct antioxidant activity, physical membrane stabilization, and signaling activities of oxidation products. The present study by Bamberger et al. investigated isoprene emissions and net photosynthesis responses in black locust trees growing under controlled environmental conditions before, during, and after drought and heat treatments. As observed in numerous other studies (e.g. Seco et al., 2015), net photosynthesis and isoprene emissions were coupled during non-stress conditions but became strongly uncoupled during heat and drought stress with substantial decreases

in net photosynthesis but a stimulation of isoprene emissions.

General Comments The paper generally lacks any new biochemical and physiological mechanistic description of how isoprene and net photosynthesis can become uncoupled at high temperatures and drought. Thus, it is not clear what new information the new study adds other than reporting these expected results in a new tree species. However, some novel aspects of the work include a characterization of the light and temperature responses of isoprene emissions during stress. However, the very low light saturation of isoprene emissions of both control and stressed trees (200-300 micromol/m2/s) indicates that the plants were not adapted to normal high light conditions of plants in natural ecosystems during the growing season). As only leaves from the lower canopy were measured, it is difficult to understand how these results can be used for modeling of natural isoprene emissions from nature. Studies show that the majority of photosynthesis and isoprene emissions from natural ecosystems occurs in the upper canopy leaves exposed to full sunlight.

Specific Comments Take care when refereeing to photosynthesis; the measurements are of net photosynthesis not of gross rates of photosynthesis, which can be drastically different under high temperatures.

PTR-MS signals at m/z 69 are not necessarily unique to isoprene, especially under drought or high temperature where C5 green leaf volatiles can significantly contribute to their signal (Fall et al. 2001). Since GC measurements were not performed, the results cannot be considered quantitative.

Suggested Citations

Seco, R., Karl, T., Guenther, A., Hosman, K. P., Pallardy, S. G., Gu, L., Geron, C., Harley, P. and Kim, S. (2015), Ecosystem-scale volatile organic compound fluxes during an extreme drought in a broadleaf temperate forest of the Missouri Ozarks (central USA). Glob Change Biol, 21: 3657–3674. doi:10.1111/gcb.12980

Fall R., Karl T., Jordon A. & Lindinger W. (2001) Biogenic C5VOCs: release from leaves after freeze-thaw wounding and occurrence in air at a high mountain observatory. Atmospheric Environment 35, 3905-3916.

Interactive comment on Biogeosciences Discuss., doi:10.5194/bg-2017-32, 2017.