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Biogeosciences Discussions

Interactive comment on "Impact of heat stress on the emissions of monoterpenes, sesquiterpenes, phenolic BVOC and green leaf volatiles from several tree species" *by* E. Kleist et al.

Anonymous Referee #1

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General comments - The manuscript by Kleist et al. aims to investigate the impact of heat stress on various biogenic volatiles organic compounds (BVOCs) belonging to some plant species. Interestingly, the application of the elegant 13CO2 labeling technique during rising temperatures contributed to dissect BVOCs synthesized by using freshly carbon assimilated through photosynthesis from the release of BVOCs stored in preexisting pools.

Despite the manuscript faces a very important issue regarding the effects of Climate Change on BVOCs emission from the vegetation, I have serious concerns about the physiological and ecological meaning of this study. Indeed kind of 'heat stress' has

been applied in an arbitrary manner to some plant individuals without a clear ecological reason behind the species selection. Plants were forced to emit BVOCs without any assessment of the physiological performances thus making the scientific outcome difficult to apply to the real world. Then, an attempt to combine abiotic (heat) with biotic (insect) stress has been made without addressing neither the kind or the level of herbivores infestation found on the plant investigated. As a consequence, the results shown in the manuscript risk to appear only a list of sterile measurements that do not add any novelty to the research field of BOVCs. Overall, the manuscript should be carefully re-worked and (re-thought) before being accepted for publication. Following my major and minor reviews.

Major reviews - The whole manuscript focuses on the impact of heat stress on BVOCs without any discussion about the basic role of BVOCs (especially isoprenoids) in plants protection by exerting a direct antioxidant action (Vickers et al. 2009), or by indirectly contribute to regulate stress-related internal signaling processes (Farmer EE, 2001; Baldwin IT et al. 2006). - Although in Material&Methods section the author mentioned that concentrations of water vapor, CO2 were measured at the same time than other gases, no results have been plotted in the manuscript but only a quick list of data is reported (page 9541 lines 15-19). Indeed it is somehow surprisingly since the kinetics of such fundamental parameters will make a significant contribution to assess plant performances during heat stress, highlighting the physiological meaning of the results achieved. - Moreover, there is no reason why the author have investigated only 'impacts of heat stress on the emissions of BVOC' without providing any information about the recovery period. In fact most often the recovery is a very much interesting period to evaluate plants ability to acclimate to previously applied stress events by activating diverse defense mechanisms. In my opinion 'killing' plants with heat does not give any useful information to investigate the effect of future global change in 'living' plants as the author expected to do. - The explanation given in Material&Methods section on experimental plant material selection is very shallow and it appears to be a random choice without a real logic behind. Therefore, a clear 'selection strategy' should be

addressed as it will also give more ecological relevance to this study. - Since in Table 2 the author shows fluxes of BVOCs in PICOmol m-2s-1, a calibration plot demonstrating the sensitivity of the analytical system employed is more than welcome because such tiny values are very much prone to artifacts. - Despite the very high temperature used to simulate heat waves (sometime reaching 51 °C!) refers to air-temperature, the author stated that this is somehow realistic (page 9547 lines 10-18) because during severe stress event (like drought) leaves inevitably overheat and therefore can experience even higher temperature than air. This is true, but since the author increased the air temperature (and not the leaf temperature), the explanation results faulty. In fact when the AIR temperature was set by the author at 51 °C (in one of the experiments shown) stomata for sure immediately shut (to prevent complete plant dehydration) thus increasing the LEAF temperature far higher than 51 °C, definitely out of any physiological range anyway. - I kindly ask the author to avoid too much broad speculations as the ones reported at the beginning of page 9556 (lines1-7). - The author should avoid to mix up information about Materials&Methods within the Result section (see page 9541 lines 7-12; page 9541-9542 lines 23-28 and lines 1-5, respectively; page 9543 lines 14-17; page 9544 lines 14-19). - English language needs to be polished. In particular, please avoid the abuse of the article “the” as well as the adjective “this/these” in order to improve the fluency of the manuscript.

Minor reviews - page 9534 (line 25): all the vegetation? - page 9534 (line 26): “The source strength of these. . .which ones? - page 0534-9535 (lines 26-1): “The source strength of these BVOCs”. . .which ones? - page 9535 (line 11): For sure there are more ‘up-to-date’ references regarding BVOCs modeling than the one mentioned (see Guenther et al. 2012). - page 9538 (line 12): it is written “chamber temperatures (between 12 and 31 C)”; does it mean 12 C=min and 31=max? If so, why did the author set such a big range of temperature variation? - page 9539: the mathematical formula shown in his page most likely misses a “Æl” letter; please double check it. - page 9541 (line 7): it is written “A three years old beech seedling”; does it mean only ONE tree? I remind the author that (as a rule of thumb) measurements should

be always taken at least in 3 different plant individuals to take into account for natural occurring biodiversity. - page 9544 (line 11): what does it mean “1h twilight”? - page 9544 (line 23-24): what is written in these two lines in not supported by any figures and/or tables in the manuscript. - page 9547 (line 13-14): please rephrase it. - page 9548 (line 11-13): what it is stated here is puzzling; please rephrase it. - page 9548-9549 (line 25-28 and lines 1-4): what it is stated here is puzzling; please rephrase it. - page 9555 (line 1-5): what it is stated here is puzzling; please rephrase it.

Interactive comment on Biogeosciences Discuss., 9, 9533, 2012.