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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Effect of mid-term drought on *Quercus pubescens* BVOC emissions seasonality and their dependence to light and/or temperature" *by* Amélie Saunier et al.

Anonymous Referee #1

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General comments

The manuscript discusses the light and temperature dependencies of several BVOC emissions from a Mediterranean oak species. This manuscript fits in the scope of the journal presenting a BVOC emission study on a relatively little studied tree species. The authors go through the methods they have used thoroughly, and the results are presented in the text and figures clearly. The discussion on the results and conclusions could, however, be deeper and underline how this study increases the understanding of BVOC emission dynamics. Though the manuscript is carefully written, some English language improvement would not be bad idea. My comments below are rather minor though their number is relatively high.

Specific comments

Line 13: You discuss many times about BVOC in singular form, though you actually mean plural BVOCs. Please check these throughout the text.

Line 23: You claim that the three sampling campaigns cover the entire seasonal cycle. However, note that there are likely sub-seasonal periods, which are not covered by your measurements. For example, the highest natural drought at the site is likely in late summer, when you did not measure. Do you think that your results from these three measurement periods are representative enough to model Q. pubescens BVOC emissions year around? If so, why? Could you describe with a few words the physiological state of the oaks during each of the campaigns, e.g. if the new leaf emergence or leaf size growth occurred during the spring measurement period?

Line 24: Amplified drought impacted all studied BVOCs, but not necessarily all the minor compounds that the trees produce but you couldn't quantify.

Line 32: Please use throughout the text the unit formatting as advised in the journal instructions.

Line 34: Please check the use of subscripts in the entire text.

Line 35: You likely mean tropospheric ozone concentration.

Lines 72-74: In my mind, seven commas per a sentence is too much and makes the sentence hard to read. Please edit the sentence e.g.: However, there are still some misunderstandings at the level of emission mechanisms and consequently on model estimations for isoprene and, a fortiori, for highly volatile BVOCs under mild or severe water stress. In addition, you could open which misunderstandings you mean here.

Line 80-81: Please correct: 2 million ha. Note that the study by Keenan et al. (2009) considers only forests, and there are other remarkable sources as well.

Line 86: The site may be free from direct human disturbance, but indirect disturbance

through e.g. air pollution it certainly has experienced.

Line 93: The plots were 200-300 m2 in size. How many trees were growing in the plots? Can you be sure that the trees at the amplified drought plot did not uptake water by their vast root system from the non-drought area?

Lines 96-97: I do not quite hit the idea of the latter part of the sentence: – corresponding for three years, to 2 months for natural treatment and 5 months for amplified treatment of drought period. Please rephrase.

Line 100: You had five trees per treatment, but how many enclosures there were per tree and per sampling campaign? Did you move enclosures from tree to tree during one sampling campaign?

Line 103: To be precise, BVOC exchange between the tree and the atmosphere is a part of tree gas exchange.

Line 104: How much biomass the enclosures enclosed? Please give some numbers (branch length, leaf area, leaf mass or equivalent).

Line 106: A PTFE air generator sounds like it would produce PTFE in the air. Please rephrase.

Line 109: What do you mean by the excess of air humidity? Was the humidity inside the enclosure controlled (currently not stated in the text) and set to some range? If so, please make an addition in the text, as this is rather critical detail in the case of water-soluble compounds.

Line 116: Rather say: made of PTFE.

Line 119: Is reference to chapter 2.2 correct or should it refer to 2.4 (BVOC analysis)?

Line 120: Please edit: gas exchange values.

Line 125: Add s: parameters. Lyophilization is not familiar term to many readers of the

journal, so say rather: –were lyophilized (freeze-dried) to assess the dry mass.

Line 140-141: You say that formaldehyde calculation took into account the humidity-dependence. What about the other humidity-dependent compounds? Could the clearly visible steps methanol and acetone fluxes in the late evenings of natural drought (fig. 4 and S3) be humidity-related? Anyhow, there seems to be something else happening simultaneously: net photosynthesis rises to positive values just before midnight (fig. 1, autumn, natural drought). Something wrong with the measurements or calculation?

Line 145: Why did you choose to express the emission rates as C (carbon)?

Line 164-165: Please rephrase for example as follows: Afterwards, linear regression tests and slope tests (equal to 1) were also performed.

Line 168: Have you any data how dry the soil actually was? Any soil volumetric water content measurements or equivalent throughout the seasons?

Line 171: Please correct spelling: other season and stomatal closure (the latter one in some following lines as well).

Line 177: I wonder if you have any tree growth data from the site? In ceasing growth (height growth or lateral growth depending on timing) you might see drought effect earlier than in photosynthesis. The results are not discussed and compared to literature too much, so you could here e.g. refer to an earlier drought study (Damesin & Rambal 1995) conducted with the same species.

Line 186-187: Reduced and increased emissions compared to what? And what is the reference for? In the discussion about isoprene emission dynamics during drought, you may also refer to Bruggemann & Schnitzler (2002), who have studied isoprene emissions of Q. pubescens saplings.

Line 193: You write here and in many other cases as well, that a compound responds to something. This reflects very much the modelling point of view. However, the plant responds to the changes in its environment, and that we see as a change in the plant

volatile emissions. I would like to see in the discussion more of this plant-point-of-view: what does the plant do so that we see these kind of fluxes.

Line 196-199: You write: "the daily cycle between natural and amplified drought was very different for each season." If I look at the fig. 2 about isoprene emissions, I don't see very different daily cycles. Please clarify what you mean. Moreover, you write: "were not the only parameters driving isoprene emissions." Please tell which other parameters you think were affecting at that time of the year.

Line 200: You discuss about MACR+MVK+ISOPOOH basically as a compound. Have you any data if all these three compounds really are present in the fluxes all the time or if one of them dominates the measured flux and thus masks the variations in the others?

Line 213: Turn the sign: <.

Line 221: Please check spelling: phenomena.

Line 227: Please change to leaf elongation.

Line 230: You write that methanol emissions respond only to temperature in nighttime. Have you taken into account that in nighttime light intensity is basically zero if no artificial light is available and stays constant over the night? Moreover, in nighttime light intensity range is far smaller than in daytime, and this will be reflected in your modelling results.

Line 254-255: Would this sentence need a reference?

Line 261: Please change phenomenon to phenomena.

Line 263: Please check spelling: the calculation of ecophysiological parameters.

Line 278: Please check spelling: vapour.

Line 327-328: Here and in some other cases as well the italics of scientific names have

been replaced with cryptic markings. Please check the reference list.

Table 1 caption: Please remove the abbreviation ER and add the explanations for ND and AD.

Figure 1: Please remove "ND: natural drought; AD: aggravated drought" as the information is in the figure. The various vertical scales make it hard to compare the seasons, so please consider unifying the scales. And please remove A from the lower right panel.

Figure 2-4 captions: Edit the last sentences: – emissions are presented –.

References

Bruggemann, N., Schnitzler, J.P., 2002. Comparison of isoprene emission, intercellular isoprene concentration and photosynthetic performance in water-limited oak (Quercus pubescens Willd. and Quercus robur L.) saplings. Plant Biol. 4, 456-463. http://dx.doi.org/10.1055/s-2002-34128.

Damesin, C., Rambal, S., 1995. Field study of leaf photosynthetic performance by a Mediterranean deciduous oak tree (Quercus pubescens) during a severe summer drought. New Phytol. 131, 159-167. http://dx.doi.org/10.1111/j.1469-8137.1995.tb05717.x.

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