Biogeosciences Discussions, 2, S134–S137, 2005
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European Geosciences Union

Biogeosciences Discussions

Interactive comment on "Emission of monoterpenes from European beech (*Fagus sylvatica* L.) as a function of light and temperature" *by* T. Dindorf et al.

T. Dindorf et al.

Received and published: 5 April 2005

Dear Dr. E.D. Schulze,

It is not clear to us whether you replied as a referee or as the editor of the manuscript. However, we assume that in contrast to the classification within your answer you responded as the editor. Within this context we would like to send our final response to the comments of the referees and the editor. Despite our former detailed replies to the referees' comments, we still face major misunderstandings within your final answer. Therefore, we would like to point out these details again:

1. Editors' comment: You measured 1 branch on 1 tree on very few days. All 3 referees mark this as a major shortcoming.

Authors' response: The measurements presented here were performed not only on few

days. We investigated the physiological behaviour of Fagus sylvatica over a time period of 24 days and we introduced 9 days of consistent VOC emission measurements. The measurements were performed on a sunlit branch that represents per se the average of several heterogeneous leaves. Comparing the branch enclosure method applied here with single leaf enclosures, we investigated 204 different leaves over the measurement period. Considering either the single leaf level or the whole branch, there are not many articles reporting such a detailed dataset. Moreover, if you carefully read the manuscript, you will recognise that our data are in good agreement to the reports of Kahl et al. and Schuh et al., who measured under laboratory conditions. Our SEF calculated for the summer of 2003 is of the same range. Furthermore, Spirig et al. (ACP) reported a SEF of 10 that was calculated from contemporaneous flux measurements by a top down model approach. Hence, our field data fit well into the data set of other groups.

2. Editors' comment: Your cuvette was not temperature controlled, and leaves were self shading and probably in different ways positioned in the 2 years, which further complicates any comparison (critique of all 3 referees). Looking at the manuscript, I think that the very high temperatures should result in acute heat stress, activating chaperones, and changes in metabolism (see chapter 1.4 by Beck in Pflanzenökologie, Spektrum Verlag). You not even consider the dramatic interaction of high temperatures with the basic metabolism. You are looking at an interaction between light and temperature and not just a light response, even though shading had an effect, the emission in the light, contain also a temperature component.

Authors' response: The presented enclosure measurements followed the natural ambient temperatures as commonly performed with branch enclosure techniques. VOC measurements were performed during high ambient temperature events, but also during moderate temperature periods. These data (plant physiology and VOC emission) are consistent with other studies. Potential heat stress effects like the activation of chaperone molecules may indeed affect plant physiology during high ambient temper-

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atures. But protein analysis was not included in the present dataset and these effects may be better investigated under controlled laboratory conditions. The partial self-shading of leaves in a branch enclosure can not be prevented and represents moreover natural conditions. We discussed this in detail in our former reply.

3. Editors' comment: The few days of measurement under un-natural conditions does not allow the calculation of "emission factors". You did not say, how you calculate such factor, but to my knowledge, the emission factor is the average emission measured over a full year per leaf weight or leaf area. You just do not have the data to do this, and the variability of your so-called emission factors indicates that this is an ad hoc description of your measuring days, which were a non-natural treatment.

Authors' response: The measurements were not performed under un-natural conditions. The large data set covers low as well as high ambient temperatures and demonstrates a consistent behaviour. However, it seems that your knowledge on the evaluation of VOC emission data is incomplete, since a standard emission factor is not simply deduced from an average measured over a full year. A standard emission factor is calculated by the formula of the G93 algorithm and/or is derived from plotting ClxCt against the VOC emission rate. This is a common procedure well know by the scientific community. We already cited the relevant articles in our former reply.

Your comment # 4. The extrapolation to whole of Europe is not justified. What to do? The paper, as it stands, cannot be accepted. If you consider to re-write the results as a short communication, presenting the chemistry of VOC under conditions of extreme temperatures and high light (2-3 pages). It is un-tolerable, that this is 1 slice out of several papers, which deal with the same experiment. The Methods are "In press" somewhere else. There is another paper in preparation (Holzke et al.) that deals with emission factors. Thus, you may also consider to join your colleagues and write one solid paper, and not 3 slices. Nevertheless, your data contain the additional problem, that you are dealing with heat stress, which prohibits any calculation of emission factors (which are not defined for a 3 day measuring period).

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Authors' response: As outlined in our former reply, the extrapolation to whole Europe was done to demonstrate the substantial influence of the standard emission factor of one single tree species within a well known model. Your proposal to write a short communication about the chemistry of VOC under extreme temperatures and high light is un-tolerable to us. Moreover, the measurements were not designed to evaluate the chemistry of VOC. Such experiments are surely better performed under controlled laboratory conditions than with a branch enclosure in the field. We did not submit 1 slice of a paper, but a consistent data set within one complete paper. The other manuscripts are dealing with other questions. E.g. the paper Kuhn et al. is a technical paper describing the automated cartridge sampling unit. It comprises several field measurements (e.g. airborne measurements in Amazonia). The paper was cited as the most recent one to present the technology applied. Finally, our manuscript does not simply deal with heat stress, but with a normal situation under seasonal development covering a wide temperature range. As outlined before, we have more than enough solid data to calculate a standard emission factor for this summer season.

We are bewildered by this discussion and evaluation of our submitted manuscript. Nevertheless, we are confident that our paper and our author comments will be noticed by the scientific community.

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