Biogeosciences Discussions, 2, S22–S24, 2005
www.biogeosciences.net/bgd/2/S22/
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.

Anonymous Referee #1

Received and published: 3 February 2005

The authors of this informative paper step from branch measurements of gas exchanges to derive information regarding a) the flux of monoterpene emission from beech leaves; b) the environmental control over this emission; c) the physiological control over this emission; d) the impact of beech emission when upscaling measurements from branches to forest communities in Europe.

Overall I believe the authors are right in their conclusion that beech may emit monoterpenes which originate from the MEP pathway. However, recognizing some weaknesses and overstatements of the paper may help to reconcile this finding with previous reports indicating beech as a low emitter. A very weak point of the paper is that measurements were carried out only on one branch of one plant (p. 141 line 8). Thus, measurements were not replicated, and whether the observed behaviour is typical of beech or

solely attributable to the specimen measured, remains an open question. In any case, it should be observed that the largest emission observed (equivalent to a medium-low basal emission of holm oak, that is, about 3 nmol m-2 s-1) was measured under very high leaf temperature conditions (figs. 2-3). The basal emission (the emission at 30°C and 1000 microE m-2 s-1) seems to be rather low, if compared with strong emitters. These considerations makes me wonder whether the parameterization, the modelling, and the integration at regional scale of beech emission are to be considered in a very conservative way as they require further levels of approximation.

The temperature problem is relevant in my view, especially because of the poor control of the cuvette system used in this work. I can see from figure 1 that leaves in the enclosure are oriented differently and often shade each other. As the authors commented (p. 148 lines 5-6) temperature may dramatically change in response to the infrared component of incident light. Thus, a wide range of temperatures and light intensities, probably resulting in a similar diversity of photosynthesis, stomatal conductance, and monoterpene emission among leaves enclosed in the cuvette, is expected. Under these conditions, it remains difficult to present rigorous dependency of monoterpene emission from light or temperature. While I am sure that the observation that monoterpene emission is controlled by light and temperature is overall correct, I wonder whether the degree of precision required to study mechanisms is met by these measurements. As an example, the statement that temperature optimum for monoterpene synthase in beech is not below 43°C (p. 146 lines 3-4) may not be correct. On a more technical viewpoint, I wonder how was leaf temperature measured as this important detail is not given. For instance I wonder whether one or more sensors were used or if the temperature was calculated with an energy balance approach. In any case, however, I am afraid the uncertainties of the approach makes it inadequate to drive firm conclusions about the underlying biochemistry and, in my view, considerations driven on the basis of inaccurate measurements of environmental parameters should be left out or very cautiously addressed.

BGD

2, S22–S24, 2005

From a more physiological standpoint, I have problems recognizing a midday depression of photosynthesis from data of Fig. 7. Perhaps some indications of midday depression may come from close inspection of Fig. 2, with this depression associated to stomatal closure (decrease of transpiration) only during 2003. Overall, the discussion about midday depression influencing monoterpenes does not appear to be substantiated. Perhaps a plot of monoterpene emission versus leaf temperature at midday for every day (those showing or not showing stomatal closure associated to depression of photosynthesis, that is, midday depression of plant physiology) could help clarify the issue, if two clear patterns appear for the two conditions. I can clearly see only a strong effect of 2003 drought on monoterpene emission but not on whole plant physiology (see also the similar photosynthesis in the data-sets presented in Figs 2-3 for the two years). To attribute to a midday depression the difference in the daily course of monoterpene emission over 2002 and 2003 (Fig. 8) is, in my view, very far-sighted on the basis of the available data-set.

Minor comments: In Fig. 2 net CO2 assimilation should be CO2 drawdown (the values are negative)? In Fig. 4 legend the correction factors C(L) and C(T) should be identified. In the reference list Tollsten and Mueller is reported twice.

Interactive comment on Biogeosciences Discussions, 2, 137, 2005.