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Biogeosciences Discussions

Interactive comment on "Seasonal variation of mono- and sesquiterpene emission rates of Scots pine" *by* H. Hakola et al.

H. Hakola et al.

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We wish to thank the referee for his constructive comments and suggestions. The comments and questions of the referee are addressed below in the order they were made.

The referee is unhappy with our limited data set. Unfortunately, we could only measure two branches and because the samples are taken manually even one sample per day during the whole growing season produces lots of samples for analysis and requires so much labor that increasing the sampling frequency was beyond our means to. Actually, there are not many data sets even as large as ours published so far. Eventually, when the PTR-MS or other on-line instruments, become more common this situation will be improved. Due to the limited data set, we have tried to state our conclusions as indications as proposed by the referee. As mentioned in the paper and also noted by the referee, diurnal measurements would be needed to properly address the light

algorithms.

7-day running median means that for every measurement point the median is calculated of three data points before and three after the particular data point. There will be as many numbers as there were measurements.

As to the comment about the complex mixture of different compounds present in the emissions from vegetation, the compounds we have reported were the only compounds detected in the study.

MBO degradation in the analytical system causes larger errors in MBO analysis than in other compounds. We can of course determine how much of the MBO standard is degraded in the analysis (about 50 %), but if the sample is degraded by as much, then no error is caused. However, we do not know what affects the degradation, if ambient conditions while sampling etc. could affect it. Therefore we can only give, as a rough estimate, that our MBO emission rates can be 0-50 % underestimated. This is now also stated in the text.

The modelling part of the manuscript has been rewritten to clarify the use of the different algorithms. The algorithms and the formulations we have used are those presented by Guenther et al. (1993) and Guenther (1997), which have generally been adopted by the emission modelling community, as well as a modified formulation by Schuh et al. (1997). As for Equation (5) of Guenther et al. (1993); when presenting the equation the authors do not cite the article suggested by the referee (which, we believe should read Tingey D.T., Manning M., Grothaus L.C., and Burns W.F., 1980. Influence of light and temperature on monoterpene emission rates from slash pine (Pinus elliottii), Plant Physiol. 65: 797-801). Instead, they refer to articles describing typical modeling practices, which is also our approach. Furthermore, it is our understanding that the original work of Tingey et al. is presented in two EPA reports dated 1978 which we unfortunately do not have access to.

The temperature and light dependence of sesquiterpene and 1,8-cineole emissions in

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July have been given special attention in this manuscript as these compounds were also investigated in our previous work (Tarvainen et al, 2005), where, however, measurements during this intense emission period were lacking. As for other compounds and other periods, this 2004 data set did not add such relevant new information to our previously published results that it would have merited repeating the whole seasonal analysis. The referee is completely correct in pointing out that diurnal measurements would be needed to comprise the dynamics of the emission behaviour and develop heavy duty algorithms. Alas, such data set is not included in these measurements but we still wanted to show that the observed emission rates of these interesting compounds could reasonably well be simulated by the existing algorithms.

Concerning the connection between sesquiterpene emission and spores in the air, we do not argue that the spores would be responsible for the sesquiterpene emission. We suggest that "This finding would support the theory that the sesquiterpenes and oxygenated monoterpenes are released by the plant for defensive purposes". Mentioning methyl jasmonate here is relevant, because this plant hormone-like substance is connected to pathogen attacks and known to induce defensive reactions in plants, including sesquiterpene emissions. The referee would like us to show more data, but unfortunately we do not have more data at this point. However, since this, to our knowledge, is the first time such data sets can be correlated under field conditions, we feel that it is worth presenting, although speculative.

We think that the statement on ozone effect in this context is important. The sesquiterpene emissions can be underestimated when removing ozone from the air entering the enclosure.

Minor revisions:

We did not remove Equation (1) as suggested by the referee. We think it is the simplest way of describing how the emission rate was determined.

The words temperature and light intensity have been added to brackets on page 1701,

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line 9.

P 1703, line 2 “in the year” has been added.

Kelvin degrees have been changed to Celsius degrees on page 1706.

Sesquiterpenes are not named as 1 and 2, instead their names are given as proposed by NIST mass spectra library.

EO in Table 2 has been defined in the table caption.

“in the same tree” has been changed to “of the same tree”

The caption of Figure 1 has been corrected to be more precise.

The error bars in Figure 5 have been explained in the figure caption.

Interactive comment on Biogeosciences Discussions, 2, 1697, 2005.