

## ***Interactive comment on “Mountain birch – potentially large source of sesquiterpenes into high latitude atmosphere” by S. Haapanala et al.***

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The authors wish to thank Anonymous Referee #2 for taking the time to review the manuscript and the valuable comments and suggestions to improve it. We have answered each of the specific comments below. Whenever the referee is cited, the text has been written inside quotation marks. Whenever the referee is cited, the text has been written inside quotation marks.

“From data in Table 1 as well as from many other related publications it is quite obvious that there is a large variability in BVOC emissions between trees of the same species and as a function of time of year. Deciphering the controls of these variations is a challenging task. There is almost no mention on statistical tools that were applied to test for the hypothesis that emissions were effected by this herbivory. “

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The current dataset doesn't suit too well for statistical testing. The only comparable numbers would be the emission potentials presented in Table 1. For example sesquiterpene emission potentials for tree #4 normalized by G97 are  $3044 \pm 401$  ng gdw<sup>-1</sup> h<sup>-1</sup> and  $98 \pm 7$  ng gdw<sup>-1</sup> h<sup>-1</sup> for 2006 and 2007, respectively. Using these numbers, statistical tests would surely suggest a change in the emissions. However, we decided to leave this out from the MS as the experiment was not originally planned for such analysis.

“One particular important question is what the sample size for this study was. The only available information is from Table 1. Here, four experiments conducted on four trees are listed during year 2006, with ‘N’ listing the number of samples in each subset. Now, is this the number of enclosure experiments that were performed on each tree, or is it the number of individual emission samples that were collected from each tree? I suspect that the latter is true, which would then add up to a total of 40 emission samples that were collected? During the second year, only one of these trees was sampled again, and only over two days, and this time a total of 16 samples were collected?”

N states the number of chamber closures. This is now indicated in the caption of Table 1 and in the text of the section 2.1.

“This reviewer's opinion is that given the variability in the emissions behavior, and uncertainties in the experimental procedures, this number of trees sampled (in year 2), number of enclosure experiments, and number of samples collected is far too small to draw the conclusions presented in this paper.”

The authors agree that the amount of data is rather small which makes it difficult to draw statistically significant conclusions on the differences between the years. However, this is quite common problem in field campaigns where limited resources must be accepted. We have reviewed the conclusions to address this problem and made it even more clear that these are only speculations.

“From the information provided in the manuscript it is not even certain if and to what

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degree tree Birch 4 may have been affected by herbivore three years earlier, so this whole discussion seems to be pure speculation.”

The referee is right in that we don't have specific observations on the herbivore damage of this particular tree. However, the herbivore damage on the area was extensive and therefore we may assume that this particular tree was affected too. Discussion is speculative as we have stated several times throughout the manuscript.

“5410/12: Is this value (2000 ng g<sup>-1</sup>h<sup>-1</sup>) the mean of the actual measured emission rates or a normalized value? A mean of the measured rates would probably not make much sense as that would be highly biased by the elevated temperatures encountered during the enclosure experiment and by the selection of the experiment days.”

This value is now replaced by the normalized value of 2600 ng g<sup>-1</sup> h<sup>-1</sup>.

“P5410/L 13: Please be more specific; ‘negligible’ is not a defined value.”

This is now corrected,  $\alpha$ -farnesene lacking completely, as stated in section 3.1.

“5413/26: What is meant here is probably ‘precision’, not ‘accuracy’?” “5414/2: How can a precision measurement be used to derive an accuracy estimate?”

Incorrect terminology is now corrected in the new version of the MS.

“Provide explanation or reference how the analytical instrument was calibrated.”

The calibration procedure is explained by Hakola et al. (2001) which is now added in the manuscript.

“5414/19: This reviewer is not certain that ‘emissions are strongly dependant on the temperature inside the chamber..’ from the review of the data in Fig. 1. For instance, temperatures on day 193 were similar or even higher (ambient) than on day 192, but emissions were lower on that day.”

The authors agree that there are several other factors affecting the emission too. How-

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ever, we still suggest that temperature dependency is one important factor and it can be clearly seen in Figure 1. The authors are not sure what the reviewer really meant with that example.

“Fig. 2: This figure is deceiving. Emissions data from four trees (?) examined over six weeks in 2006 are compared with emissions from one tree (?), sampled over a single diurnal cycle (?) in 2007.”

The authors agree that the figure was bad, and it is now replaced with a figure that shows only the relative amounts of different compounds.

“Fig. 3: Please provide information on the number of samples that went into these data. Do error bars represent the standard deviation? I imagine that the temperature data are mean values? It would be nice to also show x-axis error bars, indicating the variability in the temperature during each experiment?”

Each point represents the emission value from a single chamber closure. Y-axis error bars represent uncertainty of a single emission measurement. Information on the temperature/light variability during the closure would be useful, but comparable data for every closure is not available due to poor temporal resolution of the data, as these parameters were averaged during the experiments.

“5415/6-8: This description is confusing and not well worded.”

This description is now moved to the next section and re-worded.

“5416/24: “. . .plant species . . .”

Typo corrected.

“5415/9-17: “Average sum emissions” is not a very meaningful terminology to use here. As stated earlier in the manuscript, emissions were highly biased by the fact that air temperatures inside the enclosures at times significantly exceeded ambient levels. In the opinion of this reviewer, normalized emission rates should be used for

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any quantitative comparisons.”

We prefer mentioning the range of measured emission rates. Majority of the emission measurements were conducted in comparable temperature/illumination levels. Normalized emission rates are discussed later in the section 3.3.

“5418/20-27 and Table 1: Given the large experimental uncertainties in these measurements this reviewer does not find it appropriate to report emission results to up to 5 significant figures.”

The authors agree and have now revised the way of reporting the numbers.

“ Also, please show more clearly which columns belong under the headings in row 1.”

Vertical lines are now added in the table to separate columns.

“5419/16-18: Please explain how ‘effective temperature sum’ is determined. It clearly is not the number of days above 5 deg C?”

Effective temperature sum is now explained in the text.

“5419/20: This assessment is highly speculative and lacks any supporting data.”

We have now re-written this statement, highlighting the speculative nature.

“5420/11-12: This reviewer does not understand what this sentence is meant to state.”

This sentence is now re-worded.

“5421/13: “These interactions . . .””

Typo corrected.

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Interactive comment on Biogeosciences Discuss., 6, 5409, 2009.