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Atmospheric Chemistry and Physics Discussions

# *Interactive comment on* "Temperature and light dependence of the VOC emissions of Scots pine" *by* V. Tarvainen et al.

**Anonymous Referee #1**

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## General comments

The paper by Tarvainen and co-authors presents VOC emission measurements from Scots Pine trees, obtained from branch enclosures at two different locations in Finland. Because of the widespread appearance of this pine and its major role in boreal forests, the interest in its VOC emissions has been considerable and is documented in numerous studies. While the results presented here on temperature dependence of monoterpene emissions of Scots Pine are not ground-breaking news, the work by V. Tarvainen et al. provides some new insights on the VOC emissions of this species. The most valuable aspects of this work are 1) the complete speciation of the VOC emissions of Scots Pine including the description of sesquiterpene and MBO emissions and 2) information about the seasonal variation of VOC emissions from Scots Pine.
Unfortunately the discussion of these aspects is rather short compared to the interpre-

tations about light and temperature control of the emissions. Part of the interpretations on the controlling factors are based on very few data. However, the authors state this explicitly in their discussion and with this remark, the conclusions are acceptable. Their partly tentative character is likely to promote further work on this topic.
The presentation of the results should be improved before publication in ACP. In particular, the discussion about the applicability of different emission algorithms should be better structured. The authors are also encouraged to extend the description and discussion about emissions of compounds other than monoterpenes. After changes in these respects, I recommend the paper for publication in ACP.

**Specific remarks and questions**

The abstract is rather long and should be shortened.

2. Materials and methods

Because it is known that emission measurements from needle-trees are especially prone to artefacts by the movements/handling during enclosing of branches (even if great care is applied), it should be clearly described when the branch enclosures were placed, and how much time was allowed before the first measurements.
The number of different VOC compounds identified is a valuable part of this work. Accordingly, the description of the analytical system should be extended. It is not described whether sampling and analysis occurred on-site or if samples were stored (conditions?) before analysis. The performance of the analytical system with respect to the measurement of sesquiterpenes and MBO is of particular interest and should be described in more detail (see also the remark to section 3.1.), e.g. what was the detection limit/precision for these compounds?
Given the recent appraisal of Holzinger et al. (ACPD 2004), that past and current flux measurements may miss a large part of biogenic VOC emissions, it would also be valuable to add a statement (even of qualitative character) about non-identified compounds



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in the chromatograms and the likelihood of significant contributions of these species.

3. Results

In general, the presentation of data from two sites in combination with different classes of VOCs is rather complex. A splitting of section 3.3 (e.g. separating different compound classes) might improve the structure and readability of the results. Also, part of 3.3 is a method description rather than results.

3.1. Observed emissions

Emission of sesquiterpenes: Can major emissions of other sesquiterpenes be excluded? As this work represents one of the few reports on sesquiterpene emissions and given the later conclusion (sesquiterpenes are unlikely to cause particle formation during spring), these results are worth to be commented in more detail. Are there any speculations on the much higher sesquiterpene emissions at Sodankylä in June?

3.2. Light dependence

For the understanding of figure 2, information about the temperature inside the enclosure during this experiment should be added. Can temperature explain the decrease and increase of most monoterpene emissions within the first 4 hours in the dark as well as the differences between the morning emissions of Aug 7 and Aug 8? Could the handling of the branch associated with the removal of the cover have caused the observed after-dark burst of emissions?

3.3 Calculated emission potentials

According to section 2, the emissions were usually measured in the afternoon. This raises some concerns if the range of light intensities during these measurements was large enough in order to identify a light dependence of emissions (including the consideration of measurement uncertainties). An additional figure with scatter plots of emissions versus light and temperature may be helpful.

The authors found seasonal variation of standard emissions rates similar to results of other studies. While they speculate about the high emissions in spring, the increase



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from summer to autumn is not commented. Have the authors explored if the temperature history during the last few days might be of importance?
Page 6703, light dependence of cineole emissions: Please also indicate the performance of the pool algorithm for the cineole data. The fits for the (rather few) observations are hard to interpret without a comparison to the fits of the pool algorithm.

The discussion in 3.3 focuses on the controlling variables of the emissions, but it would also be useful to add a few remarks on the absolute level of the (standard) emissions. How do the values of this work compare to earlier results? Are there any new/modified recommendations for emission models based on this work? Statements in this direction would also be desirable in the conclusions section.

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Interactive comment on Atmos. Chem. Phys. Discuss., 4, 6691, 2004.