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Interactive
Comment

Interactive comment on “Measurements of hydrocarbon emissions from a boreal fen using the REA technique” *by* S. Haapanala et al.

S. Haapanala et al.

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The authors wish to thank Alex B. Guenther for valuable comments and suggestions to improve the manuscript. We have answered each of the specific comments below. Whenever the referee is cited, the text has been written inside quotation marks.

“The isoprene emission factor estimates could be a valuable contribution to the existing literature- but will be difficult to incorporate into regional/global models if the source is not well characterized. The paper would be considerably improved by the addition of 1) enclosure measurements on the dominant vegetation (e.g. sphagnum mosses and sedges)“

Enclosure measurements of VOCs have been performed on Siikaneva fen and are reported elsewhere, see: “C2-C10 hydrocarbon emissions from a boreal wetland and forest floor” by H. Hellén, H. Hakola, K.-H. Pystynen, J. Rinne and S. Haapanala, published in Biogeosciences Discussions, 2, 1795-1814, 2005. SRef-ID: 1810-

6285/bgd/2005-2-1795.

“2) an estimate of the relative abundance of the dominant vegetation in the flux footprint. Without this information, it will be difficult to extrapolate the estimated emission factors to areas other than the measurement site.”

Vegetation inventory was conducted in 2005 in the area and this information will be added to the manuscript.

“The authors provide some discussion of the processes that control variations in isoprene emissions but they could improve the impact of this paper by going a little further with their analyses. For example, they could examine whether the temperature and light of the past days(s) explains any of the observed deviations from the instantaneous CTxCL (as has been suggested by various investigators). In addition, they suggest that solar angle might explain some of the differences but then do not provide any evidence of whether or not this is the case. A scatter-plot of the emission deviation versus solar angle would be useful to see if there is a pattern.”

From that small and noisy dataset it is almost impossible to say whether instantaneous flux is modified by conditions during the previous days. The largest deviations indeed happen at high solar angles and PAR fluxes. This will be discussed in detail in the manuscript.

“Finally, the authors compare the above canopy fluxes with the Guenther et al. 1993 leaf-scale light response algorithms. They should instead use a canopy model to simulate these variations (and also to get the “correction factor” for estimating the normalized emission factor).”

To the authors knowledge, no real canopy model exists for mosses nor other wetland vegetation. However, we did simulate light penetration into the moss carpet with extremely simple model. It treats the moss carpet as homogenous medium where light is attenuated as described by Beer’s law. The extinction coefficient was determined from

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light compensation values for Sphagnum mosses found in the literature and average depth of green (active biomass) layer in Siikaneva moss carpet. Light intensity was calculated in 10 to 22 layers and the Guenther algorithm was applied to each of these. This model was rather insensitive to the modifications of variable values (extinction coefficient, calculation layers). Measured isoprene flux was plotted against mean CLCT. Resulting plot looks somewhat better that the original Figure 4, but the difference is not significant except for the absolute values of CLCT. However, we believe that for practical purposes it is better to report values of the original Guenther algorithm, although it was originally developed for leaf-scale use. Discussion on this will be expanded in the manuscript.

"There are very few (or none) observations of fluxes of some of the C2-C6 hydrocarbons and halogenated compounds examined during this study. The observations reported in this paper will be important if they can constrain fluxes of these compounds. However, this requires a robust estimate of the lower detection limit of the flux system. The lower detection limits given in table 1 seems optimistic. The only error considered is from the concentration measurements. This may be the most significant error component for compounds with a substantial flux (e.g. for isoprene) but what about other potential sources of error? For example, there are errors associated with assumptions required for the REA approach. There are also mechanical limitations (e.g., what if the valves do not switch exactly when they are suppose to), interferences, contaminated lines or losses, etc. While I recognize that it is difficult to quantify some of these errors, they should at least be discussed in the paper."

REA-method causes large uncertainty for single measurements. However, these errors tend to cancel out in large datasets. Assumptions in the b-coefficient and its uncertainty goes beyond the scope of this manuscript. This issue has recently been investigated by e.g. Grönholm et al. (2005). Importance of losses and chemical degrading becomes small in flux calculation because both reservoirs are similar and only the difference between the concentrations affects the flux. In addition, we did use each line/bag as

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up- and down reservoirs by turns. This was to avoid biasing the average results if there happens to be some small differences between the lines/bags. These issues will be discussed in the manuscript.

Interactive comment on Biogeosciences Discussions, 2, 1645, 2005.