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Atmospheric Chemistry and Physics Discussions



# *Interactive comment on* "Terpenoid measurements at a Northern wetland revealed a strong source of sesquiterpenes" *by* Heidi Hellén et al.

**Heidi Hellén et al.**

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Thank you for the very good comments. We have considered them and we have improved our manuscript based on them as explained in more detail here.

This study is a valuable contribution to the available observations for understanding BVOC emissions and atmospheric concentrations in northern wetlands. The manuscript is generally clear, concise and well written and the methods and uncertainties are well described.

As the authors indicate, the concentration data is difficult to interpret due to the influence of the nearby forest. It would be helpful if the authors could better describe theinfluence of the forest including species, expected BVOC fluxes, typical transport



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times of BVOC from the forest.

-We added description of the forests surrounding the site into the section 2.1, but there is very little knowledge on the emissions of this kind of sub-Arctic forests. As discussed in the manuscript, emissions of close by Norway spruce forest have been measured by Rinne et al. (2000). However, their data set was very small and sesquiterpenes were not studied. Tarvainen et al. show some results of northern Scots pine emissions and Hakola et al. (2017) have measured emissions of a boreal Norway spruce. Discussion on these emissions were added to the manuscript into section 3.3. In addition, Haapanala et al. (2009) have measured emissions of mountain birches and this was added to the manuscript as well.

The title is misleading since this landscape is not a strong source of sesquiterpenes.,The sesquiterpene emission factors reported for this study are similar to what modelsimulations (such as MEGAN) would predict for northern wetlands. Perhaps the title could indicate that sesquiterpenes dominate monoterpenes, which is unusual. In anycase, the abstract, text and conclusions should make it clear that the unusual MT/SQTratio is because MT (and isoprene) are lower than most other landscapes, not because SQT are higher. Comments that sesquiterpenes are “surprisingly” high should be re-moved and could be replaced with a statement regarding the relative MT/SQT ratio.

-title has been changed to ‘Sesquiterpenes dominate monoterpenes in Northern wetland emissions’

-Comments on unusual MT/SQT ratio was added and comments on ‘suprisingly high’ has been removed and ratio of MTs and SQTs are discussed

As is discussed in the introduction, Kramshoj et al. and related work in an Arctic landscape in Greenland reports an isoprene temperature dependence that is much higher than in temperate landscapes. In contrast, Figure 4 shows that this northernwetland vegetation has an isoprene emission response that is similar to temperatevegetation.

Please discuss the similarities and differences between this site and theKramshoj site. Any insights on why the isoprene temperature response is so different?

-discussion on results of Kramshoj et al. (2016) has been added to the manuscript

Table 1 (and elsewhere in the manuscript): Please use a more standard format for thedates. Alternatively explain the format in the Table header or at least label them asdates.

-Dates have been corrected

Page 2, line 30-33: What is known about BVOC emissions from these various species in the fen?

-There is very little information available on the emissions of these individual species. Salix species are generally having high isoprene emissions (Iseprands et al. 1999, Kramshoj et al. 2016) and wetland sedges are known to be strong isoprene emitters as well (Ekberg et al. 2009).Spaghnum moss is low emitter of both isoprene and MTs (Tiiva et al. 2009, Iseprands et al. 1999, Faubert et al. 2009). This was added to the manuscript into section 3.1.

Page 3, line 7-9: What were the BVOC concentrations in the chamber?

-mean concentrations of SQTs, MTs and isoprene were added.

Page 3, line 10: heated to what temperature?

-we added 'heated few degrees above the ambient temperature'.

Page 3, line 12: what was the size (mass of adsorbents) of the cold trap?

-excact amounts of adsorbents are not known, but it was added to the mansuscript that we used standard low flow cold trap of Perkin Elmer filled with Tenax TA (50%) and Carbopack B (50%).

Page 3, line 14: what was the flow rate for the offline tube samples? Did the 10 hour

samples exceed breakthrough volume for these tubes?

-The flow was ∼55 ml/min. This was added to the manuscript. It is possible that even when using stronger adsorbent (Carbopack B) as a back up, most volatile isoprene suffered from the breakthrough during 10-hour samples. However, these samples were taken during the nighttime when emissions were low compare to the daytime emissions. These three points were above the general temperature dependence curve, which indicates that breakthrough was not significant. Comment on possible breakthrough was also added to the manuscript.

Page 3, line 25: The temperature difference is probably not as relevant as the absolute temperature. How realistic is it for these plants to have temperatures above 40C?Discuss the implications of heat stress impacts on these results.

-It was added that due to this heat stress emission rates shown are expected to be overestimated during clear sky conditions, but this is not expected to affect emission potentials, which are normalized to 30oC.

Page 4, line 17: California is misspelled

-Corrected Page 8, line 9: Since only frame #1 was sampled more than once, it would be clearerto show the seasonal data (i.e., the data for frame 1) and then separately show datafor the other 2 frames. Otherwise it can appear all of the data are seasonal variationsfrom the same location. All of the data could still probably go in one table or figure butjust grouped differently. -Measurement periods were grouped differently as suggested by the reviewer. Page 8, line 19: How does the temperature dependence vary for individual monoter-penes and sesquiterpenes? -information on the temperature dependence of individual terpenes were added to the manuscript and as a supplement table S3. Page 14, line 17-25: Which terpenes dominate the ozone uptake? This could be shownin a figure illustrating the contribution of each compound to total ozone reactivity (anal-ogous to figure 8 for SOA). -very good idea. A figure and discussion on this was added to the manuscript into section 3.3

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