

Interactive comment on “Sources of long-lived atmospheric VOCs at the rural boreal forest site, SMEAR II” by J. Patokoski et al.

Anonymous Referee #3

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Patokoski et al. utilize a unique long term VOC data set at the SMEAR II site in Finland to analyze the possible sources of several long-lived atmospheric VOCs. HySPLIT 4.0 backwards trajectories were calculated to determine the sources of specific VOCs and the Unmix 6.0 receptor model was used to compare SO₂, anthropogenic and biogenic/combustion sources. The authors seem to have put together a novel study with relevant scientific results. However, several major issues should be reviewed and addressed to improve the quality of the presentation of the data. Of primary concern is the almost complete lack of statistical rigor. For example, in Section 3.3, p-values are stated as being equal to zero rather than less than 0.05, which was revealed in a later sentence. P-values should be stated here as well as in Fig. A1. More importantly, statistics are missing from almost the entire rest of the paper. The exception is within

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the discussion of long-term VOC trends (e.g. Table 6). Within the discussion and the conclusion statements were made using this data even though there was no statistical significance. If there is no significance, it should not be stated that the values changed over time. Another major issue is the organization of the paper. Methods were often included in the results and discussion sections and the conclusion section was mainly a simple recap of the paper rather than extending the significance of the papers findings. The description of source areas in section 3.4 (page 14607 line 23) is a good example of method details that were placed in the results section. Detail on the Unmix model at the beginning of 3.5 is another example of methods in the results/discussion. Lastly, it seems that the inclusion of monoterpenes is forced into the paper and should be removed, since it is excluded from most of the analyses and doesn't add enough to the one section to be included in the entire paper. It also does not fit with the Title of the paper.

The presentation of the hypotheses starting on page 14596 line 20 are confusing, several seem to be rather similar. It might clear it up to closely follow the section heading used in the paper. Regarding the use of the PTR-MS, I have two questions/concerns. First, did the 4 VOC mixtures used contain all of the VOCs in this study? Although PTR-MS does have a low fragmentation profile compared to other techniques there are clustering issues that should be accounted for, either by using standards or accounting for clustering ions (such as m/z 51 for methanol). Secondly, did you account for water clustering in your calculations? Low E/N ranges can increase the clustering of reagent clustering (see de Gouw et al. 2003 “Sensitivity and specificity of atmospheric trace gas detection by proton-transfer-reaction mass spectrometry” and others) and if they are not accounted for will cause over calculations of VMRs. In general there were many grammatical errors within the paper. Tenses were often changed throughout the paper between past and present instead of staying in the past tense (e.g. Page 14605 Lines 20-23). Also, the use of “e.g.” was often used in place of a description/statement rather than as an example of a description/statement (e.g. Page 14598 Line 4). Prepositions were often missing throughout the paper.

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Some specific comments/questions: + Page 14598 Line 24 – move “were measured” to after “seven masses”.

+ Page 14599 Line 1 – What about the years from 2009 to 2011? It is unclear from this paragraph.

+ Page 14599 Line 21 – were these measured at 33m throughout the entire experiment?

+ Page 15602 Line 4 – it is unclear what observations are being referred to in this sentence.

+ Page 15602 Line 1 – Why wasn't the OH and NO₃ concentrations estimated the way the O₃ concentrations were?

+ Section 3.3 – It is unclear why there is such a concentration on SO₂ and not much mention of other trace gases or VOCs. Others should be included or the section should be renamed.

+ Page 14607 Line 21 conflicts with the statement made on Page 14609 Line 9-10. Are they different or similar?

+ Page 14609 Line 2 – It is unclear what is meant by “the latter”.

+ Tables and Figures – Statistics need to be included in most

+ Figure 1 – “Medians of summer months” was a little confusing. It might be more clear to say “Median of each summer month”

+ Figure 2 – Color the star (asterisk?) for the SMEAR II site a different color than the fire locations. It is difficult to see.

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