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Interactive comment on “Ozone stress as a driving force of sesquiterpene emissions: a suggested parameterization” by E. Bourtsoukidis et al.

Anonymous Referee #2

Received and published: 15 August 2012

The article by Bourtsoukidis et al. is an attempt to evaluate parameterization of sesquiterpene emission even taking into account the ozone exposure. This is a particularly interesting and novel approach, considering that ozone is among the most detrimental atmospheric oxidants, and not enough experimental activity was able to show relationships between SQT and ozone. Overall, the article reads well with no major language flaws. The analytical approach is well described, and demonstrates a rigorous experimental protocol using state of the art technology. I appreciated a lot the amount of data available for this analysis, considering how limited is the SQT emission dataset is worldwide. This helped to understand the seasonality of SQT emission. I also appreciated the formulation of a new emission algorithm, which may help modelers to perform a better prediction of SQT emissions on large scales. The weak part of this research is the usage of only one branch to derive all the results and discussion, since

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Comment

plant-to plant variability may highlight differences in SQT emission patterns. I would have appreciated some measurements of indicators of photosynthetic parameters to show oxidative damage. The statement that SQT is a proxy for oxidative damage is not tenable in this study. I believe that the authors significantly advanced the current knowledge of SQT emissions, therefore I recommend publication in this journal after taking into account for the recommendations below.

PAG 3 Line 11: non-stomatal instead of nonstomatal Pag 3 Line 20: you may want to consider to cite Jardine et al. 2012 (GCB), where emissions of oxidation products from leaves in demonstrated. Pag 4 line 30: remove “an” and use “a”. Pag 4 line 30: did you focus the all study using just one branch? Which was the leaf area of the enclosed branch? Pag 5 line 9: what was the material of the enclosure? Did you test if it ozone and other reacting gases interact with cuvette walls? Pag.5: Please specify in the Experimental set-up session the measuring period. Pag 6 line 14: Did you calibrate SQT using just m/z 205 or you considered other fragments? This is reported in the next section although it should be mentioned here. Pag. 7 line 4: m/z 149 has been previously associated to Methyl-Chavicol (Bouvier-Braun et al. 2009). Can you exclude interference of this compound with the SQT fragment? Pag 9 line 6: Guenther and not Guether. Pag 9 equation 2: can you provide more detail on how the two unknown terms in the equation were calculated? ‘ Pag 10 lines 14-19: given the dependence of ozone with temperature, it is expected a certain correlation between SQT emission and ozone, this is not surprising. You should remove the effect of covariates before analysis regressions between ozone and SQT. Perhaps trying a step-wise multi-regressive approach may help. Pag 12 line 2: younger leaves usually have thinner cuticles. SQT emissions may come from MVA pathway but may also leak out from resin ducts, therefore leaf phenology may have an effect on SQT release from needles/branches. Pag 12 line 10-13: It is unclear why you say that during the growing period Est declined. It seems to me from figure 2b that low Est were observed outside the growing period. Pag 12, correlation coefficients: Low ozone concentration does not correlate well with SQT emission, this may be due to the limited oxidative damage when ozone is low.

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Comment**

However, showing good correlation between ozone exposure and SQT emission per se cannot justify the statement that ambient O₃ concentration can be harmful for Norway spruce. I would have appreciated some data on plant ecophysiological parameters to support this thesis. Pag 13 lines 18-19: Again, oxidative stress is mentioned without proving any oxidative damage, this sentence is too speculative. Pag 14 line 13: who says that MT emissions are not a usefull proxy for oxidative stress? Pag 14 line 14: what is a dynamical well? You mean a bell shape? Please explain. Please rephrase the all paragraph between lines 14 and 18. I don't see differences between MT and SQT emission potentials for ozone regimes above 47.7 ppb. Pag 15 lines 19-21. No need to explain again what the coefficients in the Guenther algorithm are. Pag 16 line 3: responses and not responce. Pag.17 lines 5-7: Please rephrase this paragraph, it is unclear. Moreover, I don't understand why storage pools should decrease during the year. More mature and thicker leaves should store more SQT. If you intend to keep this sentence, please provide a reference. Pag 17 lines 29-30: assumed that ozone has an effect on SQT emission, to prove oxidative stress photosynthetic parameters should be measured before using global simulation models for oxidative stress on plants. However, atmospheric chemistry models will benefit of your finding for producing a better estimate of SQT emissions.

Interactive comment on Biogeosciences Discuss., 9, 7661, 2012.

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