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Biogeosciences Discussions

Interactive comment on "Long-term dynamics of monoterpene synthase activities, monoterpene storage pools and emissions in boreal Scots pine" *by* Anni Vanhatalo et al.

Anonymous Referee #2

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Long-term dynamics of monoterpene synthase activities, monoterpene storage pools and emissions in boreal Scots pine

The end aim of this submission is modelling monoterpene emission based on plant physiology along the growth season and needle development. The relevance of terpene emission in the biosphere-atmosphere interphase is increasingly recognized, however, in fact, the link between terpene biosynthesis, storage and emission is not well understood, either the direct and indirect effects of resource availability, meteorology and carbon fixation on the whole chain of steps leading to monoterpene emission. Authors use a multiple approach combining an intensive field sampling along two years,

evaluation of terpene emission and storage pools and the activity of terpene synthases, with the inclusion of a large number of physiological and environmental variables as potential predictors of terpene emission. This multiple approach is novel and highly valuable, although the sample size for emission is relatively contained. The manuscript is well written, introduction organized in a logical sense and methodology describe the methods with precision in a concise way (but see specific comments). I have just few suggestions with alternative approaches to the data set, and minor comments on the text.

Main comments on results and discussion

I would suggest thinking as in dendroecological studies and try to decouple climate and emission checking the fit of the regression after adding different time lags . . . it is likely that meteorology or physiology during the day before could explain better the emission than during the same day. Did you try this? Please, explore it if not. Regarding Fig 5. As a suggestion, if you want mix in the same multivariate model your descriptors (meteo, physiology, etc) and your variables (emission, storage, MTS) I would suggest using a NMDS model or any other than PCA (which is a clearly parametric model for summarizing variables). Alternatively, you could summarize your ancillary properties and descriptors (including in the descriptors this time physiology, MTS and stored terpene pool) with a PCA, and then correlate the axis obtained with the emission values you got at field. A concern (that not flaw) is that MTS activity assay informs of the in vitro maximum potential activity. In vivo terpene production would depend on many factors such as enzyme activity, enzyme concentration, substrate availability, etc. Although you already state this limitation clearly in the discussion, as a suggestion, I miss a more extended discussion about this interesting point. Due to the novelty of your mixed approach, I would ask for incorporate into the last part of your discussion some material about future research, how your methodological approach provided light into future experimental designs and methodologies to be applied to, and what requirements new experiments pursuing your aim must accomplish.

Specific comments P3L14. May be the introduction would gain introducing the role of biotic induced responses as a source of plasticity in the amount and profile of terpenes. Such information would be valuable later in the discussion, as wounds made with the chamber could be a source of emission variability between samplings and plants. P4L15. You report that you tested the four experimental trees before. So, could you explain what was the reason for sampling in those 4 trees with so different emission spectrum instead to increase your sample size focussing your effort in more similar individuals. P4L25. Please report the mass (mg) of Tenax and Carbopack in the traps for allow experiment repetition. P5L5. I would suggest reportting the solvent:sample (d.w.) ratio for a complete description. P5L15. Please, state here the sample size for MTS activity. P6L5. May be I am missing something, but I cannot understand how do you apply this equation because you explain that air entering in the chamber was flowed thru a charcoal trap. P6L10. Please, report what was the range of temperatures for your emission samplings. P21. (fig 5) In order to be consistent with the codes in other figures and in the text, suggest labelling the panels with the age of the needles instead the actual year. I mean "<>1 yr old" instead "2008 needles".

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