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Interactive comment on "Comparing three vegetation monoterpene emission models to measured gas concentrations with a model of meteorology, air chemistry and chemical transport" *by* S. Smolander et al.

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Author's responses to Referee 1

The main criticism of Referee 1 is that the monoterpenes emissions models used in the study do not model the emission of monoterpenes from storage:

"If it is true that the emission from storages has been neglected, I would see it as a major flaw in the overall exercise."

First, MEGAN (and G95) is a published and widely used algorithm, so we would like to

avoid constructing a special, modified version of MEGAN specifically for this study.

But also, we would like to take a somewhat different view on the issue of storages in MEGAN in general: When emissions from a leaf are measured, we usually cannot know which fraction of the measured emission originated from storage, and which was direct emission. MEGAN is an empirical algorithm, based on fitting the emission factors to a collection of measured data. In this sense, MEGAN should be seen as "agnostic" of the origin of the emissions (from storage, or direct emission), it just tries to reflect the properties of the data MEGAN is based on.

In the case of SIM-BIM, the diffusion transport of monoterpenes out of the cell (Eq. A13, also the green arrow in Fig. 1) can introduce a delay from production inside the cell to emission from the pool inside the cell, and this can also be interpreted as emission from storage, at least in conditions when the pool inside the cell is sufficiently large.

One of the authors (S. Noe) has prepared an elaborated discussion of these topics, which is attached as a supplement to this response.

Other issues raised by Referee 1:

"P18566, L15: This would include birch and aspen which are isoprene emitters. Please reword in order to avoid misunderstandings."

We assume the reviewer means page 18568. We have improved the text to specify that the foliar density is the foliar density of pine.

"Emission models: This section needs some information about how soil emissions are modeled. This is to some degree explained later on but should be indicated here."

We changed section 2 title to "Models of vegetation BVOC emissions" to better reflect that in this section we review the mechanics of the three published vegetation emission models. We also now mention near the beginning of the section 2, that the input of the continuously measured soil emission data into the atmosphere moder is described in section 4.3.

BGD
10, C9037–C9040, 2014

"P18583, L25ff: As I recall there is also considerable birch contribution to the forest [e.g. 11]."

We have added silver birch and white birch to the list co-occurring species.

Author's responses to Referee 2

Referee brings up 3 points: (1) Conlusions needs improvement, (2) The referee calls for more use of statistics, and (3) More relevant suggestions on how to parameterize these processes in a larger scale models.

(1) Conclusions

We have worked to improve the conclusions.

In special we now also discuss: flux measurements (which have a footprint) and concentration measurements (which are point measurements) vis-a-vis modelled results, measured and modelled composition of the BVOCs, measured and modelled vertical profiles inside the canopy, the importance of the soil BVOC emissions, and try to conclude the significance of this study to larger scale modelling (which, see (3) below, is unfortunately not very absolute).

(2) More use of statistical descriptions

"There are no scatter plots"

We have added scatter plots and r^2 values for all 3 models as compared to the measured data.

"I am also missing error bars in all figures (time series and histograms)"

We have added (to section 4.2) some description and references to typical error estimates in PTR-MS measurements of monoterpene concentrations, or rather that it is actually difficult to even quantitatively estimate the error range in this kind of PTR-MS measurements. Also, it takes days of computer time (even using small cluster ma-

BGD
10, C9037–C9040, 2014

chine) to run the simulations, and the models have a large number of parameters, so a sensitivity analysis of the models is out of our reach. Thus we cannot produce proper error bars for the time series. And as the within-day variation in the time series is larger than between-day, error bars in the monthly histograms, only based on the daily values, would maybe be superfluous.

(3) Relevant suggestions to larger scale models

This is a good notion. Nevertheless, a proper comparison between detailed chemistry - boundary layer model, such as SOSA in this paper, and a more coarse scale model should be done by running both models for similar situations and set ups. After such side-by-side comparison, there would be good foundation for suggesting improved parameterizations for the coarser scale models. (And these new parameterizations should be validated by further side-by-side model runs.)

We feel that this is a significant task, and best suited for the topic of an entire new paper.

Please also note the supplement to this comment:
http://www.biogeosciences-discuss.net/10/C9037/2014/bgd-10-C9037-2014-supplement.pdf

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Interactive comment on Biogeosciences Discuss., 10, 18563, 2013.