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**Interactive
comment**

Interactive comment on "Boreal forest BVOCs exchange: emissions versus in-canopy sinks" *by* Putian Zhou et al.

Anonymous Referee #2

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Summary ———-

Zhou et al. present a new column modeling framework for studying BVOC exchange over forest canopies and apply it to investigate the role of emission, deposition, chemistry and turbulent transport over the SMEAR-II boreal site in Finland. The topic is relevant for ACP (though it would also be suitable for GMD) and will be of interest to the community. The model development is a valuable new tool for better understanding land-atmosphere BVOC exchange. Overall the paper is quite well-written.

A couple aspects of the budget discussions are confusing as they are currently presented and need to be clarified (see below). Other than that, my specific comments are minor and mainly suggestions for clarity. They will be straightforward to address and I recommend publication in ACP.

[Printer-friendly version]

[Discussion paper]

Specific comments ————-

Is this code being made publicly available to the scientific community? I see no mention of this.

18L13 and Fig 5a, it seems from this that only 20% of emitted methanol makes it out of the canopy. This seems very low. Given that methanol is one of the largest BVOC fluxes to the atmosphere globally, your finding would seem to imply a much larger gross emission flux than is broadly recognized, with the vast majority never making it out of the canopy. It would be worth discussing this in more detail and comparing with other analyses/measurements that have addressed this point.

Fig. 8, I don't see how to reconcile the data shown in Fig 8 with that shown in Fig 5. As an example, in Fig 5a we see that deposition is 5x more important than turbulent transport in removing methanol from the canopy airspace. In Fig 8e we would draw the opposite conclusion, that turbulent flux out of the canopy (blue line) is more important than deposition (purple line). Perhaps it's hard to visually integrate the area under the blue versus purple curves in 8e, but certainly the purple line integral is not 5x the blue line, and it appears to be less. The budget discussions need to be clarified so the reader fully understands what is being shown for the various figures.

5L14, some more information about the implementation of MEGAN within the model should be provided, as there have been different MEGAN versions, and there are different options for things such as treatment of the canopy, inclusion or not of a soil moisture effect, etc. Also the paper being cited (Guenther et al. 2006) only includes a description for isoprene whereas many more compounds are being simulated here.

11L25, the wording here is confusing: "the SEP of methanol is estimated to be ∼75 ng/m2/s by considering both emission and deposition processes . . .". I guess what is meant is that the 75 represents the gross emission flux (as derived from the net flux after accounting for deposition) since you are explicitly simulating deposition as a separate process. But from your wording it sounds like 75 represents the net flux,

which wouldn't make sense. Please clarify language.

16L32, 'the observed large range in formaldehyde fluxes' ... it is not clear why you would say this, as the range in Fig 4f only covers a total of 0.01 ug/m2/h, compared to the other panels which all cover much larger ranges. Do you instead mean the regular occurrence of both positive and negative fluxes?

17L10, the model "does not capture the observed abrupt increase in this downward flux between 12:00LT and 16:00LT". The abruptness of this observed change is suspicious, is it a regular feature or is it the result of extreme data from one particular anomalous day that is showing up in the mean? (I agree however with the text on lines 10-13 that given the small fluxes and large uncertainty bars this discrepancy is within error)

Fig 5, is there no chemical production of acetone from monoterpenes / sesquiterpenes? Terpene oxidation are thought to be a notable source of acetone. Is it just that the timescale for this is long compared to canopy exchange?

Section 5, except for the last paragraph the summary section is just repeating the findings from earlier. This is not that useful. I suggest streamlining this part to just the most important findings and putting more weight on interpretation / synthesis / next steps.

Minor / technical comments ————-

4L28, state why this measurement point was removed

7L1-5, and in the descriptions that follow, it would be helpful to give the units for the different parameters as they are defined.

Table 1, it seems that for OMT and OSQ that 'other minor monoterpenes' and 'other minor sesquiterpenes' should be placed under 'remarks' and C10H16, C15H24 should be placed under formula.

Fig. 2, consider putting a 2nd x-axis on the wind plot for the day and night values to

avoid confusion as the night values are shifted by 2m/s

15L1-8 and Fig. 2, please expand the temperature plot horizontally so the vertical gradients are more apparent. Right now it is too compressed to really see the changes that are discussed on page 15.

15L2-3, since you're using temperature as a proxy for potential temperature I suggest parenthetically pointing out the largest difference between the two (I think ∼0.3K for 36m) and that the observed gradients are larger than this, justifying the approximation

15L8, typo 'buoyancy'

Fig 3, the points for daytime measured SH fluxes are hard to see as they fall under the LH points. Consider changing color or symbol to make them more visible.

Fig. 4, top row missing y-axis title / label

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