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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Ethene, propene, butene and isoprene emissions from a ponderosa pine forest measured by Relaxed Eddy Accumulation" *by* Robert C. Rhew et al.

Anonymous Referee #1

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In this study, the authors measured and analysed the concentrations and fluxes of light alkenes (ethene, propene, butene), isoprene, acetylene and benzene above and within a ponderosa pine forest canopy during the summer in 2014. They concluded that these light alkenes were originated from local forest canopy, and the measured fluxes of them were about 1 to 3 times as large as the results in previous studies. The authors also found the strong responses of alkene fluxes to temperature and PAR, and then parameterized the responses with two fit functions which agreed well with the measured data.

This study provides a new dataset of measured net fluxes of light alkenes in the am-

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bient air and new parameters to model the biogenic emissions of light alkenes. The measurement techniques are described in a clear and detailed way. The parameterization methods will improve or potentially increase the accuracy of biogenic emission models (e.g., MEGAN) in simulating light alkenes. In general, this study has provided a solid understanding of biogenic emissions of light alkenes. Therefore, I recommend to accept this manuscript after some minor revisions.

P6, L1: "in (Businger and Oncley, 1990)" –> "in Businger and Oncley (1990)"

P8, L7: "next Additional" –> "next. Additional"

P9, L26: "correlation coefficients" –> "coefficients of determination (rˆ2)" Here rˆ2 is usually named as the coefficient of determination which represents the percentage of explained variation.

P11, L27: The acronym of quality control QC is not defined before.

P12, L9-10: The names of isoprene, acetylene, benzene need to be added in the table caption.

P12, L17-18: "Storage occurred at night (19-24 MST), offsetting for additional ∼25 % of measured nighttime respiration." This sentence is not clear and needed to be rephrased.

P13, L16-22: The correlations of concentrations and fluxes for acetylene and benzene should be described here or at other places since they are also plotted in Fig. 7.

P14, L11: "BVOC models" –> "BVOC emission models"

P18, L12: The equation 4 is not described clearly. Should the response equation be: F(T) = alpha*exp(beta*(T - 30)) ? Is the actual emission rate calculated as: F = F(T)*F_30? Here F_30 is from Table 2. But if this is true, the actural flux at T=30 [degC] for ethene is: 302.9 * 0.0325 = 9.84 [ug m-2 h-1], which is much lower than the measured flux shown in Table 1.

P18, L9: Is the actual emission rate calculated as: F = F(PAR)*F_1000? Here F_1000 is from Table 2. The same symbol "alpha" is used for both equations 4 and 5, but it represents different parameters. Two different symbols should be used here.

P18, L29-30: "This is consistent with respect to the observed source of isoprene in the understory, which is partially shaded." The meaning of this sentence is not clear. Why the partially-shaded subcanopy should be a large emission source of isoprene?

P18, L31: "... on average a factor of 3.4 smaller than tower-based ..." This is a bit confusing, maybe using percentage is better here.

P18-19: A general comment on section 5.4 and 5.5. 1. In section 5.4, you show the temperature response curves of light alkenes fit the measurement data more than the light response curves. Do you think the equation 4 can be used to simulate the alkene emission rates alone? If so, LDF in MEGAN 2.1 for light alkenes should be set to 0, while currently LDF of ethene is 0.8 and LDF of propene and butene is 0.2. Could you make a solid conclusion in this section about what kind of parameterization methods are better to use in the emission models?

2. In section 5.5, you have compared several parameters between MEGAN 2.1 and the parameteization methods used in this study. Although this manuscript is mainly about measurement and data analysis, I still recommend to implement the new parameters into MEGAN 2.1 and show quantitatively how much more light alkenes are emitted compared to the old version, if this is not difficult to realize.

P19, L9: "CL1 = 0.0007 α = 1.73 in this study, CL1 = 0.0007 α = 1.74 in MEGAN 2.1" This is not consistent with the values shown in Table 2.

P20, L10: "compounds be" –> "compounds should be"

P31: Figure 4: What do the dots mean in the butene plot from day 215 to 220?

P34: Figure 7: The names of acetylene, benzene should be added the caption.

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