

Interactive comment on “Gas-Phase Pyrolysis Products Emitted by Prescribed Fires in Pine Forests with a Shrub Understory in the Southeastern United States” by Nicole K. Scharko et al.

Anonymous Referee #1

Received and published: 25 April 2019

Review of Gas-Phase Pyrolysis Products Emitted by Prescribed Fires in Pine Forests with a Shrub Understory in the Southeastern United States ACP 2019-174 Scharko et al.

Summary:

The authors collected canister samples of trace gases directly ahead of the flame front during a series of prescribed burns. Fuels were representative of the Southeastern US forest with some variability in fuel speciation and moisture content. Trace gas specia-

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tion and concentration were determined offline by FTIR. Emission factors and emission ratios were calculated and compared to previously reported values from the literature. VOCs were categorized by functional group and the FTIR analytical capability with each functional group is discussed. The VOC composition is compared to metric of high/low temp pyrolysis, and to MCE. Samples from this study were consistent with dominantly high-temperature pyrolysis. MCE did not appear to correctly categorize emissions. The authors find in general much higher emission ratios for many species than have been previously reported. The discrepancy may be due to targeted collection of VOCs from one fire process (high-temperature pyrolysis) as opposed to a broad sampling of many fire processes.

Major comments:

In general I find this a well-written paper with no major issues. The methodology is appropriate and the data are presented in a well-organised way. The analysis is straightforward. The paper adds to the body of work reporting VOC composition from fires in a non-laboratory setting, and should be especially useful to operators of FTIR. I have only a few comments and suggestions listed below.

Supplementary materials were referenced in the manuscript but are not accessible online.

The paper would benefit from a tighter definition of the specific fire process being targeted, especially the distinction between pyrolysis and the flaming stage.

I don't have a good sense of how important the pre-flame pyrolysis emissions are compared to total emissions from a fire. Do the authors have a metric of what fraction of VOCs (or OH reactivity) is emitted in this process?

Specific comments:

Line 220: What is the OPAG CO detection limit?

Section 3.1: Since many VOCs were measured during this study, a more robust method

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of estimating high vs. low pyrolysis fraction could be to fit the entire VOC profiles in ppb provided in Sekimoto et al. 2018 to the measured species. It could also be helpful to compare the overall VOC profile measured here to the high-temperature pyrolysis profile.

Table 2: MCE is not reported in the table although it is in the table title.

Figure 3: The reported mixing ratios (parts-per-thousand) seem excessively high; have similarly high mixing ratios ever been reported previously in the outdoor environment?

Figure 5: I'm not sure this figure adds anything to the paper and it could be removed. What do the colours indicate?

Line 484: What is meant by secondary reactions? Photolysis or reaction with OH? Or further pyrolysis reaction? Gilman et al. 2015 and Koss et al. 2018 are laboratory studies, so atmospheric reaction seems unlikely. What reaction could reduce the level of naphthalene a factor of 10 on the timescale of a laboratory study? Or is the reduction in ER an effect of elevated CO in the other studies?

Interactive comment on Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2019-174>, 2019.