

Interactive comment on “Multi-instrument comparison and compilation of non-methane organic gas emissions from biomass burning and implications for smoke-derived secondary organic aerosol precursors” by Lindsay E. Hatch et al.

Anonymous Referee #1

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This paper reports laboratory measurements of biomass burning (BB) emissions taken during the Fire Lab at Missoula Experiment (FLAME-4). Fresh BB emission were characterized using four complimentary techniques: open-path FTIR (OP-FTIR), proton-transfer-reaction time-of-flight mass spectrometry (PTR-TOFMS), two-dimensional gas chromatography time-of-flight mass spectrometry (GC×GC-TOFMS), and whole air sampling (canister) with gas chromatography-mass spectrometry (GC-MS). FLAME-4 was the first application of PTR-TOFMS and GC×GC-TOFMS for laboratory BB emissions. FLAME-4 results from the first three techniques have been reported previously (OP-FTIR, Stockwell et al., 2014; GC×GC-TOFMS, Hatch et al., 2015; PTR-TOFMS,

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Stockwell et al., 2015). This paper synthesizes data from the four techniques to 1) compare the compositional space accessed and emission factors (EF) measured by the techniques, 2) provide comprehensive emission profiles for four fuels (Ponderosa Pine, Black Spruce, Indonesian Peat, and Chinese Rice Straw) and 3) characterize the volatility distribution of the emissions and identify potentially important secondary organic aerosol (SOA) precursors which have been understudied (e.g. in photochemical chamber experiments of SOA formation).

This paper presents new and very valuable findings for biomass burning and atmospheric chemistry fields. The study quantifies emissions for 10's of compounds that have significant potential for SOA formation, but have received little or no attention in previous studies of SOA. By doing so this paper identifies potentially important gaps in our current understanding of BB impacts on SOA. The careful 4 instrument inter-comparison presented in the paper may be useful for reinterpreting previous studies of BB that did not benefit from the unprecedented composition coverage and diversity of methods used here. I recommend this paper for publication pending consideration of the following comments.

Comments

Please provide details on PP and BS fuels. Were they both boughs? How fresh? Was combustion limited to mostly needles and fine branch wood?

Pg 4 line 19. “chemical perturbation” does this include lamps? Was the chamber dark during influx of emissions and prior to acquisition of WAS?

Figure 2b is messy and difficult to read. I suggest modifying to include only a handful of species that coincide with the main points of the corresponding text (P9, L24 – P10 L5)

Any thought on why the high contribution of alkanes for peat versus other fuels?

P11, L19-33: Does the significant interference of C₆H₈ compounds at m/z 81 identified

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in this study suggest the previously reported MT EF using PTRTOFMS (Stockwell et al., 2015) should be revised? “The MT emission factors reported by Stockwell et al. (2015) were calibrated using m/z 81 due to the high degree of fragmentation of the α -pinene standard under the PTRTOFMS drift tube conditions utilized during FLAME-4.”

P14, L33: The author not the OA concentrations were 1000-6000ug/m3. Where do these numbers come from? Are these from previously published FLAME-4 papers? Please explain the origin of the OA measurements.

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