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 #2

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Review of "Multi-instrument comparison and compilation of non-methane organic gas emissions from biomass burning and implications for smoke-derived secondary organic aerosol precursors" by Hatch et al.

The authors present emission factors for 4 different types of biomass based on laboratory measurements using 4 different methods to provide a greater coverage of organic gases in terms of mass and type. Methods are inter-compared and composite emission factors and speciation profiles are provided for the different biomass types. This is useful work for the fire science community and should be published; however, several

suggestions are made that would make this manuscript more broadly useful toward modeling wildland fire atmospheric impacts.

Emission factors for biomass burning are known to vary by combustion component (e.g., flaming to smoldering). It would be useful for the authors to describe the combustion efficiency of the samples as a function of measured CO and CO2 or if that is not available as part of the experiment some qualitative description about the relative amount of time the biomass samples were flaming or smoldering. This will allow for a more specific application of these emission factors in modeling in the future as they may be more relevant for either the flaming or smoldering component of the various biomass types included as part of this assessment.

From a modeling perspective, particle phase measurements would ideally be collected at the same time and at the same conditions as the gas phase measurements. Biomass burning clearly emits organic gases that are known to be a source of SOA in the atmosphere. However, the authors ignore ambient based field study data in their discussion of SOA formation potential that suggests little or no SOA is formed from biomass burning: Jolleys et al., 2012, ES&T, Forrister et al., 2015,GRL, Yu et al., 2016, JGR, Liu et al., 2016, JGR, and Cubison et al., 2011, ACP. This work is intended to provide emission factors and not be a chamber study looking at SOA formation so this comment is not meant to require significant changes, just to recognize that SOA formation from biomass burning in the atmosphere based on field study data is highly variable in terms of context. Perhaps IVOC emissions from biomass burning may not be that important for understanding SOA. However, future work should include measuring both gas (via the multi-instrument approach suggested here) and particle phases simultaneously to accounting for the elusive missing mass (capturing it regardless of phase).

Specific comments:

At the OA mass loadings the measurements were made at (1000-6000 ug/m3, p. 14

line 32), 50-85% of the lowest volatility IVOC they measure ($C^* = 10^3$) would be in the particle phase (or 9-37.5% of $C^* = 10^4$). While they didn't measure much mass at the lowest volatility, partitioning to the particle phase would have an impact on their results.

Including the IVOC EF in Fig 7 for each fuel type would help provide context on how the magnitude and composition of IVOC emissions changes across the fuels.

In the instrument to instrument comparison, the authors note difficulty estimating monoterpene emission factors due to interference from other compounds and the need to account for fragmentation. The novel approach presented here would seem to include sesquiterpenes which are not specifically discussed even though these compounds have notable SOA yields. Did these approaches do well at capturing sesquiterpenes? Are there similar fragmentation issues related to appropriately characterizing the emissions of of sesquiterpenes? There are not a lot of C15 compounds for these 4 biomass types (only 3 seem to have C15) but perhaps the sesquiterpenes are captured here as fragments.

In the SOA yields section, the authors note that furans are an important class of understudied organic gases in terms of SOA yield. In terms of this information being used for modeling atmospheric aerosol formation, is it possible that furans are chemically converted to traditional SOA precursors at time scales much faster than time steps in most operational air quality models and could simply be treated as a traditional SOA precursor?

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