Atmos. Chem. Phys. Discuss.,
https://doi.org/10.5194/acp-2018-487-RC1, 2018

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Emissions from village cookstoves in Haryana, India and their potential impacts on air quality" *by* Lauren T. Fleming et al.

Anonymous Referee #1

Received and published: 12 July 2018

Fleming et al. measured VOC and PM2.5 emissions from cook-stove fires in a rural village in India. Emissions were monitored from two stoves, angithi and chulha, and two fuel types, dung and brushwood. Emissions were generally higher for fuel-stove combinations that yielded the most smoldering combustion (lowest modified combustion efficiency). The authors have further assessed the impacts of emissions on OH reactivity, ozone formation, and SOA formation potential. Alkenes dominated the OH reactivity and ozone formation whereas aromatic hydrocarbons dominated the potential SOA. The work is generally well done and adds important information to the available emission inventories for real-world cook-stove fires. I recommend publication following consideration of the minor comments below.

Specific comments:

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Discussion paper

Pg 2, line 21: Please give a brief description of each stove type so that the reasons behind the differences in emissions are clearer.

Pg 3, line 1: Was the dung:brushwood ratio known for each mixed fire to accurately estimate fuel C content?

Pg 4, line 12: “The background filter mass was adjusted to match the flow rate of the sample filter by assuming the flow rate is proportional to the filter mass.” This sentence is confusing. How would mass “match” a flow rate? Are the authors saying the sampled volume of the background filter was not always the same as that of the PM sample and therefore the background mass was scaled up or down according to the ratio of the sample volumes? Also, in Figure 1, the flow rate of the background filter is nominally the same as the PM filter, so were these marginal adjustments? Please rephrase this sentence.

Pg 7, line 12: In the comparison of EFs between this work and Stockwell et al., some consideration should be given to MCE. MCE could account for some of the EF differences for brushwood given the higher MCE of this study compared to Stockwell, although it is unlikely to explain the differences for dung. Is there sufficient information in Stockwell et al. (2016) to calculate EFs in g/kg C that could be overlaid on Figure 3 (or use g/kg in figure 3)?

Section 3.2: The overall discussion section would likely flow better if the MCE section is moved earlier, as most of the preceding discussion requires consideration of MCE.

Pg 7, line 28: In Figure 3b, the EFs from the chulha stove appear to follow a clear linear trend with MCE regardless of fuel type. In contrast, emissions from the angithi stove show no apparent trend with MCE. The benzene case is also similar. Could these “complicated” MCE relationships be due to differences between the two stoves? The authors should discuss the different MCE trends observed between the different stove types.

Pg 7, line 30: Alkyne emissions from the chulha stove clearly show increasing EF with decreasing MCE (negative slope). This contradicts the discussion on pg 6, line 34 that alkynes are predominantly emitted from flaming combustion, which would show a positive EF vs. MCE slope. Please reconcile those two points.

Pg 8, line 36: "aromatics make up on average roughly 95% of SOA precursors for all cook fires." This is not at all surprising considering that nearly all of the other compounds measured are either too light to contribute significantly to SOA production or don't have a reported SOAP value (Table S3). A simple disclaimer is warranted stating as such and that the contribution of aromatic hydrocarbons to SOAP here is likely an upper limit depending on the composition of the unmeasured fraction of VOCs in cookstove emissions. The authors may additionally want to compare to Stockwell et al. 2015 (Atmos. Chem. Phys., 15, 845-865), who measured laboratory cooking fires using PTR-TOFMS and observed many other compounds that could act as SOA precursors.

Pg 9, lines 7 and 12: Do these predicted ozone mixing ratios represent the excess ozone produced from only cooking fires? Clarify the text.

Section 4: The structure would make more sense if the paragraphs were swapped.

Technical corrections: Pg 2, line 14: typo in 'Alternatvely'

Pg 2, line 17: typo in "a simulated village houses".

Equation 1: It's redundant to use the summation sign and '+' signs.

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