Reviewer 1

Evans et al. show the effects of flaming and smoldering biomass combustion on the emission chemical composition. Moreover, they also show differences after aging. Overall, the study is well-designed, and the paper is well-organized. The findings will benefit the community by helping them understand the effects of biomass-burning aerosols on climate. I have a few minor comments that I hope the author can consider.

We thank the reviewer for taking the time to read our manuscript and providing insightful comments and suggestions. We hope the following explanations and clarifications are satisfactory in addressing the reviewers comments.

1.1 *It seems like the experiments have CO and CO2 measurements. If this is true, it will be better to quantify the combustion condition based on modified combustion efficiency (MCE), and I am interested to see the correlation between chemical composition and MCE.*

> The authors appreciate the reviewers suggestion and agree that MCE is widely used to distinguish flaming and smouldering therefore these values are now included in Table 1 instead of $CO:CO_2$. As the range of MCE studied is limited we did not correlate composition and MCE in our original manuscript. The identified intermediary burn also had a very similar MCE to the flaming experiments (0.95). Therefore, to do a correlation the authors would require more repeats across the full MCE range which was not possible in this campaign. Due to not measuring at the stove flue we cannot provide MCE measurements for the fresh flue filters.

Table 1: List of the OA samples used in this study and the initial conditions at the start of the aging period

Experiment date	Conditions	Sample ID	Aging period / hrs	PM concentration / μg m^{-3}	$NO:NO_2$	OC:BC*	MCE
21/04/2022	Flaming light aged	FL_AGED_1	5:50	243.6	1.94	0.32	0.96
26/04/2022	Smouldering light aged	SM_AGED	6:05	213.6	1.81	406.3	0.78
28/04/2022	Flaming light aged	FL_AGED_2	6:05	153.4	3.74	0.21	0.93
30/08/2022	Flaming fresh flue	FL_FRESH	-	-	-	-	-
31/08/2022	Flaming fresh flue	SM_FRESH	-	-	-	-	-

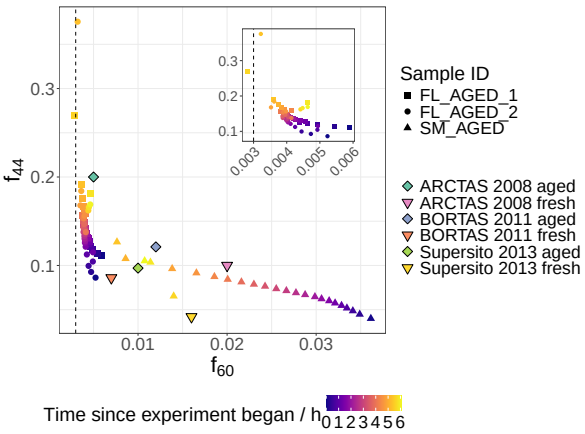
*total organic content measured by AMS

1.2 *For section 2.1.3, is there any reason why you don't use water:MeOh solution to extract the filter? If your samples were initially extracted by methanol, how would that affect water-soluble but methanol-insoluble species? And could you provide an estimation of how much organic will be lost during the process?*

> The primary reason for not using water to extract the filter is the potential production of OH radicals through the sonication step when using water ([1, 2]). Secondly, many studies have observed that the use of methanol increases the extraction efficiency for OC with studies reporting more than 90% extraction efficiency of OC from biomass burning $PM_{2.5}$ samples ([3, 4]). Therefore, we anticipate minimal loss of organic carbon in our extraction method. In addition, methanol extracts were found to be more light absorbing in previous studies due to the increased extraction of BrC components, which may otherwise be insoluble in water ([5–8]). Given biomass burning is a large source of BrC the use of methanol solvent is favourable in this respect.

1.3 *For Figure 1, I suggest adding a legend of markers as you did for other figures.*

> The authors appreciate this feedback and will add this to the manuscript. We have also added observations from aircraft campaigns and long term measurement sites.



1.4 *I think eq. 5-7 are duplicates of equ. 2-4.*

The authors clarify that the equations are not duplicates as for the aromaticity index calculation of CHON species we first subtract NO_2 for the nitro group from the formula and hence the O-2 and N-1 in Eq 5-7. However we will make this clearer by using alternate terminology in the equations.

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$$DBE_{\mathrm{CHON}} = 1 + C - \frac{O-2}{2} - S - \frac{H}{2} - \frac{N-1}{2} \tag{1}$$

$$C_{\mathrm{CHON}} = C - \frac{O-2}{2} - S - (N-1) \tag{2}$$

$$AI_{\mathrm{CHON}} = \frac{DBE_{\mathrm{CHON}}}{C_{\mathrm{CHON}}} \tag{3}$$

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