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Interactive comment on "Responses of soil physico-chemical properties to combustion: a space for time substitution study to infer how changes in climate are likely to affect response of topsoil to fires" *by* S. N. Araya et al.

S. N. Araya et al.

saraya@ucmerced.edu

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Comments on the manuscript are followed by our responses. Text locations in the manuscript are indicated by a combination of page number and line number (page#:line#).

Comment 1. The use of word "combustion" should be avoided in the title and the main text. In general, it is possible to sustain a smoldering combustion in organic soils. However, it is questionable if such combustion is possible for high-mineral soils tested

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Discussion paper

in this paper. In the furnace below 400C, the mass loss in soil is a mainly a result of pyrolysis which produces pyrolysates and black chars which does not require oxygen, so it is not a combustion. When the furnace temperature exceeds 400C, chars are further oxidized which can be called as combustion. Without such high-temperature furnace, combustion may be sustain in soil. Therefore, using "combustion" and "combustion temperature" here can be misleading, instead "heating" or "soil or environmental temperature"

Author response: We agree with this comment. Relevant occurrences of the word "combustion" in the manuscript were either removed (2:4; 3:22), or the sentences rewritten with appropriate terminology (3:19; 5:11; 11:24; 12:6-8; 14:3-6, 12; 15:27,30; 16:25-27; 17:4; 18:15-16).

Comment 2. Both the fire heating temperature and heating duration determine the fire severity. In real fire, the duration for soil sustained in a higher temperature is usually shorter, rather than a fixed 30 min. Of course, in lab experiment controlling the heating duration makes a better comparison. But it is better to emphasize what is the real fire condition to avoid confusion.

Author response: Justifications for the heating duration used was given in section 2.2 (5: 29 - 6: 10). We have decided to expand the discussion to highlight heating duration in relation to our methods in the revised manuscript. We have also rewritten a paragraph in introduction (3:14-18) to clarify the importance of heating duration in fires.

Comment 3. The air supply during the heating is not mentioned in the paper. Is the air supply sufficient, or is the furnace sealed? The oxygen supply can significantly change the decomposition process of SOM.

Author response: A sentence explaining the oxygen supply is added in methods section (5:21). All soil heating procedure was done by Thermo Scientific Thermolyne

Largest Tabletop Muffle Furnace (Thermo Fisher Scientific Inc., 81 Wyman Street Waltham, MA USA 02451). The furnace air supply was not considered limiting for the following reasons: The furnace was not sealed, and the furnace had an internal capacity of 45 L and the volume of soil in the furnace at a time was approximately 0.924 L (i.e. volume of crucible multiplied by 24 crucibles per run: $(\pi 3.5^2 \times 1) \times 24 = 924 cm^3$

Comment 4. In the paper, SOM is used very often, however, its value is not given for any soil samples. SOM should be easily measured, for example, by quantifying its inorganic matter after a complete oxidation in high-temperature oven. Comparatively, the organic carbon in soil is not so simple to quantify. Therefore, using SOM to correlate other parameters such as pH, CEC is more useful and reproduce current experiments with different soils. In fact, SOM correlates with C very well: generally increasing with the organic carbon. Correlating SOM will not alter the conclusions in this paper.

Author response: Our usage of SOM in our findings is as a general descriptor for organic compounds in soil, however when a specific data is being discussed we have used the quantity of C which was actually quantified accurately.

Comment 5. I recommend to split the discussion section and add a short discussion in each subsection of results. Most of experimental results are expected, and can be explained by a simple analysis right after showing the figure. It will also make readers easier to follow the discussion.

Author response: We agree with this comment and we have made necessary changes with the discussion to address the reviewer's concern.

We appreciate the thoughtful comments from the reviewer. Thank you!

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