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Interactive comment on "Water vapor release from biofuel combustion" *by* R. S. Parmar et al.

Anonymous Referee #3

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This paper is a significant and valuable contribution to the body of scientific literature related to the atmospheric chemistry of wildland fires. While the procedures and analysis are straightforward and may seem rather basic to some readers, the explanation provided by the authors ties the combustion physics to the biological, traditionally "fuels" science and then to the potential implications for atmospheric processes in wildland fires. Their inclusion of agricultural biofuels (sugar cane and sunflowers) also provides the reader with a basis for understanding how literature on burning these materials and the associated convection relates to wildland vegetation fires. The data used for this study were originally obtained for a study of aerosol formation. That the authors were able to use the data for the present analysis is opportune. However, given the references in the paper to the impact of "other carbon compounds" and their potential impact on the ratios observed (p.4490, lines 25-28) the authors should explicitly include some of their original aerosol results to further constrain the carbon budget. It is unfortunate

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that the authors did not measure fuel moisture before burning samples of their fuels. The reverse-estimation of fuel moisture gives values that seem quite large, especially for the oak and the "pine with dry underbrush". The conventional wisdom in wildland fire fighting is that combustion is not sustained when fuel moisture exceeds about 30%, and while conventional wisdom can easily be wrong, I am inclined to believe that it has some value. Early work on forest fires and the relationship of fuel moisture to fire danger also supports a value of "moisture of extinction"; somewhere near 25-40%. If the authors cannot provide measured fuel moistures, then the aforementioned aerosol constraint on the carbon budget is more important to their exposition. There is one other quantity that I would like to see discussed, the air temperature in the samples entering the sampling container (and how it relates to the air entering the combustion chamber). The relationship between air temperature perturbation and moisture perturbation is a topic of some speculation in wildland fire research, and any added insight would be helpful. The discussion of experimental design would be much better with a diagram illustrating the apparatus (i.e., the fuel bed, the ducting and the sample chamber). It should also explain the method of ignition and sustaining combustion in the tests. Any sort of fueled ignition using propane, methane, etc. would bias the carbon-hydrogen budget of the fuel combustion, while a purely heat-ignition would bias any temperature data. The authors' analysis of Clements et al. (2006) could be further expanded, including revision to include Clements et al. (2007). Even without the latter reference, the '06 discussion should note two additional points. First, Clements et al. (2006) noted that there was standing water in the fields during their fire, and this may bias the moisture observations. Second, those authors also estimated their fuel moisture at 8%, well below the value calculated by the present authors. Both are estimates, however, and this is why comparison with Clements et al. (2007) would be stronger. They measured fuel moisture between 22 and 26% the day of the fire. Unfortunately, they do not provide CO2 information.

Reference: Clements et al. 2007. Observing the dynamics of wildland grass fires:FireFlux - a field validation experiment. Bulletin of the American Meteorological

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Society, 88:1369-1382.

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