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Atmospheric Chemistry and Physics Discussions

# *Interactive comment on* "Airborne characterization of smoke marker ratios from prescribed burning" *by* A. P. Sullivan et al.

**Anonymous Referee #1**

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Sullivan et al. introduce an aircraft-based Particle-into-liquid-sampler (PILS) system to measure total organic carbon (TOC) in biomass burning plumes from prescribed burns in South Carolina, USA. The PILS capability also included a fraction collector system used to measure a variety of chemical markers off-line. The study is highly time-resolved (measurements taken in 2 min or less); spatial information about the chemical properties is limited to altitude. Understanding the chemical and physical dynamics of biomass burning plumes is important for multiple reasons. Such information can be used to validate mass transport and dispersion models, to better understand how fast degradation or photochemical transformation of organic markers is or isn't occurring. Moreover, these data can be important for understanding community exposure profiles among other possibilities. The study is certainly well done and it merits



publication, but the manuscript would benefit from an explicit statement or two that clearly describe the wider advantages of these measurements. It can better emphasize the value of these data and the reported relationships. In other words, what are the next steps? How will these data be used to improve which dispersion, air quality, or climate models? What is the benefit of knowing that marker/chemical property ratios are strongly influenced by fuel type? In the final analysis, the study does a superb job of presenting the data and of digging through certain interesting relationships among widely-measured chemical markers, but could further clarify the intrinsic value of what was demonstrated. Additional comments:

(i) Abstract – Use of the "RF" notation is confusing here. It should be defined. (ii) P11717, lines 15-20: This is a valid point about GC-MS. Although, levoglucosan is normally so abundant in biomass burning plumes, the sampling time requirements are strongly reduced. For example, the TAG GC-MS is capable of measuring many of these markers in 30 min or less in the atmosphere without the benefit of being in a biomass burning plume. It was nice to see all the WSOC and LG measurements match up so well, but from the perspective or air quality (for example) the real benefit of measuring LG so quickly (the off-line analysis time is reported as 59 min) is not perfectly clear. (iii) Section 2.3 should come first so that the order of activity is clear. (iv) In Fig. 2 the legend symbol for LG does not match what's in the figure. (v) Fig 3a is for one flight. What was the correlation coefficient for all flights for LG/WSOC? (vi) P11723, lines 1-2: "...with a peak in the CO concentrations are considered." Is not clear. (vii) P11725, line 27: Why is a ratio being used to check this? Doesn't that just complicate the situation? How does one know the changes and rates of reaction for WSOC and LG? (viii) P11726, lines 1-5: The $\Delta$LG/$\Delta$WSOC ratios can vary by nearly a factor of 2. What is the criteria for this ratio being "stable". Is this measurement error? (ix) P11726, lines 18-20: Again, not sure that I agree $\Delta$ m/z60/$\Delta$OA is a model of stability as implied here. What happened with RF08? (x) Table 2 should be added to the Supporting Information

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 11715, 2014.