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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Measurements of reactive trace gases and variable O_3 formation rates in some South Carolina biomass burning plumes" *by* S. K. Akagi et al.

Anonymous Referee #1

Received and published: 19 November 2012

This well-written paper presents data and analysis from prescribed forest fires in the southeastern United States. Measurements were taken by FT-IR and whole air sampling (WAS) at ground level and from aircraft, providing an opportunity to contrast lofted and low-lying emissions from the same fire. Emission factors (EFs) are provided for a large number of compounds and are compared to data from a previous study of ecologically similar fires. The significant differences in EFs between these two studies illustrate the under-constrained and highly variable nature of biomass burning emissions. The authors focused their analysis on a few topics, including the presence of monoterpenes in the initial emissions as well as their role in the chemical evolution of the plume. They also discuss the chemical evolution of other species in the plume

including ozone and methanol. HCN is highlighted as reliable biomass burning tracer, particularly for lofted emissions.

I recommend publication and ask the authors to consider the following questions and comments to improve their very good manuscript.

You discuss the rapid dilution of the observed plumes as a limiting factor in your ability to study the aging of the plume, but you do not state the cause of the fast dilution. Were these spatially small plumes, or were they subjected to unusually rapid mixing? Did high background mixing ratios have a large role in losing track of the plume?

The observed ozone production is discussed in the context of a diverse set of other studies. Aside from attributing the high production rate of the Block 9b plume to mixing with anthropogenic emissions and the lower rate of the Bamberg fire to cloud cover, no explanations are offered as to what made these fires rapidly produce ozone. If you can provide insight here, it would be helpful. Also, why is ozone formation ubiquitous in tropical biomass burning plumes but not in extratropical plumes? A citation or a sentence of explanation would be beneficial.

Is loss of analyte in the WAS canisters a concern? I am specifically wondering about samples that initially contain ozone and monoterpenes.

Have you compared the Picarro data with the AFTIR data for CO2, CO and CH4?

Page 25276, line 28: this sentence is confusing with so many qualifiers. Improving the clarity would be beneficial.

Page 25277, line 8: giving one value (90 or 91) would probably suffice given the preceding “about.”

Page 25277, line 13: you state that nighttime fires probably have higher monoterpene emissions and that most of the monoterpenes will be oxidized by NO3, but you don’t say why the monoterpene emissions would be higher. Are the higher nighttime emissions inferred from the higher ground-based ERs compared to the airborne ERs, recognizing

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the lower MCE of nighttime fires?

Page 25280, lines 21-23: isn't MCE=0.96 by definition not smoldering combustion?

Page 25304: in the "Atmospheric conditions" column, you use inches and feet. It would be better to use SI units.

In Figures 2-4, the symbols used for fire locations, hotspots, and sample locations are very similar, especially the fire locations and hotspots. Using a different symbol for fire locations would improve the maps.

The colors used in Figure 13 for SC and CA data are fairly similar– changing one of the colors or using different symbols would improve clarity.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 25255, 2012.