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Interactive comment on “Emissions from forest fires near Mexico City” *by* R. Yokelson et al.

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Considering Urban Secondary Aerosol lowers Fire Contribution to PM in Emissions from forest fires near Mexico City Yokelson et al.

This paper is an important piece of work on the impact of forest fires on emissions and concentrations of several species in the Mexico City outflow during the MILAGRO field campaign. It will also help provide a context for the interpretation of results from other platforms (ground and aircraft).

In terms of the estimate of the influence of fires on the Particulate matter (PM) concentration in the Mexico City plume (section 3.5), we do have an important comment:

Both estimates of the fraction of fire PM in the Mexico City plume rely on the emissions inventory (EI) for Mexico City, from which a ratio of 0.011 g PM / g CO is calculated an used by the authors. This factor is probably correct when considering ONLY primary particle emissions, and thus allows a comparison of PRIMARY particle emissions from the city with the primary emissions from biomass burning. However, it is too low by a factor of 4-7 when accounting for secondary species formed in the intense photochemistry of the MCMA, especially secondary organic aerosol (SOA).

To estimate the contribution of biomass burning to Mexico City outflow including SOA formation in urban air, we use 0.040-0.080 g PM / g CO for non-biomass influenced urban aerosol, as justified below. Redoing the calculation in the paper with these values gives a range of estimates of 22

We also suggest the abstract include the range of estimated contributions under the range of plausible assumptions, and not just the upper limit estimate. Otherwise someone reading only the abstract would get an exaggerated sense of the fire contribution to PM.

Justification of PM/CO ratios for urban outflow including secondary species

Numerous studies [e.g.de Gouw et al., 2005; Volkamer et al., 2006] have reported the rapid formation of SOA that exceed the primary organic aerosol (POA) mass in a few hours of photochemical activity. Our results from the previous MCMA-2003 field campaign [Further analysis of data presented in Salcedo et al., 2006; Volkamer et al., 2006] indicate that the urban airmass (in the absence of significant fire influence on April 9, 2003) reaches values of 0.028 g OA / g CO and 0.064 g PM1 / g CO after 6 hrs of photochemistry. A recent study [Peltier et al., 2007] shows Water Soluble Organic Carbon (WSOC) to CO ratios of 0.030 g/g in the Northeast US excluding biomass burning influenced plumes. When their conversion factor of 3.1 is used to convert WSOC to total OA this ratio becomes 0.093 g total OA / g CO for ratios, greatly exceeding the MCMA EI ratio for total PM10 mass due to secondary formation of aerosol mass. Note that this value of 0.093 g/g, excludes secondary inorganic contributions to total PM. Consequently, the total PM/CO ratio would be higher.

In addition, our results from the Aerosol Mass Spectrometer aboard the NCAR C-130 during the MILAGRO campaign (manuscript in preparation) suggest ratios of 0.024-0.064 g OA /g of CO for urban plumes not influenced by biomass burning. This ratio varies from directly over the city to the city outflow due to increased secondary formation with time, and the data comes from later in the campaign (3/29/06 C-130 flight) when there was generally lower fire influence as suggested by the meteorology [Fast et al., 2007] and gas phase data.

PM / CO ratios for fire emissions

For fire PM/CO emission ratios, the value of 0.133 g PM / g CO reported in this paper is close (if not slightly lower) than the preliminary value we are finding with the C-130. Although secondary formation can occur in biomass burning plumes, our data does not suggest values much larger than the value of 0.133 g / g reported in this paper. Because primary emissions from fires are so large, the addition of secondary mass does not alter the total PM / CO ratio for fires to the extent it alters this ratio for urban pollution.

Finally, we would like to point out it is possible for fire plumes to lose PM mass upon dilution as most biomass burning OA appears to be very volatile, based on both field data from Mexico City and source measurements [Huffman and al., 2007; Robinson et al., 2007; Shrivastava et al., 2006]. This effect may partially compensate for the addition of secondary mass.

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