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Atmospheric Chemistry and Physics Discussions

Interactive comment on "A review of biomass burning emissions, part I: gaseous emissions of carbon monoxide, methane, volatile organic compounds, and nitrogen containing compounds" *by* R. Koppmann et al.

Anonymous Referee #1

Received and published: 8 November 2005

General Comments:

In the opinion of this reviewer the MS does not extend the access to or interpretation of gaseous emissions from biomass burning beyond recent reviews. The reviewer agrees, however, that the forthcoming reviews on particulate emissions would fulfill a significant unmet need.

On the positive side, the authors stress the importance of biomass burning emissions

on local and global pollution, changes in response to land use, population growth, climate change, as well as of emerging research tools such as remote sensing, new analytical techniques and advanced modeling.

I find the MS tedious and difficult to digest, multiple readings were necessary for me. I would suggest starting each section with a summary: what are the major compounds and then discuss their origin, how they are influenced by fire dynamics and fuel composition, correlation with other trace gases and whatever unique information is available in a particular reference. I find the attention to tropical and subtropical field campaigns excessive, likely because they represent well documented data sets from large integrated field campaigns in Africa and South America.

The authors note the paucity of data on emissions from fires in temperate forests but do not reference recent results (e.g. GBC 15(2), 435, 2001). I also believe that newer results should have preference over historical data because they are based on better analytical techniques and sampling methods. Older data should be referenced but not discussed in detail unless they add a unique perspective.

I would have liked to see a more critical review of questions associated with sampling and analytical aspects. While the analysis of hydrocarbons and halocarbons has progressed to unprecedented resolution and quantitation, analyses of trace gases containing oxygen, nitrogen or sulfur are still uncertain, particularly because of unknown recovery and losses in tubing and sampling containers. While inter comparisons among chromatographic techniques have been done, PTRMS and FTIR (others?) should also be included. The discussion should include problems and uncertainties associated with the temporal and spatial aspects of sampling. For the study of process parameters controlled laboratory experiments are needed. For integrative effects well defined aircraft measurements are required. The Lagrangian pursuit of aging plumes is important for the understanding of troposphere chemistry and environmental effects on a regional and global scale.

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Comments on individual sections of the MS:

Abstract – meaning of the last sentence is unclear – yes or no? This statement causes questions later in 10465 L11-15.

Processes: a summary at the beginning or end of the section would be useful: i.e. what burns during the flaming and smoldering phases and what are the products in the smoke? (volatiles from plants, gaseous decomposition products of fuel, complete and partial combustion products).

You refer to the major background papers but the text is without specific references. The section is not adequate for the expert and overwhelming for a researcher trying to get an overview.

Burning equations: this section, although very important, is more complicated than it needs to be. A paragraph introducing of ER and EF, their relationship and their use in fire emission research would be helpful. Plume component concentrations [x], and Δ[x], the difference between plume and background concentrations of x, are sometimes used interchangeably in the literature which leads to confusion. I believe a careful check on your burn equations to avoid such confusion is indicated.

Open Fires: I presume you include wild fires and prescribed fires in this category. It would be worthwhile to state that boreal fires have very large temporal variability dependent on drought cycles. By contract, tropical and subtropical burns are annual or biannual events. For detection of fires and quantification of burn area remote sensing has become an indispensable tool, particularly in inaccessible areas in Africa and Siberia. Some recent references are missing. In my view the savanna data in the MS could be abbreviated and referenced instead of discussed in detail.

Gaseous emission products: Comments on ER/EF relationships are redundant.

Carbon Monoxide: it would be helpful to start with some generalizations: e.g. grass fires in the tropics/subtropics produce low CO/CO_2 ratio and are mostly flaming; tem-

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perate and boreal fires burn live coniferous or deciduous vegetation in flaming and smoldering phases and produce higher CO/CO_2 ratios. Satellite tracking makes it possible to measure individual wildfire plumes. In global CO plumes, wildfire plumes can be identified by ^{13}CO discrimination.

Methane: Can this section be condensed? Variability? yes – but what is its source? Fire dynamics, fuel composition, climate? Can you make conclusions from the data?

NMHC: some confusion here. 10474 , L15 ff talks about oxygenated compounds – do they belong here? Somewhere in the MS you must clarify your definition and use of the terms VOC, NMHC and Oxygenated Hydrocarbon. Again, I would suggest reporting what hydrocarbons are generally emitted, and than point out, where possible, what difference fire dynamics or fuel composition make. Can some chemical reasoning about the structure of the surviving hydrocarbon be made? Your referral to ER/EF relationship is important here and reinforces my comments in Burn Equations.

Oxygenated hydrocarbons: nice opportunity to discuss fire chemistry.

Halocarbons and nitrogen-containing compounds: suggest reorganization into summary plus comments on unique features.

Spelling:

There are spelling errors, some of which I caught:

10461 L14 dominate

10462 LL3 coarse

10470 L15 founr

10476 L 11 inmvestigate

10480 L 10 2.4 +/- o 10-6

Tables:

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Table 7: Insufficient title and error with charcoal to carbon conversion

Table 6: arrangement by fuel/fire would be more meaningful.

Table 4: define VOC in title or footnote

Table 2 and 3: arrange by fire type/fuel, not publication date.

Interactive comment on Atmos. Chem. Phys. Discuss., 5, 10455, 2005.