

Interactive comment on “Moisture effects on carbon and nitrogen emission from burning of wildland biomass” by L.-W. A. Chen et al.

Anonymous Referee #2

Received and published: 4 May 2010

General Comments:

This paper describes the results of laboratory measurements of the gaseous and particulate nitrogen and carbon emissions from the controlled combustion of dry and moist forest biomass. Base upon the description in the paper, a series of experiments involving the collection of biomass fuels, their pretreatment and combustion, and measurements of the composition of the resulting were thoughtfully designed and carefully conducted. Integrated and continuous composition results by fuel type and moisture content are presented and discussed. The overall results should be of interest to those who care about the physical and chemical nature and effects of biomass smoke. The only substantive technical comment concerns the lack of uncertainty estimates and the misleading use of too many significant digits for the values shown in Table 1. This de-

C2359

iciency is described in greater detail below in the last of the specific comments. The paper is generally well prepared. However, there are several instances where additional information would be helpful to the reader, as well as a few typographic or other communications issues (listed in the Specific Comments, below).

Specific comments (by page and line number):

Page 7988, line 15 – It is unclear what is meant by ~50 bulk materials were collected. Is this the count of material (e.g. 50 individual leaves, needles, stems, branches etc.), or the number of individual locations where a sample is collected (e.g. a scoop or sweeping of the surface)? Were there criteria for what was collected or excluded (e.g. only items below a certain size or weight) and roughly how much material is collected within each plot (e.g. a few grams or kilograms)?

Page 7989, line 1 – The authors should clarify what they mean by plant samples in the sentence beginning “Moisture content of plant samples...” Do they mean those collected from living plants?

Page 7989, lines 16 to 22 – The text indicates that samples were kept warm prior to and during the combustion experiment by being on a hot plate with adjustable temperatures up to 500 °C, but it doesn't indicate the temperature of the hot plate and the duration of sample heating prior to combustion. Given that the primary independent variable is the moisture content of the biomass fuel, the potential of this warming to change the moisture content of the fuel prior to combustion should be addressed with additional information.

Page 7991, lines 1 to 12 – This text qualitatively describes the differences between dry and moist fuels during the combustion process. It would be much more informative if the authors provided more specific information. For example how long did it typically take for the ignition of the dry and moist fuel? Was the hot air igniter used for the same amount of time on each sample or was it kept on longer for the moist fuel longer (e.g., until it flamed)?

C2360

Page 7993, line 10 and page 7994, line 1 – These two lines contain acronyms OPN and GTC that I couldn't find spelled out anywhere in the text. Given the numbers of such acronyms used in this paper, a complete list should be provided somewhere in the text.

Page 7994, line 19 & 20 – There's something wrong with the wording of the sentence "High thermal energy in the flames allows to break up plant organic matter. . ." Maybe the word "it" should be added after "allows".

Page 7994, line 23 – The use of the word "weakens" with respect to thermal energy doesn't seem correct. "A better choice of a word might be "decreases". However more generally for this discussion isn't it more scientifically correct to discuss it in terms of higher and lower temperatures needed to affect the various reactions instead of thermal energy?

Page 8002, Table 1 – From the footnote I understand that this table is populated with mean values from two separate burns for each fuel and moisture level. The footnote indicates that if the two values differ by more than a factor of 3, the greater uncertainty of the mean is indicated by the values being shown in brackets. It seems reasonable to suspect that the cause of such large uncertainty is the result of fuel inhomogeneity of the replicate burns, as opposed to problems of analytical accuracy/precision. The use of brackets to flag highly uncertain values is only modestly helpful when dealing with only a pair of measurements of a population that may have a large distribution. Minimum numbers of replicates to estimate the underlying variability of a parameter is generally considered to be between 4 and 7. Compounding the issue of publishing a table with values of unknown precision is the fact that the values are displayed with up to four significant digits, inappropriately implying a high degree of precision.

Based on my inspection of Table 1, it appears that there is insufficient evidence for a difference between the smoke composition values for moisture levels II and III. If the authors agreed with this observation, they should combine the two pairs of measure-

C2361

ments in order to calculate and report mean values and their standard deviations of the 4 replicates. Similarly the authors may be able to combine other sets of data (e.g. leaves and stems or plant species) to increase the numbers of measurements used to calculate means and standard deviations. In fact the only result differences that seem to be substantive are between dry and moist fuels, and among litter, duff, soil and above ground plants.

The number of significant digits used in the resulting tables should be made consistent with the precision indicated by the standard deviations (e.g., it's misleading to have more than 2 significant digits if the standard deviation exceeds 10% of the mean value; or 1 significant digit if the standard deviation exceeds the mean).

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 7985, 2010.

C2362