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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Greenhouse gas emissions from laboratory-scale fires in wildland fuels depend on fire spread mode and phase of combustion" *by* N. C. Surawski et al.

Anonymous Referee #2

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General Comments:

This manuscript deals with laboratory experimental measurement of gaseous concentrations of CO2, CO and N2O on the plume from the burning of eucalyptus liter fuel in a burning tunnel, in controlled heading, flanking and backfires. Measurements were used to calculate emission factors for the three conditions and the data was treated statistically and compared with results of other experiments and field measurements. The information gathered and the resulting calculations were used to estimate total emissions for the prescribed burnings proposed for Victoria / Australia if they are performed in heading, flanking or backfire conditions.

The paper resumes an important set of laboratory burning experiments. My doubts are that these laboratory experiments with quite uniform and low litter sizes and humidity conditions, can be representative of prescribed fires that are done in less extreme dried conditions with winds that produce a mixture of processes (heading/flank/back). Furthermore (and rightly referred by Referee 1) the experimental setup of plume sampling (only at one point) is probably not representative of the average emission composition as result of in-homogeneity of the plume in tunnel effluent as result low turbulence and temperature gradient. Also, in my opinion, the data treatment and presented formulation is given in a very confusing way with a unnecessary long discussion of equations for Emission Ratios and Emission Factors that in several cases are inaccurate, using unclear symbology. For example Emission Factors are given as a fraction of burned/fired carbon, as a fraction (g/Kg) of burned biomass and in Section 4.2 as an un-specified percentage of something.

Therefore I have doubts both in relation to the representativeness of measured plume concentrations and in the quality / clarity of the manuscript organization/presentation. In order to be accepted, data should be provided concerning the sampling representativeness and a profound re-writing of the manuscript should be taken.

Specific Comments:

Line 25, page 23129- develop experiments positioning the tube at different heights above the floor of combustion to access the homogeneity of the plume.

Line 13, page 23130- removal of fragmented material will not produce a combustible less representative of natural conditions?

Line 1-2, page 23131- To dry the combustible to this low humidity is representative of conditions of burning in prescribed fires? Usually prescribed fires are taken during periods of lower fire hazard, therefore more humid.

Line 7, page 23132- What means dilution with zero air? Is it normal external air, with

usual CO2 content, or air without CO2? Clarify. If it is air with normal ambient CO2 (and CH4, etc) which is the imprecision resulting from the subtraction for conditions when burning is producing less emissions (in the end of experiments)?

Lines 13-15, page 23132- Unclear

Pages 23132-23133- I think that this discussion about ER is probably not necessary. It is only a methodology to calculate emission factors from concentration measurements. The associated figure 4 is also not very enlightening. Is it for heading, flanking or backfires?

Equation 2- This equation is not exact. With basis in in concentration molar ratios (ppm) the values for NMHC should take into account that all hydrocarbons have more than a C atom. Also molar ratio for PC is not well defined.

Equation 3- lacks a delta before CO2

Lines 16-18, page 23134. To adapt equation 3 to N2O it needs also to substitute n for the ratio between N2O and CO2 number of atoms in the molecule (that is- 2). The consequent emission factor is in fraction of N emission per N present in the combustible burned? Clarify.

Equation 5- to use the same symbol EF for this and equation 3 is confusing. Fc needs to be in fraction in the equation and not in % as it is suggested. In the equation there is confusion between molecules and atoms of carbon.

Equation 6- The symbol NCj is used to specify the same than the symbol n in equation 3. Equation 6 is unnecessary to explain the evaluation methodology.

Equation 7- What is the meaning of EFN2O/CO2?

Table1- No specification about which data corresponds to which fire process (heading/flanking/back). Define Byram fire line intensity.

Figure 5- The colors for lines representing flanking and backfires are difficult to discrim-

inate.

Lines 19-25, page 23138- I did not understand this discussion. As far as I understood from the experimental part, the humidity of the combustible was always the same. So no influence of humidity variability on emissions could be detected because there was no humidity variability.

Section 4.1 is confusing because it is not clear which definition of EF is being discussed at each moment.

Section 4.2- I could not understand and follow most of this discussion that now uses Emission Factors in percentages, mixed with the previous definitions of EFs.

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 23125, 2014.