Scientific Significance

This paper presents the results of experimental laboratory fires used to investigate the influence of fire spread mode and phase of combustion on gas emissions. According to van Leeuwen and van der Werf (2011), explaining the large within-biome variability of emission factors that is so pronounced in the findings of Akagi et al (2011; Table 2.2) remains one of the main challenges for biomass burning emissions science. By focussing on measuring fires burning with different fire spread modes, this paper addresses one of van Leeuwen and van der Werf's main suggestions – that measurement campaigns need to pay more attention to ambient conditions. The significant differences found between emissions from different fire spread modes goes some way to explaining why we see such large variability within and between different studies of fire emissions from a particular biome (in this case, Australian temperate forests). More papers are needed like this one that attempt to describe AND explain emissions variability within a particular biome. The links made to carbon accounting and sequestration are important.

Scientific Quality

I am impressed by the attention to detail in the description of the experimental and analytical methods. A lot of effort has been made to explain and justify the experimental setup, and the particular equations used for calculating emission factors. These justifications are supported by referencing recent examples in the literature that use similar approaches. Few fire emissions papers attempt to explore statistical relationships between fuel/ambient/ignition conditions/characteristics and the resultant emissions (Meyer et al. 2012 is one exception). The MANCOVA and MANOVA tests proposed in this study are appropriate. This Section (2.4.3) lacks any reference to previous studies, so perhaps it is worth referring to Meyer et al. 2012 who also use statistical methods to explore relationships between fuel characteristics/ambient conditions and fire emission factors.

The discussion does a good job of comparing findings with the few previous studies of Australian temperate forest fire emissions. Whilst I appreciate that there has been little investigation into the influence of fire spread mode on emissions, and probably no studies of this for Australian temperate forests, it would be useful to see a comparison with any study that does look at this relationship. The only one that I can think of is that by Wooster et al. (2011) who report differences in emission factors between headfires, backing fires, and residual smouldering in field measurements of African savannahs (see Table 4 in their paper).

References:

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