

Interactive comment on “Biomass burning fuel consumption rates: a field measurement database” by T. T. van Leeuwen et al.

Anonymous Referee #2

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General Comments The paper “Biomass burning fuel consumption rates: a field measurement database” addresses an important topic in biogeochemical modeling and atmospheric sciences and is a substantial contribution to scientific progress within the scope of biogeosciences. The database assembled and presented in this study will be of great value to researchers in many fields. The paper well organized and it is well written. I recommend this paper for publication in Biogeosciences following some minor revisions/edits.

Specific Comments: Temperate fires / boreal fires. Fires in the tropics and savannas are largely intentionally ignited to pursue some land management goal. However, boreal and temperate burning is large wildfires. Obtaining fuel consumption measurements for wildfires is obviously challenging. Therefore studies often involve intention-

C3509

ally ignited fires / prescribed fires which allow researchers to set up plots prior to the planned ignition. However, these fires may not be a proxy for wildfires. For example, wildfires in western conifer forest of the US frequently involve significant canopy fire (while prescribed fires usually do not). No canopy fuel consumption noted in Table 2c. Also, are there similar prescribed vs. wildfire differences for Eucalypt forest in Australia? Please comment and discuss the possible bias of relying on planned/prescribed fire studies to represent fuel consumption for wildfires in temperate and boreal forest.

Sect. 2.3 P 8127, L24 – 27: The authors should consult & cite Hyde et al. (2011) “The combustion of sound and rotten coarse woody debris: a review”, *International Journal of Wildland Fire*, 20, 163-174.

Sect. 2.4 Of the fires used for the biome averages were these studies primarily prescribed fires or wildfires? Are there differences in FC for the two types in North America? If so, could this bias the results? Please comment.

Sect. 2.6 P 8132, L8-10: Is the sugar cane FC difference between US and Brazil due to FL?

P8133, L13-15, sentence starting “Results from several...” I don’t completely follow this statement. Do the authors mean that some studies show a link between burning depth and depth of drainage? Please clarify.

Sect 3.2 Please note the GFED3 pixel size.

P8138, L9-10 States: “Since biome-specific information on the area burned within one pixel was not available...” which implies each GFED3 pixel (0.5 degree x 0.5 degree?) may have multiple biomes. Therefore, it is difficult to interpret the comparison of first number in column 5 of Table 3 with the field study FC, P8138, L14-19: “In the fifth column FC rates per unit burned area of GFED3 are shown for the collocated grid cells, i.e. grid cells in which measurements were taken, (first number)”. Could the FC in a GFED3 pixel be dominated by a biome different from that of the field study? Could

C3510

the differences results from mapping of biome type rather than FL and CC. Could this explain the large difference between the first and second numbers of column 5 for crop residue and tropical forest? Please comment/clarify.

Section 3.2. Care should be taken in identifying “outliers”. The mismatch between the mean and median is not surprising given that surface and ground fuels tend to have a log-normal or weibull distributions. At any given site the median value may provide the best guess. However, over large areas landscapes or forest stands with very high fuel loading (“outliers”) should be important and excluding such sites or using the median value would lead to an erroneously low value. For example see Keane et al. (2013) *Forest Ecology & Management* 305, 248-263. This study examined FL data from >10,000 forests plots in the western US and found that even within specific forest types there was considerable variability.

Sect. 3.3 It may be worth noting that the FRP-based studies largely involved fires (savannas, grasslands, woodlands) in which the fuel consumed was mostly fine fuels – grasses and litter, fuel that burn predominantly by flaming combustion. I do not believe that a relationship between FRP/FRE and fuel consumption has been demonstrated for fires with significant consumption of smoldering prone fuels duff and coarse woody debris. It is unclear that duff, especially lower layers would have a heat content similar to other components (see e.g. vanWagtendonk et al. (1998) *Int. J. Wildland Fire*, 8 147-158). Also, it is not clear that the fraction of heat released as radiant energy during the smoldering combustion of duff and coarse wood would be the same as that for flaming combustion of fine fuels upon which FRP-based FC relationships have been based.

Technical Comments

P8134, L14: change ‘peat fires’ to ‘peat lands’

P 1836, L18: change ‘fire in not’ to ‘fire is not’

C3511

P8136, L26 – P8137, L3: This sentence is confusing and needs to be rewritten. I do not understand how the fragment “but due to the overall large contribution of forest floor fuels” fits in this sentence

Table 1f. Typo in row 5, CC should = 90% not 0.9?

Interactive comment on *Biogeosciences Discuss.*, 11, 8115, 2014.

C3512