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## ***Interactive comment on “Biomass burning emissions of trace gases and particles in marine air at Cape Grim, Tasmania, 41 S” by S. J. Lawson et al.***

### **Anonymous Referee #2**

Received and published: 28 July 2015

This paper presents an extensive set of opportunistic measurements of bushfire emissions made when a bushfire impacted the Cape Grim station during a campaign aimed at studying particle formation in the clean marine environment.

The paper is well written and contains significant new information on the emissions from fires in a poorly sampled region of the world. Thus I recommend publication after a number of minor issues are addressed.

1. Page 17605 line 18: “fresh and diluted BB plumes” - rephrase please- (the degree of dilution may vary but both are diluted by ambient air).

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2. Page 17606 line 10, please define whether the  $\pm$  symbol refers to standard deviation? - if so at what confidence interval?
3. Page 17611 line 12, do you really need to use the acronym “nss”? You probably do not use it enough for it to be necessary. 4. Page 17613, end of line 3 “particle” should be “particles”? 5. Page 17615, line 1 “produce” should be “produces”?
6. Page 17617-17618 and page 17627 line 25: you imply that there is a change in the absolute magnitude of the emissions from the fire (as well as the emission ratios) as a result of rain/changing combustion efficiency but I am not convinced that you present sufficient evidence for this. The concentrations increase dramatically at the measurement site but the amounts reaching the site depend both on the emissions and on the degree of mixing. A change in meteorological conditions (accompanying the rainfall) could significantly alter the degree of (e.g. vertical) mixing and produce greater concentrations at the measurement site. A change in the emissions from fully oxidised products (like CO<sub>2</sub>) to partially oxidised products (like CO), would be fully expected with a reduction in combustion efficiency due to rain, nevertheless the changes in the ratios of acetonitrile and black carbon to CO are very interesting.
7. Page 17619, the comparison of number concentrations from different sites should also point out that the degree of mixing will be a major factor in the concentrations measured.
8. Page 17620: (or somewhere else!) Somewhere you should add a sentence saying that it is assumed that the enhancement ratios measured are unaltered from the original emission ratios because of the short transport time to the measurement site.
9. Page 17621: why do you remove background amounts and then force the straight line fit through the origin? The slope of the regression should be the same regardless of what the background values are. This probably doesn't make a great deal of difference but you are likely adding unnecessary uncertainty to the results.

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10. Page 17621 last paragraph: CO and CO<sub>2</sub> are often poorly correlated when sampling a fire plume if the combustion efficiency of the fire varies during the measurement period. Thus poor correlation in itself should not be a problem, if you can determine the actual enhancement in CO<sub>2</sub> and CO as you can simply sum the total enhancements of each throughout the fire. The single grab sample measurement for CO<sub>2</sub> every 40 minutes may be more problematic when attempting to do this, so I don't have an issue with the use of a literature value for the emission factor of CO if you are really not confident that you can obtain a trustworthy one from your own data. However you do not explain the choice of the EF from Akagi et al. This seems like an odd choice to me when you point out on page 17604 "EFs from NH coniferous forests are unlikely to be representative of Australia's temperate dry sclerophyll forests". Why not use the EF from Volkova et al?? If you don't want to recalculate - just explain the choice and/or maybe comment on how much (or little) difference a different choice of EF for CO would make to your results.

11. Page 17624 line 11: delete "a factor of" before "almost a factor of"

12. Page 17626: insert "for" before "NH temperate forests"

13. Page 17626: consider changing section title to "summary and future work" ???

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Interactive comment on Atmos. Chem. Phys. Discuss., 15, 17599, 2015.

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