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# *Interactive comment on* "Impacts of prescribed burning on soil greenhouse gas fluxes in a suburban native forest of south-eastern Queensland, Australia" *by* Y. Zhao et al.

**Y. Zhao et al.**

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Referee #1's comment 1: Changing the nomenclature form '"site" to "plot" does not change the low replication number or the pseudo-replication issue. All statistics are based on only 4 chamber locations this is simply to lower a number to make any of the conclusions proposed by the authors. As outlined in our initial comments to capture the spatial variation in soil greenhouse gas (GHG) fluxes at one plot at least 5 chambers would be necessary. The authors try to describe a whole forest system with 4 chambers. The response given by the authors also highlights that this is a completely nonreplicated experiment there is now 1 site with 4 plots and 1 chamber per



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plot. If we ignore the chamber replication and spatial variation issue for a moment this type of experimental design might work in a treatment vs. control type of experiment. However, in the case of the experiment outlined in the manuscript control plots were not measured or established before the burning event. Another point that the authors have not clarified is if they measured GHG before and after the burning event at the exact same location what appears unlikely since chambers were probably removed before the burning event. Again, since no consideration has been given to generate plot means of multiple chambers per plot for the measured GHG fluxes the differences between measurements taken before and after the burn might largely be confounded by spatial variability.

Authors' response: we agree the referee's suggestion that more chambers at one plot would result in more robust conclusions. In this study we did not mean to describe the whole forest system (Toohey forest) with the 4 deployed chambers, we wanted to explore the potential impacts of burning conducted on 27 May 2014 within a relative small regions (less than 300m*300m). Yes, there were other deployed chamber rings but were designed for nutrition transformation studies leaded by Yuzhe Wang (co-author). We treated our 4 plots as replicates because of the relative homogenous stand conditions of the study area. We understood the spatial variations in both soil properties and greenhouse gas production, therefore we fully considered the stand condition, tree density, understory conditions and apparent soil conditions when chose these plots. This could be partly assessed with the parameters which measured for the 4 consecutive days during each sampling events, which already presented in Figure 2. Especially for CH4 fluxes and soil temperature (new added to Figure 2), the relative standard errors (std/mean) were less than 10% for most of the occasions. It is impossible to conduct the sampling at exactly the same location before and after burning because we have to collect the PVC rings and chambers back before the burning, and this could also destroyed the surface soil structure. The plots after burning were located within 2-3 meters of original locations. While the selected unburned plots were also within 5 meters to before the burning plots.



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Referee #1's comment 2: The response given by the authors highlights that an inappropriate statistical test was used to analyse the data. This dataset is not suitable to be analysed with a on way ANOVA since the measurements according to the authors were repeated measurements of the same subject over time. Potentially a linear mixed model might be appropriate to analyse these type of data, however; this might not be possible given the low replication number and the limited number of measurement events. The experimental design is simply not strong enough for any of these analysis and as highlighted in the first response all that was archived is to determine that soil GHG fluxes a different at different times of the year. Furthermore the correlation analysis (no information what test was used) are based on only 3 timedata points. In addition as outlined in our first set of comments some very unusual type of measurements have been correlated with the GHG fluxes in question especially gravimetric moisture content has very little use in this type of analysis Therefore it is in our eyes not possible to talk about "recovery" in the way the authors do. It is also unclear in the result section when the authors compare the before and after burn measurements and when they compare the after burn burned vs. after burn unburnt measurements.

Authors' response: we have accepted referee #1's comments and modified the section to clarify the statistical methods we used. As concluded by the referee in the "additional comments", a one way ANOVA in this study could only tell there was a temporal variation in the dataset, this was what we wanted to present in applying one way ANOVA to the gas fluxes in burned plots before and after burning. We then conducted another ANOVA analysis to compare the fluxes between the burned and unburned plots to further explore whether the temporal variations were the natural dynamics or burning induced impacts.

Pearson correlation analysis was applied to detect any potential driving factors on soil greenhouse gas emissions. All measured soil properties and gas fluxes at the 4 replicate plots during the three sampling events were pooled together for this analysis. We clarified this point in the statistical analysis section, as described below:



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"Collected soil properties and gas fluxes at the four replicate plots during the three sampling events were also pooled together for Pearson correlation analysis to detect possible effects of soil environmental variables on soil CO2, CH4 and N2O fluxes."

Referee #1's comment 3: Please outline the reasons why you would not have had access to the plots in the first 2-3 month after the burn. The investigated forest is opposite the University campus and prescribed burn areas are generally accessible to the public in within 48 hours after a burn or even directly after a burn if research permits are requested. Furthermore, assuming that soil GHG fluxes are the same in the same month of each year is quite incorrect since their seasonal and inter-annual dynamic depends on the weather (especially soil temperature and moisture), which may differ quite largely between years.

Author's responses: We started planning to do this research in Aug 2013 because we were informed by the government that there would be a burning in that month, we chose the sampling plots before the burning and made the first measurement, our origin plan was to make another measurement right after the burning which also suggested by the referee. However, the planned burning did not happen in that August due to the impropriate weather condition. While in 2014, we were informed about the burning only several days before the burning. Therefore we turned to the assumption that soil condition and gas production were similar in the same period of each year and treated the results measured in Aug 2013 as background values and selected the unburned plots in green island as reference to explore the burning impacts. We agree that inter-annual dynamics in weather conditions could affect soil gas fluxes, however, we believe it was reasonable that soil gas fluxes of the same period of each year should be comparable without significant disturbance and under similar weather conditions. To support this assumption, we added the soil temperature measurements for the 4 consecutive sampling days at the 4 sampling plots of 3 sampling events in Figure 2 to show the similarity of soil conditions. We also added a Table 1 to show detailed weather conditions during the sampling events: generally, the sampling events were conducted in clear weather



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conditions and there was very little precipitation either 30 days or 90 days before the sampling events (antecedent precipitation).

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Interactive comment on Biogeosciences Discuss., 12, 10679, 2015.