Interactive comment on "Phosphorus addition mitigates N_2O and CH_4 emissions in N-saturated subtropical forest, SW China" by Longfei Yu et al.

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Referee #3

This paper report the effects of P addition on leachate chemistry and gas exchange of N2O and CH4 in a high N deposition forest of the warm and humid part of China. The results are interesting and the paper easy to read. However, the statistical treatment is not ideal, since the repeated nature of the measurements seems not to have been considered in the model tests. I see this problem is well addressed by the other reviewers. This needs to be addressed although it will not change the outcome and major conclusions.

R 3.0: We thank referee #3 for the constructive and detailed suggestions. Regarding the statistical methods, we will reanalyze the dataset with Linear Mixed Effects Model as proposed by referee #1, so as to improve and justify the interpretation of our results. Please refer to our response to referee #1 for more details on statistical analyses.

Below is my mainly minor comments listed by line number

70: 'and'= 'but'

R 3.1: OK.

71: delete: 'even'

R 3.2: OK.

123: spell out what means PAl here at first appearance.

R 3.3: P_{AL} means "ammonium lactate-extractable P, a common method to determine plant available P". We will modify it in the revised manuscript.

126: 5-m buffer is a bit narrow, but cannot be changed

R 3.4: The designs of plot size and buffering strip were made with reference to Zheng et al. (2016) and Martinson et al. (2013). In line 126, the "5-m buffer strip separated the two plots in each block" actually means that 5-m buffer was included for each plot, thus resulting in 10-m distance between the borders of two neighboring plots. To avoid confusion, we will modify this sentence in the new version.

127: 'ad' = 'at' 130: '.... in the TSP soil.' 141: 'Within each plot, three ceramic....'

R 3.5: We appreciate and accept the linguistic corrections from referee #3. Changes will be made in the revision.

145: ‘winter’ = ‘dormant’ or ‘dormant and dry’?

R 3.6: The “winter season” mainly refers to the “dormant and dry season”. We will rephrase it accordingly.

200: should be repeated ANOVA of some kind. It seems to me that the statistical analysis is not optimal.

R 3.7: Please refer to R2.4 for details.

206: check the subscript on P

R 3.8: We will check through and unify all the subscripts to “P_{AL}”.

290: I am not in favor of discussing degrees of N-saturation; I would instead say ‘DHSRB is less N-rich with lower inorganic N availability than TSP’

R 3.9: We agree with it in general, but we will just use “less nitrate-leaching” to describe DHSRB in comparison to TSP.

303: ‘frequently’ = ‘shortly’

R 3.10: We assume that it refers to “frequently” in line 301 instead. We agree that “shortly” is more accurate.

306: delete ‘TSP’ here, implied in nearby

R 3.11: Thanks for the suggestion. We will delete “TSP”.

312-318: inhibition by NH4 cannot explain emission only lower uptake rates; so delete or reformulate

R 3.12: We are aware that the inhibition by ammonium affects gross methane uptake and not directly net emissions. However, the observed mean CH_4 exchange rates (emission or uptake) at our TSP site was significantly smaller than reported in other subtropical forests from South China (Fang et al., 2009; Zhang et al., 2008) (Figs. 5 and 6). Therefore, it is reasonable to suggest that the inhibition of methane uptake by ammonium may have contributed to reverse net methane uptake to emission during “hotspots or hot moments” (Megonigal and Guenther, 2008) of methane production.

330: like line 290; reformulate

R 3.13: Changes will be made as presented in R3.9.

328-334: I would suggest that both reason (and others as well) may have contributed

R 3.14: As presented in the introduction section (line 91-93), “whether P addition affects the methanotrophic community in soils directly or alleviates the NH_4^+-inhibition effect on CH_4 oxidation through enhanced N uptake” remains under debate (Veraart et al., 2015). In our case, we only have evidence for reduction in nitrate availability from soil water, supporting the “indirect” mechanism.

351-353: I do not understand this; what is the ‘tree biomass estimates’ doing here?

R 3.15: Other studies have documented that P limitation may restrict tree growth in Masson pine forests (Wang et al., 2007). Our hypothesis was that P addition may enhance tree growth and thus N uptake. As discussed in our manuscript, the tree biomass estimates show that no such effect occurred within two years after P addition

353-356: Why not, this should be simple and not much effort?

R 3.16: From the previous long-term study conducted at TSP forest (Huang et al., 2015), we have learned that the abundance of ground vegetation species is highly variable from year to year. This makes the evaluation of ground vegetation biomass really uncertain in a two-year scale (our study). In the long-term experiment, we have planned to include the measurements of ground vegetation.

436-38: something wrong in this ref 587: add 'lactate' 589, 594+595 add these lines to the table legend

R 3.17: We thank referee #3's efforts on our manuscript. We will revise the manuscript according to the reviewer's suggestions.

Reference 3

Fang, Y., Gundersen, P., Zhang, W., Zhou, G., Christiansen, J. R., Mo, J., Dong, S. and Zhang, T.: Soil–atmosphere exchange of N2O, CO2 and CH4 along a slope of an evergreen broad-leaved forest in southern China, Plant Soil, 319(1–2), 37–48, doi:10.1007/s11104-008-9847-2, 2009.

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