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Biogeosciences Discussions

Interactive comment on "Responses of CH_4 uptake to the experimental N and P additions in an old-growth tropical forest, Southern China" *by* T. Zhang et al.

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Thank you for providing the comments and the papers. We have found that they are very useful for improving our manuscript. The followings are responses for your comments.

We appreciate and agree with your interpretation that "these results as evidence that the P and NP treatment stimulated root growth into the treated plots from adjacent trees outside the plots. This stimulated root growth led to higher water uptake and consequently lower WFPS which in turn led to higher gas diffusion and thus higher CH4 uptake." P deficiency to plant growth in this old-growth forest is also partially supported

by the results on litterfall study, which showed that annual total litterfall fluxes were significantly increased after P addition (Liu et al., Soil Biology & Biochemistry, on 2nd revision).

We conducted this study referring to the plots design of Cleveland, C. C & Townsend, A. R (2006) in the end of 2006. With such plots design, they had studied the response of soil CO2 losses to nutrient (including N and P) addition in a diverse, primary, lowland tropical rain forest in southwest Costa Rica. As you thought, yes, the 5-m buffer strip is just an untreated strip. Our chambers for gas sampling were located on the centre of randomly selected plots (5m* 5m for each plot), but not on the edges of treatments plots.

We agree with you that our 5m * 5m manipulated plots may probably lead to the result of an edge effect in such an old-growth tropical forest. However, we have focused on the effect of N and P treatment to soil CH4 uptake. The results may affected by many factors and soil processes. Your interpretation of higher gas diffusion in P and NP treatment is one of them. Higher soil CH4 uptake after P addition in our study may results from the followings:

Increased P availability stimulated soil microbial activity which was P-limited before, and then, they oxidized more CH4 from atmosphere; Results from a more detailed research on the response of microbial to P additions from the same old-growth forest showed that addition of P significantly increased the microbial biomass and altered the microbial community composition (Liu et al., Soil Biology & Biochemistry, on 2nd revision). These results indicate that P availability is also one of the limiting factors for microbial growth in this old-growth forest.

P treatment stimulated plant root growth and led to higher water uptake, and then consequently lower WFPS which led to higher gas diffusion and thus higher CH4 uptake.

Considering the P deficiency to both microbial growth and plant growth in the old-growth forest, We believe that P addition would also significantly increased if it had conducted in a size of 40* 40 m plots, because roots and microbia are there.

In sum, this effect (P stimulated increase of CH4) could be resulted from direct P deficiency to microbial growth and indirect P deficiency to plant growth.

According to your comments, we have added more discussion and related information (such as addition of P significantly increased the microbial biomass and altered the microbial community composition (Liu et al., Soil Biology & Biochemistry, on 2nd revision)) to the revision. In the abstract, we have also replaced the sentence “Our results suggest that increased P availability may enhance soil mathanotrophic activity and potentially mitigate the inhibitive effect of N deposition on CH4 uptake in tropical forests.” with “Our results suggest that increased P availability may enhance soil mathanotrophic activity and root growth, resulting in potentially mitigate the inhibitive effect of N deposition on CH4 uptake in tropical forests”

References: Cleveland, C. C., and Townsend, A. R.: Nutrient additions to a tropical rain forest drive substantial soil carbon dioxide losses to the atmosphere, Proceedings of the National Academy of Sciences, 103, 10316-10321, 2006.

Interactive comment on Biogeosciences Discuss., 8, 4953, 2011.