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Interactive comment on "Indications of nitrogen-limited methane uptake in tropical forest soils" *by* E. Veldkamp et al.

Anonymous Referee #1

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The paper "Indication of nitrogen-limited methane uptake in tropical forest soils" deals with impacts of nitrogen deposition on alteration of the sink strength of tropical forest soils for atmospheric CH4. Despite the finding that elevated nitrogen deposition can reduce CH4 uptake in temperate forest soils, so far data of tropical forest soils are quite scarce. Considering the potential increase of N deposition in tropical regions in the near future; the manuscript deals with an important topic worthwhile to be published in Biogeosciences. The datasets presented are of high scientific value since they are detailed (fluxes and environmental conditions) and long-term (> 4 years). The manuscript is mostly clear with regard to objectives and results presented. However, there are some methodological problems which might affect results, discussions and conclusions (see comments below).

General comments:

The experimental setup for impacts of N deposition on soil CH4 exchange is not fully clear. Why 125 kg N urea, only rainy season fertilization only in the lowland but every quarter in the upland forest. It seems that this experiment is rather a nutrition experiment for forest growth than targeted to impacts of N-deposition on soil CH4 exchange. For that reason your soil NH4 concentrations are rather high (e.g. » 10 mg kg compared to Zhang et al., 2008 < 10 mg kg-1). Surprisingly also soil NH4 concentrations in the control treatment (Fig 2a) which sometimes even exceeds the concentration in the N-addition plots of the lowland forest. For the montane forest differences in soil NH4 only appear in year 3 and 4. Under aerated conditions (September year 3) there are higher uptake rates in the control. Unfortunately in year 4 you have very high wfps which may overwrites the impact of soil NH4 to CH4 exchange. Independent from the correlation using all year data (majority when there is no difference in soil NH4 between control and N-addition) I would put some emphasis on times when you observe differences in soil NH4 across treatments. For that reason I would extend Table 1 and would not present data only at yearly basis since CH4 emissions seem to dominate the annual values. Furthermore, the separation of fluxes in short term (first 6 weeks after fertilization) and long term (> 6 weeks) is somehow artificial. Why did you not cluster in dependence of NH4 (and NO3) soil concentrations? This would allow also a more detailed comparison on basis of soil DIN to other studies in temperate and tropical forests (Zhang et al., 2008, 2011). I would suggest also including soil DIN, and WFPS into Table 1. Due to the above I am not sure if the conclusions taken so far might change. Taking into account the wealth of data you have I wonder why you did not apply multiple regression (even though linear mixed effect models are mentioned in the statistics part) rather than showing Pearson correlation coefficients in Table 2. Under this aspect and keeping in mind that you studied only two tropical forest systems, I am not fully convinced at the moment that the very general statement of N limited soil CH4 uptake in tropical forest soils can be exposed as presented in the title and conclusions. Even though uptake rates have a negative sign (due to the perspective of the atmosphere) I

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would recommend presenting correlations not as CH4 fluxes (i.e. more negative values are smaller fluxes) but rather as CH4 uptake rates (i.e. more negative values represent higher uptake rates). Thus, P6008 Ln16ff your correlation would be not negative but positive as mentioned in the text with increased NO3 stimulated CH4 uptake.

Specific comments:

P6011 Ln4: recent is almost 10 years ago, delete “Only recently,”

P6011 Ln10ff: this section needs to be shorted and put rather into discussion section

P6013 Ln26ff: provide also bulk density measurements, since BD is one of the most important soil physical properties for diffusion processes.

P6014 Ln15ff: give info on sampling frequency.

P6015 Ln11ff: trapezoid rule: give more details, citation?

P6018 Ln1ff: values are mean values, data presented in Tables are annual emissions. Should be harmonized or as suggested above make a new Table with seasonal CH4 uptake rates, wfps, and DIN.

P6021 Ln8ff: add already the finding of Ln14 to this sentence

P6022 Ln6ff: This is a bit confusing, since population increase of methanotrophic bacteria would per se first increase uptake rates. However, high CH4 concentrations at times of high rainfall should correlate with low oxygen concentration which anti-correlates with increase population increases. Also, your soil NH4 concentrations are comparable high for tropical forest. This may indicate limited nitrification under high soil moisture conditions as shown in Figure 1.

P6022Ln26ff. Even though soil gas concentrations of CH4 were published

Table 1 statistic is missing

Interactive comment on Biogeosciences Discuss., 10, 6007, 2013.