

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

Anonymous Referee #3

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Understanding effects of nitrogen deposition and fertilization of methane uptake by soils, especially tropical soils is of utmost importance to better understand sinks and sources of global methane. Long term studies, under relevant conditions are rare and in this respect the present study and dataset obtained is of high value. Long-term nitrogen fertilization effects on methane flux was assessed in two sub-tropical forest soils with very different moisture regimes. Although primarily controlled by soil physical factors, the authors propose that methane uptake by these soils was N-limited as indicated by correlative evidence with soil mineral ammonium and nitrate.

Comments: 1: The manuscript has to be checked by a native speaker. In terms of style and grammar there is a lot to be improved. Besides grammar and style, the manuscript is rather long for the actual data that is shown and discussed.

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2: I think in the introduction the authors have to mention the microbiology behind methane consumption in soils. Mention high vs. low affinity methane oxidizers. Mention that methane oxidizers are not always strict obligatory methanotrophic. Also mention that not only methane but also ammonia oxidizers can oxidize methane. I think, some microbiology is necessary for the reader to understand the interpretations later on.

3: A number of times reference is made to reviews on a specific topic mentioning a certain fact. I would rather see the reference cited that show actual data proving the fact mentioned. 1: page 6009 (line 18): Conrad 2007 for 5% methane uptake by upland soils. 2: page 6010 (line 23): Conrad 1996 for inhibition of methane oxidation by ammonium. 3: Page 6011 (line 2); Conrad 2007 for inhibition by NO_x of methanogenesis.

4: Materials and methods: I would suggest to first give site description and experimental design followed by description of the N-amendment and flux measurements.

5: In section 2.5 a comprehensive statistical analyses is described for analyzing fertilizer and site effects corrected for the sampling time. Where can I find the outcome of this analyses? Should this not be displayed somewhere in Table 1?

6: I find the conclusion that methane consumption in montane forest soil is N-limited not very strong, or at least only one perspective is taken. The authors base this conclusion on negative correlations between the fluxes and ammonium concentration. Looking at the data in the montane soils, organic as well as mineral layer, there is a positive correlation with nitrate and flux in the control soils. This can mean that with higher nitrification the flux increases due to inhibitory effects of nitrification on methane consumption (via nitrite or pH). In case of the negative correlations between ammonium and flux it may very well be that nitrifiers are stimulated that subsequently oxidize more methane. The consumption of methane by nitrifiers is not considered. The other line of evidence the authors take is that higher methane concentrations (evidenced by periods of emission) can lead to growth of methanotrophs needing more nitrogen. However,

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the authors indicate methane concentrations of 2 ppm above soils surface, especially during heavy rainfall. This is barely above atmospheric concentrations. The concentrations in the soil indicated are even lower. Hence, I do not think that this is reason to belief that this would lead to N-limited growth of methanotrophs. I would argue that maybe facultative MOB feed on acetate during events of possible anoxia increasing population levels needing more nitrogen. Hence, I am not convinced of N-limitation purely based on correlations. The authors have very narrow way of explaining their results. I would suggest to take the microbiology of methane and ammonium oxidation more into account.

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