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Interactive comment on "Soil Methanotrophy Model (MeMo v1.0): a process-based model to quantify global uptake of atmospheric methane by soil" *by* Fabiola Murguia-Flores et al.

Anonymous Referee #2

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Comments on "Soil methanotrophy model (MeMo v1.0): a process-based model to quantify global uptake of atmospheric methane by soil" submitted by Fabiola Murguia-Flores et al. to Geoscientific Model Development

General comments

In this manuscript, the authors present a new process-based model of upland soil oxidation by microbes, MeMo. They showed major results on global methane uptake, its latitudinal and spatial distribution, and seasonal change, in comparison with previous models by Potter et al. (1996), Ridgewell et al. (1999), and Curry (2007). I agree that global methane budget is gathering attention in terms of global climate change and so

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Discussion paper

that the topic is timely.

The manuscript provides a detailed description of basic concept and equations, mathematical solution, and environmental dependencies. I know that GMD accepts such a descriptive paper but still want to recommend shortening main text to some extent. The results presented in this manuscript are basic and lack scientific novelty; again, main text can be truncated by removing redundant statements of results in figures and tables.

I'm not clearly sure what is the substantial advancement of the MeMO model, in comparison with previous models, because the new model used the similar framework for modeling soil methane oxidation. In fact, the estimated global total (34.3 Tg CH4/yr) is around the middle of the previous estimates (Table 7), and one apparent advantage is the better agreement with recent observations. In this regard, the low methane oxidation in humid tropics simulated by MeMO seems reasonable in comparison with previous ones. On the other hand, my serious concern is on the nitrogen limitation factor. The author seems to consider only atmospheric deposition, but in reality, fertilizer and manure input is much more important as nitrogen input into croplands. Previous models, Ridgwell et al. (1999) and Curry (2007), implicitly accounted for the effect by using land-cover data. If this is correct, the MeMo model underestimated the effect of nitrogen input on methane oxidation (as shown in Figure 9).

Overall, I conclude that the manuscript needs major revision and would be reconsidered. I also recommend reinforcing discussion part with respect to implications to experimental and observational studies and potential impacts on climate projections and management.

Specific comments

1. Page 2 Line 20: Please cite more recent syntheses of global methane budget (e.g., Saunois et al., 2016, 2017)

2. Page 8 Figure 1: Please show the atmospheric CH4 concentration for this example.

3. Page 14 Line 1: “Grosso” should be “Del Grosso”.

References

Saunois M, Bousquet P, Poulter B, Peregon A, Ciais P, Canadell JG, et al. The global methane budget: 2000–2012. Earth System Science Data 2016, 8: 697–751.

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