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Interactive comment on "Three-dimensional methane distribution simulated with FLEXPART 8-CTM-1.1 constrained with observation data" *by* Christine D. Groot Zwaaftink et al.

Anonymous Referee #2

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This is a good and valid paper without major flaws prohibiting publication. The methodology is sound. The writing is clear and well-structured. The nudging method seems to be a cost-effective and robust way to improve the simulation of 3-D field CH4 concentration. However, I found it's a bit hard to follow the Results part as some of the statement lacks explanation and conclusive sentence. I also have a few questions listed below:

- It seems the simulation of vertical profile didn't get improved after nudging. How does this affect the potential applications of 3-D CH4 concentration from FLEXPART?

- How large is the influence of priori CH4 fluxes on the model performance? It would be

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Discussion paper

helpful to address it more clearly as this will help readers from a broader background.

- How does modeled CH4 distribution compared with satellite observations like GOSAT? It would be interesting to see the evaluation against this spatially comprehensive dataset.

Specific comments:

Line 42: reference needed.

Section 2.1: more details about the setup of the methane sinks are needed.

Line 119: Please explain the reason for why applying a single global scaling factor is necessary.

Line 159: What is NOAA_2004 scale. and why NIES data is needed to be converted into NOAA-2004 scale. More statements are needed to justify this treatment.

Line 177. Does the TM5 reference simulation use same priori information as FLEXPART? Do you think it will affect the evaluation of FLEXPART with TM5?

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