

Interactive comment on “Oceanic and atmospheric methane cycling in the cGENIE Earth system model” by Christopher T. Reinhard et al.

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This paper describes a model of the global methane cycle, from the sea floor through the ocean to the top of the atmosphere. It is a somewhat new scope for modeling methane than I have seen before (I was not familiar with the cited Olson predecessor model). Papers like this are fun to read because the authors have to figure out what the most important processes are, what to put in and what to leave out, and also what the best tests of the simulation should be. Then, it's interesting to see what the sensitivities of the model are, a chance for a model to teach us something. In this paper, it is interesting to see how the concentrations of O₂ and SO₄ affect the distribution and cycling of CH₄, and interesting that a significant amount of a released CH₄ spike should degrade in the oceans, as two examples. This paper is a useful

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contribution which could be published nearly as is.

The paper is very clearly written. I have just a few specific comments and suggestions.

The kinetics of CH₄ degradation are described as an O₂-O₃-CH₄ parameterization, but there is no mention of O₃ except for that. Does O₃ do anything interesting at different O₂ concentrations, or during the CH₄ spike? If not, it would still be worth a sentence describing what role O₃ is playing in the parameterization, just for clarity.

On line 601 it is suggested that CH₄ warming might explain the warmth of the PETM. This was what Schmidt and Shindell assumed, but it doesn't work because the warming persisted after the release period was over, meaning that it must have been CO₂, not CH₄.

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