

Interactive comment on “The atmospheric cycling of radiomethane and the “fossil fraction” of the methane source” by K. R. Lassey et al.

Anonymous Referee #1

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The atmospheric cycling of radiomethane and the “fossil fraction” of the methane source K. R. Lassey, D. C. Lowe, A. M. Smith Atmos. Chem. Phys. Discuss., 6, 5039-5056, 2006

This is an important paper, well within the scope of ACP. The central conclusion is that $28.6 \pm 1.9\%$ of the global methane source is of fossil origin. This conclusion is surprisingly tightly constrained and extremely important if true. If supported after wider scrutiny, the result should have significant consequences both for greenhouse gas policy (reducing gas leaks) and for new research (finding geological sources).

Lassey et al. here develop an important new insight into the global radiomethane budget, stemming from their other ACP paper linked to this, that permits a well-constrained

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analysis of the fossil source.

The paper presents a novel approach to the use of $^{14}\text{CH}_4$ to constrain fossil methane emissions. Twenty years ago, this was a very useful signal to differentiate between fossil sources (free of $^{14}\text{CH}_4$) and biological sources (that had young $^{14}\text{CH}_4$). However, the increase in PWR nuclear reactors, which release ^{14}C , made this technique nearly useless, especially in the northern hemisphere. Lassey et al now revisit the subject.

The paper is novel, the conclusions are substantial in their significance.

I have not been in detail through the analytical development and have not reproduced the calculations. That it looks correct is clear: that it should be published is certain. The scrutiny of open publication will test its methodology further. The paper gives due credit to prior work, has suitable title and illustration, is fluently written and correctly presented. I have made a number of comments of detail (see list).

My chief concern is the assumptions made about the constancy of the methane sources since the mid-1980s. For the 1990s this may well be true, but in the mid to late 1980s I think there were sharp changes in gas and coal emissions.

In short, I strongly recommend publication with only the most minor revision.

Detailed Comments. 1. Page 3 of manuscript - Leaks from the enormous global natural gas system are somewhat under-discussed. There is much literature on the improvements in the Russian gas system, which is now probably fairly tight, but may have been very leaky in the late 1980s (in 1986-2000 period considered). See Dlugokencky et al paper Geophysical Research Letters, 21, 45-48 1994, and Reshetnikov, A. I., Paramonova N. N. & Shashkov, A. A. J. Geophys. Res. 105, 3517-3529 (2000))

Any comment on Arctic clathrates emissions? Submarine landslips also contribute. There have been a few in the time frame.

2. Similarly, the assumption on page 8 that the source has not varied since the mid-1980s can be challenged. I'd suggest "not since the LATE 80s". This could make a big

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difference for the fossil methane fraction calculation.

3. Page 9 Justify the choice of global methane Source as 560+- 40 Tg and d13C of -54 +-4 per mil. Give a reference, even to parallel paper.

4. Page 10 middle of page, end of middle paragraph. There is an oblique reference here to the BSR The term is not defined as far as I can tell (though it is in the parallel paper as Biosphere sourced methane. To most geophysicists, the term BSR means the Bottom Simulating Reflector and hence refers directly to clathrate methane stores: the BSR denotes the clathrate layer in gas-rich sediments. Presumably the oblique comment means that biospheric sources can be identified by removing fossil BSR inputs? - this comment is very obscure and needs to be made plain. Indeed, BSR emissions are so badly known that I'd be surprised anything useful could be inferred. Alternately, the usage is the same in the other paper - still confusing? Suggest remove the term BSR completely and use something else. How about MBO - methane of biological origin?

5. Conclusions - Russian gas leaks and Chinese coal emissions need more discussion.

6. There should be a brief table listing terms in mathematical equations and other abbreviations in the text.

Interactive comment on Atmos. Chem. Phys. Discuss., 6, 5039, 2006.

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