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Interactive comment on "Global Inventory of Gas Geochemistry Data from Fossil Fuel, Microbial and Biomass Burning Sources, Version 2017" *by* Owen A. Sherwood et al.

Anonymous Referee #1

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Comment on: Sherwood et al. Global inventory of gas geochemistry data. . ...

A. General remarks This is an important and useful methane inventory, a very welcome update from the work published in 2016 in association with Schaefer et al.s paper in Nature.

Atmospheric methane is increasing rapidly, growing well beyond the range that would achieve compliance with the UNFCCC Paris Agreement. Thus it is very important to understand which sources and sinks are changing in the global methane budget, and also to pinpoint the major emissions that can most easily be reduced. To identify sources and their relative emissions successfully, top-down modelling needs to use methane's C and H isotopic ratios. But the problem is that there is very little information

on these ratios, and much that is available is inaccessible, held in difficult-to-access databases, often corporate.

This compilation, which updates and substantially expands the 2016 version, is thus extremely valuable. It will make an important contribution to facilitating methane modelling both globally and regionally. Therefore I strongly recommend publication of this inventory. However, there are some points of detail that could be addressed.

B. Detailed points. Abstract: the database DOI could be given more prominence by putting it on a separate line, and then mentioning it at the start of the main text. L54 – Bruhwiler et al. could be mentioned here. L65 – Reference Rigby et al. 2017, Turner et al. 2017, Nisbet et al. 2016. L72 – 'increases' – in the box model – not necessarily in real nature. L86 – the sharp criticism of Dlugokencky et al. 2011 for being without reference to primary data is a bit unfair. . .look for example at their Fig. 3. L87 – no fossil-fuel CH4 measurements? – what about Zazzeri et al on coal? And there is lots of industry information, as L91 makes clear. L133 – "isotopic signatures are unaffected by gas processing" – this is rather sweeping. It depends what is done to the gas. L220 – no quality assessment – this is a key problem. Inverse modellers seem happy with accuracy to 1 or 2 per mil, but some numbers are likely worse than that, as the paper points out in L224. In particular for Siberia's gas, a few numbers from the academic studies of the gas industry are probably more valuable than a large database of inaccurate data. Maybe check the old Meth-MonitEUr report from 2005. But note also that some work – such as Galimov and Rabbani 2001 – is very valuable indeed (for example for the giant Iranian Pars field). Probably should also cite the old classic by Grace J.D., and Hart G. F. 1986. Giant gas fields of northern west Siberia. American Association of Petroleum Geologists Bulletin, 70: 830-852. L320 – This line may need a bit of rewriting: hard to understand what exactly is meant by samples in the abiotic field not overlapping with thermogenic. Note that coal mines can give an enormous range within the same mine. L328 – isotopic signatures of biomass burning emissions vary significantly depending on the C3 to C4 mix. Thus African savanna grasses can

give very heavy methane, while bushes nearly can emit methane that is significantly more negative in d13C. L390 – C3/C4 proportion is very important here – because the seasonal African C4 grass fires are so major in the MODIS monitoring, and have such a large leverage on global isotopic balance. L404 – this is the unweighted mean for sources, not for emissions. L410 – for coal the jury is probably still out. The problem is that there is not enough information from the Chinese coal industry, which has grown extremely rapidly (see BP Energy reports), and where the older less-modernised mines probably dominate methane emissions (but we don't know!). The 2007 World Energy Council data, presumably complied some years earlier, must surely be very out of date now. Note also that Australia and South Africa are very large-scale open cast producers nowadays. L422 – these are important comments. L427 emissions (. . .) are – not emissions (. . ..) 'is'. L437-438 – is this a fair and supported comment? How about the alternative hypothesis that the frackers realised after Karion et al and Pétron et al that they were leaking a lot of money to the sky, and then – given the competitive impacts of Saudi oil price cutting – the frackers did a lot to cut their emissions, to cut costs and boost profits in a tough market? L443 Accent missing on Pétron. L472 – shale gas. Very valuable. Most likely, each fracking play differs from the next, but they're probably mostly pretty heavy.

3. Overall comment This is a very valuable database that will contribute much to advancing our ability to do top-down analysis of the global methane budget.

I strongly recommend publication with minor revisions.

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