

Interactive comment on “Contribution of oil and natural gas production to renewed increase of atmospheric methane (2007–2014): top-down estimate from ethane and methane column observations” by P. Hausmann et al.

Anonymous Referee #2

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This paper presents column measurements of atmospheric methane and ethane from 1999–2014 at a mid-latitude site in each hemisphere. Methane increases of ~ 6 ppb/yr are reported at both sites since 2007. There is ongoing discussion in the research community about the relative contributions of biogenic (e.g. wetlands) versus thermogenic (e.g. oil and gas) sources to the recent methane increase. Using the ethane measurements and methane-to-ethane ratios, this paper suggests that oil and gas emissions account for at least 28% of the recent CH₄ increase assuming mixed oil and gas sources.

C12098

The paper is clear, well-written and thoughtful. In general the statistical analysis is robust and the arguments are convincing. Given the continuing discussion of the drivers of the recent methane increase, this paper will be a valuable addition to the literature. Most of my comments are quite minor but I would like the authors to consider whether short-term changes in emissions from biomass burning could have impacted their results, and whether their results are sensitive to a small geologic ethane source. The paper should be ready for publication once the comments below are addressed.

Specific comments

P35994, L16 – Nisbet et al. (2014) suggest that tropical wetlands dominated methane growth in 2007 (3rd last paragraph) but that since 2007 both wetlands and ruminants dominated (2nd last paragraph), so your wording needs to be slightly adjusted.

P35998, L10 – The paper reports an average CH₄ increase of ~ 6 ppb from 2007–2014. Nisbet et al. (2015) report particularly strong CH₄ growth in 2014 (P35993, L25). What were your methane and ethane growth rates in 2014? Were they also strong?

P35998, L10, 13 – As you did on L16, please put uncertainties on the other growth rates. Please state here whether the weak negative trends for ethane in each hemisphere are statistically different from zero.

P36000, L1 - What time series are the Wollongong and Arrival Heights records? Is this the full range from 1999–2014 or just the more recent 2007–2014 timeframe? Are their declines statistically significant?

P36003, L27 – Simpson et al. (2012) stated that a large geologic ethane source was unlikely but that confirming this would require more investigation – please adjust the wording here. A recent paper by Nicewonger et al. (GRL, 2016) suggests that pre-industrial geologic ethane emissions were 2.2–3.5 Tg/yr, similar to the present-day estimate by Etiope and Ciccioli (Science, 2009). What impact does a geologic ethane source of this size have on your findings?

C12099

P36006, L21 – I agree that scenario 1 is most plausible and I suggest adding this clarification in the abstract (L27) – that scenarios 2 and 3 are not considered to be as realistic.

P36007, L5 – Biomass burning also occurs at temperate and boreal latitudes – perhaps add ‘primarily’?

P36007, L7 – Is this assumption valid given that methane has a notable gradient within the northern hemisphere, with higher concentrations at boreal latitudes than at tropical latitudes?

P36007, L14 – This paper presents average methane and ethane trends for multi-year periods. Even if biomass burning emissions are constant over the long-term they can still affect calculated trends based on their interannual variability, especially if strong emissions occur at the start or end of your time series. The Zugspitze data show higher deseasonalized ethane in 2003 (mid-record for 1999-2006) that is consistent with strong boreal fire activity at that time (Figure 1d). What do your year-on-year growth rates look like? Does 1999-2006 show similar interannual variability as 2007-2014?

P36008, L19 – Perhaps explain the distinction you are making here.

Figure 1 – Do you have an explanation for the relatively high ethane at Lauder in late 2010?

Technical corrections

P35993, L8 – Define CH₄ on L6 not L8.

P35994, L9 – Please change ‘Even if introducing’ to ‘Even though they introduce’.

P35995, L4 – Change ‘report likely underestimated methane emission’ to ‘report that methane emission is likely underestimated’. Two additional references that showed this are Pétron et al. (JGR, 2014) and Karion et al. (GRL, 2013).

C12100

P35996, L27 – Hyphenate ‘micro windows’?

P35997, L8 – Define PROFFIT.

P35998, L7 – Do not capitalize ‘The’. On P36003, L7 do not capitalize ‘First’.

P35998, L24 – Change ‘as’ to ‘as the’.

P36004, L1 – Add the Xiao et al. reference.

P36004, L1-4 – Please reference Table A2 here.

P36007, L2 – Change ‘reasonable’ to ‘reasonably’.

P36007, L27 – Change ‘as’ to ‘as a’.

P36007, L29 – Change ‘with’ to ‘with a’.

P36011, L7 – Change ‘time’ to ‘the time’.

P36011, L11 – Change ‘as’ to ‘as a’.

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 35991, 2015.

C12101