

## ***Interactive comment on “Quantifying methane emissions from natural gas production in northeastern Pennsylvania” by Zachary R. Barkley et al.***

### **Anonymous Referee #1**

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Barkley et al. use measurements of methane from an aircraft to quantify emissions from the Marcellus shale area of northeast Pennsylvania. Their analysis includes both a modeled emission estimate using 10 flights in May 2015, as well as an “aircraft mass balance” estimate using 4 of those same flights. When presented as a percentage of production, the modeled emissions are 0.36% (2-sigma 0.27-0.45%) and the aircraft mass balance emissions are 0.34% (2-sigma 0.06-0.62%).

#### Main comments

This is a well-written paper, and the model seems to reproduce the various sources of CH<sub>4</sub> in Pennsylvania fairly well. There is also good agreement between the modeled emission and the mass balance determined emission.

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#### Other comments

line 109-112: what are the range of estimates for these numbers? You provided them for the Karion studies, but not these other two.

line 184: Perhaps cite the latest EPA greenhouse gas inventory.

line 260-261: do these CH<sub>4</sub> sinks account for other reactive species in the atmosphere? If not, how would background or elevated levels of ethane or other gases affect these CH<sub>4</sub> losses?

Figure 2: if possible, it would be helpful to know where Bradford County was on this map.

Figure 19: I would add the mean model optimization and aircraft mass balance emission rates to this graph, as well as the Omara and Peischl studies, along with their uncertainties. It seems like one advantage this study has, as mentioned in the introduction, is a narrowing of the uncertainties of these previous studies.

#### Technical/grammatical comments

The author numbering is not in order.

line 48: Methane also has an atmospheric sink from chlorine chemistry.

line 58: is “mining” the proper word for natural gas? It may be, I just can't say I've heard that before.

line 64: add “of” to say “quality and quantity of its emission factors”.

line 107: put “per day” before the abbreviation “MMSCFD”, instead of after it.

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