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# ***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 #1**

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### General Comments

In recent years global fossil fuel markets have changed dramatically away from coal toward oil and natural gas. These changes have been driven significantly by new extraction methods such as hydraulic fracturing that are associated by fugitive emissions of hydrocarbon gases to the atmosphere. During this same period the atmospheric abundance of methane, an important greenhouse gas, has again begun to increase following an earlier period of stagnation. Researchers have variously attributed this recent increase to two dominant sources: biogenic emissions from tropical wetlands

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and/or thermogenic emissions from the oil and gas industry. The present paper uses total column atmospheric measurements of methane, and of ethane, a gas primarily associated with thermogenic methane sources, in both hemispheres, to show that a significant but uncertain fraction of this recent methane rise is due to emissions from oil and gas production. This is an exceptionally timely and important paper, especially in the context of current policy interest in anthropogenic sources of greenhouse gas emissions and their roles in climate change. The paper is well written and clearly presented, and its tables and figures are necessary and easy to read. This reviewer is not qualified to comment on the spectroscopy in the paper, but the simple two-box model used to assess sources from total column abundances is well suited to this initial assessment of the problem. As the authors note, further refinements will require three-dimensional chemical transport models, presumably using total column and ground-based observations. I find that this is an excellent initial paper that requires only minor revision prior to publication.

### Specific Comments

The use of “MER”, defined as the mass-based methane-to-ethane ratio, and of “EMR”, defined as the molar ethane-to-methane ratio, in the same paper is unnecessarily confusing. As the tendency in geochemistry is to keep the minor constituent in the numerator, and the tendency among chemists is to use molar quantities, I suggest that ratios be given only as the EMR, that atmospheric concentrations be given as dry air mole fractions (as they already are), and that fluxes and total burdens be given in Tg per year and Tg, respectively (as they also already are).

Please define the units when they are first used. Since the abstract should be able to stand alone, this applies to the abstract separately. This request includes the definition of “ppb” as the dry air mole fraction in parts-per-billion or in parts in  $10^9$ .

In some parts of the paper uncertainties are given as 95% or 2-sigma, and in others they are given as 99% or 3-sigma. Is 3-sigma really justified given the many large

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uncertainties in this initial simple two-box model treatment? If not, I suggest that 2-sigma be used throughout.

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

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