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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Quantifying alkane emissions in the Eagle Ford Shale using boundary layer enhancement" *by* G. Roest and G. Schade

Anonymous Referee #2

Received and published: 29 December 2016

Roest and Schade use alkane data from ground sites in and around the Eagle Ford shale in Texas, along with a transport model, to determine methane and other small chain alkane emission rates for the region. The ground site data come from several sites upwind and downwind of the Eagle Ford shale. Based on estimates of wind fields, planetary boundary layer height, and emission locations, the authors perform a mass balance analysis to estimate emissions from the Eagle Ford oil and gas production. They conclude that inventory emissions levels are low by about a factor of two, which could affect the accuracy of air quality models.

General comments

This paper provides an emission estimate from a region with extensive oil and gas production whose emissions are not well known, and would therefore be an important

addition to the body of knowledge concerning methane and alkane emissions from oil and gas production regions in the U.S. However, I have some concerns regarding the analysis that I think must be addressed before this paper is ready for publication. My main concerns are discussed in the next two paragraphs. Some lesser concerns are brought up in the Other Comments section.

I am concerned with using Barnett tank alkane ratios to represent tank emissions from the Eagle Ford. First, the alkane ratios could be significantly different from the two regions. My understanding of the Eagle Ford shale is that produces a very wet mixture of hydrocarbons. Do the authors have data from any other oil producing regions in the U.S., like the Bakken or a traditional oil producing region? If they used those ratios, how would that affect the analysis results? I think more work will need to be done to show the effects of this assumption, especially since it plays such a large role in the results.

Another concern I have is with the use of ground-based sampling to represent the entire vertical extent of the planetary boundary layer. I think some discussion of the location of possible sources of methane relative to the sampling sites is necessary. This is especially true for the Floresville site, which may be influenced by emissions that have not mixed completely through the planetary boundary layer on more days than just 18 March 2015.

Other comments

p. 1, Line 25, is carbon monoxide a HAP? I don't see it here: https://www.epa.gov/haps/initial-list-hazardous-air-pollutants-modifications

p. 2, Line 10, please add Olaguer et al. to the References

p. 2, Line 14, How does the 5750 Gg of methane compare to the EPA GHG inventory? If they are the same, I'd cite the GHG inventory. If they are different, I'd still use the GHG inventory, but note the difference. Also, does this number include emissions from

petroleum production as well as natural gas? Since you included associated gas in the leak rate calculation for the Eagle Ford on p. 11, line 27, the national leak rate should also include emissions from petroleum production.

p. 3, Line 16, This emission rate is somewhat misleading. Schneising et al. reported an energy content leak rate, which is not the same as a natural gas leak rate. The energy content leak rate takes into account the oil produced as well as the natural gas. See Howarth [Energy and Emission Control Technologies, 2015, p. 48] or Peischl et al. [JGR-Atmospheres, 2016, p. 2] for a discussion on this issue.

p. 4, Line 21, Why did you use the EDAS 40 km dataset for meteorology over others? Perhaps include a sentence explaining your choice.

p. 5, Line 1, Please show a time series of the background upwind mixing ratios and the enhanced mixing ratios at Floresville. This will give the reader a sense of how well the background sites represent the background air impacting the Floresville site.

p. 7, Line 7, Please provide some discussion of the PBL height and what effect the uncertainty of the modeled PBL height has on the analysis. Has the modeled PBL height been verified using LIDAR or aircraft measurements?

p. 9, Line 1, Did you not see a seasonal change in background ethane due to greater chemical loss during the summer?

p. 11, Line 33, A comparison with the EPA inventory estimate from petroleum production would be a fairer one, considering how much oil is produced in the Eagle Ford shale.

Conclusions section, Please include a time frame for your emissions estimates. Are they for the entire study period? If so, please state this explicitly in the Conclusions.

Grammar suggestions

p. 3, Lines 7-10, This is a long sentence. Consider splitting it up into two.

p. 10, Line 1, I'm not sure "constraint" is a verb, unless it is an old-timey past tense.

Interactive comment on Atmos. Chem. Phys. Discuss., doi:10.5194/acp-2016-861, 2016.