

Interactive comment on “Quantification of Methane Sources in the Athabasca Oil Sands Region of Alberta by Aircraft Mass-Balance” by Sabour Baray et al.

Anonymous Referee #2

Received and published: 12 January 2018

This paper presents a thorough study of emissions from oil sands facilities. While methane is the focus of these aircraft measurements, a number of complimentary species help to characterize emissions and separate individual sub-sources at each site.

The authors do a nice job of contrasting the emissions from the different facilities visited, and bring in previous measurement and inventory work for context.

The paper is well-written and organized. The curtain and box methodologies are accurately and simply described. I believe this paper is appropriate for publication in ACP, with only a few minor edits:

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The first two and a half pages of introductory material discuss methane and its climate and ozone formation impacts. I think that this background material should be condensed, with more of a focus on the oil sands region.

The introductory material starting on page 5, line 11 is of utmost interest to this study. I recommend this section be supplemented with a sentence or two about anaerobic methane formation in tailings ponds, which is mentioned briefly later (p. 14 line 5).

Related to the above comment, on p. 20 line 24, the authors note that younger ponds should produce less methane. The subject of tailing pond methane emissions warrants a paragraph of discussion in the text, explaining why the high emissions from P23 and WIP might be expected (age, any other process differences), and why emissions of methane were low/undetected from other ponds.

p.14, line 19: "we did not detect methane" : Were any canisters taken showing light hydrocarbon enhancements?

p. 20 line 12: Is there a reference or previous study that looks at this degassing rate?

p. 22 line 19, and elsewhere: When discussing seasonality of emissions, it would be useful to remind the reader that these measurements were taken in August-September

p. 23, line 25: The wording "rightly or wrongly" suggests a contested issue, and I would suggest re-wording. Is there more background material on tailings ponds and their anaerobic activity that could supplement this discussion?

p. 24 line 28: Describe this methodology, e.g. by changing to "recent core sampling methodology".

Figure 1: Include wind barbs or a wind direction arrow on each map

Figures 2 and 3: The colored markers appear to be wind direction arrows, which is an important parameter in these graphs. However, the arrows are very difficult to see. I recommend mentioning them in the figure captions, and making the markers more

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obvious (sparser, outlined, or some other format)

Figure 8: remove "date" from bottom axis

Typos/typesetting

p. 4, line 19: CH₄ subscript

p.9 line 17: double-check notation/formatting of U-square. subscripts on sn, s1

p. 12 lines 24-25: degree symbol

p. 24: I suggest more emphasis on Figure 8 in this section (e.g. reference it on line 8)

Interactive comment on Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2017-925>, 2017.