Response to Anonymous Referee #1 – RC3

We very much appreciate the reviewer's comments, and are encouraged by the positive feedback and recommendation for publication. Please see below for our response to this review.

General Comments

In "Mobile measurement of methane emissions from natural gas developments in Northeastern British Columbia, Canada", Atherton et al. describe with lucidity and apply with care an improved mobile survey technique for identifying methane leaks in an understudied region of Canada's oil and gas fields. The measurements are used to probe which aspects of the oil and gas infrastructure in the portion of the Montney region surveyed are most likely to emit methane. A conservative estimate of the bottom up inventory for entire Montney development is calculated and compared against state-based estimates, which is the most uncertain part of the analysis. The manuscript clearly describes the measurement and analysis techniques, highlights the limitations of the approach, and contextualizes the results nicely. I recommend this manuscript for publication in Atmospheric Chemistry and Physics with only minor changes.

Thank you to the reviewer for this overview of our manuscript. We have made all minor changes to the manuscript that are addressed in the Specific Comments section below.

Specific Comments

Line - Comment

p.2, 1.13 - "ostensibly less environmental impact" – People have been more concerned about water-based impacts of hydraulic fracturing than those of coal, so restating this perceived advantage to be specific to atmospheric drivers of climate might be more accurate.
We agree, and have changed the wording of this in the manuscript to be more specific about the environmental benefits related to atmospheric greenhouse gas emissions.

"For this reason, natural gas has been deemed a transition fuel on the path to renewable energy because it allows for continued fossil fuel exploitation while emitting a seemingly smaller amount of greenhouse gases."

p.3, 1.13 - "super-emitters, and reduction" should be "super-emitters and reduction"
We agree and have made this change in the manuscript.

p.3, 1.26 - "significantly, with thousands" should be "significantly with thousands"
We agree and have made this change in the manuscript.

p.4, 1.3 - "August 14 2015 and September 05 2015 we" should be "August 14, 2015, and September 5, 2015, we"
We agree and have made this change in the manuscript.

p.8, 1.20 - "probably" should be "probable"
We agree and have made this change in the manuscript.

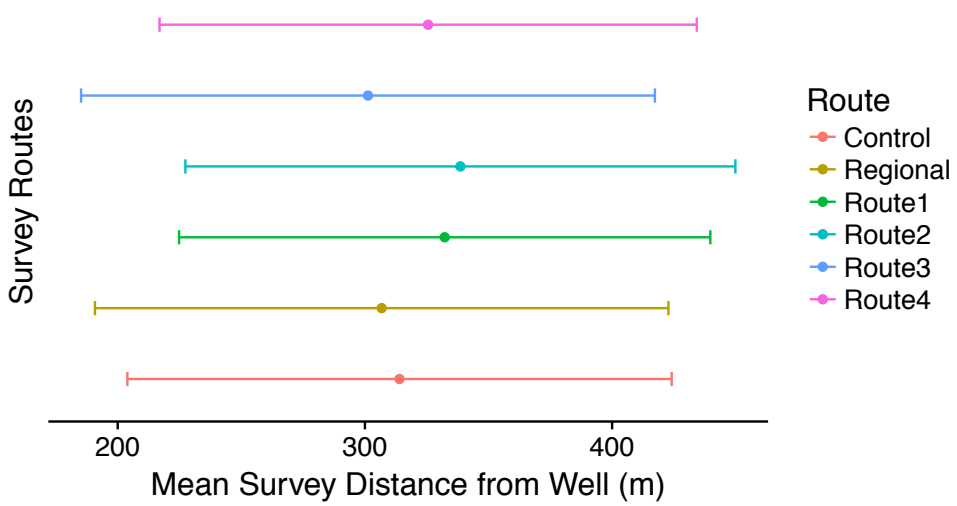
p.9, 1.7-8 - Indeed, accurate infrastructure inventories can be difficult to maintain. This statement seems to indicate that the correlations were not what was expected, which led to suspicion of the infrastructure inventories. Could you rephrase this statement to describe the limitations on analysis that uncertainties in the inventory induce?
We have removed some lines from this part of the discussion, and we have instead added some text to the Methods section (under *2.3 Emission Source Attribution*) clarifying uncertainties in the acquired infrastructure inventory.

"When possible, we attempted to validate the infrastructure locations in the database during our surveys. The locations of the majority of well pads and processing facilities appeared to be accurate, however the statuses may not have been up to date. For example, well pads recorded as "abandoned" in the database, occasionally still had infrastructure present. Although we could not verify the locations of all infrastructural sources from public roads, we concluded that in most cases, the infrastructure database locations appear to be correct, but the operational statuses might not have been up to date."

p.7, 1.25 - "FLIR" is first used here, but the acronym is first defined on page 10. Could you please reorder?
This change has been made to the manuscript.

p.12, 1.20-1 - "Montney based" should be "Montney-based"
We agree and have made this change in the manuscript.

Figure 2 - If I understood correctly, industrial sources were passed on multiple routes. Could these dots and bars be color-coded (with colors from Figure 1) by the route on which the source was observed?
For clarity we have re-created this graph to show detection distances on each route. Below is the revised graph and caption.



"Figure 2: Mean distance from infrastructure while surveying each of the six routes listed in Figure 1. One standard deviation from the mean shows the range of distances at which we were sampling downwind of infrastructure."

Figures5, 6, 7 – Please add to the caption the meaning of the grey-shaded areas around the line.

In response to a comment from Anonymous Referee #2 (below) we have illustrated these data using bar graphs instead.