

## ***Interactive comment on “Assessing the capability of different satellite observing configurations to resolve the distribution of methane emissions at kilometer scales” by A. J. Turner et al.***

### **Anonymous Referee #2**

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Summary/General comments: Turner et al. present an OSSE to assess the performance of different space-based methane measurements (TROPOMI, GeoCarb, aspirational), in particular considering the ability of these different sensors to evaluate methane emissions from the Barnett Shale, a major oil and gas production region in US. This manuscript is very well written – clear, concise, and presents interesting results of particular relevance at this junction in time. I’m supportive of publication once my minor concerns mentioned below are addressed.

Larger context issue: The work as presented lacks some context that limits the extent and value of the conclusions. This could be addressed easily and would make the

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work far more impactful. What I would like to see is more quantitative and qualitative assessment of what the Barnett shale region looks like as a source region compared to other regions and sources of methane. Is the Barnett a typical oil/gas field (for the US, for the globe)? Are emissions particularly large (or small) from this region? Are emissions particularly spatially heterogeneous (lot of intense point sources? Heavy-tail distribution of emissions?)? How does this compare to other interesting methane source regions? Would results be extensible to other oil/gas regions? To regions with intense wetlands? The work presented is convincing for the capabilities/limitations of different sensors—but I don't know if the 6ppb suggested observational threshold is actually an important threshold for studying any domain other than the Barnett.

Question on methodology: What is the impact of choosing to only simulate observations made within the region defined (dashed orange box in Fig. 2)? All the sensors considered would make observation surrounding this box as well, which would have overlapping sensitivity with this region. How does neglecting these observations impact the results? In particular, for sensors like TROPOMI with 'coarser' resolution, might the use of these observation points actually improve the results?

Minor comments (predominantly asking for more specifics/clarifications in abstract):  
Line 9: I don't typically think of the Barnett Shale as being in Northeast Texas – it appears more central than anything else.

Line 16: I'm not clear on the statement that TROPOMI is "very limited" on finer spatial scales. Does this mean TROPOMI can resolve one flux value for a 100km pixel and finer is not possible? Or is there some actual finer spatial threshold?

Line 17: 4-37% of total information. It is not clear what this means on reading the abstract at first, and even with the details later in the paper, it would be good to have further clarification on what this percentage is reported as relative to (what is "total information") in this sentence. This relates to clarifying what the 100 pieces of information is.

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Line 20: Please be more specific here for the importance of 6ppb. My impression is there is an inflection point in performance at 6ppb where the resolved flux improves drastically.

Line 24: vague – please be more specific.

Line 51: Important to state the GHGs performance is claimed but not proven.

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Interactive comment on Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2018-164>, 2018.

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