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Atmospheric Measurement Techniques Discussions

Interactive comment on "Quantifying methane point sources from fine-scale (GHGSat) satellite observations of atmospheric methane plumes" *by* Daniel J. Varon et al.

Daniel J. Varon et al.

danielvaron@g.harvard.edu

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We thank the reviewer for his comments and suggestions, which we address below. Page and line numbers in our responses refer to the revised manuscript.

1. . . . to make this work most widely applicable to the scientific community, it would be advisable to keep the paper's title more general (removing 'GHGSat').

Response: Thank you for this suggestion. We have removed 'GHGSat' from the title, which now reads, "Quantifying methane point sources from fine-scale satellite observations of atmospheric methane plumes."

2. P1, L25: With such a small number of nadir methane column observing satellites, which use a diversity of technologies that result in a range of observing characteristics, the word "conventional" does not really apply. "Most existing and upcoming methane observing satellites . . ." would be a better introductory phrase.

Response: We agree that the recommended wording is better and have implemented the change (P1, L27).

3. P1, L26: Since Jacob et al. (2016) reviews methane observations from space, the authors could easily have provided a more accurate description of SWIR mission pixel resolutions here than "1-10 km". From the list in Jacob et al. (2016) the proposed CarbonSat has the smallest pixel size at 2x2 km2 (although this was the "goal" with a "threshold" of 2x3 km2) while SCIAMACHY had the largest at 30x60km2. Regardless of exact numbers, these pixels sizes are orders of magnitude larger than those of GHGSat, but Jacob et al. (2016, Table 2) showed that the proposed missions CarbonSat and GEO-FTS have point source detection thresholds (0.80 and 0.61 tons/hour, respectively) that are much closer to GHGSat (0.25 t/h) that SCIAMACHY (68 t/h) or GOSAT (7.1 t/h) due to a greater emphasis on measurement precision. An additional sentence somewhere to clarify the differences in precision would enhance understanding for the reader.

Response: We have added sentences clarifying the differences in column precision and spatial resolution between GHGSat and previous missions (P6, L9-10; P13, L14-17). For further details on previous and upcoming satellite missions, we refer the reader to Jacob et al. 2016, which we cite heavily throughout the text.

4. Furthermore, it might be useful to make one more distinction, the difference between imaging missions (GHGSat, TROPOMI, SCIAMACHY, GeoCarb . . .) and non-imaging missions (GOSAT, MERLIN). Imaging data have clear advantages for point source work, yet the word 'image' never appears in the manuscript, aside from the references.

Response: Thank you for this suggestion. We have added sentences addressing this distinction (P1, L30; P13, L16).

5. P2, L1: Can the authors confirm whether 10x10 km2 is indeed correct, since multiple other documents (for example Germain et al., 2017, McKeever et al., 2017 etc.) say 12x12 km2.

Response: The GHGSat-D demonstration instrument does indeed target 12x12 km2 scenes, but future instruments in the constellation (e.g., GHGSat-C1, to be launched in 2019) will have slightly different scene sizes, depending on orbit altitude and the instrument specifications, which are subject to change. For clarity, we have included the 12x12 km2 figure for GHGSat-D in the manuscript (P6, L8).

6. P3, L6: Worden et al. (2013) is missing from the reference list.

Response: Thank you for catching this oversight. We have added Worden et al. (2013) to the reference list.

7. P4, L3: Subsection 2.2 should be “Source pixel method”.

Response: Agreed; we have corrected this error.

8. P8, L27: Additional clarification on the methods of median filtering and Gaussian filtering would be helpful here.

Response: We have added two sentences clarifying our filtering approach (P9, L2-4).

9. P10, L15-16: The assumption here is that a snapshot of the emissions is representative of the mean annual emission rate, i.e. the intra-annual variability is insignificant or the observation is near the mean of a predictable intra-annual variability, but it is possible that neither of these may be the case depending on the nature of the methane source.

Response: We don’t intend to make that assumption and now clarify that the retrieval is for an instantaneous source.

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