

Interactive comment on “Airborne DOAS retrievals of methane, carbon dioxide, and water vapor concentrations at high spatial resolution: application to AVIRIS-NG” by Andrew K. Thorpe et al.

Anonymous Referee #1

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In their paper on airborne DOAS retrievals Andrew K. Thorpe et al. demonstrate that small-scale plumes of greenhouse gases can be detected with their measurement system. Based on established retrieval theory they present an application where the mutual interference of spectral signatures is addressed by jointly fitting the concentrations of the related species. They demonstrate the capability of their method in a predictivist sense, i.e. they compare their retrieved data to use-novel data (data which have not been used in the retrieval as e.g. a priori information) to confirm their results. This approach is valid and apt to furnish evidence that the method chosen is indeed adequate and has the claimed merits. Further, the paper is well written and clearly structured,

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and there seems not much to be criticized.

However, I think, the paper still could be improved. Modern retrieval theory offers a lot of diagnostics which would be interesting in the given context: averaging kernels (spatial resolution and content of prior information in the data), retrieval covariance matrices (particularly retrieval error bars and detection limits inferred from these), etc. A thorough discussion of these quantities would probably shift the focus of the paper. Since a reviewer should not dictate the authors the focus of their paper, and since their way to demonstrate the capability of their measurement system and retrieval method is already convincing, I am reluctant to force the authors to include the discussion of these quantitative diagnostic data and only encourage them to consider this issue if they can easily accommodate it. At least typical retrieval errors should be easy to include.

In summary, I recommend publication of this paper in AMT after correction of the following technical issues:

p7 l8: Is there a version number of this particular HITRAN data set available?

p8 l2: ...these Jacobians are not shown. ("in Figure 1" can be deleted because it is clear from the context).

p8 l18/19 (attention: line numbering is not monotonic in my version here and on the following pages!) It is reported which gases are "included" in which retrieval. This is, however, ambiguous. This can mean "included in the forward calculation of the retrievals, using their respective a priori profiles and leaving these as they are" or it can mean "included as additional unknown variables of the retrieval". I guess you mean the latter but you should be more specific here.

p10 l7 "An H₂O retrieval..."; (replace "A" by "An")

p11 l14 "spectral mixing": Is this an established technical term in your community? In my community the superposition of spectral signatures from various species is typically

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called "spectral interference" or we use phrases like "signal from interfering species".

p13 l32 knowN

p14 l6 Appendix A is printed twice.

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