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Atmospheric Measurement Techniques Discussions

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 #2

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General comments

In the paper, the authors apply IMAP-DOAS algorithm to the AVIRIS-NG instrument for mapping CO_2, CH_4 and H_2O plumes for seven sources. The topic of the paper is well within the scope of AMT. The methods are valid and the authors present new data. However, some results are not sufficient to support some interpretation and conclusions in the paper.

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Discussion paper

The paper lacks a description and discussion of measurement uncertainties making it very difficult to evaluate the quality of the results. The authors repeatedly state that they identified over 250 CH_4 plumes with AVIRIS-NG, but they only show four examples where IMAP-DOAS was applied. They authors need to explain the reasons for choosing these four plumes and for omitting the others. Furthermore, the advantage of IMAP-DOAS over the matched filter is not clearly stated giving the impression that IMAP-DOAS is actually inferior to the filter because only four plumes are detectable. To conclude, the authors should describe measurement uncertainties and discuss how IMAP-DOAS compares to and differs from the linearized matched filter approach.

The authors claim that they are able to detect H_2O from cooling towers (Figure A4d). However, I am not able to identify these plumes in Figure A4d. The figure shows a large area of enhanced scaling factors east of the cooling ponds, but this H_2O signal more likely originates from the ponds. I agree that wind directions at cooling towers and stacks can be different due to temporal variability or the height dependency of the wind direction (Ekman spiral). However, since the plumes a very short and likely meandering, it is very difficult to estimate the wind direction from the true color composite alone in Figure A5a. Nonetheless, I think the wind direction at the cooling tower is more southerly than indicated by the blue arrows. To conclude, the authors need to add more support for their claim that H_2O has been detected from the cooling towers.

In summary, I recommend publication of this paper in AMT after adding the points above as well as the following specific comments and technical corrections.

Specific comments

- Adding a map showing all measurements sites to the paper would make it easier to locate the sites.
- The authors should change their units from ppm m to a more common unit such

as dry air column averaged mole fractions (XCO2 and XCH4).

Technical corrections

- Page 6, Section 5.1, 3rd paragraph: Add full stop after “east edge of the AVIRIS-NG scene”
- Page 7, line 39: Frankenberg et al. (2016) -> (Frankenberg et al. 2016)

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