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Atmospheric Measurement Techniques Discussions

Interactive comment on "Tropospheric Emission Spectrometer (TES) satellite validations of ammonia, methanol, formic acid, and carbon monoxide over the Canadian oil sands" *by* M. W. Shephard et al.

Anonymous Referee #2

Received and published: 6 October 2015

Review paper Mark Shephard et al,

The paper covers a very relevant subject with the validation of satellite observations of four important species by using vertically resolved observations. There are only a few studies showing vertically resolved observations of ammonia, and this study is one of the first to use the observations for the validation of satellite observed concentrations. The paper is easy to read and well structured. Both the satellite and airborne observations are explained well in the first paragraphs after which the authors go into more

detail about the difference between the observations and possible causes. After the section covering the validation the authors show the usefulness of the observations by comparing them with modelling results from the GEM-MACH model which covers the local region surrounding the oil sands.

A few minor comments and edits:

1. The title reflects the validation effort but does not cover the modelling aspect of the paper.

2. In general the validation is the strongest part of the paper and the comparison with the model, though being a good showcase of the use of the observations, feels like a separate paper/a bit of a distraction of the main message. The GEM-MACH is only mentioned in the last lines of the introduction. A small piece of extra explanation about the model and use would be helpful and improve the connection between the modelling and validation parts of the paper.

3. In the text it is mentioned that the response time of the QCL system is 60 seconds. Is this not to slow with the airplane moving quickly over possible source areas and NH3 concentrations varying quickly? And what would the possible bias be to the measured concentrations?

4. All airborne observations within $\sim$120 kilometers are being compared with the IASI pixels. What is the expected effect (a misrepresentation error) on the concentrations of the individual species? For example ammonia has a lifetime of hours up to a day. With low wind speeds it can take several hours for a plume of ammonia to bridge the 120 km. Did you analyze the effect of a stricter spatial criteria?

5. As for the altitude comparisons – The differences between the observations are shown in the form of distributions at different pressure levels. It might improve the comparison by seeing also showing a figure with the airborne and TES observations in a simple scatter plot(maybe color coded with the different levels).

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6. GEM-MACH evaluation: As mentioned fire and other natural emission sources are not included. However the timing of the observations is more or less in the middle of the Canadian fire season. Fires are one of if not the largest source of NH3 in the north and transport of NH3 in fire plumes is possible. NH3 is emitted with a certain ratio to CO and both CO and NH3 are underestimated. Will the fire emissions be included in the model in the future and if transport brings the plume this far down might it explain the difference between the model and observations? (I am not asking to include it now, just curious about the authors opinion)

Edits:

Figure 1. Missing a ruler and indication of lat/lon position/grid.

Figure 14. Not seeing the Model (orig) Hidden behind a line?

Table 1. Missing CO in the Table, estimates are given in the text, might be good as a summary.

Page 9505 Line 7: CO is missing

Page 9511, Line 11, End of line "." needed in between 2013 and These

Page 9531 line 1, add Carbon Monoxide to the sentence

Interactive comment on Atmos. Meas. Tech. Discuss., 8, 9503, 2015.