

Interactive comment on “Retrieval of ammonia from ground-based FTIR solar spectra” by E. Dammers et al.

Anonymous Referee #1

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The paper is very relevant as there are currently large uncertainties in ammonia emissions and surface based vertical observations of ammonia concentration will provide very valuable insights on this topic. The FTIR retrieval methodology is described in detail including error estimates and measurement sensitivity. The retrieval capabilities are also demonstrated at a number of location using case studies and trend analysis. The following are minor comments and edits:

1) Pg 23283, line 20 to Pg 23284 line 12: It terms of satellite validations you mention IASI, but you might also want to mention the potential for the FTIR to provide direct profile comparisons similar to recent satellite/aircraft validation studies (e.g. Shephard et al., “2015, Tropospheric Emission Spectrometer (TES) satellite validations of ammonia, methanol, formic acid, and carbon monoxide over the Canadian oil sands AMTD).

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2) Pg 23289, lines 7-10: Can more justification be provided for there being no correlations between the layers? For example, is the vertical resolution comparable to the number of vertical retrievals levels? Looking at the averaging kernels they appear to be relatively smooth indicating that there might appear to be significant interlayer correlations.

3) Pg 23290, lines 22-23 and Pg 23294 lines 22-23: It probably not completely accurate to say that 1 DOFS means that only total columns can be retrieved. It can be stated that with 1 DOFS only one piece of information can be obtained, but this is not necessary over the whole column unless the retrieval is equally sensitive over the whole column. For example, the retrieval might be mostly sensitive over a certain region of the profile so the 1 DOFS might refer to more of a partial column, etc.

4) Pg. 23291, line 15-17: To reduce some of the propagation errors due to NCEP temperature uncertainties, is it possible to also perform a temperature retrieval using the CO₂ lines with or before the NH₃ retrievals? I am not proposing it is to be done here for the results in this paper, but rather just a comment (maybe in the future).

5) Pg. 23294, lines 27-29 and Pg 23295 lines 1-7: To help demonstrate the information content that goes along with the sensitivity of these low values at Jungfrauoch it would be good to also provide the average DOFS with the average retrieved values.

6) Pg. 23295 lines 23-29 Pg. 23296 line 1: When providing background information on emission inventories you might want to also mention top-down constraints being provided by satellites (e.g. Zhu et al., 2013, Constraining U.S. ammonia emissions using TES remote sensing observations and the GEOS-Chem adjoint model, ACP), and the potential of using both FTIR and satellite observations in conjunction with chemical transport model inversions to improve emission estimates.

Edits: 1) One overall grammar correction is often there should be a “,” before the word “but” 2) Pg 23282, line 7: missing the “a” between “is major” 3) Pg 23282, lines 10-12: Might want to remove “Recently” as the reference is from 2008. 4) Pg 23282, line 28:

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change “and” to “with”? 5) Pg 23283, line 1: might want to put brackets around the “e.g. many . . . 4 weeks” 6) Pg 23283, line 22-23: missing reference for CrIS 7) Pg 23284, lines 4-5: If you like you can make this statement more general by just stating that satellite data is on order the order of 10’s of kilometers. 8) Pg 23284, line 18-19: the molecule names (e.g. Carbon Dioxide) don’t need to be capitalized in the sentence. 9) Pg 23285, line 12: change “and a HgCdTe” to “with a HgCdTe” 10) Pg 23288, line 15: should use “signal-to-noise ratio” for the “SNR” 11) Pg 23293, line 9-11: units on the error numbers. 12) Pg 23293, line 11: put a “,” before “which”

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