

Interactive comment on “Validation of ACE-FTS version 3.5 NO_y species profiles using correlative satellite measurements” by Patrick E. Sheese et al.

Anonymous Referee #2

Received and published: 22 July 2016

General comments:

The authors present a comprehensive validation study where five NO_y species (NO, NO₂, HNO₃, N₂O₅, and ClONO₂) of the most recent data version (v3.5) of the ACE-FTS instrument on the Canadian SCISAT satellite are compared to data sets of up to 11 other satellite sensors. Differences between the previously validated v2.2 and the new v3.5 data versions are also discussed. The manuscript is clearly written and well-structured and will be of interest to scientists working with the corresponding satellite data sets. I therefore recommend publishing this manuscript in AMT after addressing the comments below.

Major comment:

I would like to suggest that the authors should include the standard error of the mean

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(SEM) plotted as error bars on the mean difference profiles shown in Figures 3 to 18 (perhaps not in each altitude for better readability). This has the advantage that the reader may easily recognize whether a bias observed between instruments is significant or not.

Specific comments:

Page 10, line 5: A validation study comparing MIPAS balloon data with the new MIPAS ESA v6 species including N₂O₅ has been published by Wetzel et al. (2013) (reference: see below in technical corrections). Observed differences are within ~20% in the middle stratosphere. You should include the citation here and change the corresponding sentence accordingly.

Page 18, line 17: I cannot understand the meaning of the clause "... correlation with, and mean and standard deviation ...". This sounds a bit confusing. Please rephrase for better understanding.

Page 20, line 21: From Fig. 1 I cannot see a difference of -22%. Shouldn't it read -12%?

Page 20, line 24: "Below 10 km, where HNO₃ ...". Please include "v3.5" before "HNO₃".

Page 25 line 7: Is there an idea why the evening comparisons are better than the morning ones? May this be caused by lower amounts of NO₂ during local morning compared to local evening? Is this mainly a problem of ACE-FTS data? Please include one or two sentences on this issue.

Page 26, line 15: Please also comment on a possible reason of the local morning and evening differences in the N₂O₅ data.

Page 27, line 12: The expression "reasonably good agreement" is not very scientific. Are the observed differences within the combined systematic error limits of both instruments?

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Page 28, line 7: You state that the comparison results are typically better for the evening results but morning and evening differences have the same bias of -10%? I think this is a contradiction. Please change the text accordingly and write only “-10%” (not “ $-10\pm 10\%$ ”).

Page 29, line 12: Please add a reference for the characterization of the ACE-FTS instrumental line shape here.

Page 29, line 22: You write that near 35 km ACE-FTS has a positive bias of about 20%. In the next sentence you say that this is an improvement to data version v2.2 which also shows an agreement of 20% with other satellite data. Hence, the improvement seems to refer to other altitude regions. Please rephrase this sentence to make this issue clearer.

Page 30, line 4: From Table 1 I see that the vertical resolution of ACE-FTS and MIPAS is similar and with about 3-4 km high enough to be only slightly dependent on the a priori profile used. Hence, I don't believe that the systematic differences between ACE-FTS and MIPAS are largely due to differences in the a priori. Are the used a priori profiles really that different? You should check this to underpin your statement. Otherwise, please omit the sentence.

Technical corrections:

Page 19, line 8: The “y” in “Bry” should be subscript.

Page 38, line 7: Please include the reference: Wetzel, G., Oelhaf, H., Friedl-Vallon, F., Kleinert, A., Maucher, G., Nordmeyer, H., and Orphal, J.: Long-term intercomparison of MIPAS additional species ClONO₂, N₂O₅, CFC-11, and CFC-12 with MIPAS-B measurements, *Annals of Geophysics*, 56, Fast Track-1, doi:10.4401/ag-6329, 2013.

Page 40, Table 2: The uppermost reference should read Verronen et al. (2009) (not 2008).

Page 43, Fig. caption 1: Please write “. . . percent differences (v3.5 – v2.2 divided . . .”

(not vice versa).

Page 45, Fig. caption 4: Please write "... ACE-FTS – INST ..." (3rd line) because not only HALOE but also MIPAS is shown here.

Page 47, Fig. caption 6: Please omit the expression "legend shown in Figure 2" in the first line because it also occurs at the end of the Figure caption.

Page 55, Fig. caption 17: Please omit "top panel of" and "all" before the word CIONO2.

Interactive comment on Atmos. Meas. Tech. Discuss., doi:10.5194/amt-2016-69, 2016.

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