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Atmospheric Measurement Techniques Discussions

Interactive comment on "Retrievals of formaldehyde from ground-based FTIR and MAX-DOAS observations at the Jungfraujoch station and comparisons with GEOS-Chem and IMAGES model simulations" *by* B. Franco et al.

Anonymous Referee #1

Received and published: 2 December 2014

General comments. Two new sets of formaldehyde measurements at the Jungfraujoch station retrieved from ground-based Fourier Transform Infrared solar spectra and UV-Visible Multi-AXis Differential Absorption Spectroscopy are presented in the paper. These sets are indirectly compared to check their consistency with each other using as intermediate step two global Chemistry Transport Models, GEOS-Chem and IMAGESv2. As pointed out in the text the two sets are complementary since the vertical sensitivity of the retrieval is different for the IR and the UV technique. The data sets presented here can be of interest to many users for example to assess the accu-

racy of space based retrievals of formaldehyde. The paper is well written and clearly structured. The scientific methods used and the assumptions made are sound and well described. The subject of the paper suits well the scope of AMT. I recommend publication after minor revisions.

There are some aspects where I would appreciate a bit more information. Since the comparison between the models and the measurements is carried on using daily averages I would like to see some discussion about the daily variation of the measurements and the models and how well it is captured by those. It would be interesting to discuss how the model output has been matched to each particular measurement (I assume it is plus minus 3 and 4 hours for GEOS-Chem and IMAGES respectively but it is not clear for me when reading the text).

The discussion about FTIR retrievals mentions the large residuals introduced by the interfering species. I would suggest to add to figure 1 another panel showing the residuals when HCHO is not included in the forward model. It will give an idea of the HCHO signal in the spectra. It is also mentioned that experiments to use HITRAN 2012 instead of HITRAN 2008 produced significant changes in the retrievals when using it for the interfering species. It will be extremely useful if you could provide any further thoughts about it. I don't think changes in HITRAN 2012 with respect to HITRAN 2008 in the 2700-2850 cm-1 region can justify such an important change in the retrieved concentrations.

Since the publication of the HCHO cross sections by Meller and Moortgat in 2000, Chance and Orphal(doi:10.1016/j.jqsrt.2011.02.002) published new cross sections in 2011. Have you considered using these newer cross-sections? If not, why?

I would appreciate a comment about the daily variations of the AK.

Suggested technical corrections: Page 10716: Line 2, Correct "As a"

Page 10717: Line 1, could you please add to the list of papers Fu et al., 2007

(doi:10.1029/2006JD007853)

Page 10718: Line 20, include reference to Bey et al., 2001

Page 10719: Line 2, change “trend” for “record” since the record may or may not show a trend

Page 10720: Line 15, remove “the” in “in the northern Italy”

Page 10721: Line 2, substitute invert by inverse

Line 9, possible rephrasing of “and allows for characterizing. . .” to “and allows the characterization of the vertical information content of the measurement”

Line 25, add Dufour et al., 2009 (www.atmos-chem-phys.net/9/3893/2009/) for ACE-FTS measurements

Line 26, possible rephrasing “The simulated HCHO concentration profiles shows a. . .” to “The concentration of the simulated HCHO profiles shows. . .”

Page 10723: Line 20, correct “Finally, an S/N. . .” to “Finally, a S/N. . .”

Line 23, I would change in for of “retrieve HCHO at ISSJ consists in. . .” to “retrieve HCHO at ISSJ consists of. . .”

Line 27, I would remove “and” after parenthesis.

Line 28, I would change “as such” for something like “These spectrum-specific scaled profiles are the used as a priori. . .”

Page 10724: Line 18, is it the only MAX-DOAS in Xianghe. I think it will be better to say something like “instead of 400-720 nm as described in Wang. et al., 2014 using the reference instead of the city.

Page 10725: Line 22, I would rephrase “remote station with therefore low. . .” to “remote station with low. . .”

Page 10726: Line 15, I would rephrase “These are calculated with by utilizing the. . .” to “These are calculated using the. . .”

Page 10728: In the description of the GEOS-Chem model it may be worth to add the following reference which describes the isoprene oxidation mechanism by Mao et al., 2013 (doi:10.1002/jgrd.50817)

Page 10729: Line 11, I would suggest to remove also to have “The model uses anthropogenic. . .”

Line 15, I would change “examples” to “example”

Page 10731: Line 2, I would change “may be obtained from the MAX-DOAS averaging kernels” to “may be obtained from the MAX-DOAS measurements”.

Page 10732: Line 7, suggested rephrasing “Most of the error terms have been dealt with using perturbation methods applied to all solar spectra recorded during year 2011, according to specifics given in the last column of Table 2, while the respective contributions. . .” to “While most of the error terms have been dealt with using perturbation methods applied to all solar spectra recorded during the year 2011 (details are given in third column of Table 2) the contributions of measurements. . .”

Page 10734: Line 5, suggested rephrasing “aerosol extinction and a priori HCHO profiles, albedo)” to “aerosol extinction, HCHO a priori profiles and albedo)”.

Line 21, I would remove “In this purpose”

Page 10735: Line 11, rephrase suggestion, “for HCHO at Jungfraujoch, we have also added to the following figures involving the FTIR and MAX-DOAS columns, the HCHO concentration retrieved by MAX-DOAS. . .” to “for HCHO measurements at Jungfraujoch, we have added to figures 4, 6 and 7 involving the FTIR and MAX-DOAS columns the HCHO concentration retrieved by MAX-DOAS. . .” because with the original sentence is not clear which figures are affected.

Page 10736: Line 27, The sentence starting with “It also appears that other. . .” needs clarification.

Page 10738: Line 21, remove “-“ from highly-industrialized and -populated

Page 10743: Line 3, change equals to equal

Line 5, change equals to equal

Line 24, change “such” to “these”

Legend Table 2, rephrase suggestion, “,excepting” by “with the exception of”

Legend Table 3, it would be nice to mention that it is for the MAX-DOAS measurements

Figure 6, y-label of lower panel is not completely visible.

Interactive comment on Atmos. Meas. Tech. Discuss., 7, 10715, 2014.