

Interactive comment on “The water vapor self-continuum absorption in the infrared atmospheric windows: New laser measurements near 3.3 μm and 2.0 μm ” by Loic Lechevallier et al.

Anonymous Referee #1

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The manuscript “The water vapor self-continuum absorption in the infrared atmospheric windows: New laser measurements near 3.3 and 2.0 microns” by Lechevallier et al. presents the latest water vapor self continuum measurements from the Grenoble group, which has been steadily advancing in their quest to perform high-quality self continuum measurements in all near-IR windows of consequence to global energy balance. This new paper analyzes measured values at the high energy end of two windows, regions in which no measurements of equivalent accuracy have been performed previously. The authors ably present the measurement approach employed and compare their results to previous measurements and the MT_CKD model. The analysis is solid and the paper will make a useful addition to the literature on this subject. Acceptance is

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recommended, although the authors should implement the improvements suggested below, as well as improve some instances of awkward language (further below).

Issues:

1) The uncertainty in the derived self continuum values due to uncertainty in line widths of neighboring strong lines does not seem to be considered. The analysis presented in both regions indicates that the line contribution to the absorption coefficient is significant – for the 3007 cm^{-1} line it is even larger than the self continuum contribution. Therefore, any substantial uncertainty in the self-broadened line widths would lead to uncertainty in the derived self continuum coefficients. Unfortunately accurate information about the self-broadened line width uncertainty is hard to come by – the best approach might be to assume that it's similar to the uncertainty in the foreign-broadened widths. To develop the aer_v3.6 line parameter file, high-resolution TCCON observations in the near-IR were used to analyze and, if necessary, modify the foreign widths from three sources: HITRAN 2012, Mikhailenko et al., and one from the Regalia group. The differences between the three compilations and widths modified for aer_v3.6 could be as much as 20%. Therefore, for the present manuscript, I recommend the uncertainty provided for the derived self continuum coefficients should be revised to reflect a self line width uncertainty of $\sim 20\%$.

2. This paper states (pg. 10, line 5 and pg. 15, line 22) that MT_CKD has not yet taken the Richard et al. measurement into account. That leaves the reader with the wrong impression. The Richard et al. value was considered in developing recent MT_CKD version, but found to not be consistent with the satellite- and ground-based observations analyzed in Mlawer et al. (2012). Therefore MT_CKD was reduced as much as possible in that region to reflect the existence of the Richard et al. value but still maintain agreement with these field observations.

This paper does a thorough job comparing the new measurements and the previous ones from the Campargue group with prior ones from other teams, but puzzlingly does

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not present MT_CKD as being measurement-based in this window. This leaves the reader with a misleading impression. The disagreement between the field observations analyzed in Mlawer et al. and the Richard et al. self continuum measurement will hopefully be resolved based on further observations, such as the foreign continuum measurements planned by the Grenoble team (the foreign continuum impacts the analysis of the field measurements) and additional self measurements in this window.

3. On page 18, last paragraph, the authors have a fair amount of text discussing various analyses of atmospheric absorption based on the FTS measurements. Since this paper and the others from the Grenoble group have basically dismantled the possibility of the self continuum in the near-IR windows being as high as the room-temperature FTS measurements indicated (i.e. significantly larger than MT_CKD), these high estimates of absorptions can be ruled out. Reading this last paragraph, I expected to have this paper culminate in a clear statement that these high estimates can now be assumed to have been in error. Is there a reason why the authors avoid stating this conclusion?

Typos, minor items:

pg1 line 11 – “in the recent years” should be “in recent years” line 19 – MT_CKD3 should be MT_CKD

pg2 line 2 – A fairly small fraction of the solar radiation in the earth’s atmosphere is absorbed by water vapor (or absorbed at all). The authors likely mean that 60% of the solar radiation that is absorbed is absorbed by water vapor. line 3 – Since there are all sorts of water vapor absorption bands moving into the visible from the infrared, with weaker vibrational bands spaced with not perfect regularity, the authors might want to qualify “located every 1500-2000 cm⁻¹” with a word like “roughly” or “more-or-less”. line 4 – Suggested change for clarity: “These are formed by multitudes of narrow rovibrational absorption lines that are...” lines 18-19 - Suggested change: “This model, which is basically a far-wing line shape model in the window regions, involves a number

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of ad hoc parameters that have been...” line 20 – “long-infrared” is not typically used. line 22 – The comma after “recently” should probably be removed.

pg3 line 2 – The word “windows” should follow “4.0, 2.1, 1.6 and .25 microns” line 7 – “baseline” is usually one word line 21 – A period is missing at the end of the sentence.

pg 4 line 21 – “upstream of” line 31 – Add “with pressure” after “absorption lines”.

pg 5 line 5 – The reader will have no idea when reading the caption to Figure 1 what is meant by “spectral fit” since its meaning is only clear (the absorption coefficient calculation) when reading about the calculation on page 6 – for example, they might assume it refers to some sort of curve fitting from the data. Perhaps change it to “corresponding spectral fit, as described in the text” or “corresponding absorption coefficient calculation, as described in the text”.

pg 9 line 15 – For clarity, add the word “the” between “OFCEAS” and “CAVIAR”.

pg 10 lines 17-19 – Since 5000 cm⁻¹ is not between 4250 and 4725 cm⁻¹, the wording of this sentence should be changed.

pg 15 line 10 – The use of “law” here implies that the exponential expression is some sort of physical law that the values plotted in Figure 7 should obey. A word like “expression” might be more consistent with the intended meaning. line 13-14 – “new frequencies of” should be “new frequencies in” (note the missing letter “e”) line 15 - V3.2 version is redundant since “V” stands for “version”

pg 18 line 5 – It’s unclear why there is a reference to Ptashnik et al. here. According to the MT_CKD web page, the recent modifications to the MT_CKD foreign continuum in the near-IR are due to “Foreign continuum coefficients from 1800-3000 cm⁻¹ were modified to improve agreement with Baranov and Lafferty (2012); in the 1900-2150 cm⁻¹ region, attention was also paid to IASI measurements (Alvarado et al., 2013).... Foreign continuum coefficients at wavenumbers greater than 4000 cm⁻¹ were modified based on Baranov and Lafferty (2012) and Mondelain et al. (2014) measurements. “

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