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Atmospheric Measurement Techniques Discussions

Interactive comment on "Atmospheric observations of the water vapour continuum in the near-infrared windows between 2500–6600 cm^{-1}" *by* Jonathan Elsey et al.

Anonymous Referee #2

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General comments

This discussion paper deals with the determination of the water vapor continuum using observations of a radiometrically calibrated Fourier transform spectrometer. The continuum optical depth retrieval considers all relevant contributions ranging from aerosol optical depth over Rayleigh and spectral line contributions to other continua and thus fits well within the scope of AMT. The data used and presented are only few (from one day) but new. By a comparison of their results to the current MT_CKD continuum model the authors come to substantial conclusions that could be used for the further improvement of MT_CKD.

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Discussion paper

The used Langley method is scientifically valid and the results are mostly sufficient to support the interpretations. In general, the paper is well written and the authors give proper credit to related work. The authors manage a comprehensive comparison to other laboratory and field observations. The title reflects the contents of the paper and the abstract provides a concise summary. Smaller suggestions for improvement are given in the next section with the specific comments.

A small adaption of the overall structure could improve the readability of the paper further. Section 3 with the results contains with subsection 3.2 a comparison with MT_CKD. Section 4 is then about the comparison with laboratory observations.

Although section 3.2 is about optical depth and section 4 mostly about cross sections, it could be an advantage to lift both to the same level of sections.

Specific comments

P3, line 13: The authors state that "in many cases they use either version 2.5 or version 3.2" of MT_CKD. It would be helpful, if the authors could give a more specific reference or a short indicative list of some relevant cases.

P4, line 22: How do the authors come to the conclusion that Zugspitze measurements were taken at airmass factors of $\sim$6? Please explain this in more detail.

P5 concerning experimental setup: It remains unclear how the Microtops II sunphotometer was operated. Was this handheld device mounted on a stand/tripod? Was it mounted on a solar tracker? It would be helpful if the authors describe how it was ensured that the aerosol optical depth measurements were performed along the same atmospheric path.

P9, fig. 3c: The data shown is marked as smoothed. How exactly was this smoothing mathematically performed? Is it the same smoothing about 15 cm-1 mentioned for the continuum on p6, line 14?

P10, fig. 4: In this figure the blue shading corresponds to k=1 and the cyan shading

to k=2 uncertainty. There seems to be an envelope below and above the cyan shading that is colored again blue. If there is a physical meaning of it, could the authors please explain it?

P13, line 8: A suggestion for improvement is to mention the magnitude of the field-of-views of both the Microtops and the FTS.

P16, fig. 8: Is there any reason why the Langley and closure method derived optical depths in the upper part of the figure do not cover the same region of the residual in the lower part of the figure? If possible, they should be the same.

P19, line 4: The section title with laboratory observations fits to the lab measurements, but does not quite fit to the comparison with Reichert and Sussmann (2016) that are also included in the comparison. Their observations were field observations as the CAVIAR field data in this paper.

P19, line 8: The derived continuum optical depth tau_totalˆCAV has another naming in the following formulas, e.g. formulas (3) and (5). Additionally, the quantity tau_forˆlab mentioned on P20, fig. 11 was not introduced.

P24, line 10: The authors refer to lower temperature data (cyan point and dashed line), but in figure 13 there is no cyan point and no cyan dashed line. Seemingly, this passage is from an earlier version of this paper. CAVIAR-lab (297K) should be removed from the legend in figure 13.

P26, fig. 14: CAVIAR-lab (297) is not anymore included in the figure, so it should be removed from the legend. The same applies to the caption.

P29, fig. 16: At the beginning of the second line of the caption self-continuum is assumed to be the foreign-continuum.

P33, fig. 17: In the caption it would be more precise, to mention that the showed data corresponds only to atmospheric windows in the mentioned region. The authors could insert “in atmospheric windows” between continuum and across.

P33, fig. 17: Concerning the showed Reichert and Sussmann (2016) data, ignored is the fact that they used MT_CKD_2.5.2 model for their continuum retrieval. As the self-continuum was assumed to be consistent with the MT_CKD model a direct comparison like in this figure is challenging.

P38, line 27: Constraining the spectral coverage from 2000-7000 cm-1 to 2100-6600 cm-1 would be more precisely.

Supplement: The airmass factor definition m = cos teta contradicts the airmass factor definition given in the paper. The Beer-Bouguer-Lambert law given here is only valid with m = 1/cos teta.

Technical corrections

P3, line 7: remove “at” after temperature

P10, line 5: word repetition (distance 2) of approximation/approximately

P12, line 9: insert vapor (or vapour) between water and continuum

P27, line 3: Period/full stop is missing right after “term”.

P37, line 27, word repetition (distance 1) of aircraft

P40, line 16: remove “10”, which seems to be a line number of an earlier version of this paper

Supplement, P2: remove “the” in front of “account” in the third-to-last paragraph

There is an inconsistency in the writing of the MT_CKD versions. Mostly the current version is named MT_CKD3.2, but sometimes the naming is with a space in front of the version number. For the future reader a coherent way of writing would be an advantage, e.g. in browsing the paper. The model’s developers are using with MT_CKD_3.2 a third way of spelling.

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