Journal: AMTD
Title: Atmospheric observations of the water vapour continuum in the near-infrared windows
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Summary & General comments

This paper describes atmospheric measurements of the water vapor continuum in the near infrared windows (4.0, 2.1 and 1.6 μm) from spectra recorded with a radiometrically-calibrated Fourier transform spectrometer. The optical depth, due to water continuum (self+foreign), was retrieved after subtraction of the line-by-line, Rayleigh and aerosols contributions to the total optical depth derived with the Langley method. The optical depth due to the self-continuum is then obtained assuming either the MT_CKD3.2 foreign continuum or the CAVIAR laboratory measurements of the foreign-continuum with no temperature dependence. Vice versa, the optical depth due to the foreign-continuum is obtained assuming either the MT_CKD3.2 self-continuum or the CAVIAR laboratory measurements of self-continuum extrapolated at 280 K. Both (self- and foreign-) continua are compared to the existing literature data.

The paper is very-well written and almost all the necessary details are given. The work reported here is of high quality. This paper also shows and discusses the current limitations of the atmospheric determination of the water vapor continuum due to potential biases coming from the aerosols, mirror reflectivity and phase corrections. Even if uncertainties on the continuum optical depths are still large, this kind of study is important to test existing laboratory data. Ideas to reduce these uncertainties on retrieved continuum are discussed at the end of the paper. The paper is fully in the scope of AMT and is well-suited for a publication in this journal after some minor corrections (see the comments and remarks below).

Main remarks/comments:

P3, 1st paragraph: The first sentence "*Measuring the continuum…present in the atmosphere*" is too general. For example CRDS/OF-CEAS techniques allow for measurements at room temperature and at low pressure close to atmospheric conditions. Same remark for the next sentences: equivalent pathlenght with CRDS/OF-CEAS techniques can reach several hundreds of km and base lines are highly stable.

P6, L7: The authors have to specified the cutoff value for the Voigt profile and if they include or not in the continuum the plinth below the absorption lines.

P9, Figure 3: On panel (d) the water vapour optical depth is around 0.025. This value doesn't correspond to values reported in Fig 4 and in Supplementary Material which are between 0.01 and 0.008 for the same spectral region. Can the authors clarify this?

P9 or P10: In addition to figures 4 and 5, a figure showing the relative contribution of the aerosols and of the continuum to the optical depth after subtraction of the line-by-line and Rayleigh contributions will be very helpful to demonstrate the importance of the aerosols optical depth knowledge.

P19, L17-18: *…due to the lack of laboratory measurements at atmospheric temperatures, one must assume a temperature dependence of the self-continuum*. This sentence has to be reformulated as CRDS/OF-CEAS measurements of the self-continuum are available at room temperature. Why the authors did not adopt this data set instead of the extrapolated high temperature data of the CAVIAR laboratory measurements?

P21, L25-29: In these lines, authors discuss the two possible temperature dependences and they seem to have the same "degree of confidence" in both. This is a little bit strange as they decided to replace the room temperature CAVIAR data by the values extrapolated at 280 K from high temperature CAVIAR measurements.

P24, Fig 14 (b): The data point called Mondelain et al. (2015) should not be plotted on this panel as it was obtained at 4250 cm^{-1} and not at 4300 cm^{-1}.

P24, L20: The authors should mention here that the difference is due to the fact that, in one case (Vasilchenko et al) a purely quadratic function was used to fit the data considering that there was no adsorption on the mirrors and that in Mondelain et al an additional linear term was used to take into account the supposed adsorption contribution.

P26, L5: The authors should mention that in the 4 µm window the continuum is stronger than MT_CKD **and the extrapolated CAVIAR-lab self-continuum**.

P26, L9: The authors should add: … *a factor of 100 would be required to bring the CAVIAR-lab and CAVIAR-field self-continua into agreement, **in contradiction with CAVIAR foreign continuum***.

P27, Figure 16: Several experimental points from CRDS/OF-CEAS experiments are missing in the 4 µm window (see Campargue 2016 and Richard 2017) and in the 2.1 µm window. In the 1.6 µm window the plotted data have to be replaced by the more recent measurements of Vasilchenko 2019.

In Figure 16 (and also in Fig. 17), the uncertainties on the CAVIAR lab measurements are missing and have to be added.

P28, L 29-30: A strong affirmation is made here by considering that almost all the continuum observed in Reichert and Sussmann is due to the foreign contribution. The authors have to justify this.

Specific comments

P3, L12: *…the adjustement **of** the water vapour…*

P3, L13**: *in addition to additional** empirical adjustments*?

P3, L32: Only the reference for the foreign-continuum is given. Which self-continuum cross-section is used to obtain the estimated values given in the sentence?

P6, Eq. (2): What means τ_{other} as there is already τ_{other_gases} in the equation?

P18, L13: *…self-continuum **c**ross-section…*

P35, L17: The term AOD has to be defined.

P36, L7: *Such **an** analysis…*

P36, L25: *… the water vapour ~~**self-**~~continuum in the near-IR windows at sea level.*

In AMT paper supplementary:

P2: Just before equation (S12) it is written $y=mx+c$. This is misleading as in fact x equal to m in Equation (S12). Authors should replace m by b for example.

P3: *Additionally, the agreement between the Langley and closure data (Figure **8**)…*

Figure S3: Cosinus is missing in the legend of the y-axis. Moreover the angle θ is already used at the beginning of the paper to name the solar zenith angle. Another Greek letter should be used.