



EGUsphere, referee comment RC1
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Comment on egusphere-2022-315

Anonymous Referee #3

Referee comment on "Retrievals of Precipitable Water Vapor and Aerosol Optical Depth from direct sun measurements with EKO MS711 and MS712 Spectroradiometers" by Congcong Qiao et al., EGU sphere, <https://doi.org/10.5194/egusphere-2022-315-RC1>, 2022

The work of Qiao et al., focuses on the PWV and AOD retrievals of EKO MS711 and MS712. The method presented is based on methods of other instruments , but it is novel and since the spectral measuring instruments are becoming more popular, will become valuable in the future and fits the scope of AMT. However, the manuscript is poorly written, a lot crucial information for the reproducibility of the methodology are missing and the validation of the retrievals is very shallow. Hence, I suggest to be considered for publication after major changes. More specifically:

The two instruments are considered as one for most of the manuscript. I think it should be separated and make clear what is the performance of each one. Since the area around 940nm is overlapped by both them, the comparison of the measurements should be presented. Also, the different spectral steps and FWHM will result to very statistics in the validation process. It is crucial to present that, since the instruments are usually sold and installed separately and also in case of parallel operation, a decision should be made for the overlapping region. Finally, in section 2 more details should be mentioned such as the calibration of the instruments, the reported uncertainty and their measuring schedules. Specially, the calibration of the spectral bands is very important and could lead to high deviations for the algorithm. Is there any wavelength shift? How are the spectral channels characterized?

L75-80 More details should be provided on the cloud screening procedure. How effective was it? Give a figure showing the cloud screen data and discuss the results.

It is implied that the radiative transfer model used is MODTRAN. Please, add a section in 2, about the model, the setup , the selection of variables and the bibliographical accuracy.

In general the 1370 absorbing window is more sensitive to PWV changes, but the Direct Irradiance signal at this spectral range is a lot lower. Hence, before using it, signal to noise ratio for the instrument should be discussed and the expected uncertainty should be estimated.

L103/figure 4. This approach should be discussed thoroughly and the results need to be evaluated.

L117 Results showed in figure 5 are not enough to prove that one band is more efficient than the other. We don't know what is the testing sample, how representative is and all other effects on the measurements are already eliminated. A discussion leading to figure 5 is clearly missing.

3.2 It is not clear at which wavelengths this inversion will be used. It is a odd to name this aod inversion in general, since it is not valid for the most wavelengths (where other gases absorb). I suggest to focus in water vapor bands and close bandwidths and just calculate aod for those and keep the full aod inversion for future work that will include more trace gases.

L139 this uncertainties should be discussed and estimated in a separate section. Also, the fact that is compared with CIMEL retrievals, which was found in other studies to drift above 70° sza.

L142 "here we say", I don t understand this phrase.

Figure 7 discussion. It is clear that band 2 is underestimating PWV constantly. It is more like a constant bias of 0.02 between the two bands. So this seems more a calibration issue (between the model and the instrument) than a systematic error of the method.

Figure 2.L82 This figure does not show water vapor absorption windows. It is just two random measurements. Do we know that there was different PWV at these days? Figure 3 Clearly shows the windows, but the figure 2 has no use at this version of the manuscript.

Figure 3. I don't understand the purpose of visualizing cimel filters. Also, the aerosol line, corresponds to a specific AOD (which will change the transmittance) . Please change the legend to the actual AOD value. Also, move the legend to a position that does not hide the drop at 1300-1500nm.

Figure 4. Describe better at the caption. Information on how these spectras were retrieved.

Figure 5. What are the "real values"? If it is CIMEL retrievals, keep in mind that previous studies showed that CIMEL was the most erroneous from all the methods (GPS, radiosondes, microwave radiometer).

Figure 8. It is not wise to provide spectral AOD, when all the trace gases but the water vapor are ignored.