Atmospheric Measurement Techniques Discussions

Atmos. Meas. Tech. Discuss., referee comment RC2
https://doi.org/10.5194/amt-2022-276-RC2, 2022

Comment on amt-2022-276

Anonymous Referee #2

Referee comment on "Spectrometric fluorescence and Raman lidar: absolute calibration of aerosol fluorescence spectra and fluorescence correction of humidity measurements" by Jens Reichardt et al., Atmos. Meas. Tech. Discuss., https://doi.org/10.5194/amt-2022-276-RC2, 2022

Summary

If the first part of this work, the authors describe the addition of a second spectrometer (and its calibration) to the RAMSES lidar. This new spectrometer covers the ~UVA range and is intended to provide additional information on aerosol fluorescence characteristics as well as a way to correct water vapor measurements for aerosol fluorescence contamination. In the second part of this work, the authors discuss the performance of this new correction approach and how it performs when compared to a single channel approach.

General comments

The paper is well written and provides many valuable experimental details with regard to the spectrometer calibration. It also highlights the importance of spectral measurements when looking at aerosol fluorescence and their potential use as an additional dimension in aerosol classification studies.

My main concern is related Sec. 4.2 “Single fluorescence detection channel”, where the authors compare the spectrometer approach with the single channel method. The decision of the authors to select the 430–450 nm band unnecessarily exacerbates the effect of the aerosol fluorescence spectral shape when compared to the solution presented in Chouza et al. (2022). Chouza et al. fluorescence monitoring channel sits at 410.3 nm, less than 3 nm apart from the center of the water vapor Raman spectrum, thus greatly reducing the impact of the changing shape of the aerosol fluorescence spectrum in the correction. It also needs to be mentioned that Veselovskii et al. (2022) used their aerosol fluorescence channel for aerosol research and not as a way to correct water vapor measurements, making the range selection less relevant.

I suspect that the results of the spectrometer and single channel approach will be much more similar if the authors were to pick a much closer and narrower range. This is suggested by Fig. 7, where the difference in the fluorescence spectrum between 410 and 407 nm appears to be smaller than the random noise. Generally speaking, while it is true that the spectrometer approach is potentially more accurate than a single channel correction approach, the much higher experimental complexity, potential calibration drifts and degraded precision should also be considered when comparing it with a combination of very narrow interference filter for the water vapor channel (0.22 nm as used in RAMSES far-range receiver) and a single fluorescence monitoring channel very close to the water vapor filter.

Technical corrections

P13L285 a space is missing on “byVeselovskii”.