

Fluorescence properties of long-range transported smoke: Insights from five-channel lidar observations over Moscow during the 2023 wildfire season

Igor Veselovskii, Mikhail Korenskiy, Nikita Kasianik, Boris Barchunov, Qiaoyun Hu, Philippe Goloub, and Thierry Podvin

This manuscript is very well written, with the quality of the text being one of the positive aspects to highlight. The analysis carried out deepens the study of the aerosol biomass burning (BBA) transported over long distances including entrainment in the PBL. Based on the studies that highlight the advantage of measuring the total fluorescence spectrum, the authors use several discrete channels and obtain the spectral properties using the width of the transmission band. By using five different wavelengths, they can evaluate their performance. According to the results obtained, a current Raman lidar equipment can be significantly improved for aerosol typing by including only two fluorescence channels. This greatly contributes to current knowledge and allows using the contrasted data for future research and further advancing the characterization of atmospheric particles.

On the other hand, something that made me think was that the analysis was only carried out in the PBL, FT and UTLS. Furthermore, considering 8 to 12 km as UTLS. Perhaps 8 km would not be considered as upper troposphere and 12 km as low stratosphere either. This is something that should be considered and more appropriate language should be used or why it is treated this way should be explained.

Additionally, there are several points that could be interesting to include with the aim to have a more consistent work.

As it happens, it could be included the analysis of the particle depolarization ratio once smoke and urban particles are classified. Be that as it may, something that undoubtedly devalues the work is the quality of the figures. Its size and the size of the axes and legends, the half-titles in some cases or the lack of units in the figure itself (Figure 1 right), the letter that differentiates one subfigure from another such as a, b, c cannot be seen (Figure 2), the height range of the graphs of the same event differ from each other (Figures 5 and 6), the meaning of the different colors of the data series is not explained (Figure 7).

Another issue to point out is the fact that many are times that average period to study and plot is not indicated.

Some specific details can be found below:

Page 1 line 16

How long are the 40 smoke episodes? Are they all equally representative? How many hours of measurement does each of them include? The lidar measures 24/7?

Page 2 line 45-48

It would be advisable to explain in detail that hygroscopic growth decreases the fluorescence capacity but does not affect the fluorescence spectrum.

Page 10 line 23

The text points that despite standard deviations, all measurement sessions reveal that the fluorescence backscattering gradually decreases with wavelength but Figure 8a fails to show that.

Page 14 Figure 12

The word “Backscattering” in the upper left subfigure should be corrected.

Page 16 line 322

Perhaps the average interval established to obtain the properties of aerosol particles is too long in time considering the extent and detail of the analysis of the events.

In summary, this paper represents a major advance in Raman and fluorescence-based lidar techniques, but the presentation of the work needs to be revised to maintain the high quality of the scientific content.