Aerosol optical properties as observed from an ultralight aircraft over the Strait of Gibraltar

by Patrick Chazette

Response to the referee #2 comments

The manuscript analyzes the properties of aerosol over Gibraltar, derived from observations of elastic backscatter lidar, installed on an ultra-light aircraft, and from the coastal site Raman lidar. The manuscript is clearly and well written and can be published after some minor revisions.

Equations should be numbered.

Agree. The numbering has been added.

2. P.5 ln8. The equation is formally correct, but reader can be confused, because author first writes “N2-Raman wavelength ð˙IIJ ˛ Eð˙I ´SE˘ ” and later “the ground-based lidar ð˙IIJ ˛ Eð˙I ´S ˘ E=ð˙IIJ ˛ Eð˙IR˘ ÿ,”.

The reference for original work of Ansmann et al., 1992 should be provided.

Agree. The correction has been done and the reference to Ansmann et al. (1992) has been added.

3. P.10 ln 21. “the range of LR values found in the literature for dusts is quite wide, ranging from 28 sr (Soupiona et al., 2019) to 80 sr (Papayannis et al., 2008).” Lidar ratio of dust at 355 nm strongly depends on the imaginary part (Im) of the refractive index. (e.g. https://doi.org/10.5194/acp-2020-98). So low values of LR observed in this work may indicate to low Im in UV.

This is an interesting piece of information that has been added in the text as: "Veselovskii et al. (2020) explained that Lidar ratio of dust aerosols at 355 nm above Senegal strongly depends on the imaginary part of the refractive index and that so low values of LR observed in this work may indicate to low imaginary part.".

4. P.20 ln 3. “Saharan aerosols would have a LR of less than 34 sr.” I think this LR is too low for dust. It can be due to mixing with with maritime particles.

The available data do not allow us to understand why the LR is low. Airborne in situ measurements should be available, but even then, the uncertainties in such measurements are often too large to conclude. This part of the conclusion has been reviewed to draw the mixing hypothesis: " For such low values, there may be a mixture of marine particles in the upper aerosol layer. It may be generated by a recirculation at altitude above the PBL top of a certain quantity of marine aerosols above the coastal site (e.g. Chazette et al., 2019), but no strong argument is available to claim this, therefore that statement remains speculative. As a result, we can infer that a mixture of different types of particles is likely, to which pollution or biomass burning aerosols in varying quantities may be added. ".

5. Conclusion. P.20 ln 9. “Using the CALIOP classification in the context of this work, polluted dusts should be classified with LR 45 sr and Saharan dusts with LR less than 34 sr for the wavelength of 355 nm.” I think this statement is unsupported. There are numerous Raman lidar measurements in Africa (e.g. SAMUM, SHADOW experiments), bringing LR at 355 nm well above 40 sr.

It is not as a general conclusion, but on the case studied in this article. That's why I added " in the context of this work ". To avoid misunderstandings, I've added the precision: " It is worth noting that there are numerous other Raman lidar measurements in Africa bringing LR at 355 nm well above 40 sr (e.g. SAMUM (Ansmann et al., 2011), SHADOW (Veselovskii et al., 2020) experiments)."