

## ***Interactive comment on “Assessment of nocturnal Aerosol Optical Depth from lunar photometry at Izaña high mountain Observatory” by África Barreto et al.***

**Anonymous Referee #2**

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General

This manuscript presents an empirical approach to correct for systematic errors in AOD retrieved from lunar photometry. A simple parameterization based on moon phase and zenith angles is proposed to correct nocturnal AOD. By means of considering “stable conditions” daytime AOD was interpolated to obtain nighttime values which were compared with (corrected) AOD from lunar photometry. The correction appears to have a favourable effect. The correction procedure has been applied to three other stations to show the correction effect on AOD for different aerosol regimes.

The paper is well written and is relevant for publication in AMT. The AMT review criteria are all met, except # 13 (“Should any parts of the paper (text, formulae, figures, tables)

C1

be clarified, reduced, combined, or eliminated?”) which refers to the Introduction (which is a bit lengthy) and Figure 8 (which may be improved). I will explain these points below. In general, the paper is of good quality and I suggest only minor revisions.

Specific comments

- As stated above, the Introduction is rather long compared to the other sections of the paper. A possible solution may be to split up the introduction into a more concise version and a second section containing background information and references. In my view this will add to the readability of the paper.

- In Sections 2 and 3 the two methods for calibration are mentioned; the “common Langley technique” and the “Lunar-Langley technique”. Although well-informed readers are familiar with the two techniques I suggest to spend a few more words on the techniques and its limitations, in particular the “every-night requirement” for the common technique (including an explanation).

- Section 3.1: it is stated that stable AOD conditions are selected using ancillary vertical information from an MPL-3 lidar. Although Fig. 1 is useful I suggest to give some more information on what exactly is meant by “stable” and how stable periods are selected (is there a quantitative criterion?). The interpolation method to get nighttime AOD from daytime values is a crucial aspect in the paper, so the background of how to select stable data deserves more attention/explanation.

- An interesting and good aspect of the work is that the AOD correction has been applied to three other stations in different aerosol climates. The question that arises is: is the correction (the coefficients presented in Table 1) fully instrument-independent? Since the correction is wavelength-dependent, the assumption that the parameterization can be applied to other instruments seems to rely on comparable spectral characteristics (in particular the filters) of the reference instrument and the instruments to which the correction is applied. I suggest the authors spend a few words on explaining why the correction can safely (?) be applied to the Carpentras, Dakar and Lille

C2

instruments, and on the possible introduction of extra uncertainty.

- The title of Section 3.5 is not entirely correct since the method is not really validated. The authors have applied their correction method to AOD retrievals at the three sites but a real validation has not been performed. I suggest changing the title into something more appropriate ("Impact of correction. . ." or something equivalent). - Section 3.4 (line 19): Lille is considered to be affected by "relatively clean conditions". I think that this cannot be stated in general considering the highly polluted environment the site is located in. The AOD may be not particularly high during the selected period but "clean conditions" is maybe a bit too optimistic.

Technical corrections

- Table 1: R-squared: the value  $-0.71$  seems to be incorrect.

- Although Fig. 8 can be understood, it is not very easy to distinguish between the asterisks and the circles. It maybe an idea to present AOD differences instead of absolute values in order to avoid unclerness. If this is not desirable, the authors may think of another way to make the figure more clear.

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