Retrieval of nighttime Aerosol Optical Depth with a PREDE POM radiometer

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The lunar radiometer is a passive remote sensing device that calculates the aerosol optical properties, mainly Aerosol Optical Depth (AOD) during nighttime. It uses the Moon as its source of light. Unlike the Sun, the Moon is neither a strong nor a uniform source of light. It is a secondary source of light reflecting the sunlight we observe on the Earth. The smaller value of the signal, non-uniform reflectance, and continuous change of phase of the moon are the primary challenges encountered before calculating the aerosol optical properties. Recently, numerous steps have been taken to implement different algorithms to calculate the aerosol optical properties using lunar radiometers. For example, AERONET already provides a provisional dataset for nighttime using a specific model of lunar photometer (Cimel CE318). In parallel, Uchiyama et al 2019 [1] implemented another method to calculate the aerosol optical properties using a PREDE POM instrument. In the SKYNET network, the PREDE POM radiometers are the standard instruments used to calculate aerosol optical properties. We applied the methodology provided by Uchiyama et al 2019 [1] on data from two short MAPP project campaigns (the QUATRAM campaign in September 2021, and the Izaña campaign in September 2022) and also for the Tor Vergata site which is a permanent site at Rome (Italy) having both AERONET and SKYNET lunar photometers. The SKYNET AOD for all three cases are compared with AERONET AOD, used as a reference. The preliminary results of the intercomparison look very good. In our analysis, we found our cloud screening to be very strict, so many points were removed. Apart from cloud screening, we are also working on improving the calibration methodology. Calculation of aerosol optical properties with lunar measurements will help in bridging the data gap during nighttime. Since the Moon is used as a source of light, it can also help in the calibration of in-orbit satellites, or in the long polar nights at high latitudes.

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References

[1] Uchiyama, A., Shiobara, M., Kobayashi, H., Matsunaga, T., Yamazaki, A., Inei, K., Kawai, K., and Watanabe, Y.: Nocturnal aerosol optical depth measurements with modified sky radiometer POM-02 using the moon as a light source, Atmos. Meas. Tech., 12, 6465–6488.

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