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Interactive Comment

Interactive comment on "The new sun-sky-lunar Cimel CE318-T multiband photometer – a comprehensive performance evaluation" *by* A. Barreto et al.

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The authors propose three different calibration methods for the MOON channels (section 5.1): the Moon-Langley plot, the Moon-ratio (transfer of Moon calibration from a calibrated master by comparing coincident Moon observations) and the "Sun ratio transference" calibration, that relies on the assumption that internal gains are the same between the master and the instrument to be calibrated. In the last year, several Cimel 318-T have been calibrated in the AERONET-Europe calibration platform at Valladolid. We have investigated another possible calibration method for Moon channels, based on the measurement of the internal gains of the instrument. Both SUN and MOON

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observations consist of measuring direct normal irradiance. The only difference in raw signals between both measurements is the different internal gain or amplification used. This is based on resistances in the electronics, as it is well described by the authors. The main idea of our mentioned method is to measure the internal gains of the instrument, so that the Moon calibration can be directly calculated from the SUN calibration. The SUN calibration includes extraterrestrial signal for all wavelength channels, derived routinely for AERONET instruments by a well-known and robust procedure (Holben et al., 1998). To reach a calibration factor that converts the signal in irradiance (in Wm-2), a extraterrestrial spectrum can be used. Following the authors' notation: $\kappa(\lambda)$=E0(λ)/[V0(λ)*G] Where E0 is the solar extraterrestrial irradiance and V0 is the instrument extraterrestrial signal (SUN calibration) for a particular wavelength channel. Note that G does not depend on wavelength for all channels using the same resistances. Since Cimel 318-T has 2 detectors (Silicon and InGaAs), it will be necessary to determine the gain factor G for the Visible (340-1020nm) and the Short-Wave Infrared (1020-1640nm) channels. The gain factor G can be retrieved by the observation of a stable light source with both SUN and MOON channels of the Cimel 318-T. This was accomplished in the calibration laboratory, using an integrating sphere as light source. The G factor was calculated for all channels having more than 500 counts in the SUN (low gain) measurement. It was measured for 3 instruments with very similar results: the difference with respect to the nominal G value of 4096 (2ˆ12) was less than 1.5% for all channels (mean absolute difference of 0.5%). We have computed the $\kappa(\lambda)$ and analyzed the differences with respect to the Moon-Langley calibrations performed at Izaña for the various instruments. The mean absolute differences in the calibration coefficients range between 2.2% and 4.1% for the investigated instruments, except for 1640nm channel, that shows an absolute difference of 5.5% on average (from 4% to 7% depending on the instrument). Probably the behavior of this longer wavelength needs further assessment (low instrument signal, larger uncertainty in the ROLO model, etc.). Such discrepancy between calibration methods probably gives a good AOD uncertainty estimation, about 0.02 to 0.04 (modulated by air mass) in 440

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to 1020nm wavelength channels and a bit larger in 1640nm channel. The accuracy of this proposed method, that we could call “Sun-Moon Gain factor method”, needs further investigations, basically measuring gain factors in a larger number of instruments and looking for significant differences and biases with respect to the Langley plot method. It probably fits very well in the operational requirements for AERONET calibrations. The measurement of G is simple and can be done in conjunction with the routine sphere calibrations. Therefore the Moon calibration could be retrieved for field instruments with almost no additional work, just using the usual SUN calibration plus the additional gain measurement in the laboratory during the SKY calibration procedure. The Moon calibration obtained in this way does not require a calibrated master for the Moon channels. The SUN calibration of the master instrument is sufficient reference for the Moon channels too. Moreover, the Gain factor method is independent of the ROLO model in order to provide calibration.

Interactive comment on Atmos. Meas. Tech. Discuss., 8, 11077, 2015.