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Atmospheric Measurement Techniques Discussions

Interactive comment on "Recovering Long-term Aerosol Optical Depth Series (1976–2012) from an Astronomical Potassium-based Resonance Scattering Spectrometer" *by* A. Barreto et al.

Anonymous Referee #3

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The manuscript "Recovering Long-term Aerosol Optical Depth Series (1976–2012) from an Astronomical Potassium-based Resonance Scattering Spectrometer", by Barreto et al. presents a long aerosol optical depth (AOD) dataset of obvious scientific interest. Even though the potential of the astronomical data to provide AOD can be envisaged, the technique seems to be immature and much more detail in the methodology must be given. This is AMT journal and the technique is on the main focus here. Furthermore it is not clear what level of accuracy can be reached with this technique. I recommend that a substantial revision is done before the paper can be accepted for publication.

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General comments

1. Several aspects regarding the calibration are not convincing: the rapid changes in V0 suggest large uncertainty; the AOD diurnal cycle corrected by Cachorro et al method also suggests that the Langley procedure was not satisfactory in many cases/periods. Why only cases with AOD diurnal cycle>0.3 are subject to recalibration? This seems arbitrary and not consistent. Furthermore, it is well stated that the Langley plot method accuracy does not depend on AOD but on AOD stability. However the stability is much easier to guarantee under low AOD conditions (that is the reason why AERONET masters are sent to Izana and Mauna Loa). The condition of high correlation coefficient in the Langley plot does not completely exclude temporal AOD variations (see Marenco, 2007): "On the assumption of a constant atmospheric optical depth tau, the plot of (ln I) versus m is a straight line, and its y-intercept represents (ln I0): ln I = ln I0 - m*tau. However, the contrary is not necessarily true: obtaining a straight line in the plot of (ln I) versus m does not allow one to conclude that tau is constant, nor that the y-intercept is (ln I0)." That is the reason behind the need of a number of Langley plots close in time to perform adequate calibration. However, the exhibited rapid changes in V0 for the astronomical device do not seem to allow this approach.

The claimed AOD accuracy of 0.03 must be better justified. The large diurnal cycles and negative AOD's make it very suspect. Even if proved true, it would be in any case much larger than the accuracy of PFR and Cimel, which is below 0.005 for master instruments (Holben et al., 1998), especially for visible and near infrared channels. The 0.01-0.02 accuracy is for field instruments and would be insufficient for a high altitude location with mean AOD of 0.05 or less.

2. The dataset must be shown: a short time series of about 1 week from both Mark1 and PFR would allow a visualization of the data quality. Scatter plots of Mark1 and PFR/Cimel data are needed.

3. The cloud-screening is a key issue in AOD determination and must be explained.

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Thin cirrus clouds for instance are difficult to detect with ordinary sun photometers. Nothing is said about this issue and it could introduce significant AOD error (Chew et al, 2010).

Specific comments

1. The jump in the minimum AOD values after Pinatubo seems to be larger than 0.02. Such value is actually very small as compared to those reported by other authors. How was this estimation made?

2. Gaps in the dataset are not necessarily a problem in trend analysis if an adequate method is chosen.

3. The AOD decadal trend of -0.047 seems huge compared to typical AOD of 0.05 at Izana.

Minor comments

P4094, L10: “mirror”

P4101,L22:”affect”

P4097: Holben 2001 is not adequate citation for GAW network.

P4098, L7: “have”»”has”

Conclusions: remove “very” preliminary. “Preliminary” is enough.

P4108, L12: “mirror”

P4109, L2: “compared with”. L25: “is required”

Interactive comment on Atmos. Meas. Tech. Discuss., 7, 4093, 2014.