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Atmospheric Measurement Techniques Discussions

Interactive comment on "Metrology of the Solar Spectral Irradiance at the Top Of Atmosphere in the Near Infrared Measured at Mauna Loa Observatory: The PYR-ILIOS campaign" *by* Nuno Pereira et al.

Anonymous Referee #2

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Summary: This paper presents results from a new field campaign deployment for measuring the solar spectral irradiance in the NIR at Mauna Loa Observatory, based on improvements from the previous campaign, IRSPERAD. The paper describes the use of a spectrometer that has been calibrated, before during and after deployment, tracking the sun over 8 mornings. Particular attention is put into error analysis of the blackbody and tracking the spectrometer variability by using multiple NIST traceable lamp standards. Enhancements from previous field campaign measurements include resolution of instrument issues and a relative calibration strategy.

General Comments: This paper is well written and concise. This paper is valuable and scientifically interesting as it adds another set of measurements to identify the solar NIR spectra, which is currently contested. This paper is recommended for publication with major revision. The uncertainty analysis may not be sufficient to link the measurements to the conclusions, especially as it pertains to the actual Langley regression. Unless the issues addressed below under 'Major Issue' the sentence on line 1-2 of p. 11 should be revised or omitted:" Additionally it justifies the choice of PYR-ILIOS as the more reliable measurement due to the high confidence of the traceability of the instrument's calibration to the blackbody primary standard."

Major issue: The Langley plot example shows a regression of only 4 points (5 in the case of the shortest wavelength), which seems very low. This poses the question of what type of confidence is obtained from the linear fit, and the related uncertainty of the extrapolation to the intercept at origin. Since only 8 days are selected, this does pose the question if the omission or selection of certain Langley regression would influence the resulting values, while the selection criteria seems large (Rˆ2 >0.9, and AOD variation of 10%). Permitting AOD variations within a Langley extrapolation of up to 10% may result in systematic variation of the intercept at origin calculation by up to 10%. In addition to extra care on the Langley regression of few sampled, with increased uncertainty characterization and confidence interval of the intercept at origin, it may be best for the author to include all points from the 8 days for selected wavelengths to help guide the reader in the selection of the Langley extrapolation, and for future reproducibility. In addition, the refined Langley regression method may be better suited here to account for various issues related to varying airmass factor for Aerosol as opposed to Rayleigh scattering (see Schmid and Wehrli, 1995). More advance linear regression of the Langley extrapolation method may also be needed for the days where the Langley-plot has the lower bounds of Rˆ2, see description by Shinozuka et al. (2013)

Minor issues: - Identification or description of the flatness off the FOV of the instrument, within the 0.1° sun-tracker accuracy, and stability through temperature variations when exposed to ambient variations at the mountain top. - Potential detector non-linearity not addressed for actual measured irradiance values (only using a 2 point calibration values which may not represent irradiance levels sampling during Langley regression). - In the calculation of the uncertainty on the determination of TOA irradiance, the AMF error uncertainty should not be considered zero, variation of the distribution of the aerosol, or some trace gases affecting the column within the atmospheric column as compared to pure Rayleigh scattering AMF, should at the very minimum give some indication of the potential error in AMF calculation. At the very least, error propagation of the pressure measurement's uncertainty to the AMF calculation should be made to determine the AMF uncertainty. Variability of the AMF during measurement time period should also be determined. The Meeus derivation of solar zenith angle is expected to be an overestimate of the apparent solar zenith angle (because of atmospheric refraction), where the Duffett-Smith (1988) may provide a more accurate position.

Here are some specific points to be addressed: p. 1, line 16 – reference missing. p.1, line 17 – 'evoluted' typo? And this sentence requires some reference to prove the point that consensus on the absolute NIR level is still to be achieved. p.2 line 23 – nonsensical sentence: 'it is nowadays the instrument that measured farther the SSI in the NIR.' p.6 line 9 – 'consulted in A1' should be 'consulted in Table A1' Figure 3 – is difficult to see, color choices and symbols should be revised. Table A1: formatting of this table is confusing. The 'AM' moniker should be removed and included in the table description.

References: P. Duffett-Smith, "Practical astronomy with your calculator," 3rd ed. 1Cambridge U. Press, Cambridge, England, 19882. Schmid, B., and C. Wehrli (1995), Comparison of Sun photometer calibration by use of the Langley technique and the standard lamp, Appl. Opt., 34(21), 4500–4512. Shinozuka, Y., Johnson, R. R., Flynn, C. J., Russell, P. B., Schmid, B., Redemann, J., Dunagan, S. E., Kluzek, C. D., Hubbe, J. M., Segal-Rosenheimer, M., Livingston, J. M., Eck, T. F., Wagener, R., Gregory, L., Chand,

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