

Atmos. Meas. Tech. Discuss., referee comment RC4
<https://doi.org/10.5194/amt-2022-250-RC4>, 2022
© Author(s) 2022. This work is distributed under
the Creative Commons Attribution 4.0 License.

Comment on amt-2022-250

Stefan Wacker (Referee)

Referee comment on "New Absolute Cavity Pyrgeometer equation by application of Kirchhoff's law and adding a convection term" by Bruce W. Forgan et al., Atmos. Meas. Tech. Discuss., <https://doi.org/10.5194/amt-2022-250-RC4>, 2022

General comments:

The manuscript presents a modified equation for the Absolute Cavity Pyrgeometer (Reda et al., 2012) and four new/revised calibration techniques for the operation of the radiometer. The ACP is an Eppley PIR pyrgeometer with its dome removed and a dual compound parabolic gold-plated gold concentrator placed above the thermopile. Reda et al. (2012) proposed a calibration technique to determine the ACP's responsivity under cloud-free night skies by cooling down the pyrgeometers case over a set of periods and calculating the rate of change of the thermopile output voltage versus the changing net irradiance and thus termed it as absolute. The ACP has become a potential candidate to contribute to a new primary reference for terrestrial radiation which is intended to be realized in the upcoming years. However, the original radiometer equation is incomplete as for instance convection in the gold concentrator is not considered explicitly. In addition, the authors of the manuscript showed that the Kirchhoff's law is violated by the equation in its original form. As a result, larger uncertainties than the stated $\pm 3.96 \text{ Wm}^{-2}$ by Reda et al. (2012) can be observed under specific atmospheric conditions. The methods described in the manuscript help to explain, better understand and reduce these discrepancies as shown in the observations taken with an ACP and two IRIS radiometers (Gröbner, 2012) between January and December 2020 at Davos. The methods to characterize key parameters of the ACP are thoroughly described and quantified. The manuscript is an important contribution in regard to the realization of a new terrestrial World reference and thus should be published in AMT.

Specific comments:

Conclusions: In my opinion the authors could give clearer information about the most relevant actions to be conducted as next steps. The authors indicated and proposed some further work. However, which action(s) would they prioritize (if any)? I got the impression that there is a bunch of work to be done. So, it might be helpful the most relevant next actions to be identified.

Technical corrections:

- Line 26: may use "...convection and other issues..." (I think not only the determination of the convection (coefficient) needs to be solved)
- Line 71: may add " W_r , is given by σT_r^4 with σ as the Stefan–Boltzmann constant and T_r as the surface temperature of the thermopile receiver".
- Line 105: Philipona et al., 1995
- Line 192: I am not familiar with the term "dome irradiance coefficient" but it may be commonly used. Otherwise may replace with "the coefficients k_1 , k_2 and k_3 for domed pyrgeometers... (Gröbner and Wacker, 2012)" or similar.
- Lines 196-198: I find the sentence difficult to read; is there a verb missing? E.g., "... with the latter implying an improvement..."
- Line 201: May replace "However" by "In addition"
- Line 216: May rephrase: "Using the Jinan et al., 2010 transmission measurements with the new equation suggests..."
- Line 650: "...parameters at different..."

Apologize for the delay

stefan