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Appropriate airmass and solar irradiation attentuation parameterisations for southern Africa

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Abstract content
   (Max 300 words)

The development of solar power facilities in South Africa requires accurate knowledge of local solar irradiation characteristics. The total amount and spectral distribution of solar irradiation depends on the degree of attenuation of radiation in the atmosphere. This in turn is a function of the solar beam's relative path length through the atmosphere (referred to as airmass), and the aerosol/gas concentration, distribution and physics of light scattering as applied to individual aerosol types and shapes.
The airmass is affected by Earth curvature and refraction, which in turn depend on the atmospheric density profile. In view of the wavelength dependence on attenuation, solar light transmission through the atmosphere becomes a complex function of airmass that is generally determined empirically. Most solar irradiation models are based on North American and European atmospheric profiles, and their applicability to the typical conditions experienced over southern Africa have not been fully tested.
This paper describes the evaluation of atmospheric pressure profiles from radiosonde data gathered over several years above De Aar. Typical light paths are calculated for a range of solar zenith angles and wavelengths. The following results are thereafter presented and compared with previous work: (i) the characteristic local zenith angle-airmass relationship, and (ii) the locally appropriate broad-band Rayleigh atmosphere attenuation function - the airmass-dependent coefficient to the so-called Linke turbidity parameter.
The paper is concluded by discussing the implications of the new results for solar energy generation in South Africa.

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