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Determining Angstrom Constants for Estimating Solar Radiation in Malawi

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ABSTRACT

This paper discusses a procedure that was adopted for the development of a linear regression model for estimating solar radiation in Malawi. By making use of sunshine-hours data recorded at six selected meteorological stations in the country, namely: Salima, Makoka, Karonga, Bolero, Chileka and Mzimba over the period 1991-1995, a set of Angstrom constants were obtained and averaged in order to develop the linear regression model. This model has potential for generating ground observation data of solar radiation at any given location in the country using sunshine hours as the only required input. The Gunn-Bellan Spherical Pyranometer and the Campbell Stokes Sunshine Recorder were respectively used in the measurement of incident radiation (I_b) in $J \cdot cm^{-2}/day$ (converted to $MJ \cdot m^{-2} \cdot day^{-1}$) and sunshine hours. An Angstrom model of monthly average Clearness Index with normalized sunshine duration was then developed for each of the six meteorological stations. The resulting linear regression model was applied in estimating monthly average daily solar radiation. Regression analysis between computed and measured radiation data was applied to assess the reliability of the generated Angstrom constants. The results generally show a high degree of agreement between the two variables, with correlation coefficients ranging from 0.63 to 0.90. Angstrom constants obtained at the six meteorological stations were thereafter averaged in order to develop a linear regression model for estimating solar radiation in Malawi. Solar radiation values obtained using this model were noted to be in good agreement with those developed for each of the six meteorological stations.

KEYWORDS

Solar Radiation; Angstrom Constants; Sun-Shine Hours; Attenuation; Linear Regression Model

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