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A new empirical model for forecasting the diffuse solar radiation over Sahara in the Algerian Big South

Nadjem Bailek^{1*}, Kada Bouchouicha², Zaki Al-Mostafa³, Mohamed EL-Shimy⁴, Nouar Aoun², Abdeldjalil Slimani²
and Saad Al-Shehri³

¹ *Modeling and Simulation in Materials Science Laboratory, Department of Physics, Faculty of Exact Sciences, University DJILALI Liabès of Sidi Bel-Abbès, Algeria*

² *Unité de Recherche en Energies Renouvelables en Milieu Saharien (URERMS), Centre de Développement des Energies Renouvelables (CDER), 01000 Adrar, Algeria*

³ *King Abdulaziz City for Science and Technology, National Astronomy Center, Saudi Arabia*

⁴ *Electrical Power and Machines Department, Faculty of Engineering, Ain Shams University, Cairo, Egypt.*

Email: mohamed_bekhet@eng.asu.edu.eg

*Corresponding author at: LMSSM, University DJILALI Liabès of Sidi Bel-Abbès, Algeria.

E-mail addresses: nadjem.bailek@univ-sba.dz (N.Bailek).

Abstract

Accurate estimation of diffuse solar radiation (DSR) is among the critical concerns in successful solar energy projects. This paper presents a systematic approach for DSR estimation over the Algerian Sahara. The authors explore the available meteorological and radiometric data. These data include the sunshine hour fraction (ratio of sunshine duration to maximum possible sunshine hours), and the relative clearness index. The data cover a period of six years from 2010 to 2015 measured in the Adrar region. Through an elaborated statistical performance analysis, thirty-five models were tested for constructing the most accurate empirical model for estimating the monthly average daily DSR over the Saharian medium. The proposed correlation models were compared with 8 models available in the literature using the widely used statistical indicators i.e. MPE, RMSE, U95, R, TS and GPI. From this analysis, the quadratic equation model is selected as the most accurate model. The study concluded that the suggested correlation is applicable to estimate the monthly average daily diffuse radiation on a horizontal surface for any location over the Algerian Sahara region, which can serve as a resource for the design of photovoltaic systems.

Keywords: Diffuse solar radiation; Clearness index; Sunshine duration; Algerian Big South.

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