

GENERATION OF CLEARNESS INDEX MAPS FOR SELECTED CITIES IN SOUTH WESTERN, NIGERIA USING KRIGING TECHNIQUE

SANUSI, Y. K¹ & OJO, M. O²

¹Department of Pure and Applied Physics, Ladoke Akintola University of Technology Ogbomoso, Nigeria

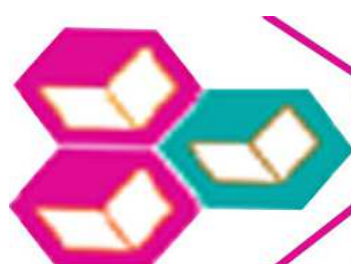
²Department of Physics, Adeyemi College of Education, Ondo, Nigeria

ABSTRACT

In this study, characterization of solar radiation for construction of clearness index maps was carried out to assess the feasibility of solar energy utilization. The materials required for this study are accumulated data of global solar radiation, relative humidity, maximum and minimum temperature which are obtained from the satellite – derived data from the Atmospheric Data Centre of National Aeronautic and Space Administration (NASA) and National Space Research and Development Agency, Abuja. The data obtained covered a period of eleven (11) years, from January 1995 to December, 2005 for six locations in South western Nigeria which lie on the latitudes and longitudes (Lat. 07° 03' N , Long. 03° 19' E) for Abeokuta, (Lat.07° 38' N, Long. 05° 12' E) for Ado Ekiti, (Lat. 07° 15' N Long. 05° 05' E) for Akure, (Lat., 06° 25' N Long. 03° 27' E) for Ikeja, (Lat., 08° 01' N Long. 04° 11' E) for Ogbomoso and (Lat., 07° 48' N Long. 04° 42' E) for Osogbo. Acquired data were used to calculate values of the clearness index K_T , diffuse ratio K_D and diffuse coefficient K_D for each location, these depict the effectiveness of the sky in scattering incoming radiation. A characterization of the sky conditions over the locations based on the calculated clearness index K_T values for the eleven years of data is presented. All monthly irradiance data given as mean monthly radiation sum are transformed into monthly clearness index values through the application of interpolation technique called Kriging method as described by Beryer et al (1997).

The results of this study show the variation of global and diffuse component of solar radiation in summer and winter months. The results revealed that the values of global solar radiation computed vary from 12.248 – 20.844 $\text{MJm}^{-2}\text{day}^{-1}$ in Abeokuta, 12.880 – 21.744 $\text{MJm}^{-2}\text{day}^{-1}$ in Ado Ekiti, 12.064 - 21.888 $\text{MJm}^{-2}\text{day}^{-1}$ in Akure, 12.600 – 19.224 $\text{MJm}^{-2}\text{day}^{-1}$ in Ikeja, 12.960 – 22.916 $\text{MJm}^{-2}\text{day}^{-1}$ in Ogbomoso and 12.420 – 21.276 $\text{MJm}^{-2}\text{day}^{-1}$ in Osogbo. The results showed a seasonal variation of global solar radiation with the highest values corresponding to dry season (November to March) while the least values are observed at the peak of the raining season between (May to October) of the years considered. The clearness index which is availability of global solar radiation varies with geographical location and period of the year. The implications of these results on the effective utilization of solar energy are discussed. The results in this study serve as very useful information for engineers and other renewable energy technologists in the process of designing and estimation of performance of solar application systems.

KEYWORDS: Ado Ekiti, Global Solar Radiation



Best Journals
Knowledge to Wisdom

Submit your manuscript at editor.bestjournals@gmail.com

Online Submission at http://www.bestjournals.in/submit_paper.php