Global Solar Radiation on Horizontal Surface in Dhaka For April 90 - March 91

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Abstract: Global solar radiation for the period 1990 - 91 in Dhaka (Latitude 23.7^0 N) is presented here in the form of monthly average daily global radiation for April 90 to March 91 along with daily average global radiation for the month of April 90 and December 90. Clearness index values have been calculated. Clearness index ranges from around 0.35 in July to around 0.54 in February.

Keywords : *Solar radiation, Horizontal surface.*

INTRODUCTION

Solar radiation data has wide variety of use. Apart from providing information as potential source of solar energy, these data are also important for architects and engineers for designing of building structures particularly in urban areas. Not many Organizations in Bangladesh are involved in collecting solar radiation data. Helali [1] in his work presented solar radiation data averaged over a period of four years from 1982 to 1986. Data and information presented here spreads over a period from April 90 to March 91.

MEASUREMENT AND METHODOLOGY

Global solar radiation measurements were performed with Kipp and Zonen Pyranometer of model CM5. The pyranometer was connected to a Kipp and Zonen CC-12 integrator with printer. The pyranometer was placed on the roof of Mechanical Engineering Department of Bangladesh University of Engineering and Technology, Dhaka (Latitude 23.7^oN). Monthly average daily solar radiation $\bar{H}$ was calculated from the daily total for the month. Clearness index K_T was calculated from $\bar{H}/\bar{H}o$ where $\bar{H}$ is the Extraterrestrial radiation which was calculated for the characteristic day for each month recommended by Klein [4]. The ratio of the daily average of bright sunshine hours "n" to the theoretically maximum possible sunshine hours " $\bar{N}$" i.e. $\bar{n}/\bar{N}$ was calculated. The value of "n" was obtained from Hossain [3] and "N" was calculated for the characteristic day recommended by Klein [4].

RESULTS AND DISCUSSION

Monthly average daily global radiation is shown in Fig. 1. It is evident from the figure that the month of April is the highest recipient of solar radiation (around 5 kWh/m^2. day) and the month of December is the lowest (around 3 kWh/m^2. day), Fig. 2 shows the daily global radiation for the above two months. The monthly average daily global radiation and $\bar{H}o$ is shown in Fig. 3 which clearly shows the effect of monsoon from May to September. $\bar{K}_T$ and $\bar{n}/\bar{N}$ is shown in Fig. 4. K_T is low for the month June, July and August and around 0.35 and the value gradually increases reaching high values during the months of November, December and January, the maximum value is around 0.54 in February. The data of author, Helali [1] and Hossain [3] are given in Table 1 and illustrated in Fig. 5. The H obtained by the author for different months are higher than those given by Helali [1] but lower than the computed values of Hossain [3]. The root mean square error RMSE between the author's data and those given by Helali [1] was calculated by using the following equation.

$$RMSE = \left[\frac{\sum_{i=1}^{x} (Y_i - X_i)^2}{x} \right]^{1/2}$$

and was found to be 0.528. This value is a bit high, this variation may be due to weather condition, method of collection of data and instrumentation.

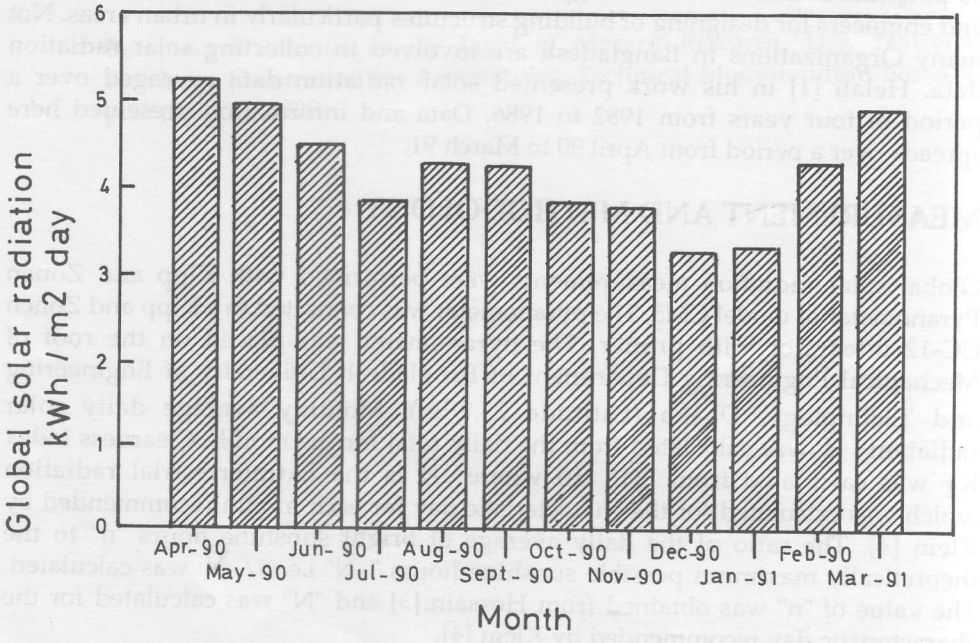

Fig. 1 Monthly average daily solar radiation for Dhaka.

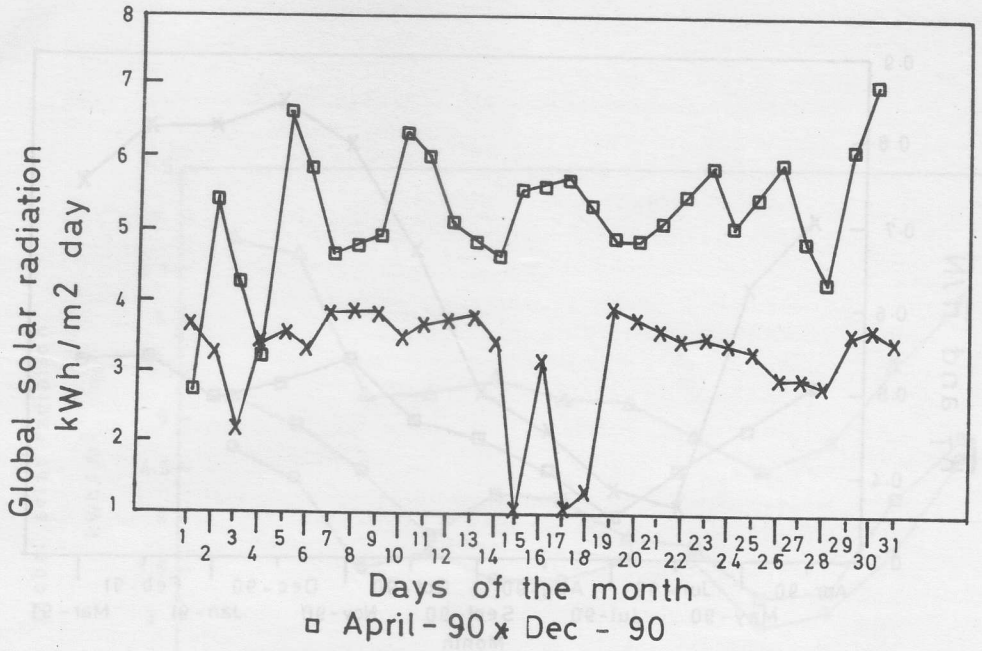

Fig. 2 Daily global radiation for the month of April - 90 and Dec-90.

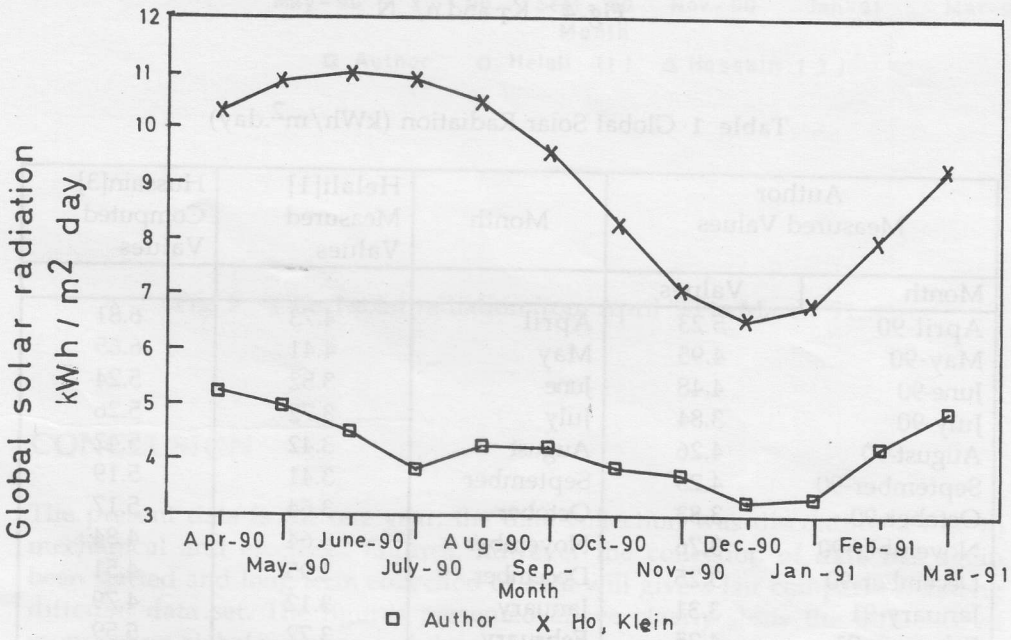

Fig. 3 Monthly average daily extraterrestrial solar radiation.

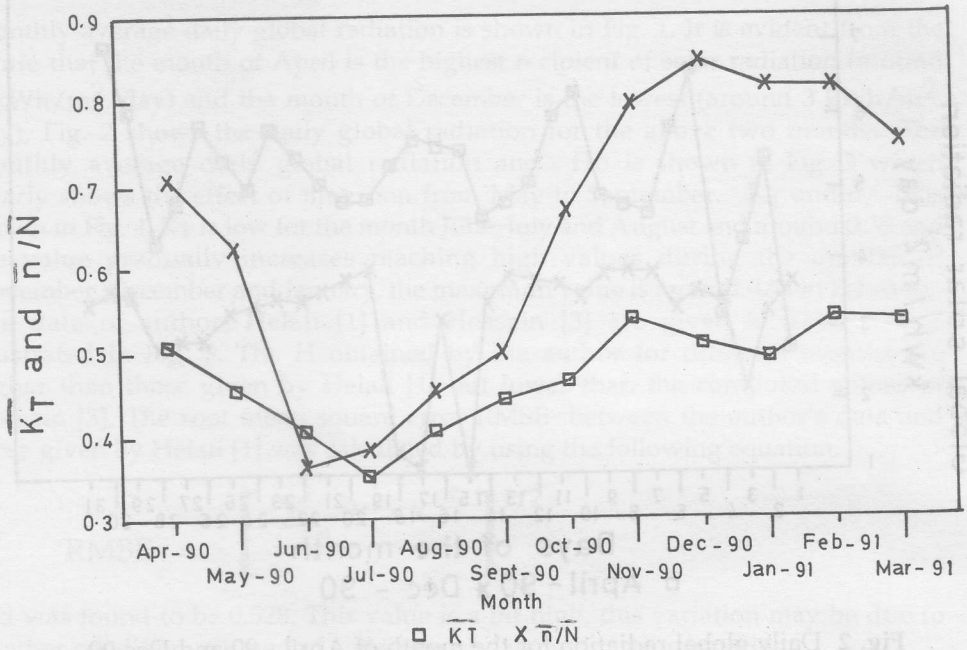

Fig. 4 $\bar{K}_T$ and $\bar{n}/\bar{N}$

Table 1 Global Solar Radiation (kWh/m^2.day)

Author Measured Values		Month	Helali[1] Measured Values	Hussain[3] Computed Values
Month	Values			
April-90	5.23	April	4.73	6.81
May-90	4.95	May	4.41	6.65
June-90	4.48	June	3.52	5.24
July-90	3.84	July	3.72	5.26
August-90	4.26	August	3.42	5.42
September-90	4.23	September	3.41	5.19
October-90	3.83	October	3.64	5.17
November-90	3.76	November	3.64	4.84
December-90	3.25	December	2.95	4.51
January-91	3.31	January	3.12	4.79
February-91	4.25	February	3.72	5.59
March-91	4.87	March	4.67	6.25

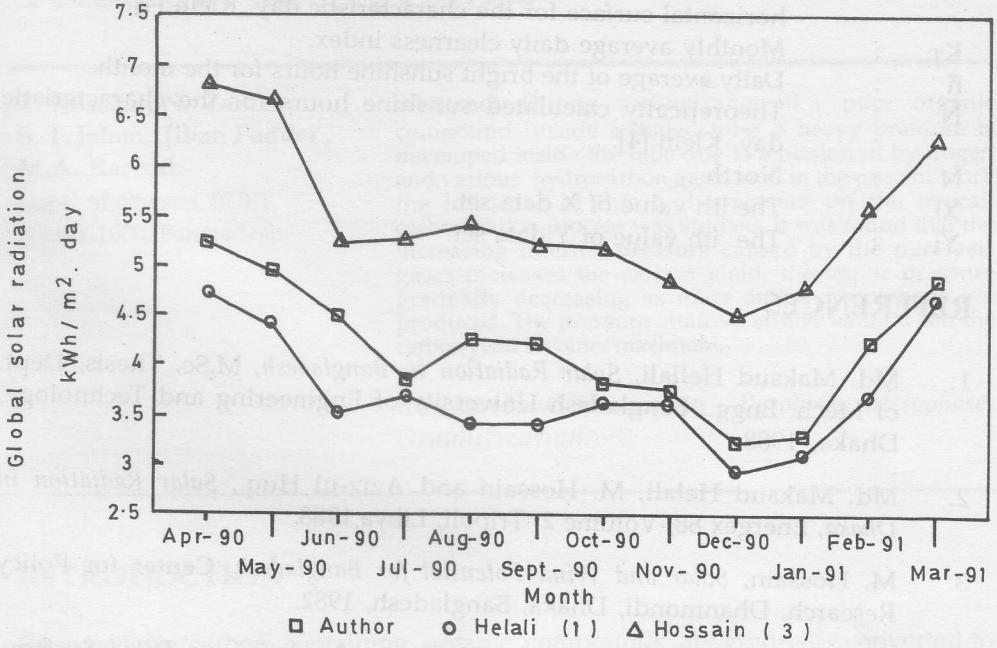

Fig. 5 Global solar radiation from April '90 to March '91.

CONCLUSION

The present data is for one year, the data collection was discontinued due to mechanical and electrical failures, however the collection of data has again been started and long term collection of data will give a fair comparison among different data set. The figures presented above clearly show the influence of monsoon on global radiation and clearness index.

NOMENCLATURE

$\bar{H}$	:	Monthly average daily global radiation on a horizontal surface.
$\bar{H}o$	:	Monthly average daily extraterrestrial radiation on a horizontal surface for the characteristic day. Klein [4].
K_T	:	Monthly average daily clearness index.
$\bar{n}$	:	Daily average of the bright sunshine hours for the month.
$\bar{N}$	:	Theoretically calculated sunshine hours for the characteristic day, Klein [4].
N	:	North
Xi	:	The ith value of X data set.
Yi	:	The ith value of Y data set.

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