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Letters to the Editor

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A STUDY OF ATMOSPHERIC TURBIDITY AND DIFFUSE SOLAR RADIATION AND THEIR CORRELATION AT DELHI

Numerous studies have been made in the past on the radiation climatology of India (Mani *et al.* 1962, 1963, 1967, 1968, 1973, 1974, 1976, 1977, 1980) and on the spatial and temporal variations of Angström turbidity coefficient β in the country (Chacko & Desikan 1965, 1969). The variations of the ratio diffuse to global solar radiation, have also been studied by many authors under different conditions (Mani *et al.* 1963, 1969, 1977).

In the present paper, the values of β and the diffuse and global solar radiation D and G measured on 641 clear (cloudless) days, during 1960-64 and 1969-71 at New Delhi were analysed and the results are presented.

2. From daily values of diffuse sky radiation D and global solar radiation G, the ratio D/G was obtained for all clear days. β was the mean of measurements made at synoptic hours during the day. The mean monthly values of D/G and β for the periods 1960-64 and 1969-71 are plotted in Fig. 1. The mean values for the years 1960-62 and 1969-71 are given in Table 1. Omitting the months when observations are limited due to clouds or haze, D/G is found to be least (0.136) in March 1970 and highest (0.418) in May 1970. Similarly, β is lowest (0.029) in January 1961 and highest (0.177) in June 1963. The highest values of D/G and β as expected are generally observed in June. D/G and β showed unusually high values during October and November 1963 and October 1969 presumably due to the absence of rainfall during these months at New Delhi.

2.1. An examination of D/G and β over an eight-year period, 1960-64 and 1969-71, confirms the earlier observations that they are a maximum in summer and a minimum in winter.

Fig. 2 shows the year by year variation of D/G and β from 1960 to 1964 and 1969 to 1971. The unusually low values of D/G and β in 1961 were presumably due to the uniformly good rainfall during the whole year. A study of the trend on

TABLE 1

	Mean for the years		Percentage increase
	1960-62	1969-71	
D/G	.223	.276	23.8
β	.054	.089	64.8

TABLE 2

Mean annual values of Diffuse D and Global G solar radiation at New Delhi

Year	D (Kwh/m²)	G (Kwh/m²)	D/G	β
1960	1.535	6.245	.248	.057
1961	1.337	5.606	.204	.046
1962	1.349	5.826	.216	.061
1963	1.639	6.059	.247	.086
1964	1.465	5.885	.238	.069
1969	1.488	5.303	.281	.088
1970	1.808	5.885	.280	.087
1971	1.919	5.524	.267	.092

D/G and β shows a 24 per cent in the former and a 65 per cent increase in the latter (Table 1).

The year by year variation of diffuse and global solar radiation was also studied. From the mean annual values of D and G on clear days for the years 1960-64 and 1969-71 given in Table 2, it will be seen that while G remains practically unchanged, β and D show an increase with time. This is to be attributed to increased atmospheric pollution caused by urbanisation and industrialization of the area round Delhi over the years.

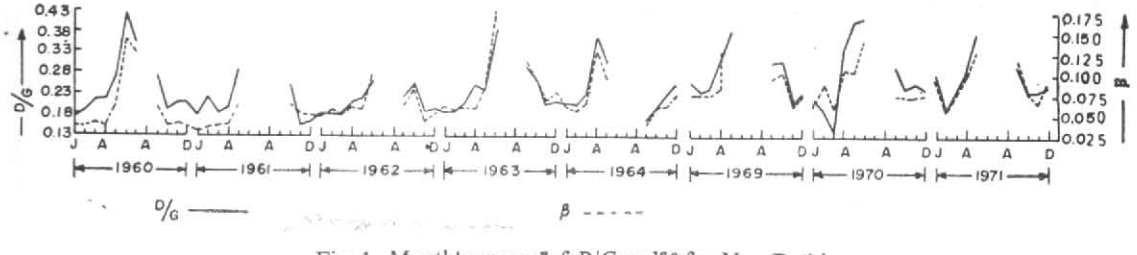

Fig. 1. Monthly means of D/G and β for New Delhi

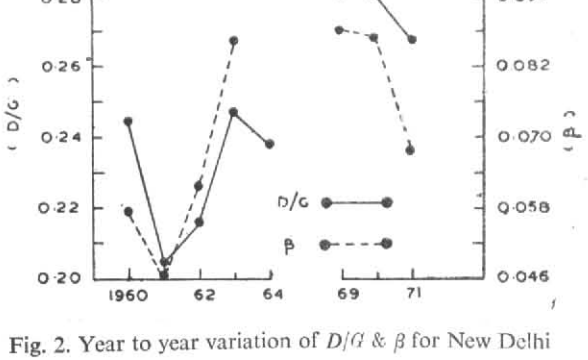

Fig. 2. Year to year variation of D/G & β for New Delhi

Variation in both D/G and β are closely linked with a high positive correlation coefficient of 0.85. The regression relationship between D/G and β obtained by the least square method given by $\beta = 0.38\ D/G - 0.02$ with a standard error of estimation of 0.016.

3. The high coefficient of correlation between D/G and β indicates that D/G is a good indicator of atmospheric turbidity.

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