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GLOBAL SOLAR RADIATION AT DAKSHIN GANGOTRI IN ANTARCTICA

1. For the first time, the India Met. Dep. scientists during the fourth Antarctica expedition, have attempted measurements of global solar radiation at *Dakshin Gangotri* ($70^{\circ} 08' S$, $12^{\circ} 00' E$) in Antarctica covering over a whole year in 1984-85.

2. From 1981 Indian expeditions to Antarctica have been organised. During the fourth expedition, Indian scientists spent well over a year in the remote place. Measurements of global solar radiation with a pyranometer and recorder were made covering over a whole year in 1984-85. This data have been studied and presented in this paper.

3. *Data* — There were many problems with the records, like zero of chart not coinciding with zero of record, want of time marks, stoppage of motor, power failures, the sensor not horizontal, shadows on sensor etc.

To the extent possible, the data have been retrieved, without losing much reliability. Mean values with smoothing effect only have been used here. Due to blizzards, there was no record during second half of February 1984.

4. *Possible duration of sunshine* — This is presented in Fig. 1. 24 hours day is experienced here for two months, from 21 November to 21 January. There is no sun rise or sunset during this period. The sun moves around the horizon. Gradually the daylight hours decrease till the place becomes totally dark for 2 months, 22 May to 22 July. Hereafter starting from a short day around noon, the daylight hours increase to 24 hours again by 21 November.

5. *Distribution of mean hourly global solar radiation* — The distribution of mean hourly global solar radiation is given in Fig. 2. The number of days of uninterrupted records available is also indicated. Isolines have been drawn every 0.5 megajoule/metre². It is seen that the highest values of 2.94 MJ/m² occur around noon in December, obviously the solar elevation being the highest. Gradually the duration and energy content decrease progressively to zero throughout the day by 22 May. From 22 July, around noon, radiation starts coming in. The duration and energy gradually increases to a maximum in December.

Values of mean hourly radiation with hours L.A.T. for April, July, September, October, November and December 1984 and January 1985 are depicted in Fig. 3. As should be expected the duration of sunshine and intensity of radiation are minimum in July and maximum in December.

6. *Month to month variation of mean daily global solar radiation* — This is depicted in Fig. 4. The maximum and minimum values observed also have been plotted.

The mean daily global solar radiation was maximum, around 34 MJ/m² in December, when the sun never

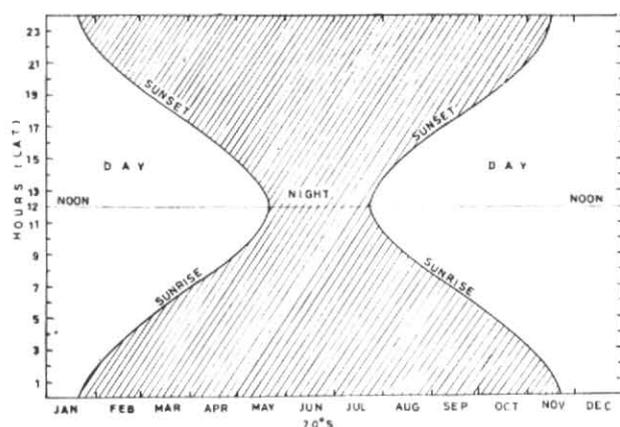
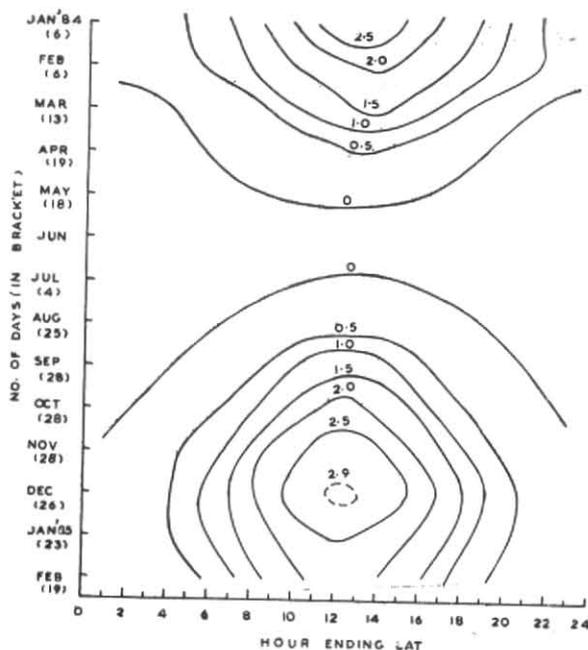


Fig. 1. Possible hour of sunshine

Fig. 2. Mean hourly global solar radiation (MJ/m²)

sets over the station. In India on a sea level station the mean value in summer is around 25 MJ/m². Thus, *Dakshin Gangotri* gets an average of about 35% more radiation per day during summer there, when compared to that in Indian summer.

7. *Percentage frequency distribution* — The percentage frequency distribution of daily values of global solar radiation month by month is given in Table 1. 100% of values in May and July are below 0.5 MJ/m². The values increase gradually. In December and January all values are above 25 MJ/m².

8. *Comparison of monthly sums of global solar radiation to that of a Russian station* — Table 2 gives the monthly sums of global solar radiation at *Dakshin Gangotri* during 1984-85 and at Pionerskaya ($64^{\circ} 44' S$)

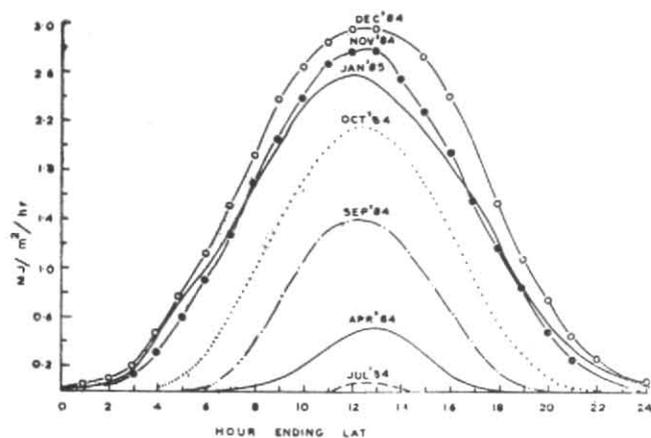


Fig. 3. Mean hourly global solar radiation, Apr, Jul, Oct-Jan

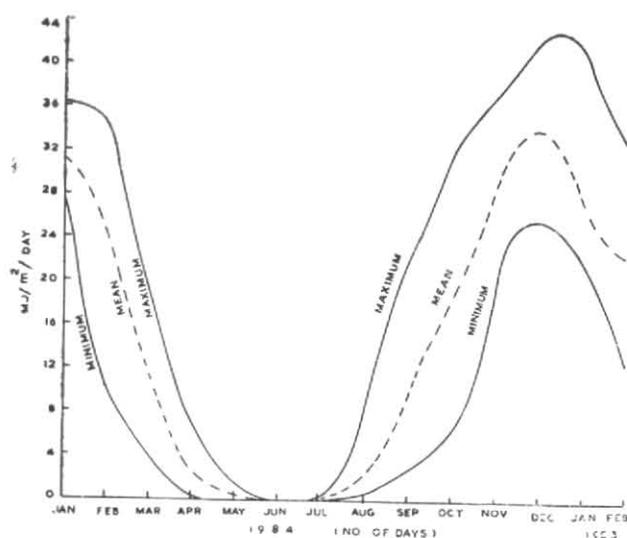


Fig. 4. Month to month variation of means daily global solar radiation

TABLE 1
Percentage frequency distribution of global solar radiation at Dakshin Gangotri

MJ/m ²	Jan '84	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan '85	Feb '85
0.1-5.0			8	95	100		100	92	28					
5.1-10.0			31	5				8	36	7				
10.1-15.0		17	38						11	36				11
15.1-20.0			23						14	21	4			26
20.1-25.0		33							11	21	32		26	26
25.1-30.0	33	33								11	21	27	39	26
30.1-35.0	33	17								4	18	31	31	11
35.1-40.0	34										25	23		
40.1-45.0												19	4	

TABLE 2

Monthly values of global solar radiation (megajoules/sq. metres)

Months	<i>Dakshin Gangotri</i> (70°08'S) 1984-85 (I)	Pionerskaya (69°44'S) 1956-58 (II)	(I)—(II)
January	839	963	-124
February	738	641	97
March	349	335	14
April	75	92	-17
May	12	4	8
June	0	0	
July	4	0	4
August	64	25	39
September	291	197	94
October	543	489	54
November	854	825	29
December	1018	992	26
Annual	4787	4564	223

a Russian station during 1956-58. This Russian station has been chosen due to its proximity to the location of *Dakshin Gangotri*. The difference in values could be due to difference in atmospheric conditions and cloudiness. The annual value measured at *Dakshin Gangotri* is 5% higher than that of Pionerskaya.

9. *Comparison of hourly global solar radiation of Dakshin Gangotri to that of Bombay*—The highest solar elevation at *Dakshin Gangotri* at local noon in December is 44° when 2.94 MJ/m² of solar radiation is received per hour. This solar elevation occurs at Bombay at 11 LAT (local apparent time) in December. The corresponding global solar radiation is 2.43 MJ/m².

Around local noon at *Dakshin Gangotri* during equinoxes the solar elevation at noon is around 20° when the hourly solar radiation is 1.39 MJ/m². At the same solar elevation around 8 LAT in October/November the hourly solar radiation is 1.01 MJ/m² at Bombay.

The higher values of radiation received at *Dakshin Gangotri* at the same solar elevations have to be attributed to the pollution-free clearer atmosphere at this unpopulated region.

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