

ON THE ACCURACY OF GLOBAL SOLAR RADIATION MEASUREMENTS USING BIMETALLIC PYRANOGRAPHS IN INDIA

1. Global solar radiation values measured with a bimetallic pyranograph was compared to that measured by a thermoelectric pyranometer at Minicoy, observations when simultaneous were available. It is seen that the values obtained using bimetallic pyranograph are lower by about 20%.

2. The bimetallic pyranograph is a cheaper, self contained instrument which is easy to instal, maintain and operate. In it the sensors are bimetal strips. The bending of blackened bimetal strip is used as a measure of radiation. The time lag of the instrument is large and the calibration factors depends on ambient temperature. The Radiation Commission of the International Association of Meteorology of the World Meteorological Organisation has recommended this instrument in 1957 for determination of daily totals only, and these daily totals must be regarded as having an accuracy not better than ± 5 to 10 per cent.

The time required for 99% response of a Moll-Gorczyński thermoelectric pyranometer is 15 seconds and its temperature coefficient is nearly -0.1% per degree centigrate. The instrument has a cosine error. The accuracy of measurement attained is better than $\pm 3\%$.

April 1983 global solar radiation values over India are presented in Fig. 1. The values obtained by bimetallic pyranographs are enclosed in rectangles. It is seen that these values are significantly lower than those obtained using thermoelectric pyranometers.

3. Simultaneous records of global solar radiation using bimetallic pyranograph and thermoelectric pyranometer were available at Miniocy. For a few months, the daily values of global solar radiation obtained from bimetallic pyranograph were worked out as a percentage of the values obtained by thermoelectric pyranometer. The number of days in the month when continuous records were available, the percentage of the sum of daily values, the maximum and minimum percentage obtained in daily values are presented in Table 1.

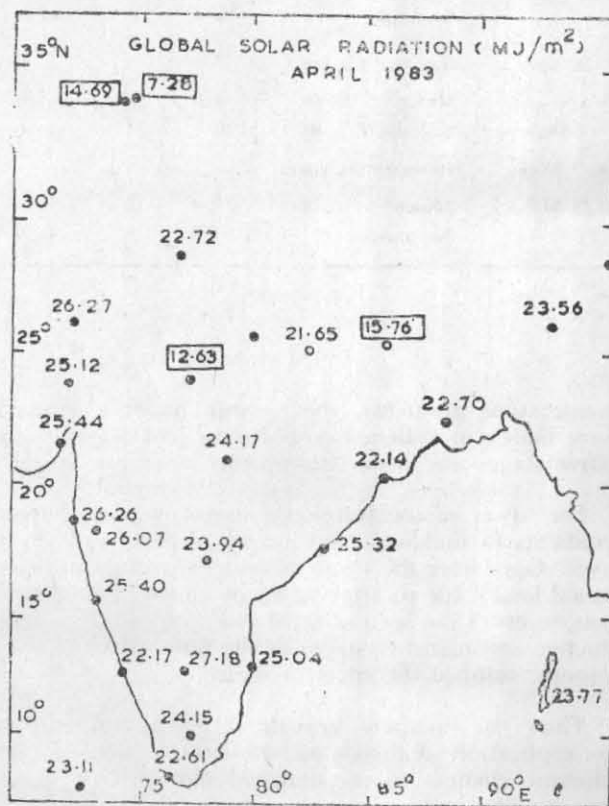


Fig. 1 Global solar radiation over India

TABLE 1
Global solar radiation by bimetallic pyranograph expressed as a percentage of that by thermoelectric pyranometer
Station : Minicoy

Month	No. of days of availability of simultaneous records	Sum of daily values	Maximum	Minimum
Nov 80	14	84.5	91.5	76.5
Dec 80	19	82.0	86.7	75.9
Feb 81	22	80.7	87.3	73.6
Mar 81	28	83.1	88.1	78.4
May 81	30	83.5	91.2	75.6
Jun 81	22	82.7	87.5	74.3
Jan 82	27	80.3	91.5	74.3
Sep 82	29	76.4	83.2	70.1
Oct 82	29	75.9	94.2	71.7

4. The global solar radiation values obtained by bimetallic pyranograph has always been lower than that obtained using thermoelectric pyranometer at Minicoy. Expressed as a percentage, it is about 80% when sum of daily values are considered. The maximum percentage obtained in daily values is about 90% and minimum 75%. Minicoy is an island and hence the temperature variations are small. It is seen in Fig. 1, the values of global solar radiation obtained using bimetallic pyranographs at inland stations are lower when compared to surrounding stations than that studied at Minicoy. In spite of the fact that the calibration factor is chosen depending on the mean temperature of the day, the error of measurements is higher in inland stations.

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Reference

WMO IGY Instruction Manual, Radiation Instruments and measurements, 1957, p. 417.

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