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The dust clouds of El Chichon over India

N. V. IYER

Meteorological Office, Pune

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सार — 1982 में मैक्सिको के ई एल चिकोन नामक ज्वालामुखी द्वारा उत्पन्न ज्वालामुखी-धूलि-मेघों के कारण सौर ऊर्जा की क्षति ज्ञात करने के लिए, भारत के प्रत्यक्ष सौर विकिरण आंकड़ों की जांच की गई। भावनगर और पुणे में लगभग 20 अप्रैल 1982 से प्रारम्भ होकर मानसून के आरंभ होने तक सौर ऊर्जा में 20-25 प्रतिशत क्षति देखी गई।

ABSTRACT. The direct solar radiation data over India have been examined for depletion of solar energy due to the volcanic dust clouds produced by the Mexican volcano El Chichon in 1982. At Bhavnagar and Pune the depletion of 20-25% of solar energy starting from about 20 April 1982 till the onset of monsoon has been noticed.

1. Introduction

The Environmental Research Laboratories of the National Oceanographic and Atmospheric Administration of the United States of America reported that the Mexican volcano E1 Chichon (17° 22′ N and 93° 13′ W) violently exploded on 28 March and 4 April 1982 and ejected ash and gases high into the stratosphere. Even after three and half months since the eruption the volcanic dust cloud remained mainly in a tropical band circling the earth roughly extending from a few degrees below the equator to 35°N and that most of the volcanic debris was centred at 15° N ± 10° latitude, as shown from satellite and aircraft observations.

Times of India of 11 August 82 contained an article 'Mexican volcanic dust here', in which it was reported that a great smog-like cloud of volcanic dust has settled over Bombay and other areas in western India. Though not visible, the height of the dust was estimated to be at 35,000 to 40,000 ft and that it absorbed a good deal of sunlight. However, IMD had found that its solar radiation measurements do not indicate any significant change.

Japan Meteorological Agency found that direct solar radiation had decreased over Japan, whereas no significant change was seen on global solar radiation.

Robinson in a book '*Solar Radiation*' edited by him states that the depletion of solar radiation due to volcanic dust clouds can be recognised in the measurement of direct solar radiation. In global solar radiation the effect is much less significant since the decrease in the sun component of radiation is compensated by an increase in diffuse radiation.

2. The global solar radiation and duration of bright hours of sunshine over Bombay

The monthly means of daily global solar radiation data of Bombay from April to August 1982, compared to that of 1981 and short period averages based on data upto 1975 is in Fig. 1. The duration of bright hours of sunshine is in Fig. 2. No significant change is recognised in these.

3. Global solar radiation at west coast stations

The monthly means of daily global solar radiation of 1982 was compared to that of 1981 and short period averages based on data upto 1975 for four coastal stations, in the west, *viz.*, Bhavnagar, Pune, Goa & Trivandrum are in Fig. 3. Here too there is no significant effect.

4. Direct solar radiation measurements

Unlike continuous records of global solar radiation, direct solar radiation measurements are spot readings

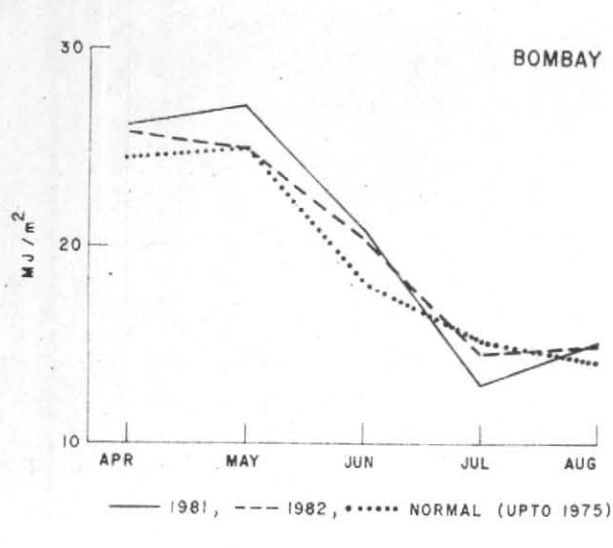

Fig. 1. Mean global solar radiation (MJ/m²)

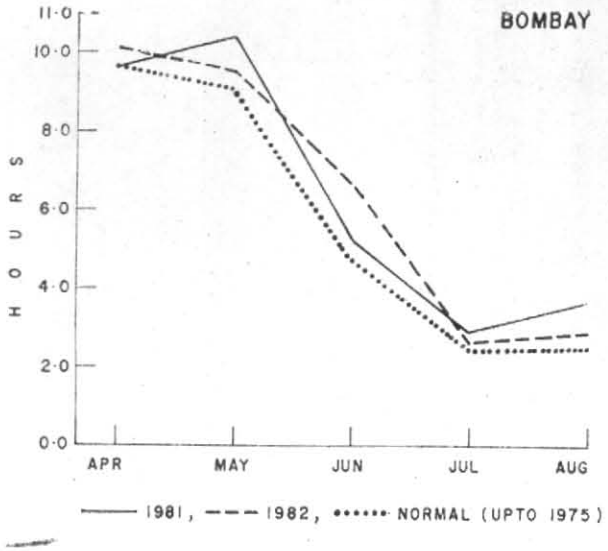

Fig. 2. Mean duration of bright hours of sunshine

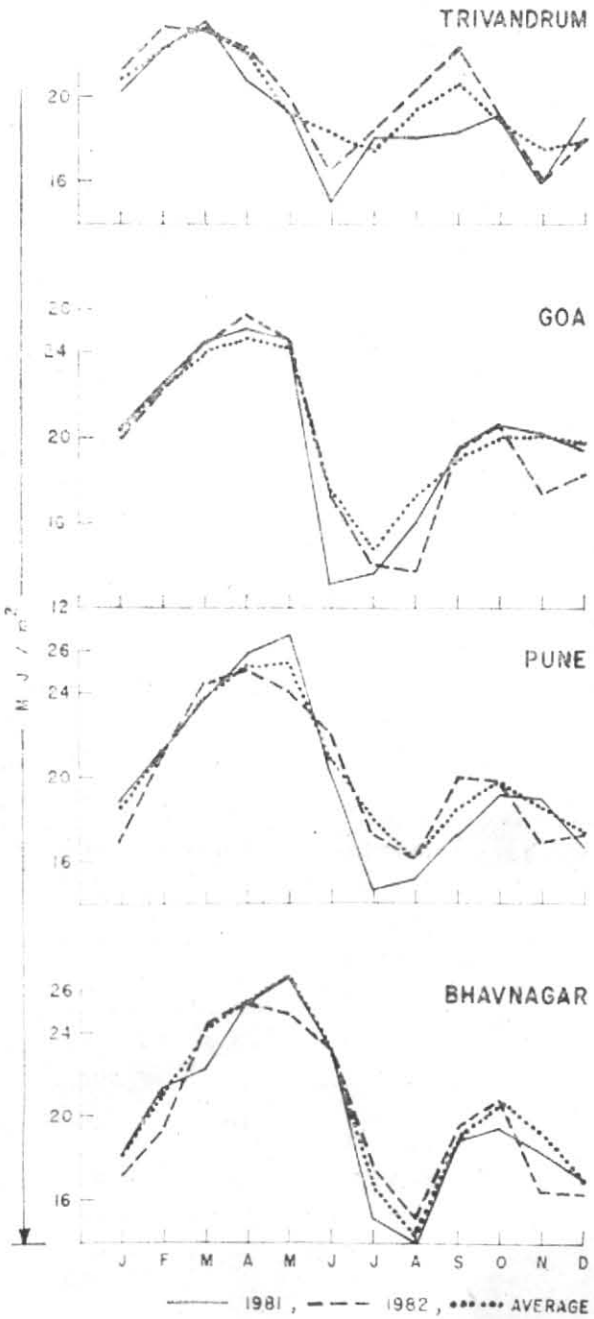

Fig. 3. Global solar radiation (MJ/m²)

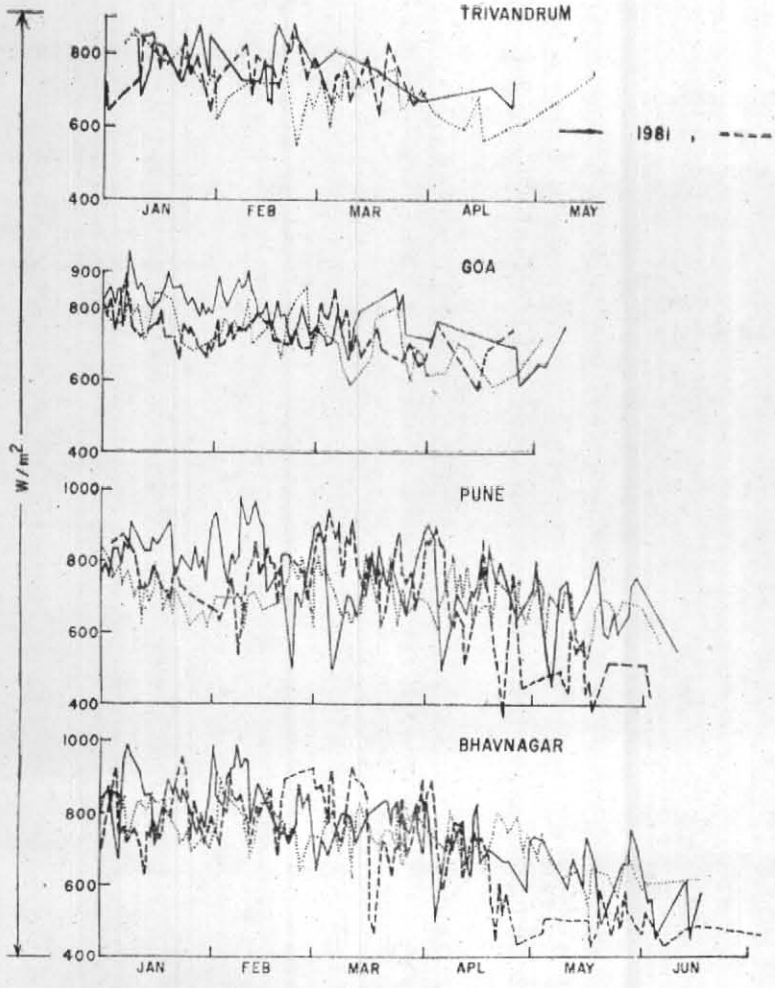

Fig. 4. Direct solar radiation watts/metre² at m=1.5 F.N.

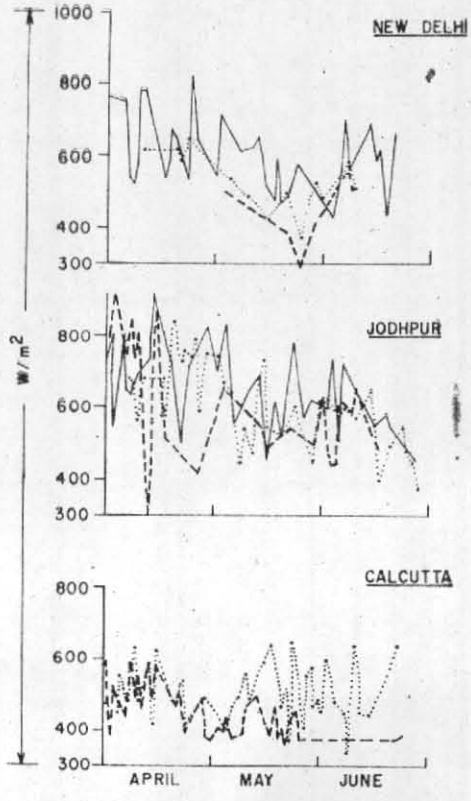

Fig. 5. Direct solar radiation watts/metre² at m=1.5 F.N.

with the pyrheliometer pointed to the sun. The readings are taken only when the sun and the near surroundings are free from clouds. The southern Peninsula is cloudy during summer and hence very few observations are available. The northern parts of the country experience dust storms during which periods observations are not taken. During monsoon, practically no observations are available throughout the country. Direct solar radiation measurements made at airmass 1.5 before noon was utilised, since the atmospheric depth and hence the scattering within the atmosphere is the least when compared to that at higher airmasses. The preference to the forenoon was because of smaller convection when compared to that in the afternoon.

Plotting individual values of direct solar radiation at 1.5 airmass (forenoon) against days for the years 1981, 1982 and 1983 were attempted for Trivandrum, Goa, Bhavnagar and Pune, from January to June and are given in Fig. 4. It is seen that the values at Pune (18° 32′ N 73° 51′ E) and Bhavanagar (21° 45′ N, 72° 11′ E) show sudden decrease around 20 April 1982. In spite of fluctuations, the mean values are low by about 20 to 25% till the commencement of the rainy season. 1983 values are not significantly different from that of 1981.

April to June data of New Delhi, Jodhpur and Calcutta are presented in Fig. 5. Jodhpur and Delhi

are semi-arid and are well known for their high dust content in summer. Calcutta is a well polluted industrial city. The depletion of solar energy at these stations is not as prominent as at Pune and Bhavnagar.

5. Conclusion

There has been depletion of solar energy caused by the volcanic dust of El Chichon to the extent of 20-25% over Bhavnagar and Pune from around 29 April till the onset of monsoon.

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