

I. PHYSICS

Astrophysics (Atomospheric Lower Layers)

METEOROLOGICAL OBSERVATIONS IN CONNECTION WITH THE TOTAL SOLAR ECLIPSE OF 16 FEBRUARY 1980

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THE India Meteorological Department had planned special observations during the total solar eclipse of February 16, 1980. These observations were mainly designed to study the effects of the total solar eclipse on the earth's frictional boundary layer and also on the troposphere.

Keywords : Meteorological Observations; Soil Surface Temperature; Radiation Balance; Baily's Beads; Diamond Ring Phenomena.

EXPERIMENT

Location and Equipment

Two special sites were chosen at Gadag and Raichur, in Karnataka, for extensive observations during the total solar eclipse. These sites were chosen keeping in view the advantages due to high altitude of the sun, duration of the totality, their inland location, and absence of sea-breezes in the afternoon. For the expedition, special equipment were carried from New Delhi and Pune and installed at Gadag and Raichur, four days before the total solar eclipse. The following special equipment were used, during the observational period :

	<i>Station</i>	<i>Purpose</i>
1. Dobson Spectrometer	Gadag	Total ozone in the atmosphere
2. Micro-meteorological tower	Gadag & Raichur	(a) Wind measurements at 1.2 and 13.5 metres, from ground. (b) temperature dry bulb, wet bulb at 1.2, 3.3, 6.5 and 13.5 metres from ground.
3. Sunshine recorder	„	Dawn to dusk record of Sunshine.
4. Pyrheliometer (mounted on heliostat)	„	Intensity of direct solar radiation.
5. Pyranometer	„	Global and diffuse radiations.
6. Net Pyrradiometer	„	Net-radiation.

INDIA METEOROLOGICAL DEPARTMENT
TOTAL SOLAR ECLIPSE EXPEDITION
CAMP A.T.C COLLEGE, MADAS (MARNAMMA)

16 FEB 1980 (TOTAL SOLAR ECLIPSE DAY)
VARIATION OF SOIL SURFACE TEMPERATURE AND AIR TEMPERATURE

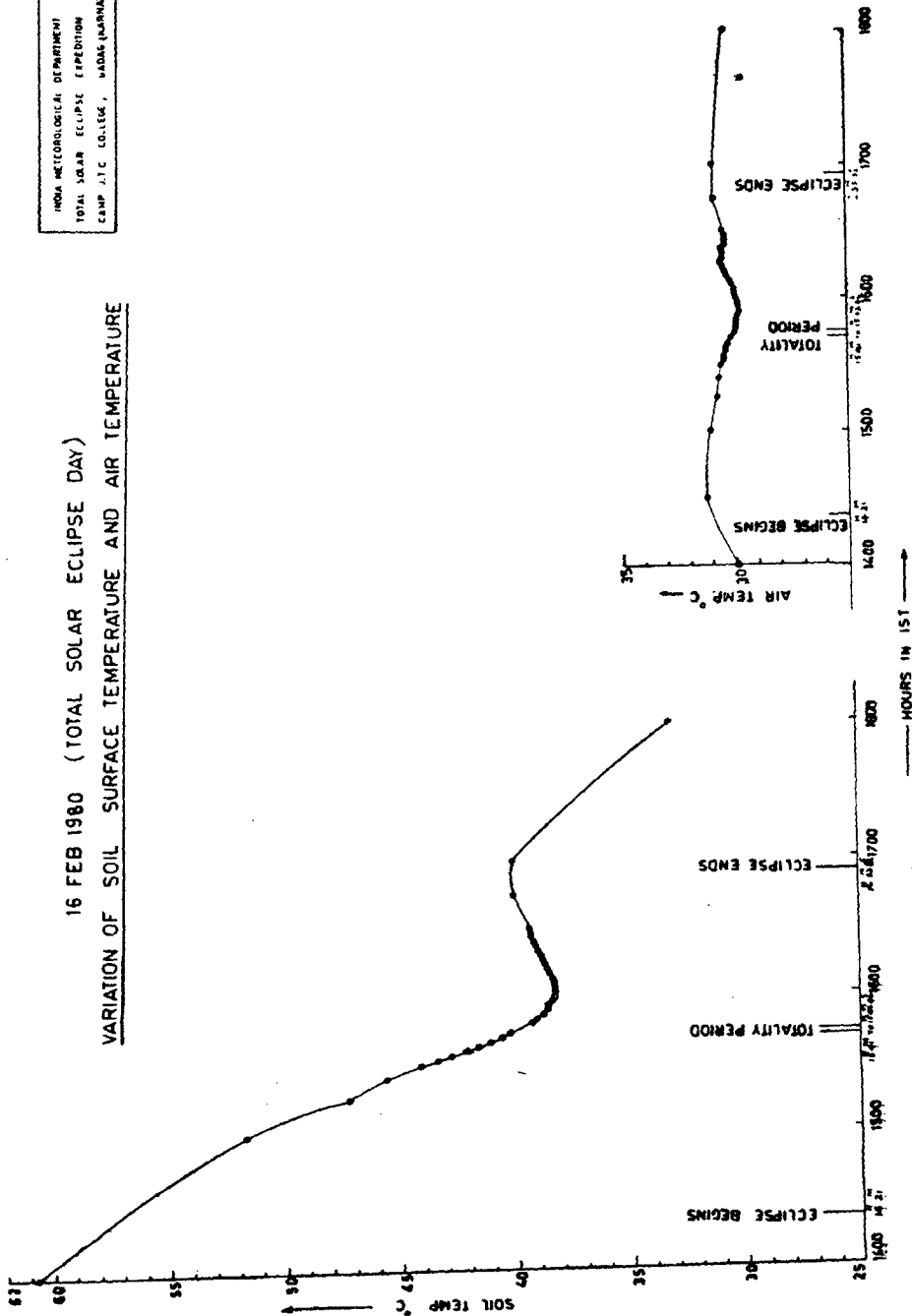


Fig. 1

NET RADIATION

TOTAL SOLAR ECLIPSE EXPEDITION GADAG

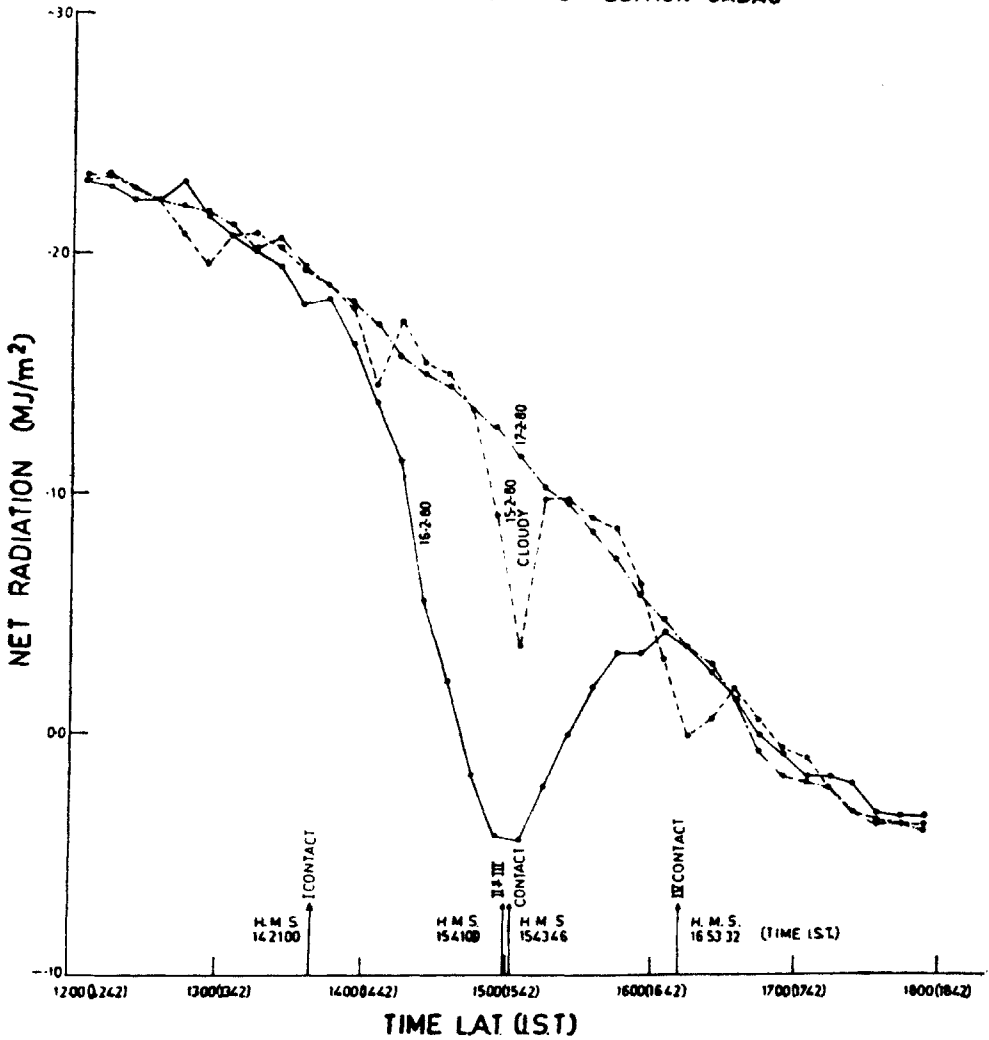


FIG. 2

- | | | |
|------------------------------------------------------------------------|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>7. Surface ozone recorder</p> <p>8. Radiosonde ground equipment</p> | <p>„</p> <p>„</p> | <p>Minute traces of ozone near ground.</p> <p>(a) for radiosonde observations in respect of pressure temperature and humidity, upto 25-30 km.</p> <p>(b) for ozone sonde observations, in respect of ozone concentration and distribution.</p> |
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TOTAL SOLAR ECLIPSE EXPEDITION
GADAG

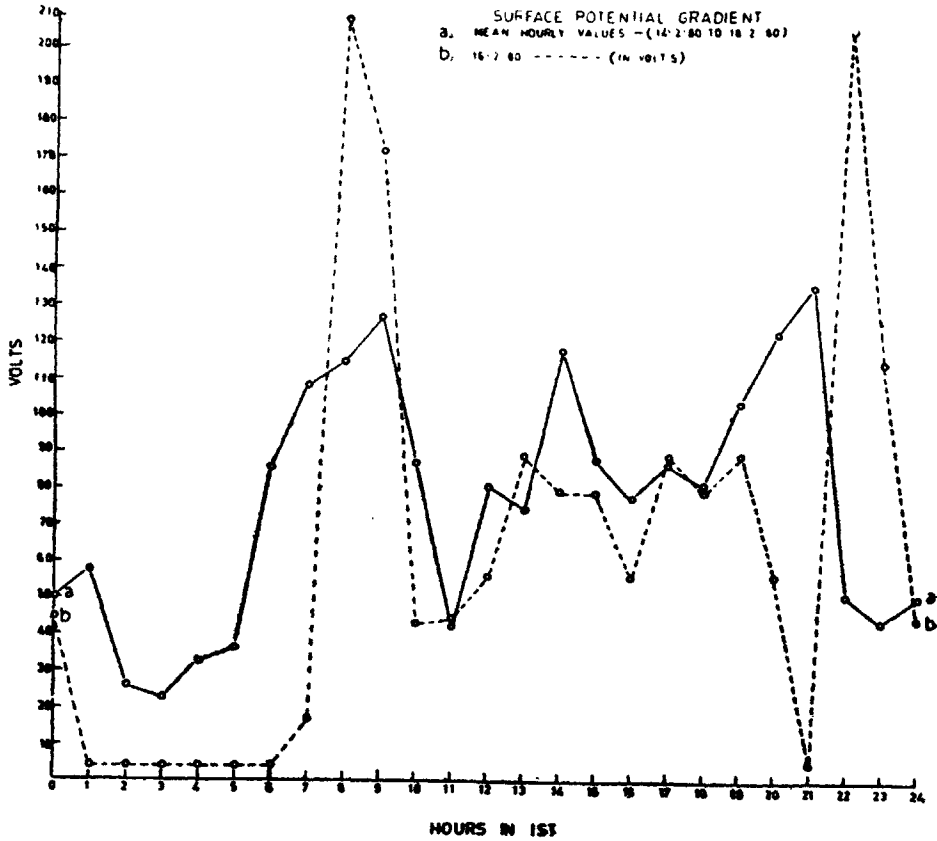


FIG. 3

(c) for radiometer-sonde observations, in respect of measurement of radiation fluxes.

In addition to the above special equipment, Stevenson screens were installed both at Gadag and Raichur, for taking conventional meteorological observations of dry bulb, wet bulb, maximum and minimum temperatures. These were supplemented by self-recording instruments like thermograph, hygrograph and barograph.

The special observations, set up at Gadag and Raichur made the following special observations :

- (a) Temperature variations in the boundary layer in the first 15 metres, above ground surface.
- (b) Temperature measurements in the vertical, using balloon-borne radiosondes.
- (c) Incoming and outgoing radiation, as measured on the ground surface.
- (d) Radiation measurements, in the vertical, using balloon borne radiometer-sondes.

UPPER AIR TEMPERATURE DATA FOR RADIOMETER SONDE
GADAG

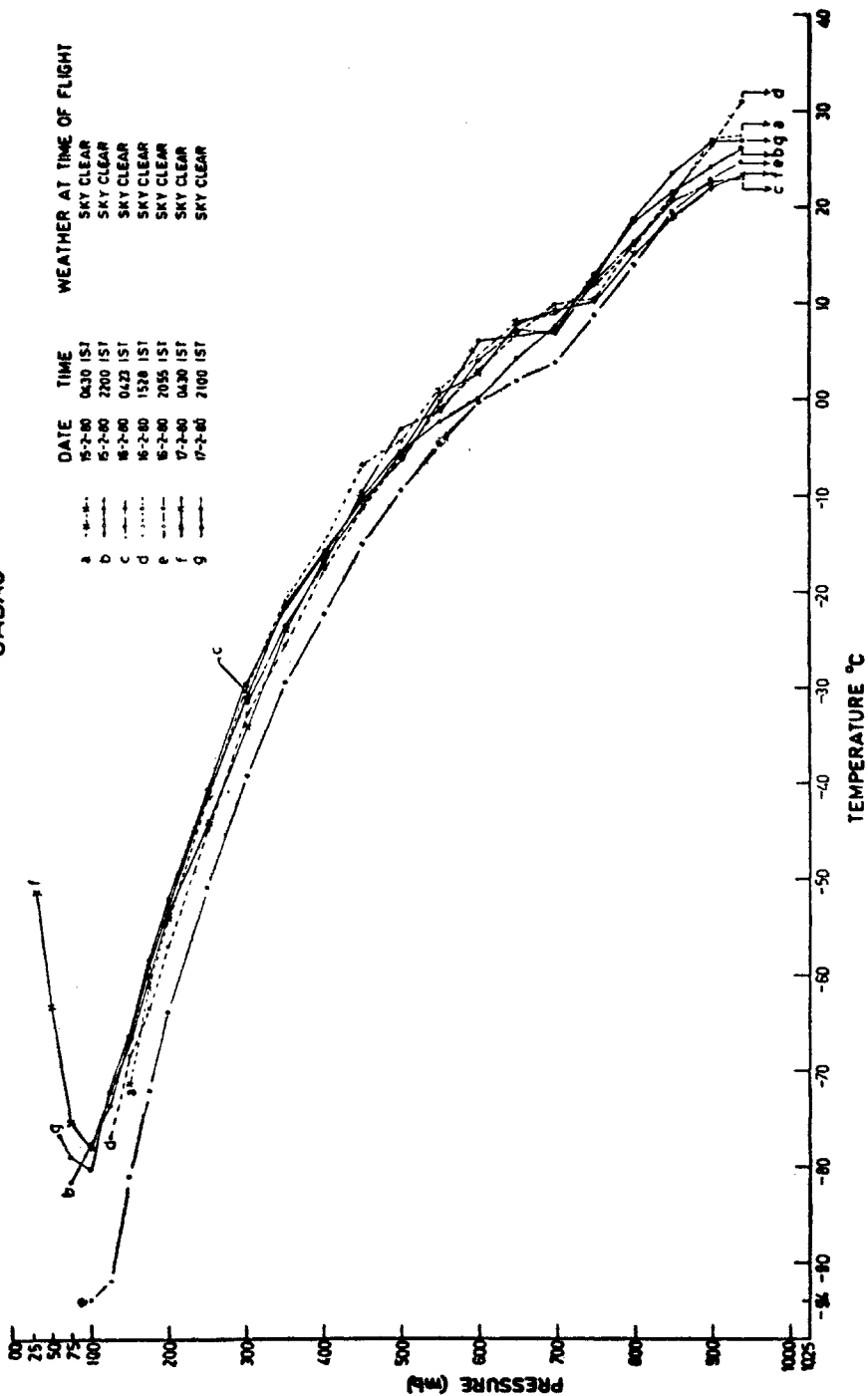


FIG. 4

(e) Surface based measurements of atmospheric electric potential gradient.

(f) Ozone measurements, both surface based and balloon-borne ozonesondes.

Sixteen existing surface and five upper air observatories in or near the path of the totality, made more frequent observations, for a period of 5 days, during February 14-18, 1980.

SUMMARY OF PRELIMINARY RESULTS

A very significant drop of 20 °C, was noticed in soil-surface temperature, whereas the drop in the earth's immediate boundary layer was about 2 °C (Fig. 1).

A significant reversal of radiation balance and variation in electrical activity was observed in the lower atmosphere (Figs. 2 & 3).

A number of radiometersonde ascents were taken, at Gadag, during the period, and the temperature data obtained has been shown in Fig. 4.

Detailed analysis of the data is in progress.

Photography

Although the photography of the Sun, during the eclipse, was not a part of the scientific programme of this Department, an attempt was made to take a few photographs with the help of conventional camera, fitted with telephoto lens. While a shot colour movie, showing corona, Baily's beads and Diamond ring phenomena, was made at Gadag, excellent colour slides of Corona were made at Raichur.

PARTICIPANTS

Apart from Dr S. M. Kulshrestha, Project Director and Dr K. Chatterjee and Dr G. P. Srivastava of the IMD who were Project Directors at Gadag and Raichur, the following participated in the expedition :—

Dr. S. K. Srivastava, Shri S. K. Bindra, Shri V. P. Verma, Shri K. S. Jain, Shri M. S. Ahuja, Shri B. B. Mondal, Shri S. Subramaniam, Shri G. S. Yadav, Shri K. B. Dania, Shri Sher Singh, Shri C. K. Chandrasekharan, Shri A. B. Sarkar,, Shri B. K. Hazra, Shri V. Radhakrishnan, Shri C. G. Rahalkar, Shri B. S. Thipae, Shri M. R. Chavan, Shri S. P. Kamble, Shri S. M. Salunka, Shri C. B. Kondhalkar Shri B. S. Gaikwad of the Instruments Division, Delhi and Shri P. M. Pakkir Mohammed, Shri V. Srinivasan, Shri V. Desikan, Shri G. Venugopal, Shri A. Narayan Kutty, Shri A. K. De, Shri R. K. Kankane, Shri B. A. Kalyankar, Shri M. R. Baluwalli, Shri D. D. Chakraborty, Shri V. C. Roysoni, Shri D. G. Kulkarni, Shri R. R. Wagholikar, Shri D. M. Chavan, Shri A. S. Shitole, Shri V. G. Gaikwad, Shri M. V. Kumbhar, Shri D. B. Bangat, Shri D. D. Jadhav and Shri D. G. Holey of Instruments Division, Pune.