SOLAR ECLIPSE EFFECT ON SHORT-PERIOD GEOMAGNETIC FIELD VARIATIONS

G. K. RANGARAJAN AND A. V. S. MURTY
Indian Institute of Geomagnetism, Colaba
Bombay 400 005, India

IT is now well established that during periods of solar eclipse, the *E*-region electron density is depleted[1], consequently weakening the current systems responsible for geomagnetic field variations. It is also known that several geomagnetic phenomena such as sudden commencements, impulses, large period pulsations, quiet-day range in *H*, etc., in the low latitudes are enhanced in magnitude in the vicinity of the dip equator indicating an ionospheric contribution in addition to the major magnetospheric part[2]. During geomagnetic disturbances certain oscillations in selected period range—100, 50, 30, 20 and 10 minutes —are quite often identified above continuum in the spectrum of the field[3,4].

The solar eclipse of February 16, 1980 had its path of totality from Karwar on the west coast to Puri on the east coast. The first contact on the west coast was around 0840 UT and the last contact on the east coast was around 1130 UT. Stations to the east of about 95° E longitude did not experience the solar eclipse.

The eclipse was preceded by a storm sudden commencement beginning at 0310 UT on February 14 and another at 1234 UT on February 15. The disturbed conditions prevailed till 22 UT of February 17, 1980. This precluded identification and estimation of eclipse-induced geomagnetic field changes on the quiet day magnetic field. However, the horizontal component (*H*) of the magnetic field was characterized by moderate agitation throughout the three days between 14 and 16 February 1980. These intervals were thus suitable for identifying short-period oscillations of the field and study of the ecllipse effect on the amplitudes.

For our analysis we have utilized magnetograms of three stations whose coordinates are given in Table I. Trivandrum is located close to the centre of the equatorial electrojet and experienced nearly 80% obscuration of the sun. Alibag is a low latitude magnetic station away from the electrojet influence and serves as a useful counterpart to study the effect of the electrojet. At Alibag also, the sun was covered upto about 85% during peak time of the eclipse. Hong Kong is a low latitude station whose location (about 3 hours east of Alibag) serves as a control centre, without the influence of both the eclipse and the electrojet. The *H* magnetograms of Alibag, Trivandrum and Hong Kong for February 14, 15 and 16 were digitized at 3-minute interval and

TABLE I

Station	Code	Geog. Latitude	Geog. Longitude	Dipole Lat.
Alibag	ALB	18°·63 N	72°·87 E	9°·43
Hong Kong	HKG	22°·2	114°·2	10°·75
Trivandrum	TRV	8°·48	76°·95	−1°·10

subjected to spectral analysis using a version of Fast Fourier Transform detailed in Rangarajan and Bhargava[4]. 4-hour intervals were utilized at a time with band width for the spectral estimates as 0·0039. The short-period oscillations are basically magnetic effects of magnetospheric variations and therefore will be governed by Universal Time (UT). Hence no attempt is made to correct for the local time difference between Hong Kong and Indian region. Time interval 09–12 UT on February 16 includes almost the entire duration of the eclipse between first and fourth contacts in Indian region whereas the other intervals provide 'control' information. Scrutiny of the spectra showed that periodicities centred around 35, 20 and 10 minutes were common to the three stations for the intervals 05–08 UT and 09–12 UT on all the three days. A typical spectrum for the interval 09–12 UT on the eclipse day for the three stations is shown in Fig. 1. The amplitude at a given frequency is calculated as $2\sqrt{P}$ where P is the power spectral density. It is noticed that the ratios of amplitudes at a particular frequency for TRV/ALB and HKG/ALB diminished from the first interval to the second on each day. The quantum of reduction for all the three days are comparable for (TRV, ALB) pair, indicating that the reduction in current strength of Sq brought about by the eclipse is nearly of the same proportion as the reduction in the current strength in (S_q + jet) close to

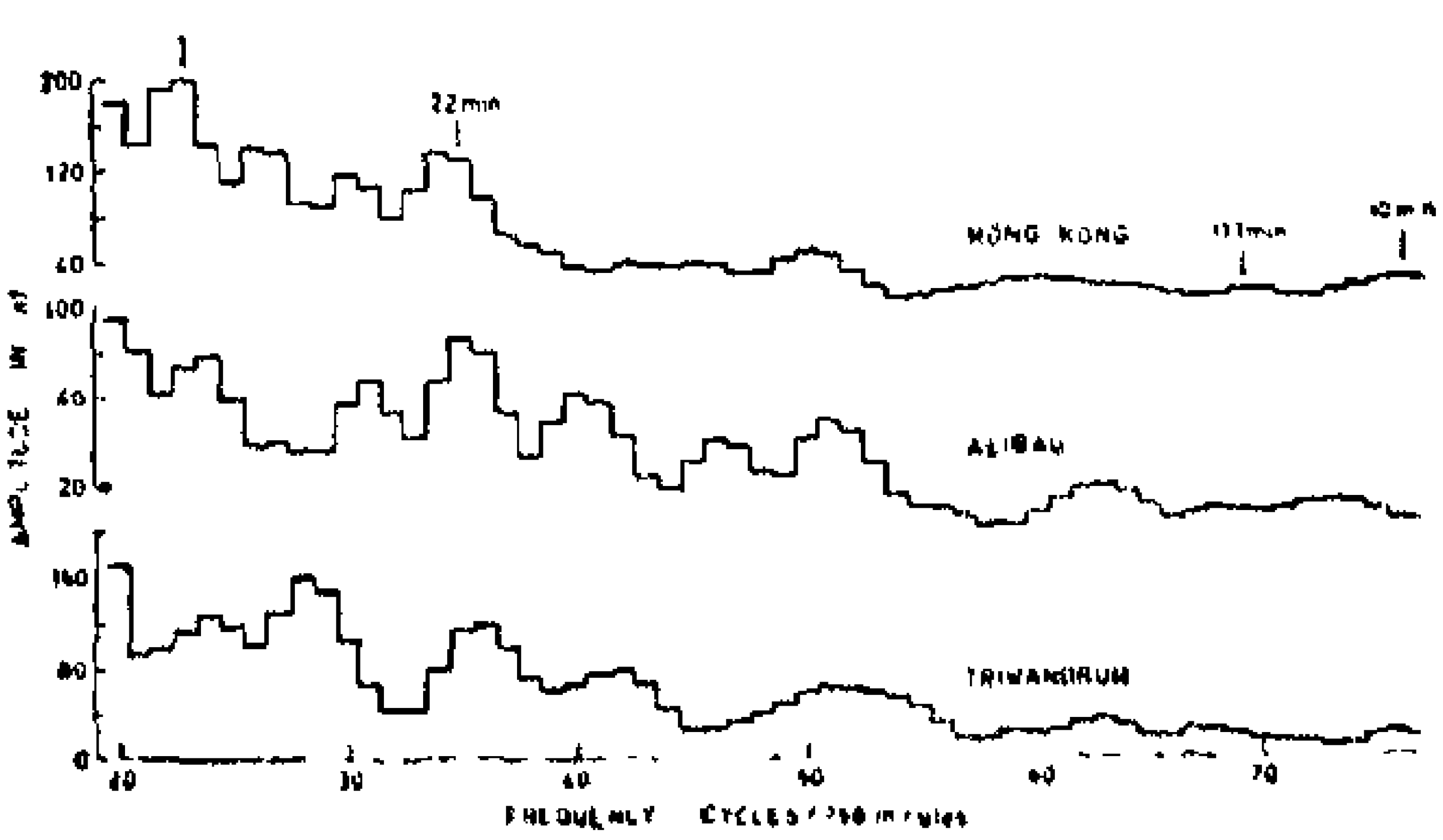

FIG. 1. Spectrum of horizontal intensity for the interval 09–12 UT of 16th February, 1980 derived from data at three magnetic observatories. Alibag and Trivandrum experienced partial solar eclipse while Hong Kong was outside the eclipse zone.

the dip equator. On the other hand, the ratios for (HKG, ALB) pair for the three days show that while the reduction varies between nearly 50 to 80% on 14 and 15 February (non-eclipse, control days), on February 16 the reduction becomes negligible varying between 0 to 25% only (see Table II). This change in the factor of reduction can definitely be attributed to the eclipse induced reduction in the amplitude for 09–12 UT duration as compared to the absence of the eclipse effect in 05–08 UT interval affecting only Alibag and not Hong Kong.

TABLE II

Percentage decrease of the ratio of the amplitudes HKG/ALB and TRV/ALB from 05–08 UT to 09–12 UT period for the short period fluctuations in H

Date	Periodicity					
	35 min		20 min		10 min	
	HKG/ALB	TRV/ALB	HKG/ALB	TRV/ALB	HKG/ALB	TRV/ALB
14-2-1980	40	24	53	25	47	67
15-2-1980	66	46	70	90	76	94
16-2-1980	15	57	Nil	76	26	80

These results clearly suggest that short period geomagnetic fluctuations at low latitudes have ionospheric contribution whose magnitude is diminished during the duration of obscuration of the Sun by the Moon.

The authors are grateful to Dr. G. O. Walker, Hong Kong University, for supplying of relevant magnetograms.

August 29, 1980.

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BIOCHEMICAL CHANGES IN RICE ASSOCIATED WITH THE RICE-ROOT NEMATODE, *HIRSCHMANNIELLA ORYZAE* INFESTATIONS

A. JAYAPRAKASH*, Y. S. RAO AND C. MOHANDAS**
Nematology Section
Central Rice Research Institute
Cuttack 753 006, India

* Central Plant Protection Training Institute
Rajendranagar, Hyderabad 500 030, India
** Central Plantation Crops Research Institute
Regional Station, Calicut 673 011, India

HIGH populations of the rice-root nematode, *Hirschmanniella oryzae* (Van Breda De Haan, 1902) Luc and Goodey, 1963 inside the root system of rice plants in low-land fields all over India are quite common. Inoculations of graded levels of rice-root nematode to rice plants revealed that high populations (100 nematodes and above) not only caused significant reduction in the number of tillers and yield but also affected the nematode multiplication in the roots[1-3]. In inoculations with less than 100 nematodes as initial population, there was no significant effect on the plant growth characteristics or yield and the population of the nematode also multiplied several times[3]. The biochemical changes caused by this graded levels of nematode infestations were studied to understand the host-parasite relationship.

Autoclaved field soils (1·5 kg) were filled in pots, mixed with 0, 10 and 100 nematodes of *H. oryzae* and one seed of rice var. *Jaya* was sown per pot in six replicates. The nematode was allowed to penetrate the rice roots and complete one life cycle. Samples of roots and shoots of rice plants were collected at 37 days age. The shoots of 1 g fresh tissues from all the treatments were extracted with 80% acetone and the total chlorophyll was estimated colorimetrically[4,5]. The shoot and root samples (1 g fresh tissue) were extracted with 80% boiling ethanol by the method of Sridhar and Ou[6]. The concentrations of total sugars of the extracts were estimated as follows: Morris method using anthrone reagent[7], reducing sugars by Nelson's method using arseno-molybdate colour reagent with glucose as standard[8], total phenols by Bray and Thorpe method using Folin-Ciocalteau reagent with catechol as standard[9], and total soluble aminoacids by Moore and Stein method using ninhydrin reagent with glutamic acid as standard[10]. In all the treatments 1 g of the fresh tissues of roots and shoots were employed.

In all the treatments, the total chlorophyll content of the foliage did not fluctuate (Table I), indicating