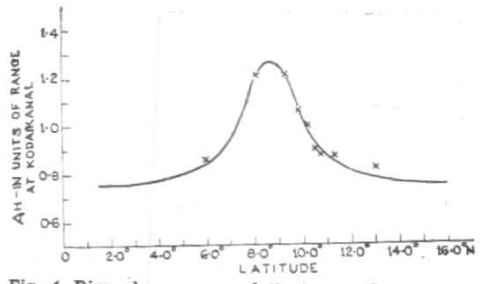

Fig. 1. Diurnal range *versus* latitude over South India

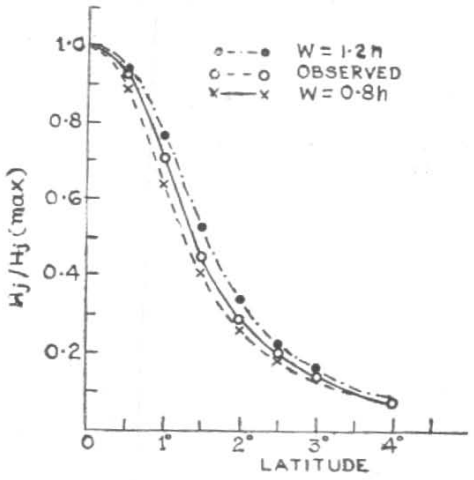

Fig. 2. Decrease of the geomagnetic effect (H_j) of the electrojet with the distance (in degrees latitude) from the centre of the jet

W is the semiwidth and h the height of the electrojet

550·371 : 550·386

WIDTH OF THE ELECTROJET OVER SOUTH INDIA (75°E — 80°E)

Valuable data on the diurnal range of the earth's horizontal magnetic field at stations in South India and Ceylon collected during the period 1950-1953 were reported by Gulatee (1950), Pramanik and Yegna Narayanan (1952), and Pramanik and Hariharan (1953). A critical examination of the data shows that the abnormally large values of the range near the geomagnetic equator can be accounted for in terms of an electrojet whose semiwidth is nearly equal to the height of the electrojet above the earth's surface, which may be taken as 110 km.

Gulatee, Pramanik and Yegna Narayanan and Pramanik and Hariharan, have reported the diurnal range $\triangle H$ of the earth's horizontal field at the various stations, as a ratio of the ranges at Kodaikanal on the corresponding days of observation. The data are presented in Table 1. The data corresponding to the disturbed days have been omitted.

A plot of the data is given in Fig. 1, which also represents a smooth curve of best fit of the data. The smooth curve is a free hand curve and not a mathematically fitted one. It will be seen that the two tails of the curve correspond to a ratio of 0·75. If this be taken as the base value, representing the general effect of the dynamo currents in the ionospheric E-layer, we may, following Onwumechilli (1959), take the ordinates above this value as the effect of the electrojet. This effect of the electrojet $\triangle H_j$ is presented in col. 2 of Table 2, again as a fraction of the diurnal range at Kodaikanal, for various latitudinal distances from the maximum. Col. 3 of Table 2, gives the ratio $\triangle H_j$ to the maximum value of $\triangle H_j$ deduced from the curve in Fig. 1.

TABLE 1

Ratios of the diurnal range to that of the corresponding values at Kodaikanal

Station	Lat. (°N)	Long. (°E)	$\frac{\triangle H(\text{Station})}{\triangle H(\text{Kodaikanal})}$	Source of Data
Galle	6·0	80·2	0·86	Gulatee (1950)
Cape Comorin	8·05	77·7	1·21	Pramanik and Yegna Narayanan (1952)
Mandapam	9·3	79·1	1·21	Gulatee (1950)
Uttamapalayam	9·8	77·3	1·06	Pramanik and Hariharan (1953)
Kodaikanal	10·2	77·9	1·00	Do.
Palni	10·5	77·5	0·90	Do.
Dharapuram	10·7	77·5	0·88	Do.
Erode	11·3	77·8	0·87	Do.
Bangalore	13·0	77·6	0·82	Gulatee (1950)
Guntakkal	15·2	77·4	0·74	Do.

TABLE 2

Value of $\triangle H_j/\ \triangle H_j$ (max), observed and computed

Distance in deg. lat. from the axis of the jet	$\triangle H_j$	$H_j/\triangle H_j$(max) deduced from Fig. 1	H_j/H_j (max) from the formula (1)		
			$w=0\cdot8h$	$w=1\cdot0h$	$w=1\cdot2h$
(1)	(2)	(3)	(4)	(5)	(6)
0·0	0·51	1·00	1·00	1·00	1·00
0·5	0·475	0·93	0·89	0·92	0·94
1·0	0·36	0·71	0·64	0·71	0·77
1·5	0·23	0·45	0·41	0·46	0·53
2·0	0·15	0·29	0·26	0·29	0·34
2·5	0·103	0·20	0·18	0·20	0·22
3·0	0·073	0·14	0·13	0·14	0·16
4·0	0·035	0·07	0·07	0·08	0·09

The effect H_j of a uniform electrojet of intensity i per unit length across the current, of semiwidth w, located at a height h above ground, on the horizontal magnetic field, at a ground station distant x from the vertical projection of the centre of the electrojet on the ground, is given by—

$$H_j = 2i \tan^{-1} \frac{2w/h}{1-\frac{w^2}{h^2}+\frac{x^2}{h^2}} \qquad (1)$$

H_j is a maximum for $x = 0$, *i.e.*, directly under the centre of the jet.

Taking h as 110 km, the values of H_j/H_j(max) are given in Table 2, for the different latitudinal distances from the jet, for $w/h = 0\cdot8$, $w/h = 1\cdot0$, and $w/h = 1\cdot2$. It will be seen that the values deduced from the observations and entered in col. 3, agree with the computed values given in col. 5 for $w/h = 1\cdot0$, and that they deviate appreciably from the values corresponding for $w/h = 0\cdot8$

and $w/h = 1{\cdot}2$. The curves in Fig. 2, illustrate the same graphically.

This suggests that the half width of the electrojet over South India is about 110 km, and that the height of the jet is about 110 km. The corresponding value reported for South America by Forbush and Casaverde (1961) is nearly 330 km, for Central Africa by Onwumechilli (1959) is nearly 220 km, and for Central Pacific by Cahill (1959) is nearly 200 km.

It will be seen from Fig. 1, that the maximum of $\triangle H_j$ occurs over geographic latitude $8°{\cdot}7$N, midway between the latitudes of Cape Comorin and Mandapam. The geographic latitude of the geomagnetic equator at this longitude is nearly $9°{\cdot}4$N. The geographic latitude of the dip equator at this longitude is nearly $8°{\cdot}9$N. Thus the centre of the electrojet appears to be slightly south of both the geomagnetic equator and the dip equator at this longitude. This observation is in agreement with the findings of Hasegawa and Ota (1948), Price and Wilkins (1951), according to which the line of the maximum daily range of H should be between the magnetic and geomagnetic equators in South America and in Africa, but to the south of these equators in the far east.

The data used refer to the period 1950-1953. Arrangements are being made to collect data on either side of the dip equator during the current year. The results will be published subsequently in the form of a full paper.

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