Terrestrial Magnetism
and
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RESULTS OF MAGNETIC AND ELECTRIC OBSERVATIONS MADE DURING THE SOLAR ECLIPSE OF JUNE 8, 1918.—*Continued.*

BY L. A. BAUER, H. W. FISK, AND S. J. MAUCHLY.

PART I.—MAGNETIC OBSERVATIONS.—*Concluded.*

VALUES OF $\triangle X$ AND $\triangle Y$.

66. The quantities $\triangle X$ (positive towards geographic north) and $\triangle Y$ (positive towards geographic east), are derived from the $\triangle D$'s (Table 9) and $\triangle H$'s (Table 17) by means of the following formulae, $\triangle D$ being expressed in minutes of arc, H and $\triangle H$ in gammas, and D being positive for east declination:

$$\triangle X = \cos D.\triangle H - H\frac{\sin D}{3438}.\triangle D = m_1\ \triangle H - m_2\ \triangle D \qquad (1)$$

$$\triangle Y = \sin D.\triangle H + H\frac{\cos D}{3438}.\triangle D = m_3\ \triangle H + m_4\ \triangle D \qquad (2)$$

The values of the multipliers m_1, m_2, m_3, and m_4 at the stations for which there are values both of $\triangle D$ and $\triangle H$ are given in Table 20. Tables 21 and 22 contain the values of $\triangle X$ and $\triangle Y$.

TABLE 20.—*Values of multipliers for June 8, 1918.*

Station	m_1	m_2	m_3	m_4
Antipolo	1.000	+0.111	+0.010	+11.12
Lukiapang	0.998	−0.561	−0.057	+ 9.81
Kakioka	0.996	−0.803	−0.093	+ 8.61
Honolulu	0.986	+1.41	+0.168	+ 8.29
Sitka	0.862	+2.30	+0.506	+ 3.91
Goldendale	0.918	+2.31	+0.396	+ 5.37
Tucson	0.972	+1.86	+0.237	+ 7.63
Lakin	0.976	+1.43	+0.216	+ 6.45
Agincourt	0.993	−0.531	−0.115	+ 4.59
Cheltenham	0.994	−0.608	−0.109	+ 5.56
Porto Rico	0.998	−0.473	−0.058	+ 8.13

TABLE 21.—*Five-minute values of ΔX for June 8, 1918.*

G.M.T.	Ant.	Luk.	Kak.	Hon.	Sit.	Gol.	Tuc.	Lak.	Agi.	Che.	P. R.
h m	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
19 00	......	−0.9	+6.5	+5.8	−3.1	......	+5.4	+8.6	+14.4	+20.5	+11.7
05	......	+0.1	+6.1	+5.5	−2.9	......	+5.4	+7.8	+14.2	+20.4	+11.8
10	......	+1.1	+6.1	+5.5	−2.4	......	+5.4	+9.8	+14.1	+22.3	+11.8
15	.....	+0.1	+6.6	+5.8	−1.3	−10.3	+5.8	+9.0	+17.0	+25.3	+11.8
20	.....	+0.1	+6.6	+4.6	+1.1	−11.9	+5.0	+9.3	+15.0	+23.3	+11.8
25	+2.0	−0.9	+8.2	+5.5	+1.2	−6.4	+5.0	+7.2	+16.0	+23.3	+10.8
30	+2.0	−0.9	+7.6	+4.5	+2.8	−2.7	+5.0	+9.0	+16.8	+22.4	+9.8
35	+2.0	+0.1	+8.2	+4.8	+2.4	−1.4	+3.3	+5.0	+14.9	+22.3	+7.9
40	+2.0	+1.1	+8.0	+4 6	+3.3	−1.8	+0.6	+2.9	+10.9	+19.4	+7.9
45	+3.0	+1.1	+9.0	+3.5	+1.0	−5.9	−0.6	−1.0	+9.0	+18.5	+5.9
50	+4.0	+2.1	+9.0	+3.4	0.0	−5 2	−2.7	−2.1	+9.3	+16.7	+6.0
55	+5 0	+2.1	+10.0	+3.2	−0.9	−7.3	−2.7	−3.6	+9.5	+17.0	+6.1
20 00	+4.0	+2.0	+9.3	+3.1	−3.0	−7.1	−3.7	−5.1	+8.6	+16.2	+5.1
05	+4.0	+2.9	+9.2	+3.0	−4.1	−5.9	−4.7	−5.4	+7.8	+16.5	+4.2
10	+3.0	+2.9	+8.6	+3.0	−5.9	−6.9	−4.7	−7.2	+9.2	+16.7	+4.2
15	+2.0	+1.9	+8.1	+2.0	−3.4	−3.2	−4.1	−3.5	+11.3	+18.6	+4.2
20	+1.0	−0.1	+6.6	+0.8	+2.4	+3.7	−3.1	−1.5	+13.1	+18.6	+4.3
25	+2.0	−2.0	+5.7	+1.0	+8.6	+9.0	−0.8	+2.7	+11.9	+17.6	+4.3
30	+2.0	−1.9	+4.7	+1.1	+18.0	+14.7	+2.1	+7.3	+13.5	+19.4	+4.3
35	+2.0	−1.8	+3.2	+0.8	+15.8	+18.9	+4.1	+11.6	+18.5	+23.4	+4.3
40	+2.0	−0.8	+2.8	+0.7	+15.8	+18.9	+4.4	+10.1	+19.6	+23.3	+4.3
45	+1.0	−1.8	+3.3	−0.3	+13.1	+18.6	+5.6	+7.2	+16.5	+22.3	+4.2
50	+2.0	+0.1	+5.2	−1.3	+10.1	+13.6	+3.5	+4.2	+12.6	+18.4	+4.3
55	+4.0	+2.1	+7.3	−1.4	+6.0	+11.5	+5.0	+5.2	+14.7	+20.6	+6.4
21 00	+4.0	+2 1	+8.9	−4.5	−3.0	+7.1	+1.8	−1.0	+12.0	+15.8	+4.4
05	+2.0	+1.8	+9.9	−4.2	−2.3	+5.1	+1.4	−0.7	+16 4	+17.1	+4.5
10	+1.0	−0.1	+8.5	−6.2	+4.0	+9.4	+1.2	+0.1	+14.7	+15.4	+2.5
15	−1.0	−1.0	+8.0	−7.2	+7.6	+5.5	0.0	+2.1	+8.3	+11.2	+1.6
20	0.0	−2.0	+7.9	−7.2	+10.7	+9.4	0.0	+4.0	+7.2	+9.2	+1.5
25	−2.0	−3.9	+7.4	−7.2	+13.5	+9.4	+2.2	+3.9	+6.0	+8.1	+1.5
30	−1.0	−3.8	+6.7	−7.2	+14.7	+6.9	+1.2	+1.9	+4.0	+5.1	+1.5
35	−1.0	−2.8	+6.3	−7.0	+14.7	+7.1	+1.2	+2.1	+3.0	+5.2	+0.5
40	−1.1	−2.8	+7.4	−6.9	+13.5	+9 0	+2.4	+2.3	+4.8	+7.1	+1.5
45	−2.1	−3.8	+6.8	−6.8	+19.5	+15.0	+3.3	+5.4	+5.7	+6.0	+1.4
50	+0.9	−2.7	+6.9	−4.8	+19.7	+15.0	+5.4	+6.7	+6.6	+6.0	+2.4
55	+0.9	−1.6	+7.1	−2.8	+19.0	+15.4	+8.0	+13.0	+12.4	+11.8	+4.3
22 00	+1.9	−1.7	+8.1	−3.8	+15.5	+13.6	+8.0	+13.4	+13.6	+11.8	+4.3
05	+2.9	−1.9	+8.0	−4.8	+13.8	+11.3	+6.0	+11.3	+10.7	+9.8	+3.3
10	+1.9	−0.9	+7.9	−4.8	+11.2	+7.1	+4.1	+9.0	+7.7	+8.0	+3.3
15	+2.9	−1.9	+7.7	−4.8	+10.1	+7.4	+2.7	+9.9	+6.7	+6.0	+2.3
20	+2.9	−2.9	+6.2	−4.8	+10.3	+5.5	+2.2	+10.8	+6.7	+5.0	+2.3
25	+3.9	−2.8	+4.0	−4.8	+9.8	+5.8	+2.0	+9.8	+4.6	+3.9	+2.2
30	+2.9	−1.8	+2.9	−4.8	+11.6	+5.1	+1.8	+12.0	+4.6	+5.8	+3.2
35	+2.9	−1.8	+2.4	−3.8	+12.4	+7.1	+1.6	+10.9	+4.8	+6.7	+3.2
40	+1.9	−1.9	+0.8	−3.8	+14.1	+8.0	+2.6	+10.6	+3.7	+7.7	+4.1
45	+2.0	−2.9	+0.2	−3.9	+16.6	+6.7	+1.6	+9.6	+2.7	+6.8	+4.1
50	+1.0	−3.0	−0.3	−4.9	+15.5	+5.3	+0.4	+9.8	+1.7	+6.7	+4.0
55	+1.0	−4.1	−1.5	−5.9	+14.7	+2.5	−0.7	+6.7	−2.4	+3.7	+3.0
23 00	0.0	−4.2	−1.6	−6.2	+12.6	+0.7	−1.7	+6.5	−3.3	+3.7	+2.9
05	0.0	−4.2	−1.7	−6.2	+9.8	−0.9	−3.6	+6.3	−4.3	+2.8	+3.9
10	−1.0	−2.2	−1.1	−6.2	+8.0	−0.9	−3.8	+6.2	−5.2	+0.8	+2.9
15	−1.0	−2.2	−1.9	−6.1	+7.4	−1.8	−4.6	+4.1	−6.1	+0.8	+2.9
20	−1.0	−2.2	−3.1	−6.2	+7.2	−0.2	−5.0	+4.1	−5.0	+1.8	+2.9
25	−2.0	−1.2	−3.8	−6.2	+5.6	+0.2	−3.6	+8.1	−4.0	+1.8	+2.9
30	−2.0	+0.8	−3.5	−5.4	+6.3	+1.2	−2.6	+10.1	−1.9	+1.9	+3.9
35	−1.0	−0.2	−3.4	−5.2	+9.3	+2.8	−2 5	+11.2	+2.2	+5.9	+4.9
40	−2.0	−1.2	−4.6	−6.3	+9.3	+1.8	−2.5	+8.1	+2.3	+4.0	+4.9
45	−4.0	−1.2	−6.0	−6.5	+7.4	−1.4	−3.4	+1.3	−0.8	+3.0	+4.0
50	−6.0	−3.3	−7.3	−8.6	+5.0	−3.9	−5.4	−2.3	−2.8	+0.1	+3.0
55	−5.9	−4.4	−7.4	−9.6	+2.2	−4.6	−8.7	−5.0	−8.9	−3.9	+1.0
24 00	−6.9	−4.4	−6.7	−9 7	+0.9	−4.4	−7.7	−3.1	−5.5	−3.8	+1.0
05	−7.9	−4.4	−4.5	−10.8	−0.5	−3.7	−7.7	+0.5	−5.4	−1.8	0.0
10	−7.9	−5.3	−4.8	−11.1	−1.6	−3.4	−8.7	+3.4	−5.4	−1.8	0.0
15	−8.9	−4.3	−4.0	−11.6	−0.7	−5.5	−8.0	+6 8	−6.4	−3.7	+0.1
20	−8.0	−4.3	−2.6	−10.6	+0.9	−0.5	−7.1	+10.6	−4.3	−2 7	+0.1
25	−9.0	−4.3	−2.6	−10.7	+5.0	−2.3	−6.1	+12.8	−4.3	−0.6	+0.1
30	−8.0	−3.2	−2.6	−9.6	+6.5	−0.2	−5.3	+15.6	−3.3	−0.6	+0.1
35	−9.0	−3.2	−3.2	−9.6	+5.6	−1.4	−5.2	+17 4	−3.4	−0.5	+0.1
40	−8.0	−3.2	−3.8	−8.9	+4.8	+0.7	−4.2	+14 6	−2.5	+0.4	+0.1
45	−8.0	−1.2	−3.4	−8.9	+1.7	−2.0	−4.0	+12.2	−5.8	−0.6	+0.1
50	−7.0	−1.1	−3.4	−8.7	+1.7	−3.2	−2.8	+16.2	−6.0	+0.4	0.0
55	......	−0.1	−2.8	−8.7	+3.0	−6.4	−2.5	+15.6	−4.0	+2.3	0.0
25 00	......	+1.0	−1.8	−5.8	+4.6	−2.3	−2.3	+14.7	−1.0	+4.1	+1.0

TABLE 22.—*Five-minute values of △Y for June 8, 1918.*

G.M.T.	Ant.	Luk.	Kak.	Hon.	Sit.	Gol.	Tuc.	Lak.	Agin.	Chel.	P. R.
h m	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
19 00	......	+1.0	+1.1	−4.1	+1.3	....	+3.0	+2.7	−6.3	−14.6	−5.6
05	......	+1.0	+2.0	−2.5	+1.0	....	+3.0	+1.8	−7.7	−15.7	−4.0
10	......	+1.9	+2.0	−2.5	+0.2	....	+3.0	+2.2	−8.6	−16.5	−4.0
15	......	+2.0	+2.0	−4.1	+0.3	−8.9	+1.4	+1.2	−9.4	−17.4	−4.0
20	......	+2.0	+2.0	−3.5	+0.1	−12 8	+0.4	−0.3	−9.6	−16.6	−3.1
25	+1.1	+1.0	+1.8	−2.5	−2.0	−10.4	+0.4	0.0	−9.3	−16.6	−3.1
30	+1.1	+1.0	+1.9	−2.6	−4.7	−11.4	+0.4	+1.2	−11.2	−16.0	−3.0
35	+1.1	+2.0	+1.8	−4.3	−8.0	−12.0	−0.8	+0.3	−10.6	−16.5	−2.1
40	−1.1	+1.9	+0.1	−3.5	−9.6	−13.5	−2.3	+0.6	−10.6	−16.2	−2.1
45	−3.3	+1 9	−1.7	−2 8	−13.6	−16.6	−1.8	−0.3	−9.4	−15.0	−1.2
50	−3.3	+1.8	−1.7	−2.0	−15.8	−15.6	−1.5	+0.3	−6.7	−13.1	−0.4
55	−3 3	+0.9	−2.7	−1.2	−16.3	−15.9	−1.5	+2.4	−4.8	−10.3	+1.3
20 00	−3.3	−0.1	−3.5	−0.3	−16.5	−16.4	−1.7	+4 5	−3.8	−8.0	+2.2
05	−3.3	−2.1	−4.3	+0.5	−16.6	−14.0	−1.9	+6.0	−1.8	−5.7	+3.0
10	−3.3	−1.2	−5.1	+0.5	−15.6	−14.4	−1.9	+4.8	+1.3	−4.1	+3.0
15	−3.3	−1.1	−5.1	+0.3	−12.0	−12.8	−0.2	+6.4	+2.0	−4.3	+3.8
20	−3.3	−1.0	−4.1	+1.0	−6.0	−11.1	0.0	+6.8	+0.3	−4.3	+4.7
25	−1.1	+0.1	−2.3	+0.2	−2.8	−10.8	−1.0	+6.2	−1.4	−4.7	+4.6
30	−1.1	+2.1	−1.3	−0.7	−1.0	−11.5	−0.3	+4.0	−4.8	−6.1	+5.5
35	−1.1	+3.0	−0.3	+1.0	+0.8	−11.0	+0.2	+3.3	−5.4	−7.1	+5.4
40	+1.1	+3.0	+0.6	+1.8	+0.8	−11.0	−1.3	+0.6	−4.6	−7.6	+4.6
45	+1.1	+3.0	+0.6	+1.7	+1.4	−10.4	−1.9	0.0	−5.2	−7.5	+3.8
50	+1.1	+2.0	−1.4	+1.5	−1.4	−11.3	−1.6	−0.7	−4.2	−6 5	+4.6
55	+1.2	+1.8	−1.6	+2.3	−2.3	−11.6	+0.4	−0.5	−3.6	−4.5	+6.2
21 00	+1.2	+0.9	−2.6	+2.6	−2.8	−9.0	+1.2	−0.2	−0.5	−2.8	+6.3
05	+1.1	−3.0	−2.7	+1.0	+3.9	−6.7	+2.8	+3 1	+2.8	−0.2	+7.9
10	0.0	−1.0	−1.7	+0.6	+5.0	−4.2	+3.5	+4.0	+5.3	+2.8	+8.8
15	+1.1	+0.1	+0.1	+0.5	+0.8	−7.8	+4.1	+4.5	+2.3	+1.0	+9.7
20	+3.3	+0.1	+3.6	+0.5	+1.5	−4.2	+4.1	+4.9	+1.0	+1.2	+8.9
25	+3.3	−0.8	+5.4	+0.5	+2.7	−6.8	+3.8	+5.7	−0.2	+0.2	+8.9
30	+4.4	+3.2	+2.8	+0.5	+0.7	−8.5	+3.5	+5.2	0.0	+0.6	+8.1
35	+4.4	+4.1	+3.8	−0.4	+0.7	−9.0	+3.5	+4.3	0 3	+1.1	+8.1
40	+5.5	+3.1	+3.8	−1.2	+2.7	−5.7	+3.0	+3.6	−1.5	+0.4	+8.1
45	+5.5	+3.2	+4.6	−2.0	+6.2	−6.9	+3.2	+3.6	−3.0	−0.1	+7.3
50	+7.8	+5.1	+5.4	−1.7	+7.9	−6.9	+3.0	+2.3	−3.6	−0.6	+6.4
55	+8.9	+7.0	+7.2	−1.3	+9.1	−8.0	+1.1	+1.2	−5.6	−2.4	+5.5
22 00	+7.8	+5.0	+6.2	−1.5	+9.1	−6.2	+1.1	−0.2	−3.9	−2.4	+5.5
05	+6.7	+2.1	+4.5	−1.7	+8.1	−6.0	+0.7	0.0	−3.1	−2.2	+5.5
10	+6.7	+2.0	+3.6	−1.7	+6.6	−6.5	+0.2	+1.1	−2.8	−0.9	+4.7
15	+7.8	+2.1	+2.8	−1.7	+6.5	−4.5	+1.5	+1.4	−3.1	−0.1	+4.8
20	+7.8	+2.1	+2.9	−1.7	+8.1	−5.2	+3.8	+2.3	−3.1	−0.5	+4.8
25	+6.7	+3.1	+2.2	−1.7	+8.9	−3.2	+4.5	+1.8	−3.3	−1.0	+3.9
30	+5.6	+3.0	+3.2	−1.7	+9.9	−4.2	+5.3	+1.5	−3.8	−1.8	+3.1
35	+5.6	+4.0	+3.2	−1.5	+10.4	−1.4	+6.0	+1.5	−2.4	−3.0	+3.1
40	+5.6	+2.1	+3.4	−1.5	+11.5	−1.0	+6.3	+3.1	−2.8	−3.1	+2.2
45	+4.5	+1.2	+2.6	−0.7	+9.2	−2.8	+6.0	+2.9	−3.1	−2.4	+2.2
50	+3.3	−0.8	+1.8	−0.8	+9.1	−2.2	+6.6	+2.1	−2.5	−3.0	+0.6
55	+2.2	−1.7	+1.0	−1.0	+6.5	−3.4	+7.1	+2.2	−3.4	−2.6	+0.6
23 00	+1.1	−2.7	+0.2	+0.6	+4.2	−4.2	+6.9	+1.9	−2.4	−2.6	−1.0
05	+1.1	−2.7	−0.7	+0.6	+3.1	−5.5	+6.4	+3.7	−2.3	−2.0	−1.0
10	+1.1	−2.8	−0.8	+0 6	+2.1	−5.5	+7.2	+4.5	−1.7	−2.3	−1.0
15	+1.1	−2.8	−3.3	−0.2	+1.2	−5.9	+6.2	+4.8	−0.7	−2.3	−1.0
20	−2.2	−2.8	−4.9	+0.6	+1.6	−4.6	+7.7	+4.8	+0.1	−2.4	−1.0
25	−2.2	−3.9	−5.7	+0.6	+2.3	−3.1	+6.4	+4.9	+0.5	−2.4	−1.0
30	−2.2	−4.0	−3.1	+1.6	+3.2	−5.2	+6.6	+5.3	+0.7	−1.3	−1.0
35	−2.2	−3.9	−2.3	+0.8	+3.9	−3.9	+5.9	+4.7	+1.6	−1.2	−1.1
40	−3.4	−2 9	−3.9	+1.5	+3.9	−4.3	+5.9	+5.0	+2.5	+0.1	−1.1
45	−3.4	−2.9	−6.4	+2.3	+3.3	−7.0	+5.6	+3.3	+1.5	+0.2	−0.2
50	−4.5	−4.7	−9.7	+2.8	+1.4	−6.1	+5.2	+1.0	+2.2	+1.1	−0.2
55	−6.7	−6.6	−10.6	+2.6	+0.2	−4.5	+6.0	−0.4	+1.5	+1.0	−0.9
24 00	−6.7	−7.6	−9.8	+3.5	+0.5	−5.1	+6.2	−0.1	+4.4	+2.1	−0.1
05	−5.6	−6.6	−7.4	+4.1	+0.8	−4.1	+6.2	+2.4	+5.3	+1.9	+0.8
10	−5.6	−5.6	−5.6	+5.8	+0.7	−2.1	+6.0	+3.0	+5.7	+2.4	+0.8
15	−5.6	−5.7	−2.2	+8.3	+1.2	−2.4	+7.7	+6.2	+5.8	+3.2	+1.6
20	−4.5	−5.7	+0.2	+8.4	+0.5	−1.5	+8.0	+7.8	+6.1	+3.1	+2.4
25	−4.5	−4.7	+0 2	+9.3	+1.4	−4.8	+8.2	+11.5	+6.1	+3.4	+2.4
30	−3.4	−3.8	+0.2	+8.6	+2.8	−4.6	+9.2	+12.9	+6.0	+4.0	+2.4
35	−3.4	−3.8	+0.3	+8.6	+2.3	−4.4	+8.4	+14.1	+5.0	+4.6	+2.4
40	−3.4	−3.8	−0.5	+10.4	+1.8	−4.2	+8.7	+12.6	+4.5	+3.9	+2.4
45	−4.5	−2.9	−2.3	+10.4	+1.0	−5.3	+7.9	+9.7	+2.5	+4.0	+1.6
50	−4.5.	−1.9	−2.3	+9.6	+1.0	−7.8	+7.4	+9.9	+0.7	+3.9	+0.8
55	......	−1.0	−1.5	+9.6	+0.7	−10.4	+5.9	+8.1	0.0	+2.6	+0.8
25 00	......	−0.1	−1.6	+10.1	+0.1	−9.9	+5.1	+7.8	+0.1	+0.7	+0.8

Salient Points of $\triangle X$-, $\triangle Y$-, and $\triangle Z$-Curves.

67. *$\triangle X$-curves (Fig. 15).*—In Table 23 are given for each station the Greenwich civil mean times of the chief salient points, *a*, *B*, *c*, *D*, etc., of the curves, as also for the entire interval of the eclipse on the Earth ($19^h\ 29^m - 24^h\ 46^m$), termed the "terrestrial eclipse-interval," and for the local eclipse interval, the average values of $\triangle X$, regardless of algebraic sign, and the maximum ranges, or differences between the highest maximum value of $\triangle X$ and the lowest minimum value. The chief crests, as indicated by the capital letters, are connected by light lines and the chief troughs are marked by small letters.

It will be noticed that lines connecting the salient points *a*, *B* and *c*, namely, those before the eclipse occurred in North America, do not depart much from vertical lines, indicating that the Greenwich mean times of the crests and troughs are in general, at all North American stations, the same within 5-15 minutes. Lines drawn through the salient points beginning with *D*, namely, through those during and after the local eclipse, tend to run parallel courses to the line supposed drawn through the points of mid-totality, as indicated on the curves by the small heavy bars.

The last columns of Table 23 show that the average five-minute value of $\triangle X$ is about the same for the terrestrial eclipse-interval and the local eclipse-interval at each station. The maximum ranges, however, are, on the average, for the terrestrial eclipse-interval about twice those for the local eclipse-interval. In fact, the maximum range for the entire eclipse-interval, $19^h\ 29^m$ to $24^h\ 46^m$, is about the same order of magnitude as for the solar-diurnal variation. (In Figs. 10, 13, 14, 15, 16, and 19, the letters at the bottom signify for the terrestrial eclipse-interval: *B*, beginning; *C. B.*, central eclipse begins; *M*, middle; *C. E.*, central eclipse ends; *E*, ending.)

Table 23.—*Greenwich mean times of chief salient points of $\triangle X$-curves, as also average effects, regardless of sign, and maximum ranges for June 8, 1918.*

Station	a	B	c	D	e	F	g	H	i	Terr. Ecl. Interval		Loc. Ecl. Interval	
	20^h	20^h	21^h	21^h	22^h	22^h	23^h	23^h	24^h	Av. Ef.	Range	Av. Ef.	Range
	m	m	m	m	m	m	m	m	m	γ	γ	γ	γ
Antipolo	.....	.....	.....	−65	−98[1]	−62	.....	.....	.....	.....	.....	.....	.....
Lukiapang	.....	.....	.....	−52	−95	−62	.....	.....	.....	.....	.....	.....	.....
Kakioka	.....	.....	.....	−65	−80	−55	−85	− 60	− 5	5.5	17.4	7.2	7.2
Honolulu	.....	.....	.....	.....	−37	− 5	−42	− 22	−16[1]	5.6	17.4	5.5	4.4
Sitka	+10	+30	00	+50	+25	+45	+25	+ 38	+10	7.6	25.6	12.1	14.1
Goldendale	−05	+38	+10[1]	+55	+75	+95	+75	+100	+55	6.5	31.7	5.5	20.0
Tucson	+08	+45	+17	+58	+80	+98	+70	.....	.....	3.8	16.7	4.1	11.4
Lakin	+10	+35	+15[1]	+60	+77	+95	+55	+ 95	+45	7.3	24.6	7.6	20.6
Agincourt	+05	+40	+35	+60	+75	+100	+55	+100	+50	8.1	28.5	4.1	13.7
Cheltenham	00	+35	+30	+58	+73	+95	+55	+100	+45	10.1	29.2	3.4	11.6
Porto Rico	+30	+55	+35	+58	+77	+98	+90	.....	.....	.....	.....	.....	.....
									Means	6.8	23.9	6.2	12.9

[1]Mean of two or more points.

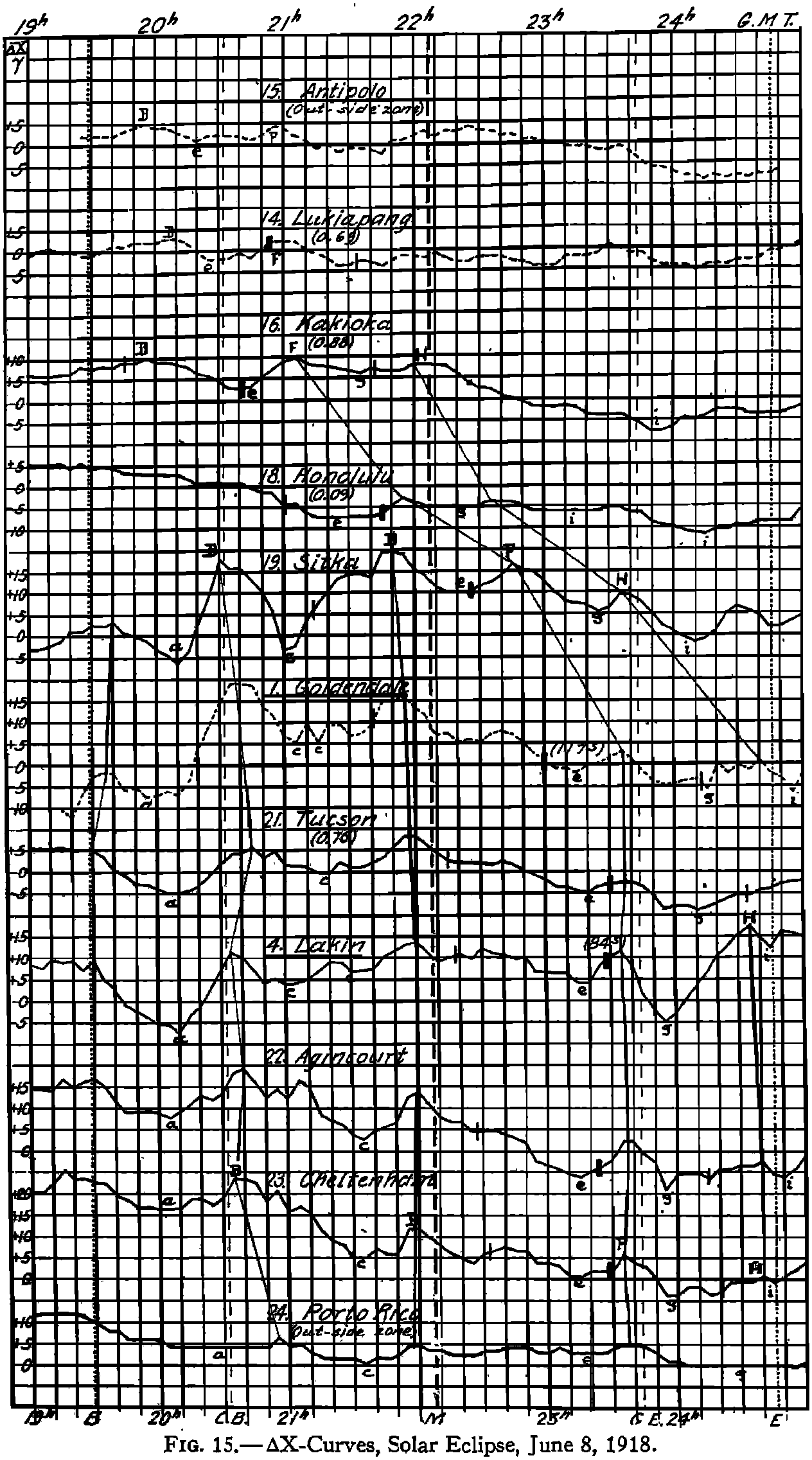

FIG. 15.—ΔX-Curves, Solar Eclipse, June 8, 1918.

68. *ΔY-curves (Fig. 16).*—The conclusions to be drawn are, in general, the same as those for the ΔD or $H\Delta D$ curves (see paragraphs 42-49). It will be noted again that for the three stations west of the meridian of Honolulu, namely, Antipolo, Lukiapang and Kakioka, the effects (chief salient points) are in general the reverse of those for the stations east of the meridian of Honolulu (see paragraph 49). This fact is shown in Table 24, as well as in Fig. 16 by the horizontal line between Kakioka and Honolulu. The general facts with regard to the Greenwich civil mean times of the chief salient points are about the same as for the ΔX-curves, as also the conclusions with respect to the average values of ΔY, regardless of sign, and the maximum ranges.

TABLE 24.—*Greenwich mean times of chief salient points of ΔY-curves, as also the average effects, regardless of sign, and maximum ranges for June 8, 1918.*

Station	a	B	c	D	e	F	g	H	i	Terr. Ecl. Interval		Loc. Ecl. Interval	
	19^h	20^h	20^h	21^h	21^h	22^h	23^h	23^h	24^h	Av. Ef.	Range	Av. Ef.	Range
	m	m	m	m	m	m	m	m	m	γ	γ	γ	γ
Antipolo	.....	+02	+57	+10	+55	.....	.....	+ 58	+35	.....	.....	.....	.....
Lukiapang	+35	+05	+40	+05	+55	+90	+42	+ 60	.....	.....	.....	.....	.....
Kakioka	+35	+12	+42	+05	+55	+85	+35	+ 55	+28	3.0	18	2.6	11
Honolulu	+35	+20	+30	00	.....	.....	.....	+102	.....	2.7	15	1.3	5
Sitka	+65	+45	+60	+10	+24[1]	+19[1]	+15	+ 38	+07[1]	4.7	28	5.4	11
Goldendale	+52[1]	+45	+55	+15[1]	+35	+40	+45	+ 80	.....	7.4	16	4.7	7
Tucson	+55[1]	+25[1]	+45	+18	+70	+80	+50	+ 90	.....	4.0	11	6.3	8
Lakin	+45	+20	+50	+25	+60	+92	+55	+ 95	.....	3.7	15	3.9	13
Agincourt	+30	+15	+40[1]	+10	+55	+100	+50	+ 83	.....	3.8	17	2.6	10
Cheltenham	+35	+15	+40	+10	+57	.....	.....	+ 95	.....	4.8	22	2.1	6
Porto Rico	.....	+30	+45	+15	.....	.....	.....	+ 90	.....	.....	.....	.....	.....
									Means	4 3	17.8	3.6	8.9

[1]Mean of two or more points.

69. *ΔZ-curves (Fig. 14).*—While the ΔZ-quantities are not in general as certain as the ΔX's, or the ΔY's, such conclusions as may be drawn safely from the curves and Table 25 are in general accord with those already deduced. It will be seen that the average values of ΔZ, regardless of sign, are about the same for

TABLE 25.—*Greenwich mean times of chief salient points of ΔZ-curves, as also average effects, regardless of sign, and maximum ranges for June 8, 1918.*

Station	a	B	c	D	e	F	g	Terr. Ecl. Interval		Loc. Ecl. Interval	
	20^h	20^h	21^h	21^h	21^h	22^h	24^h	Av. Ef.	Range	Av. Ef.	Range
	m	m	m	m	m	m	m	γ	γ	γ	γ
Antipolo	......	+70	+30	......	......	+ 69[1]	......	......	......	......	......
Lukiapang	+22	+55	+10	+ 60	+ 72	+ 98	......	......	......	......	......
Kakioka	+07	+47	+05	+ 30	+ 56[1]	+ 50	00	12.6	12	10.2	5
Honolulu	+15	......	......	+ 70	+ 97	+ 70[1]	15[1]	2.1	9	1.4	5
Sitka	+30	+70	+20	+ 72	+105	+130[1]	35	24.0	12	23.3	8
Tucson	+44[1]	+92	+57	+ 87	+ 95	+120	43[1]	4.4	6	3.4	3
Lakin	+50	+85	+35	+110	+140[1]	+140	35[1]	24.0	20	28.0	11
Agincourt	+68	+82	+68	+135	+152	+128	......	7.7	8	9.9	3
Cheltenham	+70	+95	+75	......	......	+115	......	3.8	9	3.6	6
Porto Rico	+45	+75	+60	......	......	......	......	......	......	......	......
							Means	9.8	9.5	10.0	5.1

[1]Mean of two or more points.

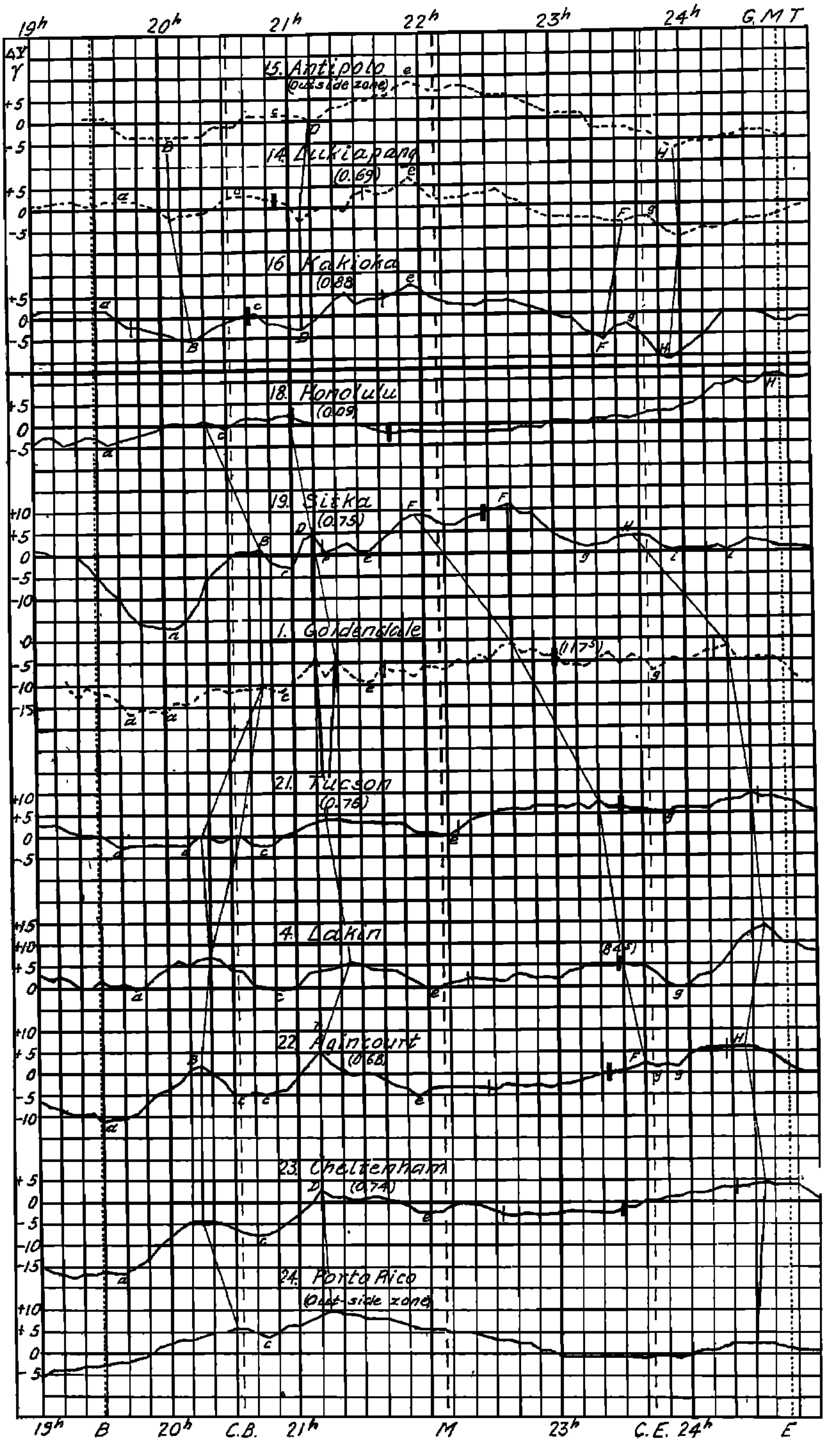

FIG. 16.—ΔY-Curves, Solar Eclipse, June 8, 1918.

the terrestrial eclipse-interval as for the local eclipse-interval, and that the maximum ranges for the entire interval ($19^{h}\,29^{m}-24^{h}\,46^{m}$) are about twice those for the local eclipse interval.

Vector Diagrams for June 8, 1918.

70. With the aid of the values of $\triangle X$, $\triangle Y$ and $\triangle Z$, as given in Tables 19-22, the vector diagrams for certain typical stations were drawn for June 8, 1918, which diagrams, as compared with similar ones for the undisturbed days, presented interesting features. Fig. 17 is a reproduction of one of these diagrams, viz., the *XY-vector diagram for Kakioka*, Japan, June 8, 1918, from 19^{h} to 25^{h}, Greenwich civil mean time. The eclipse began at this station at $19^{h}\,46^{m}$, which point is indicated in the diagram by the letter *B;* the middle (*M*) of the eclipse occurred at $20^{h}\,41^{m}$, and the end (*E*) at $21^{h}\,42^{m}$. It will be seen that from about $19^{h}.5$, when the eclipse began on the Earth, through to the points *B*, *M*, *E*, the curve is described in an anti-clockwise direction, or in the reverse direction to that for an undisturbed day. The anti-clockwise motion continues until about $22^{h}\,15^{m}$, when the normal or clockwise motion is pursued until about $23^{h}\,05^{m}$; the motion then becomes complicated, being partly clockwise and partly anti-clockwise.

Similarly the *YZ*-diagram at Kakioka on June 8, 1918, during the terrestrial eclipse-interval consists of a number of loops and reversals, and is exceedingly complicated, indeed, as compared with that for an undisturbed day. The same remarks may be made on the *XZ*-diagram of June 8, as also with regard to the *DI*-curve described on June 8 by a freely-suspended magnetic needle, showing both the changes in the declination, *D*, and the inclination, *I*.

71. Fig. 18 is the *XY-vector diagram for Cheltenham* on June 8, 1918. It will be seen that instead of a straightforward motion during the terrestrial eclipse-interval, loops are repeatedly described which are especially numerous during the period the eclipse occurs in North America; the period of the eclipse at Cheltenham is indicated on the curve by the letters *B*, *M* and *E*. Similar remarks may be made with regard to the vector diagrams of the other components, as also with respect to the curve described by a freely-suspended needle at Cheltenham on June 8, 1918.

72. The various diagrams for *Lakin*, where the eclipse was total, are all very complicated as compared with similar diagrams for undisturbed days.

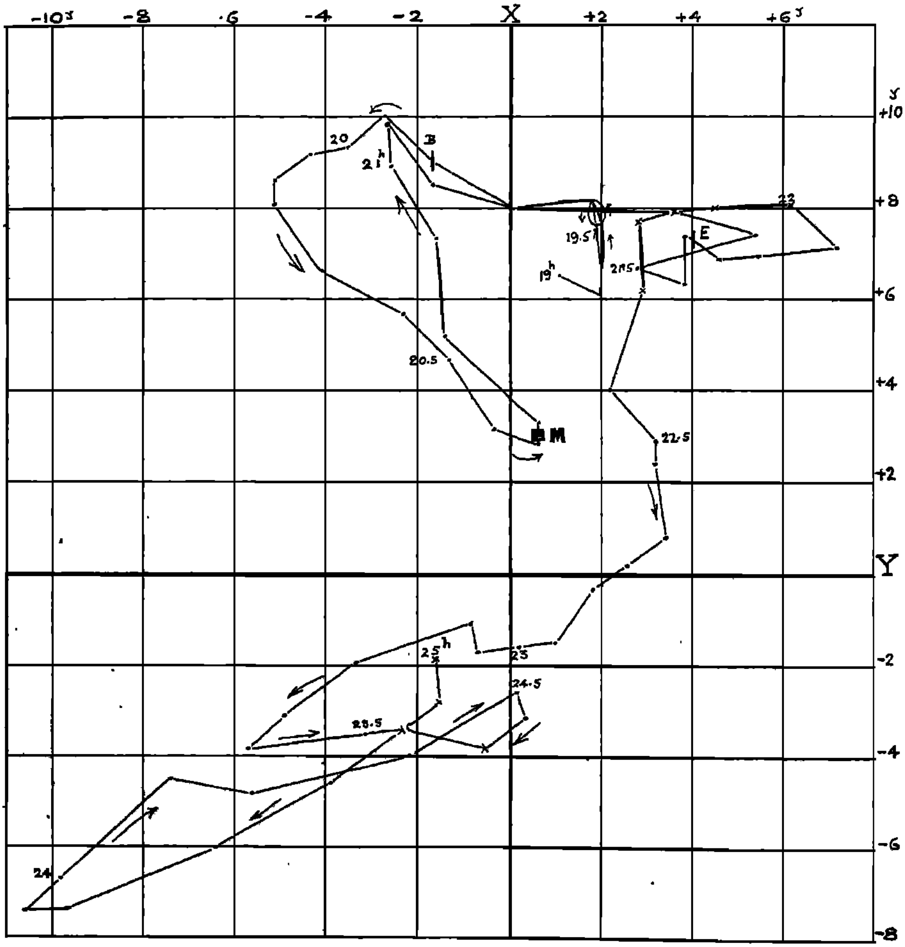

FIG. 17.—XY-Vector Diagram, Kakioka, June 8, 1918.

73. The facts revealed by the vector diagrams of June 8, 1918, are in general agreement with those found for previous eclipses,[1] namely, that, *in general, during the period of a solar eclipse, the directions in which the vector diagrams are described are either very complicated or are the reverse of those for an undisturbed day during day-hours. The reversals and loops during an eclipse are usually similar to those which occur, for example, on an undisturbed day near midnight.*

[1]See *Terr. Mag.*, vol. 5, p. 157, 1900; vol. 7, p. 179, 1902; vol. 21, p. 86, 1916.

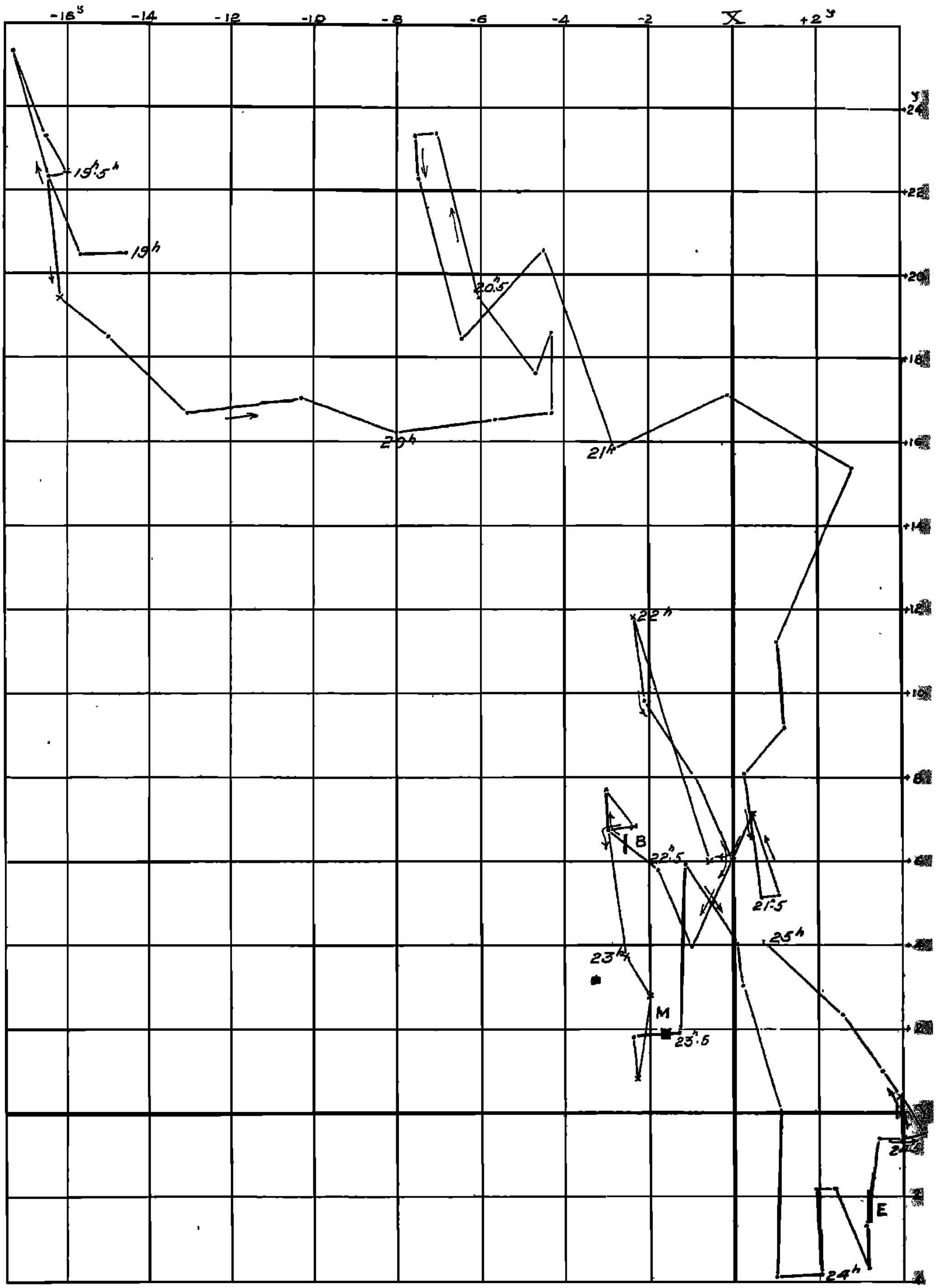

FIG. 18.—XY-Vector Diagram, Cheltenham, June 8, 1918

COMPARISON OF SOLAR-DIURNAL MAGNETIC VARIATION AND ECLIPSE MAGNETIC VARIATION.

74. Quoting from L. A. Bauer's article[1] on the results of the eclipse magnetic observations of May 28, 1900 and May 18, 1901:

"Let us suppose that the magnitude of the effect produced on any one magnetic element, as for example, the range of the declination variation, be directly proportional to the amount of sunlight a body is able to cut off from our atmosphere. Since the Earth and Moon are practically at the same distance from the Sun, we may say that the amount of sunlight these bodies cut off will approximately be to each other as the squares of their diameters, i. e., as $(3.67)^2$:1 or as 13.5:1."

Preliminary tests of this hypothesis with the aid of the data at the time available gave the following results:[2]

TABLE 26.—*Preliminary comparison of solar-diurnal variation and eclipse variation of the magnetic declination for the solar eclipses of 1871, 1900 and 1901.*

Station	Eclipse	Declination			
		d_s=solar diurnal range	d_e=solar eclipse range		d_e/d_s
			Computed	Observed	
		′	′	′	
Rocky Mount	May 28, 1900	10.8	0.8	0.9	0.08
Mauritius	May 18, 1901	6.6	0.5	0.6	0.09
Batavia	Dec. 12, 1871	6.0	0.4	0.7	0.12
		Mean.			0.10

It will be seen that if d_s is the range of the solar-diurnal variation as determined from undisturbed days near the day of the eclipse, and d_e, the average range of the eclipse magnetic effect, the ratio, d_e/d_s, on the average for the 3 stations and 3 different eclipses, was 0.10. According to the hypothesis, the ratio should be 1/13.5=0.074; thus the preliminary observational value (0.10) was of the right order of magnitude, though about 30% higher. The extensive data for the solar eclipse of June 8, 1918, afford further tests of the hypothesis.

75. The declination columns of Table 27 contain for various stations the values of d_s and d_e, for the solar eclipse of June 8,

[1] *Terr. Mag.*, vol. 7, p. 190, 1902.

[2] *Idem*, vol. 7, p. 191.

1918, as also those of d_E, the average range of $\triangle D$ for the terrestrial eclipse-interval ($19^h 29^m - 24^h 46^m$ G.M.T.). Next there are given the values of the ratios d_e/d_s and d_E/d_s. Weighting the ratios as shown in the last column, p, the weighted mean results are:

$$d_e/d_s = 0.077; \; d_E/d_s = 0.083; \; \text{mean ratio} = 0.08.$$

Thus the mean ratio, 0.08, does not differ materially from the hypothetical value, 0.074, though it is again a trifle larger.

76. A formula of the type[1]:

$$d = k \sec^2 \phi',$$

where ϕ' is the magnetic latitude, was found in general to give a satisfactory representation of the values of d_s, d_e and d_E. The only glaring departures (residuals) occurred for the stations, Meanook and Corona. For the former station (Meanook), which is the nearest station to the magnetic pole, the observed value d_s as derived from the 5 quiet days in June 1918 appears abnormally low. As regards Corona the interesting developments shown at this high mountain station were already pointed out in paragraphs 44-46. The value of ϕ' is derived from the formula, I being the magnetic inclination:

$$\tan \phi' = \tfrac{1}{2} \tan I.$$

A preliminary solution by the method of least squares gave the following formulae:

$$d_s = 3.'90 \; \sec^2 \phi'$$
$$d_e = 0.'292 \; \sec^2 \phi'$$
$$d_E = 0.'332 \; \sec^2 \phi'$$

From these formulae we get practically the same ratios for d_e/d_s and d_E/d_s as those in the previous paragraph.

A formula of the type[1], $d = k'/H^2$, where H is the horizontal intensity, yields practically the same results as that used above. (The reference at the end of paragraph 51 should have been to paragraph 75, not to 74.)

77. The horizontal-intensity columns of Table 27 contain the values of the average ranges h_S, h_e and h_E, as well as the ratios of

[1] See L. A. BAUER'S article in *Terr. Mag.*, vol. 2, p. 70, 1897.

[1] See L. A. Bauer's article in *Terr. Mag.* vol. 2, p. 70, 1897.

TABLE 27.—*Ranges of solar-diurnal variation and of solar eclipse variation of the magnetic elements for June 8, 1918.*

Station	Declination					Hor. Intensity					Ver. Intensity					p
	d_s	d_e	d_E	d_e/d_s	d_E/d_s	h_s	h_e	h_E	h_e/h_s	h_E/h_s	z_s	z_e	z_E	z_e/z_s	z_E/z_s	
	′	′	′			γ	γ	γ			γ	γ	γ			
Antipolo[1]	3.4	....	0.50	.....	0.15	46	....	4.52	.....	0 10	33	. .	4.45	.....	0.13	0.5
Lukiapang[2]	6.3	0 37	0.29	0.06	0.05	23	4.50	3.74	0.20	0.16	24	1.20	1.80	0.05	0.08	0.5
Kakioka[3]	6.6	0.51	0.69	0.08	0.10	17	4.80	4.47	0.28	0.26	13	2.75	3.13	0.21	0.24	1.0
Honolulu[4]	5.8	0.64	0.43	0.11	0.07	22	1.40	2.00	0.06	0.09	23	5.00	3.65	0 22	0.16	0.5
Sitka[4]	13.8	1.12	0.88	0.08	0.06	42	6.53	9.52	0.16	0.23	21	3.00	2.89	0.14	0.14	0.5
Goldendale[5]	[10]	0.78	0.81	0.08	0.08	[30]	4.48	5.90	0.15	0.20	..	.....	.....	. .	.....	0.5
Meanook	16.8	2.00	2.14	0.14	0.15	....	....	....	.....	.....	..	.....	.....	.....	.....	0.5
Corona[6]	[14]	1.37	1.59	0.10	0.11	....	....	....	.....	.....	..	.....	.....	.....	.....	0.5
Tucson[4]	8.5	0.48	0.56	0.06	0.07	17	3.15	3.95	0.19	0.23	26	0.70	0.98	0 03	0.04	1.0
Lakin[7]	11.5	0.64	0.71	0.06	0.06	29	7.90	7.40	0.27	0.26	30	4 25	3.88	0 14	0.13	1.0
Agincourt[8]	15 2	1.02	1.09	0.07	0.07	38	5.00	8.06	0.13	0 21	10	1.55	2.13	0.16	0.21	1.0
Cheltenham[4]	12.5	0.75	0.81	0.06	0.06	34	4.03	6.06	0.12	0.18	15	2.00	2.42	0.13	0.16	1.0
Porto Rico[4]	5.2	. . .	0.67	.....	0.13	19	....	2.44	.....	0.13	11	...	2.20	....	0.20	0.5
Weighted Means	......			0 077	0 083	.		....	0.182	0 199	..	. .	...	0.135	0 151	

[1]Solar-diurnal ranges are for 5 quiet days in June 1911.

[2] " " " " " " " " " " 1913.

[3] " " " " " " " " " " 1913; when June data were missing, as was the case for H, the mean of May and July was taken.

[4]Solar-diurnal ranges are for 10 quiet days in June 1918.

[5] " " approximate; derived from other stations.

[6]Solar-diurnal range approximate; derived from observations June 7 and 9.

[7]Solar-diurnal range for D derived from 3 quiet days (June 7, 23, 24); for H and Z from June 7.

[8]Solar-diurnal ranges for 5 quiet days in June 1918.

h_e and h_E to h_s. The significance of the subscripts is the same as for the declination ranges. The weighted mean ratios are:

$$h_e / h_s = 0.182; \; h_E / h_s = 0.199; \text{ mean ratio} = 0.19.$$

Hence, the mean ratio of the average range of the eclipse horizontal-intensity effect to the range of the solar-diurnal variation of the horizontal intensity, as derived from the quiet days in June 1918, is about 2.5 times the hypothetical ratio referred to in paragraph 74.

78. The vertical-intensity columns of Table 27 contain similarly the average ranges for the vertical-intensity effects, namely, z_s, z_e and z_E, and the ratios. The weighted mean ratios are:

$$z_e / z_s = 0.135; \; z_E / z_s = 0.151; \text{ mean ratio} = 0.14.$$

Hence, the mean ratio of the average range of the eclipse vertical-intensity effect to the range of the solar diurnal variation of the vertical intensity, as derived from the quiet days in June 1918, is about 2 times the hypothetical ratio (0.074).

79. Before deriving the ranges of the eclipse magnetic variation contained in Table 27, 15-minute means, in order to smooth out accidental irregularities, were formed of the $\triangle D$'s in Table 9, of the $\triangle H$'s in Table 17 and of the $\triangle Z$'s in Table 19. The general conclusion to be drawn from paragraphs 75-78 is that *the declination effects of the eclipse variation are, on the average, slightly larger and the intensity effects about two times larger than would result on the hypothesis that the effect is directly proportional to the amount of sunlight cut off from our atmosphere by the Moon during an eclipse.*

Periods of Solar-Eclipse Magnetic Variation, June 8, 1918.

80. Looking over the various curves in Figs. 13-16, it will be noticed that for the interval of observation there are a series of short waves, generally from three to four at any station. The average periods of these waves on June 8, 1918, are given in Table 28 for the effects $\triangle H$, $\triangle X$, $\triangle Y$ and $\triangle Z$ at various stations. The local eclipse-intervals are given in the last column. It will be seen from the mean quantities at the bottom of the table that *the average period-length of the short waves of the eclipse magnetic variation is about 1^h.3, whereas the average length of the local eclipse interval is about 2^h.*

Table 28.—*Average short periods of eclipse magnetic variation, June 8, 1918.*

Station	ΔH	ΔX	ΔY	ΔZ	Loc Ecl. Int.
	h m	h m	h m	h m	h m
Lukiapang	1 22	1 15	0 57	1 19	[1 20]
Kakioka	1 35	1 35	1 50	1 35	1 56
Honolulu	1 09	1 09	1 50	1 52	1 29
Sitka	1 03	1 03	0 54	1 18	2 27
Goldendale	0 55	0 55	1 04	....	2 31
Tucson	1 14	1 39	1 28	1 35	2 19
Lakin	1 06	1 06	1 28	1 15	2 12
Agincourt	1 19	1 19	1 34	1 35	1 48
Cheltenham	1 11	1 11	1 45	1 51	1 48
Means	1 13	1 15	1 26	1 32	1 59

In addition to the period of about 1^h.3, there is *long period* clearly discernible in various curves of Figs. 13-16, the average length of which *is found to be 5^h.2, or practically the same as the terrestrial eclipse-interval,* 5^h 17^m (19^{h}29^m—24^{h}46^m G.M.T.).

81. An examination of the magnetic effects as shown near the ends of the curves in Figs. 13-16, reveals the interesting fact that the eclipse magnetic variation does not completely cease at the end of the terrestrial eclipse-interval, viz., at $24^{h}46^{m}$ G.M.T. June 8, 1918, but continues for some time after. As judged by the extended curves for which data are at present available, *the magnetic effects continue an hour or more after the eclipse is over on the Earth.*

Preliminary Analysis of Solar-Eclipse Magnetic Variation.

82. A preliminary analysis of the solar-eclipse magnetic variation on June 8, 1918, indicates that the chief source of the effect must be ascribed to an electric system above the Earth's surface, supplemented by an internal system originating possibly as the result of induction by the outer system. The combined system is similar to that causing the solar-diurnal variation of the Earth's magnetic field in the respect that the magnetic poles are approximately east and west of each other; it is dissimilar in the respect that the solar-eclipse system, as it travels easterly over the Earth with the advancing shadow cone, causes, in general, the reverse of the magnetic effect arising from the system of the solar-diurnal variation, which may be supposed to move around the Earth in an east-west direction.

In the case of the solar-diurnal variation system we have a north-end attracting pole moving westerly towards a station in the Northern Hemisphere early in the morning, causing the easterly elongation of the declination-needle, followed by a south-end attracting pole, or north-end repelling pole, which causes in the early afternoon hours the westerly elongation of the needle. For the solar-eclipse variation system of June 8, 1918, on the other hand, we have, as the shadow-cone progresses, a north-end attracting pole moving *easterly* towards a station in the Northern Hemisphere, followed by a north-end repelling pole; hence, the reversed effects of the two systems.

83. The eclipse magnetic effects, other things being equal, are generally the same in character and not greatly different in magnitude at stations along the isochrone line of maximum obscuration for several hundred miles distant from the belt of totality.

A final analysis is deferred until the results from the observations to be made in connection with the solar eclipse of May 29, 1919, in the South Magnetic Hemisphere, are available.

Chief Conclusions for Part I (Magnetic Observations).

84. The following conclusions are drawn covering the chief results of the magnetic observations made in connection with the solar eclipse of June 8, 1918:

a. Appreciable magnetic effects were observed during the solar eclipse of June 8, 1918, at stations distributed over the entire zone of visibility and immediately outside. (How much further some of the effects may have extended must be left for future study.) The chief characteristics of the effects took place generally in accordance with the local eclipse circumstances and in general accord with effects observed during previous eclipses. The evidences of a direct relation between the magnetic effects and the solar eclipse are so numerous as to warrant drawing the definite conclusion that an appreciable variation in the Earth's magnetic field occurs during a solar eclipse. This particular variation is termed here the "solar-eclipse magnetic variation".

b. The range of the solar-eclipse magnetic variation, according to the particular magnetic element, is about 0.1 to 0.2 that caused by the solar-diurnal variation on undisturbed days. The effects are of a more or less complicated character, according to location of observation-station in the zone of visibility. The effects caused during the local eclipse-interval are superposed upon those caused by the continued disturbance of the Earth's magnetic field in the region over which the shadow-cone has already passed. It is thus possible to discern effects having a period approaching that of the local eclipse-interval and others having a period approximately that of the entire or terrestrial eclipse-interval.

c. The general character of the system causing the solar-eclipse magnetic variation is the reverse of that causing the day-light portion of the solar-diurnal magnetic variation. The range of the eclipse variation is comparable with that of the lunar-diurnal variation, and, like the latter, the variation usually consists of a double oscillation during its period of development.

d. The range of the apparent effect on the intensity of magnetization of the Earth during the solar-eclipse magnetic variation, is about equal to that found associated with a 10 percent change in the solar radiation as shown by changes in the solar-constant values.

e. The results at the high mountain-station, Corona, Colorado, indicate that the magnetic effects during a solar eclipse may be modified and even intensified by altitude of station, topography and meteorological conditions. In view of the bearing of these results upon the theory of the solar eclipse magnetic variation and possibly upon the theory of other variations of the Earth's magnetic field as well, it will be highly desirable in the planning of future eclipse work to include as many mountain-summit stations as conveniently possible.

PART II.—METEOROLOGICAL AND MISCELLANEOUS OBSERVATIONS

85. The General Scheme of Work, see paragraph 4, called for such meteorological observations as the observers found it convenient to include in their observational programs. It was suggested that, at least, the temperature be read every fifth minute (directly after the magnetic reading for that minute). As far as the United States was concerned more elaborate meteorological work was fully provided for by the United States Weather Bureau.

TEMPERATURES INSIDE OBSERVING TENTS.

86. Table 29 contains the five-minute temperatures read with standardized thermometers inside a tent, or house, in connection with the magnetic readings at the field stations in North America. With the exception of the "outside" temperatures given for Corona in Table 30, the figures plotted in Fig. 19 do not represent the actual temperatures of the free or outside air; it should be remembered that, as was found necessary, a source of illumination of the magnet-scale was used, thus heating the air inside the observing tent or house. Nevertheless the temperature curves of Fig. 19 are of some interest in showing *relative* temperature-changes and the lag in the temperature-drop at totality, or at maximum obscuration; in general this temperature-lag inside the tents was from 5 to 10 minutes. It will be seen from an inspection of the two Corona curves (temperatures inside tent and in the open) that they run parallel courses, although the temperatures which they represent may differ considerably as to absolute amounts.

METEOROLOGICAL OBSERVATIONS AND SHADOW BANDS AT CORONA, COLORADO.

87. The following is a report by Prof. E. Waite Elder, head of the physical laboratory of East Side High School of Denver, who was associated with L. A. Bauer's party at Corona. The site of the thermometer-shelter and the place where the shadow bands were observed by him during the eclipse were directly north of the magnetic station (see Fig. 4). For observing the shadow bands there was prepared a levelled space, about 8x9 feet and about 1 foot deep at the east end; the center of this space is 42 feet about north of the cross in the rock marking the magnetic station. The Fahrenheit thermometer used was loaned by Mr.

TABLE 29.—*Centigrade temperatures recorded at field stations during magnetic observations of June 8, 1918.*

Greenwich Mean Time	Goldendale	Green River	Corona	Lakin[1]	Mena	Brewton	Orlando	Berkeley	Lake Moraine	Urbana	Columbia	Austin	Washington[1]	Woburn	Rivière du Loup
h m	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
19 00	26.0	31.3	28.5	29.0	20.8	34.6	29.4	22.6	16.0	.....	.....	32.0	21.0	27.6	18.1
05	26.8	32.8	29.3	.....	21.3	33.4	27.2	22 6	18.0	.....	.....	33.1	21.0	27.5	18.6
10	26.1	35.3	30.0	29.0	21.2	32.7	26.6	22.7	18.0	.....	.....	33.4	21.0	27.6	18.8
15	26.0	31.8	29.8	31.4	21.2	32.0	25.8	22.9	22.0	.....	.....	31.7	21.0	27.0	18.9
20	26.6	31.6	29.9	29.1	21.7	33.3	25.0	22.7	23.0	.....	.....	29.0	21.1	26.9	18.9
25	27.5	31.3	30.5	30.8	21.3	34.3	25.6	23.0	22.0	.....	.....	29.0	21.1	27.0	19.8
30	27.8	32.5	31.4	28.0	21.3	31.2	25.2	23.3	21.0	.....	.....	31.5	21.0	26.8	19.7
35	29.0	32.0	32.0	32.2	21.2	30.6	25.0	23.6	20.0	.....	.....	31 5	21.1	26.6	19.0
40	29.0	33.0	31.8	29.2	21 3	30.7	25.2	23.4	17.0	.....	.....	33.0	21.1	26.2	18.1
45	29.0	32.3	30.1	29.2	21.5	30.1	27.0	23.6	16.0	.....	.....	31.0	21.2	26.6	17.2
50	28.0	33.5	28.2	31.9	21.7	29.9	28.1	23.2	16.5	.....	.....	33.2	21.3	26.8	17.8
55	29.0	34.8	26.5	29.9	21.5	29.8	29.2	23.0	16.0	.....	.....	33.8	21.5	26.7	18.2
20 00	29.2	33.2	24.8	34.2	21.4	29.4	29.3	23.0	15.0	.....	31.2	34.2	21.6	27.0	18.5
05	28.7	34.4	23.8	33.4	21.5	29.1	31.0	23.0	15.2	.....	32.2	34.7	21.8	26.6	18.1
10	28.7	34.9	21.1	33.3	21.7	29.0	30.6	23.2	15.2	.....	32.8	35.1	21.8	26.2	17.7
15	28.4	35.0	19.7	30.0	21 8	28.9	30.0	23.6	16.0	.....	33.2	34.0	21.5	26.2	17.9
20	29.0	36.6	17.7	33.4	21.8	28.7	28.9	24.1	17.0	.....	34.2	33.4	21.6	25.7	17.9
25	28.2	33.2	15.9	34.1	22.1	28.7	29.3	24.5	15.6	.....	34.6	35.5	21.7	25.5	17.6
30	29.1	33.0	14.6	33.2	21.8	28.4	29.0	24.0	15.0	.....	32.2	35.2	21.8	25.6	17.8
35	28.0	33.8	13.8	32.8	21.8	28.4	29.0	24.3	16.0	.....	31.3	35.7	21.7	26.0	17.9
40	28.2	34.0	14.6	33.8	21.8	28.2	28.0	24.5	18.8	.....	30.4	35.5	21.6	26.3	17.8
45	27.8	34.2	16.7	32.2	21.7	26.4	28.0	24.7	19.0	.....	30.2	35.6	21.7	26.4	17.8
50	28.5	35.5	18.0	33.9	21.8	26.0	27.5	25.0	17.2	.....	30.8	36.0	21.6	26.0	17.5
55	28.2	34.2	18.0	30.5	22.0	25.8	26.7	24.7	15.5	.....	33.7	35.0	21.6	26.1	17.0
21 00	28.0	32.1	18.0	31.7	.....	25.7	27.0	25.0	14.5	.....	32.2	35.0	21.5	26.0	17.2
05	28.0	33.2	18.8	31.3	21.6	25.4	27.0	25.3	13.5	.....	31.6	34.8	21.3	25.9	17.0
10	27.5	34.1	20 8	32.0	22.0	25.4	27.1	25.7	12.0	.....	32.5	35.6	21.3	25.7	17.0
15	28.6	36.0	21.9	31.6	21.8	25.2	27.7	25.7	10.5	.....	31.0	36.2	21.5	25.4	14.6
20	27.8	37.3	21.1	31.8	21.9	25.0	27.2	25.0	9.0	.....	30.0	36.5	21.6	25.4	14.7
25	28.1	34.4	20.2	30.5	21.9	25.2	27.0	24.8	8.3	.....	30.0	36.0	21.8	25.6	14.7
30	28.0	35.3	19.3	29.3	22.0	25.4	27.0	25.1	7.8	.....	29.9	36.4	21.7	25.8	15.1
35	29.0	34.4	18.3	29.3	22.2	25.3	27.0	24.8	8.0	.....	29.3	36.2	21.8	25.6	15.2
40	30.0	28.8	17.2	30.2	22.3	25.0	27.1	24.7	8.0	.....	29.2	36.6	21.9	25.7	16.2
45	29.3	35.4	16.4	31.2	22.7	25.1	27.2	24.7	7.2	.....	29.5	37.0	21.9	25.8	15.8
50	28.6	33.5	15.7	31.2	22.9	25.2	27.0	25.2	7.5	.....	30.2	35.4	21.8	25.4	16.0
55	30.0	33.8	15.1	29.8	23.0	25.0	27.0	25.2	7.6	.....	30.0	36.0	21.8	25.1	16.0
22 00	29.0	34.2	14.8	29.4	23.1	25.1	27.0	24.9	7.5	.....	31.4	34.4	21.5	25.0	16.0
05	28.5	32.0	14.5	29.8	23.2	25.0	27.0	24.2	7.5	.....	30.3	36.0	21.5	25.1	[16.0]
10	28.0	28.2	14.6	30.1	23.3	25.0	27.0	24.2	7.2	.....	31.8	36.5	21.5	24.7	16.0
15	28.0	27.8	14.7	29.5	23.6	24.8	26.9	24.6	7.8	.....	31.6	37.0	21.9	24.2	16.2
20	28.0	34 5	15.2	28.2	23 8	24.8	26.5	24.2	8.0	30.0	32.2	37.0	21.9	24.2	16.0
25	28.0	31.8	15.8	29.2	23.8	24.9	25.8	23.6	8.3	30.0	30.8	36.9	21.9	24.2	15.0
30	28.3	32.6	16.1	29.2	24.1	24.9	25.6	23.5	8.0	29.9	31.3	36.2	21.6	24.0	14.3
35	27.7	32.6	16.7	28.7	24.2	24 9	25.8	23.0	8.2	29.3	32.3	36.3	21.7	23.5	14.7
40	27.0	29.8	17.1	26.8	24.2	24.7	25.8	22.8	8.2	29.0	31.2	36.6	21.7	23.3	14.8
45	27.0	28.5	17.5	26.9	23.9	24.4	26.8	22.7	8.2	28.8	31.0	37.0	21.4	23.1	14.8
50	26.6	27.4	17.9	27.0	23.2	24.3	28.0	22.2	9.0	28.6	30.0	37.2	21.3	22.6	14.9
55	26.0	26.8	18.1	26.8	23.4	24.6	26.8	22.0	9.0	28.4	29.8	36.2	21.4	22.1	14.1
23 00	26.0	27.0	18.1	25.7	23.1	24.2	25.4	22.0	9.1	27.8	30.2	36.0	21.0	21.9	14.1
05	25.0	28.1	18.0	25.1	23.1	.....	25.6	22.1	9.2	27.2	29.8	35.0	21.9	21.4	13.9
10	25.0	27.9	17.5	24.7	23.0	24.1	25.7	21.7	9.2	26.8	29.7	34.6	21.8	20.8	14.0
15	25.6	27.8	16.8	23.7	22.8	24.0	25.1	21.6	9.0	26.0	27.8	34.2	21.9	20.0	13.9
20	25.8	25.9	15.9	23.0	22.7	23.9	25.0	21.5	8.8	25.1	27.7	33.4	22.0	19.5	13.9
25	26.0	25.2	15.0	22.7	22.8	24.0	25.0	21.2	.....	24.8	27.3	33.0	22.0	18.9	13.9
30	26.2	25.2	14.1	22.1	22.5	24.0	25.0	21.4	9.0	24.0	26.6	32.0	21.9	18.6	13.8
35	26.9	25.7	13.6	22.0	22.3	24.0	25.0	21.6	9.4	23.5	26.5	31.8	21.9	18.0	13.8
40	27.0	25.8	13.0	22.1	22.4	.....	25.0	21.7	9.2	23.7	26.7	31.8	21.9	17.5	13.7
45	27.0	26.0	12.9	22.4	22.6	23.7	25.0	22.1	9.0	23.0	26.8	31.8	21.6	17.2	13.4
50	27.3	26.5	12.6	22 8	22.7	24.0	25.1	22.0	9.1	23.0	26.8	31.8	21.5	17.0	13.2
55	27.6	26.9	12.6	23.0	22.5	24.3	25.1	21.7	8.2	23.0	26.9	31.6	21.4	16.6	13.5
24 00	27.5	27.0	12.8	23.2	22.1	24.2	25.0	21.6	8.0	23.2	27.3	31.6	21.4	16.2	13.5
05	27.1	27.3	12.8	23.6	22.0	23.8	25.0	21.8	8.0	23.3	27.4	31.7	21.3	15.8	13.8
10	27.2	27.5	12.9	23.7	21.9	23.6	25.0	21.9	8.0	23.3	27.7	31.6	21.3	15.2	13.8
15	27.5	28.0	12.8	23.6	21.8	23.6	25.2	22.3	8.8	23.6	27.3	31.5	21.2	14.9	13.7
20	27.7	28.3	12.8	24.2	21.8	24.0	.....	23.0	9.2	23.8	27.7	31.3	21.1	14.7	13.7
25	28.0	28.0	12.2	24.2	21.9	23.9	.....	23.0	8.0	23.7	27.6	30.8	21.1	14.3	13.7
30	28.1	27.1	12.0	24.0	21.8	23.9	.....	23.2	7.6	23.4	27.4	30.8	21.0	14.0	13.5
35	29.0	27.8	12.0	23.8	21.7	23.9	.....	23.2	8.2	23.0	27.2	30.6	21.0	13.7	13.2
40	29.3	27.9	12.2	23.4	21.7	23.9	.....	23.0	9.1	22.7	27.2	30.6	21.0	13.2	13.5
45	29.6	27.6	12.3	22.9	21.8	23.8	.....	22.7	8.8	.....	26.9	30.5	21.0	13.0	13.5
50	29.4	27.5	12.4	22.4	21.8	23.8	.....	22.7	9.0	21.8	27.8	30.4	20.8	13.0	13.6
55	29.0	27.4	12.9	22.5	21.7	23.6	.....	22.8	9.0	21.2	26.4	30.0	20.6	12.5	13.6
25 00	29.0	26.7	13.5	22.3	21.6	23.7	.....	22.8	9.0	.....	26.3	29.7	20.6	12.0	13.6

[1]Lakin and Washington readings were mostly 2 minutes earlier than 5-minute readings.

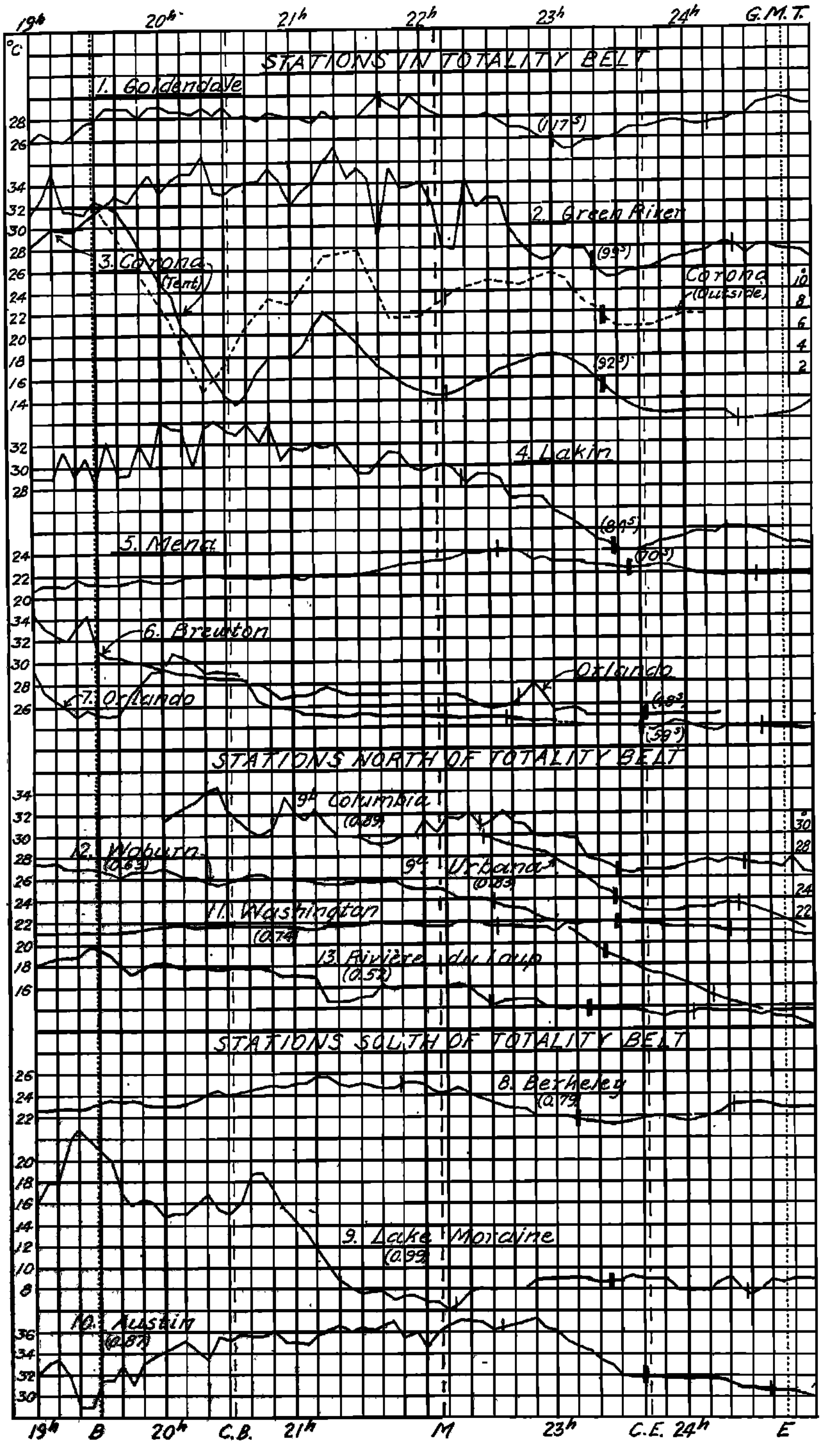

Fig. 19.—Temperature Curves, Solar Eclipse, June 8, 1918

A. L. Britt, telegraph operator at Corona; it was compared with standardized C. I. W. centigrade thermometer No. 6722 and the recorded temperatures were thus reduced to standard. Plate I, Fig. 1 will give some idea of the prevalent meteorological conditions near time of totality; see also paragraph 9.

Prof. Elder used a watch for noting the times, the correction of which on Greenwich mean time was controlled by means of the time signals received at Corona on June 7, 8 and 9.

Table 30.—*Meteorological Observations and Shadow Bands at Corona, June 8, 1918.*

G.M.T.	L.M.T.	Corrected Temp. Fahr.	Corrected Temp. Cent.	Remarks
h m	h m	°	°	
19 30	12 27	64.5	18.1	Cloudy; wind from N.
20 03	13 00	44.8	7.1	Raining
20 20	13 17	33.6	0.9	Snowing
20 30	13 27	37.7	3.2	Snow stopping
20 40	13 37	43.8	6.6	Sun shining
20 50	13 47	48.9	9.4	Cloudy
21 00	13 57	47.9	8.8	Clearing
21 15	14 12	55.9	13.3	Clouding
21 30	14 27	56.9	13.8	Cloudy
21 45	14 42	45.9	7.7	Cloudy; snowing a little
22 00	14 57	45.9	7.7	Cloudy
22 15	15 12	49.9	10.0	Sun barely showing
22 32	15 29	51.9	11.1	Clouds thinning
22 45	15 42	50.9	10.5	Clouds thinning; light wind from South at surface; thin clouds over Sun drifting slowly eastward.
23 00	15 57	52.9	11.6	Clouds still thinning
23 05	16 02	51.9	11.1	Shadow of Moon shows tubular form in clouds
23 10	16 07	49.9	10.0	Sun very clear; no wind at surface; clouds drift S. W.
23 15	16 12	47.9	8.8	Cloud over Sun
23 18	16 15	....	....	Halo color 5° S. E.
23 19	16 16	....	....	Halo south of Sun in clouds; clouds thinner
23 20	16 17	46.9	8.3	Halo 3° N. of Sun
23 21	16 18	....	....	Clouds beautifully bordered with color
23 23	16 20	45.9	7.7	Had to use match to read thermometer. Too cloudy to see *shadow bands* at beginning of totality; *shadow bands* about 10 cm. wide and 20 cm. apart
23 25	16 22	44.9	7.2	Brisk wind from N. W.; at end of totality, *shadow bands* 15° N. of E. traveling 2.5 to 3 m. per sec., toward S. E. by S.
23 30	16 27	43.9	6.6	
23 35	16 32	43.9	6.6	Clouds thin
23 40	16 37	43.9	6.6	
23 45	16 42	43.9	6.6	
24 00	16 57	45.9	7.7	
24 10	17 07	45.9	7.7	

Some Astronomical Observations at Corona, Colorado.

88. The following is a report by Mr. A. L. Britt, in charge at the time of the Western Union Telegraph office at the Denver and Salt Lake R. R. station, Corona, Colorado. Mr. Britt had just purchased a 3.5 inch refracting telescope, and kindly volunteered to put at our disposal any observations he might obtain. He selected as his observation-point the summit of the mountain on the side of which the magnetic station was located. His location was about ¼ mile east of the magnetic station (see Fig. 4), and several hundred feet higher, making his altitude above sea-level about 13,000 feet.

Location.—Windy Point, about one-half mile east of Corona station, Colorado, on the Denver and Salt Lake Railroad.

Weather.—Part cloudy.

Instrument used.—3.5-inch refractor, using 100-power eye-piece.

Remarks.—The first and second contacts were obscured by clouds, but the Sun cleared about 15 seconds after second contact, and the total phase was visible from that time until third contact under fair to favorable conditions. The last contact was obscured by clouds. The Sun was visible under varying conditions of favorableness for a total period of approximately one hour and thirty minutes.

Owing to a slight mistiness prevailing in the vicinity of the Sun during the total phase, the corona was not very brilliant and did not extend as far as the Moon's disc as it otherwise would under more favorable seeing. However, the apparent circular flow of the corona in the equatorial regions was fairly well defined.

Of the three red prominences noticed, the one on the Sun's north limb exhibited a peculiar curvature at its apex and, unlike the other two, seemed to be composed of two prominences near the base but it formed a junction about half-way out toward the point.

My efforts to detect the actual movement of the total shadow on the Earth's surface were to no avail, owing to cloudy condition of sky, I think, but I was able to note this movement on the clouds immediately after the total phase; the appearance of the shadow closely resembled a huge storm cloud, the resemblance being greatly enhanced by the part cloudy condition.

At the middle of totality the day-light circle, which was plainly visible in all directions from my vantage point, was a wonderful and inspiring spectacle. I regret that I did not have time to pay much attention to shadow bands on the surface, or make any measurements of same.

Corona, Colorado, June 12, 1918. A. L. Britt.

Part III.—ATMOSPHERIC-ELECTRIC OBSERVATIONS.

Atmospheric-Electric Observations at Lakin, Kansas.

89. It has been stated already in paragraph 10 that Lakin, Kansas, was the main station of the Department of Terrestrial Magnetism, and that complete magnetic and electric observations were made there. The results of the magnetic observations having already been given in Part I, it now remains to give an account of the atmospheric-electric work carried out during the period June 2 to 13 by S. J. Mauchly, assisted by A. Thomson and M. B. Smith. The electric observations comprised in general: potential-gradient, positive and negative conductivity, ionic content of positive sign, and penetrating radiation. At first the observations of potential-gradient and conductivity are reported upon in order that the main results will be accessible to those who may be planning to undertake similar work in connection with the solar eclipse of May 29, 1919.

Fig. 2[1] shows the location of Lakin in the belt of totality and Fig. 5 gives a view of the magnetic station. The geographic position of Lakin is: latitude, 37° 53′ N; longitude, 101° 18′ or $6^h\ 45^m$ W. The approximate local eclipse-circumstances, June 8, 1918, were:

Greenwich Civil Mean Time.			Totality.		
Beginning	Middle.	End.	Loc. M. T. Middle.	Magnitude.	Duration.
h m	h m	h m	h m		s
22 18	23 28	24 30	16 43	1.01	84

90. *Weather.*—During the forenoon of June 8, 1918, the sky was heavily overcast at Lakin. About noon all clouds disappeared except a fringe of cumulus near the horizon. Throughout the afternoon the dome of the heavens was free from clouds; although the fringe of clouds near the horizon persisted throughout the eclipse period, it was at all times much below the position of the Sun.

Potential-Gradient.

91. The station was located on a level and treeless plain to facilitate reduction of results to absolute values. The actual site was about 325 meters south of the magnetic observatory shown in Fig. 5 (*l. c.*). The method used for the potential-gradient observa-

[1] *Terr. Mag.* vol. 23, p. 97, 1918.

tions was that described by Simpson and Wright:[1] A wire about 25 meters long was supported about 95 centimeters from the ground by two posts 1 meter high from which it was insulated by two sulphur insulators. To the middle of this wire were attached two ionium collectors and one of its ends was connected to a Wulf electroscope.[2] The electroscope was located in a low sheltering hut several meters removed from one of the posts.

92. With this equipment it was easily possible to follow the short-period fluctuations of the potential-gradient. Control measurements were made on a number of days both before and after the day of the eclipse. Of these days, June 5, 6, 9, and 12 are comparable, as regards weather conditions, with the afternoon of June 8. On June 8, the observations were made by M. B. Smith at intervals of 2 minutes over a period of 6 hours, approximately central about totality. The results of the individual readings are given in Table 31, and are represented graphically in Fig. 20, where is also shown the mean potential-gradient curve for June 5, 6, 9, and 12.

93. It is instructive to consider the potential-gradient graphs of June 8 from two points of view:

(1) The rapid decrease in absolute value of gradient just preceding and during totality, the sharp minimum 6 minutes after mid-totality, and the persistence of a well-marked minimum for about 20 minutes after totality. This is almost identical with the findings of Julius Elster on the Algerian Coast in connection with the eclipse of May 28, 1900,[3] and is very similar to what was observed in 1905 by Elster and Geitel at Palma,[4] by Le Cadet at Tortosa in 1905,[5] and by Ludwig in India in 1898.[6] Striking variations from the above are Knoche and Laub's[7] failure to find *any* effect on the potential-gradient in Brazil during the 1912 eclipse and Nordmann's observation of an *increase* with obscuration culminating in a maximum 45 minutes after totality of the 1905 eclipse. Here it must be noted that the observations of Knoche and Laub correspond to an overclouded sky.

[1] G. C. SIMPSON and C. S. WRIGHT, *Proc. R. Soc.* A., vol. 85, p. 182, 1911.

[2] This electroscope was provided with an insulated subsidiary case, to which auxiliary potentials could be applied, and by means of which it was possible always to make the readings at maximum sensitivity, as also to keep the images of the fibers from going off the scale.

[3] *Phys. Zeit.*, vol. 2, p. 67, 1900.

[4] *Terr. Mag.*, vol. 11, p. 15, 1906.

[5] *Met. Zeit.*, vol. 41, p. 308, 1906.

[6] *Wiener Anzeiger*, p. 66, 1899; abstract in *Terr. Mag.*, vol. 4, p. 208, 1899.

[7] *Terr. Mag.*, vol 21, p. 203, 1916.

[8] *Met. Z. S.*, vol. 41, p. 306, 1906.

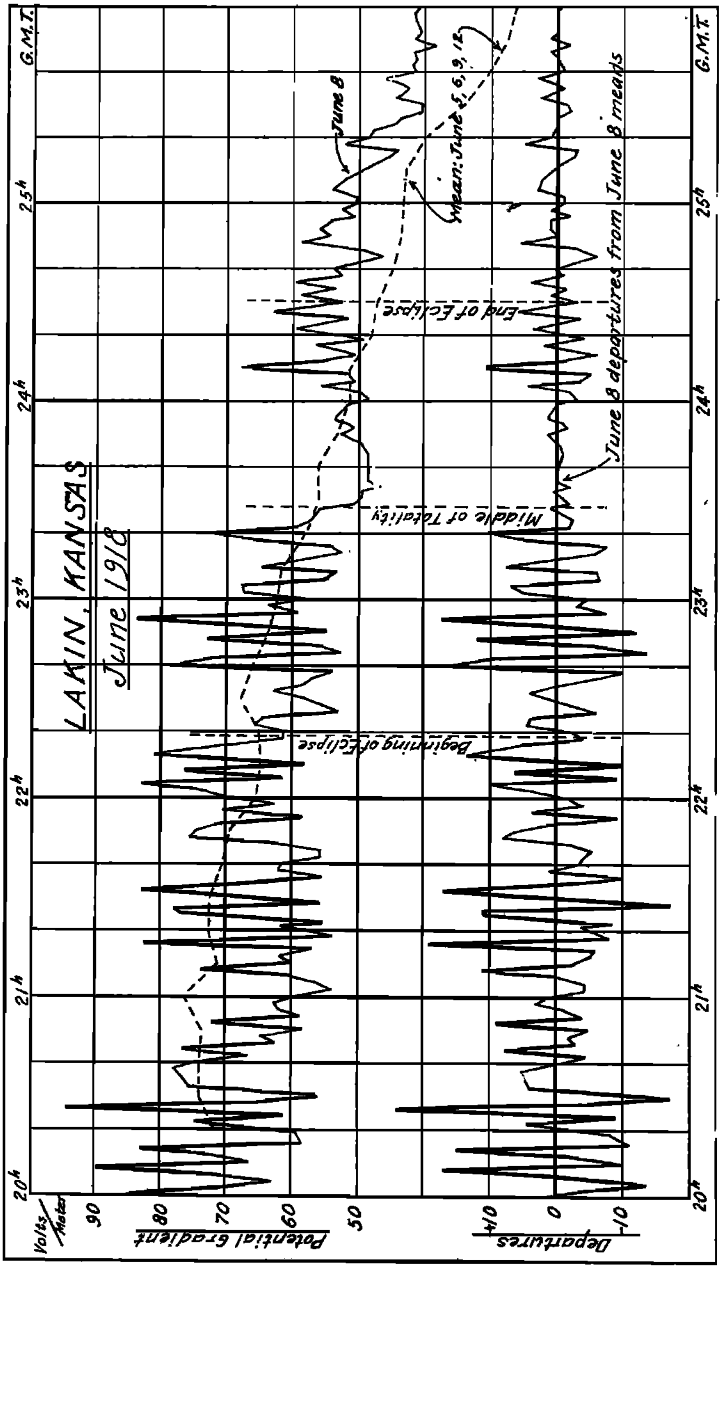

FIG. 20.—Variation of Potential-Gradient at Lakin for Solar Eclipse, June 8, 1918, and Mean Curve.

(2) Another interesting feature of the potential-gradient curve of June 8 is the well-marked diminution in the amplitude of the short period fluctuations observed just preceding, during, and for 20 minutes after totality. To separate this effect from the changes in absolute value, each of the individual potential-gradient observations of June 8 is compared with the mean of 5 observations having the same mean time and formed as follows: Observation 3 is compared with mean of observations 1, 2, 3, 4, and 5; observation 4 with mean of 2, 3, 4, 5, and 6, etc. The lower graph of Fig. 20 shows the departure of each observation from its own reference mean.

94. Not only does a much diminished amplitude accompany the minimum established during and shortly following totality, but both the absolute values and the amplitudes increase together with the disappearance of the eclipse. It is also noteworthy that with approaching sunset, which occurred at $2^h\ 03^m$ Greenwich civil mean time June 9, or $19^h\ 18^m$ local mean time June 8, the progress of both phenomena is very similar to that just preceding, during, and shortly after totality.[1]

Electrical Conductivity.

95. Conductivity observations were made for both λ_+ and λ_- at a station about 80 meters northeast of the potential-gradient station. In order to avoid making alternate observations for λ_+ and λ_- on a single instrument, a separate Gerdien conductivity apparatus was used for each sign. The crank-shaft of each apparatus was provided with a pulley; these pulleys were connected by belts to two larger pulleys on a jack-shaft so that both fans could be driven by one observer and at the same speed. Both instruments were covered by a skeleton roof 6 feet high, which provided shelter for observers and instruments, and prevented the conductivity results from being influenced by the potential-gradient. (See Fig. 23.)

96. Tests showed that determinations of λ could be made with an accuracy of 2 to 3 per cent during so short a period as 2 minutes, and, as frequent determinations were considered more desirable than high accuracy, the two-minute observation period was adopted. The observations on both instruments were made by the same observer, thus preventing the entrance of different personal errors into the λ_+ and λ_- results. The outer case of each

[1] Although attention appears not previously to have been directed thereto, we find evidence of the phenomenon of greatly dimished amplitude during totality and during about 20 minutes immediately thereafter in the photographic record obtained by Elster and Geitel in 1905. *Cf. Terr. Mag.*, vol. 11, p. 15, 1906.

apparatus was connected to earth and the initial potential-difference between inner and outer cylinders was between 57 and 58 volts. The jack-shaft was driven at a speed sufficient to keep the ordinary driving shafts of the instruments at 120 revolutions per minute.[1] With initial potential-difference and speed of fan as given above, Hewlett[2] at the Department of Terrestrial Magnetism found the results of the Gerdien conductivity apparatus to be "free from any error due to lack of ventilation." In general, after a set of 6 two-minute observations had been made on each instrument (total time requirement about 13 minutes) a calibration of the electroscopes was made and each instrument tested for leak. This procedure was followed throughout the afternoons of a number of days before and after the eclipse, and showed very satisfactory behavior of the instruments, while affording control data as well. On June 8, 20 consecutive two-minute observations were made on each instrument during 45 minutes symmetrical about totality. The June 8th conductivity observations were made by A. Thomson. The individual results are shown in Table 31, and together with mean values of λ_+ and λ_- for June 5, 6, 9, and 12, are represented graphically in Fig. 21.

97. It is seen that a large increase in both λ_+ and λ_- occurred just before totality, and that *both* continued abnormally large throughout the period (about 20 minutes) following totality and corresponding to the potential-gradient minimum. These graphs show no sign of a radically different effect for the two conductivities, such as has been suggested on the basis of some results which have been obtained by others. There is a dearth of reliable eclipse-data for conductivity, but Geitel (*l. c.*) found in Algeria on May 28, 1900, an increased conductivity for a considerable period following totality, and Le Cadet, in Spain (1905), concluded that the conductivity diminished with growing obscuration until totality, and then began to increase. However, Le Cadet's observations (*l. c.*) were made under unfavorable weather conditions. In this connection, it is of interest to note that for clouded sky and rain, Knoche and Laub (*l. c.*), in Brazil (1912), found diminution in both λ_+ and λ_- during and following the period of totality. Fig. 22 represents the total conductivity and the air-earth current-density, computed from total conductivity and potential-gradient, for June 8, and corresponding means for June 5, 6, 9, and 12.

[1] Corresponding to 2160 fan-revolutions per minute.

[2] *Cf. Ter. Mag.*, vol. 19, p. 136, 1914.

(*To be continued.*)

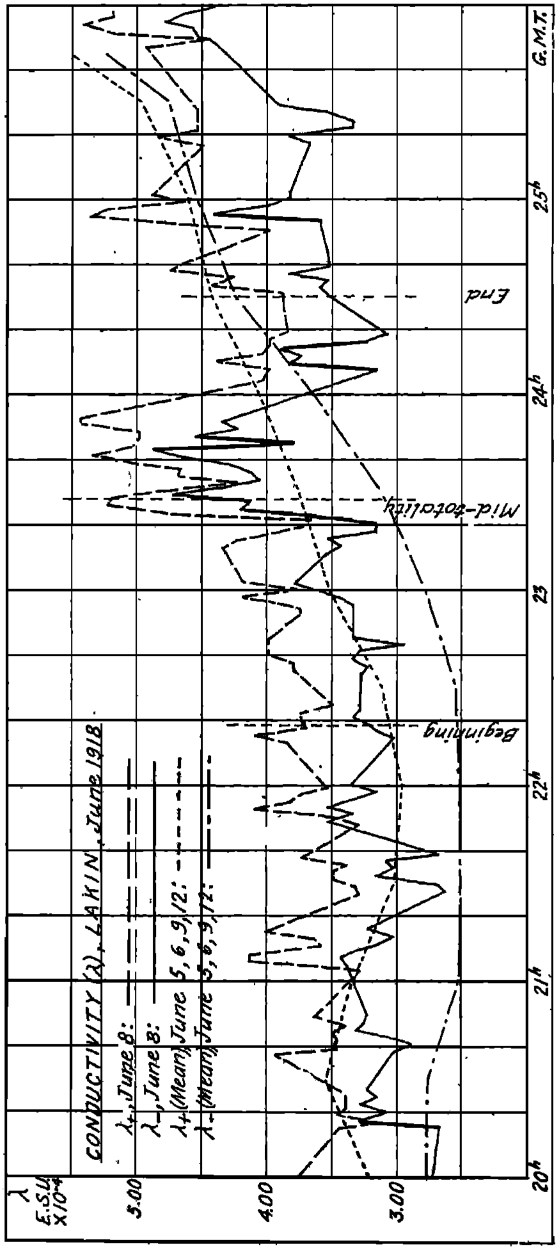

FIG. 21.—Variation of Positive and Negative Conductivities at Lakin for Solar Eclipse, June 8, 1918, and Mean Curves.

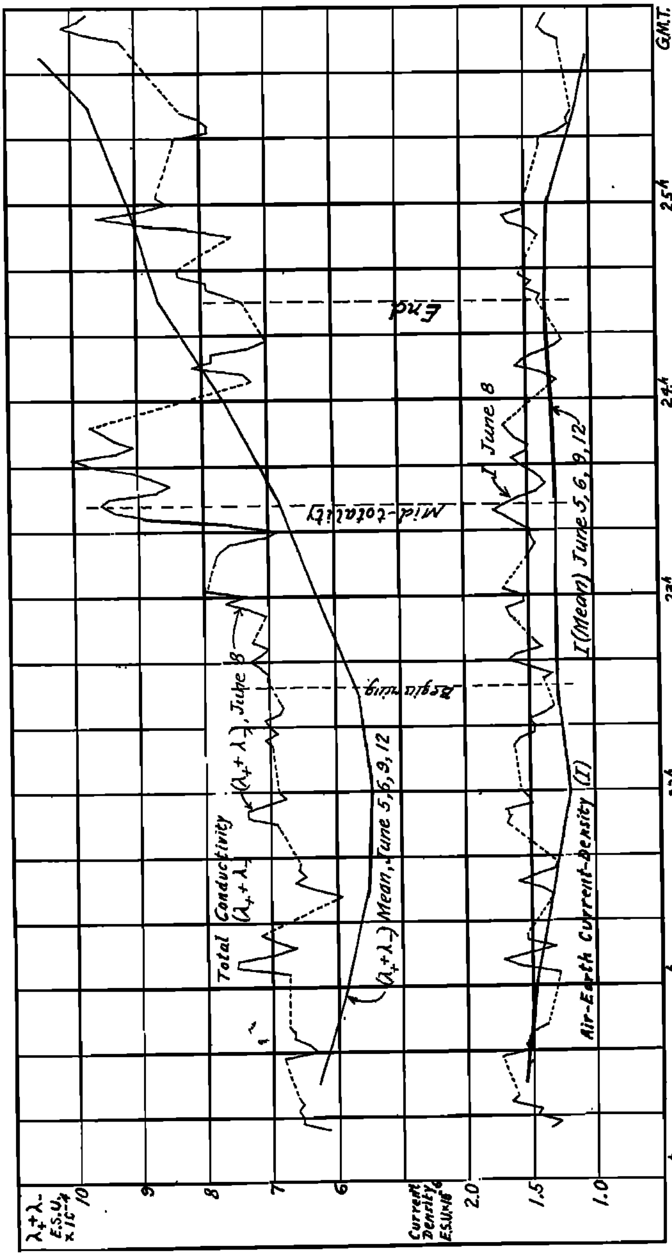

FIG. 22.—Variation of Total Conductivity and Air-Earth Current-Density at Lakin for Solar Eclipse, June 8, 1918, and Mean Curves.