

ON PRECURSORS OF MAGNETIC STORMS.¹

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In the issue of "Nature" of April 28, 1910 (p. 254), the Rev. J. de Moidrey, director of the magnetic observatory at Zi-ka-wei, China, gives some notes on what he has termed the "precursor" of magnetic storms observed by him on the records of his observatory as preceding the magnetic storms which have sudden beginnings. As he asks for further information on the subject from other observatories these notes are submitted.

In defining what he terms "precursors," de Moidrey states "that disturbances with a 'sudden start' very generally have a kind of 'preliminary tremor' some hours before the start; the curve, which we suppose to be quite smooth, is interrupted by a short movement, which lasts but for the remaining hours. The tremor may be very small indeed, but the two characteristics, to be found on a smooth curve, and to be of very short duration, make it very easy to point out and tell the time."

Keeping in mind the above given characteristics of the "precursor," the magnetograms of the United States Coast and Geodetic Survey observatories at Cheltenham, Baldwin, and Honolulu were carefully examined for the disturbances of the corresponding dates given by de Moidrey. These observatories were purposely chosen as being both in higher and lower latitudes than Zi-ka-wei. As the magnetic curves are in general smoother and less disturbed as the equator is approached, it was thought that a favorable comparison could be made by taking stations in both greater and less latitudes than Zi-ka-wei.

The table opposite shows the results of the comparison, the third and fourth columns giving the times of the sudden beginnings of the storms and the times of occurrence of the "precursor" at Zi-ka-wei, the remaining columns giving the times of occurrence of the "precursor" at the station named at the head of the column.

The times given in the table for Cheltenham, Baldwin, and Honolulu were in each case read from one of the curves only, the time being read from the curve where the disturbance best conformed to the appearance that I supposed the precursor should be like. In Nos. 1 and 6 at Baldwin and Honolulu the times given were read from the declination curve, and in Nos. 7 and 24 from the horizontal intensity curve. The time given for Cheltenham in No. 7 was read from the declination curve, and for No. 13 from the horizontal intensity curve. In the case of Nos. 1, 6 and 7 the disturbance was noted on all three elements (D , H and Z), H in general showing the largest deflection and Z the least. No disturbance was noted in the vertical intensity curve in No. 13, nor in No. 24 at Baldwin.

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The twenty-four cases given in the table showed storms with sudden beginnings at Cheltenham, Baldwin, and Honolulu, but it is seen that there were but few instances when anything resembling the "precursor" could be recognized, the best example being No. 7. No. 6 and No. 24 were fair examples, and No. 1 was less defined than the others.

No.	Date	Zi-ka-wei		Cheltenham	Baldwin	Honolulu
		Sudden Starts	Preliminary	$\phi=38^{\circ} 44'.0$ $\lambda=76^{\circ} 50'.5$	$\phi=38^{\circ} 47'.0$ $\lambda=95^{\circ} 10'.0$	$\phi=21^{\circ} 19'.2$ $\lambda=158^{\circ} 03'.8$
	1907	d h m	d h m	d h m	d h m	d h m
1	Jan. 8	8 16 45	8 1 45	None	8 1 50.7	8 1 46.2
2	" 11	11 8 45	10 3 10	"	None	"
3	" 14	14 19 35	14 10 30	"	"	"
4	Feb. 7	7 8 10	6 23 55	"	"	"
5	" 9	9 14 12	.....	.....	.....	.....
6	" 14	14 4 37	13 19 47	"	13 19 59.6	13 19 48.4
7	Mar. 10	10 5 03	9 16 ?	9 13 41.4	9 13 44.0	9 13 56.1
8	" 11	11 17 23	11 13 45	None	No record	None
9	" 21	21 13 33	21 9 50	"	None	"
10	May 18	18 13 58	18 10 52	"	"	"
11	June 3	3 22 55	.....	.....	.....	.....
12	" 18	18 3 42	17 17 20	"	"	"
13	July 10	10 14 23	10 11 00.5	10 10 21.1	"	"
14	" 25	25 4 18	24 14 40	None	"	"
15	" 28	28 0 12	.....	.....	.....	.....
16	Aug. 14	14 15 03	14 11 00	"	"	"
17	" 20	20 2 24	19 13 30	"	"	"
18	" 30	30 7 15	30 5 08	"	"	"
19	Sep. 10	10 1 50	9 15 00.25	"	"	"
20	Oct. 13	13 7 45	13 0 00.5	"	"	"
21	Nov. 21	21 10 45	.....	.....	.....	.....
22	Dec. 4	4 5 45	3 20 57	"	"	"
	1908					
23	Jan. 27	27 13 48	27 0 25	"	"	"
24	Feb. 22	22 12 08	21 19 20	"	21 19 19.5	21 19 18.2

In all of them, except No. 7, the curves show disturbances at other intervals than at the time given, and the disturbances do not stand out alone on otherwise smooth curves as definite impulses, that is, other small disturbances occur before and after the one the time of occurrence of which is given in the table. In the case of No. 7 at Cheltenham, the duration of the preliminary impulse was twenty-two minutes, and its amplitude was two minutes of arc on the declination trace. In making the foregoing comparisons the traces of all three elements, *D*, *H* and *Z*, were examined for each of the twenty-four dates given.

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