STONYHURST COLLEGE
OBSERVATORY.

RESULTS
OF
METEOROLOGICAL AND MAGNETICAL OBSERVATIONS.

1879.

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1880.

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INTRODUCTION.

In the course of the year 1879 no change was made in the daily routine meteorological work of the observatory, except the addition of the synchronous meteorological observations which were requested for the French central office. The usual observations for the Board of Trade, and the observatory series of meteorological readings, which has now been continued uninterruptedly for more than thirty years, were both carried on by the same staff of observers as in previous years. The report drawn up at Stonyhurst on the Climate of Kerguelen, has been published by the Meteorological Committee. Three anemometers were sent out to Manila by request of P. Faura, for the use of his observatory.

The monthly and weekly observations of the earth's magnetic elements, and the photographic records of the variations of the Declination and of the two components of the Intensity, have been continued as usual, and much greater progress has been made than heretofore with the reduction of the curves of the self-registering instruments. This renders it possible to add to this report some preliminary results for the Declination, which will, it is hoped, soon be followed by a more complete treatment of the subject.

The astronomical work of the observatory has been carried on this year with increased energy, and several papers have appeared in the Royal Astronomical Society's monthly notices, and in other scientific publications on the results of the observations of Jupiter's satellites, of the November meteors, and of measures of the chromosphere.

The greatest change this year in the observatory has been the introduction of daily observations of the chromosphere. The large automatic spectroscope, of which mention was made in last year's report, has received numerous additions in the course of the year, which have made it practically serviceable for mapping the solar chromosphere. The instrument returned in its present complete shape from London in October last, and daily observations were started in November. It is encouraging to remark that, even at that season of the year, satisfactory observations of the whole, or of great part, of the chromosphere were made on 11 days in the first month, and on 8 days in the second.

This automatic spectroscope was constructed by Browning, and has received every attention at his hands. It consists of 6 prisms of 60°, and the same screw which enables the observer to sweep slowly or rapidly along the spectrum, adjusts at the same time all the prisms automatically to the minimum angle of deviation. The rapid movement is managed very conveniently by unclamping the slow-motion piece, and thus allowing the nut to run freely on small ivory rollers along the screw. The path of the pencil of light which traverses the slit may be followed very readily. After passing through the collimator, it falls on a prism of total reflection, and is thus sent through the lower half of the dispersing prisms until it meets a second total reflection prism, which sends the pencil of rays into the upper portion of the last dispersing prism, and then through the upper half of all the battery of prisms, till at last the rays fall on the object-glass of the telescope used for examining the spectrum. As the second prism of total reflection is moveable, and can be placed in a moment behind any one of the dispersing prisms, the observer can easily examine an object successively with a dispersing power of two, four, six, eight, ten, or twelve prisms of 60°. A dispersion of eight prisms is generally preferred for the study of the chromosphere, but two prisms are amply sufficient to show the chromosphere and prominences. A micrometer is attached for measuring the distance between the lines of the spectrum, and the method adopted for recording each whole revolution of the screw is simple and very effective. A pin on the inside of the micrometer head moves at each revolution one tooth of the wheel of an auxiliary index, and each time the pin acts a click is heard whilst the index advances one number: the whole revolution can therefore be counted by eye or ear. In observing the varying height of the chromosphere, it is found to be much more convenient to use a photographic scale reading to hundredths of a millimetre, than to employ a spider-line micrometer; a very convenient scale has therefore been photographed by an assistant. As it may be found desirable to try to take photographs of solar prominences, or of certain portions of the spectrum, a small photographic camera has been provided, which can, when required, be screwed into the place generally occupied by the eye-telescope.

The spectroscope is attached to the eye end of the large equatoreal by means of an adapter, provided with two screws at right angles to each other, which allow the observer to place the slit of the spectroscope either radial or tangential to the limb of the sun, whilst the sun's centre is at the centre of the field of the telescope. It is then easy by aid of rack and pinion to sweep round the solar ircumference, and measure the height of the chromosphere and the prominences, without ever removing the sun from the centre of the field. By this means the whole chromosphere is now measured daily, when the sky is clear, between 11 a.m. and 1 p.m. Position-circles are attached to both telescope and spectroscope for reading the angular distance of any prominence from the N. or S. point of the sun's disk.

The alterations and additions made to the spectroscope in the course of the year were in some cases of vital importance. Thus the addition of a rack and pinion to the adapter, and a change in the place of the position-circle, were imperatively necessary; the millimetre scale and the photographic camera are extremely useful, and the various tints of coloured glass and the cylindrical lenses for the eye-piece are needful for experiments.

The readings of the chromosphere taken during the months of November and December, show that the mean height of this solar envelope was then from 5″ to 6″, but on one occasion a prominence was observed which attained the enormous height of 3′ 43″. This last observation showed the necessity of procuring the additional slit for the collimator, by means of which prominences of exceptional dimensions might more readily be measured.

Two of the larger telescopes, one a Cassegrain reflector of 9½ inch aperture, exceedingly well mounted as an altazimuth, the other a 4 inch achromatic with equatoreal mounting, including Right Ascension and Declination circles and slow motion screws, now stand permanently in the grounds adjoining the observatory, and can be used for occasional observations, and also habitually for educational purposes.

S. J. Perry.

Stonyhurst Observatory.

Lat. 53° 50′ 40″ N. Long. 9m. 52s. 68. W. Height of the Barometer above the sea, 381 ft.

METEOROLOGICAL REPORT.

January, 1879.

Results of Observations taken during the month.		Mean for the last 32 years.
Mean Reading of the Barometer	29·613	29·417
Highest ,, on the 27th	30·074	30·007
Lowest ,, on the 3rd	29·080	28·568
Range of Barometer Readings	0·994	1·439
Highest Reading of a Max. Therm. on the 13th and 14th	46·0	51·6
Lowest Reading of a Min. Therm. on the 11th	17·3	21·0
Range of Thermometer Readings	28·7	30·6
Mean of all the Highest Readings	35·9	42·3
Mean of all the Lowest	25·0	33·0
Mean Daily Range	10·9	9·3
Deduced Monthly Mean (from Mean of Max. and Min.)	30·3	37·5
Mean Temperature from dry bulb	30·1	37·6
Adopted Mean Temperature	30·2	37·6
Mean Temperature of Evaporation	28·7	36·2
Mean Temperature of Dew Point	24·2	34·1
Mean elastic force of Vapour	0·130 in	0·199 in
Mean weight of Vapour in a cubic foot of air	1·5gr	2·3gr
Mean additional weight required for saturation	0·5gr	0·4gr
Mean degree of Humidity (saturation 1·00)	0·77	0·86
Mean weight of a cubic foot of air	560·6gr	548·3gr
Fall of Rain	1·532 in	4·205 in
Number of days on which Rain fell	8	20·8
Amount of Evaporation	0·322 in	0·798 in

	N	NE	E	SE	S	SW	W	NW
No. of days in the month on which the prevailing wind was	2	11	10	0	1	3	4	0
Mean Velocity in miles per hour	5·7	5·9	12·3	0	11·7	6·5	7·9	0
Total No. of miles for each Direction	275	1554	2958	0	281	469	754	0

The total number of miles registered during the month was 6291.

The max. Velocity of the wind was 29 miles per hour; direction S. on the 14th at 11 a.m.

Mean amount of Cloud (an overcast sky being indicated by 10·0)				6·9
In the month of January, the highest reading of the Barometer during 32 years, was on the 8th, in 1859, and was				30·310
The lowest	,,	,,	15th, 1865	27·939
The highest Temperature		,,	7th, 1877	59·9
The lowest	,,	,,	13th, 1867	9·2
The highest adopted mean temperature of the month,			1875	42·5
The lowest	,,	,,	1879	30·2

The mean reading of the Barometer for the month is 0·2 of an inch above the average for January, and as the mercury never fell below 29 inches, the range is half an inch less than the mean of the last 32 years.

The adopted mean Temperature, which is the lowest ever recorded for January, is 7°4 below the average for the month, and the Dew point is almost 10° lower than the mean value.

The fall of Rain was exceedingly small, and the number of days on which rain or snow fell was scarcely more than one third of the usual number.

The evaporation was very slight, and the prevailing wind was N.E. by E.

February, 1879.

Results of Observations taken during the month.		Mean for the last 32 years.
Mean Reading of the Barometer	29·075	29·486
Highest ,, on the 26th	29·764	30·079
Lowest ,, on the 10th	28·370	28·680
Range of Barometer Readings	1·394	1·399
Highest Reading of a Max. Therm. on the 9th	50·3	51·6
Lowest Reading of a Min. Therm. on the 22nd	24·8	22·7
Range of Thermometer Readings	25·5	28·9
Mean of all the Highest Readings	40·7	44·0
Mean of all the Lowest	32·4	33·9
Mean Daily Range	8·3	10·1
Deduced Monthly Mean (from Mean of Max. and Min.)	36·2	38·6
Mean Temperature from dry bulb	35·7	38·7
Adopted Mean Temperature	36·0	38·7
Mean Temperature of Evaporation	34·7	36·7
Mean Temperature of Dew Point	32·8	34·9
Mean elastic force of Vapour	0·188 in	0·199 in
Mean weight of Vapour in a cubic foot of air	2·1 gr	2·4gr
Mean additional weight required for saturation	0·4 gr	0·4gr
Mean degree of Humidity (saturation 1·00)	0·88	0·87
Mean weight of a cubic foot of air	543·7 gr	548·3gr
Fall of Rain	2·698 in	3·618 in
Number of days on which Rain fell	21	17·9
Amount of Evaporation	0·383 in	0·804 in

	N	NE	E	SE	S	SW	W	NW
No. of days in the month on which the prevailing wind was	3	8	5	0	2	7	3	0
Mean Velocity in miles per hour	7·3	7·5	7·7	0	10·8	9·4	5·9	0
Total No. of miles for each Direction	524	1436	918	0	516	1586	428	0

The total number of miles registered during the month was 5408.

The max. Velocity of the wind was 30 miles per hour; direction S. at 7 a.m. on the 7th, and N.N.W. at 1 p.m. on the 23rd.

Mean amount of Cloud (an overcast sky being indicated by 10·0)...			9·5
In the month of February, the highest reading of the Barometer during 32 years, was on the 11th, in 1849, and was		....	30·452
The lowest	,,	,, 6th, 1867	28·208
The highest Temperature		,, 8th, 1877	58·3
The lowest	,,	,, 1st, 1855	10·1
The highest adopted mean temperature of the month, 1869		....	44·0
The lowest	,,	,, 1855	28·6

During this month the Barometer was more than half an inch lower than in January, and yet the Rainfall did not reach the average in amount, although the number of days on which rain fell was large.

The Temperature was very much higher than in the preceding month, but it still remained almost 3° below the mean for February. Evaporation still very slight.

Wind almost equally from the N.E. and from the S.W.

March, 1879.

Results of Observations taken during the month.		Mean for the last 32 years.
Mean Reading of the Barometer	29·517	29·455
Highest ,, on the 7th	30·158	30·070
Lowest ,, on the 30th	29·070	28·705
Range of Barometer Readings	1·088	1·365
Highest Reading of a Max. Therm. on the 8th	54·8	56·5
Lowest Reading of a Min. Therm. on the 12th	24·3	23·2
Range of Thermometer Readings	30·5	33·3
Mean of all the Highest Readings	46·5	46·8
Mean of all the Lowest	33·9	34·4
Mean Daily Range	12·6	12·4
Deduced Monthly Mean (from Mean of Max. and Min.)	39·2	39·6
Mean Temperature from dry bulb	39·0	40·0
Adopted Mean Temperature	39·1	39·8
Mean Temperature of Evaporation	37·2	38·0
Mean Temperature of Dew Point	34·7	35·5
Mean elastic force of Vapour	0·202 in	0·206 in
Mean weight of Vapour in a cubic foot of air	2·3gr	2·4gr
Mean additional weight required for saturation	0·5gr	0·5gr
Mean degree of Humidity (saturation 1·00)	0·85	0·85
Mean weight of a cubic foot of air	548·4gr	546·3gr
Fall of Rain	2·511 in	3·151 in
Number of days on which Rain fell	16	18·0
Amount of Evaporation	1·271 in	1·659 in

	N	NE	E	SE	S	SW	W	NW
No. of days in the month on which the prevailing wind was	1	7	4	0	4	9	6	0
Mean Velocity in miles per hour	7·3	15·6	14·1	0	10·2	15·7	10·8	0
Total No. of miles for each Direction	176	2620	1351	0	980	3381	1555	0

The total number of miles registered during the month was 10063.

The max. Velocity of the wind was 40 miles per hour; direction W.S.W. at 11 a.m. on the 12th.

Mean amount of Cloud (an overcast sky being indicated by 10·0)...				8·6
In the month of March, the highest reading of the Barometer during 32 years, was on the 6th, in 1852, and was				30·401
The lowest	,,	,,	31st, 1860	28·199
The highest Temperature		,,	25th, 1871	68·0
The lowest	,,	,,	4th, 1866	14·5
The highest adopted mean temperature of the month,			1871	44·0
The lowest	,,	,,	1855	35·6

This month approaches much nearer the average of previous years than the months immediately preceding it, though the Rainfall is still small. The wind comes equally from the N.E. to the S.W., just as in February; but stronger from both directions. The amount for the month almost equals that of January and February combined.

April, 1879.

Results of Observations taken during the month.		Mean for the last 32 years.
Mean Reading of the Barometer	29·278	29·481
Highest ,, on the 29th	29·916	29·962
Lowest ,, on the 7th	28·504	28·758
Range of Barometer Readings	1·412	1·204
Highest Reading of a Max. Therm. on the 7th	59·9	67·0
Lowest Reading of a Min. Therm. on the 12th	27·5	28·8
Range of Thermometer Readings	32·4	38·2
Mean of all the Highest Readings	50·2	54·1
Mean of all the Lowest	34·6	38·2
Mean Daily Range	15·6	15·9
Deduced Monthly Mean (from Mean of Max. and Min.)	40·9	44·7
Mean Temperature from dry bulb	40·4	44·8
Adopted Mean Temperature	40·7	44·8
Mean Temperature of Evaporation	38·1	41·9
Mean Temperature of Dew Point	34·8	38·8
Mean elastic force of Vapour	0·202 in	0·237 in
Mean weight of Vapour in a cubic foot of air	2·4gr	2·7gr
Mean additional weight required for saturation	0·6gr	0·7gr
Mean degree of Humidity (saturation 1·00)	0·80	0·80
Mean weight of a cubic foot of air	542·2gr	541·6gr
Fall of Rain	1·559 in	2·386
Number of days on which Rain fell	16	15·3
Amount of Evaporation	1·465	2·637

	N	NE	E	SE	S	SW	W	NW
No. of days in the month on which the prevailing wind was	2	15	1	0	4	3	5	0
Mean Velocity in miles per hour	6·0	9·7	7·8	0	11·8	4·7	4·9	0
Total No. of miles for each Direction	288	3477	188	0	1131	337	587	

The total number of miles registered during the month was 6008.

The max. Velocity of the wind was 33 miles per hour; direction S.E. on the 6th, from 1 p.m. till 4 p.m.

Mean amount of Cloud (an overcast sky being indicated by 10·0)...				7·3
In the month of April, the highest reading of the Barometer during 32 years, was on the 22nd, in 1855, and was			... .	30·191
The lowest	,,	,,	20th, 1868	28·358
The highest Temperature		,,	14th, 1852	74·1
The lowest	,,	,,	12th, 1862	24·7
The highest adopted mean temperature of the month,			1865	48·5
The lowest	,,	,,	1879	40·7

The reading of the Barometer for the month is low, and the range large, but the Rainfall continues light. For the first four months of 1879 the total fall of Rain is only 8·300 in. against 13·360 in. for the mean for the same months during 32 years.

There is also a deficiency of heat, the adopted mean temperature being the lowest ever recorded for April. The evaporation is consequently small.

The prevailing wind for the month is the N.E.

May, 1879.

Results of Observations taken during the month.		Mean for the last 32 years.
Mean Reading of the Barometer	29·577	29·521
Highest ,, on the 4th	30·104	29·944
Lowest ,, on the 31st	29·152	28·967
Range of Barometer Readings	0·952	0·977
Highest Reading of a Max. Therm. on the 21st	64·8	71·8
Lowest Reading of a Min. Therm. on the 1st and 9th	30·0	31·4
Range of Thermometer Readings	34·8	40·4
Mean of all the Highest Readings	57·1	59·6
Mean of all the Lowest	39·7	42·2
Mean Daily Range	17·4	17·4
Deduced Monthly Mean (from Mean of Max. and Min.)	46·7	49·2
Mean Temperature from dry bulb	46·6	49·6
Adopted Mean Temperature	46·7	49·4
Mean Temperature of Evaporation	43·4	46·2
Mean Temperature of Dew Point	39·7	42·9
Mean elastic force of Vapour	0·245 in	0·277 in
Mean weight of Vapour in a cubic foot of air	2·9 gr	3·2 gr
Mean additional weight required for saturation	0·8 gr	0·9 gr
Mean degree of Humidity (saturation 1·00)	0·78	0·77
Mean weight of a cubic foot of air	540·9 gr	536·9 gr
Fall of Rain	2·381 in	2·476 in
Number of days on which Rain fell	21	15·5
Amount of Evaporation	1·864 in	3·555 in

	N	NE	E	SE	S	SW	W	NW
No. of days in the month on which the prevailing wind was	1	7	3	0	1	7	8	4
Mean Velocity in miles per hour	7·2	7·9	6·3	0	6·6	7·7	9·5	12·8
Total No. of miles for each Direction	173	1335	457	0	158	1300	1817	1229

The total number of miles registered during the month was 6469.

The max. Velocity of the wind was 33 miles per hour; direction W.N.W. at 1 p.m. on the 15th.

Mean amount of Cloud (an overcast sky being indicated by 10·0)...				7·6
In the month of May, the highest reading of the Barometer during 32 years, was on the 22nd, in 1855, and was				30·124
The lowest	,,	,,	28th, 1877	28·559
The highest Temperature		,,	19th, 1864	82·5
The lowest	,,	,,	4th, 1855	23·5
The highest adopted mean temperature of the month,			1848	55·1
The lowest	,,	,,	1855	45·0

The Barometer agrees well with the mean, but the Thermometer still keeps below the average. The rain fell often but not heavily. The wind was mostly from the West.

June, 1879.

Results of Observations taken during the month.		Mean for the last 32 years.
Mean Reading of the Barometer	29·324	29·521
Highest ,, on the 13th	29·731	29·894
Lowest ,, on the 21st	28·988	29·004
Range of Barometer Readings	0·743	0·890
Highest Reading of a Max. Therm. on the 15th	70·0	76·9
Lowest Reading of a Min. Therm. on the 1st	38·0	39·1
Range of Thermometer Readings	32·0	37·8
Mean of all the Highest Readings	63·7	65·3
Mean of all the Lowest	47·9	48·1
Mean Daily Range	15·8	17·2
Deduced Monthly Mean (from Mean of Max. and Min.)	54·0	54·9
Mean Temperature from dry bulb	53·1	54·7
Adopted Mean Temperature	53·6	54·8
Mean Temperature of Evaporation	50·6	52·1
Mean Temperature of Dew Point	47·7	49·0
Mean elastic force of Vapour	0·330 in	0·358 in
Mean weight of Vapour in a cubic foot of air	3·7gr	3·9gr
Mean additional weight required for saturation	0·9gr	0·9gr
Mean degree of Humidity (saturation 1·00)	0·80	0·79
Mean weight of a cubic foot of air	529·9gr	530·9gr
Fall of Rain	4·794 in	3·772 in
Number of Days on which Rain fell	24	17·4
Amount of Evaporation	3·746 in	3·791 in

	N	NE	E	SE	S	SW	W	NW
No. of days in the month on which the prevailing wind was	0	4	2	2	6	12	4	0
Mean Velocity in miles per hour	0	7·1	8·0	8·2	12·2	9·6	8·2	0
Total No. of miles for each Direction	0	683	382	394	1753	2766	785	0

The total number of miles registered during the month was 6763.

The max. Velocity of the wind was 34 miles per hour; direction S. at 2 and 3 p.m. on the 10th.

Mean amount of Cloud (an overcast sky being indicated by 10·0)...				8·7
In the month of June, the highest reading of the Barometer during 32 years, was on the 15th, in 1874, and was			....	30·219
The lowest	,,	,,	12th, 1862	28·632
The highest Temperature		,,	27th, 1878	87·2
The lowest	,,	,,	30th, 1856	34·2
The highest adopted mean temperature of the month, 1858				59·0
The lowest	,,	,	1856 and 1860	52·2

Barometer low and range rather small.

Temperature only slightly below that of previous years.

Rainfall frequent and heavy; in amount an inch above the mean.

Wind generally S.W. by S.

July, 1879.

Results of Observations taken during the month.		Mean for the last 32 years.
Mean Reading of the Barometer	29·325	29·509
Highest „ on the 28th	29·672	29·881
Lowest „ on the 1st	28·735	29·001
Range of Barometer Readings	0·937	0·880
Highest Reading of a Max. Therm. on the 29th	74·2	78·9
Lowest Reading of a Min. Therm. on the 11th	42·8	42·1
Range of Thermometer Readings	31·4	36·8
Mean of all the Highest Readings	63·2	68·1
Mean of all the Lowest	50·4	51·0
Mean Daily Range	12·8	17·1
Deduced Monthly Mean (from Mean of Max. and Min.)	54·9	57·7
Mean Temperature from dry bulb	54·5	58·0
Adopted Mean Temperature	54·7	57·9
Mean Temperature of Evaporation	52·6	55·1
Mean Temperature of Dew Point	50·6	52·5
Mean elastic force of Vapour	0·368 in	0·396 in
Mean weight of Vapour in a cubic foot of air	4·1 gr	4·5 gr
Mean additional weight required for saturation	0·7 gr	1·0 gr
Mean degree of Humidity (saturation 1·00)	0·86	0·82
Mean weight of a cubic foot of air	527·2 gr	527·1 gr
Fall of Rain	6·789 in	4·051 in
Number of days on which Rain fell	26	17·3
Amount of Evaporation	2·219 in	4·062 in

	N	NE	E	SE	S	SW	W	NW
No. of days in the month on which the prevailing wind was	1	4	2	0	4	11	7	2
Mean Velocity in miles per hour	1·7	5·2	6·2	0	9·5	11·4	13·5	12·0
Total No. of miles for each Direction	41	503	297	0	911	3008	2274	576

The total number of miles registered during the month was 7610.

The max. Velocity of the wind was 34 miles per hour; direction S.S.W. at 2 p.m. on the 2nd.

Mean amount of Cloud (an overcast sky being indicated by 10·0)...		9·5
In the month of July, the highest reading of the Barometer during 32 years, was on the 24th, in 1868, and was	....	30·112
The lowest ,, ,, 15th, 1877	....	28·564
The highest Temperature ,, 22nd, 1873	....	88·2
The lowest ,, ,, 1st, 1857	....	36·0
The highest adopted mean temperature of the month, 1852	....	63·0
The lowest ,, ,, ,, 1879	....	54·7

Mean Barometer still low, and Thermometer again considerably below par, the adopted mean temperature being the lowest on record for July.

Rainfall very heavy, and evaporation small.

Wind W.S.W. by S.

August, 1879.

Results of Observations taken during the month.		Mean for the last 32 years.
Mean Reading of the Barometer	29·346	29·484
Highest ,, on the 31st	29·833	29·889
Lowest ,, on the 28th	28·888	28·953
Range of Barometer Readings	0·945	0·936
Highest Reading of a Max. Therm. on the 12th	77·0	77·1
Lowest Reading of a Min. Therm. on the 31st	41·0	41·6
Range of Thermometer Readings	36·0	35·5
Mean of all the Highest Readings	65·2	67·2
Mean of all the Lowest	49·7	50·9
Mean Daily Range	15·5	16·3
Deduced Monthly Mean (from Mean of Max. and Min.)	55·8	57·4
Mean Temperature from dry bulb	56·0	57·6
Adopted Mean Temperature	55·9	57·5
Mean Temperature of Evaporation	53·2	54·7
Mean Temperature of Dew Point	50·7	52·3
Mean elastic force of Vapour	0·372 in	0·393 in
Mean weight of Vapour in a cubic foot of air	4·2 gr	4·3 gr
Mean additional weight required for saturation	0·8 gr	0·9 gr
Mean degree of Humidity (saturation 1·00)	0·84	0·83
Mean weight of a cubic foot of air	526·3 gr	527·1 gr
Fall of Rain	7·706 in	4·989 in
Number of days on which Rain fell	22	19·8
Amount of Evaporation	2·671 in	3·437 in

	N	NE	E	SE	S	SW	W	NW
No. of days in the month on which the prevailing wind was	0	2	2	1	7	14	5	0
Mean Velocity in miles per hour	0	8·0	6·8	4·0	5·0	13·1	7·1	0
Total No. of miles for each Direction	0	834	327	95	841	4395	847	0

The total number of miles registered during the month was 6889.

The max. Velocity of the wind was 32 miles per hour; direction S.W. at 3 p.m. on the 29th.

Mean amount of Cloud (an overcast sky being indicated by 10·0)...			8·5
In the month of August, the highest reading of the Barometer during 32 years, was on the 21st, in 1874, and was		....	30·114
The lowest	,,	,, 31st, 1876	28·555
The highest Temperature		,, 2nd, 1868	88·0
The lowest	,,	,, 21st, 1864 & 1869	36·0
The highest adopted mean temperature of the month, 1857			61·0
The lowest	,,	,, 1848	52·5

Barometer and Thermometer both rather low. Evaporation keeps small. Wind S.W. Rainfall excessive, the amount being almost double the average. The fall during this and the two preceding months has been 6·5 in. above the mean of these summer months in other years.

September, 1879.

Results of Observations taken during the month.		Mean for the last 32 years.
Mean Reading of the Barometer	29·516	29·504
Highest " on the 1st	30·019	30·038
Lowest " on the 9th	28·843	28·863
Range of Barometer Readings	1·176	1·175
Highest Reading of a Max. Therm. on the 6th	71·0	72·1
Lowest Reading of a Min. Therm. on the 29th	34·0	36·7
Range of Thermometer Readings	37·0	35·4
Mean of all the Highest Readings	60·1	62·2
Mean of all the Lowest	45·0	47·0
Mean Daily Range	15·1	15·2
Deduced Monthly Mean (from Mean of Max. and Min.)	52·6	53·3
Mean Temperature from dry bulb	53·1	54·0
Adopted Mean Temperature	52·9	53·7
Mean Temperature of Evaporation	50·1	51·1
Mean Temperature of Dew Point	47·3	48·5
Mean elastic force of Vapour	0·3268 in	0·342 in
Mean weight of Vapour in a cubic foot of air	3·7gr	3·8gr
Mean additional weight required for saturation	0·84gr	0·8gr
Mean degree of Humidity (saturation 1·00)	0·81	0·82
Mean weight of a cubic foot of air	540·2gr	531·9gr
Fall of Rain	3·401 in	4·666 in
Number of days on which Rain fell	21	18·6
Amount of Evaporation	2·096 in	2·351 in

	N	NE	E	SE	S	SW	W	NW
No. of days in the month on which the prevailing wind was	0	5	2	1	3	9	10	0
Mean Velocity in miles per hour	0	4·1	4·8	13·8	7·1	11·8	8·0	0
Total No. of miles for each Direction	0	492	228	330	509	2542	1926	0

The total number of miles registered during the month was 6027.

The max. Velocity of the wind was 43 miles per hour; direction S. at at 3 p.m. on the 15th.

Mean amount of Cloud (an overcast sky being indicated by 10·0)...				7·3
In the month of September, the highest reading of the Barometer during 32 years, was on the 15th, in 1851, and was			....	30·274
The lowest	,,	,,	22nd, 1863	28·371
The highest Temperature		,,	6th, 1868	85·0
The lowest	,,	,,	6th, 1855	30·7
The highest adopted mean temperature of the month, 1865			....	59·1
The lowest	,,	,,	1863	50·9

Barometer and Thermometer differ little from the mean. Rainfall small. Wind from the W.S.W. by S. A strong south wind on the 15th.

October, 1879.

Results of Observations taken during the month.		Mean for the last 32 years.
Mean Reading of the Barometer	29·707	29·411
Highest ,, on the 8th	30·151	29·987
Lowest ,, on the 20th	28·845	28·658
Range of Barometer Readings	1·306	1·329
Highest Reading of a Max. Therm. on the 5th	62·9	64·7
Lowest Reading of a Min. Therm. on the 15th	28·0	29·9
Range of Thermometer Readings	34·9	34·8
Mean of all the Highest Readings	53·1	54·8
Mean of all the Lowest	40·4	42·4
Mean Daily Range	12·7	12·4
Deduced Monthly Mean (from Mean of Max. and Min.)	46·8	47·6
Mean Temperature from dry bulb	47·5	48·2
Adopted Mean Temperature	47·2	47·9
Mean Temperature of Evaporation	45·1	45·7
Mean Temperature of Dew Point	42·8	43·3
Mean elastic force of Vapour	0·274 in	0·283 in
Mean weight of Vapour in a cubic foot of air	3·2gr	3·2gr
Mean additional weight required for saturation	0·5gr	0·6gr
Mean degree of Humidity (saturation 1·00)	0·86	0·85
Mean weight of a cubic foot of air	542·6gr	537·1gr
Fall of Rain	4·145 in	5·369 in
Number of days on which Rain fell	20	21·6
Amount of Evaporation	2·375 in	1·627 in

	N	NE	E	SE	S	SW	W	NW
No. of days in the month on which the prevailing wind was	1	5	2	0	1	8	12	2
Mean Velocity in miles per hour	4·0	8·2	3·8	0	2·3	7·3	10·2	7·2
Total No. of miles for each Direction	95	987	183	0	55	1398	2926	343

The total number of miles registered during the month was 5987.

The max. Velocity of the wind was 40 miles per hour; direction W.S.W. at noon on the 19th.

Mean amount of Cloud (an overcast sky being indicated by 10·0)...		8·1
In the month of October, the highest reading of the Barometer during 32 years, was on the 6th, in 1877, and was	....	30·282
The lowest ,, ,,	19th, 1862	28·139
The highest Temperature ,,	9th, 1869	72·8
The lowest ,, ,,	21st, 1859	25·2
The highest adopted mean temperature of the month, 1861 and 1876		51·6
The lowest ,, ,,	1850	44·8

Barometer high and Thermometer at par. Rain below and Evaporation above the monthly mean. Wind from W. by S.

November, 1879.

Results of Observations taken during the month.		Mean for the last 32 years.
Mean Reading of the Barometer	29·825	29·457
Highest ,, on the 7th	30·180	30·060
Lowest ,, on the 11th	29·202	28·607
Range of Barometer Readings	0·978	1·453
Highest Reading of a Max. Therm. on the 18th	56·2	55·5
Lowest Reading of a Min. Therm. on the 30th	21·4	25·4
Range of Thermometer Readings	34·8	30·1
Mean of all the Highest Readings	45·0	46·7
Mean of all the Lowest	33·4	36·1
Mean Daily Range	11·6	10·6
Deduced Monthly Mean (from Mean of Max. and Min.)	39·2	41·0
Mean Temperature from dry bulb	39·6	41·1
Adopted Mean Temperature	39·4	41·1
Mean Temperature of Evaporation	37·3	38·7
Mean Temperature of Dew Point	34·6	37·4
Mean elastic force of Vapour	0·201 in	0·223 in
Mean weight of Vapour in a cubic foot of air	2·3gr	2·6gr
Mean additional weight required for saturation	0·5gr	0·4gr
Mean degree of Humidity (saturation 1·00)	0·83	0·86
Mean weight of a cubic foot of air	553·7gr	547·9gr
Fall of Rain	1·316 in	3·988 in
Number of days on which Rain fell	16	19·1
Amount of Evaporation	1·132 in	1·299 in

	N	NE	E	SE	S	SW	W	NW
No. of days in the month on which the prevailing wind was	0	10	0	0	0	10	4	6
Mean Velocity in miles per hour	0	7·8	0	0	0	7·7	12·0	9·3
Total No. of miles for each Direction	0	1875	0	0	0	1857	1149	1342

The total number of miles registered during the month was 6223.

The max. Velocity of the wind was 40 miles per hour; direction W.N.W. on the 12th at 2 a.m.

Mean amount of Cloud (an overcast sky being indicated by 10·0)...				6·5
In the month of November, the highest reading of the Barometer during 32 years, was on the 12th, in 1857, and was			....	30·350
The lowest	,,	,,	1st, 1859	28·007
The highest Temperature		,,	6th, 1872	61·9
The lowest	,,	,,	17th, 1861	19·1
The highest adopted mean temperature of the month, 1877.........				44·2
The lowest	,,	,,	1851.........	36·7

Barometer very high, but range small as the mercury never fell below 29·2 in. Temperature low. Rainfall only one-third of the average for the month. Strongest Winds from the W., but frequent milder Winds from the N.E.

December, 1879.

Results of Observations taken during the month.		Mean for the last 32 years.
Mean Reading of the Barometer	29·842	29·450
Highest ,, on the 12th	30·338	30·056
Lowest ,, on the 31st	29·054	28·615
Range of Barometer Readings	1·284	1·441
Highest Reading of a Max. Therm. on the 28th	54·2	52·9
Lowest Reading of a Min. Therm. on the 4th	12·0	20·2
Range of Thermometer Readings	42·2	32·7
Mean of all the Highest Readings	39·3	42·8
Mean of all the Lowest	26·8	33·4
Mean Daily Range	12·5	9·4
Deduced Monthly Mean (from Mean of Max. and Min.)	33·1	38·1
Mean Temperature from dry bulb	33·2	38·5
Adopted Mean Temperature	33·2	38·3
Mean Temperature of Evaporation	31·8	37·4
Mean Temperature of Dew Point	28·2	35·4
Mean elastic force of Vapour	0·154 in	0·209 in
Mean weight of Vapour in a cubic foot of air	1·8 gr	2·4 gr
Mean additional weight required for saturation	0·5 gr	0·4 gr
Mean degree of Humidity (saturation 1·00)	0·79	0·88
Mean weight of a cubic foot of air	568·5 gr	547·7 gr
Fall of Rain	3·563 in	4·406 in
Number of days on which Rain fell	14	20·3
Amount of Evaporation	1·307 in	0·927 in

	N	NE	E	SE	S	SW	W	NW
No. of days in the month on which the prevailing wind was	6	9	1	2	4	7	2	0
Mean Velocity in miles per hour	3·2	4·5	8·6	3·9	8·1	16·0	5·5	0
Total No. of miles for each Direction	458	969	207	186	773	2686	263	0

The total number of miles registered during the month was 5542.

The max. Velocity of the wind was 41 miles per hour; direction W. on the 30th at 5 p.m.

Mean amount of Cloud (an overcast sky being indicated by 10·0)...				6·2
In the month of December, the highest reading of the Barometer during 32 years, was on the 22nd, in 1849, and was			....	30·378
The lowest	,,	,,	5th, 1876	28·028
The highest Temperature		,,	9th, 1876	58·1
The lowest	,,	,,	24th, 1860	6·7
The highest adopted mean temperature of the month,			1857	44·6
The lowest	,,	,,	1878	30·3

Barometer slightly higher even than last month, and Thermometer much below the mean. Rainfall small. Evaporation above the average. S.W. Winds predominated.

Summary of the Observations

FOR 1879.

		Mean for the last 32 years.
Mean Reading of the Barometer	29·495	29·478
Highest „ on December 12th	30·338	30·281
Lowest „ on February 10th	28·370	28·276
Range of Barometer Readings	1·968	2·005
Highest Reading of a Max. Therm. on August 12th	77·0	81·7
Lowest Reading of a Min. Therm. on December 4th	12·0	15·7
Range of Thermometer Readings	65·0	66·0
Mean of all the Highest Readings	51·7	54·6
Mean of all the Lowest	38·3	40·9
Mean Daily Range	13·4	13·7
Deduced Yearly Mean (from Mean of Max. and Min.)	44·1	46·7
Mean Temperature of dry bulb	44·1	46·9
Adopted Mean Temperature	44·1	46·8
Mean Temperature of Evaporation	41·9	44·6
Mean Temperature of Dew Point	39·0	42·1
Mean elastic force of Vapour	0·249 in	0·276 in
Mean weight of Vapour in a cubic foot of air	2·9gr	3·2gr
Mean additional weight required for saturation	0·6gr	0·7gr
Mean degree of Humidity (saturation 1·00)	0·82	0·84
Mean weight of a cubic foot of air	535·4gr	538·5gr
Total Fall of Rain in the Year	42·395 in	47·432 in
Number of days per Month on which Rain fell	18·8	18·5
Amount of Evaporation	20·851 in	27·059 in

The Maximum monthly mean height of the Barometer was in March 1854, and was ... 29·861

The Minimum „ „ in December 1868, and was ... 28·984

The Maximum yearly mean height of the Barometer was in 1858, and was ... 29·544

The Minimum „ „ „ „ in 1866, and was ... 29·389

The greatest monthly range of the Barometer was in November, 1859, and was		2·290
The least ,, ,,	in July, 1852, and was	0·505
The highest reading of the Barometer, during 32 years, was on February 11th, 1849, and on March 4th, 1854, and was		30·452
The lowest ,, ,,	on July 22nd, 1873, and was	27·939
Extreme range		2·513
The highest temperature was on July 15th, 1868, and was		88·2
The lowest ,, ,,	December 24th, 1860	6·7
The highest adopted mean temperature of a month, July 1868		62·4
The lowest ,, ,,	February, 1855	28·6
The highest adopted mean temperature of a year, 1868		49·1
The lowest ,, ,, ,, ,,	1879	44·1
The greatest monthly mean weight of vapour, in a cubic foot of air	July, 1852	5·1
The least ,, ,, ,,	February, 1855	1·4
The greatest fall of rain in a month, was in October, 1870, and was		13·437 in
The least ,, ,,	May, 1853, and May, 1859	0·3
The greatest number of days on which rain fell in one month	July, 1861, December, 1868	31
The least ,, ,,	March, 1852	3
The greatest fall of rain in 24 hours was on November 16, 1866, and was		3·893

The adopted mean temperature of the year is the lowest ever recorded; that of 1855, which was the previous minimum, is 0·5 higher than the mean for 1879. The months of April and July contributed largely to this result, having mean temperatures 4·1 and 3·2 respectively below the averages for these months. Only two months of the year were entirely free from frost, viz., July and August.

The Rainfall was 5 inches less than the mean of previous years, and the evaporation less by rather more than 6 inches. The heavy rains, with one single exception, fell during the four summer months, June to September, and most of the electric storms occurred in June, July, and August.

DATES OF OCCASIONAL PHENOMENA.

1879.	Frost.	Hoar frost only.	Snow.
January	1—13, 15, 31	2, 4—7, 9, 12, 16, 17, 20, 23, 26, 28	3, 11, 18
February	1—4, 8, 11, 12, 16—26, 28	11, 25	1, 2, 18—21, 23, 24
March	1, 3, 7, 8, 10, 12—14, 16, 17, 20—27, 29, 30	1, 8	14, 25—27
April	1, 4, 6, 10—13, 16—18, 21, 24, 25	2, 12, 13, 14, 18, 19, 22	12, 16
May	1—4, 6, 9	2—4, 10, 12, 15	1, 6, 7
June	4	5	
July			
August			
September	28, 29	29, 30	
October	14, 15, 17, 31	16, 18, 21, 26, 28	
November	1—3, 10, 12, 15, 21—30	2, 3, 14, 15, 24, 29, 30	20, 21, 22, 26
December	1—13, 16, 27, 29, 30	1—6, 8, 11—13, 19, 23, 27	1, 2, 5, 30

1879.	Hail.	Heavy rain.	Fog.	Lightning.	Thunder.	Lunar Halo.	Solar Halo.
January			13, 16			1, 2	16
February	2, 5, 17 (soft)		9—11, 16, 27, 28			8	
March			1, 7		30		
April	17	8					
May	1, 7, 10, 14		21, 27	20	14, 20		
June	3, 29	3, 11, 24, 25		8, 9, 12, 21, 29	3, 8, 9, 12, 21, 25, 29		
July		19, 29		8, 29	8, 9, 29		
August	17, 22, 31	22, 23, 25, 30, 31	2	13, 17, 21, 22, 30	13, 22, 23, 25, 30		
September	25	7, 9, 25	29	7	7	23	24
October	25		6—9, 23, 29				
November	11		7, 18				
December	30		8, 16, 18			22	

AGRICULTURAL NOTES.

JANUARY.—Owing to the severity of the weather all agricultural work has been at a standstill.

FEBRUARY.—The greater part of the month has been exceedingly cold. and there has been very little tillage in consequence. The ploughing, in preparation for oats, during the first week had to be suspended.

MARCH.—Still very cold and frosty, yet the ploughing had to be done. and oat sowing commenced during the last week.

APRIL.—Cold still severe. Oats were all sown before the end of the first week, and most of the green crops by the end of the month. Everything late; grass looking quite brown. A few early flowers were in blossom towards the middle of the month.

MAY.—During the first half of the month, weather cold with frost at night; afterwards more genial. Woods leafless, but large quantities of blossom on the fruit trees gave good promise. Moisture sadly wanted for the grass.

JUNE.—Rain came at last, but little sun. Vegetation very backward. Grass poor. Potatoes late, and showing symptoms of disease. Stone-fruit good. Apples and pears sadly in want of sun, the newly-formed fruit falling off rapidly.

JULY.—Wet and cold. Wheat and oats looked bad. Grass cut on the 7th; crop below average. Strawberries ripe towards end of month, but few in number, and inferior in quality. Peas and beans scarce. Early potatoes very small, and diseased. Fruit generally very poor. The worst season for years. Very little hay as yet housed.

AUGUST.—Still very wet. No grain; and much grass as yet to cut. Gooseberries rather fewer than usual; currants fair; apples and pears small and few. Green crops greatly in need of warmth.

September.—Weather more favourable, but still wet. Oats and wheat cut on the 11th; oats slightly, and wheat very much, below par as to quality, but oats a very heavy crop, and wheat fairly plentiful.

October.—Wheat and oats mostly got in by end of second week, and potatoes towards end of month. Champion potatoes very good both in quantity and quality; others badly diseased. Plums fair. Peaches and apricots failed generally. Green crops small.

November.—The green crops were all housed by the end of the first week. Wheat was sown during the second week. Sharp frost during great part of month.

December.—Frost too severe for out-door work.

OBSERVATIONS OF CROPS AND FLOWERS.

GRAIN, ETC.					GREEN CROPS.				FLOWERS.	
Name.	When sown.	In Flower.	In Ear.	When cut.	Name.	When sown.	Above grnd.	Stored.	Name.	In Blossom.
Wheat	Nov. 11th	June 22nd	July 10th	Sep. 11th	Potatoes	April	May 23rd	Oct. 23rd	Anemone	Ap. 20th
Oats	Mar. 29th	June 20th	July 11th	Sep. 11th	Turnips	,,	May 25th	Nov. (first week)	Wild Hyacinth	May 24th
Beans	Mar. 3rd	June 14th		Aug. 15th	Beet	,,	May 23rd	Nov. ,,	Primrose	Ap. 20th
Peas	Mar. 1st	June 9th		July 23rd	Mangel	,,	May 23rd	Nov. ,,	Renunculus	Ap. 20th
					Onions	,,	May 2nd	Oct. 20th	Wood Violet	May 14th
									May Flower	May 23rd
									Jonquil	May 14th
									Snowdrop	Feb. 12th
									Crocus	Mar. 15th
									Daffodil	Ap. 18th
									Forget-me-not	May 23rd
									Monkshood	July 16th
									Sweet William	July 15th

OBSERVATIONS OF TREES AND SHRUBS.

FOREST TREES, ETC.				FRUIT TREES, ETC.			SHRUBS.		
Name.	In Bud.	In Leaf.	Divested of Leaves.	Name.	In Blossom.	Ripe.	Name.	In Blossom.	Divested of Leaves.
Field Elm	May 16th	May 24th	Nov. 10th	Apple	May 21st	Sept. 19th	Lilac	June 3rd	Oct. 30th
Oak	May 21st	June 2nd	Nov. 19th	Pear	May 5th	Aug. 25th	Privet	Aug. 15th	Nov. 5th
Sycamore	Ap. 20th	May 5th	Oct. 19th	Cherry	Ap. 28th	Aug. 3rd	Syringa	May 18th	Oct. 30th
Plane	Ap. 20th	May 5th	Oct. 21st	Peach	Ap. 20th	none	Laburnum	May 28th	Oct. 28th
Lime	Ap. 16th	May 8th	Oct. 19th	Red Currant	Ap. 20th	Aug. 3rd	Red Flowering Currant	Ap. 26th	Nov. 23rd
Hawthorn	May 2nd	June 15th	Nov. 5th	White Currant	Ap. 25th	Aug. 3rd			
Hazel	Ap. 22nd	May 14th	Nov. 2nd	Black Currant	Ap. 28th	Aug. 8th			
Ash	May 16th	June 5th	Nov. 5th	Strawberry	May 26th	July 20th			
Beech	Ap. 14th	May 16th	Oct. 25th	Gooseberry	Ap. 24th	Aug. 30th			
Horse Chesnut	Ap. 18th	May 16th	Nov. 3rd	Plum	May 5th	Oct. 20th			
				Apricot	Ap. 7th	none			

OBSERVATIONS OF UPPER CLOUDS (CIRRUS).

Date.	G. M. T.	Cloud Direction.	Velocity.	Wind. Direction.	Wind. Force (0-12).
January 1	Noon.	W.	5	W.	1
,, 8	10 a.m.	S.S.E.	3	E.	4
,, 16	4 p.m.	W. by N.		N.N.E.	1
,, 17	9 a.m.	W.		N.N.E.	0
,, ,,	10 a.m.	W.		N.N.E.	0
February 8	4.30 p.m.	S.W. by W.	5	S.W.	2
,, 22	9 a.m.	S.S.E.	1	E.	0
,, 25	Noon.	N. by W.	1	N.	2
March 13	9 a.m.	N.N.W.	3	S.S.W.	1
,, 23	Noon.	S.E. by E.	2	N.E.	5
,, 29	8 a.m.	W. by N.	3	S.W.	2
,, 30	9 a.m.	S. by W.	1	S.	4
April 1	6 p.m.	S.W.	3	W.	1
,, 2	7 a.m.	S.S.W.	2	W.N.W.	0
,, ,,	8 a.m.	S. by W.	2	W.N.W.	0
,, ,,	9 a.m.	S.S.W.	1	S. by W.	0
,, ,,	10 a.m.	S.W. by W.	1	S.W. by S.	1
,, 4	6 p.m.	W. by S.	1	W.	1
,, 7	6 p.m.	E.S.E.	3	S.E. by E.	1
,, 8	6 p.m.	S. by E.	2	S. by E.	0
,, 19	7 p.m.	S.W.	2	S.E. by E.	2
May 5	3.30 p.m.	W.N.W.	3	W. by S.	4
,, ,,	5 p.m.	N.	1	W. by S.	4
,, ,,	6 p.m.	N. by W.	1	S.W. by W.	2
,, 13	5.30 p.m.	S.S.W.	1	W.	1
,, 16	5 p.m.	N. by W.	2	W.	2
,, 23	5 p.m.	N.W.	3	W. by N.	4
,, 28	6 p.m.	S.S.E.	3	N.E.	1
,, 30	6 p.m.	N.E. by N.	3	W.	1
June 10	4 p.m.	S. by E.	1	N.W.	1
,, 11	7 a.m.	S.S.W.	1	N.N.E.	1
,, ,,	8 a.m.	S. by W.	1	N.E.	1
,, 19	7 a.m.	S.W. by S.	1	N.N.E.	0
,, ,,	8 a.m.	S.W.	1	S.E.	1
,, 20	8.30 p.m.	W.	5	S.W.	1
,, 24	10 a.m.	E.S.E.	3	W.S.W.	3
,, 29	7 p.m.	S.S.W.	2	S.W.	3
,, 30	6 p.m.	W.	3	S.W.	2
July 3	2 p.m.	S.W. by W.	2	W.S.W.	3
,, ,,	8 p.m.	W.N.W.	3	S.W.	2

OBSERVATIONS OF UPPER CLOUDS (*Continued*).

Date.		G. M. T.	Cloud Direction.	Velocity.	Wind. Direction.	Force (0-12).
July	17	4 p.m.	N. by E.	1	N.N.E.	1
,,	30	2 p.m.	N.W.	1	W.S.W.	1
,,	,,	6 p.m.	W.S.W.	2	S.W.	1
August	2	4 p.m.	S.	1	N.N.E.	1
,,	8	2 p.m.	S. by W.	3	W. by N.	2
,,	12	6 p.m.	S.E. by E.	1	E. by N.	1
Sept.	2	Noon.	W.S.W.	2	S.W.	4
,,	,,	1.30 p.m.	S.W. by W.	2	S.W.	3
,,	,,	6 p.m.	S.W.	3	S.W. by S.	2
,,	4	7 a.m.	W. by S.	1	E.N.E.	0
,,	,,	8 a.m.	S.W. by W.	1	N.N.W.	0
,,	,,	10 a.m.	W.S.W.	1	N. by E.	0
,,	,,	Noon.	W. by S.	2	N.	0
,,	18	8 a.m.	W.	1	N.E. by N.	0
,,	22	5 p.m.	W.S.W.	2	S.W. by W.	1
,,	24	7 a.m.	S.	3	N. by E.	1
,,	,,	9 a.m.	S.S.W.	3	N.N.E.	0
,,	30	7.30 a.m.	S.W. by S.	2	N.E. by N.	1
October	6	5 p.m.	S. by E.	1	S.W.	0
,,	17	7 a.m.	W. by N.	3	W. by S.	5
,,	18	8 a.m.	N.	3	N.W. by N.	1
,,	19	10.45 a.m.	W.S.W.	2	W. by S.	7
,,	27	4.30 p.m.	E.	1	N.E.	2
Nov.	7	9.15 a.m.	W.S.W.	2	W. by N.	1
,,	,,	10 a.m.	N.W.	2	S.W. by W.	0
,,	,,	2 p.m.	W.N.W.	1	W.S.W.	1
,,	,,	4 p.m.	W.N.W.	2	W. by N.	0
,,	,,	4.30 p.m.	W.S.W.	3	W. by N.	0
,,	12	10 a.m.	W.N.W.	3	W. by N.	2
,,	,,	11 a.m.	N.W.	4	N.N.W.	2
,,	14	Noon.	N.E.	3	N.E.	0
,,	,,	3.30 p.m.	N.	1	E. by N.	0
Dec.	12	Noon.	N.N.W.	1	N.N.E.	1
,,	,,	4 p.m.	N.	2	N.N.E.	1
,,	13	Noon.	N.E.	2	N. by W.	1
,,	,,	2 p.m.	N.E.	1	W.S.W.	1
,,	25	2 p.m.	N.	1	S.S.E.	0
,,	26	1 p.m.	W.	2	S.E. by S.	1
,,	29	3.30 p.m.	S.E.	3	S.W.	3

Monthly Magnetical Observations taken at the College Observatory, Stonyhurst, 1879.

THE Horizontal, Vertical, and Total forces are calculated to English measure; one foot, one second of mean solar time, and one grain being assumed as the units of space, of time, and of mass.

The Vertical and Total forces are obtained from the absolute measures of the Horizontal force and of the Dip.

In the observations of Deflection and Vibration, taken each month for absolute measure of Horizontal force, the same magnet has always been employed.

The moment of inertia of the magnet with its stirrup, for different degrees of temperature, and the co-efficients in the corrections required for the effects of temperature and of terrestrial magnetic induction on the magnetic moment of the magnet, were determined at the Kew Observatory by the late Mr. Welsh.

The moment of inertia of the magnet with its stirrup, using the grain and foot as the units of mass and of linear measure, is 5·27303. Its rate of increase for increase of temperature is 0·00073 for every 10 of Fahr.

The weight of the magnet with its stirrup is approximately 825 grains, and the length of the magnet is nearly 3·94 inches. The moment of inertia was determined, independently of the weight and dimensions, by the method of vibration, with and without a known increase of the moment of inertia.

The temperature corrections have always been obtained from the formula $q(t^{\circ}-35^{\circ})+q'(t^{\circ}-35^{\circ})^2$, where t° is the observed temperature and 35° Fahr. the adopted standard temperature. The values of the co-efficients q and q' are respectively ·0001128 and 0·000000436.

The induction co-efficient μ is 0·000244.

The correction for error of graduation of the Deflection bar at 1·0 foot is +0·00004 ft., at 1·3 + 0·000064 ft.

The observed times of vibration are entered in the Table without corrections.

The time of one vibration has been obtained each month from the mean of twelve determinations of the time of 100 or of 200 vibrations.

The angles of deflection are each the mean of two sets of readings.

In deducing from these observations the ratio and product of the magnetic moment m of the magnet, and the earth's horizontal magnetic intensity X, the induction and temperature corrections have always been applied, and the observed time of vibration has been corrected for the effect of torsion of the suspending thread; but no correction has been required for the rate of the chronometer, or for the arc of vibration, the former having been always under 3″·5, and the latter never over 50′.

The average deflection of the magnet caused by a twist of the torsion circle through 90°, has been about 8′·0 of arc.

In the calculations of the ratio $\frac{m}{X}$, the third and subsequent terms of the series $1 + \frac{P}{r^2} + \frac{Q}{r^4} + \&c.$, have always been omitted.

The adopted value of the constant P is 0·0055035.

The Declination observations have been taken once a week. Each reading has been corrected by the photographic curves for all irregular disturbances, as well as for daily and monthly range.

OBSERVATIONS OF DEFLECTION FOR ABSOLUTE MEASURE OF HORIZONTAL FORCE.

Month.	G. M. T.	Distances of centres of Magnets.	Temperature.	Observed Deflection.	Log $\frac{m}{X}$
	D. H. M.	FOOT.	°	° ′ ″	
January ...	29th 4 5 p.m.	1·0	35·1	13 46 58	9·07830
	,, 4 32 p.m.	1·3	36·7	6 15 15	9·07931
February...	28th 10 41 a.m.	1·0	43·1	13 47 38	9·07914
	,, 11 4 a.m.	1·3	44·3	6 15 13	9·07976
March ...	29th 9 22 a.m.	1·0	49·0	13 47 47	9·07961
	,, 9 49 a.m.	1·3	50·0	6 12 10	9·07661
April	25th 11 47 a.m.	1·0	48·4	13 48 26	9·07990
	,, 12 13 p.m.	1·3	48·6	6 14 18	9·07898
May	28th 8 25 a.m.	1·0	52·1	13 45 46	9·07878
	,, 8 50 a.m.	1·3	52·9	6 14 6	9·07905
June	18th 12 2 p.m.	1·0	61·2	13 47 40	9·08040
	,, 12 28 p.m.	1·3	62·4	6 15 14	9·08102
July.........	21st 9 54 a.m.	1·0	59·7	13 46 35	9·07973
	,, 10 51 a.m.	1·3	59·9	6 13 46	9·07915
August ...	30th 11 50 a.m.	1·0	60·4	13 46 11	9·07958
	,, 12 11 p.m.	1·3	60·3	6 13 30	9·07887
September.	24th 11 33 a.m.	1·0	51·5	13 46 28	9·07910
	,, 11 58 a.m.	1·3	52·0	6 14 8	9·07902
October ...	14th 10 59 a.m.	1·0	55·2	13 43 56	9·07805
	,, 11 20 a.m.	1·3	56·6	6 13 6	9·07812
November.	12th 9 50 a.m.	1·0	56·8	13 44 20	9·07828
	,, 10 11 a.m.	1·3	57·6	6 12 58	9·07803
December.	20th 12 13 p.m.	1·0	50·6	13 45 31	9·07854
	,, 12 30 p.m.	1·3	47·5	6 12 55	9·07731

m represents the Magnetic moment of the Deflecting Magnet.
X represents the Earth's Horizontal Magnetic Intensity.

VIBRATION OBSERVATIONS FOR ABSOLUTE MEASURE OF HORIZONTAL FORCE.

Month.	G. M. T.	Temperature.	Time of one vibration.	Log m X	Value of m.
	D. H. M.	°			
January ...	29th...10 52 a.m.	30·8	5·66764	0·20750	0·43950
February...	28th...12 15 p.m.	43·6	5·67946	0·20614	0·43934
March	28th... 8 35 a.m.	32·6	5·67429	0·20681	0·43899
April	25th... 9 38 a.m.	41·5	5·68167	0·20611	0·43932
May.........	27th... 9 46 a.m.	51·2	5·67996	0·20683	0·43942
June	18th...11 11 a.m.	59·0	5·69054	0·20606	0·43993
July.........	21st ... 8 55 a.m.	57·9	5·68508	0·20662	0·43958
August ...	30th...10 52 a.m.	58·8	5·68496	0·20666	0·43948
September.	24th... 9 42 a.m.	48·8	5·68700	0·20572	0·43892
October ...	15th...10 6 a.m.	57·3	5·68823	0·20618	0·43867
November.	12th... 8 54 a.m.	59·1	5·68033	0·20744	0·43934
December.	20th...11 5 a.m.	48·0	5·67993	0·20674	0·43887

Dip Observations.				Magnetic Intensity.		
Month.	G. M. T.	Needle.	Dip.	X, or Horizontal Force.	Y, or Vertical Force.	Total Force.
	D. H. M.		° ′ ″			
January ...	30th...10 34 a.m.	1	69 23 12	3·6673	9·7425	10·4099
	,, ...11 13 a.m.	3	69 21 30			
February .	27th...10 48 a.m.	1	69 19 44	3·6589	9·7150	10·3812
	,, ...11 15 a.m.	3	69 23 47			
March ...	28th...11 10 a.m.	1	69 21 3	3·6674	9·7157	10·3942
	,, ...11 55 a.m.	3	69 19 43			
April	26th...10 59 a.m.	1	69 18 58	3·6588	9·7057	10·3726
	,, ...11 38 a.m.	3	69 22 28			
May	29th...10 45 a.m.	1	69 19 57	3·6641	9·7082	10·3766
	,, ...11 25 a.m.	3	69 18 45			
June	17th...11 4 a.m.	1	69 18 43	3·6532	9·6802	10·3466
	,, ...12 10 p.m.	3	69 20 9			
July	22nd..10 55 a.m.	1	69 22 55	3·6610	9·7362	10·4018
	,, ...11 40 a.m.	3	69 24 15			
August ...	29th...11 22 a.m.	1	69 19 14	3·6620	9·6928	10·3615
	,, ...12 5 p.m.	3	69 17 8			
September	27th...11 22 a.m.	1	69 26 2	3·6588	9·7273	10·3926
	,, ...11 59 a.m.	3	69 20 25			
October...	16th...10 35 a.m.	1	69 21 17	3·6648	9·7256	10·3932
	,, ...11 25 a.m.	3	69 21 2			
November	13th...11 15 a.m.	1	69 20 30	3·6699	9·7353	10·4040
	,, ...12 10 p.m.	3	69 20 59			
December	22nd..10 2 a.m.	1	69 24 44	3·6678	9·7488	10·4159
	,, ...10 56 a.m.	3	69 21 6			
	Means.		69 21 9	3·6628	9·7194	10·3875

DECLINATION OBSERVATIONS.

Month.	G. M. T.	Uncorrected. Observation.	Uncorrected. Monthly Mean.	Corrected. Observation.	Corrected. Monthly Mean.
	D. H. M.	° ′ ″	° ′ ″	° ′ ″	° ′ ″
January ...	6th... 9 4 a.m.	20 32 20		20 32 37	
	14th... 9 0	33 23		33 6	
	20th... 9 8	36 40		37 49	
	28th... 9 1	32 43	20 33 47	33 52	20 34 31
February..	3rd .. 9 6	33 37		33 54	
	11th... 9 0	29 56		30 13	
	17th... 9 8	33 49		35 45	
	24th... 8 58	27 55	20 32 4	29 55	20 32 27
March ...	5th... 9 3	34 2		36 30	
	11th... 8 59	28 10		29 36	
	17th... 8 56	32 4		33 56	
	24th... 9 10	32 7	20 31 30	33 33	20 33 4
	31st... 9 2	30 36		31 45	
April	7th... 9 7	28 58		31 26	
	15th... 9 4	28 31		31 57	
	22nd.. 8 56	29 5		32 49	
	28th... 9 4	31 35	20 29 10	32 44	20 31 40
May	4th... 9 4	27 41		29 24	
	12th... 9 2	26 56		28 56	
	18th... 9 14	29 42		30 25	
	25th... 9 6	29 7	20 27 48	30 33	20 29 50
June	4th... 9 4	26 24		27 33	
	11th... 8 59	28 16		31 8	
	16th... 9 9	24 38		26 21	
	25th... 9 5	32 20	20 27 55	33 53	20 29 44
July	1st... 9 13	35 1		34 27	

DECLINATION OBSERVATIONS (*Continued*).

Month.	G. M. T.	Uncorrected. Observation.	Uncorrected. Monthly Mean.	Corrected. Observation.	Corrected. Monthly Mean.
	D. H. M.	° ′ ″	° ′ ″	° ′ ″	° ′ ″
July ……	8th 9 0 a.m.	20 28 16		20 32 34	
	16th 9 5	26 25		28 50	
	22nd 9 4	21 41		22 50	
	28th 8 58	19 19	20 26 8	23 54	20 28 23
August …	4th 9 3	26 18		27 27	
	12th 9 5	19 14		21 32	
	20th 8 54	17 54		21 3	
	26th 9 6	24 36	20 22 1	27 12	20 24 29
September	2nd 9 4	22 46		24 29	
	8th 9 13	22 14		23 23	
	15th 9 6	18 37		21 2	
	23rd 9 6	20 20		22 54	
	29th 9 7	21 5	20 21 0	23 40	20 23 6
October …	6th 8 57	18 16		19 59	
	13th 9 5	17 54		20 19	
	20th 9 2	24 59		26 17	
	28th 9 8	25 22	20 21 38	27 22	20 23 29
November	4th 9 0	20 59		22 25	
	10th 9 4	21 8		22 17	
	18th 9 8	19 21		20 49	
	24th 9 5	24 26	20 21 29	25 52	20 22 51
December .	1st 8 55	23 34		24 43	
	8th 9 5	26 57		27 14	
	15th 9 1	19 16		20 42	
	24th 9 10	19 47		21 30	
	29th 9 6	19 6	20 21 44	20 49	20 23 0
Yearly mean			20 26 21		20 28 3

MAGNETIC DISTURBANCES.

JANUARY.—An Easterly movement of the Declination magnet at 9 p.m. on the 4th, was succeeded by a very calm period, which lasted until the evening of the 13th, when the magnet was somewhat disturbed between 8 and 11 p.m. This was followed by slight irregularities on the 14th from 3 to 4 a.m., on the 15th from 10 p.m. to midnight, and towards 8 p.m. on the 17th.

On the 20th, at 3 p.m., the first recorded storm of the year commenced with an Easterly movement of the needle, and the whole disturbance only lasted about seven hours. The maximum Westerly excursion of the magnet was reached 5 p.m., and the Easterly at $8^{h.}\ 22^{m.}$ The H.F. curve clearly indicated the presence of a disturbing cause, but the irregular movements are not extended. The V.F. showed a gradual increase until $7^{h}\ 30^{m.}$, after which it returned to its normal value.

The magnets then remained very quiet until the evening of the 27th, but on that and the two following nights there were several slight irregularities in the Declination.

FEBRUARY.—The first disturbance of any moment began shortly after midnight on the 18th, and continued during the greater part of the morning, but there was never any very considerable departure from the mean. The magnet was also very unsteady from 9 a.m. on the 24th until the evening of the following day. The rest of the month was remarkably quiet.

MARCH.—This month was much more disturbed than those which preceded it. The first irregularity was a tremulous motion of the Declination magnet, which began at 4.20 a.m. on the 3rd, and continued for about thirteen hours, accompanied by a gradual increase of Westerly Declination. Two Easterly movements of the needle occurred between 5 and 8 p.m. on the 5th, and a rather more considerable one from 8 to 10 p.m. on the 7th. The chief disturbance of the month began about noon on the 9th, and lasted until 4 a.m. of the following day. An irregular movement of the needle towards the East on the evening of the 11th was repeated on the 13th and 15th, but was only just perceptible on the intermediate days. The Easterly excursion of the magnet on the 15th was accompanied by a sudden increase of the H.F., and a diminution of the V.F. Another disturbance commenced by a tremulous motion of the magnet shortly after 6 a.m, on the 23rd, and lasted till midnight. The greatest irregularity occurred towards 7 p.m., when the H.F. rose considerably above its mean value. The V.F. was higher than the mean from $2^{h.}$ to $7^{h.}$ $25^{m.}$ The photographic traces of the Declination and H.F. magnets were rather irregular from 10 p.m. on the 28th to 3 a.m. on the 29th, and at nine p.m. on the following evening the greatest Easterly excursion of the month differed 15′ 49″ from the mean.

APRIL.—The Daily Range is strongly marked on the Declination curve throughout the greater part of this month, but no disturbance of any notable extent occurred previously to the morning of the 15th, when two similar waves followed immediately one the other between midnight and 4 a.m. There is also a successive double undulation in the H.F. and V.F. curves, but not well marked.

On the 19th, at 8.40 p.m., a magnetic storm commenced with a rapid movement of the needle towards the East. It remained for about six hours East of its main position, and returned Westward only towards the end of the disturbance, when the magnet moved through 20′ 24″·7 between 2.30 p.m. and 3.10. The H.F. trace bears witness to this storm only by an irregular undulation, but the V.F. curve shows a considerable decrease, the minimum being reached at about $3^{h.}$ $35^{m.}$ a.m. on the 20th, the Declination needle having attained its maximum Western elongation twenty-five minutes earlier. No important irregularity occurred from this time until the end of the month.

MAY.—On the morning of the 12th a tremulous motion of the Declination magnet denoted the presence of some disturbing cause, and for the next three days there was a good deal of irregularity in the movements of the magnets, but no great storm occurred. The H.F. irregularities were never of any considerable extent. The range on the 20th was large. Shortly before midnight on the 23rd a great disturbance began. The motion of the magnet about 4 a.m. on the 24th was very rapid, moving Westward through 19′ 30″·9 between 3.15 and 4.8, and then returning Eastward through 21′ 7″·6 before 5 a.m. This was accompanied by a sudden increase of the H.F. The V.F. fell at 2 a.m., and still more rapidly at 4, and its range was considerable on the evening of the same day, as also at the same time on the 20th.

JUNE.—The month began by a slight disturbance for about four hours; but the magnets were otherwise very quiet until shortly after 8 p.m. on the 8th, when an irregular movement commenced, which lasted during part of the following morning. A sudden and not inconsiderable deflection towards the West occurred shortly after 3 a.m. on the 18th, the maximum being attained at about 2.30 a.m.; the needle then returned rapidly to its original position. This movement of the Declination magnet was accompanied by a considerable increase of the H.F. ordinate, and a rapid decrease of the V.F., which last did not regain its normal value before 10 a.m. The magnets were unsteady during the night of the 26th, but remained quiet for the remainder of the month.

JULY.—A more than ordinary disturbance began about noon on the 5th, and lasted for about eighteen hours. The irregularities consisted of a succession of long waves in the Declination curve, and of a long rise and fall of the V.F. magnet, the maximum being attained at 6.40 p.m. The only other perturbation of any great extent was on the morning of the 25th. This began shortly before 3 a.m., and continued until 7. The V.F. ordinate decreased considerably between 3 and 4 a.m. The Daily Range was well marked on the V.F. trace during the month.

AUGUST.—A magnetic storm began at 25 minutes after midnight on the 2nd, and ended at 10 a.m. on the 4th. During the greater part of this time the Declination magnet was in a continual state of tremour, and the only change of any great extent was a rapid Easterly movement at 8 p.m. on the 2nd. The H.F. and V.F. magnets were not much affected by this disturbance of the earth's magnetism.

On the evening of the 9th an irregular movement of the Declination was the beginning of a disturbance which lasted until 10 a.m. of the following day. The next night the magnet was rather unsteady, as it was also on the last two days of the month.

SEPTEMBER.—This month opened with a disturbance which considerably increased the V.F. ordinate, and, though the succeeding days were generally tranquil, an irregularity, very noticeable on most days, recurred from the 3rd to the 8th, between 6 and 8 p.m. Irregular movements, which began on the morning of the 10th, continued with little interruption until the 13th, the greatest departure from the mean Declination occurring shortly after 10 p.m. on the 11th, when there was also a sudden diminution of the V.F. During the afternoon of the 10th, the V.F. was somewhat above its mean value. The Declination magnet was rather unsteady and tremulous from the morning of the 25th to that of the 28th.

OCTOBER.—At 6.45 p.m. on the 4th, there was a sudden movement of the needle towards the East, followed by an equally rapid return to its former position. The V.F. decreased rather rapidly between 2 and 3 a.m. on the 5th. Between 6 p.m. on the 7th and 8 p.m. on the 8th, there was considerable disturbance, especially about midnight, the V.F. magnet being remarkably unsteady. During this month the magnet seemed to be more frequently disturbed just before midnight than at any other time. The recurrence of a slight irregularity in the H.F. between 10 p.m. and midnight on the 24th, 25th, and 26th, is easily detected on the curves.

NOVEMBER.—The first irregularities of any importance were two successive Easterly movements of the Declination needle between 8 and 10 p.m. on the 11th, and a rather larger one between 7 and 8 p.m. on the 13th. Another minimum at about 11 p.m. on the 27th completes the irregular movements of November, which was remarkably quiet, even the Daily Range being scarcely perceptible.

DECEMBER.—The month began with a slight Westerly movement, which reached its maximum just after 2 a.m. on the 1st. The magnet again showed signs of disturbance on the evening of the 6th. These were somewhat more developed on the following evening, and increased yet more on the afternoon of the 8th.

Shortly before 2 p.m. on the 10th, the movements of the needle became somewhat irregular, and then followed a storm, which was one of the most severe of the year. Between 5.5 and 6.25 p.m. on the 11th, the Declination magnet moved 26′ 15″ towards the East, and then returned rapidly Westward. The H.F. was not much affected, but there was a marked decrease of the V.F. from 10 to 11 p.m. the same night.

A disturbance, commencing at about 5 a.m. on the 22nd, continued for more than twenty-four hours, the most marked feature being an increase of the V.F. between 4 and 11 p.m. From shortly after midnight on the 25th until 10 p.m. on the 28th, the magnets were subject to a succession of slight perturbations.

DAILY RANGE OF THE MAGNETIC DECLINATION FROM 1868 TO 1879.

THE observation of the earth's magnetic elements was first undertaken at Stonyhurst in the year 1858, when, by the advice of Sir Edward Sabine, a set of instruments were purchased for obtaining monthly determinations of the absolute values of the Declination, Dip, and Horizontal Force: but it was not until nearly ten years later that the observatory was completely mounted for the study of terrestrial magnetism. This was effected by the addition of a set of self-recording magnetographs for the photographic registration of every change in the Declination and in the Horizontal and Vertical components of the Intensity.

These magnetographs were constructed by Adie, and the expense was defrayed by a grant of the Royal Society out of the Government fund placed annually at its disposal. Whilst the instruments were being made, a subterranean chamber was built for their reception, along with a room adjoining, in which all the photographic work connected with the magnetic records could be carried on in the most convenient way possible. From the central room of the observatory a descent of five and twenty steps leads into the chief subterranean chamber in which the magnetographs now stand. The dimensions of this chamber are 20 feet by 18, which affords ample space for the magnetic instruments, and also enables the barograph to be placed without any inconvenience in one of the corners. The roof is arched, with two rings of brick set in blue lias lime, and the whole covered with 6-lb. lead, and then with earth and gravel. The walls are three in number. The inner one is a single-brick wall set in hydraulic lime. Surrounding this is a cavity for air three inches wide, one foot apart, all round the room. Enclosing this is a rubble wall two feet thick. And at the outside of all, as a protection from the surrounding earth, is one foot of loose rubble, which serves admirably for drainage. The flagged floor is built upon piers, and is thus raised eighteen inches above the sand. Owing to these precautions the room keeps remarkably dry, and the temperature may be considered almost constant, the mean daily range not being more than 0°.2 Fah. This constancy of temperature during each day is of the highest importance as magnets are most sensitive to heat, and there must always be a considerable hesitation about applying temperature corrections, when the whole variation is so small as is generally the case for magnets.

The magnetographs rest on three stone pillars, and a fourth pillar supports the three cylinders on which the continued variations are photographically recorded; the clock which drives these cylinders through an entire revolution in four-and-twenty hours also stands on the fourth pillar. Two additional stone pillars are surmounted by telescopes and scales, by aid of which the observer is able to read at any moment the state of the magnets without interfering with the continuity of the photographic curves.

The suspension of the declination and of the horizontal force magnets is very sensitive, as the former hangs in the magnetic meridian by a silk thread, and the latter is held at right angles to the meridian by the torsion of two parallel lengths of a thin steel wire; but the vertical force magnet appears to be less perfectly mounted, the magnet being fixed to an agate knife-edge which rests on an agate plane.

The method of registration is identical for all three magnetographs. A strong gas light, after passing through a convex lens, falls on two plane semi-circular mirrors. One of these is attached immoveably to the stone pillar, and therefore sends the half of the pencil of light, which falls upon it, always in the same direction towards the revolving cylinder covered with sensitized paper; this half-pencil will therefore describe a straight line on the paper, and serve as a base line. The other semi-circular mirror is fixed to the moveable magnet, and thus sends the second half-pencil of light in directions changing with every variation of the magnet. A curve must consequently be traced by this second half-pencil on the sensitized paper, and the ordinates of this curve, measured from the base line, give the position of the magnet at any moment. The abscissæ of the curve depend on the rate of the driving clock, and every two hours a screen is placed by clock-work in front of the pencil of light to mark accurately, by breaks of continuity, the divisions of the time scale.

During remarkably large disturbances the telescopes and scales enable an observer to note changes which are too great to be recorded on the photographic cyclinders. The most rapid change ever perfectly recorded photographical at Stonyhurst, was a disturbance of 2° 30′ in the declination, which occupied only nine minutes.

The reduction of the photographic curves necessarily involves much time and labour, as hourly measures have to be taken of each of the three daily traces, before the hourly, daily, monthly, and yearly means required, can be computed. Up to the present date the task of measuring the ordinates, and of computing the means, has been completed for the declination, and is in an advanced state for the other two elements. The work already done renders it easy to print at once a first instalment of the results in the adjoined table of the Mean Daily Range of the magnetic declination at Stonyhurst from 1868 to 1879. The method adopted in forming these tables from the measures of the photographic curves has been the following. After eliminating the periods of great disturbance, and also any irregularity greater than 0·12 of an inch, the hourly means are computed for each month, and the differences between these and the Monthly Mean give the values of the Daily Range for each separate month from January, 1868, to December, 1879. As such a table would be too bulky to publish in this report, the resulting figures are first combined so as to give the mean Daily Range for each separate year of the period, and then the mean for each of the twelve months. The ordinates of the curves have been expressed in angular measurement before being entered into Tables I. and II., in order that the comparison with the results of other magnetic stations may be rendered more easy.

The greatest Westerly elongation of the magnetic needle occurs for the first eight months of the year, either a little before, or a little after 1.30 p.m., but for the remaining four months it is seldom much later than 1 p.m. The Easterly maximum is more irregular, occurring in March and April at about 8 a.m., in May and June at 7.30 a.m., in July and August at 7 a.m., in September going back to 7.30 a.m., and in October to 8 a.m., whilst in Winter there is a complete change, the minimum falling at 10.30 p.m. for November and December, and at 11 p.m. for January and February, although the minimum in February is not unfrequently at 8 a.m. The reason of this alteration of the minimum in the Winter months is the appearance at that season of a slight second inflexion in the daily curve.

Some of the salient points connected with each month are collected in Table III., which shows clearly that the years 1870 and 1871 are those of greatest range, and that 1877 is the centre of the more quiet period. The progression from the one period to the other is very regular. The monthly means show a far less orderly progression, especially in the summer months. From a secondary maximum in August the daily range diminishes until December, and then increases until April, the month of greatest range. Between April and August the variation is but slight. The activity of summer is well marked, but that of April surpasses any of the summer months either in the mean, or maximum, range, or in the hourly velocity. The mean daily range for April, 1871, was five times that for January, 1878, which is the widest difference on record for the monthly means. The local time at which the magnetic needle passes through its mean position in the evening varies considerably, but the morning mean is very close to 10 a.m., at which time the velocity of the magnet is always greatest. One consequence of the magnet moving more rapidly when West of its mean position, is that the compass generally indicates a bearing somewhat less than its true value.

Of the four plates of curves appended to this report, 1 and 3 are graphical representations of the numbers contained in Tables I. and II., and the other two bring out in bolder relief the secular variation and the semi-annual inequality of the daily range. In both the yearly and the monthly curves the tranquillity of the needle during the night hours is very apparent, the N. end of the magnet remaining almost steady, and slightly to the true N. of its mean position, often for more than twelve hours together.

The plates 1 and 2 show clearly that the secular variation follows some well defined law. The five years from 1869 to 1873, and also the five from 1875 to 1879, may well be grouped together on account of their similarity of character, the years of the former group being each as much in excess of the mean range, as those of the latter are below it. The two other years, 1868 and 1874, the latter of which separates the two groups, appear to be neutral, agreeing well with the mean, although 1868 approaches much nearer the second group than the first. If we take the differences between the mean daily range of the whole period over which the observations extend, and the mean daily range of each separate group of five years, the result, as shown in plate 2, is very striking.

Plates 3 and 4 are good evidence of the existence of a semi-annual inequality of the daily range, or of the difference in character of the Winter and Summer curves, and this naturally stands out more prominently when the two are brought into juxta-position. The result is even more marked than ever when the equinoctial months are kept separate, as the character of the month of March approaches very closely to the Summer type, whilst that of September resembles more the Winter form.

TABLE I.—YEARLY MEANS OF THE DAILY RANGE OF THE DECLINATION.

	1 a.m.	2	3	4	5	6	7	8	9	10	11	Noon.
	E	E	E	E	E	E	E	E	E	E	W	W
	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″
1868	1 20·7	1 17·3	1 27·6	1 46·6	2 12·4	2 26·1	2 46·7	2 53·3	2 12·4	0 30·9	2 3·8	4 19·5
1869	1 20·7	1 36·1	1 44·9	2 3·8	2 41·6	3 14·3	3 26·3	3 22·8	2 50·2	0 48·1	2 19·2	5 14·6
1870	1 50·0	1 53·4	2 0·3	2 50·2	3 33·2	4 4·1	4 38·5	4 57·4	3 12·5	1 5·3	2 43·3	6 2·7
1871	1 44·9	1 44·9	2 3·8	2 45·0	3 22·8	3 57·2	4 33·2	4 43·6	3 36·6	1 15·6	2 14·1	5 28·4
1872	1 41·3	1 43·1	2 3·8	2 15·8	2 53·6	3 31·4	3 53·8	3 57·2	3 21·1	1 12·2	2 31·3	5 6·0
1873	2 2·0	1 48·3	1 53·4	1 55·2	2 33·0	3 2·2	3 28·0	3 28·0	2 48·5	0 51·6	2 12·4	4 41·9
1874	1 8·8	1 31·0	1 32·7	1 48·3	2 19·2	2 52·6	3 5·7	3 9·1	2 48·5	1 12·2	2 2·0	4 4·1
1875	1 5·3	1 8·8	1 15·6	1 27·6	1 58·6	2 15·8	2 33·0	2 39·9	2 5·5	0 39·5	2 0·3	3 50·4
1876	0 58·5	0 53·3	1 0·2	1 17·3	1 46·6	2 10·6	2 27·8	2 31·3	2 5·5	0 44·7	1 43·1	3 29·7
1877	0 49·9	0 53·3	0 58·5	1 8·8	1 44·9	1 51·7	2 14·1	2 22·7	1 53·4	0 29·2	1 44·9	3 24·6
1878	1 3·6	0 58·5	1 5·3	1 15·6	1 43·1	2 3·8	2 19·2	2 27·8	1 43·1	0 17·2	2 12·4	3 43·5
1879	0 55·0	0 56·7	0 58·5	1 8·8	1 46·6	2 7·2	2 26·1	2 29·5	2 0·3	0 37·8	1 56·9	3 40·0

TABLE I. (*continued*).—YEARLY MEANS OF THE DAILY RANGE OF THE DECLINATION.

	1 p.m.	2	3	4	5	6	7	8	9	10	11	Mdnght.	Range.
	W	W	W	W	W	W	E	E	E	E	E	E	
1868	5′ 21″·4	5′ 6″·0	3′ 53″·8	2′ 38″·1	1′ 25″·9	0′ 25″·8	0′ 1″·7	0′ 30″·9	1′ 15″·6	1′ 29″·3	1′ 39″·5	1′ 15″·6	8′ 16″·8
1869	6 25·1	...	4 33·2	2 57·1	1 25·9	0 41·3	0 6·9	0 34·4	1 8·8	1 22·4	1 31·0	1 34·4	9 51·3
1870	7 26·9	7 21·6	5 35·2	3 34·9	1 53·4	0 56·7	W 0 15·5	0 10·3	0 53·3	1 15·6	1 27·3	1 58·6	12 24·3
1871	7 8·2	7 14·8	5 36·9	3 52·1	1 53·4	1 5·3	0 13·8	0 8·6	0 30·9	0 58·5	1 32·7	1 46·6	11 59·2
1872	6 40·5	6 42·3	4 59·1	3 36·6	1 51·7	0 56·7	0 8·6	0 20·6	0 49·9	1 27·6	1 44·9	2 7·2	10 39·4
1873	6 9·6	5 54·1	4 50·5	3 24·6	1 55·2	1 8·8	W 0 27·5	0 10·3	1 7·0	1 24·1	1 56·9	1 58·6	9 37·5
1874	5 24·9	5 18·0	3 53·8	2 39·9	1 19·1	0 32·7	E 0 1·7	0 22·4	0 58·5	1 10·5	1 27·6	1 34·4	8 33·9
1875	4 50·5	4 36·8	3 17·7	2 5·5	1 7·0	0 24·1	0 8·6	0 27·5	0 55·0	1 10·5	1 15·6	1 12·2	7 30·3
1876	4 31·4	4 17·8	3 10·8	2 2·0	1 0·2	0 18·9	0 8·6	0 27·5	0 44·7	1 1·9	1 15·6	1 0·2	7 2·8
1877	4 4·1	3 46·9	2 43·3	1 39·5	0 46·4	0 15·5	0 8·6	0 27·5	0 43·0	0 55·0	1 1·9	0 58·5	6 26·7
1878	4 26·3	3 53·8	2 38·1	1 36·1	0 43·0	0 12·0	0 15·5	0 29·2	0 46·4	1 0·2	1 1·9	1 1·9	6 54·2
1879	4 36·8	4 14·3	2 52·6	1 44·9	0 48·1	0 15·5	0 15·5	0 30·9	0 53·3	1 0·2	0 58·5	1 0·2	7 6·3

TABLE II.—MONTHLY MEANS OF THE DAILY RANGE OF THE DECLINATION.

	1 a.m.	2	3	4	5	6	7	8	9	10	11	Noon.
	E	E	E	E	E	E	E	E	E	E	W	W
	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″
January	1 39·7	1 19·1	1 0·2	1 3·6	1 8·8	0 56·7	1 1·9	1 5·3	1 12·2	0 20·6	1 12·2	2 22·7
Feby.	1 13·9	1 10·5	1 10·5	1 20·7	1 19·1	1 31·0	1 31·0	1 41·3	1 32·7	0 36·1	1 36·1	3 21·1
March	1 39·5	1 34·4	1 46·6	1 50·0	2 2·0	2 44·4	3 9·5	3 31·4	3 7·5	1 7·0	2 15·8	4 59·1
April	1 15·6	1 19·1	1 43·1	2 17·5	2 33·0	3 16·0	4 33·2	5 9·4	4 9·2	2 7·2	1 44·9	5 18·0
May	0 41·3	1 8·8	1 27·6	2 7·2	2 31·4	4 24·6	4 45·3	4 45·3	3 31·4	1 20·7	2 0·3	4 57·4
June	1 3·6	1 24·1	1 55·2	2 38·1	4 19·5	4 59·1	5 21·4	5 12·8	3 43·5	1 29·3	2 7·2	4 45·3
July	1 7·0	1 22·4	1 51·7	2 26·1	3 55·5	4 55·7	5 9·4	4 53·9	3 38·3	1 44·9	1 48·3	4 40·2
August	1 22·4	1 34·4	2 2·0	2 31·3	3 41·8	4 28·0	4 48·8	4 19·5	2 41·6	0 18·9	3 16·0	5 52·4
Septem.	1 43·1	1 58·6	2 3·8	2 22·7	2 34·7	2 57·1	3 28·0	3 34·9	2 26·1	W 0 15·5	3 29·7	6 1·0
October	1 43·1	1 34·4	1 25·9	1 27·6	1 32·7	1 43·1	2 0·3	2 38·1	2 27·8	E 0 49·9	2 34·7	4 36·8
Novem.	1 19·1	1 1·9	0 46·4	0 51·6	1 7·0	1 19·1	1 22·4	1 31·0	1 27·6	0 8·6	2 14·1	3 41·8
Decem.	1 10·5	0 55·0	0 49·9	0 46·4	0 53·3	0 44·6	0 41·3	0 43·0	0 39·5	W 0 10·3	1 24·1	2 24·4
Annual Mean	1 20·7	1 22·4	1 31·0	1 48·3	2 22·7	2 48·5	3 9·1	3 16·0	2 33·0	E 0 48·1	2 7·2	4 24·6

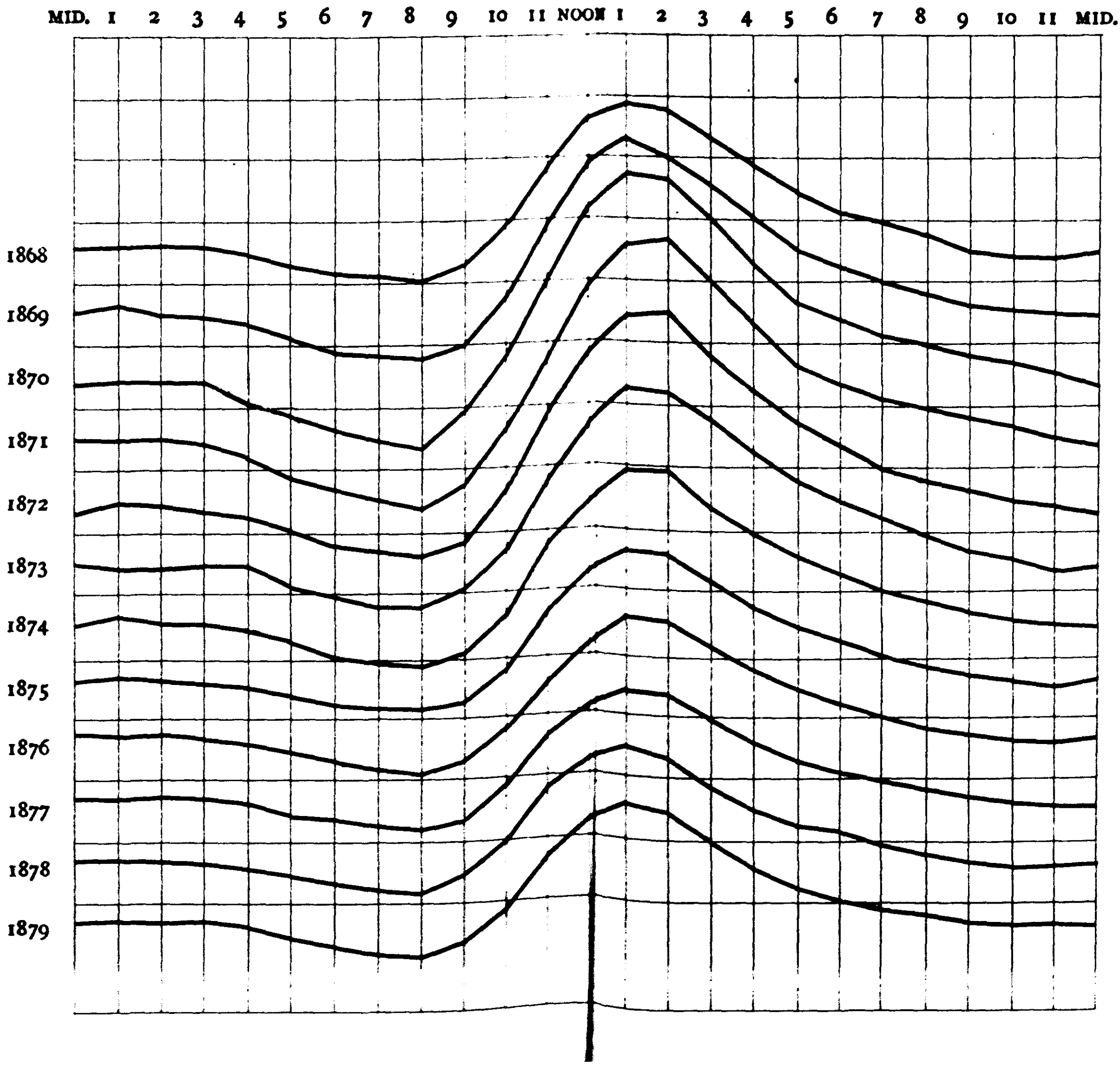
TABLE II. (*continued*).—MONTHLY MEANS OF THE DAILY RANGE OF THE DECLINATION.

	1 p.m.	2	3	4	5	6	7	8	9	10	11	Mdnght.	Range.
	W	W	W	W	W	W		E	E	E	E	E	
	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″
January	3 12·5	3 22·8	2 22·7	1 29·4	1 8·8	0 41·3	0	0 34·4	1 24·1	1 44·9	1 50·0	1 43·1	5 12·8
Feby.	4 33·2	4 35·0	3 19·4	1 56·9	1 0·2	0 22·4	W 0 10·3	0 29·2	1 24·1	1 46·6	1 48·3	1 46·6	6 23·3
March	6 33·7	6 25·1	4 52·3	2 45·0	1 3·6	0 12·0	E 0 10·3	0 29·2	1 8·8	1 29·3	1 48·3	1 53·4	10 5·0
April	7 21·6	7 18·2	5 24·9	3 36·6	1 44·9	0 34·4	0 12·0	0 18·9	0 36·1	0 53·3	1 19·1	1 27·6	12 31·1
May	6 7·9	5 47·2	4 47·1	3 29·7	1 50·0	0 55·0	W 0 10·3	0 3·4	0 17·2	0 22·4	0 39·5	0 48·1	10 54·9
June	6 18·2	6 16·5	5 12·8	4 7·5	2 24·4	1 32·7	0 30·9	W 0 8·6	W 0 3·4	0 6·9	0 25·8	0 46·4	11 41·3
July	6 4·4	6 21·6	5 12·8	4 4·1	2 12·4	1 19·1	0 32·7	0 15·5	0 1·7	0 10·3	0 30·9	0 39·5	11 29·3
August	7 26·9	6 57·7	4 53·9	3 2·2	1 5·3	E 3·4	E 0 20·6	E 0 20·6	E 0 43·0	1 5·3	1 5·3	1 22·4	12 15·7
Septem.	6 54·3	6 9·6	3 50·4	2 12·4	0 48·1	W 0 1·7	0 12·0	0 37·8	1 7·0	1 27·6	1 34·4	1 51·7	10 22·2
October	5 33·5	5 2·5	3 40·0	2 7·2	0 55·0	0 29·2	0 8·6	0 39·5	1 22·4	1 37·8	2 3·8	1 46·6	8 11·6
Novem.	4 16·0	3 31·4	2 26·1	1 44·9	1 8·8	0 30·9	0 13·8	0 44·7	1 36·1	2 3·8	2 7·2	1 52·2	6 23·3
Decem.	2 46·7	2 34·7	1 58·6	1 17·3	0 53·3	0 32·7	0 1·7	0 44·7	1 12·2	1 39·5	1 37·8	1 27·6	4 26·4
Annual Mean	5 35·2	5 21·4	4 0·7	2 39·9	1 20·7	0 36·1	0	0 24·1	0 53·3	1 12·2	1 24·1	1 27·6	8 5·1

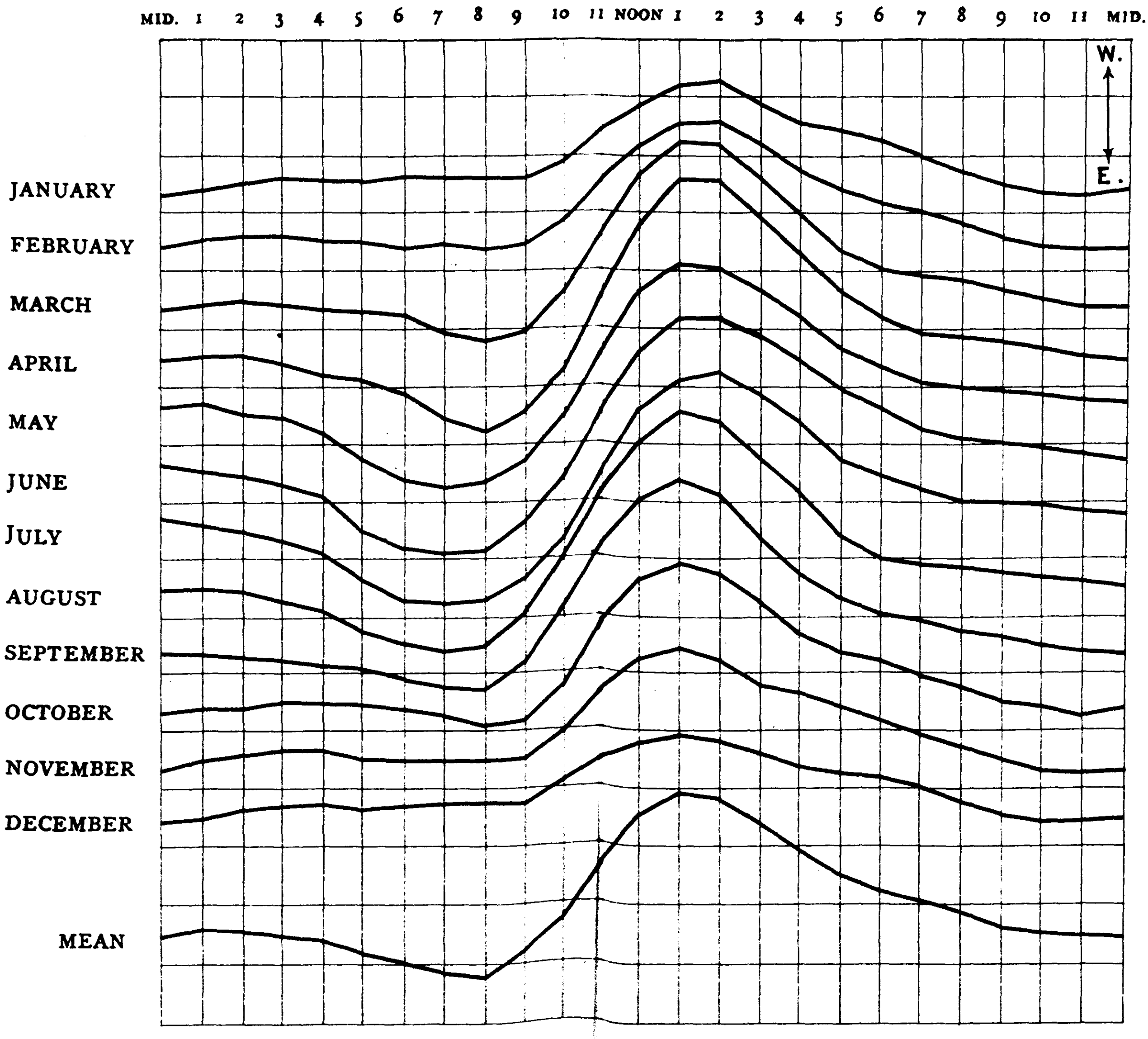
TABLE III.—MONTHLY MAXIMA AND MINIMA.

	Greatest Daily Range.	Least Daily Range.	Mean.	Greatest Hourly Velocity.	L.M.T. of Mean Position. a.m.	p.m.
					h. m.	h. m.
January	9′ 0″ in 1871	3′ 35″ in 1878	5′ 13″	1′ 33″	10 3	6 50
February................	10 8 1870	4 35 1876	6 23	2 12	10 6	7 6
March	14 37 1871	7 32 1878	10 5	3 23	10 9	6 21
April	17 20 1871	9 17 1877 & 79	12 31	3 52	10 23	6 34
May......................	16 49 1870	8 17 1877	10 55	3 21	10 14	7 35
June.....................	15 45 1871	9 36 1877	11 40	3 37	10 15	9 10
July.....................	17 10 1870	7 25 1877	11 31	3 35	10 20	8 59
August	16 52 1870	7 23 1877	12 16	3 35	9 55	5 47
September	14 54 1870	7 48 1876	10 29	3 14	9 44	5 58
October	11 55 1871	5 40 1878	8 27	3 25	10 5	6 36
November	12 48 1870	4 13 1878	6 39	2 23	9 54	6 32
December	6 28 1870	3 9 1876	4 42	1 14	9 38	6 47

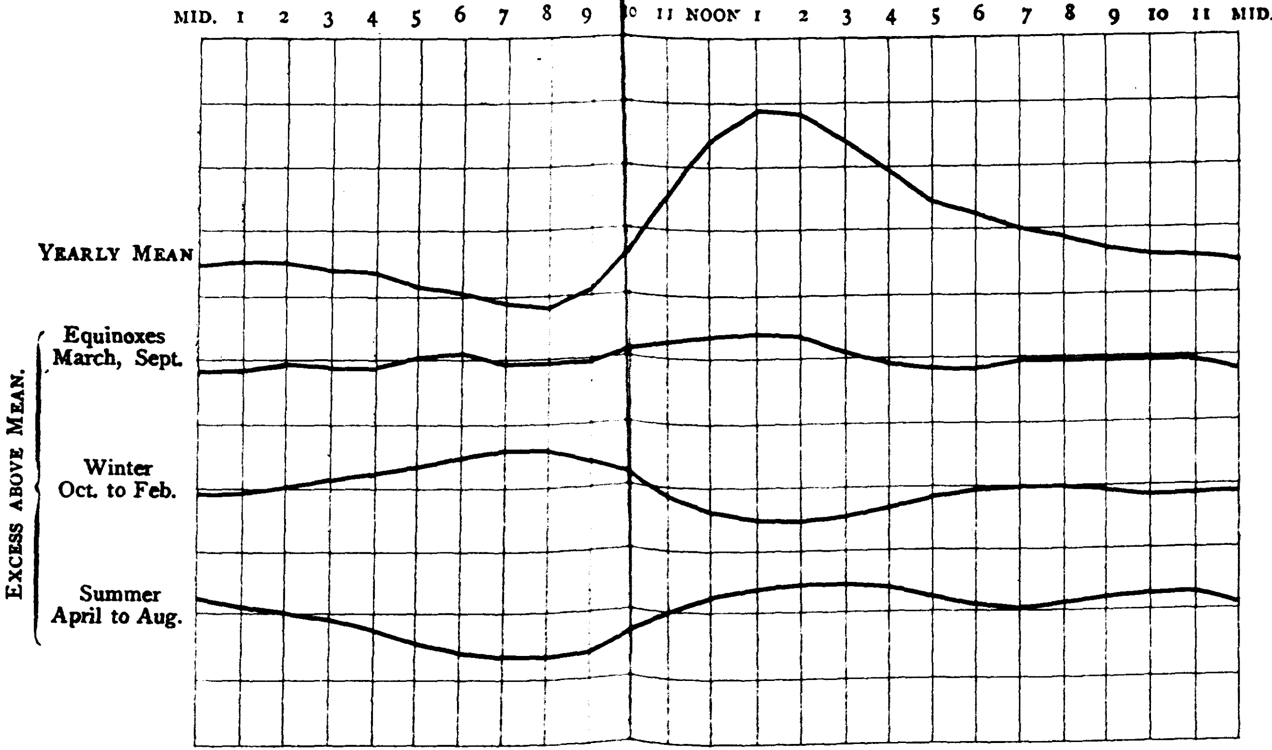
MEAN DAILY RANGE OF DECLINATION MAGNET AT STONYHURST (1868—1879).



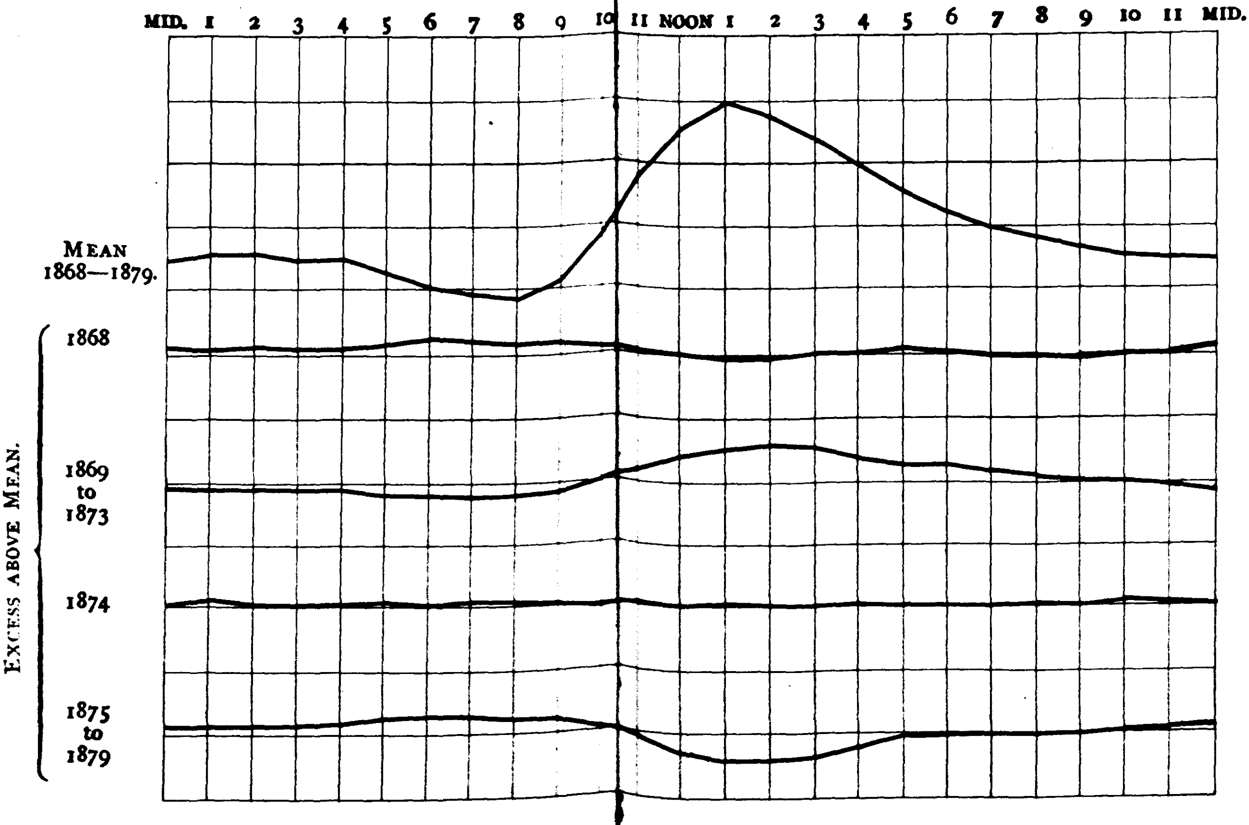
MEAN DAILY RANGE OF DECLINATION MAGNET AT STONYHURST (1868—1879).



SEMI-ANNUAL INEQUALITY OF THE DAILY RANGE OF THE DECLINATION.



SECULAR INEQUALITY OF THE DAILY RANGE OF DECLINATION.



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