# PHILOSOPHICAL

# TRANSACTIONS

OF THE

# ROYAL SOCIETY

OF

# LONDON.

FOR THE YEAR MDCCCLXIII.

VOL. 153.

LONDON:

PRINTED BY TAYLOR AND FRANCIS, RED LION COURT, FLEET STREET

MDCCCLXIV.

# XII. *Results of the Magnetic Observations at the Kew Observatory, from* 1857 *and* 1858 *to* 1862 *inclusive.*—No. I.

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Received May 21,—Read June 18, 1863.

§ 1. *A tabular synopsis of ninety-five of the principal disturbances of the magnetic declination recorded by the Kew Photograms between January* 1858 *and December* 1862 *inclusive; and a comparison of the Laws of the Disturbances derived therefrom, with the Laws derived by the more usual method.*

It seems difficult to understand how any one having the opportunity of examining the daily photographic records of a magnetic observatory, and viewing them with an intelligent eye, can fail to discern in the magnetic disturbances the systematic operation of laws depending upon the solar hours; and to perceive that these laws are different from those which govern the regular solar-diurnal variation (upon which the disturbances, whensoever occurring, are superposed).

There are, however, many persons who have not the opportunity of examining for themselves these full and complete records, but who may, nevertheless, be desirous of obtaining a clearer and more distinct understanding of the true character of these remarkable phenomena, in the belief that such knowledge is indispensable as the *first step* of an inductive inquiry which may ultimately reveal to us their causes, and the nature of the causation by which they are produced; and also from the prominency which is given to such an investigation in the Report of the Royal Society in 1840, wherein it is asserted that "the progressive and periodical variations are so mixed up with the casual and transitory changes, that it is *impossible* to separate them so as to obtain a correct knowledge and analysis of the progressive and periodical variations, *without taking express account of and eliminating the casual and transitory changes.*" The elimination of the disturbances was thus early foreseen to be an essential preliminary step in the systematic investigation of the periodical magnetic variations generally. The whole course of subsequent research has manifested the sagacity and importance of this early precept, and the necessity of placing this fundamental point of our investigations on a secure basis. I have thought, therefore, that it might be desirable to place before the Royal Society a synopsis of the deflections from the normal positions of the declinometer, tabulated from the photograms of the Kew Observatory, in a large portion of the most notable disturbances which occurred between January 1858 and December 1862, showing the direction and the amount of disturbance at twenty-four equidistant epochs in each of the disturbed days—in the belief that those who may desire to do so will obtain, by a careful examination of such a tabular view, and of the appended comments, a more distinct and definite perception of the character of the magnetic disturbances than appears to be usually possessed.

In forming the Table which occupies pages 276 and 277, the principle of selection adopted, and invariably adhered to, has been to take all those days in which twelve at the least of the twenty-four equidistant epochs have been disturbed to an amount equalling or exceeding 0·15 inch of the photographic scale, or 3′·3 of arc, on either side of the normal of the month and hour to which the recorded position corresponds, the normal itself having been obtained by recomputation after the omission of all disturbances amounting to 3′·3. The figures in the Table are the differences of the disturbed positions from the normals as above defined. By the process thus described the solar-diurnal and other minor variations are eliminated. There have been ninety-five such days in the five years. The Summary at the close of Table I. shows the resulting aggregate values, both of Easterly and of Westerly deflection, at each of the twenty-four equidistant epochs in each of the five years, as well as in the whole period. The hours of astronomical time at the Kew Observatory have been taken for the twenty-four equidistant epochs.

It is obvious, on the most cursory view of the Summary at the close of the Table (page 277), that the Easterly and Westerly deflections are both subject to systematic laws, and that these laws are distinct and dissimilar in the two cases. Thus the easterly deflections prevail during the hours of the night, and the westerly during the hours of the day. In the day-hours the easterly are small, and vary but slightly; they begin to increase about 5 or 6 P.M., and augment progressively until 11 or 12 P.M., when they attain a value (speaking always of aggregate values) nine or ten times as great as on the average of the day-hours. This great development of easterly disturbance continues until one or two hours after midnight, when it as steadily and progressively subsides until 5 or 6 A.M. The westerly deflections, on the other hand, are distinguished not only by their great prevalence at the hours when the easterly deflections are small, viz. 5 A.M. to 6 P.M., but also by having two distinct epochs of maximum about eight or nine hours apart, viz. one about 6 or 7 A.M., and the other about 3 P.M. This last-named distinction between the two classes of deflection, viz. a single maximum in the one, and a double maximum in the other, is the more worthy of notice, because, as will be shown hereafter, a similar distinction prevails at the greater part of the stations where the laws of the disturbances have been investigated, although, whilst in certain localities of the globe it is, as at Kew, the easterly disturbances which have the single maximum, and the westerly the double maximum, in other localities the converse is found to take place. The increased prevalence of each of the two classes of deflection for about half the twenty-four hours, and diminished prevalence during the other half, appears also to be a usual characteristic,—but with the reservation, that the hours of the prevalence of each class are not the same in different localities, and that they vary *independently of each other*—so much so that at some stations the two classes of disturbance, instead of affecting opposite parts of the twenty-four hours as at Kew, may even have their greatest prevalence at the same hours.

If we now take the pains to compare the summaries of the easterly and westerly deflections in *each* year with those of the means of the *five* years, the accordance is too manifest to admit of a doubt remaining as to the general and systematic character of the laws which have been thus placed in evidence. And if we further proceed to examine *seriatim* the general progression of disturbance in each of the ninety-five days, we shall see reason to conclude that by far the greater part of the disturbances are in conformity with these laws (which are of course more fully and clearly shown by the annual and quinquennial summaries)—thus manifesting the general prevalence of a common type in the disturbing action, even when the days are regarded individually.

In the greater part of the ninety-five days it is easy to trace the presence of *both* the features which may be regarded as the leading characteristics of a disturbance: viz., 1, a deflection (of very considerable amount at certain hours) from the mean or normal position of the magnet; and 2, rapid fluctuations on either side of the deflected position. All days of disturbance are marked by one or the other of these two features, and frequently by both. The *deflections* from the normal are variable in *amount*, but in *direction* they are generally conformable to the systematic laws which have been already adverted to, and which will be more fully discussed in the sequel. The *fluctuations* are extremely irregular both in direction and amount, conveying the impression that the magnet at such times is under the action of two opposing forces, of which sometimes the one and sometimes the other preponderates. A tremulous motion of the magnet is occasionally shown by the photographic traces unaccompanied by changes of direction, as if both the opposing forces were at such times in a state of agitation, but without more than a merely momentary preponderance of either. When large and rapid fluctuations present themselves, we sometimes find considerable and apparently irregular differences in the successive tabulated directions of the magnet (taken, as must be remembered, at the precise instants of the equidistant epochs); but the more regular and systematic prevalence of easterly deflection at particular hours, and of westerly deflection at other hours, usually overrides, even in the individual cases as it does altogether in the means, the partial influence of the fluctuations.

The excess of easterly over westerly, or of westerly over easterly deflection at the several hours in the ninety-five days is a measure of the influence which the disturbances would necessarily exercise on the "diurnal inequality" derived from the hourly means of the ninety-five days, if the elimination of the disturbances were unattended to: the excess thus referred to constitutes, in fact, the *disturbance-diurnal variation* due to that portion of the disturbances occurring in the five years which is included in the ninety-five days contained in the Table. This part of the subject will be resumed in the third section of this paper.

TABLE I.—Synopsis of Ninety-five days of most notable Disturbance of the Magnetic Declination in the years 1858 to 1862 inclusive. From the Kew Photograms.

| Dates. | 0h. | 1h. | 2h. | 3h. | 4h. | 5h. | 6h. | 7h. | 8h. | 9h. | 10h. | 11h. | 12h. | 13h. | 14h. | 15h. | 16h. | 17h. | 18h. | 19h. | 20h. | 21h. | 22h. | 23h. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Kew Astronomical Hours. | | | | | | | | | | | | | | | | | | | | | | | |
| 1858. | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ |
| Jan. 8. | ... | ... | ... | ... | E. 9·8 | ... | E. 3·6 | E. 4·7 | ... | ... | ... | E. 24·3 | E. 10·0 | W. 4·4 | E. 4·0 | ... | ... | W. 9·1 | W. 10·8 | W. 21·0 | ... | W. 12·2 | W. 5·7 | ... |
| Mar. 13. | W. 7·6 | W. 5·1 | W. 5·2 | W. 10·3 | W. 10·4 | W. 10·1 | W. 9·8 | W. 7·1 | E. 10·9 | W. 7·4 | ... | ... | W. 14·0 | E. 7·1 | E. 14·5 | E. 12·0 | E. 15·8 | ... | E. 5·5 | ... | ... | ... | ... | ... |
| 14. | ... | ... | W. 7·2 | W. 6·5 | W. 7·1 | W. 7·6 | ... | E. 11·1 | E. 6·4 | E. 10·1 | E. 3·4 | ... | E. 4·1 | E. 4·5 | W. 6·6 | ... | W. 5·9 | ... | ... | W. 9·2 | ... | ... | ... | ... |
| April 9. | ... | W. 4·4 | W. 11·0 | W. 14·2 | W. 43·9 | W. 18·5 | W. 36·6 | ... | W. 5·6 | W. 5·3 | E. 4·7 | E. 4·3 | E. 10·6 | E. 7·2 | E. 3·5 | ... | ... | ... | ... | ... | W. 10·7 | W. 3·7 | ... | ... |
| 10. | W. 5·9 | W. 4·2 | W. 5·5 | W. 8·3 | W. 5·7 | W. 5·9 | W. 5·0 | E. 15·5 | E. 3·4 | ... | ... | E. 8·4 | E. 13·4 | ... | E. 4·0 | E. 7·3 | E. 7·2 | ... | ... | W. 3·4 | W. 3·8 | W. 4·1 | ... | W. 5·1 |
| 24. | E. 13·5 | E. 14·8 | E. 13·5 | E. 9·9 | E. 6·7 | E. 4·6 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | W. 4·6 | W. 6·6 | W. 9·5 | W. 10·5 | W. 6·2 | ... | E. 6·3 |
| May 18. | E. 12·2 | E. 12·9 | E. 11·5 | E. 7·9 | E. 5·7 | E. 4·2 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | W. 6·0 | W. 7·9 | W. 10·5 | W. 12·6 | W. 9·6 | W. 4·1 | ... | E. 5·3 |
| 19. | E. 10·7 | E. 12·5 | E. 10·5 | E. 8·0 | E. 5·3 | E. 4·1 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | W. 3·8 | W. 5·3 | W. 7·3 | W. 9·2 | W. 8·3 | W. 4·3 | ... | ... |
| June 3. | W. 4·2 | W. 6·7 | W. 5·5 | W. 4·8 | ... | ... | W. 3·9 | ... | ... | W. 6·1 | W. 3·7 | ... | ... | W. 10·5 | ... | E. 6·6 | ... | W. 9·1 | W. 6·2 | ... | ... | ... | ... | W. 4·1 |
| 22. | ... | ... | ... | E. 3·6 | E. 4·6 | E. 4·3 | ... | ... | ... | ... | E. 13·1 | ... | ... | E. 7·9 | E. 4·5 | E. 4·8 | E. 7·0 | E. 3·8 | W. 6·1 | W. 21·0 | W. 8·7 | ... | ... | ... |
| 23. | ... | ... | ... | ... | W. 7·2 | E. 3·5 | W. 8·4 | E. 5·8 | E. 9·5 | ... | E. 26·2 | ... | ... | E. 10·3 | E. 3·6 | W. 9·3 | W. 8·1 | ... | W. 9·9 | W. 8·3 | W. 10·6 | W. 6·2 | W. 7·8 | W. 3·3 |
| 24. | W. 3·2 | ... | ... | ... | ... | ... | E. 3·4 | E. 10·1 | E. 6·1 | E. 9·0 | E. 6·1 | E. 5·1 | E. 7·6 | E. 9·5 | E. 7·5 | W. 3·7 | W. 9·2 | W. 4·7 | W. 11·0 | W. 10·5 | W. 5·8 | W. 6·2 | ... | ... |
| July 5. | E. 4·8 | ... | ... | ... | ... | ... | ... | E. 6·1 | E. 4·6 | E. 4·1 | E. 10·3 | E. 8·3 | E. 14·9 | E. 7·2 | ... | W. 5·0 | E. 4·8 | E. 4·8 | E. 4·0 | E. 3·2 | ... | ... | ... | ... |
| Sept. 20. | W. 8 7 | ... | W. 6·2 | W. 5·3 | E. 4·2 | W. 3·9 | W. 3·8 | ... | ... | E. 4·4 | ... | E. 11·5 | ... | E. 14·8 | E. 9·1 | E. 6·5 | ... | ... | ... | W. 8·2 | W. 6·6 | W. 5·3 | ... | ... |
| 21. | ... | ... | ... | W. 4·6 | E. 5·8 | ... | ... | ... | E. 6·4 | W. 6·1 | E. 10·1 | E. 11·8 | E. 10·3 | E. 12·5 | W. 4·1 | E. 4·3 | W. 4·4 | W. 6·7 | W. 5·2 | W. 5·6 | ... | ... | ... | ... |
| Oct. 18. | ... | ... | E. 4·5 | E. 3·8 | E. 4·0 | ... | ... | ... | ... | ... | W. 6·8 | E. 6·4 | E. 16·1 | E. 3·8 | E. 5·1 | E. 5·3 | E. 6·2 | ... | ... | W. 3·3 | W. 8·3 | W. 8·3 | ... | ... |
| Dec. 4. | ... | ... | ... | ... | ... | ... | ... | ... | W. 6·2 | E. 13·2 | E. 6·6 | E. 10·7 | E. 16·5 | E. 10·1 | E. 15·0 | E. 23·5 | W. 3·5 | W. 12·7 | W. 13·0 | W. 20·6 | W. 6·8 | ... | W. 3·3 | ... |
| 22. | ... | ... | W. 4·1 | W. 5·7 | W. 4·0 | ... | ... | ... | ... | E. 4·3 | ... | ... | E. 4·3 | E. 5·4 | ... | ... | ... | W. 6·0 | W. 6·3 | W. 3·5 | W. 3·4 | W. 4·6 | W. 6·3 | W. 3·7 |
| 23. | W. 9·8 | W. 4·8 | ... | W. 4·9 | W. 4·9 | W. 3·7 | W. 4·0 | E. 5·4 | ... | ... | ... | ... | E. 3·8 | E. 18·4 | E. 9·4 | ... | ... | ... | W. 4·4 | ... | W. 3·3 | ... | ... | W. 3·9 |
| 1859. | | | | | | | | | | | | | | | | | | | | | | | | |
| Jan. 15. | W. 6·9 | W. 7·1 | W. 4·7 | W. 8·3 | W. 8·7 | W. 6·0 | W. 7·6 | E. 5·4 | E. 5·6 | E. 6·1 | E. 7·2 | E. 12·4 | E. 6·7 | E. 10 5 | E. 11·1 | E. 8·0 | ... | W. 3·4 | W. 3·5 | W. 5·5 | W. 6·5 | W. 6·1 | W. 4·2 | W. 4·3 |
| Feb. 9. | ... | ... | W. 4·9 | W. 6·0 | W. 6·5 | W. 5·5 | W. 13·0 | ... | ... | E. 6·5 | E. 6·3 | ... | E. 3·2 | ... | E. 12·3 | E. 4·5 | W. 6·7 | W. 13·8 | W. 3·4 | W. 5·2 | ... | ... | W. 4·5 | ... |
| 23. | ... | ... | ... | ... | ... | ... | E. 7·0 | E. 10·9 | E. 5·9 | ... | E. 3·9 | E. 15·3 | E. 8·6 | E. 5·2 | E. 3·9 | E. 3·9 | ... | W. 4·0 | W. 7·8 | W. 12·4 | W. 8·6 | W. 11·7 | W. 11·4 | W. 5·9 |
| April 21. | ... | ... | W. 6·8 | W. 10·4 | W. 21·7 | W. 17·4 | W. 16·8 | W. 15·0 | ... | E. 5·7 | E. 16·9 | E. 9·0 | E. 4·7 | E. 8·9 | E. 14·8 | E. 14·9 | ... | E. 4·8 | ... | ... | ... | ... | ... | ... |
| 29. | W. 3·5 | W. 6·8 | ... | W. 7·1 | W. 12·2 | W. 5·7 | ... | ... | E. 4·9 | E. 3·7 | E. 12·4 | E. 8·3 | E. 5·8 | E. 9·9 | W. 4·4 | ... | W. 4·2 | ... | ... | W. 8·0 | W. 8·5 | W. 6·6 | ... | ... |
| June 8. | W. 9·9 | ... | E. 6·1 | W. 8·6 | W. 14·9 | W. 14·0 | W. 13·5 | E. 9·2 | ... | W. 3·7 | ... | ... | ... | ... | ... | ... | W. 24·7 | E. 3·4 | W. 15·2 | W. 11·1 | W. 11·3 | W. 5·9 | W. 6·0 | W. 4·6 |
| 16. | ... | W. 5·7 | W. 6·5 | W. 5·4 | W. 5·8 | W. 3·6 | ... | ... | ... | ... | E. 3·3 | ... | E. 4·0 | E. 3·5 | ... | W. 3·3 | W. 3·6 | ... | W. 3·4 | ... | W. 4·4 | W. 3·7 | ... | ... |
| July 11. | ... | ... | ... | W. 3·6 | ... | W. 4·5 | E. 5·4 | ... | ... | W. 4·5 | ... | E. 3·5 | E. 7·3 | E. 6·1 | E. 14·0 | E. 10·8 | E. 11·5 | E. 8·4 | E. 7·9 | ... | ... | W. 4·2 | W. 5·0 | ... |
| 18. | W. 4·3 | W. 6·1 | W. 12·2 | W. 10·8 | ... | W. 6·1 | W. 3·5 | ... | ... | ... | ... | W. 4·0 | ... | ... | W. 4·2 | ... | W. 4·8 | W. 7·4 | W. 5·6 | W. 4·8 | ... | W. 4·4 | ... | ... |
| Aug. 26. | W. 5·3 | W. 6·2 | W. 4·8 | ... | ... | ... | ... | ... | ... | E. 4·9 | E. 3·4 | E. 5·3 | E. 4·3 | E. 4·9 | E. 5·9 | ... | ... | ... | E. 5·3 | E. 5·1 | E. 5·1 | E. 3·3 | ... | ... |
| 28. | ... | ... | ... | ... | ... | W. 3·5 | W. 4·2 | E. 8·9 | E. 5·9 | ... | E. 3·4 | E. 6·4 | ... | E. 24·7 | E. 32·6 | ... | W. 17·8 | W. 47·8 | W. 34·4 | ... | ... | W. 26·1 | W. 25·2 | ... |
| Sept. 1. | W. 8·3 | W. 4·7 | W. 4·5 | W. 4·5 | ... | ... | ... | ... | ... | ... | E. 3·9 | ... | ... | ... | ... | ... | E. 8·5 | W. 52·3 | W. 55·1 | E. 20·9 | E. 27·8 | E. 4·4 | E. 13·7 | ... |
| 2. | E. 17·3 | ... | ... | W. 6·2 | W. 4·3 | W. 6·9 | E. 6·8 | ... | W. 4·8 | E. 25·9 | W. 8·4 | E. 7·6 | W. 15·5 | ... | E. 11·4 | E. 5·3 | W. 7·4 | ... | ... | ... | ... | ... | ... | ... |
| 3. | W. 6·8 | W. 9·0 | W. 11·7 | W. 25·3 | W. 16·4 | W. 13·4 | E. 36·3 | ... | ... | ... | ... | W. 10·7 | W. 12·0 | ... | ... | ... | W. 5·9 | ... | W. 5·1 | W. 7·4 | ... | ... | ... | ... |
| 4. | W. 4·0 | W. 7·9 | W. 6·0 | ... | ... | ... | ... | ... | W. 3·4 | ... | ... | E. 7·6 | W. 7·9 | E. 4·8 | W. 5·4 | ... | ... | ... | E. 4·4 | E. 4·9 | ... | W. 5·3 | ... | W. 9·8 |
| 5. | ... | ... | ... | W. 8·3 | W. 8·5 | ... | ... | W. 5·9 | W. 4·1 | W. 12·3 | ... | ... | ... | W. 6·3 | W. 5·5 | ... | W. 4·1 | W. 3·5 | W. 3·8 | W. 4·9 | W. 9·4 | W. 4·2 | W. 3·5 | W. 11·5 |
| 24. | ... | W. 4·8 | W. 5·4 | W. 3·3 | W. 4·1 | W. 5·2 | W. 13·9 | W. 5·0 | W. 7·4 | ... | E. 15·9 | E. 4·7 | E. 5·0 | B. 8·7 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| Oct. 17. | W. 3·7 | ... | ... | ... | ... | ... | ... | ... | ... | E. 32·3 | E. 12·9 | E. 16·9 | ... | E. 3·9 | E. 3·8 | E. 7·0 | E. 12·6 | W. 6·7 | W. 4·3 | W. 16·0 | W. 10·3 | W. 10·2 | W. 14·1 | W. 10·0 |
| 18. | W. 6·4 | W. 4·9 | ... | ... | W. 3·5 | ... | ... | ... | ... | ... | E. 6·0 | E. 10·2 | E. 8·8 | W. 5·2 | E. 8·6 | E. 6·6 | ... | ... | W. 5·5 | ... | W. 5·1 | W. 4·1 | ... | W. 4·0 |
| 20. | W. 5·5 | W. 7·0 | W. 3·6 | W. 7·9 | W. 5·0 | ... | ... | ... | ... | E. 5·8 | ... | E. 5·9 | ... | ... | E. 4·7 | ... | ... | ... | W. 5·1 | W. 3·4 | W. 5·5 | W. 4·1 | W. 4·0 | ... |
| 21. | ...... | W. 4·5 | W. 3·9 | W. 7·3 | W. 10·0 | W. 4·8 | ... | W. 4·1 | W. 3·5 | ... | ... | ... | ... | ... | ... | ... | E. 3·5 | ... | W. 5·2 | ... | W. 5·0 | W. 5·5 | W. 4·1 | ... |
| Nov. 12. | ... | W. 3·9 | W. 3·6 | W. 5·3 | W. 5·3 | ... | E. 4·1 | ... | ... | E. 7·9 | E. 10·6 | E. 9·7 | E. 9·1 | E. 18·5 | E. 5·4 | ... | ... | W· 7·0 | W. 7·6 | W. 14·8 | W. 10·9 | ... | W. 10·1 | W. 4·3 |
| Dec. 6. | W. 7·1 | W. 5·1 | ... | W. 4·6 | ... | E. 6·5 | W. 5·0 | ... | E. 5·2 | ... | ... | ... | E. 4·2 | E. 4·1 | ... | W. 11·7 | W. 4·1 | ... | W. 3·4 | W. 3·3 | ... | ... | ... | ... |
| 1860. | | | | | | | | | | | | | | | | | | | | | | | | |
| Feb. 21. | W. 4·2 | W. 11·5 | ... | W. 8·5 | W. 7·8 | ... | ... | ... | ... | E. 5·0 | E. 9·9 | W. 20·3 | E. 14·2 | E. 11·0 | E. 11·9 | E. 10·4 | E. 10·5 | E. 8·2 | ... | ... | ... | W. 5·5 | W. 8·3 | W. 3·7 |
| 22. | W. 7·7 | W. 7·7 | W. 6·1 | W. 6·4 | W. 7·9 | E. 6·5 | ... | ... | E. 6·8 | E. 4·9 | E. 6·6 | E. 3·2 | ... | W. 3·3 | W. 4·2 | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| Mar. 17. | ... | W. 3·8 | ... | ... | W. 5·2 | W. 3·4 | E. 7·3 | ... | ... | E. 5·9 | E. 7·0 | E. 7·9 | E. 8·1 | E. 11·8 | E. 6·0 | E. 4·6 | E. 6·1 | ... | W. 4·4 | ... | W. 4·0 | W. 5·8 | W. 7·2 | W. 7·2 |
| 28. | W. 17·6 | W. 7·4 | W. 8·4 | ... | ... | ... | ... | ... | ... | ... | ... | E. 3·7 | W. 3·9 | E. 4·2 | E. 12·8 | W. 4·4 | W. 5·3 | W. 10·0 | W. 20·2 | W. 14·2 | W. 9·5 | W. 14·1 | W. 7·3 | W. 8·3 |
| 29. | W. 10·7 | W. 4·8 | W. 12·7 | W. 30·0 | W. 37·3 | ... | W. 3·2 | ... | E. 12·8 | ... | ... | ... | E. 8·3 | E. 3·6 | ... | W. 3·4 | ... | ... | ... | ... | ... | W. 5·9 | W. 6·2 | W. 5·6 |
| Apr. 9. | W. 6·2 | W. 9·5 | W. 8·1 | W. 20·4 | W. 12·5 | W. 15·7 | W. 16·2 | ... | W. 4·5 | E. 7·9 | W. 3·5 | E. 14·9 | E. 16·1 | E. 6·3 | E. 8·3 | ... | ... | ... | ... | W. 4·0 | W. 6·3 | W. 9·3 | W. 7·3 | W. 8·4 |
| 13. | ... | ... | ... | ... | ... | ... | ... | E. 4·5 | ... | E. 4·8 | ... | E. 7·0 | E. 9·6 | E. 3·4 | E. 6·6 | E. 9·5 | ... | ... | W. 3·3 | W. 3·3 | W. 4·7 | W. 6·2 | W. 6·9 | ... |
| May 5. | ... | W. 3·2 | W. 6·7 | W. 7·8 | W. 5·9 | ... | ... | ... | ... | ... | ... | ... | E. 4·0 | E. 3·3 | E. 5·5 | E. 8·1 | E. 4·4 | ... | ... | ... | ... | E. 6·0 | E. 6·0 | E. 3·5 |
| 6. | ... | W. 5·0 | W. 9·1 | W. 9·2 | W. 3·3 | ... | ... | E. 7·8 | E. 5·3 | ... | E. 3·3 | E. 3·3 | E. 9·4 | E. 4·1 | E. 8·2 | E. 10·4 | E. 7·6 | E. 7·2 | ... | ... | ... | ... | ... | ... |
| June 30. | W. 5·3 | W. 3·2 | W. 8·7 | ... | E. 5·9 | E. 4·2 | E. 4·9 | E. 7·9 | E. 6·5 | E. 9·7 | E. 10·7 | E. 17·2 | E. 7·6 | E. 21·2 | E. 27·1 | E. 6·7 | E. 6·4 | E. 14·3 | ... | W. 6·2 | E. 4·1 | E. 8·8 | E. 14·1 | E. 21·1 |
| July 1. | ... | ... | ... | E. 7·1 | ... | E. 5·4 | E. 5·4 | E. 4·4 | E. 20·6 | E. 20·7 | E. 14·3 | E. 5·4 | E. 9·6 | E. 7·5 | E. 7·0 | E. 8·3 | E. 9·4 | E. 7·5 | E. 7·7 | E. 5·1 | E. 10·4 | E. 4·5 | E. 7·7 | E. 5·7 |
| 4. | W. 3·7 | W. 5·2 | W. 4·6 | W. 4·4 | W. 6·2 | W. 4·3 | ... | ... | W. 3·4 | W. 3·4 | ... | ... | E. 9·2 | E. 7·8 | E. 18·2 | E. 12·9 | ... | E. 11·3 | ... | E. 6·0 | ... | ... | ... | W. 6·2 |

| | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Aug. 6. | ... | E. 3·7 | E. 3·5 | E. 4·6 | ... | ... | E. 4·5 | ... | ... | ... | ... | ... | E. 5·1 | E. 7·8 | E. 5·4 | ... | E. 12·4 | E. 5·6 | E. 8·4 | E. 26·2 | ... | E. 13·9 | W. 6·2 | E. 6·1 |
| 10. | ... | ... | ... | E. 4·4 | W. 4·9 | ... | ... | W. 4·9 | W. 5·5 | W. 5·5 | E. 3·4 | W. 7·2 | W. 14·1 | W. 17·3 | E. 5·4 | W. 3·7 | ... | ... | ... | ... | ... | ... | ... | E. 4·2 |
| 12. | W. 5·5 | ... | W. 9·0 | W. 21·7 | E. 3·5 | E. 13·0 | W. 3·7 | W. 7·8 | ... | ... | ... | W. 17·4 | W. 19·2 | ... | W. 13·3 | E. 15·5 | E. 8·0 | E. 4·8 | ... | ... | ... | ... | ... | E. 6·9 |
| Sept. 15. | ... | ... | ... | ... | ... | ... | ... | ... | ... | E. 11·3 | E. 4·6 | E. 7·9 | E. 4·0 | E. 11·0 | E. 10·1 | E. 8·4 | E. 13·2 | E. 7·4 | W. 4·8 | W. 12·7 | W. 9·0 | W. 8·7 | W. 11·3 | ... |
| Oct. 4. | W. 6·9 | ... | W. 3·4 | ... | ... | W. 4·8 | ... | E. 12·6 | ... | ... | E. 3·8 | E. 5·0 | E. 5·7 | E. 5·4 | E. 5·6 | E. 5·4 | ... | ... | W. 5·5 | ... | ... | W. 3·3 | W. 3·3 | ... |
| Nov. 2. | W. 4·6 | W. 4·9 | W. 7·7 | W. 10·0 | W. 3·9 | ... | W. 7·8 | W. 8·7 | W. 21·5 | W. 23·1 | W. 24·0 | ... | W. 3·7 | W. 4·6 | W. 6·3 | ... | ... | ... | ... | ... | W. 3·3 | W. 3·6 | ... | W. 3·7 |
| 4. | W. 3·8 | ... | ... | ... | ... | ... | W. 3·8 | W. 3·6 | W. 4·9 | W. 4·2 | W. 4·1 | ... | E. 4·6 | E. 14·1 | E. 9·8 | E. 6·6 | E. 3·4 | E. 3·7 | ... | ... | W. 3·4 | ... | ... | W. 7·8 |
| Dec. 10. | ... | W. 4·5 | W. 12·2 | W. 10·7 | W. 10·8 | W. 10·6 | ... | E. 3·8 | E. 16·5 | E. 14·1 | E. 5·1 | E. 10·4 | E. 12·0 | E. 15·5 | E. 15·4 | ... | E. 7·6 | ... | W. 8·3 | W. 8·4 | W. 7·2 | W. 9·0 | W. 3·8 | W. 7·3 |
| 1861. | | | | | | | | | | | | | | | | | | | | | | | | |
| Jan. 24. | W. 6·4 | W. 4·8 | W. 14·9 | W. 5·0 | W. 6·1 | ... | ... | W. 4·5 | E. 13·6 | ... | E. 10·6 | E. 15·9 | ... | W. 3·6 | E. 3·3 | E. 4·0 | ... | ... | W. 3·3 | ... | ... | ... | W. 3·2 | W. 7·9 |
| 25. | W. 3·9 | W. 7·2 | W. 7·7 | W. 3·5 | W. 9·4 | E. 10·9 | | E. 6·7 | ... | E. 4·8 | E. 3·5 | E. 4·4 | E. 3·7 | E. 4·0 | E. 9·8 | E. 3·3 | W. 10·8 | ... | W. 8·0 | W. 6·1 | W. 7·3 | W. 3·3 | ... | ... |
| 26. | W. 6·4 | ... | W. 6·8 | W. 4·5 | W. 5·9 | ... | W. 4·7 | ... | ... | E. 8·5 | E. 3·9 | E. 32·8 | E. 16·4 | ... | W. 3·6 | ... | ... | W. 5·0 | W. 21·8 | W. 15·0 | W. 8·5 | W. 4·4 | W. 8·1 | W. 6·7 |
| Feb. 27. | W. 3·3 | W. 7·2 | W. 6·9 | W. 7·9 | W. 6·8 | W. 4·9 | ... | W. 9·5 | E. 6·5 | ... | E. 7·9 | E. 14·1 | E. 20·3 | E. 10·1 | E. 9·4 | E. 12·5 | E. 12·7 | ... | ... | ... | ... | W. 3·5 | W. 4·1 | W. 5·9 |
| 28. | W. 6·1 | W. 7·9 | ... | W. 5·5 | W. 5·0 | W. 5·2 | ... | E. 5·9 | ... | E. 12·9 | E. 8·7 | E. 6·4 | E. 12·3 | E. 15·1 | ... | E. 9·3 | E. 4·9 | W. 9·5 | W. 9·1 | W. 6·1 | W. 5·5 | ... | ... | ... |
| Mar. 1. | ... | ... | W. 4·9 | W. 6·2 | W. 5·7 | E. 12·4 | ... | W. 5·3 | E. 9·7 | E. 4·4 | ... | E. 3·7 | E. 7·8 | ... | ... | E. 4·5 | ... | ... | ... | W. 4·5 | W. 5·1 | W. 4·0 | ... | ... |
| 9. | ... | W. 6·4 | W. 3·9 | ... | ... | W. 7·9 | ... | ... | E. 7·2 | E. 6·5 | E. 29·6 | E. 13·8 | E. 10·3 | E. 14·2 | E. 13·7 | E. 9·9 | E. 19·1 | E. 20·9 | E. 21·9 | E. 19·9 | E. 19·1 | E. 17·6 | E. 17·4 | ... |
| 25. | W. 5·2 | W. 6·5 | W. 4·7 | W. 4·0 | W. 4·5 | W. 5·1 | ... | E. 4·1 | ... | E. 8·2 | ... | E. 3·9 | E. 5·5 | E. 5·0 | E. 10·6 | E. 7·2 | E. 6·9 | ... | ... | ... | W. 5·2 | W. 4·7 | W. 6·4 | W. 6·2 |
| Aug. 2. | W. 4·8 | W. 9·9 | W. 9·4 | W. 5·7 | W. 5·3 | W. 3·9 | W. 4·4 | W. 3·7 | ... | ... | E. 3·7 | E. 6·1 | E. 11·8 | ... | E. 3·9 | ... | E. 3·6 | ... | ... | ... | ... | ... | ... | ... |
| 19. | ... | ... | ... | ... | E. 6·7 | ... | E. 4·8 | E. 13·9 | ... | ... | ... | E. 3·3 | ... | ... | W. 3·3 | ... | ... | W. 5·2 | W. 4·3 | W. 3·6 | W. 5·9 | W. 4·2 | W. 5·2 | W. 4·5 |
| Sept. 19. | W. 4·4 | W. 7·0 | W. 3·5 | W. 5·5 | E. 4·2 | ... | ... | ... | E. 3·4 | ... | ... | ... | ... | E. 10·1 | ... | ... | ... | W. 11·0 | W. 4·3 | W. 5·0 | W. 7·8 | W. 4·9 | ... | ... |
| Oct. 10. | W. 8·5 | W. 13·1 | W. 14·9 | W. 6·8 | W. 4·5 | ... | ... | E. 16·4 | ... | E. 20·8 | E. 10·4 | E. 24·7 | E. 16·7 | ... | E. 16·1 | ... | ... | W. 5·5 | W. 4·0 | ... | ... | ... | ... | ... |
| 24. | W. 5.5 | W. 7·3 | W. 9·3 | ... | W. 15·6 | W. 9·8 | ... | ... | E. 6·3 | E. 15·3 | E. 9·6 | E. 7·9 | ... | ... | E. 7·0 | E. 12·3 | E. 8·0 | W. 8·3 | ... | W. 11·0 | ... | ... | ... | ... |
| Nov. 7. | W. 4·1 | W. 3·3 | W. 3·7 | W. 6·2 | W. 5·6 | ... | ... | E. 16·4 | E. 5·2 | E. 7·7 | ... | ... | E. 8·7 | ... | ... | ... | ... | W. 4·2 | W. 4·3 | W. 13·0 | W. 9·1 | W. 6·4 | W. 4·4 | ... |
| 18. | ... | ... | ... | ... | ... | ... | ... | ... | ... | E. 6·5 | E. 3·7 | E. 4·5 | E. 4·1 | E. 3·9 | E. 7·8 | E. 3·6 | ... | ... | ... | W. 7·5 | W. 6·5 | W. 6·4 | W. 5·2 | W. 3·9 |
| Dec. 4. | ... | W. 3·6 | W. 7·3 | W. 6·8 | W. 11·5 | W. 5·4 | ... | E. 3·5 | E. 6·6 | W. 11·8 | E. 5·8 | ... | ... | ... | W. 5·7 | ... | ... | ... | ... | ... | W. 3·3 | W. 6·9 | W. 5·6 | ... |
| 9. | ... | ... | ... | ... | ... | E. 8·5 | ... | ... | E. 11·1 | ... | E. 7·4 | E. 10·0 | E. 4·5 | E. 4·8 | E. 4·3 | ... | ... | W. 8·1 | W. 5·3 | W. 4·4 | W. 6·4 | W. 6·7 | W. 6·6 | W. 5·8 |
| 1862. | | | | | | | | | | | | | | | | | | | | | | | | |
| Jan. 15. | ... | ... | ... | ... | ... | W. 5·0 | E. 4·2 | E. 3·9 | E. 4·2 | ... | E. 12·2 | E. 5·6 | E. 12·7 | E. 18·4 | E. 15·4 | E. 11·5 | E. 7·2 | ... | W. 4·5 | W. 7·1 | W. 8·5 | E. 19·6 | E. 19·1 | ... |
| Feb. 21. | W. 4·4 | W. 6·7 | W. 11·7 | W. 7·2 | W. 12·8 | W. 7·4 | W. 8·7 | E. 7·4 | E. 26·7 | ... | E. 5·9 | E. 3·5 | E. 8·3 | E. 10·7 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| Mar. 16. | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | E. 4·4 | E. 5·0 | E. 5·2 | E. 5·5 | E. 6·7 | E. 3·8 | E. 7·3 | E. 4·9 | ... | W. 4·9 | W. 8·0 | W. 9·9 | W. 9·5 | W. 8·1 |
| April 2. | W. 7·9 | W. 6·4 | W. 14·5 | W. 6·0 | W. 6·3 | ... | E. 8·9 | E. 4·2 | E. 6·5 | E. 13·2 | E. 18·6 | E. 5·4 | ... | ... | ... | ... | ... | W. 5·1 | ... | ... | ... | ... | ... | ... |
| 10. | W. 5·1 | W. 5·9 | W. 8·8 | W. 8·9 | W. 7·4 | W. 5·2 | W. 3·5 | ... | ... | ... | E. 5·1 | E. 4·7 | E. 4·8 | E. 7·3 | E. 11·7 | E. 16·4 | E. 20·5 | E. 7·6 | ... | W. 11·7 | W. 9·8 | W. 8·3 | W. 8·3 | W. 7·2 |
| 27. | ... | ... | ... | ... | ... | ... | ... | E. 5·1 | ... | E. 7·7 | E. 9·0 | E. 10·7 | E. 18·7 | E. 9·9 | E. 14·1 | E. 9·5 | E. 5·2 | ... | ... | ... | W. 9·0 | W. 6·8 | W. 8·5 | W. 4·2 |
| July 5. | ... | E. 4·2 | ... | ... | ... | ... | W. 6·1 | ... | E. 12·4 | ... | E. 4·6 | E. 3·8 | E. 3·3 | ... | E. 4·4 | ... | ... | ... | W. 5·4 | W. 9·5 | W. 8·7 | W. 3·3 | W. 4·9 | W. 4·3 |
| 30. | ... | ... | W. 4·3 | W. 4·4 | W. 3·3 | ... | ... | E. 4·4 | ... | ... | ... | E. 5·4 | E. 7·0 | E. 5·6 | ... | ... | ... | ... | ... | E. 3·3 | E. 4·7 | E. 6·2 | E. 5·5 | E. 4·1 |
| August 4. | ... | W. 10·0 | W. 7·5 | W. 8·5 | ... | W. 5·6 | ... | ... | W. 3·6 | ... | ... | ... | ... | W. 11·1 | W. 8·7 | E. 9·1 | W. 8·7 | W. 5·3 | W. 16·7 | W. 3·3 | W. 4·9 | W. 10·9 | ... | ... |
| 28. | ... | ... | ... | W. 3·6 | W. 4·9 | ... | W. 4·8 | ... | ... | E. 19·3 | E. 7·5 | E. 6·4 | E. 6·6 | ... | W. 7·4 | W. 6·8 | ... | ... | ... | W. 5·3 | W. 9·0 | W. 10·6 | W. 5·9 | W. 3·6 |
| 30. | ... | W. 3·3 | ... | ... | ... | ... | E. 18·0 | E. 4·9 | ... | ... | ... | ... | E. 3·8 | W. 9·8 | E. 6·6 | E. 8·2 | W. 4·6 | W. 7·3 | W. 10·8 | W. 14·5 | W. 9·5 | W. 6·6 | ... | ... |
| Sept. 29. | ... | ... | ... | E. 3·7 | E. 5·4 | E. 4·3 | ... | ... | ... | ... | W. 4·4 | W. 5·7 | W. 5·1 | W. 4·6 | W. 6·8 | W. 5·2 | W. 7·0 | W. 7·2 | W. 4·5 | ... | ... | ... | ... | ... |
| Oct. 3. | ... | W. 3·8 | W. 4·4 | ... | ... | ... | ... | E. 4·4 | E. 24·0 | E. 15·4 | E. 49·9 | E. 24·4 | E. 19·2 | E. 14·6 | E. 14·8 | E. 8·6 | W. 3·8 | W. 25·1 | W. 37·0 | W. 33·4 | W. 20·4 | W. 28·2 | W. 9·9 | W. 4·2 |
| 22. | W. 7·9 | W. 11·3 | W. 5·6 | W. 10·3 | E. 21·0 | W. 3·3 | ... | E. 6·3 | ... | W. 16·5 | ... | E. 16·5 | ... | W. 4·8 | ... | ... | ... | W. 10·7 | W. 4·9 | W. 4·4 | W. 6·1 | W. 6·2 | ... | W. 5·7 |
| Dec. 14. | ... | ... | ... | W. 11·2 | W. 6·3 | E. 12·2 | E. 5·3 | W. 23·1 | E. 14·6 | E. 32·9 | E. 28·1 | E. 13·7 | E. 29·5 | E. 20·5 | E. 14·9 | E. 8·5 | ... | ... | W. 3·6 | ... | ... | ... | ... | ... |
| 24. | W. 4·2 | ... | W. 3·9 | ... | E. 3·4 | ... | E. 9·9 | E. 7·0 | E. 13·2 | E. 7·5 | E. 18·1 | E. 19·4 | E. 20·3 | E. 22·4 | E. 29·9 | E. 16·1 | ... | E. 6·9 | ... | W. 10·9 | W. 11·7 | W. 5·2 | W. 5·9 | W. 4·8 |

## Summary.

| | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Easterly Deflections. | 1858. | 41·2 | 40·2 | 40·0 | 33·2 | 46·1 | 20·7 | 7·0 | 58·7 | 47·3 | 45·1 | 80·5 | 90·8 | 111·6 | 118·7 | 80·2 | 70·3 | 41·0 | 8·6 | 9·5 | 3·2 | ... | ... | ... | 11·6 |
| | 1859. | 17·3 | ... | 6·1 | ... | ... | 6·5 | 59·6 | 34·4 | 27·5 | 98·8 | 106·1 | 122·8 | 71·7 | 113·7 | 128·5 | 61·0 | 36·1 | 16·6 | 17·6 | 30·9 | 32·9 | 7·7 | 13·7 | ... |
| | 1860. | ... | 3·7 | 3·5 | 16·1 | 9·4 | 29·1 | 22·1 | 41·0 | 68·5 | 84·3 | 68·7 | 85·9 | 127·5 | 138·0 | 163·3 | 106·8 | 89·0 | 70·0 | 16·1 | 37·3 | 14·5 | 33·2 | 27·8 | 47·5 |
| | 1861. | ... | ... | ... | ... | 10·9 | 31·8 | 4·8 | 66·9 | 69·6 | 95·6 | 104·8 | 151·5 | 122·1 | 67·2 | 85·9 | 66·6 | 55·2 | 20·9 | 21·9 | 19·9 | 19·1 | 17·6 | 17·4 | ... |
| | 1862. | ... | 4·2 | ... | 3·7 | 29·8 | 16·5 | 46·3 | 47·6 | 101·6 | 96·0 | 163·4 | 124·5 | 139·4 | 114·9 | 118·5 | 91·7 | 40·2 | 19·4 | ... | 3·3 | 4·7 | 25·8 | 24·6 | 4·1 |
| Sums... | | 58·5 | 48·1 | 49·6 | 53·0 | 96·2 | 104·6 | 139·8 | 248·6 | 314·5 | 419·8 | 523·5 | 575·5 | 572·3 | 552·5 | 576·4 | 396·4 | 261·5 | 135·5 | 65·1 | 94·6 | 71·2 | 84·3 | 83·5 | 63·2 |
| Westerly Deflections. | 1858. | 39·4 | 25·2 | 44·7 | 64·6 | 83·2 | 49·7 | 71·5 | 7·1 | 11·8 | 24·9 | 10·5 | ... | 14·0 | 14·9 | 10·7 | 18·0 | 40·9 | 66·1 | 97·3 | 145·9 | 96·4 | 65·2 | 23·1 | 20·1 |
| | 1859. | 71·7 | 83·7 | 78·6 | 132·9 | 126·9 | 96·6 | 77·5 | 30·0 | 23·2 | 20·5 | 8·4 | 14·7 | 35·4 | 11·5 | 19·5 | 15·0 | 83·3 | 145·9 | 168·4 | 96·8 | 85·5 | 102·1 | 92·1 | 54·4 |
| | 1860. | 76·7 | 70·7 | 96·7 | 129·1 | 105·7 | 38·8 | 34·7 | 25·0 | 39·8 | 36·2 | 31·6 | 44·9 | 40·9 | 25·2 | 23·8 | 11·5 | 5·3 | 10·0 | 46·5 | 48·8 | 47·4 | 71·4 | 67·8 | 58·2 |
| | 1861. | 58·6 | 84·2 | 97·9 | 67·6 | 85·9 | 42·2 | 9·1 | 23·0 | ... | 11·8 | ... | ... | ... | 3·6 | 12·6 | ... | 10·8 | 56·8 | 64·4 | 76·2 | 70·6 | 55·4 | 48·8 | 40·9 |
| | 1862. | 29·5 | 47·4 | 60·7 | 60·1 | 41·0 | 26·5 | 23·1 | 23·1 | 3·6 | 16·5 | 4·4 | 5·7 | 5·1 | 30·3 | 22·9 | 12·0 | 24·1 | 60·7 | 87·4 | 105·0 | 105·6 | 96·0 | 52·9 | 42·1 |
| Sums... | | 275·9 | 311·2 | 378·6 | 454·3 | 442·7 | 253·8 | 215·9 | 108·2 | 78·4 | 109·9 | 54·9 | 65·3 | 95·4 | 85·5 | 89·5 | 56·5 | 164·4 | 339·5 | 464·0 | 472·7 | 405·5 | 390·1 | 284·7 | 215·7 |

§ 2. *Comparison of the laws of the disturbance-diurnal variation derived from the ninety-five days of disturbance tabulated in the first section of this paper, with the conclusions derived, at the same place and for the same period, from the wider basis of investigation supplied by the process first introduced and published by myself eighteen years ago.*

The process here referred to consists, as is well known, in separating from the whole body of observations employed, *all*, without exception and whensoever occurring, which differ from their respective normals of the same month and hour by a certain value, constant for the same element at the same station—the amount of this arbitrary standard, or minimum value of a disturbance, being regulated by one condition only, viz. that it shall not be so small as to endanger the inclusion amongst the separated observations of any in which the cause of the irregularity may with probability be ascribed to any other source than that of the class of phenomena whose laws we desire to study. In the case of the hourly positions tabulated from the Kew Photograms from January 1858 to December 1862, 0·15 inch of the photographic scale, or 3·3 minutes of arc measured from the normal of the same month and hour after the omission of the disturbed observations, has been taken as the standard or minimum value of a disturbance. There are altogether in the photograms of the five years at Kew the effective records of 43,456 hourly positions; the number of failures in the photographic registration from *all* causes being only 368. Of these 43,456 recorded positions, 5941, being about 1 in 7 of the whole body, differed by an amount equalling or exceeding 3'·3 from their respective normals. The aggregate value of the differences of the disturbed positions, measured from the normals, was 36,580·8 minutes of arc, of which 19,748'·7 were easterly, and 16,832'·1 were westerly deflections.

Table II. exhibits the *aggregate values* of the disturbances distributed into easterly and westerly deflections, and into the several *hours* of their occurrence. The easterly deflections derived from the ninety-five days are in column 2, and those derived from the 5941 disturbed positions (*i. e.* from all disturbances equalling or exceeding 3'·3) in column 3; the westerly deflections derived from the ninety-five days occupy column 4, and those obtained from the 5941 disturbed positions column 5. The *Ratios* which the aggregate values of easterly and westerly deflection at the different hours bear to their respective mean hourly values are shown in the same Table (II.), the easterly in columns 6 and 7; the westerly in columns 8 and 9. By comparing the values in columns 6 and 7 with each other, it will be seen that the Ratios of the easterly deflections exhibit approximately the same law, whether obtained from the ninety-five days, or from all disturbances equalling or exceeding 3'·3; and by comparing the ratios in columns 8 and 9, it will be seen, in like manner, that there is a similar general accordance in the ratios of the westerly deflections, whether obtained from the ninety-five days, or from the more extensive induction: the *laws*, when examined by the *ratios*, are seen to be approximately the same when derived by either process, although the aggregate values are very dissimilar—being more than three times as great when the method of investigation is such as to comprehend all disturbances equalling or exceeding 3'·3, as when it is limited to the disturbances in ninety-five days of principal note.

TABLE II.

| Kew Astronomical Hours. | Aggregate Values. | | | | Ratios. | | | | Kew Astronomical Hours. |
|---|---|---|---|---|---|---|---|---|---|
| | Easterly Deflections. | | Westerly Deflections. | | Easterly Deflections. | | Westerly Deflections. | | |
| | From 95 Days. | From all Disturbances. | From 95 Days. | From all Disturbances. | From 95 Days. | From all Disturbances. | From 95 Days. | From all Disturbances. | |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
| 0 | 59 | 247 | 276 | 1074 | 0·25 | 0·30 | 1·15 | 1·53 | 0 |
| 1 | 48 | 269 | 311 | 1157 | 0·21 | 0·33 | 1·57 | 1·65 | 1 |
| 2 | 50 | 308 | 379 | 1232 | 0·21 | 0·37 | 1·56 | 1·76 | 2 |
| 3 | 53 | 245 | 454 | 1175 | 0·23 | 0·30 | 1·88 | 1·67 | 3 |
| 4 | 96 | 371 | 443 | 1039 | 0·41 | 0·45 | 1·86 | 1·48 | 4 |
| 5 | 105 | 478 | 254 | 718 | 0·46 | 0·58 | 1·07 | 1·02 | 5 |
| 6 | 140 | 647 | 216 | 506 | 0·60 | 0·79 | 0·89 | 0·72 | 6 |
| 7 | 249 | 999 | 108 | 314 | 1·07 | 1·21 | 0·44 | 0·45 | 7 |
| 8 | 315 | 1322 | 78 | 233 | 1·35 | 1·61 | 0·33 | 0·33 | 8 |
| 9 | 420 | 1562 | 110 | 257 | 1·81 | 1·90 | 0·45 | 0·37 | 9 |
| 10 | 524 | 1983 | 55 | 160 | 2·26 | 2·41 | 0·23 | 0·23 | 10 |
| 11 | 576 | 1978 | 65 | 156 | 2·47 | 2·40 | 0·27 | 0·22 | 11 |
| 12 | 572 | 1946 | 95 | 301 | 2·46 | 2·36 | 0·40 | 0·43 | 12 |
| 13 | 553 | 1706 | 86 | 371 | 2·38 | 2·07 | 0·35 | 0·53 | 13 |
| 14 | 576 | 1558 | 90 | 441 | 2·48 | 1·89 | 0·37 | 0·63 | 14 |
| 15 | 396 | 1245 | 57 | 376 | 1·71 | 1·51 | 0·24 | 0·54 | 15 |
| 16 | 262 | 862 | 164 | 488 | 1·12 | 1·05 | 0·68 | 0·70 | 16 |
| 17 | 136 | 419 | 340 | 839 | 0·58 | 0·51 | 1·40 | 1·20 | 17 |
| 18 | 65 | 243 | 464 | 1058 | 0·28 | 0·30 | 1·91 | 1·51 | 18 |
| 19 | 95 | 262 | 473 | 1175 | 0·41 | 0·32 | 1·95 | 1·67 | 19 |
| 20 | 71 | 289 | 406 | 1039 | 0·31 | 0·35 | 1·67 | 1·48 | 20 |
| 21 | 84 | 274 | 390 | 981 | 0·36 | 0·33 | 1·61 | 1·40 | 21 |
| 22 | 84 | 287 | 285 | 838 | 0·36 | 0·35 | 1·18 | 1·19 | 22 |
| 23 | 63 | 250 | 216 | 910 | 0·27 | 0·30 | 0·89 | 1·30 | 23 |
| Sums... | 5592 | 19750 | 5815 | 16838 | 233=1·00 | 823=1·00 | 243=1·00 | 701=1·00 | Mean hourly values. |
| Means.. | 233 | 823 | 243 | 701 | | | | | |

For the convenience of those who prefer graphical to tabular representation, the diurnal course of the easterly deflections, corresponding to the Ratios in columns 6 and 7 of Table II., is exhibited in Plate XIII. figure 1, where the broken line shows the diurnal march indicated by the ratios obtained from the ninety-five days, and the unbroken line the diurnal march obtained from all the disturbances equalling or exceeding 3′·3. Figure 2 is a similar representation of the diurnal march of westerly disturbance-deflection, obtained, as shown by the broken line, from the ninety-five days, and by the unbroken line from the more comprehensive investigation. The general aspect of the two figures seems to establish in the most conclusive manner—

1. That the disturbances have systematic laws:

2. That the easterly and westerly deflections have each their own systematic laws, distinct and different from each other:

3. That these laws are approximately the same, whether derived from the more limited or from the more comprehensive basis, although in the latter case the *aggregate values* of disturbance are more than three times as great as when the disturbances of the ninety-five days only are taken into account.

Hence it follows that by taking only the most notable days of disturbance in five years (averaging nineteen in each year), we may gain an approximately correct view of the *character* of the disturbance-diurnal variation; but if we desire not only to learn its character, but also to *eliminate its influence*, in compliance with the prescribed condition of "eliminating the casual and transitory changes as a first and essential step towards a correct knowledge of the more regular periodical variations," then we see that *the mere omission of those ninety-five days is altogether inadequate for the desired object*, as it would scarcely eliminate a third part of the systematically disturbing element, shown to admit of elimination by a more suitable process.

§ 3. *Disturbance-diurnal Variation.*

Table III. exhibits the excess of easterly over westerly, or of westerly over easterly deflection at twenty-four equidistant epochs of the solar day, derived, in column 2, from the disturbances in the ninety-five days, and in column 3, from all disturbances equalling or exceeding 3′·3 from their respective normals. These columns consequently show the disturbance-diurnal variation corresponding to the more complete, and to the less complete, process of elimination. The *character* of the progression is seen to be substantially the same in both cases, but the *amount* of disturbance is between three and four times as great in column 3 as in column 2.

TABLE III.—Disturbance-diurnal Variation; or Excess of Easterly over Westerly, or of Westerly over Easterly Deflection, at twenty-four equidistant epochs in the twenty-four hours.

| Kew Astronomical Hours. | Derived from the ninety-five days of most notable disturbance. | Derived from all disturbances equalling or exceeding 3′·3. | Kew Astronomical Hours. |
|---|---|---|---|
| (1) | (2) | (3) | (4) |
| 0 | 2·17 W. | 8·26 W. | 0 |
| 1 | 2·63 W. | 8·89 W. | 1 |
| 2 | 3·29 W. | 9·24 W. | 2 |
| 3 | 4·01 W. | 9·30 W. | 3 |
| 4 | 3·47 W. | 6·07 W. | 4 |
| 5 | 1·49 W. | 2·40 W. | 5 |
| 6 | 0·76 W. | 1·41 E. | 6 |
| 7 | 1·41 E. | 6·86 E. | 7 |
| 8 | 2·37 E. | 10·89 E. | 8 |
| 9 | 3·10 E. | 13·05 E. | 9 |
| 10 | 4·69 E. | 18·23 E. | 10 |
| 11 | 5·11 E. | 18·22 E. | 11 |
| 12 | 4·77 E. | 16·44 E. | 12 |
| 13 | 4·67 E. | 13·36 E. | 13 |
| 14 | 4·86 E. | 11·17 E. | 14 |
| 15 | 3·40 E. | 8·69 E. | 15 |
| 16 | 0·97 E. | 3·74 E. | 16 |
| 17 | 2·04 W. | 4·20 W. | 17 |
| 18 | 3·99 W. | 8·15 W. | 18 |
| 19 | 3·78 W. | 9·13 W. | 19 |
| 20 | 3·34 W. | 7·50 W. | 20 |
| 21 | 2·06 W. | 7·06 W. | 21 |
| 22 | 2·01 W. | 5·51 W. | 22 |
| 23 | 1·53 W. | 6·60 W. | 23 |

For those who prefer graphical representation, the curved line in Plate XIII. fig. 3 exhibits the excess of easterly over westerly, or of westerly over easterly deflection, *i. e.* the disturbance-diurnal variation, obtained from the 5941 disturbances equalling or exceeding $3'\cdot3$ from the respective normals, as shown in column 3 of Table III. The straight horizontal line in figure 3 represents the mean or normal position of the magnet at the several hours, after the omission of the disturbances. It is figured for convenience as a straight line, though in reality it is itself a curve following the progression of the solar-diurnal variation. The lengths of the ordinates which are *above* the normal line indicate the excess of the easterly over the westerly deflections at the hours when the easterly preponderate, and those which are *below* the normal line the excess of the westerly over the easterly at the hours when the westerly deflections predominate.

The easterly portion of the disturbance-diurnal variation is seen to be continuous for about ten hours, or from about 6 P.M. to 4 A.M. The westerly portion is also continuous, extending over the remaining fourteen hours, or from about 4 A.M. to 6 P.M. The easterly has a single maximum occurring about midway between its commencement and its termination. The westerly is more complex, having two maxima separated by an interval of about 8 or 9 hours. But whilst the westerly excess extends over more hours than the easterly, the areas of the two portions have nearly the same dimensions; or, in other words, the sums of the hourly deflections in opposite directions are at Kew nearly equal, and any small difference between them is not a persistent one, the easterly exceeding in some years and in others the westerly. The equality or otherwise of the sum of the deflections in opposite directions is apparently a point of some theoretical significance, as will be further noticed when the analogous phenomena in other localities come to be discussed.

As we find the same general forms of the two portions of the disturbance-diurnal variation, which have been thus derived from the Kew photograms, reproduced in other localities in the separated portions of the easterly and westerly deflections (with only such slight variations as may well be supposed to be due to accidental or subordinate causes), it may be desirable to examine somewhat more closely what may be viewed as the characteristic differences of the deflections in the two directions. The easterly deflection is represented, as we have already seen, in Plate XIII. fig. 1: it is distinguished by its approximately conical form and single maximum, and by the small and nearly equable amount of variation during the ten or eleven hours when the ratios are least. Its general form thus bears a striking resemblance to the diurnal curve of the solar-diurnal variation (as obtained after the careful separation and omission of the casual and transitory changes); but the two phenomena differ from each other in the important circumstance, that in the solar-diurnal variation the solar hours corresponding to its different features are *the same* in all meridians in the extra-tropical parts of the same hemisphere, whilst in the portion of the disturbance-diurnal variation which is now under notice, the solar hours corresponding to its different features *vary*, apparently without limit, in different meridians. This is a distinction which may well be supposed to indicate a difference in the *mode* of causation, although it would not justify an inference that the sun may not be the originating cause in both cases.

The westerly deflections at Kew, represented in Plate XIII. fig. 2, have a decided double maximum, with an intervening interval of about eight or nine hours. The analogous form in other localities has the double maximum sometimes more and sometimes less decidedly marked. The interval intervening between the maxima is usually of about the same duration at stations in the northern hemisphere; at some stations in the southern hemisphere it is apparently somewhat longer.

The conical form and single maximum which characterize the *easterly* deflections at Kew belong also to the easterly deflections in all localities in North America where the laws of the disturbances have been investigated. But when we view the phenomena at Nertschinsk and Pekin, which are the only two localities in Northern Asia for which the investigation has yet been made, we find, on the contrary, that the conical form and single maximum characterize the *westerly* deflections, whilst the easterly have the double maximum. Further, we find that at the two Asiatic stations the aggregate values of the *westerly* deflections decidedly predominate, whilst in America the *easterly* deflections are no less decidedly predominant; and at Kew, which we may regard as an intermediate locality, the amount of deflection in the two directions may be said to be balanced, there being in some years a slight preponderance of westerly, and in other years of easterly deflection.

There is another circumstance which seems to connect, in what may prove even a more instructive relation, the westerly deflections in Northern Asia with the easterly in other parts of the northern hemisphere. I refer here to an approximate accordance in *absolute time* which appears in the most marked features of the diurnal curve at the widely separated localities of Pekin, Nertschinsk, Kew, and Toronto, at each and all of which the curves as they are presented in Plate XIII. figs. 1, 4, 5, and 6 are the mean result of several years of hourly observation*. These localities appear to be particularly well suited for a comparison of this nature, being not very dissimilar in geographical latitude, whilst they include a difference in longitude of no less than 195°. If we select the epoch of the maximum deflection (or the apex of the curve) as the most marked feature, the comparison would stand nearly as follows; commencing with the most easterly, and proceeding in succession from east to west:—

* The figures 1, 4, 5, and 6 in Plate XIII., representing respectively the Easterly deflections at Kew and Toronto and the Westerly at Nertschinsk and Pekin, are delineated from the following formulæ, in which $a$, expressed in degrees 15 to the hour, is reckoned from the mean noon at the station:—

| | |
|---|---|
| Kew . . . | $1+0{\cdot}98\,(\sin a+280^\circ\,22')-0{\cdot}417\,(\sin 2a+286^\circ\,29')$: |
| Toronto . . | $1+1{\cdot}05\,(\sin a+285\;58)-0{\cdot}332\,(\sin 2a+334\;07)$: |
| Nertschinsk . | $1-0{\cdot}94\,(\sin a+309\;02)-0{\cdot}238\,(\sin 2a+\;13\;11)$: |
| Pekin . . . | $1-0{\cdot}76\,(\sin a+289\;12)-0{\cdot}200\,(\sin 2a+\;\;1\;42)$. |

Assuming that the formulæ represent correctly the ratios at the several hours, the observed values are in very tolerable accord with them; at Kew and Nertschinsk they are the most so; at Kew the probable error of a single hourly ratio is $\pm 0{\cdot}056$, at Nertschinsk $\pm 0{\cdot}062$.

| Deflections. | Localities. | Latitudes. | Longitudes. | Approximate | |
|---|---|---|---|---|---|
| | | | | Local solar Hour. | Absolute Hour at Kew. |
| Westerly...... | Pekin ............ | 39° 54′ N. | 116° 6′ E. = 7h·8 | 22 | 14 |
| | Nertschinsk ...... | 51 19 N. | 114 9 E. = 7·7 | 21 | 13 |
| Easterly ...... | Kew............... | 51 29 N. | 0 = 0·0 | 11 | 11 |
| | Toronto ......... | 43 40 N. | 79 0 W. = 5·3 | 10 | 15 |

It must be remembered that the time of the occurrence of the apex (or maximum of deflection) scarcely admits of very *precise* determination; and further, that assuming for the disturbing impulse a common origin at any other point of the terrestrial surface than at the geographical pole, and an equable but appreciable velocity of propagation, the difference of the geographical meridians would not be the sole consideration in deducing the absolute epoch from the local hours at different stations.

Could we thus identify the westerly deflections in Asia with the easterly in Europe and America, we should have a confirmation on a very extended scale of M. Gauss's conclusion derived from the comparison of synchronous disturbances at stations remote from each other, viz. that "the synchronous disturbances of the same element not only differ widely in amount, but occasionally appear to be even *reversed* in direction."

It may be that this may prove the first step in the inductive inquiry which may lead eventually to a complete understanding of the systematic distinction which we find in comparing the solar-diurnal with the disturbance-diurnal variations,—by referring the first to causes which, within the sphere of their operation, produce the same phenomena at the same solar hours; and the second to effects originating (as far as the terrestrial surface is concerned) in special localities from whence they are propagated, and admitting of classification by means of the absolute hours to which they approximately correspond. For a conclusion of such moment, however, much preliminary investigation is still required, for which materials either do not yet exist, or have not yet been submitted to the necessary processes of examination. It seems especially important that the laws of the disturbances, and of their respective easterly and westerly deflections, should be known at a station or stations intermediate between Nertschinsk and Kew.

The propriety of making the easterly and the westerly deflections the subjects of distinct investigation will be still more apparent by reverting to Plate XIII. fig. 3, and remembering that the areas containing respectively the ordinates above and below the normal line are subject at different stations to horizontal displacements, each independent of the other; and thus that at some stations the opposite deflections may have a tendency to mask each other's influence in the resultant mean deflection (*i. e.* in the *excess* of easterly over westerly, or of westerly over easterly deflection). It happens at Kew that the large disturbances in opposite directions take place at opposite hours of the twenty-four, and that they thus record themselves in great measure independently of each other; but experience has already shown that there are stations where large disturbances show themselves in both directions, on different days, at the same hours; and such deflections would of course tend to neutralize each other in the resultant mean, thus masking the operation of the general causes whose laws we desire to learn. This inconvenience is in great measure remedied by the method of analysis which has been adopted, whereby the deflections are exhibited separately as well as in their combination.

## § 4. TABLE IV.—Kew, Diurnal Inequality of the Declination from January 1, 1858 to December 31, 1862.

| Months. | Astronomical Hours. $0^h$. | $1^h$. | $2^h$. | $3^h$. | $4^h$. | $5^h$. | $6^h$. | $7^h$. | $8^h$. | $9^h$. | $10^h$. | $11^h$. | $12^h$. | $13^h$. | $14^h$. | $15^h$. | $16^h$. | $17^h$. | $18^h$. | $19^h$. | $20^h$. | $21^h$. | $22^h$. | $23^h$. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| January | w. 3·67 | w. 4·19 | w. 3·95 | w. 2·74 | w. 1·75 | w. 1·05 | w. 0·84 | E. 0·10 | E. 1·21 | E. 1·80 | E. 2·63 | E. 2·86 | E. 2·26 | E. 1·87 | E. 1·53 | E. 1·31 | E. 1·08 | E. 0·86 | E. 0·70 | E. 0·56 | E. 0·93 | E. 1·10 | w. 0·33 | w. 2·23 |
| February | w. 4·47 | w. 5·83 | w. 5·72 | w. 4·51 | w. 2·88 | w. 1·99 | w. 0·77 | E. 0·17 | E. 1·46 | E. 2·33 | E. 2·65 | E. 2·92 | E. 2·75 | E. 2·12 | E. 1·86 | E. 1·77 | E. 1·42 | E. 1·34 | E. 1·38 | E. 1·52 | E. 2·06 | E. 2·10 | E. 0·52 | w. 2·14 |
| March | w. 6·57 | w. 8·07 | w. 7·49 | w. 6·04 | w. 3·74 | w. 1·35 | E. 0·04 | E. 0·91 | E. 1·77 | E. 1·77 | E. 2·52 | E. 2·41 | E. 2·65 | E. 2·42 | E. 2·26 | E. 2·14 | E. 2·37 | E. 2·25 | E. 2·21 | E. 2·73 | E. 3·98 | E. 3·42 | E. 0·79 | w. 3·46 |
| April | w. 6·91 | w. 8·77 | w. 8·29 | w. 6·16 | w. 4·27 | w. 1·84 | w. 0·45 | E. 0·91 | E. 1·17 | E. 1·25 | E. 2·06 | E. 2·57 | E. 2·54 | E. 2·20 | E. 2·25 | E. 2·21 | E. 2·29 | E. 2·35 | E. 3·25 | E. 4·43 | E. 5·43 | E. 4·12 | E. 1·01 | w. 3·28 |
| May | w. 5·90 | w. 6·81 | w. 6·34 | w. 4·95 | w. 3·31 | w. 1·67 | w. 0·26 | E. 0·42 | E. 0·57 | E. 0·60 | E. 0·82 | E. 1·25 | E. 1·30 | E. 1·11 | E. 1·27 | E. 2·05 | E. 2·39 | E. 3·31 | E. 4·17 | E. 4·88 | E. 4·78 | E. 3·23 | E. 0·32 | w. 3·20 |
| June | w. 5·89 | w. 7·15 | w. 7·23 | w. 6·06 | w. 4·33 | w. 2·38 | w. 1·03 | E. 0·02 | E. 0·25 | E. 0·44 | E. 0·86 | E. 0·87 | E. 0·98 | E. 1·27 | E. 1·99 | E. 2·25 | E. 2·90 | E. 4·42 | E. 4·96 | E. 5·64 | E. 5·15 | E. 3·85 | E. 0·90 | w. 2·87 |
| July | w. 5·65 | w. 7·32 | w. 7·31 | w. 6·07 | w. 4·33 | w. 2·58 | w. 1·11 | w. 0·35 | E. 0·20 | E. 0·24 | E. 0·74 | E. 1·19 | E. 2·02 | E. 1·99 | E. 1·96 | E. 2·08 | E. 2·78 | E. 4·37 | E. 5·14 | E. 5·27 | E. 4·78 | E. 3·23 | E. 1·05 | w. 2·45 |
| August | w. 6·88 | w. 8·32 | w. 7·76 | w. 5·59 | w. 3·14 | w. 0·63 | E. 0·50 | E. 1·03 | E. 0·78 | E. 1·04 | E. 1·47 | E. 1·72 | E. 1·93 | E. 1·89 | E. 2·36 | E. 2·53 | E. 2·91 | E. 3·42 | E. 4·09 | E. 5·00 | E. 4·43 | E. 2·30 | w. 0·96 | w. 4·17 |
| September | w. 7·25 | w. 8·26 | w. 7·08 | w. 5·04 | w. 2·62 | w. 0·80 | E. 0·69 | E. 1·16 | E. 1·49 | E. 2·05 | E. 3·05 | E. 2·42 | E. 2·04 | E. 2·22 | E. 2·20 | E. 2·59 | E. 2·75 | E. 2·26 | E. 2·52 | E. 3·50 | E. 3·86 | E. 2·15 | w. 1·06 | w. 4·88 |
| October | w. 6·50 | w. 7·40 | w. 6·76 | w. 4·73 | w. 2·53 | w. 1·21 | w. 0·38 | E. 0·90 | E. 2·01 | E. 3·14 | E. 3·78 | E. 3·74 | E. 3·29 | E. 2·36 | E. 2·32 | E. 2·05 | E. 1·62 | E. 0·69 | E. 0·98 | E. 1·67 | E. 2·70 | E. 2·30 | w. 0·12 | w. 3·86 |
| November | w. 4·62 | w. 5·11 | w. 4·73 | w. 3·62 | w. 1·89 | w. 1·14 | w. 0·17 | E. 0·75 | E. 1·76 | E. 2·65 | E. 2·35 | E. 2·78 | E. 2·67 | E. 1·81 | E. 1·34 | E. 1·24 | E. 1·14 | E. 1·00 | E. 0·98 | E. 0·89 | E. 1·26 | E. 1·45 | w. 0·10 | w. 2·73 |
| December | w. 3·52 | w. 4·06 | w. 3·95 | w. 2·94 | w. 1·67 | w. 0·94 | w. 0·76 | E. 0·29 | E. 1·86 | E. 2·33 | E. 3·21 | E. 2·91 | E. 2·79 | E. 2·13 | E. 1·92 | E. 0·92 | E. 0·54 | E. 0·25 | E. 0·21 | E. 0·20 | E. 0·40 | E. 0·63 | w. 0·51 | w. 2·15 |
| Semiannual Means ... Apr. to Sept. | w. 6·41 | w. 7·77 | w. 7·34 | w. 5·65 | w. 3·67 | w. 1·65 | w. 0·28 | E. 0·53 | E. 0·74 | E. 0·94 | E. 1·50 | E. 1·67 | E. 1·80 | E. 1·78 | E. 2·01 | E. 2·29 | E. 2·67 | E. 3·36 | E. 4·02 | E. 4·79 | E. 4·74 | E. 3·15 | E. 0·21 | w. 3·48 |
| Semiannual Means ... Oct. to Mar. | w. 4·89 | w. 5·78 | w. 5·43 | w. 4·10 | w. 2·41 | w. 1·28 | w. 0·48 | E. 0·52 | E. 1·68 | E. 2·34 | E. 2·86 | E. 2·94 | E. 2·74 | E. 2·12 | E. 1·87 | E. 1·57 | E. 1·36 | E. 1·06 | E. 1·08 | E. 1·26 | E. 1·89 | E. 1·83 | E. 0·04 | w. 2·76 |
| Annual Means | w. 5·65 | w. 6·77 | w. 6·38 | w. 4·87 | w. 3·04 | w. 1·46 | w. 0·38 | E. 0·53 | E. 1·21 | E. 1·64 | E. 2·18 | E. 2·30 | E. 2·27 | E. 1·95 | E. 1·94 | E. 1·93 | E. 2·02 | E. 2·21 | E. 2·55 | E. 3·02 | E. 3·31 | E. 2·49 | E. 0·13 | w. 3·12 |

## § 4. TABLE V.—Kew, Solar-diurnal Variation of the Declination from January 1, 1858 to December 31, 1862.

| Months. | $0^h$. | $1^h$. | $2^h$. | $3^h$. | $4^h$. | $5^h$. | $6^h$. | $7^h$. | $8^h$. | $9^h$. | $10^h$. | $11^h$. | $12^h$. | $13^h$. | $14^h$. | $15^h$. | $16^h$. | $17^h$. | $18^h$. | $19^h$. | $20^h$. | $21^h$. | $22^h$. | $23^h$. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| January | w. 3·10 | w. 3·78 | w. 3·50 | w. 2·12 | w. 1·32 | w. 0·89 | w. 0·48 | E. 0·09 | E. 0·92 | E. 1·40 | E. 1·68 | E. 1·66 | E. 1·48 | E. 1·13 | E. 1·01 | E. 0·66 | E. 0·89 | E. 1·11 | E. 1·09 | E. 1·21 | E. 1·47 | E. 1·25 | w. 0·10 | w. 1·83 |
| February | w. 3·65 | w. 4·72 | w. 5·07 | w. 3·78 | w. 2·30 | w. 1·35 | w. 0·76 | w. 0·14 | E. 0·68 | E. 1·22 | E. 1·90 | E. 1·76 | E. 1·69 | E. 1·58 | E. 1·23 | E. 1·17 | E. 1·21 | E. 1·56 | E. 1·72 | E. 1·79 | E. 2·32 | E. 2·48 | E. 1·09 | w. 1·70 |
| March | w. 5·87 | w. 7·24 | w. 6·81 | w. 5·13 | w. 2·94 | w. 1·11 | w. 0·22 | E. 0·47 | E. 0·80 | E. 1·36 | E. 1·66 | E. 1·76 | E. 1·74 | E. 1·34 | E. 1·49 | E. 1·46 | E. 1·74 | E. 2·41 | E. 2·48 | E. 3·39 | E. 4·43 | E. 4·01 | E. 1·41 | w. 2·66 |
| April | w. 6·62 | w. 8·44 | w. 7·87 | w. 5·73 | w. 3·34 | w. 1·43 | w. 0·12 | E. 0·45 | E. 0·81 | E. 0·95 | E. 1·00 | E. 1·33 | E. 1·21 | E. 1·22 | E. 1·53 | E. 1·79 | E. 2·07 | E. 2·47 | E. 3·39 | E. 5·26 | E. 6·39 | E. 4·86 | E. 1·60 | w. 2·79 |
| May | w. 5·79 | w. 6·63 | w. 6·04 | w. 4·61 | w. 2·91 | w. 1·74 | w. 0·44 | E. 0·31 | E. 0·26 | E. 0·20 | E. 0·32 | E. 0·62 | E. 0·72 | E. 0·85 | E. 1·09 | E. 1·68 | E. 2·30 | E. 3·52 | E. 5·00 | E. 5·36 | E. 5·12 | E. 5·37 | E. 0·48 | w. 2·94 |
| June | w. 5·66 | w. 6·86 | w. 6·83 | w. 5·86 | w. 4·17 | w. 2·30 | w. 0·85 | w. 0·12 | w. 0·03 | E. 0·15 | E. 0·17 | E. 0·49 | E. 0·61 | E. 0·96 | E. 1·41 | E. 1·98 | E. 2·94 | E. 4·66 | E. 5·75 | E. 6·16 | E. 5·37 | E. 3·90 | E. 0·80 | w. 2·64 |
| July | w. 5·50 | w. 6·96 | w. 6·77 | w. 5·45 | w. 3·96 | w. 2·14 | w. 1·10 | w. 0·58 | w. 0·26 | E. 0·02 | E. 0·19 | E. 0·47 | E. 1·36 | E. 1·12 | E. 1·48 | E. 1·68 | E. 2·81 | E. 4·23 | E. 5·38 | E. 5·73 | E. 5·23 | E. 3·69 | E. 0·95 | w. 1·94 |
| August | w. 6·94 | w. 8·21 | w. 7·66 | w. 5·40 | w. 2·97 | w. 0·68 | E. 0·46 | E. 0·67 | E. 0·87 | E. 0·76 | E. 1·18 | E. 1·09 | E. 1·57 | E. 1·63 | E. 1·84 | E. 2·29 | E. 2·83 | E. 3·92 | E. 4·81 | E. 5·37 | E. 4·91 | E. 2·72 | w. 0·65 | w. 4·24 |
| September | w. 6·38 | w. 7·43 | w. 6·45 | w. 4·22 | w. 2·13 | w. 0·53 | E. 0·16 | E. 0·60 | E. 1·00 | E. 1·05 | E. 1·34 | E. 1·43 | E. 1·66 | E. 1·60 | E. 2·01 | E. 2·18 | E. 2·55 | E. 2·77 | E. 3·22 | E. 3·96 | E. 4·18 | E. 2·88 | w. 0·89 | w. 4·54 |
| October | w. 5·51 | w. 6·24 | w. 5·61 | w. 3·79 | w. 2·11 | w. 0·93 | w. 0·48 | E. 0·20 | E. 0·91 | E. 1·48 | E. 1·85 | E. 2·03 | E. 1·92 | E. 1·54 | E. 1·41 | E. 1·64 | E. 1·47 | E. 1·58 | E. 1·89 | E. 2·46 | E. 3·56 | E. 3·33 | E. 0·60 | w. 3·14 |
| November | w. 3·92 | w. 4·41 | w. 3·90 | w. 2·96 | w. 1·82 | w. 1·20 | w. 0·26 | E. 0·37 | E. 1·24 | E. 1·81 | E. 1·92 | E. 1·95 | E. 1·70 | E. 1·28 | E. 1·14 | E. 0·96 | E. 1·02 | E. 1·12 | E. 1·22 | E. 1·42 | E. 1·65 | E. 1·69 | E. 0·27 | w. 2·18 |
| December | w. 2·66 | w. 3·39 | w. 3·15 | w. 2·35 | w. 1·23 | w. 0·80 | w. 0·55 | E. 0·27 | E. 0·98 | E. 1·42 | E. 1·61 | E. 1·89 | E. 1·49 | E. 1·17 | E. 1·07 | E. 0·68 | E. 0·69 | E. 0·78 | E. 0·84 | E. 0·84 | E. 0·93 | E. 1·18 | w. 0·03 | w. 1·59 |
| Semiannual Means ... Apr. to Sept. | w. 6·15 | w. 7·42 | w. 6·94 | w. 5·21 | w. 3·25 | w. 1·47 | w. 0·32 | E. 0·22 | E. 0·44 | E. 0·52 | E. 0·70 | E. 0·90 | E. 1·19 | E. 1·23 | E. 1·56 | E. 1·93 | E. 2·58 | E. 3·60 | E. 4·59 | E. 5·31 | E. 5·20 | E. 3·57 | E. 0·38 | w. 3·18 |
| Semiannual Means ... Oct. to Mar. | w. 4·12 | w. 4·96 | w. 4·67 | w. 3·35 | w. 1·95 | w. 1·05 | w. 0·46 | E. 0·21 | E. 0·92 | E. 1·45 | E. 1·77 | E. 1·84 | E. 1·67 | E. 1·34 | E. 1·22 | E. 1·09 | E. 1·17 | E. 1·43 | E. 1·54 | E. 1·85 | E. 2·40 | E. 2·32 | E. 0·54 | w. 2·18 |
| Annual Means | w. 5·13 | w. 6·19 | w. 5·81 | w. 4·28 | w. 2·60 | w. 1·26 | w. 0·39 | E. 0·22 | E. 0·68 | E. 0·99 | E. 1·24 | E. 1·37 | E. 1·43 | E. 1·29 | E. 1·39 | E. 1·51 | E. 1·88 | E. 2·51 | E. 3·07 | E. 3·58 | E. 3·80 | E. 2·95 | E. 0·46 | w. 2·68 |