

RESULTS OF THE MAGNETIC
AND METEOROLOGICAL OBSERVATIONS

MADE AT THE ABINGER MAGNETIC STATION, SURREY
AND THE ROYAL OBSERVATORY, GREENWICH
RESPECTIVELY IN THE YEAR

1940

UNDER THE DIRECTION OF
H. SPENCER JONES, Sc.D., F.R.S.
ASTRONOMER ROYAL

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MAGNETIC AND METEOROLOGICAL RESULTS, 1940

E R R A T A

Page iv. Line 13 *for* PLATES I - XII *read* PLATES I - XI.

Line 15 onwards, deduct 2 from all Page Nos. e.g. APPENDIX should read:

APPENDIX. - K-Indices for the Years 1929-1939 determined at Abinger D 59

ROYAL GREENWICH OBSERVATORY

March, 1954

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THE ROYAL OBSERVATORY, GREENWICH,

AND

ABINGER MAGNETIC STATION, SURREY.

MAGNETIC AND METEOROLOGICAL OBSERVATIONS, 1940.

INTRODUCTION

STAFF

During the year 1940, the staff serving in the Magnetic and Meteorological Department consisted of W. M. Witchell, Superintendent, E. A. Chamberlain, G. F. Wells, P. L. Rickerby, B. R. Leaton, N. S. C. Rhodes and two ladies engaged in computational work. Mr. Chamberlain, resident observer and assistant-in-charge, with his assistant Mr. Rickerby, were employed exclusively at the Abinger Magnetic Station.

ABINGER MAGNETIC OBSERVATIONS

THE MAGNETIC STATION - *Site* (Lat. $51^{\circ} 11' 5''$ N; Long. $0^{\circ} 23' 12''$ W). Established in 1924 the station is situated on the northern slope of Leith Hill, Surrey, 800 feet above sea level. It is approximately 26 miles from the former site at Greenwich in a direction a little south of south-west. The nearest railway track lies at a distance of about $2\frac{1}{2}$ miles.

The Pavilions. The absolute observations are made in the main pavilion which is constructed of carefully chosen non-magnetic materials. It is approximately 28 feet long by 15 feet wide and contains four stoutly built hard wood piers embedded into concrete bases which are free from contact with the floor. On the north pier is mounted the declination instrument; on the central pier, the coil magnetometer for measuring horizontal intensity; on the south-east pier, the coil-magnetometer for measuring the vertical intensity; and on the south-west pier the Earth-inductor for observing the magnetic inclination.

A second pavilion, erected in 1926 for the testing and standardising of magnetic instruments (work formerly undertaken at Kew Observatory), and measuring 16 feet by 12 feet, is situated about 40 feet south-east of the main pavilion and contains three concrete piers passing through the floor without contact.

A third pavilion measuring 20 feet square was added in 1932. More convenient and suitable for comparative observations than the second, this pavilion occupies a corresponding position to

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the north-east of the main pavilion. It contains three circular wooden piers set into concrete and free from contact with the floor, similar to those in the main pavilion.

The Magnetograph House stands 50 feet east of the main pavilion and is oriented with its principal axis north and south. An inner chamber, designed to house the magnetographs at a uniform temperature, measures 15 feet long by 12 feet wide by 8 feet high and is supported on small concrete piers. The whole structure is contained within an outer chamber whose walls are constructed to have a low thermal conductivity and are nearly two feet thick. Between the walls of the two chambers is an air space of from 2 to 3 feet. The inner chamber is electrically heated by a series of low-temperature non-magnetic metallic resistances distributed along the base of the walls and fed by alternating current drawn from the public mains supply.

The temperature of the magnetograph chamber is controlled by a thermostat placed at the centre of the room at the same level as the magnetic instruments. Daily readings of a thermometer attached to one of the variometers show that the departures from a mean temperature do not exceed $0^{\circ}.2$ C.

Projecting up through the floor are five concrete piers. Two of these, designed originally to support recording mechanisms, occupy the north-west and south-east corners of the room, their longer sides being transverse to the meridian. In 1938 a massive slate slab measuring 8 feet by 2 feet by $1\frac{1}{2}$ inches was cemented upon the pier occupying the south-east corner. The other three piers are situated at positions 2 feet west and 2 feet 6 inches south of the north-east corner; 5 feet 6 inches west and 5 feet south of the same corner and 2 feet east and 3 feet north of the south-west corner. Also, in 1938 a heavy wooden table 8 feet by 3 feet was installed near the centre of the room to carry new recording mechanism. The legs of this table pass freely through the floor of the chamber and are cemented into the concrete base of the main building.

LAYOUT OF RECORDING INSTRUMENTS. At the beginning of March 1938 the apparatus used since 1925 to record D and H was superseded by La Cour variometers. These instruments are set up at the south end of the recording chamber in a line running geographically east and west. They occupy the eastern half of the slate slab previously described. The La Cour recording mechanism is mounted upon the table also referred to in the previous paragraph.

Occupying the western halves of the slate slab and wooden table is a "quick-run" magnetograph (See p. vii). On the opposite corner pier is mounted the recording mechanism of a wide-range magnetograph, the declinometer of which is carried by the same pier (See p. vii). The accompanying H variometer is mounted on the south-west pier, formerly occupied by the Watson quartz-fibre Z variometer.

VARIOMETERS - *The La Cour Horizontal Intensity Variometer*. A complete description of this instrument is to be found in *Publikationer fra det Danske Meteorologiske Institut*, No. 11 (Copenhagen 1930), but for general information some details are given here. The magnet of cobalt steel, is 8 millimetres long and weighs about 25 milligrams, the magnetic moment being 3.2 c.g.s. units. It is suspended at right angles to the earth's horizontal field by means of a quartz-fibre thickened at each end to form a small cone. Each cone fits into a conical brass socket having a fine slit in its side through which the fibre has passed. The focal length of the lens which projects the ray from the mirror attached to the magnet is 160 cms. Compensation for the effect of temperature on the moment of the magnet and the torsional constant of the quartz fibre is attained by optical means in which compensatory deflection of the emergent ray is produced by proportional curving (under temperature changes) of a bi-metallic lamina which supports a prism controlling the ultimate direction of the ray.

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A small Helmholtz-Gaugain coil, having a field of 7.43 gamma per milliampere and made to envelop the variometer, is used both to orientate the magnet correctly with respect to the earth's field and to determine the scale-value of the record. The adopted scale-value during 1940 was 4.50 gamma per millimetre.

The La Cour Declination Variometer. The general features of this instrument correspond closely to those of the variometer just described. The scale-value adopted during 1940 was 0'.92 per millimetre. Expressed as magnetic intensity the scale-value would be 4.96 gamma per millimetre at the present time.

The La Cour Vertical Intensity Variometer. This instrument is fully described in *Publikationer fra det Danske Meteorologiske Institut No. 8*. The recording magnet, including knife-edges and mirror, is fashioned from a single piece of cobalt steel, with the purpose of eliminating the possibility of relative movements among its parts. It is oriented approximately at right-angles to the magnetic meridian. Compensation for temperature changes is optically effected as in the horizontal intensity variometer. The scale-value, determined by the small Helmholtz-Gaugain coil already mentioned, is 4.00 gamma per millimetre.

The instrument was installed in 1938, but records of Z were continued with the Quartz-thread variometer until the end of 1939.

The Quick-run Variometers. These consist of a set of instruments closely resembling those described above and adapted by La Cour's method to record on a time scale of 3 mm. to one minute, i.e. twelve times as great as the normal scale. This recorder has been in regular use since 1938 November.

The Wide-range Variometers. Instruments formerly serving as standard variometers for H and D have been adapted to serve as wide-range recorders capable of registering on a small scale the largest variations in the two elements deemed possible of occurrence at Abinger. The H variometer which was superseded as the standard by the La Cour recorder, has been "desensitised" by the addition, immediately beneath its base-plate, of a bundle of strongly magnetised needles set at right-angles to the magnetic meridian. The scale value is 19.5 gamma per millimetre. The D variometer used at Greenwich from 1917 to 1925, is now fitted with a lens of 50 cms. focal length which gives a scale value of 3'.7 per millimetre. The two instruments are located as described on p. vi. The present position of the D variometer is such that it is necessary to deflect the recording light-rays towards the recording cylinder through a large angle, and an appropriate mirror rigidly supported between the variometer and cylinder, forms part of the apparatus. The wide-range variometers have been in regular operation since 1940 June.

Recording Mechanism. The two principal features of the La Cour recorders are: the three elements H, D and Z are recorded on separate strips of a single photographic sheet; the range over which the elements are able to record is greatly extended by the use of prisms in the optical train which furnish a multiple set of images. For each element are formed six secondary images, three on each side of the principal image, the separation being so adjusted that the image from one prism appears at the edge of the record just before the adjacent image passes off the opposite edge. The time scale is approximately 15 mm. to the hour.

The time-marks are in all cases photographically printed on the sheets by momentary automatic illumination of an electric lamp. In the case of the La Cour magnetograph the original arrangement provides a series of small dots which constitute a second interrupted trace of the element.

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These marks, however, have been supplemented by thin time lines extending the whole width of each record, these lines being produced by adjustable long narrow mirrors which reflect light from an auxiliary time signal lamp. In the case of the "quick-run" and "wide-range" recorders, only the thin lines are printed.

The time-signals are derived from a relay connected to a mean solar clock in the computing room. For a period of one second at every tenth minute of Universal Time the clock operates a relay which in turn operates the lamps. Additional signals at the first and fifty-ninth minute of each hour serve to distinguish the hour signals. The error of the clock is observed daily by comparison with a time-signal radiating from one of the official broadcasting stations. The error which seldom exceeds one second, is eliminated by temporarily adjusting the clock rate electro-magnetically over the required period of a minute or two.

OBSERVING INSTRUMENTS - Declinometer. A hollow cylindrical magnet with scale and collimating lens is used in conjunction with a small telescope mounted independently on the same pier. The magnet is suspended by tungsten wire of diameter 0.02 mm. Frequent reversals are made to eliminate the collimation error of the magnet from the results, and the position of torsional zero of the suspension wire is also frequently checked. 90° of torsion deflects the magnet about 3' of arc. The telescope has a six-inch circle on which azimuths are read by means of two microscope-micrometers to 1" of arc. An azimuth mark is fixed on the top of a concrete pillar 10 feet high, erected at the northern extremity of the Observatory grounds at a distance of approximately 300 feet from the observing pier. Determinations of the azimuth of this mark are made at intervals by means of observations of Polaris. During each observation both direct and reflected views of the star are taken. The effect of error of level of the telescope is thus entirely eliminated. Reflection is obtained from the surface of mercury contained in a shallow copper dish.

The Schuster-Smith Coil Magnetometer. This instrument is on loan to the Observatory from the National Physical Laboratory. It is the second of the type constructed and is rather smaller than the original instrument, a detailed description of which is to be found in *Philosophical Transactions of the Royal Society*, Vol. 223 (1923), pp. 175-200. It is erected on a pier in the centre of the absolute observation pavilion and was brought into use as the standard instrument for measurement of horizontal intensity on 1927 February 1. In general eight independent determinations are made each week-day.

The following is a brief description of the instrument and the method employed in measuring horizontal intensity:-

A hollow marble cylinder of 50 cms. diameter rests, with its axis horizontal, on a brass support which can be turned in azimuth. The azimuth may be read to 10" of arc from a graduated circle on the base-plate by the usual vernier attachment. On the periphery of the cylinder, near each end and at a mean distance of 25 cms. from each other, are two windings, in series, of ten turns of bare silver wire, the method of winding in a double spiral being that adopted in the original instrument referred to above. The whole forms a Helmholtz-Gaugain system at the centre of which a very uniform magnetic field parallel to the axis exists when an electric current is passing through the coils.

A chromium-steel magnet, 15 mm. long and 2 mm. square in cross section, is supported horizontally in a light vertical aluminium frame; the frame carries also a small concave mirror and a damping vane, and is suspended by a single silk fibre in a suspension tube passing through a hole in the upper surface of the cylinder. A square box with optically-plane glass sides supports the tube and encloses the magnet frame, allowing the mirror to project an image of a source of light during observation. The suspension fibre is adjusted so that the magnet hangs at the centre of the coil system.

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To afford an easy means of reading the azimuth of the cylinder and the indications of the magnet, graduated ivorine scales are placed horizontally on stands at a distance of approximately 2 metres from the pier, and spots of light are reflected to them by small concave mirrors in the instrument.

Situated outside the observing pavilion, about 40 feet to the south, is a storage battery of 25 cells which produces the current required for the observation. The amount of current employed is very accurately adjusted to a specific quantity by rheostat according to the indications of a Broca galvanometer in a potentiometer circuit in which the fall of potential across a known resistance is brought to equality with the voltage of a Weston standard cell.

Careful precaution is exercised in arranging the circuits both to eliminate accidental magnetic fields and to secure the highest degree of insulation. The latter has been found, in practice, to be of great importance, especially with regard to insulation of the galvanometer circuit, as any stray current here will lead to a difference of potential between the terminals of the standard cell and the standard resistance. It is desirable that the resistance of the galvanometer should be as low as possible consistent with sensitivity.

Theory of the observation:-

If a horizontal magnetic field whose intensity is slightly greater than that of the earth is imposed at an angle of nearly 180° with the earth's field, a precise angle can be found at which the resultant of the two fields becomes directed at right angles to the earth's field. The intensity F of the imposed field, and its angle α with the earth's field being known, the horizontal intensity of the earth's field can then be calculated from the simple relation $H = F \cos \alpha$.

An observation proceeds as follows:-

Torsion having been eliminated from the suspension thread by substituting a copper bar of similar dimensions for the magnet, the magnet is replaced and allowed to hang freely in the earth's field. The position on the appropriate scale of the spot of light reflected by the magnet-mirror is noted. This scale is normally on the west side of the instrument. By optical methods, reference marks on two other scales placed respectively to the magnetic north and south of the instrument are adjusted accurately to points 90° from the spot reflected by the magnet-mirror. A current is next passed round the coil in the direction which produces a field augmenting that of the earth, and the coil is turned in azimuth until the addition of the imposed field produces no alteration in the direction of the magnet. The axis of the coil is then accurately parallel to the horizontal component of the earth's field, and the coil-mirror can be adjusted so that it reflects a spot of light to the reference mark, i.e. to the zero graduation of the north scale as already set.

The current is now reversed in the coil by a commutator switch and the coil is turned until the resultant force on the magnet is in a direction at right angles to the earth's field. This is indicated on either the north or south scale by the magnet-mirror, which is carried round 90° by the magnet. The azimuthal angle through which the coil has been turned is read from the north scale, and the coil is then turned to an approximately equal angle on the opposite side of the magnetic meridian. This reverses the direction of the resultant field and a further small adjustment of the coil brings the spot of light reflected by the magnet-mirror accurately to the reference mark on the opposite scale to that last used. A second reading of the azimuth of the coil completes the observation.

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The suspension box and tube are turned by the observer as the magnet turns, so that no torsional change is introduced. The effect of any small error in the assumed direction of the earth's horizontal field, due say, to residual torsion on the suspension thread, is eliminated on taking the mean of the two results.

After preliminary details have been gone over, a complete measurement of horizontal intensity is readily obtained in two minutes.

If F be the factor of the coil and i be the current passing, in amperes, then the intensity of the field at the centre of the coil, in gamma units, is $Fi \times 10^4$. The adopted value of the factor F of the coil is $3.59570 (1 - .0000043t)$, t being temperature Celsius.

The observed value of horizontal intensity obtained from this instrument is subject to a correction of -1γ for the effect of the field of magnets in instruments placed permanently in the vicinity. The effect is determined experimentally by reversal of the magnets. The correction is applied in the reduction of the observation.

The constants of the coil and of the potentiometer at various standard temperatures have been precisely determined at the National Physical Laboratory and are checked from time to time. The dimensions of the coil were re-examined in November 1931. The electrical constants on which the reduction of observations made in 1940 is based were verified in February 1939. To convert the measure of current from international units to c.g.s. units the factor adopted prior to 1938 January 1 was .99997; but from this date onward the value has been .99988. The change introduces a discontinuity into the deduced values of H of -1.7γ .

A *Kew-Pattern Unifilar Magnetometer* (Casella No.181) is also used to determine absolute horizontal intensity. Deflection observations are made at three distances, namely 22.5, 30 and 40 cms. Eleven observations of the moment of inertia of the collimator magnet were made during the year 1940. The mean observed value of $\log K$ from these determinations was 2.42369. This value has been used in the reductions and is based on the Greenwich Standard Inertia Cylinder (*See Appendix II of the Magnetic Results 1926*).

The mean values of the distribution constants P and Q derived from 11 normal determinations made during the year are $+10.10$ and -1879 respectively.

The values used in the reduction of the 1940 observations, however, are the mean values obtained from a series of 235 special observations made during 1936. These values are: $-P = +9.17$; $Q = -1409$. The principle and method employed in the reduction of these special observations are described in the Results for 1936. In computing the observed values of horizontal intensity the deflection at 22.5 cms. has not been used since 1936.

The magnetometer, mounted until August 1928 in the main pavilion, is now used in the north-east pavilion (*See p. v*).

The Vertical Intensity Coil Magnetometer. This instrument, designed by D. W. Dye, for direct measurement of vertical intensity and constructed under his supervision at the National Physical Laboratory, Teddington, is on loan to the Royal Observatory from the Laboratory. It is erected on the south-east pier of the observing pavilion and was adopted as the standard for measurement of vertical intensity from 1929 January 1.

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A full description of the instrument is published in *Proceedings of the Royal Society*, Ser.A, Vol.117 (1928), pp.434-458. In brief, the instrument consists of a Helmholtz-Gaugain coil wound on a marble cylinder, the axis of which is vertical as truly as can be determined, together with accessory apparatus for accurately controlling and measuring the current passed through the coil, and for testing the resultant field at its centre.

The observation consists of an adjustment of the current until the artificial field imposed at the centre of the coil exactly annuls the vertical component of the earth's field. The intensity of this component is then easily calculable from a knowledge of the dimensions of the coil and the amount of current indicated by potentiometer measurement (*cf* p. x). The current is taken from the battery which supplies the *Schuster-Smith* instrument.

The special feature of the instrument is the means adopted for ascertaining when the vertical component of the earth's field is exactly annulled at the centre of the marble cylinder. This consists of a diamond-shaped vibrating test-coil about 2 cms. long suspended by bronze strip stretched horizontally between two supports and carrying a light plane mirror. The principle of the instrument requires that the axis of rotation of the detector coil should be horizontal and its plane vertical in the equilibrium position. The method of securing these adjustments is included in the full description mentioned above.

A weak alternating current, supplied from a generator at some distance from the instrument, passes through the test coil. The reaction between the field produced and the surrounding magnetic field subjects the test coil to a forced oscillation which vanishes only when the vertical field is annulled. The resulting vibration is brought to a maximum by adjustment of the generator frequency to synchronism with the natural frequency of the coil (about 15 per second) and high sensitivity is thus obtained. Microscopic vibration is exhibited by projection from the small mirror on the test coil of an image of illuminated cross wires to a screen erected about 2 metres distant.

The adopted value of the factor F of the coil is $F = 3.59643 (1 - 0.000079t)$, t being temperature Celsius. The constants of the potentiometer in use during the year 1940 for the measurement of the current were verified at the National Physical Laboratory in 1939 February. The factor adopted for the conversion from international amperes to c.g.s. units was the same as for the *Schuster-Smith* coil (*See* p. x). The change on 1938 January 1, introduces a discontinuity of -3.9γ into the deduced values of Z .

The Absolute Inclination Instrument. An Earth Inductor by the Cambridge Instrument Company, in conjunction with a Broca galvanometer, is used to determine magnetic inclination. About six determinations are made each week. Observations are made in four positions to eliminate any small errors arising from slight asymmetry in the instrument. After the first adjustment the coil-support is reversed about a horizontal axis and a second adjustment is obtained; the instrument is then reversed in azimuth and two further adjustments are made. The circle for the measurement of inclination is 8 inches in diameter and is read by means of microscope-micrometers to one second of arc. The levels on the base can likewise be read to one second. A detailed description of the inductor will be found in the volume for 1915. Since 1929 January 1 the observations of inclination have not been used for determination of vertical intensity.

REDUCTION OF RESULTS - *Time* - The system of time used in the reductions is *Universal Time* (U.T.).

Hourly Values. The estimated mean ordinates of the photographic traces for each hour are measured from the base-line by the aid of an etched glass scale - the hour being the period of

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sixty minutes commencing at the time named in the tables. From the tables of these measures are obtained the mean daily and mean monthly values for each hour of the day and the value of the elements for each day of the month.

Base-lines. Values of the base-lines are adopted from smooth curves drawn through points plotted upon charts, each point representing the mean of several independently observed values. Ten observations of declination, eight of horizontal intensity and six of vertical intensity are made, on an average, each week-day. Prior to 1929 the base-line values for vertical intensity traces were computed from absolute observations of inclination I , combined with simultaneous values of horizontal intensity H , taken from the magnetograms, in accordance with the relation $Z = H \tan I$. From 1929 January 1 the values have been obtained directly from observations of vertical intensity with the coil-magnetometer. The change introduces a discontinuity of 30γ into the definitive values of vertical intensity, corresponding to $0'9$ in inclination. The latter is to be attributed to hitherto unsuspected wear in the bearings of the Earth inductor which, at the time of its discovery, made the observed values of inclination too large by this amount.

Temperature Corrections. As the magnetograph chamber is maintained at a sensibly constant temperature and, moreover, the temperature compensation in the variometers themselves has been closely attained, in general no temperature corrections are required.

K - Indices. In conformity with a resolution passed at the Washington Assembly of the International Association of Terrestrial Magnetism and Electricity in 1939 September, the magnetic character of each day is estimated by means of three-hour-range indices, the index "K" for each three-hour period from 0^h to 24^h U.T. being assigned according to the principles described in an article published in *Terrestrial Magnetism and Atmospheric Electricity*, Vol.45, pp.411 *et seq* (December 1939).

The scale adopted for this purpose is constructed as follows:- The average quiet day variation during a particular three-hour period being reckoned as "0", any excess greater than 5γ but less than 10γ is reckoned as "1"; an excess between 10γ and 20γ as "2"; between 20γ and 40γ as "3"; between 40γ and 70γ as "4"; between 70γ and 120γ as "5"; between 120γ and 200γ as "6"; between 200γ and 330γ as "7"; between 330γ and 500γ as "8"; greater than 500γ as "9".

The traces of all three elements are examined and the largest variation recorded in the interval is used to give the "K" index for that interval.

THE TABLES. Tables I to III contain respectively the hourly mean values of declination, horizontal intensity and vertical intensity.

Table IV gives for each element the mean daily value, the maximum and minimum values with the times of their occurrence and the daily range.

Table IVA contains, for each day of the year, the eight individual K-indices, arranged in succession, together with their sums. Corresponding figures for the years 1929-1939 are given in an Appendix to the Magnetic and Meteorological Results.

Tables V to VII contain the mean diurnal inequalities obtained from "all" days and from "quiet" and "disturbed" days as selected by the International Committee. In addition to monthly and annual values there are given values for the seasons, viz. Winter (January, February,

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November, December), Equinox (March, April, September, October) and Summer (May, June, July, August). The values in these tables are *not* adjusted for the effect of non-cyclic change.

The figures quoted for the north and west components and the inclination are computed from the corresponding inequalities in declination, horizontal intensity and vertical intensity, the computations being in general carried out to one significant figure beyond that printed. Extreme values are indicated in heavy type.

Tables VIII and IX contain the harmonic coefficients obtained from an analysis of the inequalities in the north (X), west (-Y) and vertical (Z) components. In the case of the International Quiet and Disturbed Days, the inequalities are adjusted for non-cyclic change before analysis, but in analysing the results for "All" days the non-cyclic change is ignored. The phase-angles in Table IX are corrected to refer to Abinger Local Mean Time.

Table X. In the annual volumes from 1926-1931 this table contains the range of the mean diurnal inequalities abstracted from the figures given in Table V to VII for the months, the year and the seasons. In 1932 a change was made which was inadvertently not noted at the time. Thenceforth the figures given for the *year and the seasons* are derived from Table X itself by meaning the values of the months constituting the particular group.

Table XI gives in similar arrangement the non-cyclic change 24^h minus 0^h . The quantities are computed from Table I to III, the value of 0^h to 24^h being taken as the mean of the last value on one day and the first value on the day following.

Table XII contains the mean monthly and annual values of the components collected together. In forming this table corrections are applied when necessary, to the values of H and Z taken from Table IV to remove the effect of any small secular changes in potentiometer constants found at the periodical re-measurement of the constants at the National Physical Laboratory.

Tables XIII to XVA contain the daily values of the base-lines of the magnetograms reduced from the absolute observations.

Table XVI. The first part of this table contains mean annual values of magnetic elements determined at the Royal Observatory, Greenwich, over the whole period of observation. Included in the table are results of early observations of declination made from 1818 to 1820. The second part contains corresponding values determined at the Abinger Station since 1925.

REPRODUCTION OF MAGNETOGRAMS. A brief descriptive summary of the more significant movements recorded in the magnetic elements during the year is accompanied by reduced copies of the Abinger Magnetograms illustrating disturbances of special interest.

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GENERAL. With the year 1940 a century of routine meteorological observations at the Royal Observatory has been completed.

The majority of the meteorological instruments are situated in an enclosure in Greenwich Park, 350 yards to the east of the Astronomical Observatory. In the enclosure (which will be

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referred to as "The Christie Enclosure") there are the barometer, the thermometers, used for ordinary eye observations, the recording wet-bulb and dry-bulb thermometers, thermometers for solar and terrestrial radiation, two earth thermometers and two rain gauges; also the instrument for automatically recording pollution of the air.

The anemometers, the self-registering rain gauge and the sunshine recorder are fixed above the roof of the Octagon Room (the ancient part of the Observatory).

The observations comprise eye observations of the ordinary meteorological instruments, including the barometer, dry-bulb and wet-bulb thermometers, radiation and earth thermometers; continuous autographic record of the variations of the barometer, dry-bulb and wet-bulb thermometers; continuous automatic record of the direction, pressure and velocity of the wind and of the amount of rain; registration of the duration of sunshine and at night of the visibility of stars near the celestial Pole; the general record of ordinary atmospheric changes of weather, including numerical estimation of the amount of cloud and estimations of "visibility"; registration and measurement of the pollution of the air by solid matter.

Universal Time (U.T.) - which at the Royal Observatory coincides with local Mean Solar Time - has been employed throughout the meteorological section, except in regard to the sunshine registers (*See p. xvii*).

INSTRUMENTS. *Standard Barometer.* The standard barometer is Newman No. 64. Its tube is 0.565 inch in diameter, and the depression of the mercury due to capillary action is 0.002 inch, but no correction is applied on this account. The cistern is of glass and the graduated scale and attached rod are of brass. At its lower end the rod terminates in a point of ivory which in observation is made just to meet the reflected image of the point as seen in the mercury. The scale is divided to 0.05 inch, sub-divided by vernier to 0.002 inch.

The barometer was mounted in 1840 on the southern wall of the western arm of the Upper Magnet Room at a height above mean sea level of 159 feet. On 1917 April 3 it was transferred to the new magnetograph house in the Christie Enclosure, where the height above mean sea level is 152 feet (*See also p. xviii*).

The barometer is read at 9^h, 12^h (noon), 15^h every day and also at some convenient time during the evening. Each reading is corrected by application of an index-correction and reduced to the temperature 32° F. The readings thus found are used to determine the value of the instrumental base-line on the photographic record.

The Photographic Barometer. A siphon barometer is employed which, at its open end, operates a plunger resting on the surface of the mercury. On account of the optical magnification associated with a moving mirror at some distance from the recording drum, the motion of the plunger must be mechanically reduced in being transferred to the arm which carries the mirror. In the actual arrangement two levers are used. One is connected to the stem of the plunger resting on the free surface of the mercury and is 12 inches long from plunger to pivot. A pin with a rounded conical point is screwed into this lever at a distance of 1 inch from the pivot. On this pin rests the place under-surface of a shorter lever, which is 4 inches long from its pivot to the pin and is set at right angles to the first lever. Both levers are approximately horizontal in their mean position. The moving mirror of the instrument is mounted horizontally, in a suitable frame, just above the pivots, and attached to the short lever. The first lever lies east and west, so that the axis about which the mirror turns is in the same direction. The recording drum

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is horizontal and the motion of the beam of light is transformed, so as to be horizontal, by a fixed right-angled prism supported above the mirror. A lens of suitable focus is mounted in a vertical plane in front of the prism and brings the beam of light from the straight-filament electric lamp to a focus on the drum. A base-line mirror, similar to the moving mirror, is mounted in a vertical plane below the lower half of this lens. Provision is made for all the necessary adjustments of the directions of the two beams of light. The weight of the plunger and lever mechanism is relieved by a balance-weight on the far side of the pivot, so that the plunger rests on the mercury surface without appreciably depressing it.

The instrument is 12 feet from the recording drum. At this distance the calculated scale-value of the record is 3 inches on the sheet for 1 inch change of height of the standard barometer. (Near the surface of the mercury, both arms of the siphon tube are of the same bore, so that the plunger moves through one half the change of the indication of the standard barometer).

The scale-value of the instrument is, in effect, determined experimentally by comparison with the readings of the standard barometer. The base-line values corresponding to the three daily readings of the standard are represented graphically by points on a chart. The adopted value at any time is read from a smooth curve drawn through the points.

The photographic sheets being $9\frac{1}{2}$ inches wide, a range of over 3 inches barometric motion can be included and re-adjustment of position of the trace is unnecessary.

Dry-bulb and Wet-bulb Thermometers. On 1937 December 31 the standard dry-bulb and wet-bulb thermometers and maximum and minimum self-registering thermometers, both dry- and wet-bulb, were transferred from the revolving open screen on which hitherto they had been mounted to a Stevenson screen of large dimensions which had been set up a few yards to the westward. The old screen was subsequently erected in a new position on the north side of the Christie Enclosure, and daily readings, at 9^h, of maximum and minimum temperature in the open screen were resumed from 1938 May 1.

The corrections to be applied to the thermometers in ordinary use are determined by comparison with the Kew standard thermometer No.515.

The dry-bulb thermometer used throughout the year was Negretti and Zambra No.45354. The correction $-0^{\circ}.4$ has been applied to the readings of this thermometer. The wet-bulb thermometer used throughout the year was Negretti and Zambra No.94737. The correction $-0^{\circ}.3$ has been applied to the readings of this thermometer.

The dry-bulb and wet-bulb thermometers are normally read at 9^h, 12^h (noon), 15^h every day and also once during the evening. Readings of the maximum and minimum thermometers are taken at 9^h, 15^h and near 21^h every day. It became necessary to discontinue evening readings from the middle of August on account of enemy action. The readings are employed to correct the indications of the recording dry-bulb and wet-bulb thermometers.

Dry-bulb and Wet-bulb Recording Thermometers. The photographic apparatus which had been in use since 1887 was superseded on 1938 January 1 by a distant recording thermograph. The action of this instrument depends on the pressure of mercury in a long flexible capillary tube of steel. The pressure alters the curvature of a Bourdon coil which in turn controls the position of a recording pen.

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The Thermometers exerting the pressure are mounted in the Stevenson screen which contains also the standard thermometers. The recording mechanism is set up in the basement of the building, about 40 feet distant, constructed for the Yapp equatorial telescope, and the steel tube transmitting the pressure is laid in earthenware pipes buried about eighteen inches beneath the surface of the ground. The traces (in ink) showing the variations in temperature are directly visible through a window. The scale-value is approximately 20° F per inch.

Radiation Thermometers. These thermometers are placed in an open position in the Christie Enclosure. The thermometer for solar radiation is a mercurial maximum thermometer with its bulb blackened and enclosed in a glass sphere from which the air has been exhausted. The thermometer employed was Negretti and Zambra No.C.G.10220. The thermometer for radiation to the sky is a spirit minimum thermometer. Negretti and Zambra No.C.G.18256 replaced No.D.11197 when this was broken on September 9. The thermometers are laid on short grass, freely exposed to the sky.

Earth Thermometers. There are two thermometers in use, the bulbs of which are sunk to depths of 4 feet and 1 foot, respectively, below the surface. Both thermometers are read daily at noon, the readings of the former being given in the daily results.

Osler Anemometer. This self-registering instrument, devised for continuous registration of the direction and pressure of the wind together with the amount of rain, is fixed above the north-western turret of the ancient part of the Observatory. The direction of the wind is registered by means of a large vane (9 ft. 2 in. in length), connected by shaft and pinion with a rack-work carrying a pencil; the latter marks on a flat sheet of paper, moving horizontally. The vane is 25 feet above the roof of the Octagon Room, 60 feet above the adjacent ground and 215 feet above the mean level of the sea. A fixed mark near the north-eastern turret in a known azimuth, as determined by celestial observation, is used for examining at any time the position of the direction-plate over the registering table to which reference is made by means of a direction pointer when adjusting a new sheet on the travelling board.

A circular pressure plate with an area of 192 square inches is attached 2 feet below the vane; moving with the latter it is always kept directed against the wind. A light wind causes the plate to compress slender springs, the motion being registered on the horizontal sheet by a pencil connected with the plate by a flexible brass chain which is always in tension. Higher wind pressures bring stiffer springs into play behind the plate, and the two sets of springs are adjusted by screws and clamps so as to afford fixed scales on the sheet, the scale for light winds being double that for strong winds. The scale is determined experimentally in pounds per square foot from time to time. The most recent determination was made on 1934 November 20. The recording sheet is changed daily at noon. The time scale is approximately 15 millimetres to the hour. The instrument was brought into use as long ago as 1840.

Robinson Anemometer. This instrument, for registration of the horizontal movement of the air, is mounted above the roof of the Octagon Room and was brought into use in 1866. The four hemispherical cups are 5 inches in diameter, the centre of each cup being 15 inches distant from the vertical axis of rotation. The cups are 21 feet above the roof of the Octagon Room, 56 feet above the adjacent ground and 211 feet above the mean level of the sea. A motion of the recording pencil through 1 inch corresponds approximately to horizontal motion of the air through 100 miles. The time scale is the same as for the Osler anemometer and the sheet is also changed daily at noon.

The velocity recorded by the instrument is three times the actual velocity v of the cups.

From tests made by W. H. Dines at Hershham in 1889 on his 'whirling machine' it appeared that the relation between the velocity of the wind, V and the velocity of the cups v is approximately

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represented by the expression $V = 4.0 + 2.0v$ and that the instrument fails to record wind velocities less than 4 miles per hour. This relationship is used to modify the velocity recorded by the instrument. For the period between December 6 and 22 the anemometer was out of action while damage which occurred during a gale on December 6 was being repaired. The measures in the interval were obtained from eye-readings of a Browning anemometer mounted on the same platform.

Rain Gauges. During the year 1940 three rain gauges were employed. The gauge No.1 forms part of the Osler anemometer apparatus and is self-registering, the record being made on the sheet on which the direction and pressure of the wind are recorded. The apparatus is fully described in volumes previous to 1914.

Gauge No.6 is an 8 inch circular gauge placed with the receiving surface 5 inches above the ground. No.8 is a newer gauge of the same diameter, but of the modified Snowdon pattern adopted by the Meteorological Office, having its receiving surface 1 foot above the ground. It is fixed about 4 feet north of the standard gauge No.6 which is read daily at 9^h, and 15^h and in the evening. No.8 is used as a check on the readings of No.6 and is normally read at 9^h only. The gauges are also read at midnight on the last day of each calendar month.

The present height of the standard gauge above mean sea-level is 5 feet 9 inches less than in its old position in the Observatory grounds before its removal to the Christie Enclosure in 1899 January.

The monthly amounts of rain collected in gauges Nos.6 and 8 are given on page D 118 of the Meteorological Results.

Sunshine Recorder. The hourly results relate to *apparent* time. The instrument in use is of the Campbell-Stokes pattern with 4 inch glass globe. It was examined at the Meteorological Office in 1926 and found to be in satisfactory condition. It bears the serial number M.O.113. The recorded durations are those of *bright* sunshine, no register being obtained when the sun shines faintly through fog or cloud or is very near the horizon. Conformity with Meteorological Office standards of measurement is maintained as far as possible and with this in view independent measures of four selected sunshine cards from each of the months January, July and September 1940 have been made at the Meteorological Office. These showed satisfactory agreement with the Greenwich estimations.

Night-Sky Recorder. The object of this instrument is to supplement the daily sunshine record in so far as it gives an indication of the amount of cloud. It consists of a small camera constructed of wood, mounted until November 18, on a brick pier in the courtyard to the north of the Transit Pavilion, and permanently directed towards the celestial pole. On November 18 the site was changed to one about 20 yards south of the Altazimuth building.

The lens is of 18.8 inches focal length and 0.8 inch aperture. The actual camera is enclosed in a larger box about twice its length, extending nine inches beyond the lens. The lens itself is further surrounded by a hood. Adequate protection from dew is thus obtained, and also from rain, except when hard driven from the north. The photographic plates used are ordinary quarter-plate ($3\frac{1}{4}$ by $4\frac{1}{4}$ inches). Exposure is intended to be made during the period that the sun remains more than 10° below the horizon. The period is thus centred approximately on apparent midnight, but in practice the mean times of commencing and ending the exposure are not varied at intervals of less than seven days.

The traces selected for measurement are those of Polaris and δ Ursæ Minoris. The measurement is effected by means of a glass scale on which pairs of concentric circles are photographically imprinted. The radii of these circles are slightly greater and slightly less than the radius of the trace to be measured, and the circles are divided into a time-scale of hour angle, with

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ten-minute units. The plate is placed over the scale in a measuring frame and adjusted so that the trace is concentric with the containing circles on the scale. The hour-angle of the star, according to the scale, at the commencement and ending of the various portions of the trace is then read off to the nearest minute of time.

The correction for error of orientation of the plate is made during the computation of mean time corresponding to hour-angle of star in the following manner. Whenever the sky is seen to be clear at the commencement of exposure, the difference between the hour-angle given by the scale for the beginning of the trace and the corresponding mean time noted by the observer is taken as the quantity to be applied to the scale readings throughout the night, due allowance being made for the acceleration of sidereal time over mean time. When the sky is not clear at commencement, a computed quantity is used which includes an adopted mean value of the error of orientation. Variations in the error of orientation are found seldom to exceed two or three minutes of time and are unimportant to the records.

ARRANGEMENT OF RESULTS. The results given in the Meteorological Section refer to the day commencing at 0^h U.T., excepting the case of the night-sky record, for which they relate to the period from dusk on the day named to dawn of the following day.

All results in regard to atmospheric pressure, temperature of the air and of evaporation, with deductions therefrom, are derived from the continuous records, excepting that the maximum and minimum values of air temperature are those given by eye observation of the ordinary maximum and minimum thermometers, reference being made, however, to the autographic register, when necessary, to obtain the values corresponding to the limits "midnight to midnight". The hourly readings for the elements mentioned are measured direct from the traces and reduced so as to be based fundamentally, both as regards scale and zero, on the readings of the standard instruments.

The barometer results are not reduced to sea-level, neither are they corrected for the effect of gravity by reduction to the latitude of 45°. The monthly mean barometer reading is, however, corrected for the effect of the change of site of 1917 April before deducing the deviation from the mean of sixty-five years 1841-1905 (pp. D 86-108). This correction, amounting to -007 inch, was by oversight omitted in the years 1917-1926.

From 1926 January 1 the mean daily temperature of the dew-point and degree of humidity have been deduced from the mean daily temperatures of the air and of evaporation by use of *Hygrometric Tables*, issued by the Meteorological Office, Air Ministry. In the same way the mean hourly values of the dew-point temperature and degree of humidity in each month (pp. D 113 and D 114) have been calculated from the corresponding mean hourly values of air and evaporation temperatures (pp. D 112 and D 113).

The excess of the mean temperature of the air on each day above the average of sixty-five years, given in the "Daily Results of the Meteorological Observations" is found by comparing the numbers contained in column 5 with a table of average daily temperatures obtained by smoothing the accidental irregularities of the daily means derived from the observations for sixty-five years 1841-1905. In this series the mean daily temperature from 1841 to 1847 depends usually on 12 observations daily, in 1848 on 6 observations daily and from 1849 to 1905 on 24 hourly readings from the photographic record. The smoothed numbers are given in Table VII, *Reduction of the Greenwich Meteorological Observations*, Part IV, also in the Introduction to *Results* for 1910.

In the case of maximum and minimum temperature the average of sixty-five years has been corrected for the presumed effect of the change of thermometer screen which took place on 1938

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January 1. The corrections are given below. They were derived from comparisons between readings on the revolving stand and in a closely adjacent Stevenson screen, recorded daily during the period 1900 April to 1913 December.

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Maximum Temp.	0°0	-0°3	-0°6	-1°1	-1°7	-1°8	-2°1	-1°9	-1°1	-0°5	-0°1	0°0
Minimum Temp.	+0°5	+0°5	+0°5	+0°5	+0°5	+0°5	+0°5	+0°6	+0°6	+0°6	+0°5	+0°5

The daily register of rain contained in column 16 is that recorded by the Gauge No.6, whose receiving surface is 5 inches above the ground (*See* p.xvii). The continuous record of the Osler self-registering gauge shows whether the amounts measured at 9^h are to be placed to the same, or to the preceding day; and also gives in cases in which rain fell both before and after midnight, the means of ascertaining the proper proportion of the 9^h amount which should be placed to each day. The number of days of rain given in the footnotes and in the abstract tables pages D 111 and D 118 is formed from the records of gauge No.6. In this numeration only those days are counted on which the fall amounted to, or exceeded 0.005 inch.

It may be understood, generally, that the greatest wind pressures usually occur in gusts of short duration. In the "Mean of 24 Hourly Measures" each measure represents the mean hourly value centred at the nominal hour. With regard to "Proportions of wind referred to the cardinal points" in the monthly summary on pages D 86-109, formerly the figures were such that the whole month was represented by the number of days in the month. In the "Results" for 1933 a change was made, and the whole month is now represented by 100, so that the figures are the equivalent of "percentages".

The amount of cloud given in the footnotes on the right-hand pages D 87 to D 109, and in the abstract table, page D 111, is the mean found from observations made at 9^h, 12^h (noon) 15^h and 21^h each day.

As regards the notation for clouds and weather, several changes were made in the 1934 volume in order to bring the symbols into general accordance with those in use at the British Meteorological Office.

The following are the symbols which have been adopted. Where a change from the symbols previously in use has been made, an asterisk (*) is placed after the word or words for which the symbol stands.

BEAUFORT WEATHER NOTATION

(modified in conformity with the usage of the British Meteorological Office)

b	blue sky (less than one quarter covered with cloud)
bc	sky partially cloudy (less than three quarters covered)
c	sky generally cloudy, but not completely overcast
d	drizzle
e	wet air without falling rain
f	fog, with objects invisible distant more than 1100 yards
F	fog, with objects invisible distant more than 220 yards
g	gloom (*)

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h hail (*)
 i intermittent
 k storm (in combination with other symbols) (*)
 l lightning
 m mist, with limit of visibility between 1100 and 2200 yards
 o sky overcast with unbroken cloud
 p passing showers (*)
 q squall (*)
 r rain
 s snow (*)
 rs sleet (*)
 t thunder
 u threatening sky
 v exceptional visibility; i.e. abnormal transparency of air
 w dew (*)
 x hoar frost (*)
 y dry air; i.e. relative humidity less than 60 per cent
 z haze (*)

A capital letter indicates "intense"
 The suffix o indicates "slight"
 A letter repeated indicates "continuous"

CLOUD FORMS (*)

<i>Acu</i>	Alto-cumulus	<i>Cist</i>	Cirro-stratus	<i>St</i>	Stratus
<i>Ast</i>	Alto-stratus	<i>Cu</i>	Cumulus	<i>Stcu</i>	Strato-cumulus
<i>Ci</i>	Cirrus	<i>Cunb</i>	Cumulo-nimbus	<i>Fr</i>	Fracto-
<i>Cicu</i>	Cirro-cumulus	<i>Nbst</i>	Nimbo-stratus		

ADDITIONAL SYMBOLS

<i>lu-ha</i>	lunar halo	<i>prhn</i>	Parhelion	<i>so-ha</i>	solar halo
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ROYAL OBSERVATORY, GREENWICH.
ABINGER MAGNETIC STATION.

Results of Magnetic Observations

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TABLE IV. - DAILY MEAN AND EXTREME VALUES OF MAGNETIC ELEMENTS AS RECORDED BY THE MAGNETOGRAPHS

Table with 13 columns: Date, Declination West (Mean Daily Value, Maximum, Minimum, Range), Horizontal Intensity (Mean Daily Value, Maximum, Minimum, Range), and Vertical Intensity (Mean Daily Value, Maximum, Minimum, Range). Rows include July (1-31), Mean, Mean *, Mean **, August (1-31), and Mean, Mean *, Mean **.

* International Quiet Day. ** International Disturbed Day.

TABLE IV(A). - THREE-HOUR-RANGE INDICES 'K' FOR THE YEAR 1940.* (SEE INTRODUCTION PAGE XII).

Date	January		February		March		April		May		June	
	Indices	Sum	Indices	Sum	Indices	Sum	Indices	Sum	Indices	Sum	Indices	Sum
1	3212 3243	20	4333 5655	34	1322 2211	14	5554 4544	36	2221 2332	17	1122 3122	14
2	4322 2214	20	3233 3443	25	2111 1122	11	2222 3365	25	1221 1221	12	2322 3322	19
3	2422 4754	30	3222 3545	26	2221 2223	16	7754 4554	41	2122 2111	12	1112 4332	17
4	3213 4555	28	1111 1433	15	0110 2113	9	3223 3434	24	2111 2113	12	2111 1111	9
5	2422 1123	17	3122 4434	23	1221 1111	10	3223 1333	20	2222 2222	16	2131 3334	20
6	3333 4453	28	4222 3354	25	1111 0222	10	3233 2132	19	1111 1100	6	4444 4433	30
7	3222 4345	25	4222 3232	20	2211 2222	14	1011 2121	9	1222 2222	15	5534 4334	31
8	3432 3333	24	3222 2243	20	2221 2144	18	1122 1311	12	2211 2211	12	4323 3444	27
9	1122 3453	21	3322 2213	18	4521 2332	22	2112 1111	10	3412 3422	21	2333 3443	25
10	2222 5555	28	2211 1233	15	2222 2222	16	1101 2112	9	2222 3344	22	3231 1112	14
11	2333 3265	27	2112 3243	18	2111 1221	11	1111 3311	12	3332 3342	23	2112 1312	13
12	3343 4445	30	3322 4422	22	1111 1455	19	1211 2211	11	3332 3334	24	1101 3322	13
13	2332 2121	16	3222 3243	21	3322 2313	19	2222 3422	19	3112 3343	20	1111 2222	12
14	1111 1123	11	2212 2112	13	2232 2233	19	2332 2322	19	2323 3333	22	2333 5645	31
15	4211 1213	15	2123 3222	17	1102 3101	9	2222 4433	22	2332 3443	24	4443 4432	28
16	2222 3343	21	2212 1333	17	1111 3233	15	4322 3233	22	3101 2122	12	3233 3333	23
17	4332 5343	27	1122 2321	14	2121 1101	9	3321 2221	16	2323 3443	24	2333 3432	23
18	2333 4762	30	1111 1122	10	0011 1111	6	2111 2112	11	4454 5332	30	2343 2232	21
19	3122 2221	15	1111 1212	10	2222 3443	22	2211 2311	13	4122 2324	20	2332 4422	22
20	2222 2241	17	4432 3333	25	4323 4345	28	1232 3333	20	2323 3421	20	1211 2121	11
21	1111 1210	8	4332 3522	24	4332 2233	22	4332 2233	22	2411 1233	17	1311 2111	11
22	1112 1331	13	4332 2333	23	3322 2244	22	3432 3422	23	4554 3331	28	1104 4322	17
23	1122 2233	16	2221 2133	16	1145 3456	29	3112 3223	17	2312 2653	24	4111 2332	17
24	3322 3343	23	4232 2334	23	6333 6999	48	3112 3311	15	3647 5454	38	3333 4244	26
25	3332 4313	22	4343 5553	32	9777 6467	53	4732 3567	37	4311 2433	21	5657 8664	47
26	1111 1222	11	2121 2243	17	6443 3463	33	6432 4443	30	3432 3544	28	4322 2644	27
27	2221 1212	13	3321 2111	14	5444 3434	31	4321 2332	20	5323 2334	25	2222 3321	17
28	2111 1111	9	1112 2123	13	4333 3343	26	3222 2312	17	2433 3333	24	3111 2431	16
29	2111 2443	18	2223 3433	22	2224 4868	36	4322 3321	20	3211 2332	17	1211 2242	15
30	3323 3433	24			7876 6775	53	1212 4343	20	1111 2222	12	4411 3332	21
31	3333 4454	29			6448 7755	46			1111 2111	9		

* Corresponding figures for the years 1929-1939 are given on Pages 61-63 in the Magnetic and Meteorological Results.

TABLE IV(A). - THREE-HOUR-RANGE INDICES 'K' FOR THE YEAR 1940.* (SEE INTRODUCTION PAGE XII).

Date	July		August		September		October		November		December	
	Indices	Sum	Indices	Sum	Indices	Sum	Indices	Sum	Indices	Sum	Indices	Sum
1	4212 2231	17	4312 2223	19	3333 4321	22	4323 3552	27	2333 2230	18	2322 2233	19
2	1211 1222	12	2112 3353	20	1112 3443	19	2122 3423	19	1232 1102	12	4324 2444	27
3	1233 3444	24	2333 6643	30	3433 4434	28	3332 4453	27	3333 2133	21	3213 4435	25
4	4333 3334	26	4233 1332	21	4332 2334	24	4311 1311	15	3332 4454	28	2322 3442	22
5	3221 4343	22	2323 3333	22	3322 2332	20	3322 2111	15	3323 3241	21	3322 2232	19
6	3422 4332	23	3243 3455	29	2222 3213	17	1113 3425	20	2232 1232	17	2211 1122	12
7	2222 3332	19	2223 3431	20	4443 3414	27	4354 4465	35	2133 3112	16	2111 1101	8
8	2110 2324	15	3233 3313	21	3224 4423	24	5543 3346	33	2111 1011	8	1100 0010	3
9	3422 4343	25	3344 4463	31	4333 3344	27	4222 2122	17	1232 3322	18	2233 4213	20
10	4443 4424	29	3223 3422	21	2220 1001	8	1112 2133	14	1111 1101	7	2332 1432	20
11	3432 3322	22	3332 3434	25	1012 2321	12	3321 2114	17	1110 1102	7	2112 2324	17
12	2312 2121	14	2331 2323	19	2111 2212	12	3223 3324	22	3134 3346	27	3222 2332	19
13	1236 6643	31	3222 2322	18	1111 3321	13	2121 2111	11	4553 3332	28	4323 2232	21
14	3433 3433	26	1332 3222	18	3321 3353	23	1111 2111	9	3332 3335	25	3122 3544	24
15	3322 3432	22	2111 1121	10	2333 3342	23	2224 3332	21	3323 2233	21	2111 3334	18
16	3312 3323	20	1121 1121	10	1221 4432	19	2131 2351	18	4212 2553	24	3223 2321	18
17	2211 2311	13	1111 1212	10	1112 1122	11	2211 2213	14	1211 2455	21	1101 3233	14
18	1111 1111	8	1111 2534	18	1021 1122	10	3232 3333	22	3121 2112	13	3212 2221	15
19	2311 2223	16	3112 3433	20	2111 2111	10	2343 3244	25	2133 2222	17	2111 2113	12
20	2111 1222	12	3333 3331	22	1123 4443	22	2222 2124	17	1122 2334	18	3234 5655	33
21	2212 2332	17	2202 3223	16	3234 3322	22	3223 2344	23	5343 3225	27	3533 3354	29
22	2343 4332	24	3222 2442	21	1123 3232	17	2344 4121	21	4554 4255	34	3233 5422	24
23	3111 3323	17	2111 2232	14	1111 2111	9	1121 1110	8	3344 3231	23	3122 3454	24
24	2332 3224	21	1111 1000	5	1201 1113	10	1011 1100	5	1121 1124	13	2221 2243	18
25	3332 2312	19	1000 3233	12	3434 3444	29	1112 3455	22	3225 6545	32	2332 1333	20
26	3311 3211	15	3313 4346	27	2111 1675	24	3334 5555	33	5543 3421	27	1323 2143	19
27	1111 1311	10	3432 2323	22	6432 3465	33	3323 3443	25	2112 3343	19	3322 4312	20
28	2112 3212	14	4322 3232	21	4443 3453	30	3222 3352	22	0112 2124	13	2123 2145	20
29	1222 2243	18	3113 4222	18	3222 4242	21	1421 2111	13	3444 5545	34	4322 1344	23
30	2333 4443	26	2001 3223	13	2111 2243	16	3211 1122	13	4323 3434	26	2453 3454	30
31	3433 3333	25	2111 2224	15			3231 3221	17			4333 4442	27

* Corresponding figures for the years 1929-1939 are given on Pages 61-83 in the Magnetic and Meteorological Results.

TABLE VIII. - HARMONIC COMPONENTS OF THE DIURNAL INEQUALITY OF MAGNETIC INTENSITY

Values of a_n, b_n, in the series Σ (a_n cos nt + b_n sin nt), t being reckoned in hours from 0^h U.T. and converted into arc at the rate of 15° to each hour.

Table with columns for Month and Season, NORTH COMPONENT, WEST COMPONENT, and VERTICAL COMPONENT. Each component has sub-columns for coefficients a1-a4 and b1-b4. Rows include monthly data for 1940, Winter, Equinox, Summer, and summary rows for International Quiet and Disturbed Days.

TABLE IX. - HARMONIC COMPONENTS OF THE DIURNAL INEQUALITY OF MAGNETIC INTENSITY

Values of c_n, alpha_n in the series Σ c_n sin (nt + alpha_n), T being reckoned in hours from midnight, Abinger Local Mean Time, and converted into arc at the rate of 15° to each hour. New phase-angles expressing the inequalities relative to Local Apparent Time may be obtained from the tabulated angles by applying corrections alpha, 2alpha, 3alpha, 4alpha respectively, where alpha has the following values:-

Small table with 4 columns for months (January, February, March, April, May, June, July, August, September, October, November, December, Winter, Equinox, Summer) and 2 columns for values (degrees/minutes).

Table with columns for Month and Season, NORTH COMPONENT, WEST COMPONENT, and VERTICAL COMPONENT. Each component has sub-columns for coefficients c1-c4 and alpha1-alpha4. Rows include monthly data for 1940, Winter, Equinox, Summer, and summary rows for International Quiet and Disturbed Days.

TABLE X. - RANGE OF MEAN DIURNAL INEQUALITIES FOR THE MONTHS, YEAR AND SEASONS OF 1940

Month and Season	'All' Days			Quiet Days			Disturbed Days			'All' Days			Quiet Days			Disturbed Days		
	D	I	H	D	I	H	D	I	H	X	Y	Z	X	Y	Z	X	Y	Z
	'	'	Y	'	'	Y	'	'	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
January	6.60	1.66	16.7	4.47	1.11	18.6	13.76	6.39	66.8	18.4	34.9	19.0	18.7	23.9	6.6	69.5	75.8	65.2
February	6.09	1.01	15.1	3.70	0.93	16.0	9.77	2.24	26.8	19.2	31.9	15.4	18.7	17.9	8.4	33.4	49.0	29.8
March	10.15	2.79	48.1	9.40	2.18	33.4	20.78	12.86	263.6	43.8	53.5	38.9	31.7	49.6	12.6	251.0	113.7	247.3
April	11.42	2.16	43.2	12.98	2.23	39.0	12.43	4.96	77.2	42.8	60.9	30.6	39.5	66.7	25.8	76.0	67.8	92.6
May	11.65	2.26	45.9	10.92	1.70	30.6	12.98	4.15	83.8	43.1	61.2	38.5	30.4	59.6	28.6	81.6	63.2	53.4
June	12.63	2.73	52.4	12.52	2.20	41.6	15.70	3.41	70.2	51.3	67.8	38.6	44.6	65.0	32.8	67.0	90.2	77.6
July	11.91	2.52	48.1	11.04	1.93	36.4	13.00	3.30	58.2	45.8	65.1	32.6	33.2	59.9	26.8	56.9	70.4	47.6
August	12.19	2.48	44.4	13.48	2.67	43.4	11.26	3.20	57.8	44.1	65.7	32.1	42.4	74.2	23.6	56.9	58.1	42.8
September	11.80	2.39	39.6	10.14	1.96	36.2	14.88	3.77	51.0	41.4	63.4	30.1	35.6	54.7	22.6	55.9	74.2	60.0
October	8.46	2.24	33.3	7.48	2.18	35.0	14.60	5.42	55.4	37.3	41.7	20.5	37.5	38.3	10.2	52.1	77.6	68.4
November	7.57	1.94	26.0	4.32	1.17	20.6	13.74	3.70	40.6	29.0	37.2	18.2	23.0	22.4	9.8	50.1	70.7	44.0
December	6.39	1.43	18.5	3.50	0.71	11.4	7.66	3.97	48.6	20.8	32.7	15.7	11.2	19.2	9.2	47.8	39.4	36.0
Mean for Year	9.74	2.13	35.9	8.66	1.75	30.2	13.38	4.78	75.0	36.4	51.3	27.5	30.5	46.0	18.1	74.9	70.8	72.1
Winter	6.66	1.51	19.1	4.00	0.98	16.7	11.23	4.08	45.7	21.9	34.2	17.1	17.8	20.9	8.5	50.2	58.7	43.8
Equinox	10.46	2.40	41.1	10.00	2.14	35.9	15.67	6.75	111.8	41.3	54.9	30.0	36.1	52.3	17.8	108.8	83.3	117.1
Summer	12.10	2.50	47.7	11.99	2.13	38.0	13.24	3.52	67.5	46.1	65.0	35.5	37.7	64.7	28.0	65.6	70.5	55.4

TABLE XI. - NON-CYCLIC CHANGE (24^h minus 0^h)

Month 1940	'All' Days			Quiet Days			Disturbed Days		
	Declination West	Horizontal Intensity	Vertical Intensity	Declination West	Horizontal Intensity	Vertical Intensity	Declination West	Horizontal Intensity	Vertical Intensity
	'	Y	Y	'	Y	Y	'	Y	Y
January	-0.29	-0.3	-0.1	-0.74	+1.8	-2.2	-1.38	-18.8	+6.4
February	+0.29	+0.3	+0.2	-1.00	+2.8	-0.2	+3.84	+7.8	+0.2
March	+0.04	-1.7	-0.8	-0.16	+6.2	-2.2	+1.73	-12.7	-4.7
April	-0.25	+1.7	+0.3	+0.22	+3.8	-1.6	-1.90	-2.6	+9.0
May	+0.10	+0.3	0.0	+0.22	+6.6	-1.2	-1.54	-7.8	-6.4
June	-0.01	-0.2	+0.3	-0.02	+1.2	-0.4	+2.60	-11.4	+4.4
July	-0.03	+0.2	-0.3	+0.34	+6.4	-1.0	+0.14	-4.8	+3.0
August	-0.21	+0.1	-0.2	-0.02	+3.6	-0.8	-3.04	-12.0	-4.8
September	+0.18	+0.1	+0.3	+0.26	+4.6	-0.2	+1.06	-6.2	+4.0
October	-0.04	-0.3	+0.1	+0.38	+4.8	-1.4	+0.24	-13.0	+8.0
November	-0.08	-0.1	+0.2	+1.06	+8.4	-3.2	-1.00	-8.2	+1.0
December	0.00	-0.2	+0.1	+0.44	+3.4	-0.6	+0.40	-2.0	+2.2
Year 1940	..	..	..	+0.08	+4.5	-1.3	+0.10	-7.6	+1.9

TABLE XII. - MEAN MONTHLY AND ANNUAL VALUES OF GEO-MAGNETIC ELEMENTS AT THE ABINGER MAGNETIC STATION

Month 1940	Declination West	Inclination	Intensity				
			Horizontal	North	West	Vertical	Total
	o /	o /	c.g.s.	c.g.s.	c.g.s.	c.g.s.	c.g.s.
January	10 47.1	66 44.3	.18525	.18198	.03466	.43094	.46907
February	10 46.4	66 43.6	.18533	.18206	.03464	.43089	.46906
March	10 45.3	66 44.3	.18524	.18199	.03457	.43093	.46906
April	10 44.4	66 44.4	.18526	.18202	.03452	.43099	.46912
May	10 44.0	66 43.4	.18538	.18214	.03452	.43093	.46911
June	10 43.5	66 43.4	.18539	.18215	.03450	.43097	.46916
July	10 42.5	66 43.3	.18542	.18219	.03445	.43099	.46918
August	10 42.3	66 43.4	.18540	.18217	.03444	.43098	.46917
September	10 41.4	66 43.9	.18533	.18211	.03438	.43098	.46914
October	10 40.6	66 44.3	.18531	.18210	.03433	.43107	.46921
November	10 39.7	66 44.4	.18531	.18211	.03428	.43110	.46924
December	10 39.0	66 44.0	.18537	.18218	.03426	.43111	.46927
Year 1940	10 43.0	66 43.9	.18533	.18210	.03446	.43099	.46915

TABLE XIII. - DAILY MEAN VALUE OF THE BASE-LINE OF THE DECLINATION MAGNETOGRAMS AT ABINGER MAGNETIC STATION

Day	January	February	March	April	May	June	July	August	September	October	November	December
	o /	o /	o /	o /	o /	o /	o /	o /	o /	o /	o /	o /
1	10 35.7	10 36.1	10 36.3	10 36.4	10 35.8	10 36.8	10 39.3	10 22.3	10 22.5	10 22.5	10 22.0	10 22.0
2	35.8	36.1	36.3	36.2	35.9	36.8	$\frac{39.3}{22.3}$	22.4	22.6	22.5	22.0	21.8
3	35.8	36.1	36.4	36.2	35.9	36.8	22.3	22.3	22.6	22.5	21.9	21.7
4	36.4	36.1	36.3	36.2	35.9	36.8	22.3	22.3	22.6	22.5	21.8	22.6
5	36.4	36.1	36.2	36.2	35.9	36.8	22.2	22.4	22.6	22.4	$\frac{21.8}{22.6}$	22.6
6	36.5	36.1	36.4	36.3	36.0	36.7	22.3	22.2	22.5	22.2	22.6	22.6
7	36.3	36.1	36.3	36.3	35.9	36.5	22.3	22.3	22.6	22.2	22.6	22.6
8	36.4	36.2	36.2	36.3	35.9	36.4	22.3	21.9	22.5	22.2	22.6	22.4
9	36.4	36.3	36.2	36.3	35.9	36.4	22.2	21.9	22.6	$\frac{22.2}{22.6}$	22.6	22.4
10	36.4	36.2	36.2	36.3	35.9	36.4	22.3	21.8	22.6	22.6	22.6	22.4
11	36.3	36.3	36.1	36.3	36.0	$\frac{36.2}{38.6}$	22.3	$\frac{21.9}{22.6}$	22.6	22.8	22.6	22.3
12	36.4	36.3	36.1	36.3	36.0	38.6	22.3	22.7	22.6	22.8	22.6	22.3
13	36.3	36.2	36.1	36.3	36.0	38.6	22.3	22.7	22.6	22.6	22.6	22.4
14	36.3	36.3	36.2	36.3	36.1	$\frac{38.7}{39.3}$	22.3	22.7	22.5	22.5	22.6	22.3
15	36.3	36.2	36.1	36.3	36.1	39.4	22.3	22.6	22.2	22.5	22.6	22.4
16	36.3	35.9	36.2	36.3	36.1	39.3	22.3	22.6	22.2	22.4	22.6	22.4
17	36.3	35.7	36.2	36.3	36.2	39.2	22.3	22.6	22.1	22.5	22.6	22.4
18	36.2	35.5	36.1	36.3	36.2	39.3	22.3	22.5	22.1	22.6	22.6	22.4
19	36.2	35.5	36.1	36.3	36.1	39.3	22.3	22.5	$\frac{22.1}{22.5}$	22.6	22.5	22.3
20	36.2	35.6	36.1	36.3	36.1	39.4	22.2	22.5	22.6	22.5	22.5	22.3
21	36.0	35.5	36.1	36.3	36.1	39.3	22.2	22.5	22.7	22.6	22.5	21.9
22	36.1	35.6	36.1	36.3	36.0	39.3	22.3	22.5	22.6	22.6	22.6	21.7
23	36.0	35.6	36.1	36.3	36.0	39.3	22.4	22.5	22.6	22.6	22.6	21.7
24	36.1	36.1	36.1	36.3	36.1	39.3	22.5	22.4	22.6	22.6	22.6	21.6
25	36.0	36.3	36.1	36.3	36.2	39.3	22.4	22.4	22.7	22.6	22.6	21.6
26	36.0	36.2	36.1	36.2	36.2	39.3	22.3	22.3	22.5	22.6	22.6	22.5
27	36.1	36.3	36.0	36.2	36.3	39.3	22.3	22.2	22.5	22.6	22.5	22.5
28	36.1	36.3	35.9	36.1	36.2	39.3	22.4	22.2	22.5	22.5	22.4	22.5
29	36.2	36.3	35.8	36.1	36.2	39.3	22.4	$\frac{22.0}{22.4}$	22.5	22.5	22.2	22.5
30	36.1		36.4	36.1	$\frac{36.3}{36.9}$	39.3	22.3	22.5	22.5	22.4	22.2	22.5
31	36.0		36.3		36.9		22.4	22.5		22.2		22.5

Sudden small dislocations of the trace, of uncertain origin, occurred on June 9, July 2, August 11, 29, September 19, October 9 and November 5.

TABLE XIV. - RESULTS OF THE DETERMINATIONS OF THE ABSOLUTE VALUE OF HORIZONTAL INTENSITY FROM OBSERVATIONS MADE WITH THE SCHUSTER-SMITH COIL MAGNETOMETER IN THE MAGNETIC PAVILION AT ABINGER, WITH THE DEDUCED VALUES OF THE BASE-LINE OF THE HORIZONTAL INTENSITY MAGNETOGRAMS

Universal Time	No. of Obs.	Observed Horizontal Intensity	Deduced Value of Base-line	Universal Time	No. of Obs.	Observed Horizontal Intensity	Deduced Value of Base-line	Universal Time	No. of Obs.	Observed Horizontal Intensity	Deduced Value of Base-line
Aug. 19	8	18513	18356	Oct. 3	8	18468	18355	Nov. 16	8	18535	18355
20	8	18514	18356	4	8	18498	18355	18	8	18530	18355
21	8	18509	18356	5	8	18514	18354	19	8	18542	18356
22	8	18559	18356	7	8	18466	18354	20	8	18547	18354
23	8	18510	18356	8	8	18468	18355	21	8	18494	18354
24	8	18503	18356	9	8	18524	18355	22	8	18519	18354
26	8	18526	18357	10	8	18534	18353	23	8	18464	18354
27	8	18508	18356	11	8	18524	18355	25	8	18494	18355
28	8	18514	18357	12	8	18526	18355	26	8	18514	18354
29	8	18516	18356	14	8	18544	18353	27	8	18538	18354
30	8	18526	18356	15	8	18515	18353	28	8	18531	18354
31	8	18537	18356	16	8	18530	18355	29	8	18527	18354
				17	8	18533	18355	30	8	18507	18355
				18	8	18532	18354				
Sept. 2	8	18541	18357	19	8	18488	18354	Dec. 2	8	18535	18355
3	8	18488	18356	21	8	18537	18354	3	8	18537	18355
4	8	18464	18355	22	8	18528	18354	4	8	18540	18353
5	8	18495	18356	23	8	18520	18354	5	8	18536	18354
6	8	18503	18357	24	8	18522	18355	6	8	18542	18354
7	8	18477	18356	25	8	18545	18354	7	8	18539	18353
9	8	18545	18357	26	8	18555	18354	9	8	18551	18352
10	8	18515	18357	28	8	18528	18355	10	8	18548	18353
11	8	18504	18357	29	8	18529	18354	11	8	18533	18353
13	8	18521	18356	30	8	18522	18354	12	8	18544	18352
14	8	18527	18356	31	8	18509	18355	13	8	18518	18352
16	8	18541	18356					14	8	18548	18353
17	8	18543	18356	Nov. 1	8	18533	18354	16	8	18537	18352
18	8	18556	18356	2	8	18530	18354	17	8	18547	18352
19	8	18524	18355	4	8	18516	18356	18	8	18550	18351
20	8	18523	18356	5	8	18516	18356	19	8	18544	18352
23	8	18534	18355	6	8	18521	18355	20	8	18544	18353
24	8	18519	18355	7	8	18529	18355	21	8	18509	18353
25	8	18537	18354	8	8	18532	18355	23	8	18540	18353
26	8	18524	18354	9	8	18522	18355	24	8	18529	18353
27	8	18487	18355	11	8	18541	18355	26	8	18506	18352
28	8	18510	18355	12	8	18500	18355	27	8	18542	18352
30	8	18525	18354	13	8	18497	18356	28	8	18526	18352
Oct. 1	8	18492	18355	14	8	18517	18355	30	8	18530	18352
2	8	18495	18355	15	8	18528	18354	31	8	18538	18352

TABLE XIV(A). - RESULTS OF THE DETERMINATIONS OF THE ABSOLUTE VALUE OF HORIZONTAL INTENSITY FROM OBSERVATIONS MADE WITH THE UNIFILAR MAGNETOMETER CASELLA 181 AT ABINGER, WITH THE DEDUCED VALUES OF THE BASE-LINE OF THE HORIZONTAL INTENSITY MAGNETOGRAMS

Universal Time	Observed Horizontal Intensity	Deduced Value of Base-line	Universal Time	Observed Horizontal Intensity	Deduced Value of Base-line	Universal Time	Observed Horizontal Intensity	Deduced Value of Base-line			
h	m	h	m	Y	Y	h	m	h	m	Y	Y
Jan. 10	10	18	11	18546	18357	July 24	9	25	11	18505	18357
						30	9	23	11	18524	18360
Mar. 5	9	17	10	18536	18352	Aug. 9	9	13	10	18473	18356
						15	9	52	10	18517	18361
July 16	14	5	15	18541	18357	21	9	24	11	18515	18359
						Aug. 27	9	9	11	18515	18360
						Sept. 4	9	31	10	18468	18359
						Oct. 22	9	37	11	18517	18355

TABLE XV. - RESULTS OF THE DETERMINATIONS OF THE ABSOLUTE VALUE OF VERTICAL INTENSITY FROM OBSERVATIONS MADE WITH THE DYE COIL MAGNETOMETER IN THE MAGNETIC PAVILION AT ABINGER, WITH THE DEDUCED VALUES OF THE BASE-LINE OF THE VERTICAL INTENSITY MAGNETOGRAMS

Universal Time				Universal Time				Universal Time						
h m		No. of Obs.	Observed Vertical Intensity	Deduced Value of Base-line	h m		No. of Obs.	Observed Vertical Intensity	Deduced Value of Base-line	h m		No. of Obs.	Observed Vertical Intensity	Deduced Value of Base-line
			Y	Y				Y	Y				Y	Y
Aug.	19 13 42 - 14 16	8	43081	42989	Oct.	2 9 49 - 10 18	8	43107	42998	Nov.	15 9 56 - 10 27	8	43104	42999
	20 10 7 - 10 55	8	43075	42991		3 9 46 - 10 5	8	43107	42997		16 9 53 - 10 14	8	43101	42999
	21 9 48 - 10 34	8	43072	42993		4 9 43 - 10 3	8	43107	42997		18 9 57 - 10 36	8	43099	42998
	22 1 26 - 2 28	8	43098	42993		5 9 59 - 10 27	8	43093	42995		19 9 49 - 10 22	8	43102	42999
	23 9 25 - 9 49	8	43088	42994		7 14 14 - 14 41	8	43148	42998		20 10 3 - 10 30	8	43100	42997
	24 9 35 - 10 14	8	43094	42993		8 9 29 - 9 53	8	43099	42996		21 9 17 - 10 8	8	43099	42998
	26 11 20 - 11 54	8	43074	42994		9 9 29 - 9 59	8	43112	42997		22 9 42 - 10 12	8	43093	42998
	27 9 58 - 10 29	8	43090	42992		10 9 34 - 9 56	8	43108	42998		23 10 14 - 10 46	8	43118	42998
	28 9 40 - 10 16	8	43091	42991		11 9 55 - 10 15	8	43102	42997		25 10 0 - 10 32	8	43103	42997
	29 9 49 - 10 8	8	43076	42991		12 9 51 - 10 17	8	43103	42999		26 10 3 - 10 35	8	43111	42998
	30 9 42 - 10 15	8	43087	42994		14 0 54 - 1 20	8	43106	42997		27 10 10 - 10 37	8	43106	42997
	31 9 19 - 9 41	8	43093	42995		15 9 44 - 10 7	8	43093	42997		28 10 9 - 10 39	8	42101	42999
						16 10 3 - 10 33	8	43096	42997		29 10 2 - 10 24	8	43102	42996
						17 9 57 - 10 24	8	43103	42997		30 9 53 - 10 25	8	43109	42997
						18 9 49 - 10 23	8	43095	42996					
Sept.	2 1 57 - 2 53	8	43103	42993		19 9 55 - 10 20	8	43104	42998	Dec.	2 10 4 - 10 31	8	43103	42998
	3 10 10 - 10 30	8	43085	42994		21 14 1 - 14 28	8	43107	42995		3 10 1 - 10 31	8	43104	42998
	4 9 45 - 10 19	8	43088	42991		22 9 58 - 10 27	8	43099	42995		4 10 3 - 10 40	8	43106	43000
	5 10 3 - 10 32	8	43091	42993		23 9 52 - 10 16	8	43104	42996		5 10 10 - 10 26	8	43107	43001
	6 10 5 - 10 41	8	43081	42993		24 10 4 - 10 27	8	43104	42995		7 9 57 - 10 24	8	43103	42999
	7 9 24 - 9 48	8	43084	42994		25 9 46 - 10 9	8	43095	42997		9 10 19 - 10 43	8	43103	42997
	9 13 41 - 14 12	8	43107	42996		26 10 9 - 10 26	4	43092	42996		10 9 46 - 9 53	8	43101	42998
	10 9 57 - 10 45	8	43094	42996		28 9 48 - 10 12	8	43105	42997		11 9 51 - 10 23	8	43106	42997
	11 10 4 - 10 47	8	43084	42997		29 9 46 - 10 18	8	43107	42998		12 9 58 - 10 22	8	43107	42999
	13 9 45 - 10 16	8	43083	42995		30 10 3 - 10 30	8	43102	42997		13 9 55 - 10 40	8	43097	42996
	14 9 40 - 10 11	8	43086	42998		31 10 1 - 10 27	8	43102	42996		14 9 56 - 10 26	8	43103	42998
	16 13 50 - 14 22	8	43101	42995							16 10 4 - 10 37	8	43099	42998
	17 14 5 - 14 27	8	43094	42995	Nov.	1 9 47 - 10 16	8	43105	42997		17 9 53 - 10 18	8	43103	42999
	18 9 35 - 9 59	8	43089	42993		2 10 7 - 10 30	8	43104	42999		18 10 5 - 10 32	8	43104	42997
	19 9 47 - 10 27	8	43078	42994		4 10 7 - 10 33	8	43101	42998		19 9 54 - 10 30	8	43099	42997
	20 10 15 - 10 50	8	43062	42994		5 9 57 - 10 19	8	43111	42998		20 10 1 - 10 57	8	43097	42997
	23 14 32 - 15 4	8	43095	42997		6 10 0 - 10 23	8	43108	42999		21 9 59 - 10 29	8	43117	42995
	24 9 44 - 10 42	8	43091	42997		7 9 54 - 10 17	8	43102	42997		23 10 1 - 10 22	8	43108	42995
	25 1 2 - 1 46	8	43105	42997		8 9 50 - 10 11	8	43103	42998		24 9 58 - 10 28	8	43108	42997
	26 9 35 - 10 11	8	43093	42997		9 9 59 - 10 20	8	43100	42998		26 10 1 - 10 29	8	43105	42999
	27 10 8 - 10 42	8	43101	42997		11 9 55 - 10 12	8	43097	42998		27 9 55 - 10 22	8	43101	42996
	28 9 50 - 10 16	8	43092	42996		12 10 15 - 10 41	8	43099	42999		28 10 5 - 10 26	8	43103	42997
	30 14 20 - 14 45	5	43102	42997		13 9 51 - 10 20	8	43099	42999		30 10 2 - 10 32	8	43113	42997
Oct.	1 9 45 - 10 25	8	43101	43001		14 9 55 - 10 19	8	43102	42999		31 9 43 - 10 15	8	43107	42998

TABLE XV(A). - DAILY VALUE OF THE BASE-LINE OF THE VERTICAL INTENSITY MAGNETOGRAMS AT THE ABINGER MAGNETIC STATION, DEDUCED FROM OBSERVATIONS OF MAGNETIC DIP MADE WITH THE EARTH INDUCTOR

Day	January	February	March	April	May	June	July	August	September	October	November	December
	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
1	42951	42955	42989	-	42999	43001	42995	43000	-	43002	43000	-
2	42950	42956	42994	42994	42998	-	42998	42995	43001	43003	43001	42998
3	42967	42956	-	43001	42997	43002	42993	42997	43002	42998	-	43001
4	42959	-	42997	43003	42996	42999	42996	-	42996	43004	43002	43003
5	42951	42957	43002	42983	-	42991	42995	43001	43000	43001	43003	43003
6	42951	-	42996	42990	43001	42992	42996	42992	42996	-	43003	43002
7	-	42997	42989	-	-	42994	-	42995	42997	43000	43002	42999
8	42955	42996	42991	42990	43000	42989	-	42996	-	43004	43006	-
9	42956	42995	42990	42994	42996	-	42997	42995	43001	42997	43006	42998
10	42964	42992	-	42998	43000	42995	42999	42999	43000	43000	-	43000
11	42952	-	42998	42996	42996	-	42997	-	43002	43001	43003	42998
12	42954	42993	42986	42995	-	42991	42996	43002	-	43000	43003	42998
13	42958	42987	42998	42991	43000	42992	42995	42997	42997	-	43004	42998
14	-	42987	42995	-	-	42996	-	42998	42994	42999	43006	43001
15	42956	42991	42995	42991	42998	42993	42996	42999	-	43000	43003	-
16	42957	-	42991	42994	42996	-	42987	42995	43001	43001	43006	43003
17	42956	42986	-	42997	43001	42994	42997	42996	43005	43002	-	43002
18	42958	-	42993	42999	42994	42994	42995	-	42999	42998	43004	42999
19	42949	42985	42994	42997	-	42992	42997	42997	43003	42997	43007	42997
20	-	42988	42991	42992	42998	42997	42993	42996	42997	-	43006	42997
21	-	-	42996	-	42997	42994	-	43000	43003	43000	43005	42998
22	42954	42990	-	42996	42997	42994	-	42995	-	42996	43003	-
23	42958	42988	42996	42997	42999	-	42994	42999	43001	43001	43006	42993
24	42958	42986	-	42997	43003	42999	42996	42995	42998	42998	-	42997
25	42950	-	-	42997	42996	42995	43003	-	42998	43001	43007	-
26	42958	-	42990	42994	-	42993	42994	42998	43000	43000	43005	43001
27	42958	42990	42985	-	43005	42994	42995	42995	42999	-	<u>43002</u> 43002	43001
28	-	42996	42994	42998	43001	42995	-	42999	43001	43000	42995	43001
29	42960	42991	42990	42999	42997	42998	43000	42995	-	43002	42999	-
30	42960		42989	42991	42999	-	42995	42992	42997	43000	42999	43001
31	42968		-		43001		42996	42999		43000		43003

Adjustments were made to the variometer on February 6 and 7.

Adjustments of the bearings of the axis of the rotating coil of the Inductor was made on June 5 and November 27.

TABLE XVI(A). - MEAN ANNUAL VALUES OF MAGNETIC ELEMENTS DETERMINED AT THE ROYAL OBSERVATORY,
GREENWICH, BETWEEN THE YEARS 1818-1925

Year	Declination West	Horizontal Intensity	Vertical Intensity	Dip	Year	Declination West	Horizontal Intensity	Vertical Intensity	Dip
	° /	C. G. S. Unit	C. G. S. Unit	° /		° /	C. G. S. Unit	C. G. S. Unit	° /
1818	24 19 †	..	..	..	1862	18 22.3	0.1806	0.4375	67.34.2
1819	24 21	..	..	..	1863	18 15.0	0.1812	0.4381	67 31.7
1820	24 21	..	..	..	1864	18 7.6	0.1814	0.4379	67 29.7
1841	23 16.2	..	..	..	1865	18 1.7	0.1817	0.4380	67 28.0
1842	23 14.6	..	..	..	1866	17 54.5	0.1818	0.4377	67 27.1
1843	23 11.7	..	..	69 0.6	1867	17 49.1	0.1819	0.4380	67 26.6
1844	23 15.3	..	..	69 0.3	1868	17 40.4	0.1822	0.4383	67 25.6
1845	22 56.7	..	..	68 57.5	1869	17 34.9	0.1823	0.4380	67 24.3
1846	22 49.6	0.1731	..	68 58.1	1890	17 28.6	0.1825	0.4381	67 23.0
1847	22 51.3	0.1736	..	68 59.0	1891	17 23.4	0.1827	0.4380	67 21.5
1848	22 51.8	0.1731	..	68 54.7	1892	17 17.4	0.1829	0.4379	67 20.0
1849	22 37.8	0.1733	..	68 51.3	1893	17 11.4	0.1831	0.4373	67 17.9
1850	22 23.5	0.1738	..	68 46.9	1894	17 4.6	0.1831	0.4374	67 17.4
1851	22 18.3	0.1744	..	68 40.4	1895	16 57.4	0.1834	0.4378	67 16.1
1852	22 17.9	0.1745	..	68 42.7	1896	16 51.7	0.1835	0.4382	67 15.1
1853	22 10.1	0.1748	..	68 44.6	1897	16 45.8	0.1838	0.4377	67 13.5
1854	22 0.8	0.1749	..	68 47.7	1898	16 39.2	0.1840	0.4377	67 12.1
1855	21 48.4	0.1756	..	68 44.6	1899	16 34.2	0.1843	0.4380	67 10.5
1856	21 43.5	0.1759	..	68 43.5	1900	16 29.0	0.1846	0.4380	67 8.8
1857	21 35.4	0.1769	..	68 31.1	1901	16 26.0	0.1850	0.4381	67 6.4
1858	21 30.3	0.1762	..	68 28.3	1902	16 22.8	0.1852	0.4377	67 3.8
1859	21 23.5	0.1761	..	68 26.9	1903	16 19.1	0.1852	0.4386	67 1.2
1860	21 14.3	..	..	68 30.1	1904	16 15.0	0.1854	0.4359	66 57.6
1861	21 5.5	0.1773	..	68 24.6	1905	16 9.9	0.1854	0.4355	66 56.3
					1906	16 3.6	0.1854	0.4353	66 55.6
1861		0.1759	..	68 15.8	1907	15 59.6	0.1855	0.4357	66 56.2
1862	20 52.6	0.1763	0.4403	68 9.6	1908	15 53.5	0.1854	0.4356	66 56.3
1863	20 45.9	0.1764	0.4396	68 7.0	1909	15 47.6	0.1854	0.4348	66 54.1
1864	..	0.1767	0.4393	68 4.1	1910	15 41.2	0.1855	0.4345	66 52.8
1865	20 33.9	0.1767	0.4388	68 2.7	1911	15 33.0	0.1855	0.4342	66 52.1
1866	20 28.0	0.1773	0.4397	68 1.3	1912	15 24.3	0.1855	0.4340	66 51.8
1867	20 20.5	0.1777	0.4392	67 57.2	1913	15 15.2	0.1853	0.4333	66 50.5
1868	20 13.1	0.1779	0.4395	67 56.5					
1869	20 4.1	0.1782	0.4396	67 54.8					
1870	19 53.0	0.1784	0.4392	67 52.5	1914	15 6.3	0.1853	0.4333	66 50.8
1871	19 41.9	0.1786	0.4389	67 50.3	1915	14 56.5	0.1851	0.4331	66 51.6
1872	19 36.8	0.1789	0.4383	67 47.8	1916	14 46.9	0.1848	0.4326	66 52.2
1873	19 33.4	0.1793	0.4386	67 45.8	1917	14 37.1	0.1848	0.4330*	66 53.0
1874	19 28.9	0.1797	0.4387	67 43.6	1918	14 27.8	0.1846	0.4325	66 52.8
1875	19 21.2	0.1797	0.4383	67 42.4	1919	14 18.2	0.1845	0.4324	66 53.3
1876	19 8.3	0.1799	0.4383	67 41.0	1920	14 8.6	0.1845	0.4325	66 53.6
1877	18 57.2	0.1800	0.4381	67 39.7	1921	13 57.6	0.1845	0.4322	66 53.0
1878	18 49.3	0.1802	0.4382	67 38.2	1922	13 46.7	0.1844	0.4318	66 52.3
1879	18 40.5	0.1806	0.4382	67 37.0	1923	13 35.1	0.1843	0.4314	66 51.9
1880	18 32.6	0.1806	0.4380	67 35.7	1924	13 22.8	0.1843	0.4311	66 51.6
1881	18 27.1	0.1807	0.4379	67 34.7	1925	13 9.9	0.1841	0.4308	66 51.4

In 1818, 1819 and 1820 numerous observations of Declination were made with a Dollond needle.

In 1861 new Unifilar Apparatus for absolute Horizontal Intensity and the Airy Dip-Circle were introduced, both sets of apparatus being used in that year. In 1864 the excavation of the Magnetic Basement caused a suspension of Declination Observations. From 1914 the Dip was determined with an Inductor.

N.B.- In the above table the values of Vertical Intensity for the years 1862-1913 inclusive were computed from the corresponding values of Horizontal Intensity and Dip, the values of Dip being the mean of all the absolute observations taken in any year, and the time of observation approximating to noon on the average. Beginning with 1914 the values of Dip have been computed from the corresponding annual mean values of Horizontal and Vertical Intensity.

† Mean of seven months June to December.

* Mean of ten months, March to December.

TABLE XVI(B). - MEAN ANNUAL VALUES OF MAGNETIC ELEMENTS DETERMINED AT THE ABINGER MAGNETIC STATION,
FOR THE YEARS 1925-1940

Year	Declination West	Horizontal Intensity	Vertical Intensity	Inclination
	° /	C. G. S. Unit	C. G. S. Unit	° /
1925	13 22.7	0.18597	0.42946	66 35.1
1926	13 10.4	0.18581	0.42947	66 36.3
1927	12 58.4	0.18575	0.42932	66 36.2
1928	12 47.0	0.18564	0.42941	66 37.3
1929	12 35.8	0.18555	0.42918	66 37.2
1930	12 24.6	0.18542	0.42924	66 38.2
1931	12 13.7	0.18543	0.42923	66 38.1
1932	12 2.6	0.18536	0.42940	66 39.1
1933	11 51.7	0.18532	0.42942	66 39.4
1934	11 41.1	0.18533	0.42955	66 39.7
1935	11 30.3	0.18527	0.42981	66 40.9
1936	11 20.0	0.18524	0.43007	66 41.8
1937	11 10.4	0.18522	0.43031	66 42.7
1938*	11 1.4	0.18522	0.43050	66 43.2
1939	10 51.9	0.18528	0.43074	66 43.5
1940	10 43.0	0.18533	0.43099	66 43.9

The values of Inclination are computed from the corresponding values of horizontal and vertical intensity.

Commencing with the years 1927 and 1929 respectively, the values of horizontal and vertical intensity are based upon observations with Coil-magnetometers.

* Discontinuities of -1.7γ in H and -3.9γ in Z were introduced in 1938. See Introduction p. x and xi.

January. During the first two days there was considerable unsteadiness which was followed by a brisk, though short-lived, disturbance having a well marked sudden commencement at 3^d 14^h 39^m (Plate I). The range in this disturbance was greatest in vertical intensity, which in two hours increased 160γ and then suffered a steady decline, reaching normal by 4^d 1^h. The range in H was 140γ and in D, 43'. Several prominent waves appeared in the traces during 4^d to 7^d - one of +80γ in H at 4^d 21^h and one of +20' in D at 6^d 18½^h being perhaps the most noteworthy - and conditions remained rather unsteady throughout several succeeding days. At about 10^d 13½^h another period of moderate disturbance began. This lasted until 13^d 0^h, though there was a relatively quiet interval from 10^d 22^h to 11^d 18^h. The range in H was 160γ and in Z, 75γ. The period from 13^d 0^h to 15^d 0^h was almost quiet. Then small oscillatory movements began which soon increased in amplitude and irregularity. From 16^d 12^h general unsteadiness was shown which later culminated in a moderate disturbance lasting from 18^d 14^h to 22^h. During this short active stage there was a range of 45' in D, over 200γ in H and 150γ in Z, (Plate I). The prevailing characteristic during subsequent days was small undulatory movement with a few larger irregularities superposed. Gradually the latter preponderated and from 29^d 16^h general unsteadiness merged into a state of mild disturbance with movements in H frequently exceeding 50γ.

The range in declination during the month was from 10° 12'·2 on 18th to 11° 19'·7 on 3rd, in horizontal intensity, from ·18337 on 18th to ·18605 on 7th; in vertical intensity, from ·43072 on 6th to ·43256 on 3rd.

February. Almost continuous unsteadiness characterised the traces throughout the month, though the periods from 13^d to 15^d and 17^d to 19^d were least affected. Greater activity was shown on 1st (a wave in H, +100γ, at 17½^h); on 3rd (a wave in D, +15', at 17½^h); and during a further period which began abruptly at 24^d 22^h 10^m and lasted about 24 hours.

The range in declination during the month was from 10° 3'·2 to 10° 45'·3 both on 18th; in horizontal intensity from ·18442 on 25th to ·18607 on 1st; in vertical intensity, from ·43060 on 20th to ·43161 on 25th.

March. The month began with nearly quiet conditions. A few irregularities appeared on 3rd and 4th and unsteadiness increased during 7th. The first disturbance of the month occurred between 8^d 20^h and 9^d 5^h. It was undulatory in character and slight in degree, the whole range being only 22' in D, 75γ in H and under 60γ in Z. General unsteadiness remained, however, and between 12^d 16^h and 13^d 4^h there was a second slight disturbance in which the ranges in H and Z respectively were 114γ and 73γ. Small irregularities continued to appear until 17^d 0^h at which time a short quiet period set in which lasted until 19^d 0^h. The traces then began to show considerable and increasing activity. The range in Z on 19th was 66γ and in H on 20th, 144γ. Activity declined during the next two days, but was renewed at 6^h on 23rd. Large fluctuations in D and H were shown between 23^d 21^h and 24^d 1^h (31' in D, 163γ in H) while Z diminished rapidly by 100γ. At 24^d 13^h 40^m all traces began to show rapid fluctuation in the elements. Within two hours one of the greatest storms of the past ninety years was in full development. It was even more remarkable for the intensity of the disturbance than for the extent. Many of the movements of the traces were lost on account of their rapidity. The main part of the storm lasted from 24^d 15^h to 25^d 5^h during which period the ranges were: 131' in D, 1370γ (at least) in H, and 1000γ in Z. Extremely rapid oscillations continued until 25^d 15^h by which time the storm had ceased, (Plate II). A second storm began abruptly at 25^d 20^h and lasted about ten hours. It was of only moderate intensity, the ranges being 53' in D, 200γ in H and 210γ in Z. Vertical intensity remained about 200γ below its normal value for some 30 minutes at the climax of this storm, (Plate V). Disturbance in varying amount continued through 26th, 27th and 28th, there being a specially prominent bay in D (-30') at 26^d 19½^h. At 29^d 16^h 3^m a sudden movement in all traces was the beginning of a storm or rather, series of storms lasting until the end of April 3. These, though not comparable in violence to the storm of March 24-25 were each of sufficient magnitude to be classed as "great", that is, the ranges in intensity of field were of the order of 500γ. The main features are reproduced in Plates III, IV and V.

The range in declination during the month was from $9^{\circ} 50'7$ to $12^{\circ} 1'7$ both on 24th; in horizontal intensity from $\cdot 17850$ on 25th to $\cdot 19220$ on 24th; in vertical intensity from $\cdot 42719$ on 25th to $\cdot 43719$ on 24th.

April. The period $2^d 0^h - 19^h$ was a practically quiet interval between two large disturbances, the earlier of which was in progress, though well past its climax, when the month began. The second disturbance started abruptly at $2^d 19^h 3^m$ and ended about $3^d 22^h$. Several movements exceeded 100γ in H, the largest being a wave, +210γ, at $3^d 2\frac{1}{2}^h$; while between $3^d 1^h$ and 7^h Z was almost 150γ below normal intensity. The main part of the storm was over by $3^d 9^h$, (Plate V). From 4^d conditions became notably quieter for a considerable period, though small irregularities and occasional inconspicuous waves still affected the traces until the end of 6th. From $7^d 0^h$ to $11^d 12^h$ all disturbance ceased. Increasing unsteadiness then set in which reached a maximum on 15th, afterwards declining rapidly. About $19^d 12^h$ another period of unsteadiness began which, without any specially marked features, continued till $24^d 18^h$. Ten hours of quiet were succeeded at $25^d 2^h 5^m$ by the sudden outbreak of a storm which (including a protracted lull between $25^d 5^h$ and 17^h) lasted until $26^d 4^h$. The most active period was from $25^d 21^h$ to 23^h , when ranges of 29' in D, 216γ in H and 110γ in Z were recorded, (Plate VI). Activity steadily declined after the end of 26th and no further significant movements occurred.

The range in declination during the month was $10^{\circ} 14'7$ on 3rd to $11^{\circ} 13'3$ on 25th; in horizontal intensity, from $\cdot 18359$ on 1st to $\cdot 18643$ on 2nd; in vertical intensity, from $\cdot 42964$ on 3rd to $\cdot 43165$ on 25th.

May. Apart from small irregularities, which were almost continuous, there were no marked features on the traces during the first week. The quietest day was 6th. On 9th, movements began to grow in size and from $10^d 12^h$ a state of mild disturbance existed in greater or less degree until the end of 22nd. Movements seldom approached 50γ in H or 10' in D, however, until 18th, on which day disturbance notably increased and one movement of 100γ in H and 20' in D occurred while the value of Z fluctuated within a range of 70γ. Movements almost as great in magnitude also occurred between $22^d 2^h$ and 10^h . Activity then declined and had almost ceased when a particularly well marked "sudden commencement" in all traces at $23^d 17^h 54^m$ initiated the most important disturbance of the month, (Plate VI). The special feature of this storm was the relatively large range of 350γ in H. The ranges in D and Z were 31' and 120γ respectively. The storm ended with a number of rather rapid oscillatory movements which had ceased by $25^d 4^h$. Irregularities of considerable amount appeared in the traces on 25th and, more notably, on 26th-27th when the range in H exceeded 100γ and that in Z approached 100γ. Conditions then gradually became quiet and no significant departures from a smooth curve appeared on the traces during 31st.

The range in declination during the month was from $10^{\circ} 28'8$ on 27th to $11^{\circ} 0'9$ on 24th; in horizontal intensity, from $\cdot 18323$ on 24th to $\cdot 18676$ on 23rd; in vertical intensity, from $\cdot 43043$ to $\cdot 43163$ both on 24th.

June. Slight general unsteadiness affected the traces during the first five days of the month, and at $5^d 21^h$ this rapidly increased to the proportions of mild disturbance. Marked fluctuation in intensity continued throughout 6th to 9th inclusive, amounting occasionally to 50 or 60γ in H, while movements of 10' in D were also recorded on several occasions. On 10th conditions returned to the generally prevalent unsteadiness. At about $14^d 12^h$ a period of brisk activity set in during which there was a range of 190γ in H, 90γ in Z and nearly 30' in D. The principal movement took place between $14^d 15^h$ and $15^d 0^h$. Activity then decreased but great unsteadiness continued until the end of 19th. The 20th and 21st were practically quiet days. A small sudden movement in all traces appeared at $22^d 10^h 50^m$, after which, irregularity began again to be shown and subsequently to increase to a marked extent. At $25^d 2^h 53^m$ there was another sharp movement in all traces which, this time, was followed by a storm of great intensity, which however, was of comparatively short duration. The storm did not at once develop. After a prominent peak in each

trace, but particularly in D (+30'), there was a period of six hours characterised only by small, very rapid oscillatory movement. Full development began at 25^d 10^h. The storm reached greatest intensity between 13^h and 14^h and was virtually over by the end of the day. The ranges were 52' in D, 468γ in H and 250γ in Z, (Plate VII). A remarkable isolated movement occurred on the following day at 26^d 17^h 9^m when horizontal intensity increased 180γ in seven minutes and then fell to normal value in two stages during the next half hour, (Plate VII). A similar but much smaller change took place in Z at the same time and there was corresponding movement in the D trace. Neither, however, was remarkable. During the remainder of the month the traces, though showing great irregularity, were not affected by movements calling for particular comment.

The range in declination during the month was from 10° 19'4 to 11° 11'6; in horizontal intensity, from '18392 to '18860; in vertical intensity, from '43038 to '43288. All these ranges occurred on 25th.

July. Continuous small irregularities affected the traces on 1st and 2nd and increased greatly during 3rd, frequently assuming an oscillatory character. The ranges of the movements on 3rd and 4th were about 25γ in H. Rather larger movements appeared occasionally on 5th and then the unsteadiness declined. The period 7^d 20^h to 8^d 22^h was practically quiet. Considerable activity was shown during 9th and 10th, without special features, the total range in H being 160γ. After two days of nearly quiet conditions a short period of brisk activity began at 13^d 9^h. H fluctuated rapidly by amounts exceeding 150γ while Z increased 180γ in six hours. The disturbance proper ceased about 13^d 20^h, (Plate VIII), but great unsteadiness persisted throughout the two following days. From 17^d 0^h relatively quiet conditions prevailed until 19^d 20^h, after which unsteadiness re-appeared. This increased during 21st, and on 22nd some movements reached 50γ in H. Unsteadiness prevailed in varying degree for the remainder of the month, though the interval between 26^d 6^h and 29^d 18^h was least affected. On 30th two or three movements reached 50γ in H.

The range in declination, during the month was from 10° 31'5 on 4th to 10° 58'4 on 13th; in horizontal intensity, from '18432 on 13th to '18614 on 9th; in vertical intensity, from '43058 to '43170 both on 13th.

August. There was considerable unsteadiness in the elements throughout the first half of the month. In addition there were periods when sharp movements in the traces occurred, although these never lasted long. Noteworthy instances were at 2^d 19^h to 20^h - a wave in H (-100γ) and in D (-14'); at 3^d 14½^h to 16^h - a double wave in H (+100γ); at 3^d 17^h - a wave in H (+100γ); and at 9^d 19^h to 20^h - two waves in H (+100γ) with a double wave in D (-10' +12') and a pronounced decrease in Z (70γ). General mild disturbance prevailed during 7th, 8th and 9th. Early on 15th conditions became quiet and so remained until 18^d 15^h, when prominent movements began in all traces. One movement in H, at 18^d 17^h, almost reached 100γ. The range in Z on 18th and 19th was unusually large. A gradual return to quiet conditions took place after 22nd the period 24^d 0^h to 25^d 12^h being the calmest of the month. Unsteadiness then began to affect the traces again and developed during 26th to the dimensions of a mild disturbance. A prominent movement showed in all traces at 26^d 22^h, that in H being a decrease of 120γ. General unsteadiness was resumed on 27th and persisted in varying degree for the remainder of the month. The period from 29^d 3^h to 29^d 20^h was, however, practically quiet.

The range in declination during the month was from 10° 27'7 on 9th to 10° 55'7 on 3rd; in horizontal intensity, from '18434 on 3rd to '18628 on 9th; in vertical intensity, from '43065 on 25th to '43173 on 3rd.

September. Mild disturbance was general throughout the first nine days of the month, but particular mention may be made of the periods 1^d 0^h to 1^d 21^h, 7^d 0^h to 8^d 2^h and 9^d 2^h to 10^d 0^h. On 1st there was a range of 25' in D and 65γ in Z; on 7th there were several movements of 10' in D

accompanied by similar movements up to 50Y in H; on 9th there were some rather rapid oscillations between 18^h and 24^h none of which, however, reached the dimensions of those on the 7th. From 10^d 0^h to 13^d 12^h quiet conditions existed. Unsteadiness then set in, lasting until 16^d 20^h. In addition, a prominent bay in H (-75Y) occurred at 14^d 19^h, following a sudden movement in all traces at 14^d 18^h 10^m, and there was a short period of brisk activity from 16^d 12^h to 16^d 17^h. A return to practically quiet conditions was shown soon afterwards which, with negligible exceptions, continued to 20^d 10^h. Considerable activity prevailed from 20^d 12^h to 21^d 18^h comprising in the earlier stages movements of over 50Y in H and 10' in D. After a further quiet period extending from 23^d 0^h to 24^d 20^h unsteadiness set in and rapidly increased to the dimensions of a mild disturbance. This temporarily died away at 26^d 0^h, but at 26^d 17^h 4^m a sudden movement occurred in all traces, typical of the onset of a magnetic storm of considerable magnitude, and was followed immediately by a series of extremely rapid oscillations. The storm proved to be in no way remarkable however, and the most active stage had passed by 24^d 4^h, (Plate VIII). Continuous oscillation of an irregular character was prolonged until 29^d 4^h, a number of the movements exceeding 75Y in H, 10' in D and 25Y in Z. A specially prominent peak appeared at 28^d 18^h in each trace, (Plate IX). Thereafter the movements rapidly subsided until only an occasional wave disturbed nearly smooth traces.

The range in declination during the month was from 10° 2'6 on 26th to 10° 57'3 on 1st; in horizontal intensity, from '18407 to '18637, both on 26th; in vertical intensity, from '43037 on 27th to '43176 on 26th.

October. A brisk disturbance developed soon after 13^h on 1st and lasted until 22^h. The main feature was a general decrease in declination (35') between 1^d 14^h and 1^d 20^h - which then partially recovered - together with a steady increase in Z (80Y) until 18^h, followed by a rapid return to normal. The movements in H were numerous but the largest did not exceed 70Y. During the next three days there was considerable unsteadiness, which culminated in a prominent wave in D (20') and in H (+90Y) at 3^d 18^h; thereafter quieter conditions set in and continued until 6^d 8^h. From about 6^d 21^h unsteadiness increased rapidly to the dimensions of a moderate disturbance. There was a prominent wave in D (+15') at 6^d 21^h; between 7^d 6^h and 7^d 8^h H decreased 120Y, and by 7^d 14^h the main disturbance was in progress. In D and H the characteristic was frequent irregular oscillation with total ranges of 40' and 280Y respectively; in Z there was first a general increase of 110Y followed, from 7^d 18^h, by a fluctuating decrease of 170Y, which ended at 8^d 4^h and was succeeded by similar though considerably smaller changes in the next twenty four hours, (Plate X). Quiet then prevailed from 9^d 1^h until 10^d 20^h. Moderate unsteadiness was general between 11^d and 18^d without noteworthy features but became intensified during the second half of 18th, and a state of moderate activity existed until 22^d 15^h. A few movements approaching 50Y occurred in H in this period. A further quiet spell lasted from 22^d 15^h to 25^d 10^h, after which, signs of an approaching disturbance appeared at about 25^d 14^h. The initial stage of the disturbance consisted of a number of irregular oscillations - chiefly in H - accompanied by a general decrease in D of about 15'. This occurred between 25^d 20^h and 26^d 0^h. A nearly quiet interval followed, terminated at 26^d 8^h by the gradual development of the main disturbance. The principal features of this were: a temporary decrease in H from 26^d 14^h to 26^d 22^h with a number of fairly sharp fluctuations, a few exceeding 50Y; great irregularity in D, with a total range of 30' during the same period; and a much increased diurnal inequality in Z (60Y). From 27^d 0^h disturbance rapidly subsided, leaving a state of marked unsteadiness, however, which persisted until 28^d 6^h. Thereafter the only noteworthy features were a few isolated waves in each trace, the largest of which occurred at 28^d 20^h.

The range in declination during the month was from 10° 13'6 on 7th to 10° 54'5 on 1st; in horizontal intensity, from '18422 on 7th to '18609 on 21st; in vertical intensity, from '43034 on 8th to '43203 on 7th.

November. The month began with quiet conditions prevailing. Irregularity in the traces developed on 3rd and increased during 4th. Between 4^d 16^h and 5^d 6^h nearly regular oscillation in the H and D

traces was a prominent feature, some of the waves being 50 γ in extent in H, while Z showed a slow upward surge of 60 γ . Conditions then became nearly quiet again and so remained until 12^d 8^h, with the exception of a few small irregularities (notably on 9th). The first definite disturbance in the month developed gradually from 12^d 8^h. Many small fluctuations showed on the traces before 12^d 21^h. Movements then became much larger and more irregular. A wave in H (+120 γ) occurred at 12^d 21 $\frac{1}{2}$ ^h and was accompanied by a decrease of 60 γ in Z. A temporary increase of H (80 γ) at 13^d 3 $\frac{1}{2}$ ^h followed by three waves in D, 20' in extent, marked the culmination of the disturbance, which thereafter rapidly subsided. From 13^d 9^h a normal state of moderate unsteadiness prevailed until 20^d 15^h interrupted by two short bursts of activity, between 16^d 16^h and 17^d 0^h and between 17^d 15^h and 18^d 1^h respectively. Conditions varied from "considerable unsteadiness" to "mild activity" during the remainder of the month. Periods of unsteadiness were chiefly comprised in the intervals 23^d 10^h to 25^d 8^h; 26^d 6^h to 28^d 20^h and 30^d 0^h to 24^h. The principal periods of activity were 25^d 8^h to 26^d 8^h and 28^d 21^h to 30^d 0^h. During the first of these two active periods several movements of approximately 100 γ occurred in H, the largest being a wave at 25^d 15^h (-120 γ), and there were also large oscillations in D (20') accompanying them. The diurnal range in Z was greatly increased as well and amounted to 90 γ , (Plate XI). The second period was chiefly remarkable for the frequency of the movements, though one wave in D approached 20'.

The range in declination during the month was from 10° 15'·9 on 13th to 11° 0'·6 on 25th; in horizontal intensity, from ·18403 on 25th to ·18601 on 29th; in vertical intensity, from ·43040 on 13th to ·43170 on 4th and 25th.

December. During the first four days considerable unsteadiness was exhibited by the traces, movements up to 70 γ in H and 10' in D being recorded on 2nd. Quiet conditions then prevailed until the end of 8th. From 9^d 5^h irregularities re-appeared, few of which, however, were at all conspicuous. There was a sharp decrease in H (70 γ) at 10^d 16 $\frac{1}{2}$ ^h and a short period of minor activity extending from 11^d 20^h to 12^d 2^h. From 14^d 12^h to 16^d 2^h numerous fluctuations were recorded, several of which exceeded 50 γ in H. Activity then declined again until 20^d 6^h. At 20^d 9^h a rapid decrease in H occurred (100 γ) which was the initial movement of a brisk disturbance. The disturbance, though not remarkable for range of movement, was rather protracted and, (if a relatively quiet interval between 22^d 19^h and 23^d 12^h be neglected), lasted until 24^d 0^h. The most active period was from 20^d 12^h to 21^d 8^h when numerous sharp fluctuations in H and D were shown some of which approached 100 γ and 20' respectively, and there was an increased diurnal range in Z. A prominent peak in the H trace (+120 γ) occurred at 21^d 20 $\frac{1}{2}$ ^h. The last noteworthy movement of the disturbance was in H (+100 γ) and took place at 23^d 19 $\frac{1}{2}$ ^h. The period between 24^d 0^h and 28^d 20^h contained a few isolated bays and also a short spell of marked unsteadiness (25^d 15^h to 26^d 10^h). A further period of mild disturbance then set in, announced by a large wave in D (+20') at 28^d 21^h. The development was gradual, as was the decline. The principal movements occurred between 30^d 6^h and 31^d 2^h, the largest being a decrease in H (100 γ) at 30^d 7^h. Quiet conditions were reached by 31^d 21^h.

The range in declination during the month was from 10° 17'·0 to 10° 50'·5 both on the 20th; in horizontal intensity from ·18443 on 20th to ·18612 on 21st; in vertical intensity, from ·43076 on 21st to ·43177 on 20th.

The absolute maximum and minimum values respectively of the elements recorded during the year were:

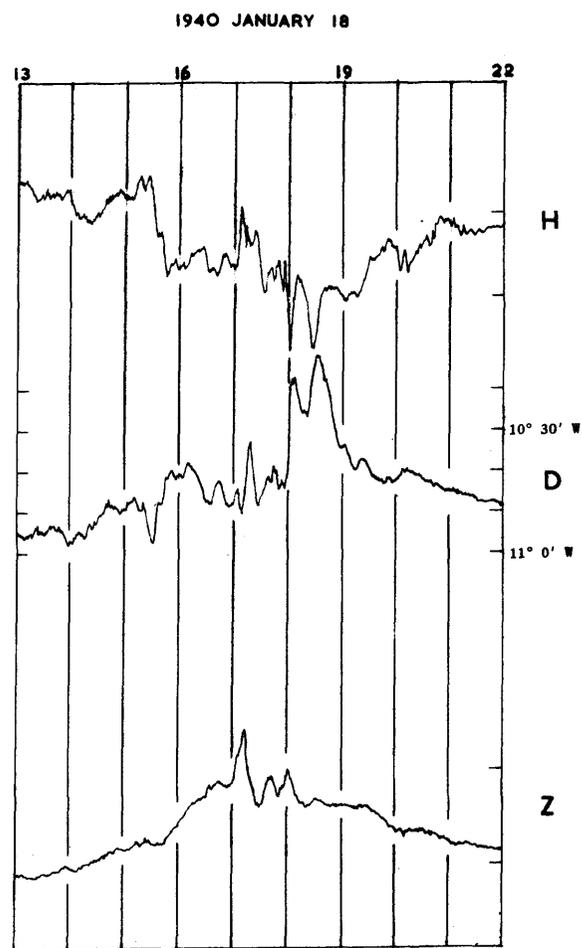
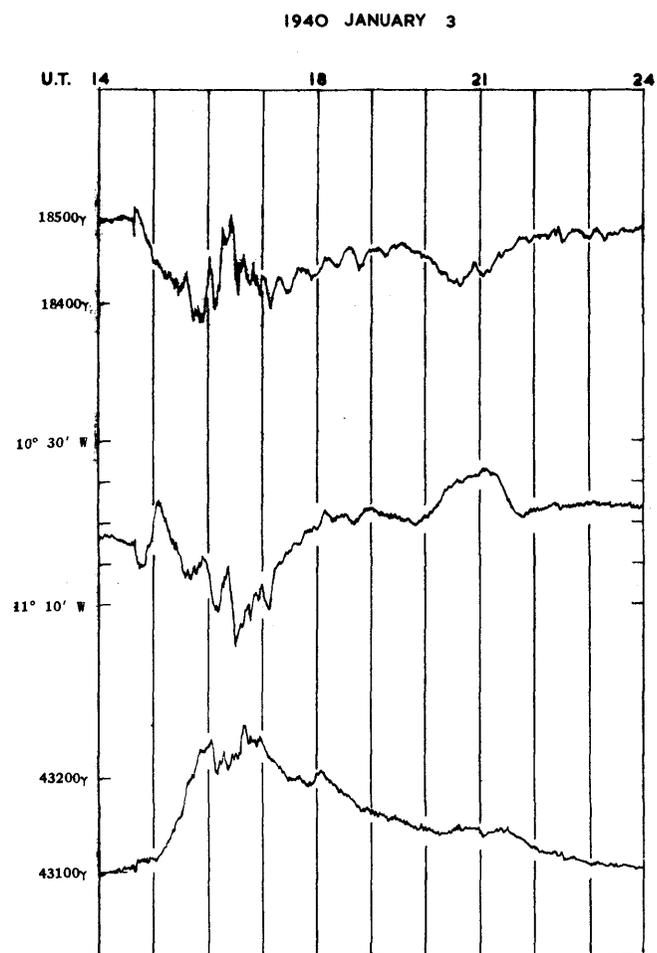
Declination, 12° 1'·7, 9° 50'·7 - both on March 24th.

Horizontal Intensity, ·18860 on June 25th; ·17870 or less (the register is confused) on March 24th.

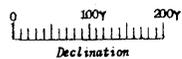
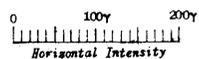
Vertical Intensity, ·43744, ·42695 - both on March 24th.



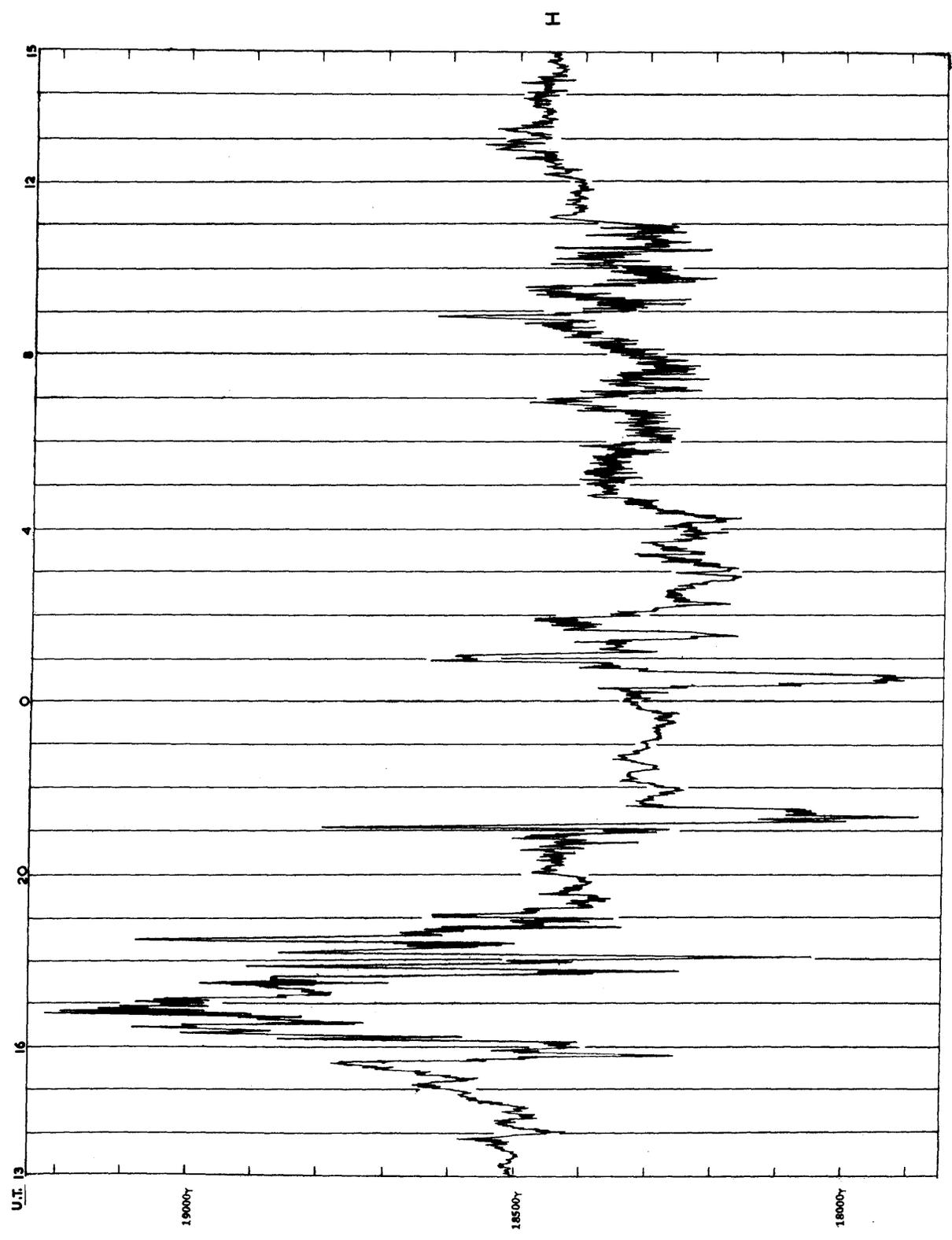
Plate I



SCALES FOR THE MAGNETIC ELEMENTS



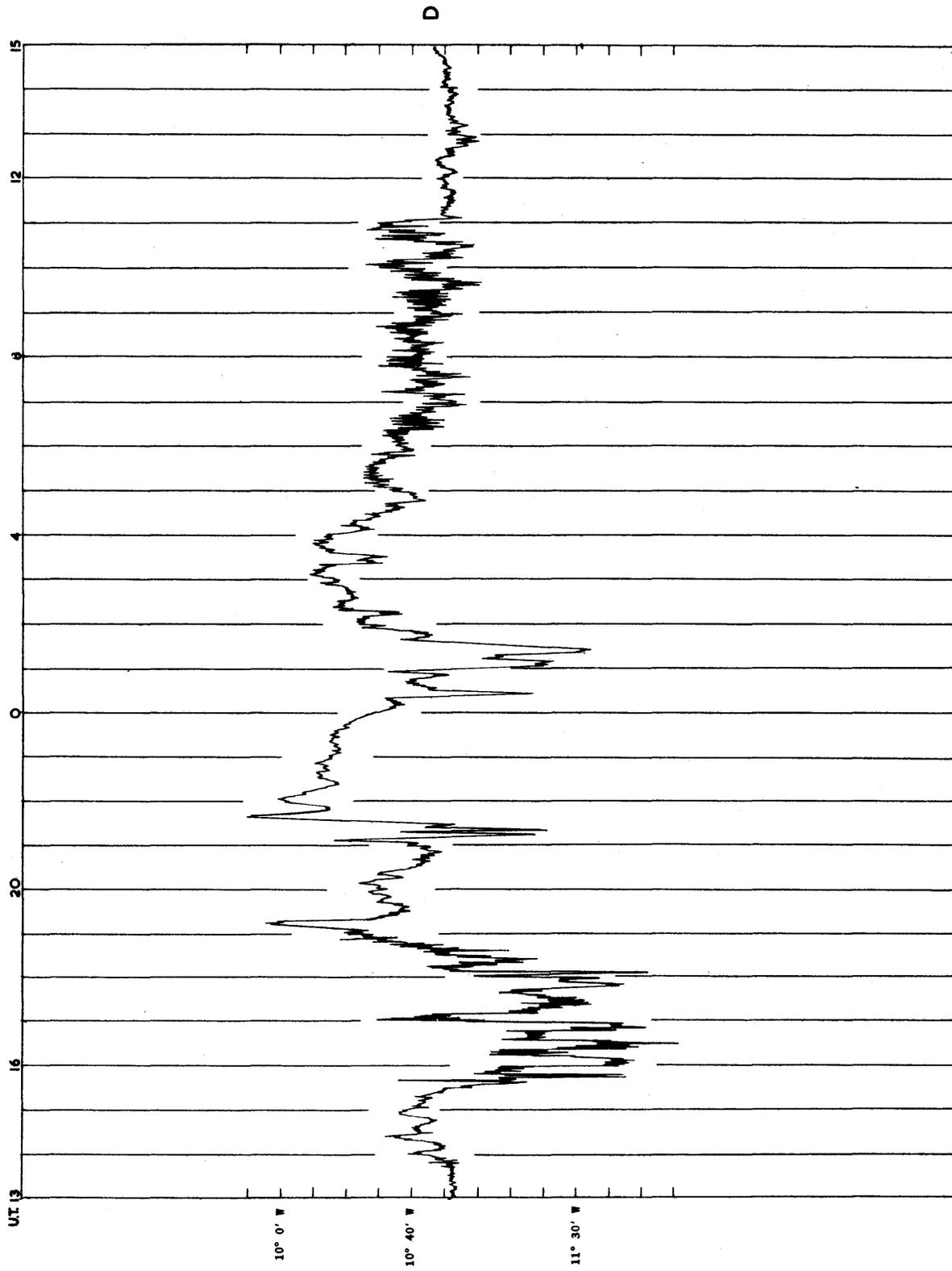
1940 MARCH 24 - 25



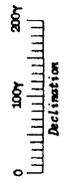
SCALE FOR H



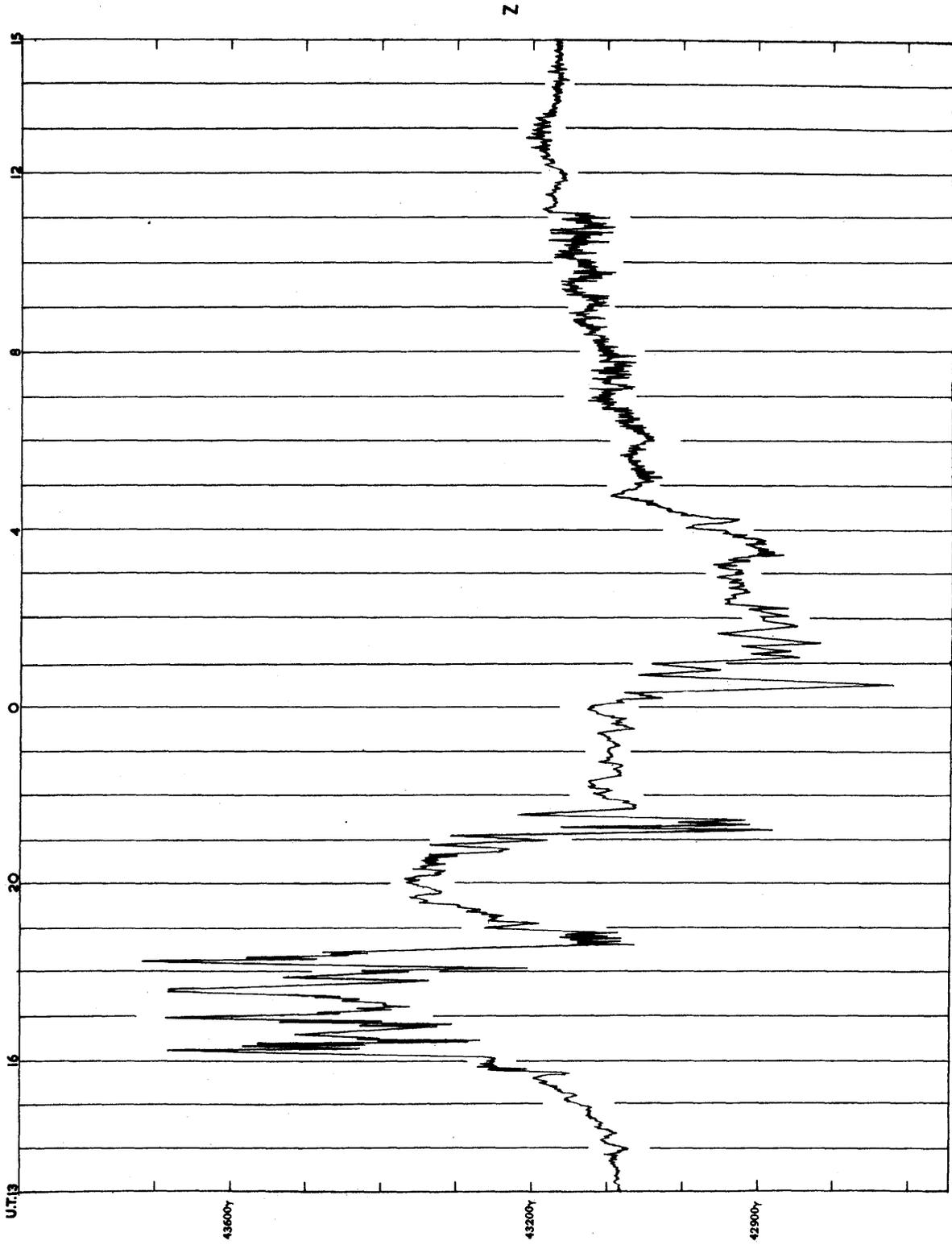
1940 MARCH 24 - 25



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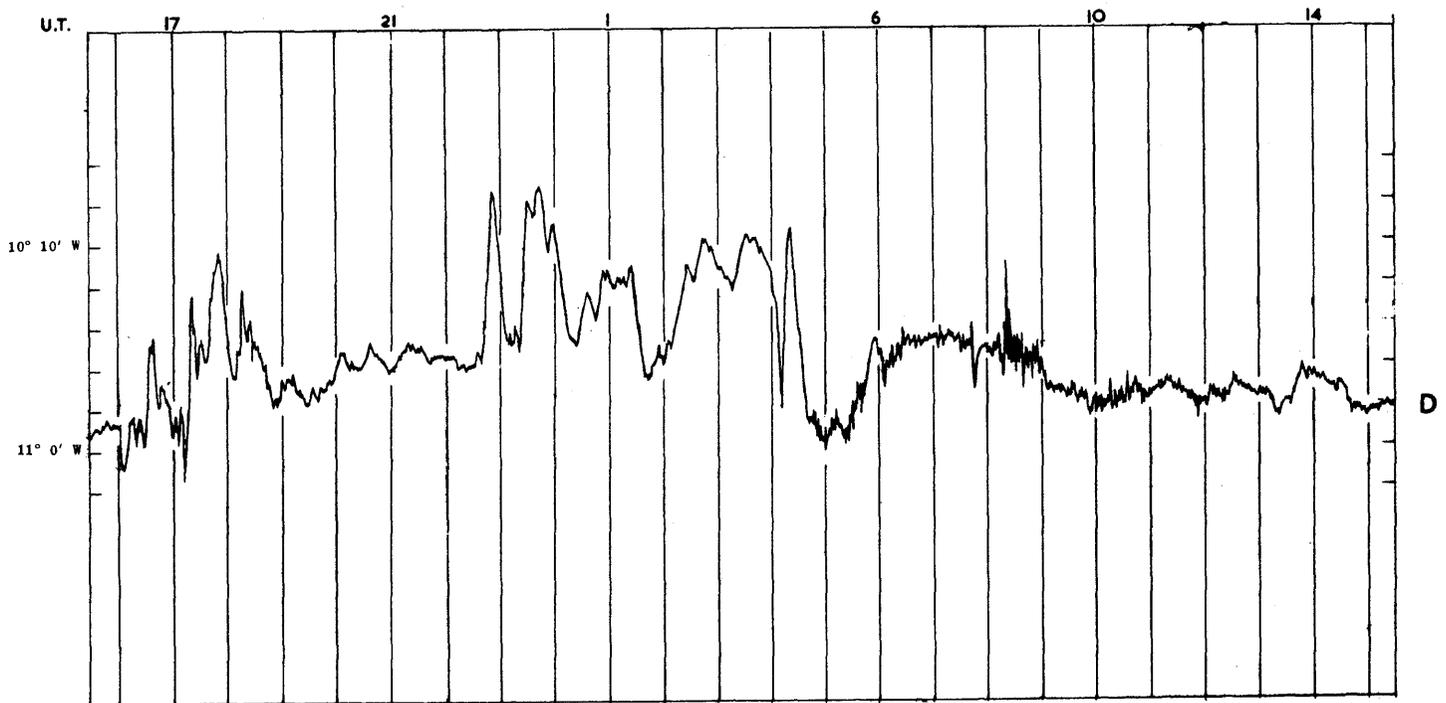
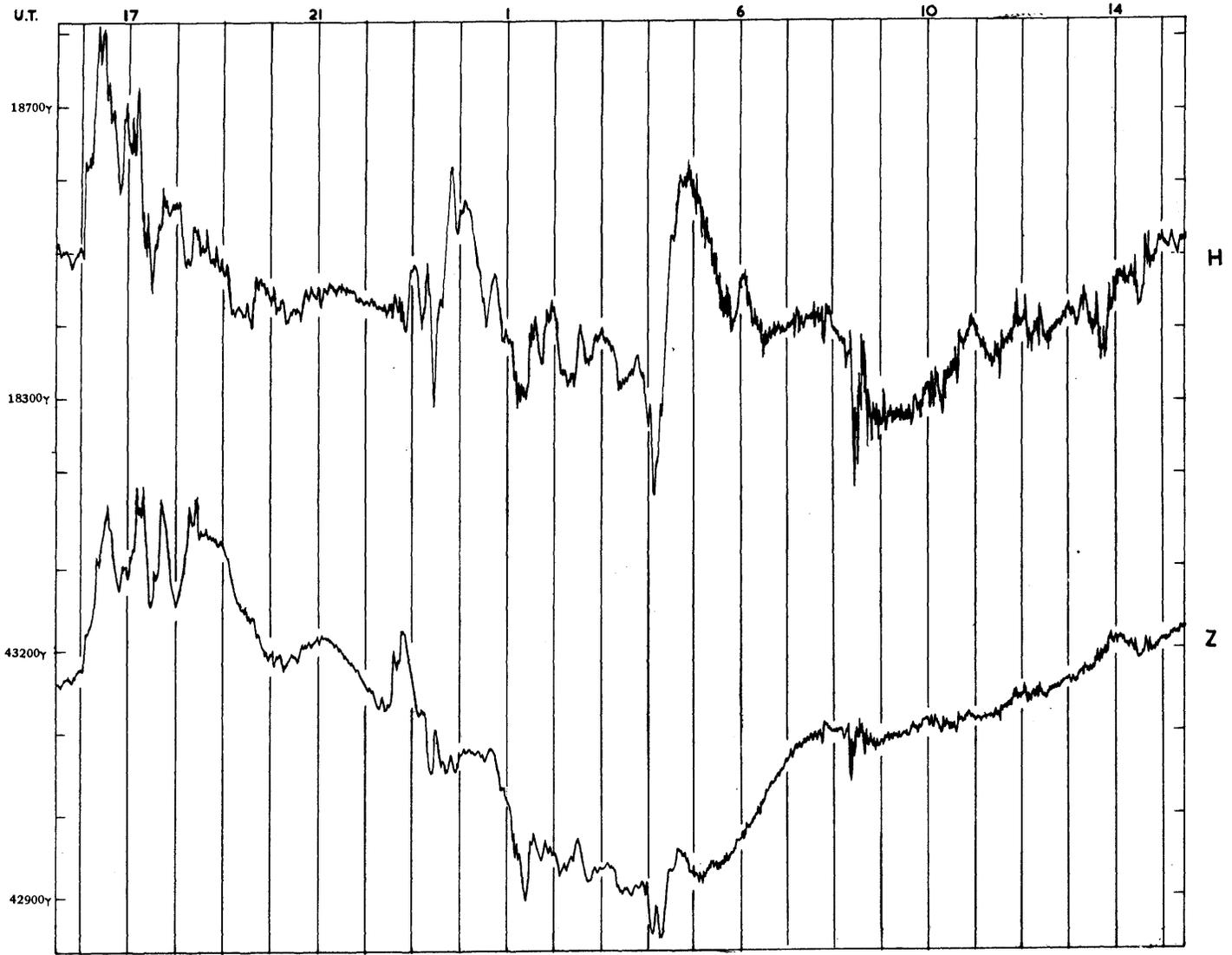


1940 MARCH 24-25

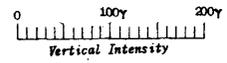
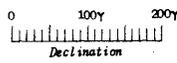
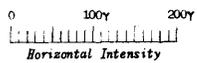


SCALE FOR Z





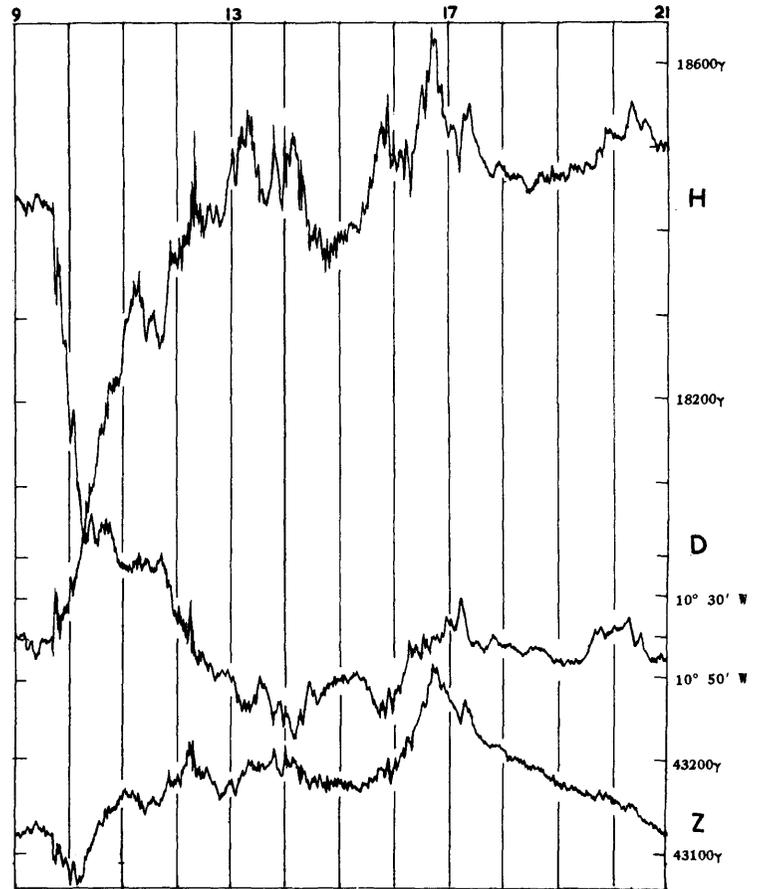
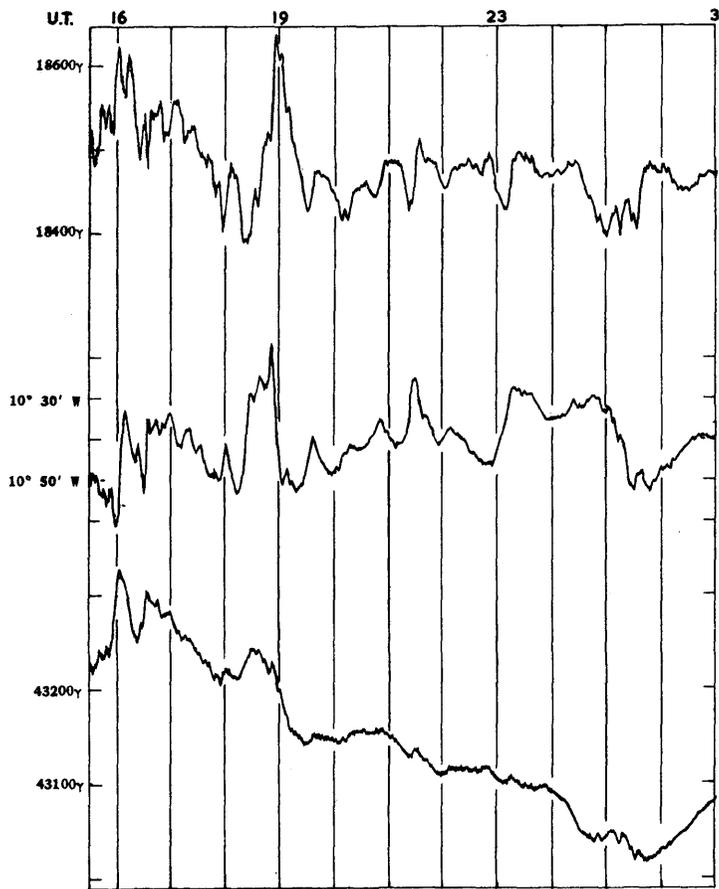
SCALES FOR THE MAGNETIC ELEMENTS



1940 MARCH 30 - 31

1940 MARCH 31

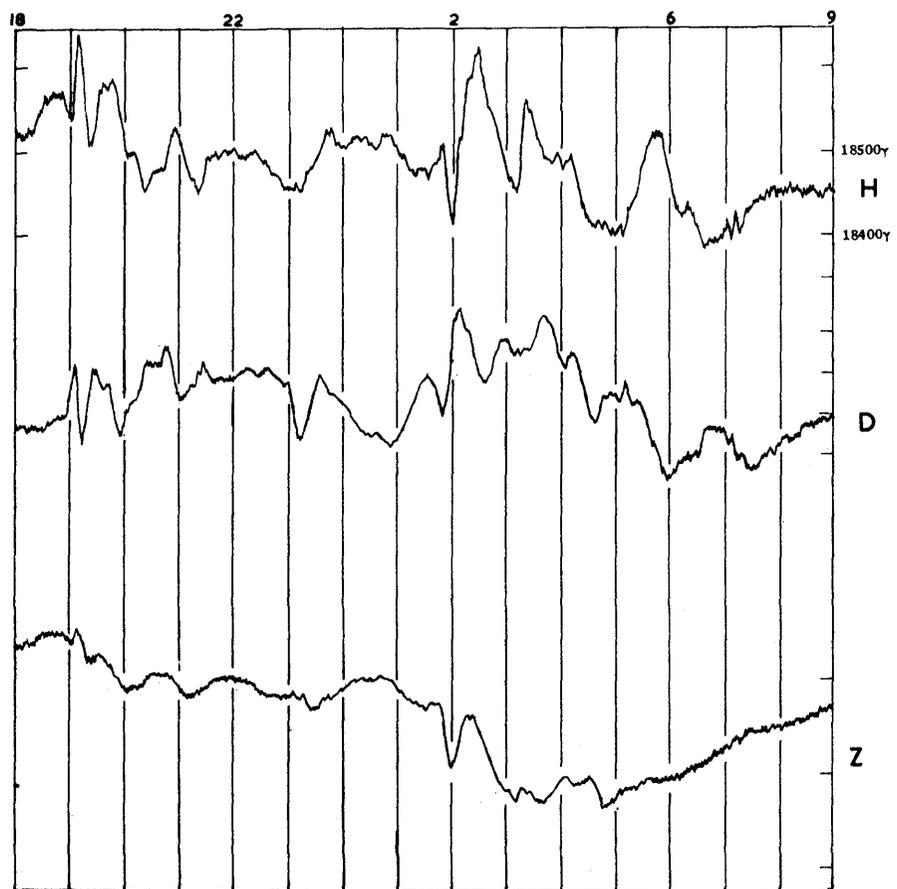
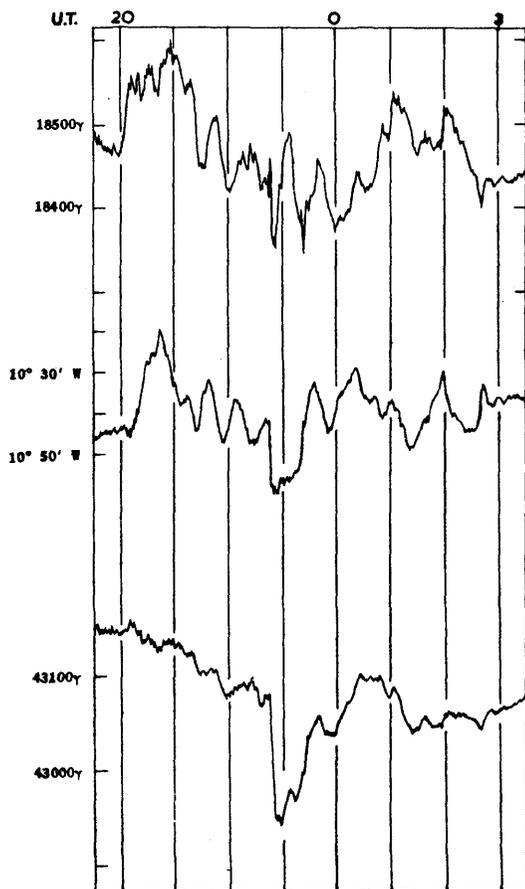
Plate IV



1940 MARCH 25 - 26

1940 APRIL 2 - 3

Plate V



SCALES FOR THE MAGNETIC ELEMENTS

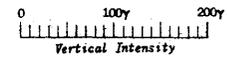
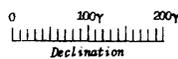
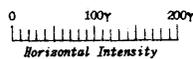


Plate VI

1940 APRIL 25

1940 APRIL 25-26

1940 MAY 23

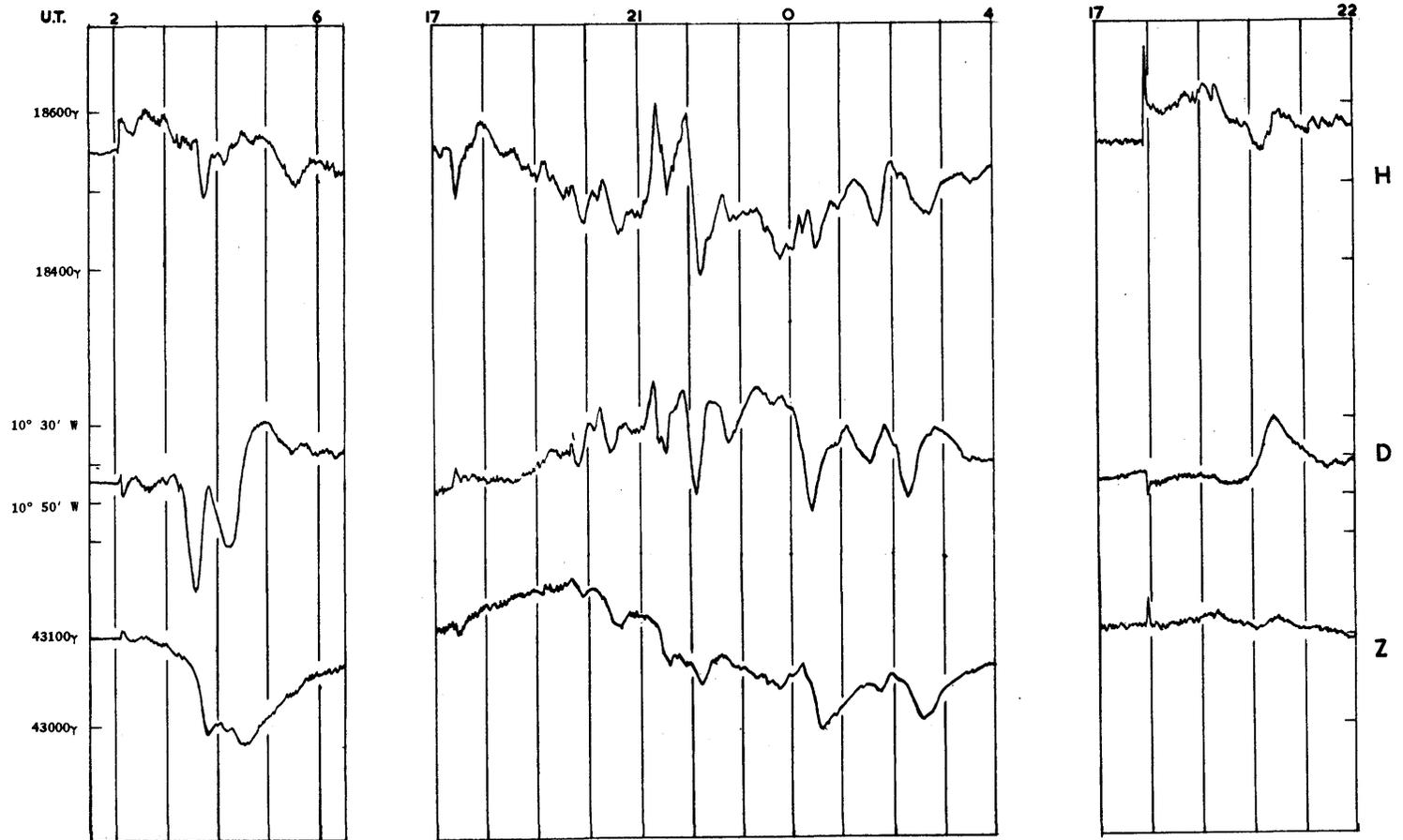
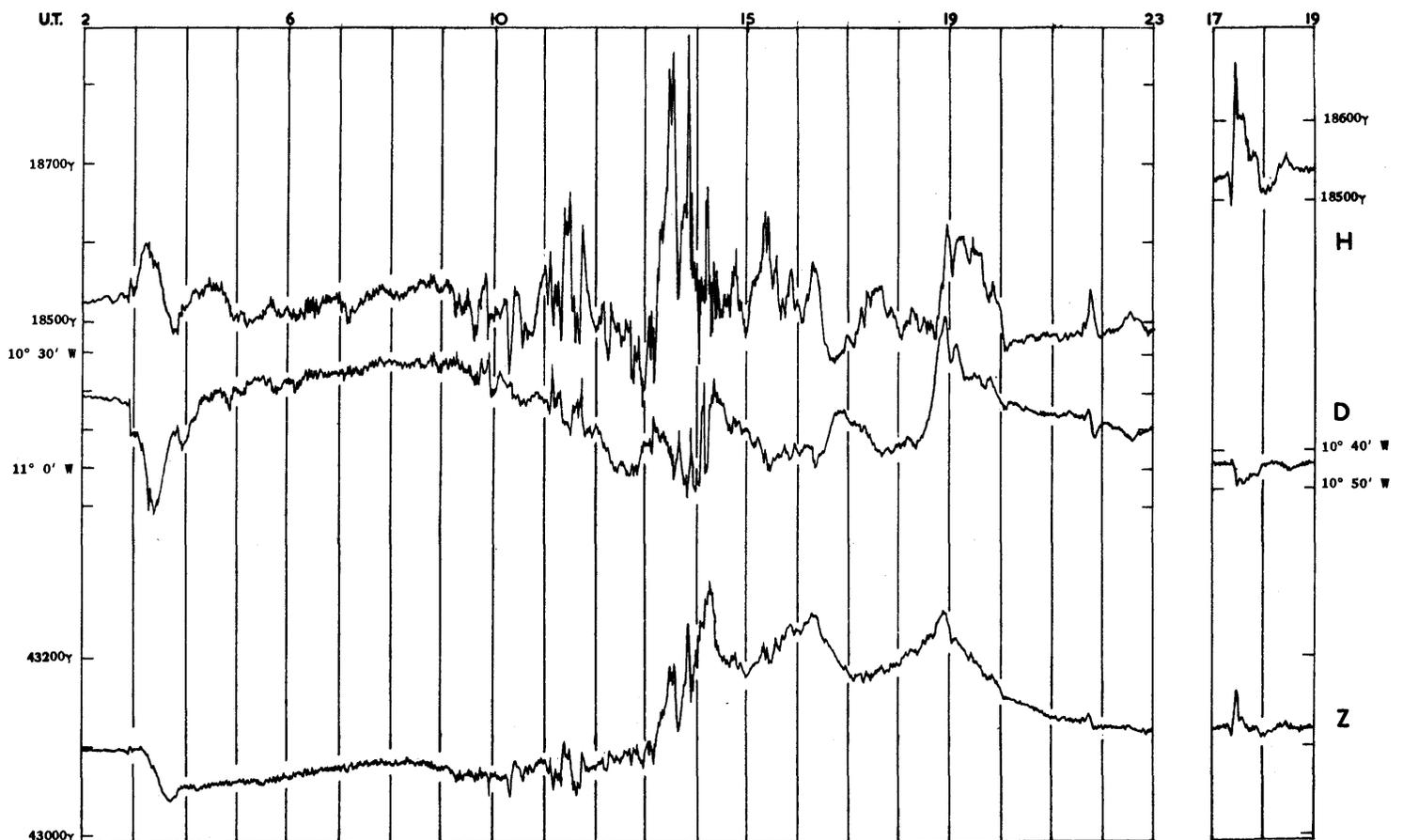


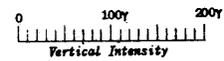
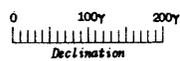
Plate VII

1940 JUNE 25

1940 JUNE 26



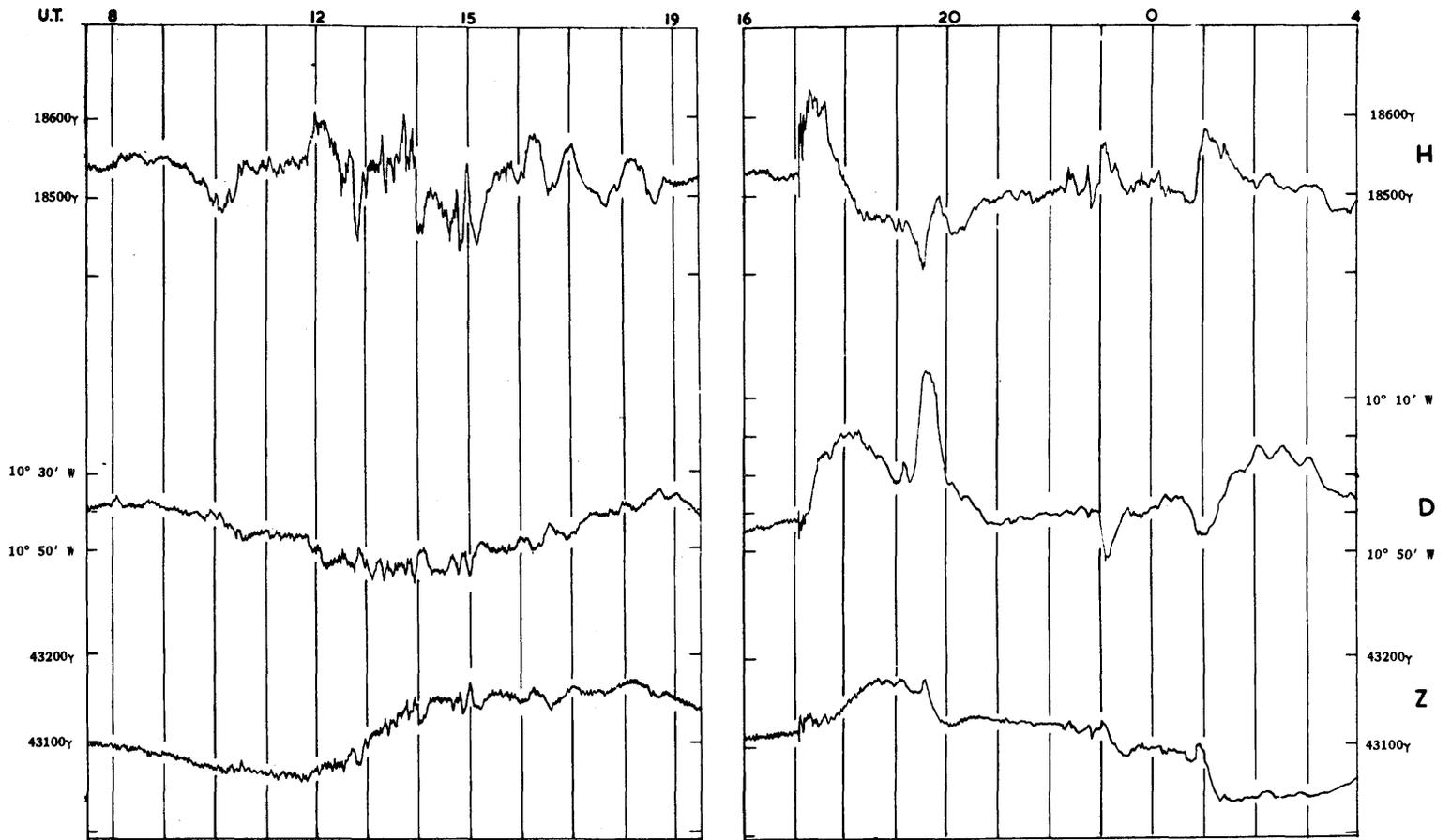
SCALES FOR THE MAGNETIC ELEMENTS



1940 JULY 13

1940 SEPTEMBER 26-27

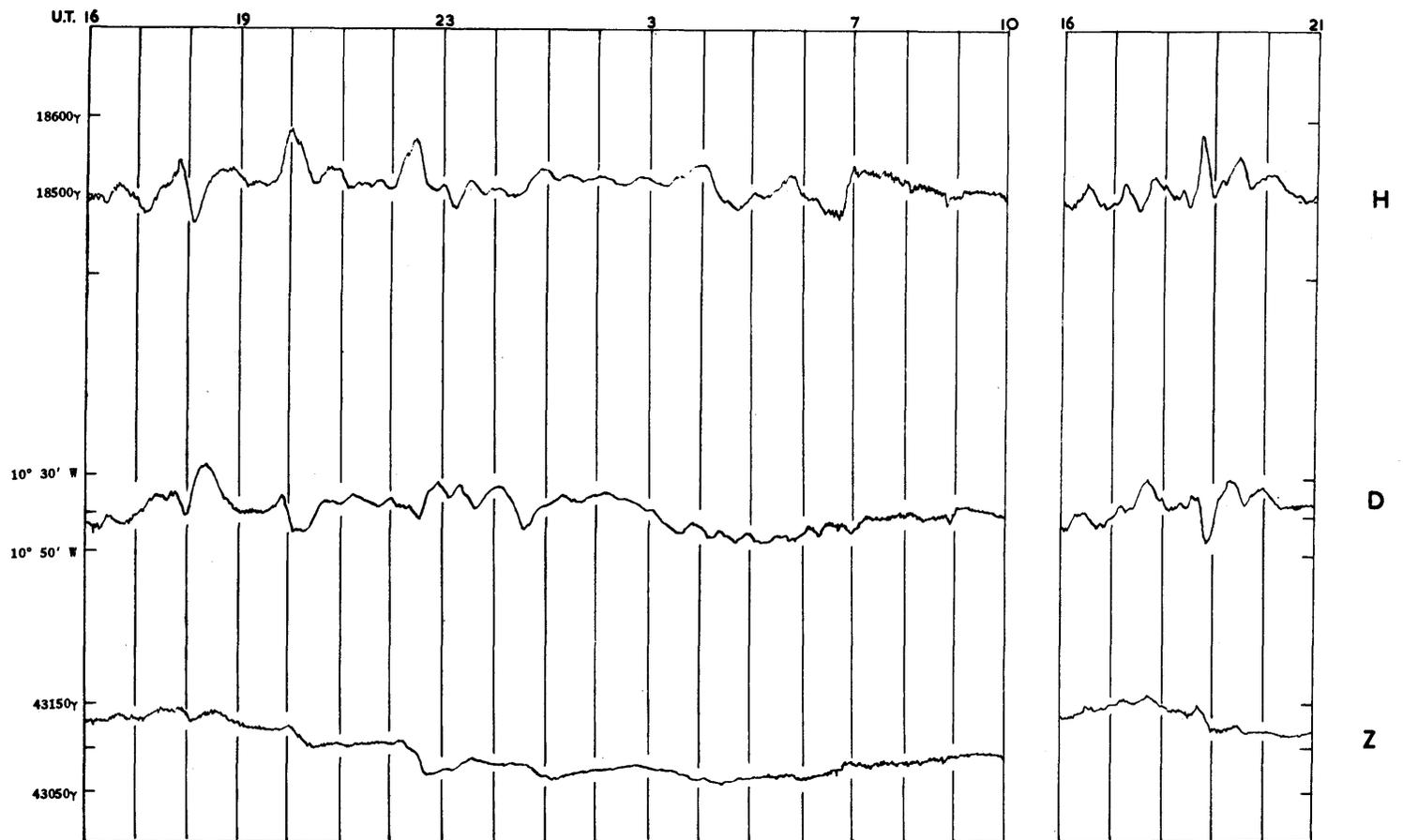
Plate VIII



1940 SEPTEMBER 27-28

1940 SEPTEMBER 28

Plate IX



SCALES FOR THE MAGNETIC ELEMENTS

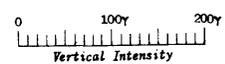
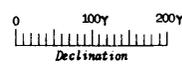
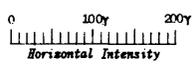


Plate X

1940 OCTOBER 7-8

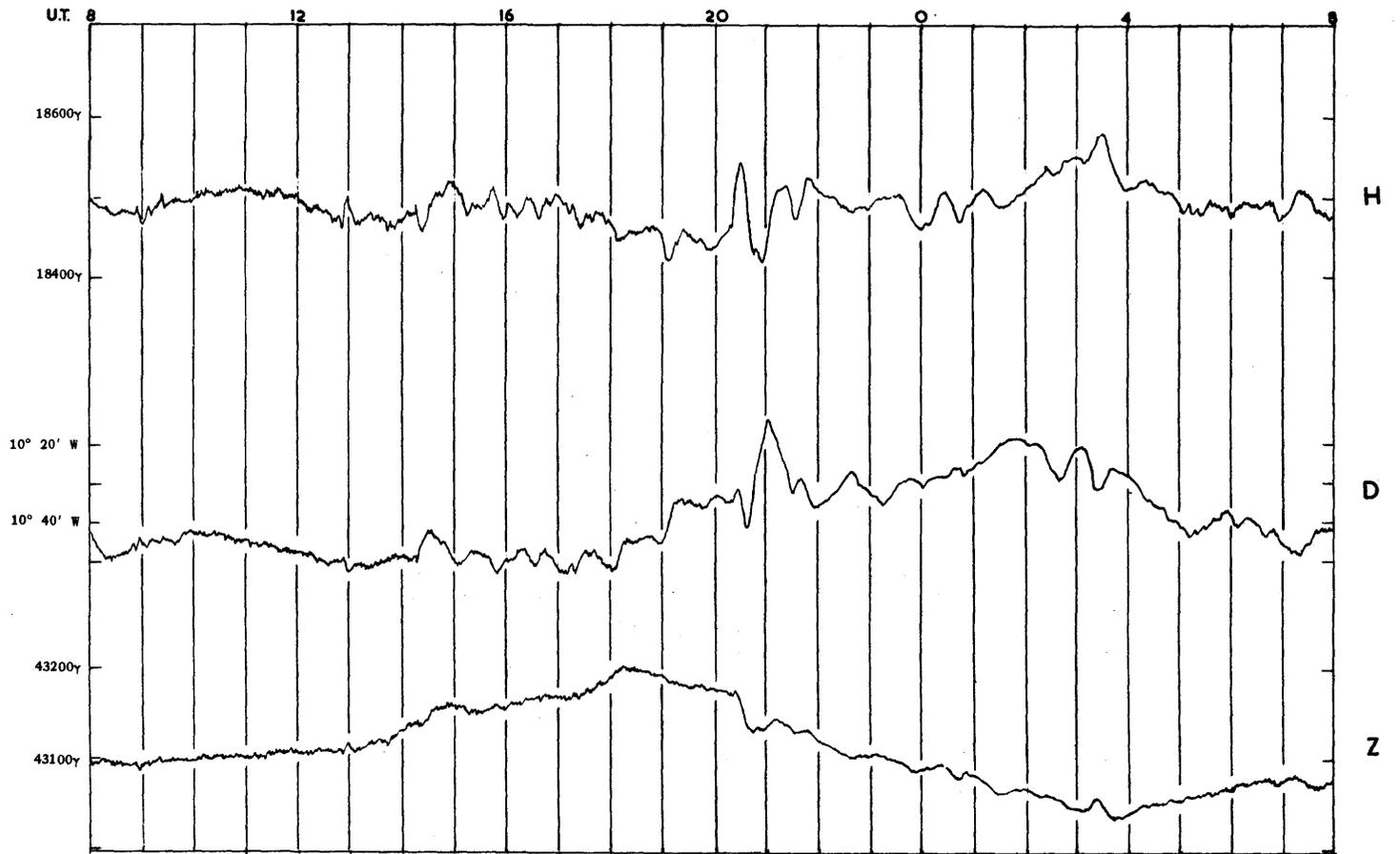
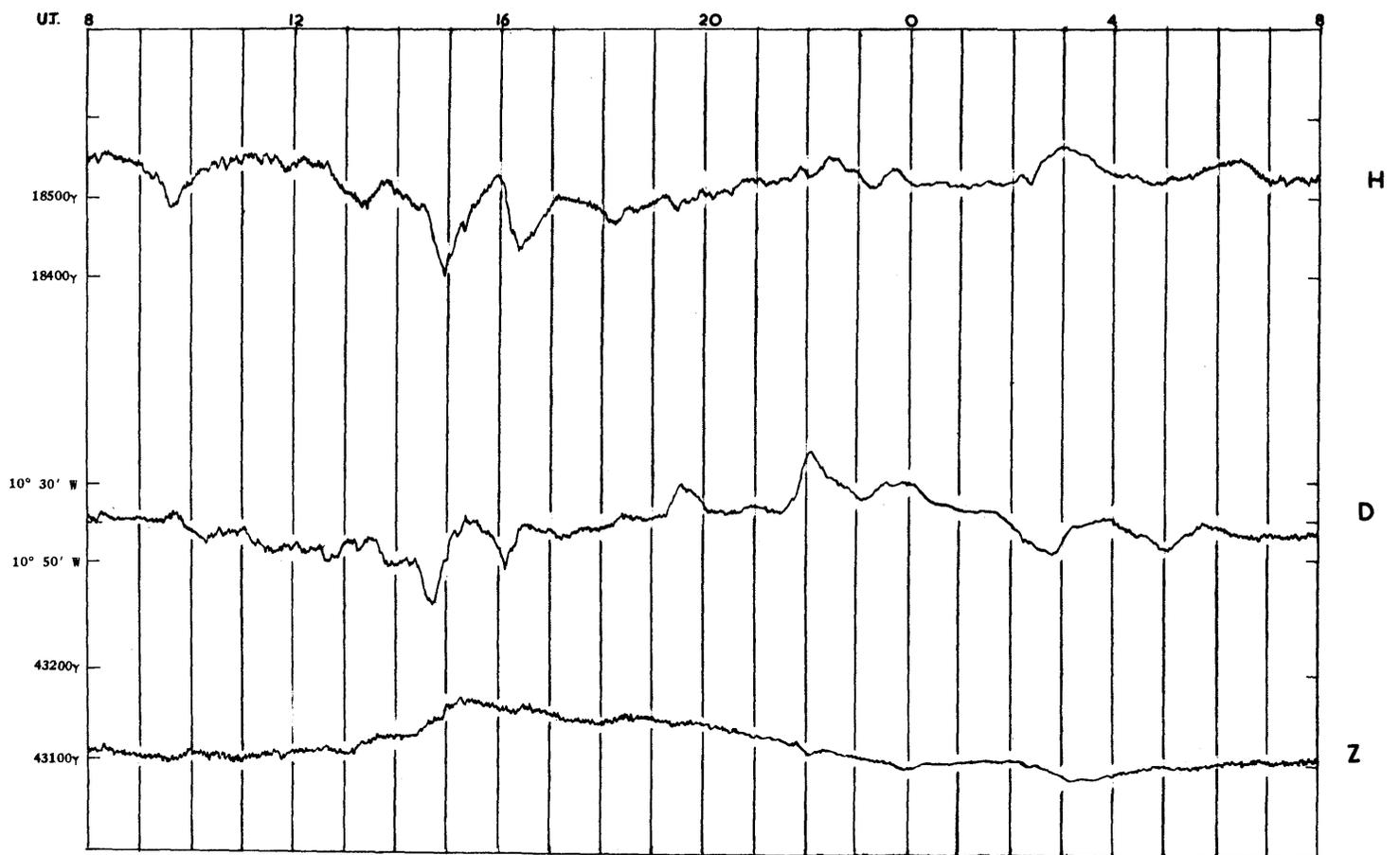
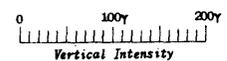
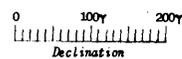
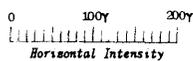


Plate XI

1940 NOVEMBER 25-26



SCALES FOR THE MAGNETIC ELEMENTS



ROYAL OBSERVATORY, GREENWICH

**K-indices for the years
1929 to 1939
determined at Abinger**

APPENDIX TO GREENWICH MAGNETIC & METEOROLOGICAL RESULTS, 1940.

THREE-HOUR-RANGE INDICES 'K' FOR THE YEARS 1929-1939												
Date 1929	January		February		March		April		May		June	
	Indices	Sum	Indices	Sum	Indices	Sum	Indices	Sum	Indices	Sum	Indices	Sum
1	1102 1112	9	3212 2212	15	3233 3333	23	3232 2233	20	3122 3332	19	2223 3322	19
2	1111 1112	9	2022 2112	12	2222 2131	15	3112 2223	16	4333 2322	22	2332 2322	19
3	1011 2333	14	1232 2110	12	2122 2343	19	3232 1223	18	3333 3223	22	2222 3321	17
4	4332 2321	20	1022 2110	9	3222 2211	15	2234 5332	24	3323 1103	16	0111 2310	9
5	1313 2454	23	1213 3111	13	0323 4321	18	1112 3333	17	3122 3110	13	1122 1211	11
6	3222 2341	19	1122 2345	20	2212 2123	15	3121 1221	13	1213 3221	15	1112 1231	12
7	0001 1111	5	4223 3123	20	2121 2443	19	1112 2212	12	1222 2223	16	4322 2231	19
8	2211 3215	17	2122 1344	19	3443 3352	27	3223 3122	18	1012 3232	14	1222 3424	20
9	4423 3444	28	3233 3443	25	3332 2333	22	2122 1111	11	2223 3220	16	3232 4443	25
10	3222 3434	23	3233 3531	23	2312 2313	17	0023 3222	14	1121 2220	11	4344 4443	30
11	4442 2110	18	2223 3323	20	2333 5544	29	4221 3322	19	1112 3322	15	4333 4443	28
12	0121 1111	8	3222 2231	17	6665 6665	46	1122 2223	15	3433 2322	22	3311 3241	18
13	1122 2123	14	3222 1120	13	5433 3324	27	2222 2221	15	3434 5443	30	2113 3221	15
14	3223 4443	25	1121 1201	9	2212 3334	20	1122 1121	11	3223 4344	25	1023 1210	10
15	3222 2322	18	0011 2111	7	1123 4545	25	1112 2333	16	3334 4444	29	0122 2222	13
16	1111 1223	12	1111 3335	18	5534 3434	31	4542 4434	30	4423 3433	26	2231 2222	16
17	2011 1110	7	5554 4665	40	4432 3343	26	5333 3434	28	3332 3320	19	2122 2231	15
18	0112 2110	8	4534 2233	26	3222 2331	18	3232 3223	20	1121 2133	14	2222 2110	12
19	0111 1112	8	3433 4433	27	2211 2234	17	3312 2112	15	1222 3232	17	0012 2213	11
20	1112 2222	13	3212 2133	17	3322 3444	25	1112 1212	11	2212 3322	17	2222 2321	16
21	2112 3222	15	3332 2234	22	4543 4544	33	2432 2223	20	2122 1232	15	0222 3432	18
22	3312 3323	20	3323 3454	27	3343 4423	26	2312 1111	12	2222 2222	16	2453 4354	30
23	2111 1221	11	4332 2133	21	1222 3333	19	1111 1112	9	3344 3322	24	3333 4444	28
24	1111 2122	11	3322 2221	17	3332 3433	24	1111 2122	11	2212 2333	18	2333 4332	23
25	1111 1220	9	(1112)2234	16	1321 2313	16	2121 2224	16	4423 2332	23	3333 3120	18
26	0111 1232	11	3112 1244	18	2131 1124	15	2121 1222	13	4122 3332	20	2112 1210	10
27	2001 1210	7	5543 3587	40	3222 3233	20	3111 2213	14	3222 3231	18	1222 3322	17
28	0102 2312	11	6634 5441	33	3322 2334	22	3423 2333	23	3233 4431	23	2233 4331	21
29	1212 3143	17			3322 2312	18	2232 3343	22	2223 2311	16	1222 2212	14
30	2221 2122	14			3112 1211	12	2232 3532	22	1223 2433	20	3332 4335	26
31	2222 2111	13			2122 1013	12			1233 3232	19		

THREE-HOUR-RANGE INDICES 'K' FOR THE YEARS 1929-1939												
Date 1929	July		August		September		October		November		December	
	Indices	Sum	Indices	Sum	Indices	Sum	Indices	Sum	Indices	Sum	Indices	Sum
1	4322 3232	21	4334 5455	33	3122 3323	19	1121 1122	11	3333 3244	25	2112 1121	11
2	2322 2222	17	3432 2234	23	4123 3221	18	1022 1123	12	4233 4254	27	1112 2221	12
3	2111 2333	16	2121 2322	15	1222 3212	15	3322 2222	18	4545 5666	41	1101 3366	21
4	2232 3221	17	2322 2223	18	1122 3212	14	3323 3334	24	4433 3554	31	5444 5453	34
5	1222 3633	22	5332 3323	24	0122 2111	10	3113 1122	14	3333 3553	28	4554 4333	31
6	3443 3323	25	1112 1111	9	1112 3224	16	1222 2111	12	3223 3444	25	4533 3453	30
7	2332 2332	20	1121 1221	11	5544 3443	32	1224 4456	28	2224 4535	27	4323 3312	21
8	2232 3321	18	1111 2110	8	2223 2213	17	5345 4556	37	2332 2113	17	3422 3424	24
9	2311 2222	15	1111 1111	8	3333 2324	23	3224 5244	26	2223 3321	18	2222 2234	19
10	2246 6756	38	1120 1212	10	4553 3553	33	3333 3443	26	1012 1111	8	2221 4323	19
11	4333 3333	25	2334 4453	28	4353 4343	29	3322 1232	18	0122 2200	9	4422 3444	27
12	3222 2222	17	3222 3222	18	2334 4444	28	4433 3233	25	1312 2114	15	4433 3132	23
13	2112 2221	13	2122 2211	13	4424 3433	27	3433 3433	26	3212 2123	16	2222 2210	13
14	1022 2443	18	1111 4655	24	4443 4554	33	2222 3223	18	3112 2223	16	1012 1241	12
15	5443 3545	33	5343 3434	29	4333 2342	24	1122 2203	13	4233 2444	26	2111 2113	12
16	4323 4652	29	4333 3432	25	3433 3433	26	1223 4566	29	3543 4554	33	2212 4463	24
17	2343 4232	23	3222 2323	19	2323 3112	17	5443 2355	31	2212 2111	12	2233 2355	25
18	1212 3322	16	4444 3333	28	2122 3133	17	4432 3435	28	1122 2312	14	3423 3224	23
19	2121 1212	12	4333 5431	26	1212 2212	13	4543 3443	30	1112 2212	12	2212 2211	13
20	2223 4323	21	3222 2221	16	2113 3203	15	1223 3442	21	1121 3442	18	2112 2110	10
21	3223 3332	21	3322 2213	18	4222 2445	25	4222 2233	20	2121 2241	15	1011 1012	7
22	3324 3232	22	2121 2210	11	5434 4443	31	1122 2234	17	1102 2332	14	2324 4454	28
23	2221 2321	15	2222 2212	15	2123 3323	19	3222 2324	20	3212 2121	14	4322 1343	22
24	2212 4353	22	1322 2222	16	2321 2223	17	4323 3244	25	1111 1121	9	2112 2224	16
25	3213 3314	20	1120 2111	9	3212 4324	21	3323 2133	20	0111 2311	10	2321 2233	18
26	3222 3312	18	1111 2333	15	3223 3333	22	2112 2211	12	1122 2233	16	2211 2232	15
27	2211 2110	10	2222 2221	15	3323 4453	27	2212 1231	14	3222 3344	23	3111 2221	13
28	1113 1211	11	2221 1101	10	2112 2211	12	0122 2213	13	3233 2242	21	1112 1323	14
29	1111 2312	12	1122 1321	13	1112 1211	10	5333 3222	23	3323 2333	22	2113 1222	14
30	2122 2233	17	2221 2211	13	2222 3222	17	2223 5354	26	1211 2333	16	3133 2211	16
31	3232 3215	21	2312 3334	21			4332 2244	24			3113 3432	20

THREE-HOUR-RANGE INDICES 'K' FOR THE YEARS 1929-1939												
Date	January		February		March		April		May		June	
1930	Indices	Sum	Indices	Sum	Indices	Sum	Indices	Sum	Indices	Sum	Indices	Sum
1	4223 3242	22	4433 4433	28	4444 4444	32	4333 4334	27	3313 2221	17	5444 4454	34
2	2212 2233	17	4323 4343	26	4334 3555	32	3222 3333	21	2111 2222	13	5443 4554	34
3	2234 3444	26	4333 4443	28	4244 3323	25	3332 2212	18	2122 3312	16	4444 4444	32
4	3342 4364	29	2233 3133	20	3332 3231	20	0121 1322	12	3443 4334	28	3433 4454	30
5	4434 3553	31	2232 3221	17	0122 2110	9	2323 1221	16	5655 5455	40	3323 3333	23
6	3423 5555	32	1112 2231	13	1122 1110	9	2223 4455	27	4533 5535	33	3232 3334	23
7	3334 4554	31	1122 2231	14	0122 1110	8	4433 3456	32	5444 3455	34	4553 4445	34
8	4333 3323	24	1113 2322	15	1122 2211	12	6446 5345	37	4333 3344	27	5433 4343	29
9	3221 2122	15	2112 2212	13	1212 1211	11	4334 4544	31	3343 4445	30	3333 3433	25
10	2111 1331	13	1112 2212	12	0111 1122	9	3434 4445	31	4333 3333	25	4333 2331	22
11	1111 1111	8	3212 1212	14	1113 3354	21	5435 4444	33	3223 2224	20	2323 2223	19
12	2111 1211	10	3333 4436	29	4555 6654	40	5434 3445	32	5433 3344	29	3434 5645	34
13	2422 1221	16	5344 5454	34	3433 4555	32	5333 3434	28	3434 4443	29	4353 4533	30
14	2122 2112	13	5333 5554	33	4353 4454	32	4422 2343	24	3332 3334	24	4333 2111	18
15	1112 1334	16	4333 4454	30	5442 4433	29	3443 4443	29	2233 3434	24	0223 2332	17
16	4212 2231	17	4433 4354	30	4334 3354	29	3423 4225	25	4433 4665	35	1365 6444	33
17	1102 3343	17	3333 4443	27	3333 3543	27	4433 3223	24	4455 5555	38	5434 4343	30
18	2312 2243	19	2233 2254	23	3322 3355	26	2213 3444	23	4433 4543	30	4333 4544	30
19	4333 3333	25	4423 3442	26	5344 4234	29	2333 4353	26	5334 3443	29	3334 4423	26
20	4323 3354	27	3213 2344	22	3222 2335	22	3555 4545	36	3443 3333	26	3333 4342	25
21	4222 3324	22	2222 2224	18	3322 3434	24	4434 5435	32	5433 3443	29	3323 4422	23
22	3323 3343	24	2231 2123	16	4343 3433	27	5434 4555	35	4455 3232	28	3333 2221	19
23	3222 3223	19	3233 2332	21	2122 3333	19	4443 4455	33	4333 3532	26	1212 1211	11
24	3211 1332	16	3323 2242	21	4454 4341	29	3334 4533	28	2232 2333	20	1332 3211	16
25	2222 2211	14	2434 4455	31	2331 4334	23	3333 5533	28	3333 4533	27	2122 2221	14
26	2112 1111	10	4233 2422	22	4333 3432	25	4342 4342	26	3433 3222	22	2323 3422	21
27	1111 1111	8	3433 3333	25	2354 3345	29	2234 3333	23	2233 3221	18	4444 4435	32
28	1111 2232	13	2333 4444	27	4344 3345	30	2222 2432	19	2233 3321	19	5343 4555	34
29	2233 3122	18			4334 3434	28	2122 4435	23	1333 2432	21	3423 4454	29
30	2233 3324	22			3432 3233	23	4233 3553	28	3331 3555	28	3433 3443	27
31	3233 2242	21			3122 3233	19			6543 5665	40		

MAGNETIC OBSERVATIONS, ABINGER 1940.

THREE-HOUR-RANGE INDICES 'K' FOR THE YEARS 1929-1939												
Date 1930	July		August		September		October		November		December	
	Indices	Sum	Indices	Sum	Indices	Sum	Indices	Sum	Indices	Sum	Indices	Sum
1	3323 3333	23	3332 3323	22	3544 5434	32	2233 3544	26	3223 3321	19	3212 2211	14
2	2222 4444	24	2322 3322	19	5334 2332	25	3233 3335	25	2012 4414	18	1111 1122	10
3	3332 4443	26	2222 3233	19	3333 5666	35	5425 4554	32	4122 1121	14	3233 5765	34
4	3243 3444	27	2322 2123	17	4444 2222	24	4333 4343	27	1334 3114	20	4543 3322	26
5	3333 4453	28	2212 3444	22	3333 4454	29	3333 4443	27	3122 2343	20	4111 2221	14
6	3422 3322	21	5554 6565	41	4335 4433	29	4334 3353	28	2223 2201	14	1112 1132	12
7	2332 3231	19	5455 4455	37	3233 3333	23	3322 3344	24	1113 2332	16	4212 2312	17
8	2121 2323	16	4434 5564	35	3322 2442	22	3343 3442	26	2223 2353	22	1001 2110	6
9	2211 5455	25	4453 4444	32	1233 4444	25	4221 2324	20	4313 2333	22	0111 2321	11
10	6543 3543	33	3334 4524	28	4332 2232	21	1121 2332	15	1132 1113	13	1111 1212	10
11	5533 4344	31	5334 4452	30	1132 3333	19	2222 2131	15	3001 1012	8	2112 1111	10
12	3454 4455	34	3444 4465	34	2221 2225	18	0111 2132	11	2212 2110	11	0101 2243	13
13	3543 5643	33	5433 4342	28	3321 2123	17	1111 1211	9	0002 1132	9	4323 3434	26
14	4332 4331	23	3233 3364	27	2321 2222	16	3434 4355	31	3332 2465	28	2222 2323	18
15	3332 3422	22	4543 ***0	-	2332 1221	16	4223 1101	14	4334 3213	23	2111 2132	13
16	2244 4454	29	2333 3443	25	0121 2311	11	2222 1122	14	2122 2223	16	1111 1110	7
17	4343 4432	27	3112 2333	18	0122 3331	15	2344 4656	34	3232 1223	18	1111 1111	8
18	2343 3332	23	3113 2334	20	1126 5665	32	3333 3244	25	2212 1343	18	1112 1111	9
19	2333 3242	22	4244 5332	27	5343 4444	31	3333 2143	22	1212 1211	11	1112 3333	17
20	1322 3222	17	3322 2343	22	2322 3132	18	4355 3443	31	1112 1111	9	1211 2463	20
21	2232 2112	15	3324 4444	28	0144 4433	23	3233 2242	21	1112 1112	10	3334 4454	31
22	1211 3232	15	6443 3244	30	4222 3201	16	1112 1432	15	1002 1111	7	3422 2443	24
23	1023 3232	16	4342 3544	29	1234 2233	20	1212 2222	14	1111 1253	15	2222 2434	21
24	3132 2336	23	4323 3434	26	4344 3333	27	1112 2221	12	3434 4556	34	3332 3341	22
25	5444 4544	34	3223 3332	21	3122 2234	19	2212 3444	22	5544 4565	38	2312 3233	19
26	4443 4352	29	2222 3334	21	2211 2221	13	5544 5555	38	4333 3442	26	1122 2433	18
27	3222 4333	22	3332 4332	23	2212 2212	14	5435 5555	37	4223 2442	23	1212 3223	16
28	3322 3343	23	2212 3333	19	2334 3355	28	4334 4553	31	3222 2133	18	1212 1111	10
29	3335 4444	30	4312 2343	22	4454 5465	37	4334 3554	31	3232 3343	23	1111 2234	15
30	2343 2433	24	3421 2234	21	5664 3331	31	4433 4555	33	1222 3322	17	2012 2121	11
31	3333 2332	22	4431 2343	24			1234 4454	27			1112 1111	9

THREE-HOUR-RANGE INDICES 'K' FOR THE YEARS 1929-1939												
Date 1931	January		February		March		April		May		June	
	Indices	Sum	Indices	Sum	Indices	Sum	Indices	Sum	Indices	Sum	Indices	Sum
1	2222 2224	18	2221 1123	14	2212 2111	12	0011 2342	13	2122 2211	13	1322 2435	22
2	3211 1112	12	4322 1113	17	0112 3333	16	3112 2222	15	2232 3220	16	2444 4534	30
3	1111 1110	7	3321 1221	15	2432 2333	22	2111 3333	17	1121 1122	11	3322 3222	19
4	1111 2101	8	1232 1123	15	2111 1213	12	1112 2243	16	2221 2121	13	2212 2211	13
5	1011 1111	7	3311 1123	15	2112 2231	14	3222 2111	14	1212 2332	16	1211 2122	12
6	2111 1110	8	1121 1122	11	1121 2221	12	0022 2210	9	2243 3331	21	2223 2332	19
7	0111 1101	6	1122 2113	13	1122 3232	16	0111 1112	8	4544 3432	29	2112 3322	16
8	1111 1101	7	2222 1112	13	3221 2233	18	3112 2222	15	3222 2120	14	1211 2344	18
9	4332 3224	23	2121 2212	13	4222 3232	20	2222 3323	19	0221 1110	8	4432 3322	23
10	4332 2242	22	2122 2110	11	1111 2433	16	2333 3333	23	2221 1101	10	1332 3422	20
11	1122 1323	15	1111 2122	11	2122 1121	12	2122 3331	17	0332 3344	22	4332 3323	23
12	3111 1112	11	1001 1111	6	3112 2344	20	1010 0111	5	3322 2223	19	3123 3332	20
13	1011 2102	8	2333 4435	27	5233 3354	28	0111 1211	8	1331 2354	22	1211 3222	14
14	1011 2112	9	4424 4345	30	3333 2233	22	0111 1212	9	3332 2445	26	2212 2222	15
15	2223 2123	17	3233 4443	26	3222 2212	16	1111 2321	12	4443 3342	27	2211 2111	11
16	3333 4545	30	4222 2110	14	2112 2210	11	2111 1122	11	2331 3332	20	1111 2112	10
17	4334 4453	30	1112 1323	14	1121 2211	11	2111 2222	13	2221 2221	14	2011 2221	11
18	3244 3443	27	2112 2221	13	1011 1110	6	2323 3232	20	3332 2222	19	3111 2221	13
19	2123 2134	18	1001 1322	10	0112 1221	10	2112 4344	21	2121 1210	10	1212 3222	15
20	4111 3333	19	2101 2111	9	1011 2324	14	4434 2211	21	1122 3233	17	2222 3221	16
21	2211 2222	14	0112 1111	8	2323 3244	23	1121 1121	10	2222 2120	13	1211 3442	18
22	2222 1111	12	1012 2131	11	4321 1123	17	2222 2323	18	1221 2210	11	1122 3332	17
23	3112 2111	12	2111 2123	13	3321 1223	17	3111 2202	12	1221 2121	12	2223 2222	17
24	1211 1110	8	2444 4453	30	3221 **11	-	2121 1212	12	1222 2211	13	2222 2233	18
25	0122 1244	16	2111 2335	18	2132 1234	18	1112 2323	15	1331 2333	19	1222 1211	12
26	4222 1121	15	5332 3414	25	5323 3212	21	1332 1222	16	3443 3432	26	1112 4534	21
27	0011 2233	12	3233 3342	23	3223 2223	19	2011 1210	8	2322 2120	14	3433 4533	28
28	3321 3224	20	2211 2212	13	3321 1232	17	0111 2222	11	0221 1111	9	4433 3444	29
29	2112 3322	16			2222 2223	17	1111 1111	8	1222 3421	17	2213 2221	15
30	1112 1110	8			1111 1210	8	2221 1111	11	1221 2211	12	0213 2221	13
31	1111 1143	13			0122 3210	11			1222 2210	12		

THREE-HOUR-RANGE INDICES 'K' FOR THE YEARS 1929-1939

Date 1931	July		August		September		October		November		December	
	Indices	Sum	Indices	Sum	Indices	Sum	Indices	Sum	Indices	Sum	Indices	Sum
1	0112 2112	10	1212 3333	18	4332 2233	22	4343 3444	29	3132 2324	20	1221 4343	20
2	2322 3334	22	1111 1112	9	1111 2111	9	4224 4655	32	2222 2322	17	3234 4455	30
3	2233 3332	21	2332 2212	17	1223 2333	19	4322 2232	20	3233 2435	25	4443 3444	30
4	1121 2343	17	2121 2231	14	5434 5533	32	4221 3455	26	4433 3221	22	3244 4544	30
5	1222 2222	15	1211 3322	15	3333 2233	22	5444 4554	35	1342 3454	26	4332 4444	28
6	1112 2321	13	2223 3221	17	3343 3444	28	4332 2333	23	3434 4534	30	3323 3333	23
7	1211 2323	15	1232 4333	21	4442 3242	25	3222 2300	14	3223 4234	23	2222 2233	18
8	3221 2211	14	4333 4444	29	1223 2335	21	1222 1223	15	3444 4455	33	3111 1123	13
9	1111 1222	11	5333 4443	29	3342 3343	25	2312 3210	14	3433 3443	27	2012 3232	15
10	1111 1222	11	2221 3323	18	3222 2431	19	0113 2323	15	4333 2443	26	3343 2113	20
11	1222 3333	19	3432 3322	22	2222 2222	16	2123 2113	15	1113 3313	16	2213 3354	23
12	2222 2231	16	2111 2221	12	3123 4232	20	3112 3446	24	1112 2211	11	4223 4444	27
13	1322 3231	17	2211 2332	16	1112 2331	14	5443 4423	29	1113 2244	18	3222 4334	23
14	1233 3431	20	1322 2132	16	1222 3434	21	3222 2432	20	3223 4452	25	3112 2344	20
15	2243 3322	21	0111 2233	13	4324 4444	29	2332 3433	23	1212 3445	22	2222 2445	23
16	4322 3112	18	2223 4333	22	5333 3424	27	3221 2111	13	4322 3555	29	3223 3343	23
17	3111 1212	12	1111 1212	10	5433 3332	26	3323 2154	23	3222 3444	24	4322 3233	22
18	1222 2221	14	2121 1222	13	1113 3123	15	3323 4433	25	4333 4344	28	1121 1221	11
19	1211 2301	11	4223 3334	24	2011 2132	12	2334 2344	25	3323 3353	25	1112 1011	8
20	0122 1221	11	3443 4443	29	3111 2444	20	3122 2143	18	2233 2423	21	1101 1011	6
21	2221 2322	16	3344 3434	28	5333 3234	26	3222 3342	21	1221 3320	14	1102 1112	9
22	1111 2111	9	2202 3312	15	3321 3334	22	4323 2343	24	1111 1111	8	1321 2112	13
23	2334 5543	29	2223 3332	20	2222 4424	22	1122 2335	19	1012 1123	11	2011 2343	16
24	3334 2312	21	3222 2324	20	4332 4333	25	3333 2212	19	2121 1123	13	2111 1111	9
25	2232 4434	24	4443 4443	30	2222 2233	18	2101 2213	12	1222 2223	16	2322 1353	21
26	4333 3322	23	1223 3334	21	3322 2232	19	2111 1142	13	3313 5545	29	1111 1112	9
27	2111 2322	14	3322 4424	24	3321 2231	17	3122 4452	23	4434 2344	28	0111 1111	7
28	2323 4344	25	4133 3222	20	1101 1121	8	3424 3454	29	2122 2222	15	2112 3445	22
29	2331 3323	20	2222 2223	17	1111 2231	12	1224 5765	32	1211 2214	14	3334 4433	27
30	3232 2313	19	1111 2322	13	2113 4434	22	3545 4653	35	3222 1111	13	6433 3334	29
31	2211 2111	11	2222 1222	15			2343 3333	24			3233 2343	23

THREE-HOUR-RANGE INDICES 'K' FOR THE YEARS 1929-1939												
Date 1932	January		February		March		April		May		June	
	Indices	Sum	Indices	Sum	Indices	Sum	Indices	Sum	Indices	Sum	Indices	Sum
1	3223 4354	26	3102 2123	14	1111 1111	8	3322 3435	25	3223 2312	18	2111 2212	12
2	3333 4545	30	2111 1122	11	2222 3345	23	5343 3454	31	5222 3234	23	1212 2222	14
3	4331 3242	22	2233 4555	29	4333 4344	28	3322 2355	25	4333 3333	25	2111 2211	11
4	2111 2132	13	5234 4553	31	4434 4354	31	3322 4334	24	3222 2544	24	0112 2221	11
5	1011 1223	11	3333 2444	26	4333 3455	30	3433 3325	26	4222 3444	25	1222 3221	15
6	2112 2223	15	3233 3434	25	4333 3344	27	3333 2334	24	3333 4234	25	0122 2322	14
7	1111 1244	15	3222 3343	22	2222 2344	21	4444 4245	31	2322 2122	16	1222 3423	19
8	1333 3334	25	3223 3442	23	6423 1444	28	5333 3333	26	2112 2232	15	4233 5444	29
9	3323 3345	26	2123 3334	21	3322 3455	27	4323 3343	25	1111 2121	10	4332 4333	25
10	3333 3443	26	3233 3544	27	4423 3465	31	3222 3243	21	3121 3133	17	3433 4333	26
11	3332 3454	27	3223 3544	26	6433 2344	29	2121 2133	15	4323 4442	26	3323 3422	22
12	4333 3434	27	3434 2435	28	2223 3232	19	3211 2211	13	3222 3322	19	3122 3331	18
13	3222 2213	17	3223 3333	22	2312 2233	18	1111 2556	22	2322 3342	21	2223 3221	17
14	4212 2214	18	3313 2233	20	3222 3322	19	3433 3441	25	3322 3433	23	1222 2322	16
15	2143 1241	18	4211 2132	16	2211 2211	12	4333 3243	25	4233 3442	25	0111 1111	7
16	1212 2443	19	2111 1112	10	1111 1331	12	2324 3323	22	2442 4422	24	1111 2312	12
17	3111 1311	12	1102 1112	9	1111 1233	13	4233 2323	22	3223 2222	18	1222 3211	14
18	1112 1120	9	1111 1133	12	3323 3362	25	4333 3544	29	1211 2221	12	1122 2202	12
19	1111 1122	10	3323 2232	20	3322 1232	18	3111 2222	14	2121 1211	11	1212 2233	16
20	2111 2201	10	3443 3342	26	1121 3333	17	1112 2111	10	1112 2211	11	3223 3541	23
21	1111 1111	8	1123 3221	15	4432 3355	29	0111 1120	7	2233 4321	20	2111 2323	15
22	1111 1111	8	2233 4443	25	3433 4444	29	1123 4424	21	3122 4321	18	1422 3441	21
23	2111 1132	12	4221 1264	22	5322 3323	23	3334 4445	30	0012 4345	19	3232 2222	18
24	1122 ***	-	3334 3333	25	3222 3214	19	3334 3444	28	1322 3223	18	2212 2231	15
25	*** 3453	-	3422 2343	23	3121 1112	12	4233 3444	27	4432 3433	26	0012 3421	13
26	3233 2345	25	3212 2222	16	1121 1221	11	5333 3444	29	3322 2333	21	2223 3221	17
27	5222 3544	27	1111 1220	9	1112 1232	13	3333 2343	24	2222 2333	19	1111 2221	11
28	4332 5354	29	0121 1111	8	4313 4454	28	3331 3443	24	3322 3343	23	2111 1220	10
29	4222 2133	19	1111 1112	9	4423 4454	30	2222 2333	19	3334 6755	36	0021 2312	11
30	2222 3223	18			3343 4555	32	1322 2231	16	5753 5543	35	1111 3321	13
31	3324 2412	21			5344 4453	32			3322 2443	23		

THREE-HOUR-RANGE INDICES 'K' FOR THE YEARS 1929-1939												
Date 1932	July		August		September		October		November		December	
	Indices	Sum	Indices	Sum	Indices	Sum	Indices	Sum	Indices	Sum	Indices	Sum
1	1111 2231	12	2222 3433	21	3221 3323	19	3111 2113	13	2443 3222	22	1122 1232	14
2	1121 1311	11	5333 4545	32	3322 3313	20	2113 4233	19	3332 3131	19	2111 1132	12
3	1122 2211	12	3243 4444	28	1111 2223	13	3232 3113	18	1233 1221	15	1211 1122	11
4	1212 4333	19	3343 3321	22	1121 2233	15	2121 3323	17	2222 2333	19	2211 2212	13
5	3221 3444	23	3334 3232	23	2121 3313	16	3212 2233	18	3222 2322	18	2211 1112	11
6	3444 5423	29	3211 3223	17	2333 4444	27	2111 1122	11	2222 1122	14	2211 1124	14
7	3333 3332	23	1221 2111	11	1112 1224	14	4111 2211	13	2112 1421	14	2110 1001	6
8	3233 3434	25	2221 1221	13	4521 2343	24	1211 1133	13	1122 1123	13	2332 2224	20
9	3223 3433	23	1333 1112	15	4322 2333	22	3112 3433	20	2122 2111	12	4333 2332	24
10	3323 2323	21	1121 2121	11	2211 2223	15	3322 3442	23	1222 1121	12	3122 3333	20
11	1212 2222	14	1112 1223	13	2221 2211	13	2122 1133	15	1121 2121	11	1111 1123	11
12	1223 2232	17	3412 3423	22	1121 1113	11	3111 1233	15	2122 2332	17	1222 1010	9
13	1212 2111	11	3342 2333	23	1212 2212	13	1022 2222	13	2222 2323	18	1212 2334	18
14	1122 3112	13	2122 2222	15	1222 2332	17	0011 1222	9	2133 3314	20	3224 4554	29
15	1101 1122	9	1112 2322	14	1122 2213	14	2444 4434	29	2321 2342	19	4322 3354	26
16	2143 5334	25	2112 1211	11	1122 2210	11	4443 2312	23	4444 4455	34	5222 2444	25
17	3322 2212	17	1111 2221	11	0021 2222	11	3233 4444	27	2233 4343	24	4223 3353	25
18	1222 2321	15	2112 2122	13	3122 2425	21	3211 2212	14	2222 2343	20	3321 3111	15
19	1212 2324	17	1211 2111	10	4233 3424	25	1332 2111	14	2122 2222	15	2222 3342	20
20	1111 1222	11	0111 2212	10	4332 3323	23	1122 3545	23	2122 2323	17	3121 1111	11
21	2223 3323	20	3332 3333	23	3332 1223	19	4534 3221	24	2111 1222	12	2110 1110	7
22	3111 2133	15	3123 3451	22	2323 3434	24	1112 3353	19	1121 1210	9	0111 1121	8
23	1221 2320	13	1223 3312	17	3343 3454	29	4333 4544	30	1111 2112	10	0111 1112	8
24	0111 2333	14	2112 1222	13	4443 4553	32	2223 4243	22	0111 1111	7	2112 1111	10
25	2111 1222	12	1221 2223	15	4433 4545	32	2222 1321	15	0222 2433	18	0222 3333	18
26	2332 1322	18	2111 2112	11	4333 1243	23	2212 2121	13	2122 1101	10	3221 2232	17
27	1122 2212	13	2343 5555	32	4322 3433	24	1223 4423	21	0210 1112	8	4412 2232	20
28	1221 2111	11	5555 4544	37	2221 2212	14	1211 0110	7	1112 2311	12	1112 4444	21
29	1111 2211	10	434* *455	-	4112 2133	17	1111 1114	11	3222 4323	21	2111 2222	13
30	1112 3333	17	3333 4444	28	3232 2314	20	3233 3333	23	3122 1110	11	1222 2233	17
31	3222 2432	20	3232 3223	20			3121 2112	13			4232 2244	23

THREE-HOUR-RANGE INDICES 'K' FOR THE YEARS 1929-1939												
Date 1933	January		February		March		April		May		June	
	Indices	Sum	Indices	Sum	Indices	Sum	Indices	Sum	Indices	Sum	Indices	Sum
1	3222 2353	22	1011 1112	8	2212 3133	17	3323 2333	22	3233 5665	33	4533 3332	26
2	3322 2133	19	2222 2322	17	3112 1122	13	2212 1133	15	5222 2223	20	2212 3322	17
3	3211 2111	12	1011 1224	12	1212 2332	16	3333 4222	22	3332 3342	23	2222 2322	17
4	2111 1101	8	3012 2232	15	3212 1121	13	4321 2122	17	3332 2451	23	2112 2221	13
5	1111 1110	7	3221 2111	13	0111 1111	7	2222 2222	16	2332 3334	23	2211 2111	11
6	1433 4223	22	3111 1111	10	1111 3211	11	3222 2234	20	4423 4234	26	0121 1111	8
7	3312 2331	18	1222 3222	16	0011 2112	8	2323 3454	26	4222 3211	17	2221 1212	13
8	2222 2113	15	0122 2122	12	2111 2222	13	2223 2443	22	2112 2231	14	2333 2243	22
9	2111 2212	12	3322 1122	16	2111 1112	10	3133 3312	19	0112 1211	9	3232 3311	18
10	1111 1111	8	2211 1103	11	2211 1122	12	2222 3431	19	1222 1110	10	2112 3321	15
11	1112 1111	9	1011 1211	8	4312 3212	18	1122 2211	12	2212 2221	14	1211 2211	11
12	1011 2111	8	1122 2210	11	1122 2222	14	1111 1111	8	1111 1212	10	2211 2223	15
13	2111 1111	9	0001 1102	5	1313 2321	16	1112 2111	10	1322 2233	18	4543 5445	34
14	2111 1133	13	2222 2142	17	1322 2311	15	0011 3332	13	4223 2453	25	4233 3323	23
15	3454 2124	25	2322 2323	19	1112 2101	9	1313 3354	23	2323 2334	22	4222 2223	19
16	3222 2211	15	1111 1101	7	3111 1221	12	3423 3355	28	3111 2332	16	1112 2221	12
17	1133 2112	14	0011 1110	5	1012 2222	12	4434 5334	30	3112 2334	19	1221 3212	14
18	1212 1122	12	0001 2232	10	3432 3436	28	5333 3434	28	4433 3332	25	1112 2122	12
19	1222 4433	21	3324 4455	30	5322 3565	31	4233 4344	27	2222 3243	20	2223 3223	19
20	3431 1112	16	5334 3334	28	5433 3454	31	2443 3343	26	2211 1112	11	4433 3433	27
21	1111 1022	9	3433 4546	32	4334 4325	28	3223 3346	26	2221 1112	12	2122 3223	17
22	1121 2445	20	5333 3454	30	5434 4343	30	3342 3443	26	2212 3213	16	3221 2221	15
23	3222 3244	22	4432 4554	31	3533 3544	30	2342 3343	24	1212 2223	15	0111 1222	10
24	5322 3322	22	3344 3555	32	3443 3545	31	3222 2223	18	1112 2222	13	1122 1121	11
25	4233 3334	25	3333 2245	25	3332 3322	21	3122 3322	18	3122 3232	18	1212 2443	19
26	4322 3343	24	4433 3245	28	2133 1322	17	4122 2342	20	1111 1100	6	2223 2311	16
27	4333 3445	29	3323 1224	20	1232 3432	20	1212 1134	15	1111 2343	16	0133 4422	19
28	4323 4444	28	2211 1113	12	2322 3334	22	3212 2223	17	4211 2122	15	4221 4343	23
29	3222 2333	20			2223 2334	22	2111 2122	12	1132 3344	21	3322 3422	21
30	3423 2323	22			3212 2213	16	1112 3555	23	4332 3443	26	2322 3323	20
31	3222 2313	18			3223 2233	20			2323 5423	24		

THREE-HOUR-RANGE INDICES 'K' FOR THE YEARS 1929-1939

Date 1933	July		August		September		October		November		December	
	Indices	Sum	Indices	Sum	Indices	Sum	Indices	Sum	Indices	Sum	Indices	Sum
1	1112 2233	15	1111 2211	10	3322 3223	20	1101 1122	9	1222 2122	14	2222 2212	15
2	3221 2222	16	1211 2213	13	3222 2324	20	2222 2121	14	1223 2333	19	2212 2324	18
3	3222 1331	17	2211 1211	11	2122 2222	15	1111 1113	10	1212 2354	20	2213 3154	21
4	2211 2231	14	1112 1122	11	2222 3132	17	2221 2223	16	2232 4454	26	2344 4342	26
5	3222 2311	16	3233 4563	29	1131 3211	13	4334 4234	27	2322 2334	21	2443 5533	29
6	2212 1221	13	4433 4441	27	0132 1223	14	3443 4321	24	4333 5444	30	3222 3323	20
7	0113 2212	12	2222 3213	17	2231 3223	18	4434 3544	31	5333 3554	31	3223 4243	23
8	2122 2344	20	2222 2323	18	3332 2233	21	3334 2333	24	4544 5344	33	2111 2221	12
9	4244 4332	26	2221 2222	15	3565 4433	33	3432 3444	27	2332 2344	23	1111 4445	21
10	1222 2333	18	2222 2212	15	4433 3333	26	4333 2354	27	2422 2223	19	3222 2445	24
11	3223 4322	21	1121 1111	9	3232 2223	19	3223 2224	20	3333 3343	25	2221 2232	16
12	3321 3222	18	1112 1222	12	4322 3321	20	5532 3211	22	3222 2232	18	2110 2222	12
13	2112 2212	13	2122 3464	24	1112 4464	23	0223 4525	23	2213 2321	16	3210 2212	13
14	3221 2122	15	2322 3323	20	4223 3454	27	5234 3452	28	1213 1222	14	1211 2222	13
15	1112 2211	11	2222 3342	20	5532 4434	30	2311 3332	18	2322 2221	16	0212 1222	12
16	1112 3222	14	2221 2123	15	3223 2444	24	2222 2211	14	0212 2112	11	2201 1232	13
17	2223 4333	22	2332 4332	22	3222 2342	20	2111 2224	15	2222 1222	15	2222 3222	17
18	4323 3331	22	3232 3554	27	4423 3322	23	3333 3443	26	2222 3321	17	3322 1244	21
19	2211 2222	14	4343 3222	23	1221 3434	20	3111 1113	12	2212 2224	17	4222 3322	20
20	3223 3311	18	2221 3334	20	3322 2322	19	2111 2212	12	4212 1234	19	2111 2233	15
21	1311 1220	11	3232 4542	25	3322 2123	18	2112 2211	12	4312 3423	22	2111 1131	11
22	3111 2221	13	2122 1111	11	4222 3213	19	0122 1211	10	3212 2221	15	1212 2223	15
23	2113 4435	23	1134 4443	24	3232 2223	19	1112 1113	11	2312 1233	17	1111 1222	11
24	4353 4512	27	2244 2443	25	3221 2212	15	1223 3332	19	2222 1211	13	1011 2111	8
25	2112 3312	15	4332 2222	20	2212 3333	19	4333 2333	24	2212 1122	13	1211 1322	13
26	1122 3323	17	3322 3321	19	2122 2234	18	3231 2314	19	2212 1111	11	2221 2123	15
27	3333 3234	24	2222 2112	14	2322 2233	19	3211 1112	12	1211 2354	19	2111 1321	12
28	1222 2121	13	1211 2122	12	3222 2244	21	2222 2111	13	3232 3221	18	1111 1124	12
29	2212 3211	14	2221 2110	11	3221 1331	16	1111 1111	8	2212 2232	16	4311 1221	15
30	1111 2112	10	2111 2211	11	0112 2232	13	1111 1211	9	3211 2132	15	0111 1101	6
31	2121 3222	15	1211 2212	12			0012 2210	8			1111 2211	10

THREE-HOUR-RANGE INDICES 'K' FOR THE YEARS 1929-1939												
Date 1934	January		February		March		April		May		June	
	Indices	Sum	Indices	Sum	Indices	Sum	Indices	Sum	Indices	Sum	Indices	Sum
1	1123 2555	24	2111 2111	10	1112 1232	13	3333 3444	27	3222 2212	16	1111 2222	12
2	2323 4441	23	1113 2144	17	2224 3343	23	3213 3232	19	3222 3455	26	0112 2222	12
3	1232 2322	17	1212 2133	15	4212 2121	15	2223 3342	21	4332 3324	24	0142 2112	10
4	3111 2211	12	3322 2444	24	0012 3546	21	3122 2445	23	2113 3113	15	1111 3343	17
5	1212 1121	11	3112 2333	18	3454 3355	32	4233 3442	25	2112 2332	16	4323 4544	29
6	0101 2221	9	1111 2112	10	4333 3342	25	3334 2233	23	2212 2223	16	4333 2432	24
7	2111 1232	13	3113 2122	15	3334 3345	28	3222 2221	16	2111 1232	13	3222 3211	16
8	2222 2213	16	1011 1233	12	3222 2123	17	1121 3323	16	3111 1212	12	1012 3443	18
9	2211 2113	13	5433 3442	28	2122 1243	17	1311 2120	11	1222 3212	15	3322 3233	21
10	2111 2122	12	1212 4452	21	3333 3243	24	0221 1013	10	3211 2224	17	2211 2222	14
11	3112 2122	14	2322 2233	19	2422 2153	21	2111 2211	11	2322 2236	22	2122 3443	21
12	1222 2111	12	2212 1134	16	2212 1212	13	2211 2221	13	5332 2324	24	4422 3431	23
13	2122 1211	12	3222 1124	17	1111 1133	12	2113 2211	13	3222 3211	16	1212 2211	12
14	2122 2335	20	2112 2111	11	1012 1222	11	1112 2222	13	1211 2221	12	1121 3334	18
15	3222 2143	19	2113 2444	21	4323 3111	18	2112 2114	14	0112 1112	9	4332 2321	20
16	3323 2133	20	1122 6453	24	1133 3234	20	3333 4433	26	1212 1210	10	2112 3332	17
17	1112 2212	12	3333 3344	26	4212 2223	18	2212 1211	12	1212 1213	13	1211 3333	16
18	2223 2153	20	3223 3543	25	3222 2324	20	0011 1112	7	1333 5533	26	1122 3533	20
19	3221 2121	14	1223 2332	18	3122 2112	14	0112 2332	14	4222 3323	21	2122 2221	14
20	2112 3221	14	2223 2232	18	2111 1121	10	2321 2322	17	1111 1331	12	0312 2333	17
21	1232 2221	15	1112 2233	15	3121 2222	15	2112 3221	14	2113 3442	20	0111 2111	8
22	1012 2224	14	3322 1122	16	2432 2345	25	2122 3312	16	1123 3322	17	0112 1111	8
23	4222 2343	22	2121 2222	14	3221 1345	21	1112 1122	11	2232 2331	18	1111 1232	12
24	3222 2233	19	1112 2224	15	2122 1235	18	1223 1112	13	1111 1332	13	1222 1111	11
25	3121 2222	15	2213 3213	17	5324 3434	28	1222 2223	16	1112 2443	18	1121 1220	10
26	1122 2233	16	2112 2211	12	3111 1244	17	2111 1122	11	3212 1221	14	1112 2110	9
27	2211 2112	12	1112 2322	14	2221 2243	18	2121 2222	14	0111 1211	8	0112 3433	17
28	2012 3323	16	2113 2321	15	1011 3244	16	2221 2101	11	0011 1200	5	3222 2323	19
29	3323 2232	20			4323 2323	22	1012 1221	10	0111 2221	10	3211 2221	14
30	3222 2133	18			2221 2134	17	0111 2222	11	1211 2222	13	1111 2111	9
31	2212 2232	16			4344 5344	31			2112 2221	13		

THREE-HOUR-RANGE INDICES 'K' FOR THE YEARS 1929-1939												
Date 1934	July		August		September		October		November		December	
	Indices	Sum	Indices	Sum	Indices	Sum	Indices	Sum	Indices	Sum	Indices	Sum
1	3411 2222	17	4333 3322	23	2122 3324	19	1122 3223	16	0111 1111	7	0323 3333	20
2	2222 2211	14	2222 3332	19	3431 3444	26	2222 2121	14	2112 1111	10	2422 2111	15
3	1114 5542	23	3424 4543	29	4233 3333	24	1112 2101	9	0112 1142	12	2322 2225	20
4	3233 3322	21	3232 3344	24	2222 3333	20	0111 3223	13	1212 2212	13	5543 4423	30
5	3332 3322	21	4313 3213	20	0122 2112	11	1112 2321	13	1012 2333	15	3322 1441	20
6	2222 2321	16	3233 3213	20	2012 2222	13	1122 2213	14	3112 1111	11	1122 2221	13
7	2322 2221	16	1113 3122	14	3212 2221	15	1121 3322	15	1324 4554	28	1232 2142	17
8	1111 2222	12	0112 3213	13	3122 2331	17	0112 2101	8	3234 3423	24	2221 1222	14
9	2321 2222	16	1111 1121	9	1111 1122	10	1011 1100	5	3333 2132	20	1111 1222	11
10	2121 1111	10	2221 1222	14	0111 2112	9	0011 2121	8	2121 2222	14	1011 1122	9
11	1211 2441	16	2222 2111	13	2122 3132	16	0112 2111	9	1112 1222	12	1112 2321	13
12	2311 2232	16	1111 1345	17	3333 2232	21	3322 2123	18	2111 1232	13	0101 2212	9
13	1122 2321	14	4222 3413	21	1111 3112	11	3332 2233	21	0012 2223	12	0210 1013	8
14	1112 2342	16	1112 3334	18	1122 2211	12	2221 1211	12	2321 1212	14	1011 1233	12
15	3222 2311	16	1221 2233	16	1021 1223	12	1222 3444	22	0012 1222	10	3222 2231	17
16	3332 2331	20	3212 3223	18	2323 3333	22	2112 1111	10	1121 1111	9	2101 1000	5
17	0113 2323	15	3221 3333	20	4233 3322	22	3111 1133	14	1211 2113	12	0011 1012	6
18	2212 2221	14	3223 2233	20	2212 2012	12	4212 1120	13	3211 1122	13	1111 1114	11
19	1222 1211	12	3312 3433	22	1111 2434	17	0011 1110	5	2211 2111	11	3221 2122	15
20	1121 3321	14	1012 1222	11	3122 3323	19	0111 1244	14	1111 1111	8	3111 2111	11
21	2111 3113	13	0122 3331	15	1111 2233	14	3222 2232	18	1111 1111	8	3122 4342	21
22	2112 1111	10	2233 3331	20	5222 3221	19	2321 2121	14	0011 1101	5	2221 1114	14
23	0022 2111	9	1011 1133	11	2112 2211	12	2111 1103	10	2111 1111	9	2111 1001	7
24	0112 2322	13	1211 2101	9	1244 4345	27	3444 4432	28	1121 2543	19	1212 2434	19
25	1122 2213	14	1112 1122	11	5544 5673	39	4232 3533	25	3233 2212	18	4222 3343	23
26	2222 2121	14	2223 4334	23	3113 3234	20	3233 4441	24	3111 1111	10	2322 2111	14
27	2211 2121	12	4432 3434	27	2442 3553	28	3212 2213	16	2111 1112	10	1101 1221	9
28	1112 2222	13	4344 3434	29	3123 4241	20	1321 3311	15	2222 2133	17	3111 1211	11
29	2322 3332	20	3443 3344	28	1112 2342	16	1111 1111	8	1111 2331	13	1122 3565	25
30	1454 5323	27	2333 3333	23	3332 2253	23	2111 1212	11	1111 1111	8	5323 4543	29
31	4222 2532	22	3122 3223	18			0122 1211	10			3411 2344	22

THREE-HOUR-RANGE INDICES 'K' FOR THE YEARS 1929-1939												
Date 1935	January		February		March		April		May		June	
	Indices	Sum	Indices	Sum	Indices	Sum	Indices	Sum	Indices	Sum	Indices	Sum
1	1244 2133	20	1223 3433	21	1133 4242	20	0021 1121	8	1113 6546	27	2212 2211	13
2	4323 2331	21	3533 3442	27	2133 3322	19	1122 1111	10	4423 2222	21	0212 2221	12
3	2123 3234	20	1133 4232	19	3212 2353	21	0022 3211	11	1212 3211	13	1111 2111	9
4	4132 1333	20	2122 2121	13	3112 2211	13	2222 2223	17	0011 2212	9	2323 4433	24
5	2122 1133	15	2111 1113	11	0111 1224	12	1223 2112	14	2011 1111	8	1232 3422	19
6	1111 0002	6	2222 1112	13	2122 1232	15	2121 1110	9	1011 2110	7	1213 3232	17
7	1122 1121	11	1111 2223	13	2102 2224	15	1022 3111	11	2112 3111	12	1233 5646	30
8	1111 2123	12	3212 3322	18	2122 2233	17	1233 2423	20	1111 2110	8	5344 4443	31
9	3111 1112	11	3221 2131	15	2212 3212	15	3433 2311	20	0011 1211	7	3234 5444	29
10	1111 1223	12	2122 2411	15	2212 2222	15	2124 4554	27	1121 3543	20	3234 4453	28
11	4222 2213	18	1111 1112	9	2212 4232	18	5445 5555	38	3323 3333	23	2311 5642	24
12	2111 2123	13	3222 1111	13	2121 1114	13	4343 4544	31	3322 2215	20	2112 2333	17
13	3222 2122	16	2333 3456	(28)	4323 3551	26	4433 4543	30	3222 2333	20	3213 2222	17
14	1112 1113	11	5434 3433	29	2244 5654	32	3222 2223	18	3221 2110	12	3213 2211	15
15	3223 2323	20	3323 2333	22	4443 4443	30	3322 2322	19	0011 2233	12	0111 1111	7
16	1111 1124	12	2123 3343	21	3233 3544	27	2132 2324	19	3344 4322	25	1112 2222	13
17	5334 4424	29	3222 1133	17	2323 3224	21	3221 2322	17	2211 3211	13	2212 2433	19
18	4322 3344	25	4132 1144	20	4111 2343	19	1432 3243	22	0211 2143	14	3332 4463	28
19	3122 2232	17	1222 2131	14	3223 2132	18	2112 3222	15	3222 2213	17	4324 4333	26
20	3232 1123	17	1223 2333	19	3222 3344	23	3123 1212	15	3543 3333	27	3332 2243	22
21	2122 1144	17	4224 3434	26	2333 3544	27	2211 2121	12	2122 2333	18	2212 3321	16
22	4322 1323	20	3323 1121	16	4221 1112	14	1011 2222	11	3312 2222	17	1222 2111	12
23	4323 3344	26	2222 2235	20	2211 3223	16	1122 3134	17	1112 1222	12	1212 3222	15
24	2323 2444	24	2113 3333	19	4422 3343	25	3111 3323	17	1111 2111	9	1212 2222	14
25	3212 3233	19	4223 3222	20	2122 3212	15	1311 2211	12	2112 3221	14	1111 2122	11
26	4212 2313	18	3432 3433	25	2212 1222	14	0121 1212	10	2222 2322	17	2112 1221	12
27	1112 4255	21	1112 2101	9	3322 2222	18	2111 1111	9	0112 2222	12	3123 2221	16
28	5333 3222	23	0112 2212	11	1012 2212	11	1101 1010	5	1221 2211	12	2322 3233	20
29	3021 1010	8			2111 1102	9	0011 1111	6	2222 2321	16	3222 2333	20
30	0122 3122	13			0012 5544	21	1022 2322	14	1222 4333	20	3323 3332	22
31	3244 2111	18			1223 2311	15			1222 2321	15		

THREE-HOUR-RANGE INDICES 'K' FOR THE YEARS 1929-1939												
Date 1935	July		August		September		October		November		December	
	Indices	Sum	Indices	Sum	Indices	Sum	Indices	Sum	Indices	Sum	Indices	Sum
1	2212 3221	15	3222 3322	19	5422 2111	18	2342 2133	20	2323 2211	16	2243 3434	25
2	2323 3322	20	2112 3211	13	0111 2211	9	1111 1334	15	2333 3434	25	3333 4214	23
3	2121 2221	13	2111 2211	11	0222 2222	14	3111 1111	10	4233 2433	24	4322 2432	22
4	1222 2222	15	1111 2231	12	2112 3344	20	2112 2231	14	2112 2101	10	2111 1112	10
5	1122 3221	14	2123 2233	18	2322 3232	19	2111 2101	9	3223 3555	28	2112 1222	13
6	1212 2122	13	2222 3323	19	1122 2212	13	0111 1112	8	4443 2101	19	1111 2112	10
7	0111 2214	12	3222 2222	17	2311 4322	18	4223 3233	22	1112 2132	13	1212 3233	17
8	3353 4333	27	2111 3313	15	3122 2210	13	1112 3333	17	2222 2331	17	3112 1232	15
9	3322 3323	21	2222 1222	15	1211 2233	15	3113 3211	15	1013 2123	13	2112 2134	16
10	2112 2222	14	2222 2223	17	3324 3343	25	2211 2444	20	1111 1211	9	4112 1312	15
11	1134 4321	19	1111 2221	11	4443 6566	38	1212 4453	22	1122 2233	16	1122 2114	14
12	1322 2222	16	1122 2111	11	5532 1232	23	4112 2211	14	3434 4435	30	2121 2333	17
13	1122 3222	15	1112 3123	14	1212 2212	13	2212 2221	14	5333 3434	28	3232 3321	19
14	3132 3533	23	1112 1210	9	1112 2233	15	2343 3133	22	3333 2354	26	1113 4445	23
15	2222 3321	17	0112 3322	14	2122 3334	20	4423 4443	28	2222 1110	11	4442 3442	27
16	2122 3312	16	2213 2232	17	3432 3334	25	3433 3341	24	0012 1233	12	3234 4434	27
17	1112 2211	11	1111 1112	9	5442 3433	28	2322 3333	21	2112 1121	11	2223 3113	17
18	2111 3222	14	1011 2110	7	4343 4224	26	4332 2232	21	1111 2424	16	2222 2243	19
19	3422 3323	22	1232 3333	20	3433 2244	25	3233 3143	22	3233 3324	23	3122 3223	18
20	2113 3321	16	2332 3323	21	3223 2111	15	2125 5555	30	1132 3423	19	3121 2222	15
21	1112 2232	14	4333 2323	23	1111 2112	10	2344 3665	33	2223 2310	15	1022 1222	15
22	2342 3324	23	3123 3243	21	1111 1112	9	4333 4343	27	0012 1233	12	2011 1111	8
23	3223 3311	18	4243 3223	23	2233 6544	29	3223 1122	16	2122 1200	10	0001 1111	5
24	2233 3355	26	3122 3223	18	5323 3333	25	2145 4532	26	1112 2122	12	1111 2124	13
25	5444 4443	32	4232 1121	16	4455 4534	34	3223 2244	22	2011 1101	7	4223 2343	23
26	3212 1331	16	1212 2221	13	3443 4322	25	4221 2111	14	2111 1022	10	3332 3444	26
27	3322 2223	19	1111 3454	20	3242 3223	21	2334 3455	29	1021 2451	16	3433 3343	26
28	1122 2122	13	3232 3432	22	3232 3332	21	4223 3443	25	1122 3222	15	5335 3244	29
29	2221 3232	17	1311 3212	14	3222 2124	18	3213 2421	18	1212 1244	17	4222 3234	22
30	2212 2211	13	3232 2212	17	1233 3545	26	2332 3422	21	2343 3444	27	3222 2243	20
31	1211 2323	15	3332 1223	19			2333 3443	25			2112 2323	16

THREE-HOUR-RANGE INDICES 'K' FOR THE YEARS 1929-1939												
Date 1936	January		February		March		April		May		June	
	Indices	Sum	Indices	Sum	Indices	Sum	Indices	Sum	Indices	Sum	Indices	Sum
1	3211 1221	13	3111 1122	12	1222 2111	12	2123 3343	21	4322 2210	16	2233 3554	27
2	2111 2212	12	1111 1344	16	0012 1113	9	3223 2325	22	2222 2121	14	2334 4553	29
3	1111 1121	9	2222 1132	15	1111 1111	8	1223 3454	24	1222 1122	13	2332 3434	24
4	2011 1122	10	2232 2221	16	1012 2111	9	3233 2111	16	2222 5544	26	3223 3322	20
5	1122 1101	9	1122 2111	11	3122 2113	15	0123 1111	10	2222 2322	17	1221 3221	14
6	0111 1121	8	3022 2211	13	2333 1213	18	1122 2221	13	2112 2221	13	1111 1221	10
7	1112 1211	10	0021 2321	11	1122 3111	12	1112 3320	13	0112 2121	10	0112 2332	14
8	1332 3334	22	2012 2323	15	2223 3413	20	1233 3332	20	2122 1220	12	3232 3535	26
9	4323 1343	23	2423 3334	24	1223 3342	20	2122 2121	13	0111 2210	8	3454 5643	34
10	3223 3342	22	3324 2444	26	2222 2211	14	1123 2211	13	0112 4553	21	2433 4443	27
11	2122 2331	16	3323 2113	18	0111 2110	7	3122 2232	17	3234 4432	25	3222 4323	21
12	3323 3243	23	0112 3111	10	1122 2111	11	3222 3334	22	3344 4465	33	2232 3322	19
13	4223 3443	25	1011 1111	7	1121 2220	11	2333 3533	25	4322 1223	19	3322 3433	23
14	2222 2323	18	2012 3432	17	0221 1222	12	2233 2243	21	1222 4333	20	3333 3434	26
15	2222 1122	14	4212 3422	20	3222 2223	18	1243 3443	24	3223 1332	19	4433 4443	29
16	2012 1102	9	3125 5454	29	2222 1122	14	4322 2231	19	4343 4434	29	3333 3342	24
17	2322 1112	14	4333 3453	28	2122 2334	19	3123 2335	22	3333 2233	22	3221 3322	18
18	2423 3443	25	2212 2321	15	3223 2244	22	6533 3454	33	5244 3354	30	2212 3345	22
19	2222 3232	18	2233 3566	30	3233 2243	22	3433 3535	29	3433 4443	28	5664 5433	36
20	1111 1243	14	4212 2233	19	3433 3334	26	4432 3444	28	3333 4443	27	4442 3431	25
21	3211 2244	19	3233 4453	27	4434 2344	28	4343 4456	33	2231 3433	21	1222 3211	14
22	3223 2333	21	4433 4335	29	5213 2343	23	4454 5555	37	2312 2312	16	1222 3322	17
23	2332 1112	15	2223 3345	24	2343 3452	26	4343 4544	31	2211 2222	14	1121 2211	11
24	4212 2455	25	3113 3223	18	3343 3454	29	3232 2323	20	0111 1110	6	1122 3433	19
25	4433 3421	24	3212 3233	19	4323 3224	23	3223 4213	20	0101 2232	11	3311 1211	13
26	4333 3435	28	4223 2444	25	5333 3244	27	1112 2321	13	2222 4333	21	0222 3543	21
27	2322 3224	20	4334 3322	24	3222 3343	22	0112 2331	13	1222 2323	17	3222 2112	15
28	3332 3231	20	2213 2111	13	4323 3222	21	1312 3323	18	3121 3332	18	3221 2222	16
29	1111 2243	15	1013 2324	16	3423 2212	19	1322 2011	12	1223 5433	23	2122 1221	13
30	2333 3333	23			2213 1111	12	1222 2312	15	2221 3434	21	1111 3222	13
31	4122 2233	19			3123 2322	18			4311 2221	16		

THREE-HOUR-RANGE INDICES 'K' FOR THE YEARS 1929-1939												
Date 1936	July		August		September		October		November		December	
	Indices	Sum	Indices	Sum	Indices	Sum	Indices	Sum	Indices	Sum	Indices	Sum
1	2212 2222	15	4222 2222	18	1112 1121	10	3222 2123	17	1012 2223	13	2222 2232	17
2	3444 4453	31	3132 2323	19	2223 3211	16	1112 3311	13	1121 4133	16	2222 2123	16
3	4222 2221	17	2112 3233	17	1122 2211	12	1112 2111	10	2423 3363	26	2212 *332	(17)
4	• 0112 2233	14	2323 3112	17	2223 2223	18	2022 2113	13	3432 2312	20	2323 3322	20
5	4334 2432	25	1223 3432	20	2223 2222	17	1122 3343	19	4223 2223	20	3222 2233	19
6	4234 5434	29	3332 2331	20	2312 2102	13	3433 2225	24	2233 2224	20	3213 2332	19
7	3323 3431	22	0111 1122	9	0012 2111	8	2132 3344	22	2233 3234	22	2111 2241	14
8	3323 3342	23	2222 2444	22	1122 2221	13	3433 2341	23	3122 1324	18	2111 1131	11
9	1111 1332	13	2322 2333	20	3122 3321	17	1234 3343	23	4422 1211	17	1111 2111	9
10	3333 4454	29	2232 4331	20	1213 3222	16	4544 2331	26	2132 2333	19	1211 1111	9
11	4344 4553	32	1112 2221	12	2223 3424	22	1122 3212	14	1332 2555	27	1112 1111	9
12	3222 3335	23	1102 3323	15	2211 1223	14	1022 1111	9	2421 2221	16	1211 3332	16
13	3332 3441	23	1233 2121	15	1121 1111	9	0122 2212	12	1111 1111	8	3312 2234	20
14	1211 2221	12	1112 3322	15	1112 2211	11	0022 2322	13	3112 1221	13	2322 3311	17
15	1222 2222	15	2232 2222	17	2212 2211	13	3332 2234	22	2233 3434	24	1112 2111	10
16	4432 3332	24	2111 1221	11	1001 2110	6	2232 2455	25	2333 3433	24	1011 1232	11
17	4223 3444	26	2112 0122	11	1111 1003	8	5543 3232	27	2222 2334	20	1112 2121	11
18	3423 3332	23	2111 1110	8	1123 3232	17	3234 2210	17	3333 3444	27	2121 2121	12
19	3222 3222	18	0112 2311	11	1101 2111	8	1112 2233	15	3333 3343	25	1112 1110	8
20	3222 3321	18	1112 3332	16	1112 2211	11	4322 3332	22	3232 2212	17	1112 2122	12
21	1122 2122	13	3122 2211	14	1023 3113	14	3112 2211	13	2111 3123	14	2122 2223	16
22	1222 1222	14	2121 1220	11	2223 2223	18	0021 2111	8	2111 1111	9	1111 2212	11
23	1121 2211	11	0112 2222	12	2333 3311	19	1111 2244	16	1111 1111	8	2212 2111	12
24	1121 2221	12	1112 2222	13	2222 2212	15	2223 4554	27	1002 1111	7	1101 1111	7
25	2223 3223	19	1111 2323	14	1111 1112	9	2222 2311	15	1111 1111	8	0111 1110	6
26	3121 2121	13	3112 3211	14	3333 4334	26	2112 3111	12	1112 2231	13	0012 1110	6
27	1122 3332	17	2123 3223	18	1123 3321	16	0111 1111	7	2111 0111	8	0322 3345	22
28	4322 3332	22	2222 2223	17	1114 3223	17	1122 2211	12	0001 2215	11	4544 4423	30
29	1233 5644	28	1111 1124	12	2322 3233	20	1211 2212	12	5645 4332	32	1122 2212	13
30	3332 2121	17	4432 3543	28	1011 1112	8	2221 2211	13	1122 2321	14	1111 1133	12
31	0123 3423	18	3333 2221	19			4244 4421	25			1112 1212	11

THREE-HOUR-RANGE INDICES 'K' FOR THE YEARS 1929-1939												
Date 1937	January		February		March		April		May		June	
	Indices	Sum	Indices	Sum	Indices	Sum	Indices	Sum	Indices	Sum	Indices	Sum
1	1111 2211	10	3332 2221	18	3234 3345	27	3*** 3333	-	4423 3333	25	3333 3331	22
2	1112 2234	16	0123 2224	16	4343 3342	26	3334 2464	29	2221 2323	17	2333 3323	22
3	2312 2212	15	6554 3573	38	2123 2110	12	4443 3334	28	1222 2344	20	4223 2211	17
4	3222 2222	17	3224 4243	24	0122 3112	12	3222 3232	19	3333 3454	28	1222 4433	21
5	1222 2222	15	3333 3354	27	2335 4435	29	2222 2221	15	6653 5621	34	4333 3335	27
6	2122 2212	14	2324 3343	24	4222 2112	16	1222 3211	14	1211 2111	10	5544 4433	32
7	2112 2464	22	2233 3233	21	1012 2211	10	1122 2323	16	1121 3321	14	3222 3333	21
8	3222 2222	17	1122 2223	15	0123 1121	11	1111 0101	6	1022 1223	13	3222 2334	21
9	2234 3345	26	4223 4355	28	3313 2222	18	1111 1110	7	2223 4334	23	3122 2121	14
10	4123 3345	25	3322 4133	21	2112 2322	15	0112 2212	11	3322 3233	21	0442 1222	17
11	2232 2235	21	3332 3343	24	1122 1**2	-	4333 2331	22	4332 3321	21	3222 3321	18
12	3222 3423	21	2122 2344	20	1022 2211	11	1123 4444	23	2322 3322	19	1112 2221	12
13	4332 2232	21	1333 3334	23	0*** 2325	-	4022 2233	18	1332 3312	18	2334 5532	27
14	1123 1112	12	4222 2354	24	5533 2423	27	0221 1222	12	1233 4443	24	3442 3333	25
15	1111 1211	9	4222 3342	22	3234 4322	23	1111 2222	12	3332 4422	23	2242 3222	19
16	2212 2211	13	4223 3412	21	2122 2233	17	1121 2321	13	4222 3333	22	4332 3433	25
17	0122 2222	13	1223 3323	19	3233 2224	21	1222 2232	16	2222 2331	17	4433 4332	26
18	1222 2212	14	3313 2244	22	1132 2223	16	4322 3123	20	0132 3332	17	3332 3332	22
19	1102 1222	11	5233 4543	29	3122 2222	16	3222 2234	20	1242 3221	17	2321 2231	16
20	1112 2342	16	2323 3332	21	2222 2112	14	3333 3222	21	0132 3121	13	4452 4454	32
21	3223 3334	23	1322 3343	21	0121 2333	15	4333 2322	22	1112 2532	17	4322 1333	21
22	2222 3221	16	1133 3321	17	3334 4445	30	1122 2313	15	0113 3331	15	2235 4443	27
23	1121 2211	11	2222 2213	16	3333 4221	21	2122 2342	18	2233 3232	20	2322 3322	19
24	0022 3112	11	1233 2222	17	2122 2234	18	2223 4547	29	1032 2233	16	2232 4442	23
25	1122 3010	10	2333 2221	18	1123 2112	13	6342 2677	37	3433 3334	26	3332 3323	22
26	0032 2211	11	1223 2311	15	2123 3244	21	5433 3577	37	4431 2333	23	2122 2120	12
27	0134 4343	22	3323 3221	19	4334 4434	29	6542 3356	34	3333 4444	28	3434 5644	33
28	2233 3233	21	3123 3232	19	4443 3324	27	6676 6755	48	3435 5445	33	3333 3322	22
29	3333 2212	19			1221 2113	13	1233 4444	25	5443 2333	27	3232 4222	20
30	1122 3432	18			2222 3342	20	3433 *343	-	2322 2333	20	2321 3231	17
31	1012 2211	10			2464 4555	35			4312 1233	19		

MAGNETIC OBSERVATIONS, ABINGER 1940.

THREE-HOUR-RANGE INDICES 'K' FOR THE YEARS 1929-1939												
Date	July		August		September		October		November		December	
1937	Indices	Sum	Indices	Sum	Indices	Sum	Indices	Sum	Indices	Sum	Indices	Sum
1	3222 3332	20	3322 2433	22	1222 4424	21	5343 3343	28	0012 1222	10	4432 2231	21
2	2222 2343	20	4553 5533	33	2211 1110	9	3222 1110	12	3323 2233	21	3333 2112	18
3	2131 2112	13	2233 3234	22	2121 1111	10	3324 3444	27	3133 1111	14	2221 2132	15
4	2111 3222	14	6342 2341	25	1232 2222	16	6664 4433	36	0022 2210	9	2112 2111	11
5	3323 3433	24	4221 2332	19	4333 2222	21	2232 3312	18	1132 2111	12	1111 1231	11
6	4123 4433	24	2322 233*	(19)	2212 3322	17	2234 4331	22	1111 1111	8	2312 2223	17
7	4343 3333	26	***4 4232	-	1222 2232	16	3343 4334	27	2222 2333	19	2233 2442	22
8	1212 2322	15	2322 2211	15	1111 2232	13	5643 3522	30	4333 3334	26	3322 3443	24
9	1333 5434	26	1123 3321	16	1222 2213	15	0134 5554	27	3233 4313	22	2312 2233	18
10	5333 3211	21	1322 2221	15	1222 2446	23	4454 3325	30	1122 3301	13	3221 3233	19
11	1222 4534	23	1122 1233	15	5543 3322	27	2234 6553	30	2123 3243	20	3232 4222	20
12	4232 2221	18	2221 2221	14	1013 1112	10	3245 3265	30	3323 2133	20	3111 1121	11
13	1212 3224	17	2222 2221	15	3232 1334	21	3224 4310	19	1121 1331	13	1112 2122	12
14	2343 4542	27	1211 1133	13	2333 3222	20	1433 2221	18	2221 2101	11	1011 1111	7
15	3323 3433	24	3332 3212	19	3222 2122	16	1133 3352	21	0011 1111	6	0012 2211	9
16	1213 5422	18	1122 1222	13	1233 2242	19	2132 2222	16	1001 0000	2	2111 1111	9
17	2232 3333	21	1212 2212	13	2432 3231	20	2222 2222	16	1121 1322	13	1111 1211	9
18	1122 3233	17	2222 22**	-	2211 1334	17	3212 2122	15	3433 3444	28	1322 3544	24
19	1222 4563	25	***2 2323	-	4312 2120	15	1113 2231	14	3233 4423	24	4343 3552	29
20	4443 3333	27	1021 1231	11	1011 1013	8	1011 2110	7	3343 4424	27	3323 3543	26
21	3232 3233	21	2222 1213	15	5311 1024	17	0023 2232	14	2222 3233	19	2221 1333	17
22	4354 3344	30	1575 5442	33	1023 2222	14	1223 3334	21	2335 4553	30	2132 3232	18
23	3333 4554	30	2122 3221	15	2213 2234	19	4243 3546	31	3233 4554	29	3233 5551	27
24	6433 3443	30	1011 1110	6	2432 2212	18	6234 4454	32	3342 3242	23	1010 2463	17
25	4433 4543	30	0121 2220	10	2123 1212	14	3233 3323	22	2022 2232	15	2223 2113	16
26	2332 3321	19	**3 2232	-	1034 3212	16	4453 3444	31	1121 1213	12	3434 3300	20
27	1222 3331	17	2332 3434	24	3231 2321	17	3343 3333	25	1012 2234	15	1121 1110	8
28	2223 2222	17	3224 4222	21	1222 1221	13	2233 3334	23	2332 4434	25	0111 2211	9
29	0211 1222	11	3322 2212	17	2122 1100	9	2222 2322	17	3224 4444	27	3111 1111	10
30	2223 4422	21	2111 1200	8	0023 5555	25	3122 1021	12	2423 3565	30	1112 2211	11
31	0112 2323	14	1122 2112	12			2121 2032	13			2221 3355	23

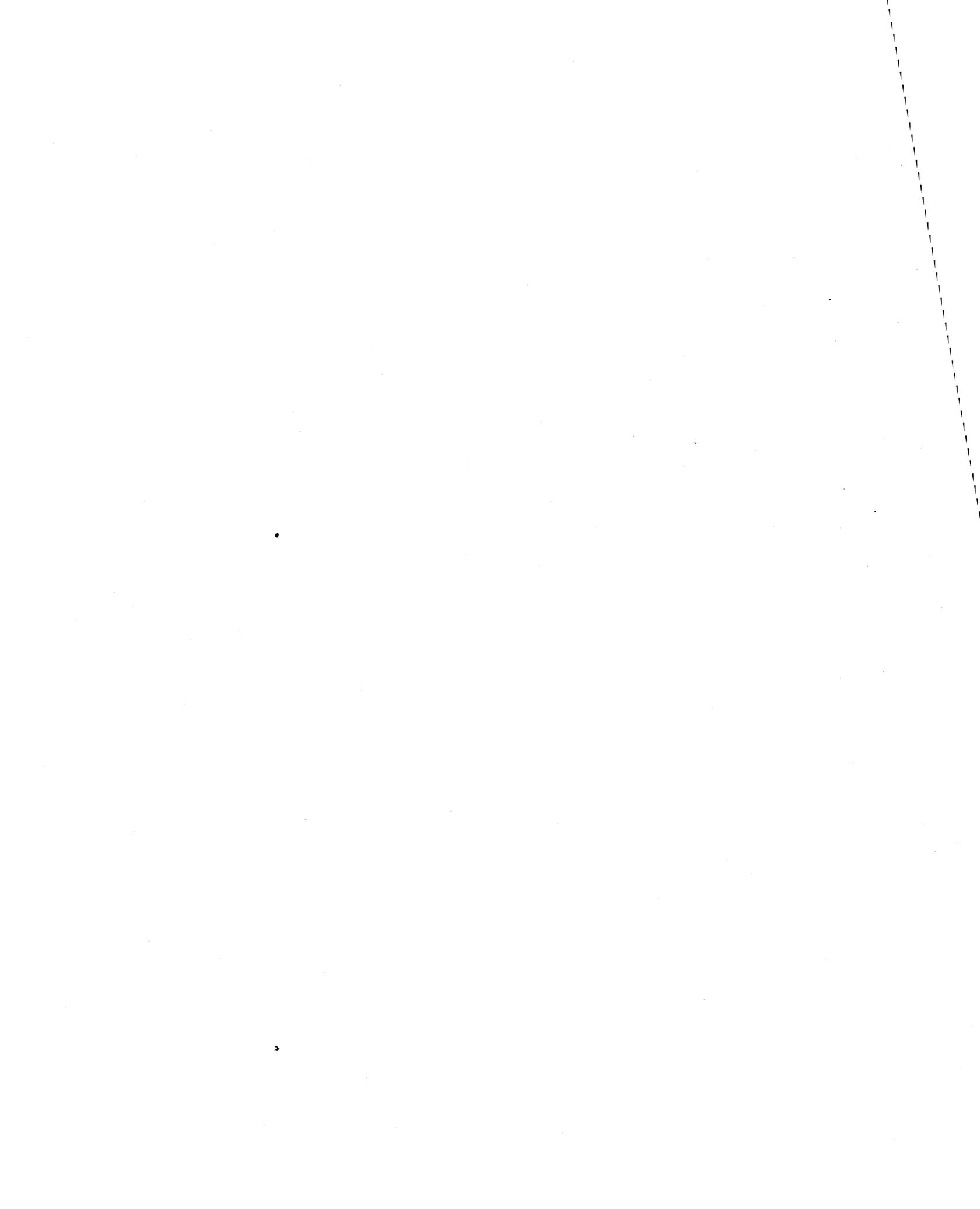
THREE-HOUR-RANGE INDICES 'K' FOR THE YEARS 1929-1939												
Date 1938	January		February		March		April		May		June	
	Indices	Sum	Indices	Sum	Indices	Sum	Indices	Sum	Indices	Sum	Indices	Sum
1	3223 2333	21	2222 4245	23	4333 4353	28	1032 1332	15	2222 2223	17	2232 2232	18
2	2322 4333	22	3222 3332	20	423* **3	-	1133 1122	14	2132 3222	17	2*22 4445	(26)
3	3112 3342	19	3233 3433	24	3423 2221	19	3222 3332	20	2432 3334	24	4222 2123	18
4	2233 5555	30	3222 4433	23	1122 3334	19	2223 3322	19	4532 3653	31	2322 2220	15
5	3234 2211	18	3222 2221	16	4243 4565	33	1122 2101	10	3322 3444	25	2333 3331	21
6	2122 3532	20	3553 4564	35	5344 2333	27	2353 3344	27	3343 3421	23	2232 3321	18
7	4322 3455	28	4333 5433	28	3232 3331	20	4433 3322	24	0113 2310	11	2222 2225	19
8	4432 1124	21	2223 3665	29	2222 2213	16	2223 2333	20	1222 3223	17	4443 5554	34
9	5232 2211	18	4544 3443	31	1122 2223	15	1133 3233	19	1112 3223	15	2332 3433	23
10	2212 1221	13	4543 4312	26	1122 2211	12	3123 3332	20	4322 3322	21	2333 3442	24
11	2221 2321	15	4543 2331	25	1122 2233	16	1223 3534	23	3333 2888	38	3343 3444	38
12	1222 2455	23	1233 3212	17	3333 3322	22	2233 3243	22	6553 4546	38	4444 3555	34
13	4543 2343	28	4234 3343	26	1132 2213	15	2133 4546	28	5212 3213	19	3554 4434	32
14	2231 3223	18	3445 4542	31	3333 3232	22	5554 4443	34	3334 5435	30	4222 3212	18
15	2122 2244	19	2122 2111	12	3333 3222	21	4344 4333	28	5433 4423	28	2112 2222	14
16	2132 3337	24	2222 3102	14	1123 1222	14	3796 7545	46	3333 3333	24	0133 3333	19
17	6565 7746	46	0022 3012	10	3223 2312	18	2333 4544	28	3332 3343	24	2222 2342	19
18	3433 4555	32	2332 3313	20	2122 0211	11	4232 3453	26	2332 2221	17	1132 2222	15
19	3333 3553	28	2121 1101	9	1132 2211	13	4233 3343	25	2121 3322	16	2111 3421	15
20	2332 4453	26	0121 2102	9	1121 2222	13	2232 3232	19	2010 3212	11	2221 2223	16
21	3453 5535	33	1122 1100	8	2221 3335	21	2232 3333	21	2133 2311	16	3334 4222	23
22	5689 5655	49	0111 2212	10	4454 4345	33	3311 3444	23	2221 3432	19	2322 2212	16
23	3333 2244	24	3333 4333	25	5445 3365	35	4343 3545	31	1112 2221	12	0112 2220	10
24	3433 2334	25	3232 2233	20	5553 2313	27	3323 3332	22	1112 4544	22	1123 3332	18
25	4225 6799	44	2114 3441	20	3222 **34	-	3333 3333	24	4332 3234	24	2212 3222	16
26	9544 4442	36	3122 2243	19	5323 3333	25	3223 3212	18	2**2 2321	-	1132 3221	15
27	2333 3443	25	2222 3434	22	4121 2022	14	1212 2322	15	2322 2432	20	2223 3122	17
28	2222 3243	20	4333 3254	27	2222 2112	14	1212 2310	12	2343 4443	27	2122 2222	15
29	2323 1145	21			2023 3341	18	2211 2201	11	3453 5634	33	2131 2252	18
30	4222 2243	21			1233 2101	13	1222 2311	14	2243 4333	24	2322 3321	18
31	4234 3466	32			1032 3222	15			2232 2232	18		

THREE-HOUR-RANGE INDICES 'K' FOR THE YEARS 1929-1939												
Date 1938	July		August		September		October		November		December	
	Indices	Sum	Indices	Sum	Indices	Sum	Indices	Sum	Indices	Sum	Indices	Sum
1	2452 4444	29	3233 3434	25	3222 2322	18	5644 3254	33	2222 3221	16	1111 2222	12
2	3433 3321	22	4433 3445	30	1223 3222	17	3322 3334	23	1123 3212	15	2112 3365	23
3	1222 3222	16	4232 1437	26	2332 2323	20	3222 2344	22	1122 2222	14	5433 3453	30
4	2222 5555	28	5464 4535	36	2122 3324	19	2313 4222	19	2123 2232	17	4322 1232	19
5	5423 5342	28	4442 5443	30	3323 4421	22	0132 2221	13	1122 2321	14	2223 3212	17
6	3323 3431	22	3333 2333	23	1122 2223	15	0233 3231	17	2122 2132	15	2211 2233	16
7	1121 3333	17	2342 4532	25	2222 2432	19	0243 5674	31	1133 1132	15	1111 2231	12
8	2322 3322	19	1233 3232	19	3222 3331	19	5654 5442	35	3324 3435	27	1122 1210	10
9	2122 2344	20	2133 3222	18	1133 3432	20	2143 2344	23	5353 3554	31	1322 2433	20
10	5333 4664	34	1333 4433	24	2233 3222	19	3333 3234	24	4222 2112	16	2233 3564	28
11	4332 2231	20	4343 4544	31	2323 3334	23	3323 2331	20	1022 2222	13	2333 2222	19
12	1232 4312	18	3333 3323	23	3322 3334	23	1133 2133	17	2122 2111	12	2232 3222	18
13	1213 4344	22	4322 3221	19	2422 2356	26	1122 2233	16	2132 2111	13	3232 2243	21
14	5433 4342	28	112* ***3	-	5532 3555	33	2132 2112	14	1022 3453	20	2123 2343	20
15	3353 5565	35	1223 2311	15	5664 5565	42	1132 2212	14	3222 2223	18	2222 2221	15
16	5345 4464	35	1113 1221	12	4232 2334	23	3323 3333	23	1222 2224	17	2223 3454	25
17	3232 2221	17	1122 3422	17	3431 3311	19	3113 3211	15	2223 5544	27	5443 3445	32
18	0122 3332	16	2222 2211	14	2212 3213	16	1223 2232	17	2223 3243	21	5334 4544	32
19	4333 3221	21	1221 2332	16	2112 2233	16	3322 3223	20	3233 2122	18	2232 3444	24
20	1232 2322	17	1111 2121	10	3121 3211	14	3333 3341	23	2132 3232	18	4222 3344	24
21	3223 3332	21	0023 3342	17	1122 3234	18	2213 3223	18	1124 4444	24	2222 3122	16
22	1322 2331	17	2221 5553	25	2333 3321	20	1133 3333	20	3432 3322	22	3453 3233	26
23	1221 3333	18	4444 6432	31	2332 3222	19	2233 3335	24	3332 3323	22	3122 2213	16
24	2132 2222	16	1223 3254	22	2222 2222	16	3333 4435	28	3332 3443	25	1122 2122	13
25	3122 2321	16	4333 3332	24	1122 2222	14	5334 4345	31	3223 2422	20	2112 3211	13
26	1222 3221	15	1233 3222	18	3254 4455	32	4334 4555	33	3343 3423	25	1110 2221	10
27	1232 3322	18	2233 3222	19	3232 2446	26	4443 4444	31	3223 2112	16	1012 2223	13
28	1232 3322	18	1232 3443	22	6643 4332	31	4233 4442	26	1122 2222	14	2112 2222	14
29	0123 4333	19	3232 2343	22	2333 3233	22	3231 1443	21	2132 1324	18	1122 2222	14
30	3544 5454	34	3433 3332	24	1213 5375	27	4122 2110	13	3112 2221	14	2213 2322	17
31	4222 2221	17	2322 2111	14			2212 2112	13			3112 2212	14

THREE-HOUR-RANGE INDICES 'K' FOR THE YEARS 1929-1939												
Date 1939	January		February		March		April		May		June	
	Indices	Sum	Indices	Sum	Indices	Sum	Indices	Sum	Indices	Sum	Indices	Sum
1	2121 2211	12	2122 3354	22	3223 4445	27	3433 3455	30	2236 5455	32	2233 4543	26
2	1222 2222	15	4333 3454	29	4434 3223	25	3422 2444	25	5444 4333	30	4443 4443	30
3	2122 2111	12	3332 3233	22	3333 3436	28	3333 3333	24	4333 3443	27	3333 4332	24
4	0121 2222	12	2323 3122	18	4432 3344	27	4332 3354	27	2223 2321	17	3333 4432	25
5	2322 3334	22	2123 2244	20	3222 2344	22	3333 4322	23	2333 3465	29	3333 4323	24
6	3112 2343	19	2335 4454	30	3232 3433	23	1232 3221	16	4443 5545	34	3231 3322	19
7	2222 3232	18	4433 3343	27	4222 2323	20	2132 3421	18	5544 4433	32	2122 3221	15
8	3322 3343	23	2122 2234	18	3433 2232	22	1222 2343	19	5343 4344	30	2221 3231	16
9	2232 3334	22	2222 3344	22	3344 3342	26	3222 3343	22	3534 4423	28	1221 2222	14
10	2323 3332	21	3322 3443	24	3222 3224	20	5443 4455	34	2222 3431	19	3322 3322	20
11	2222 3344	22	4423 2221	20	2233 3423	22	4334 3554	31	2223 3210	15	1123 2223	16
12	2222 3222	17	2121 3111	12	3223 2344	23	3333 3223	22	2222 3322	18	2222 3212	16
13	2122 3212	15	1021 1233	13	3223 3112	17	3232 3333	22	1243 4322	21	3332 3444	26
14	3223 3314	21	1122 2232	15	1123 3313	17	2323 3323	21	1223 3222	17	5566 4433	36
15	2322 2211	15	4322 3322	21	1223 3433	21	1222 2222	15	2332 3333	22	3333 4333	25
16	2112 3243	18	2333 3324	23	4434 4343	29	2122 1224	16	4444 4332	28	4446 3331	28
17	4323 3223	22	2233 **43	-	4332 3332	23	6675 7665	48	2333 3343	24	2112 2234	17
18	3332 2213	19	2132 2324	19	4112 2111	13	2354 5554	33	3334 3423	25	3333 4444	28
19	1122 1223	14	3332 3243	23	0121 2133	13	4343 5753	34	3433 2333	24	4433 4434	29
20	3332 1232	19	2322 2322	18	4322 2312	19	3344 4533	29	3434 3333	26	4343 4333	27
21	3222 4341	21	2212 1111	11	0334 2342	21	4343 3434	28	2222 3544	24	4433 3443	28
22	1221 2244	18	1112 2221	12	3433 4444	29	3322 3453	25	4354 3325	29	3333 2333	23
23	3223 4222	20	3222 ***4	-	4333 3335	27	3675 5653	40	3333 3454	28	3223 4343	24
24	1331 2113	15	3313 3466	29	2222 3334	21	3232 3785	33	5423 4444	30	3322 3323	21
25	3212 2112	14	6554 5545	39	2322 2214	18	6444 5654	38	4433 3544	30	2222 3222	17
26	1111 2110	8	2212 2224	17	3222 2244	21	3321 3322	19	4333 3343	26	2322 2355	24
27	0120 2211	9	1111 3211	11	4333 2355	28	0012 1325	14	3323 2344	24	3334 4422	25
28	1222 2333	18	2222 3433	21	3333 4565	32	4323 3433	25	4353 2234	26	2222 4534	24
29	3212 1212	14			5556 6555	42	2333 3442	24	4454 4544	34	3444 4423	28
30	2222 3221	16			4333 3565	32	2222 3341	19	2234 3222	20	4334 4333	27
31	0212 2111	10					4333 4334	27			2331 2233	19

THREE-HOUR-RANGE INDICES 'K' FOR THE YEARS 1929-1939

Date 1939	July		August		September		October		November		December	
	Indices	Sum	Indices	Sum	Indices	Sum	Indices	Sum	Indices	Sum	Indices	Sum
1	3234 3232	22	3222 2222	17	1222 2321	15	3322 2323	20	3223 3231	19	2333 2232	20
2	3332 3333	23	1221 2221	13	1222 2425	20	1122 2223	15	1222 2211	13	1121 2233	15
3	3544 6464	36	0021 2222	11	5544 4543	32	3243 5455	31	3122 3223	18	1111 1124	12
4	4333 5565	34	0212 2322	14	3312 3220	16	5533 4332	28	3132 2112	15	3221 2112	14
5	5555 6664	42	1133 2222	16	1213 2223	16	3223 3252	22	1123 3221	15	1111 2444	18
6	4333 2222	21	2122 2212	14	3222 3223	19	3533 3333	26	1122 2233	16	4232 3255	26
7	1112 2121	11	2222 3121	15	3222 3221	17	2223 4455	27	2212 2332	17	5534 5445	35
8	2112 3232	16	1111 1332	13	2114 2232	17	3322 2333	21	1111 3121	11	3442 3544	29
9	3122 2211	14	1122 2111	11	4343 3333	26	4363 5342	30	1222 2211	13	4233 4342	25
10	2222 3311	16	0224 3442	21	3332 4342	24	1122 3213	15	1212 2221	13	2122 3333	19
11	1223 5441	22	2122 4445	24	2222 3322	18	3233 3244	24	2321*2133	17	3222 2122	16
12	1234 5532	25	5665 4345	38	3333 2223	21	3221 2211	14	4213 3322	20	3122 2334	20
13	1221 2322	15	5333 3443	28	2223 3323	20	*454 4576	(40)	3544 3454	32	3222 3311	17
14	2345 5534	31	3432 2211	18	3323 3323	22	5555 5654	40	4433 3334	27	3111 2222	14
15	3232 3333	22	1121 2432	16	3223 2224	20	6653 4553	37	3222 2332	19	2222 2322	17
16	2434 4554	31	1333 6655	34	3212 3232	18	3333 3655	32	2111 2321	13	1212 1325	17
17	4433 4434	29	5433 3331	25	3443 5554	33	4444 4454	33	1122 2232	15	3222 2122	16
18	3322 2332	20	1232 2323	18	3332 2211	17	3334 3464	30	1122 2222	14	2121 1211	11
19	2222 2335	21	1233 3521	20	2344 3445	29	4433 3343	27	1113 3432	18	0111 1111	7
20	4544 5544	35	2223 3332	20	5443 3453	31	3223 1211	15	3311 1132	15	1121 2232	14
21	3314 6433	27	2123 3324	20	3223 3333	22	1133 3244	21	1112 2211	11	2243 4343	25
22	4434 3433	28	6544 5666	42	2233 3324	22	2222 2243	19	1011 2112	9	5332 4434	28
23	4232 3321	20	6655 5344	38	2222 2123	16	1232 4423	21	1222 2221	14	1322 2224	18
24	2232 4343	23	4232 4313	22	2332 3121	17	4222 2221	17	1112 3244	18	2233 2333	21
25	3443 2321	22	3322 4322	21	1233 3333	21	2222 2210	13	3432 2355	27	3212 3223	18
26	2554 5534	33	2223 3232	19	4533 3353	29	1122 1233	15	4333 3243	25	2312 2212	15
27	3332 3434	25	2223 4333	22	2221 2233	17	1122 2212	13	1323 2232	18	2313 3342	21
28	2233 2322	19	1123 3321	16	2222 2120	13	1123 3234	19	1212 2*21	(13)	1222 2333	18
29	2223 2331	18	4222 2121	16	0122 2211	11	3332 2242	21	2122 3323	18	3222 2434	22
30	1323 2311	16	1122 2432	17	1233 2243	20	4222 2232	19	1321 2232	16	4212 2322	18
31	2222 2222	16	1112 2321	13			3222 2221	16			1121 2211	11



ROYAL OBSERVATORY, GREENWICH.

**Results of
Meteorological Observations**

1940

TABLE XVII. - DAILY RESULTS OF THE METEOROLOGICAL OBSERVATIONS

Month and Day 1940	RECORD OF THE NIGHT SKY				WIND AS DEDUCED FROM SELF-REGISTERING ANEMOMETERS					CLOUDS AND WEATHER			
	Polaris		δ URSÆ MINORIS		OSLER'S			Robin-son's					
	Duration	Fraction of Total Exposure	Duration	Fraction of Total Exposure	General Direction		Pressure on the Square Foot		Horizontal Movement of the Air				
					A.M.	P.M.	Greatest	Mean of 24 Hourly Measures		0 ^h to 6 ^h	6 ^h to 12 ^h	12 ^h to 18 ^h	18 ^h to 24 ^h
hours		hours				lbs.	lbs.	miles					
Jan. 1	10.3	0.75	10.0	0.72	Calm	E:ESE	1.2	0.05	209	c b f x	b f F f	b Ci f c	c b x
2	13.7	1.00	13.7	1.00	ESE	E	0.6	0.05	243	b x m	b x m	b x m	b m x
3	11.8	0.86	10.8	0.79	E	E	2.0	0.18	311	b m x	b x c Cist m	c Cist so-ha b m _o	b
4	4.0	0.29	3.0	0.22	E	E	1.3	0.12	277	b	b St m b c	c m _o	c m _o
5	6.8	0.50	6.4	0.46	E	ENE: Calm	0.0	0.00	194	c b x m _o	b x f m	b Cist m	b m x F
6	0.0	0.00	0.0	0.00	Calm	Calm: SSE	0.1	0.00	159	FeFe x	FeFe	FeFe o f	o f d
7	0.0	0.00	0.0	0.00	S: SSW	SSW: Calm	0.0	0.00	203	dd f	dd c f	c f	c f m rr
8	0.0	0.00	0.0	0.00	NNW	NNW	1.1	0.07	251	rrr _o c m	c b Frcu f	b c Cist Frst m	c m c
9	10.0	0.73	9.4	0.69	NNE: NE: ENE	ENE: E	1.1	0.14	301	c	c m _o	c m _o	c b x
10	13.8	1.00	13.8	1.00	E: ESE	ESE: E	0.5	0.02	238	b x	b x m	b Cist y m _o x	b x
11	13.8	1.00	13.8	1.00	Calm: NE	ENE: NE	1.5	0.10	263	b x	b f m _o x	b m x	b m _o x
12	13.8	1.00	13.8	1.00	NE	NE: ENE	0.6	0.06	266	b x	b x f m _o	b bc b m _o	b x
13	13.3	1.00	13.3	1.00	ENE: Calm	Calm: NE	0.0	0.00	197	b m _o x	b f x	b f x	b f x
14	0.3	0.03	0.0	0.00	ENE: Calm	Calm	0.0	0.00	148	b f x	f f x	F f x	ffx
15	2.6	0.20	1.9	0.14	WSW	SW: WSW	0.0	0.00	231	ffx	b f x	b f x	b f c x
16	13.1	0.99	12.7	0.96	WSW: NNW	NNW: NNE	2.7	0.32	368	c b x c	c x m b	b c Nbst ss _o b	bc s _o b
17	13.3	1.00	13.3	1.00	NNE: NNW	NNW: W	2.0	0.25	347	b x	b x f c Frst m _o	bc Frst b m _o x	b m _o x
18	4.8	0.36	3.7	0.28	WSW	WSW: SW: S	0.2	0.01	272	b m _o x	b f c Cist f so-ha x	b Ci Acu f	b f c s _o c
19	12.9	0.97	10.9	0.82	S	S: SE	1.2	0.05	255	c s _o c b	b bc Frcu Acu m c Cist	c bc Stcu b	b Cist lu-ha
20	12.8	0.98	12.8	0.97	ESE: Calm	Calm: NNE: N	0.4	0.03	213	b f	b f b Acu Ci	b c b	b
21	0.0	0.00	0.0	0.00	N: NNW	N	2.7	0.30	318	b c b	b m c Acu Nbst s _o	s _o s _o m _o	s c
22	0.6	0.04	0.0	0.00	N	N: Calm	3.0	0.27	299	c s _o c	c	c s _o c	c
23	12.7	0.97	12.2	0.94	NNW: W	WSW: SSW	0.1	0.00	220	c	c St ff b f	b Ci ff	f b
24	0.0	0.00	0.0	0.00	SSW: SW	SW	1.4	0.07	285	b	b m c Stcu f m _o	c Frcu m _o	c m _o
25	1.0	0.07	0.5	0.03	SW: SSW	SSW: SSE	0.3	0.01	225	c	c Acu m bc m _o	bc Acu Cist prhn y c	f c
26	0.0	0.00	0.0	0.00	SSE	SSE: Calm	1.0	0.03	196	c	c Acu Macu d _o d _o	d _o d _o rr rs s c	c
27	0.0	0.00	0.0	0.00	ESE	ESE	3.0	0.27	345	c r _o rr	rr Nbst m _o r _o	o Nbst irro s _o s	ss
28	0.0	0.00	0.0	0.00	ESE	ESE	1.8	0.28	368	ss s _o	is _o c Nbst is _o	c r _o s _o	r _o s _o r _o s _o
29	0.0	0.00	0.0	0.00	ESE	ESE	4.5	0.89	482	c ss	c s St	c Nbst	o s _o s _o
30	0.0	0.00	0.0	0.00	ESE: E	E	1.6	0.23	360	s _o s _o	c Nbst is _o	is _o c St	r _o s _o r _o s _o c
31	0.0	0.00	0.0	0.00	E	ENE	0.8	0.14	309	c r _o s _o	c r _o s _o r _o s _o f c St d _o	Nbst d _o d _o f	d _o d _o f o
Means	6.0	0.44	5.7	0.42	..	..	..	0.13	270				
No. of Col. for Ref.	19	20	21	22	23	24	25	26	27	28	29	30	31

The mean *Temperature of Evaporation* for the month was 29°·7, being 7°·5 lower than
 The mean *Temperature of the Dew Point* for the month was 27°·7, being 7°·4 lower than
 The mean *Degree of Humidity* for the month was 87·2, being 0·4 greater than
 The mean *Elastic Force of Vapour* for the month was 0·148 in., being 0·057 in. less than } the average for the 65 years, 1841-1905.

The mean amount of *Cloud* for the month (a clear sky being represented by 0 and an overcast sky by 10) was 5·6.

The mean proportion of *Sunshine* for the month (constant sunshine being represented by 1) was 0·206. The maximum daily amount of *Sunshine* was 6·3 hours on January 10.

The highest reading of the *Solar Radiation Thermometer* was 59°·1 on January 7; and the lowest reading of the *Terrestrial Radiation Thermometer* was 10°·1 on January 20.

The *Proportions of Wind* referred to the cardinal points were N.19, E.40, S.17, W.10, calm or nearly calm conditions, 14, the whole month being represented by 100.

The *Greatest Pressure of the Wind* in the month was 4·5 lbs. on the square foot on January 29. The mean daily *Horizontal Movement of the Air* for the month was 270 miles; the greatest daily value was 482 miles on January 29, and the least daily value was 148 miles on January 14.

Rain (0·005 in. or over) fell on 11 days in the month, amounting to 2·222 in., as measured by gauge No.6 partly sunk below the ground; being 0·341 in. greater than the average fall for the 65 years, 1841-1905.

TABLE XVII. - DAILY RESULTS OF THE METEOROLOGICAL OBSERVATIONS

Month and Day 1940	RECORD OF THE NIGHT SKY				WIND AS DEDUCED FROM SELF-REGISTERING ANEMOMETERS				CLOUDS AND WEATHER				
	Polaris		δ URSAE MINORIS		OSLER'S			Robin-son's					
	Duration	Fraction of Total Exposure	Duration	Fraction of Total Exposure	General Direction		Pressure on the Square Foot		Horizontal Movement of the Air				
					A.M.	P.M.	Greatest	Mean of 24 Hourly Measures		0 ^h to 6 ^h	6 ^h to 12 ^h	12 ^h to 18 ^h	18 ^h to 24 ^h
hours		hours				lbs.	lbs.	miles					
Feb. 1	0.0	0.00	0.0	0.00	ENE:NNE	NNE	0.5	0.01	232	o f	o f d _o o Nbst	d _o o f	o s _o s _o f
2	0.0	0.00	0.0	0.00	Calm:NNE	E:ENE	0.0	0.00	208	s _o s _o f	f o St	c o m	o m
3	1.9	0.15	0.9	0.07	ENE:E	E:ESE	0.7	0.05	257	o r dd _o f	o d _o o St f	o f m	c b c r _o r _o
4	0.0	0.00	0.0	0.00	ESE:S	SSW	0.4	0.02	245	rrr _o d _o o	d _o c rr _o m	rr c m	c b c m f
5	0.0	0.00	0.0	0.00	SW	Calm	0.0	0.00	181	c m f	c m f	c St m f	c f
6	0.0	0.00	0.0	0.00	SW:Calm	S:SSE	0.0	0.00	195	c f	c Stcu f c	c Stcu	c
7	0.0	0.00	0.0	0.00	SSE	SSW:SW:WSW	2.8	0.19	334	c r _o	c rr _o r _o c Nbst ir _o	c r _o	r _o d _o c r
8	0.0	0.00	0.0	0.00	NW:NNW	NNW:NE:ENE	2.8	0.17	338	c id	c id _o m _o	c NBst id _o m _o	o d _o m _o
9	3.5	0.28	3.1	0.25	ENE	ENE	3.0	0.66	449	c id _o m _o	c St id _o m _o	c id _o m _o	c id _o c m _o
10	9.8	0.82	8.2	0.68	ENE:E	E:Calm	2.8	0.33	317	c b	b x bc Ci Cist	b Cist bc	b x m
11	1.6	0.14	1.6	0.14	Calm	N:NE	0.4	0.04	191	c b c x m	c Stcu m f	c Prcu f	c f
12	4.4	0.36	4.2	0.35	ENE:NE	NE:NNW	1.4	0.13	302	c b f	c Acu s _o	s _o s _o bc Prcu	b c b c
13	1.7	0.14	1.6	0.13	NNW:N	NNE:N	2.0	0.17	301	c s _o ss c	c Nbst s _o s _o mc Prcu Stcu	c Stcu Nbst s _o c	c b
14	0.0	0.00	0.0	0.00	NE:ENE	NNE:N	0.7	0.07	263	c ps _o bc c sso	s _o s _o bc Acu Prcu m	bc Prcu c	c
15	3.0	0.25	2.8	0.24	NNE:Calm	NNW:Calm	0.3	0.02	187	c	c St m _o f	o St f	c
16	0.0	0.00	0.0	0.00	Calm:SSE	SSE	1.9	0.11	229	c b x c	c m bc m _o c	c Ast Prst m _o	o m _o s _o ss
17	5.1	0.45	5.1	0.45	SE:ESE	ENE:NNE	2.9	0.23	314	ss s _o s _o c m _o	c St iso m _o	c m _o	c b m _o
18	0.0	0.00	0.0	0.00	Calm:SSW	S:Calm	2.5	0.08	217	b c m _o	c m _o	c s _o m _o	c d _o rr m _o
19	0.0	0.00	0.0	0.00	Calm:NE	Calm:E	0.5	0.01	165	rr dd	dd f c St m	o d _o dd f	dd f m
20	6.0	0.52	5.3	0.46	Calm	SSW	0.3	0.02	195	dd f m	dd c Ast f	c f m _o	c lu-ha b
21	1.3	0.11	1.3	0.11	SSW	SSW	0.4	0.04	235	b c d _o c	c Prcu Acu	c	c f w
22	7.2	0.62	5.1	0.45	Calm:S	SSW	0.7	0.07	236	c m w	c Acu m Prst m _o	c Cist	c b bc lu-ha w
23	6.0	0.52	6.0	0.52	SW:SSW	SW	2.5	0.15	306	c lu-ha d	c Stcu r _o c	c Stcu d _o c	c r _o r c
24	0.0	0.00	0.0	0.00	WSW:W	W:Calm	2.0	0.15	301	c b	b Prst bc Acu Prcu	bc c Prcu Stcu	c
25	0.0	0.00	0.0	0.00	Calm	ESE:ENE	0.2	0.00	151	c	c Stcu m	c	c m f
26	0.8	0.07	0.6	0.05	Calm	SSW:S	1.2	0.07	207	c m f w	c Prcu f b m	b m c	c d _o
27	1.5	0.14	1.0	0.09	S:SSW	SSW	4.5	0.27	327	d _o o c d _o c	c id _o c St bc c Prcu Acu	c r	rrr _o c b c
28	0.0	0.00	0.0	0.00	SSW:SW	SW:N	3.3	0.57	397	c r _o r _o c	c Nbst id _o	c d id _o c	c
29	0.0	0.00	0.0	0.00	NNE:NE	NE:ENE	2.8	0.35	367	c d _o o c	c Nbst	c ir _o	ir _o c
Means	1.9	0.16	1.6	0.14	..	..	..	0.14	264				
No. of Col. for Ref.	19	20	21	22	23	24	25	26	27	28	29	30	31

The mean *Temperature of Evaporation* for the month was 36°·5, being 1°·2 lower than
 The mean *Temperature of the Dew Point* for the month was 34°·7, being 0°·3 lower than
 The mean *Degree of Humidity* for the month was 88·5, being 4·9 greater than
 The mean *Elastic Force of Vapour* for the month was 0·201 in., being 0·003 in. less than
 The mean amount of *Cloud* for the month (a clear sky being represented by 0 and an overcast sky by 10) was 8·9.
 The mean proportion of *Sunshine* for the month (constant sunshine being represented by 1) was 0·076. The maximum daily amount of *Sunshine* was 8·3 hours on February 24.
 The highest reading of the *Solar Radiation Thermometer* was 96°·8 on February 24; and the lowest reading of the *Terrestrial Radiation Thermometer* was 18·0 on February 12.
 The *Proportions of Wind* referred to the cardinal points were N.19, E.22, S.26, W.12, calm or nearly calm conditions, 21, the whole month being represented by 100.
 The *Greatest Pressure of the Wind* in the month was 4·5 lbs. on the square foot on February 27. The mean daily *Horizontal Movement of the Air* for the month was 264 miles; the greatest daily value was 449 miles on February 9, and the least daily value was 151 miles on February 25.
Rain (0·005 in. or over) fell on 18 days in the month, amounting to 1·429 in. as measured by gauge No.6 partly sunk below the ground; being 0·051 in. less than the average fall for the 65 years, 1841-1905.

} the average for the 65 years, 1841-1905.

TABLE XVII. - DAILY RESULTS OF THE METEOROLOGICAL OBSERVATIONS

Month and Day 1940	RECORD OF THE NIGHT SKY				WIND AS DEDUCED FROM SELF-REGISTERING ANEMOMETERS					CLOUDS AND WEATHER			
	Polaris		δ URSAE MINORIS		OSLER'S			Robinson's					
	Duration	Fraction of Total Exposure	Duration	Fraction of Total Exposure	General Direction		Pressure on the Square Foot		Horizontal Movement of the Air				
					A.M.	P.M.	Greatest	Mean of 24 Hourly Measures		0 ^h to 6 ^h	6 ^h to 12 ^h	12 ^h to 18 ^h	18 ^h to 24 ^h
hours		hours				lbs.	lbs.	miles					
Mar. 1	1.7	0.16	1.5	0.13	E:ENE	E:ENE	6.6	1.44	487	c	c b y	b bc y	b bc c
2	10.6	0.98	10.0	0.93	E:ENE	E:ENE	4.5	0.78	410	c d o c b	b Ci y	bc Ci Cist y	bc y b
3	9.8	0.91	6.7	0.63	NE:ENE	Calm	0.3	0.02	187	b x	b x f b y	b bc y	b m f x
4	3.0	0.28	2.9	0.27	WSW:W	W:NNW	3.6	0.17	281	b x c m f	c St m f	c Stcu b Cist m	b c b c
5	6.5	0.60	6.5	0.60	N	N	2.2	0.31	319	c	c bc b bc Cu Frcu y	bc y c	c y b
6	10.3	0.96	10.0	0.93	N	N:Calm	1.2	0.14	253	b bc c m o	c bc c Frcu Acu m o	c y z o	c b m o x
7	9.8	0.91	6.9	0.64	Calm	Calm	0.0	0.00	120	b x m	b x f c Stcu z o y	c Ast z o y c f	c b f x
8	8.6	0.80	7.9	0.74	SW:Calm	SW	0.2	0.02	198	b x	b c Ast f c y	c Acu y b	b
9	4.9	0.47	2.6	0.25	WSW	WSW	1.3	0.13	285	b x	b m bc Cist Frcu y	bc c Acu Ast y	c y b bc
10	3.7	0.36	1.8	0.18	WSW:Calm:SSW	SW	0.8	0.06	234	b bc c	c Cist so-ha m c Stcu y	c Stcu y	c b c b
11	7.7	0.77	5.8	0.56	SW	SSW	1.3	0.09	287	b c b	bc Nbst rr o c Cist pr m y	bc Cist so-ha y	bc b c
12	0.7	0.06	0.4	0.04	SSW	SSW:SW	3.5	0.44	394	c b bc	c Stcu Acu Nbst d o	d o rr c Nbst d o c r o	r o c d o d o r
13	0.5	0.05	0.2	0.02	SSW:SW	SW:WSW	2.1	0.24	338	rr c	c Acu so-ha	c Nbst rr R c	c r
14	9.4	0.92	8.0	0.78	ENE:NE	NNW:SW	3.0	0.20	333	rr R rr o	r o r s ss s o Nbst	s o s o c r s	c b x
15	6.3	0.62	5.9	0.58	SW:WSW	WSW:W	3.3	0.32	335	b x	b bc y Cist Frcu so-ha	c y Nbst d o r o	d o r o c bc
16	0.0	0.00	0.0	0.00	WSW	SW:SSW	1.1	0.05	247	bc b c	c f c Ast	c	c r o
17	0.0	0.00	0.0	0.00	S:SSE	SSW	2.0	0.15	291	r o r o dd m o	d rr m o r o	d o r c	r o r o rr c
18	3.6	0.37	2.7	0.28	SW	SSW	2.2	0.26	348	c rr o c	c Nbst rr o c so-ha c	c St	c bc ir
19	7.4	0.76	6.5	0.67	SW	SW:WSW	8.5	1.41	533	bc ir	bc irc Acu Cu p q Nbst	c p t c y q	c
20	8.7	0.89	8.3	0.85	SW:WSW	W:WSW	6.3	0.92	474	c b	b Acu bc Nbst y	bc p bc y b	b c b
21	3.3	0.34	2.6	0.27	WSW	WSW:SW	2.0	0.20	328	b	b c Nbst	c Stcu	c b c
22	0.4	0.04	0.3	0.03	SW:S	SSW:SW	0.8	0.03	232	c	c Stcu c Ast Nbst r o	c Nbst Ast r o c	c
23	2.3	0.25	1.4	0.15	WSW	SW:SSW	2.1	0.19	310	c r c	c r c Prst	c	r o ir o c
24	4.8	0.52	3.5	0.38	Calm:SW	SSW:Calm	0.2	0.01	192	c m o	c Prst m o	c m o	c Aurora bc c m o
25	0.0	0.00	0.0	0.00	E:ENE	E:ENE	2.0	0.19	298	c m o	c bc Ast Acu m o c y	c St y rr	r o c r o r o
26	..	..	..	..	NE:NNE	NNE	3.5	0.48	387	r o r o rr	rr Nbst	rr Nbst	c
27	7.0	0.76	6.7	0.72	N:NNW	NNW:NW	3.3	0.45	390	c bc	b bc Prst y	c Prst bc y	bc y b
28	9.3	1.00	8.3	0.89	NW:NNW	NNW:NW	4.5	0.60	385	b c b	b bc Frcu y	bc c y	bc b y x
29	0.0	0.00	0.0	0.00	Calm:SSW	SSW:W	4.1	0.39	330	b x m	b c Ast y	c ir o	c ir o r o d
30	7.3	0.84	6.8	0.78	NW	NW:W:SSW	5.2	0.63	376	c	c bc b Frcu y	b c y	c b
31	1.1	0.12	0.5	0.05	SSW:SW	SSW	4.0	0.65	401	b c b c	c Stcu	c r o c	c bc c
Means	5.0	0.49	4.2	0.41	..	..	..	0.35	321				
No. of Col. for Ref.	19	20	21	22	23	24	25	26	27	28	29	30	31

The mean *Temperature of Evaporation* for the month was 40°·1, being 0°·7 higher than
 The mean *Temperature of the Dew Point* for the month was 35°·0, being 0°·6 lower than
 The mean *Degree of Humidity* for the month was 71·9, being 6·2 less than
 The mean *Elastic Force of Vapour* for the month was 0·204 in., being 0·005 in. less than
 The mean amount of *Cloud* for the month (a clear sky being represented by 0 and an overcast sky by 10) was 6·4.
 The mean proportion of *Sunshine* for the month (constant sunshine being represented by 1) was 0·311. The maximum daily amount of *Sunshine* was 9·7 hours on March 2 and 28.
 The highest reading of the *Solar Radiation Thermometer* was 117°·7 on March 23; and the lowest reading of the *Terrestrial Radiation Thermometer* was 18°·8 on March 8 and 29.
 The *Proportions of Wind* referred to the cardinal points were N.18, E.11, S.29, W.33, calm or nearly calm conditions, 9, the whole month being represented by 100.
 The *Greatest Pressure of the Wind* in the month was 8·5 lbs. on the square foot on March 19. The mean daily *Horizontal Movement of the Air* for the month was 321 miles; the greatest daily value was 533 miles on March 19, and the least daily value was 120 miles on March 7.
Rain (0·005 in. or over) fell on 12 days in the month, amounting to 3·796 in., as measured by gauge No.6 partly sunk below the ground; being 2·276 in. greater than the average fall for the 65 years, 1841-1905.

} the average for the 65 years, 1841-1905.

TABLE XVII. - DAILY RESULTS OF THE METEOROLOGICAL OBSERVATIONS

Month and Day 1940	RECORD OF THE NIGHT SKY				WIND AS DEDUCED FROM SELF-REGISTERING ANEMOMETERS						CLOUDS AND WEATHER			
	Polaris		δ URSAE MINORIS		OSLER'S				Robin-son's					
	Duration	Fraction of Total Exposure	Duration	Fraction of Total Exposure	General Direction		Pressure on the Square Foot		Horizontal Move-ment of the Air					
					A.M.	P.M.	Greatest	Mean of 24 Hourly Measures		0 ^h to 6 ^h	6 ^h to 12 ^h	12 ^h to 18 ^h	18 ^h to 24 ^h	
Apr. 1	6·3	0·72	4·4	0·51	SSW	SW:WSW	9·6	0·87	427	c b c	c b bc Acu y	c Acu Nbst q	c b	
2	0·0	0·00	0·0	0·00	SSW:SW	SW:SSW	3·2	0·11	280	b c	c p c Nbst Frcu y	c p c y Cu Acu	c bc c	
3	5·5	0·83	5·1	0·58	SSW:SSE: Calm	NW:WSW	1·6	0·17	288	o dd	dd o g G c Nbst	c p c Cumb Frcu b	b	
4	7·8	0·89	7·8	0·89	SW:WSW	WSW:NW	8·6	0·57	409	b c rr	rr c Ast Nbst	c p q b Nbst	bc b	
5	3·8	0·43	3·4	0·39	NW:NNW	N:NNE	4·0	0·58	422	b c	c Frcu Acu Nbst y	c Nbst	c	
6	8·3	1·00	8·3	1·00	NNE:NE:E	ESE:S	0·2	0·04	220	c b	b c Stcu Nbst y	c b	b x	
7	6·7	0·81	6·6	0·79	S:SSW	SW:SSW	0·7	0·07	264	b x	b c b Cu Cist y	b c Stcu y	ro c b	
8	2·3	0·27	2·1	0·25	NW:NNW	N:NNE	2·0	0·13	297	b c	b c ro c Nbst	c Nbst ro c	bc b c	
9	··	··	··	··	N	N:NNE	2·2	0·16	298	c	c Stcu Acu y	c y	c y c	
10	8·3	1·00	8·3	1·00	N:NNE	NNE	3·1	0·28	349	c b c	c Nbst Stcu y	c Stcu Nbst y	c b x	
11	0·0	0·00	0·0	0·00	Calm:N	NW:WSW	0·9	0·04	206	b x mo	b mo zo bc y	bc c so-ha y	c y c	
12	5·1	0·62	4·6	0·56	WSW:NW	N:NE	2·2	0·16	309	c id ro	c Nbst Ast ir o do c y	c so-ha y	c b	
13	0·0	0·00	0·0	0·00	N	N:NW:W	0·9	0·07	258	b c	c Nbst y	c y	c	
14	1·7	0·22	1·0	0·13	WNW:NW	WNW:WSW	4·0	0·41	413	c ir o	c Frcu y	c y	c y c	
15	6·8	0·91	6·8	0·91	WSW:W	WSW	8·2	1·10	497	c ro ro r	r c Acu Frcu y	c do c r R c	c q do b lu-ha	
16	6·7	0·89	6·4	0·86	WSW	WSW:SW	2·3	0·20	302	b	b bc Frcu Acu y	c Nbst Cumb rsr	c do rr c b	
17	7·5	1·00	7·5	1·00	WSW	SW:SSW	0·4	0·03	205	b x	b Acu Ci y	b Cu bc c b y	bc lu-ha prsl	
18	0·0	0·00	0·0	0·00	Calm:E	E:SE	6·2	0·54	312	bc lu-ha x	c Acu Ast	c Nbst ir rr c	c r c rr ir	
19	1·3	0·17	1·0	0·14	W	WSW:SW	5·0	0·68	414	ir c	c b Frcu y	b c ir	ir c	
20	3·1	0·43	3·0	0·42	S:Calm	Calm:SE:S	0·6	0·03	199	c	c Nbst ir o	ir o c y	c bc c	
21	7·3	1·00	7·3	1·00	SSW:SW	SW:Calm	1·6	0·06	239	c b	b c Frcu bc Ci y	bc b y so-ha	b lu-ha	
22	0·2	0·03	0·2	0·03	ESE:E	E	4·2	0·50	339	b bc	bc Cist b Ci y	b	b c	
23	0·0	0·00	0·0	0·00	E	SSW:WSW	1·8	0·13	280	c	c St Stcu y	c Ast St y	c rr c	
24	4·0	0·55	3·7	0·52	Calm:N	NW:Calm	0·4	0·02	190	c d c r m	rr Nbst	rr o c r	r c b c b	
25	4·0	0·56	3·5	0·48	WSW	WSW:SW	0·4	0·04	246	c	b c Acu Cu	c Cu Cumb y	c b c	
26	0·0	0·00	0·0	0·00	Calm	SSW:Calm	0·2	0·01	135	c b w	b w c Cu Frcu y	c y ir o	ir o c	
27	0·8	0·12	0·7	0·10	Calm	Calm:E	0·5	0·03	164	c m	c St mo bc y	c t ir c	c bc c	
28	0·0	0·00	0·0	0·00	Calm	Calm	0·0	0·00	132	o mf	c ddo c mo	c bc Acu	c ro ro	
29	0·0	0·00	0·0	0·00	Calm:SSW	Calm:ENE	0·5	0·04	190	c	c Nbst	c bc	bc c	
30	0·2	0·02	0·2	0·02	ENE	ENE:Calm	0·3	0·05	200	o m f	o f m	c St Nbst ro Rr c f	c f	
Means	3·4	0·42	3·2	0·40	..	..	..	0·24	281				
No. of Col. for Ref.	19	20	21	22	23	24	25	26	27	28	29	30	31	

The mean *Temperature of Evaporation* for the month was 44°·5, being 0°·6 higher than
 The mean *Temperature of the Dew Point* for the month was 39°·6, being equal to
 The mean *Degree of Humidity* for the month was 72·3, being 2·2 less than
 The mean *Elastic Force of Vapour* for the month was 0·244 in., being equal to
 The mean amount of *Cloud* for the month (a clear sky being represented by 0 and overcast sky by 10) was 7·1.
 The mean proportion of *Sunshine* for the month (constant sunshine being represented by 1) was 0·280. The maximum daily amount of *Sunshine* was 10·9 hours on April 21.
 The highest reading of the *Solar Radiation Thermometer* was 132°·6 on April 27; and the lowest reading of the *Terrestrial Radiation Thermometer* was 20°·6 on April 11.
 The *Proportions of Wind* referred to the cardinal points were N.21, E.14, S.21, W.27, calm or nearly calm conditions, 17, the whole month being represented by 100.
 The *Greatest Pressure of the Wind* in the month was 9·6 lbs. on the square foot on April 1. The mean daily *Horizontal Movement of the Air* for the month was 281 miles; the greatest daily value was 497 miles on April 15, and the least daily value was 132 miles on April 28.
Rain (0·005 in. or over) fell on 16 days in the month, amounting to 1·645 in., as measured by gauge No. 6 partly sunk below the ground; being 0·079 in. greater than the average fall for the 65 years, 1841-1906.

TABLE XVII. - DAILY RESULTS OF THE METEOROLOGICAL OBSERVATIONS

Table with columns for Month and Day 1940, Record of the Night Sky (Polaris, 6 URSAE MINORIS), Wind as deduced from self-registering anemometers (OSLER'S, Robin-son's), and Clouds and Weather (0h to 6h, 6h to 12h, 12h to 18h, 18h to 24h). Rows include daily data from May 1 to 31 and summary means.

The mean Temperature of Evaporation for the month was 50°·7, being 1°·7 higher than the average for the 65 years, 1841-1905. The mean Temperature of the Dew Point for the month was 45°·3, being 0°·5 higher than the average for the 65 years, 1841-1905. The mean Degree of Humidity for the month was 68·4, being 5·5 less than the average for the 65 years, 1841-1905. The mean Elastic Force of Vapour for the month was 0·304 in., being 0·006 in. greater than the average for the 65 years, 1841-1905. The mean amount of Cloud for the month (a clear sky being represented by 0 and an overcast sky by 10) was 5·2. The mean proportion of Sunshine for the month (constant sunshine being represented by 1) was 0·476. The maximum daily amount of Sunshine was 14·6 hours on May 19. The highest reading of the Solar Radiation Thermometer was 139°·2 on May 15; and the lowest reading of the Terrestrial Radiation Thermometer was 26°·2 on May 12. The Proportions of Wind referred to the cardinal points were N.23, E.23, S.14, W.15, calm or nearly calm conditions, 25, the whole month being represented by 100. The Greatest Pressure of the Wind in the month was 3·0 lbs. on the square foot on May 15 and 19. The mean daily Horizontal Movement of the Air for the month was 229 miles; the greatest daily value was 312 miles on May 16, and the least daily value was 150 miles on May 1. Rain (0·005 in. or over) fell on 8 days in the month, amounting to 1·033 in., as measured by gauge No.6 partly sunk below the ground; being 0·882 in. less than the average fall for the 65 years, 1841-1905.

TABLE XVII. - DAILY RESULTS OF THE METEOROLOGICAL OBSERVATIONS

Month and Day 1940	RECORD OF THE NIGHT SKY				WIND AS DEDUCED FROM SELF-REGISTERING ANEMOMETERS					CLOUDS AND WEATHER			
	Polaris		δ URSÆ MINORIS		OSLER'S				Robin-son's				
	Duration	Fraction of Total Exposure	Duration	Fraction of Total Exposure	General Direction		Pressure on the Square Foot		Horizontal Movement of the Air				
					A.M.	P.M.	Greatest	Mean of 24 Hourly Measures		0 ^h to 6 ^h	6 ^h to 12 ^h	12 ^h to 18 ^h	18 ^h to 24 ^h
hours		hours				lbs.	lbs.	miles					
June 1	1.5	0.32	1.5	0.32	Calm: NNW	NNW: NNE	0.3	0.04	203	b c	c Frcu Frst	c Stcu y	c b c
2	4.5	1.00	4.5	1.00	N: Calm	E	0.7	0.07	216	bc b	b bc c Frcu y	c b y	b
3	3.8	0.79	3.8	0.79	Calm: E	E	1.1	0.08	224	b c b m	b Frcu Ci Cu y	b Cu y	b
4	4.4	0.98	4.3	0.97	E	E	1.2	0.17	288	b c	c Frcu	b Ci y	b
5	4.5	1.00	4.5	1.00	E	E	2.0	0.26	306	b c	c b Ci y	b y	b
6	4.5	1.00	4.5	1.00	ENE	E: ENE	2.0	0.20	290	b mo	b y	b v y	b
7	3.9	0.87	3.9	0.87	E	E: ESE: Calm	0.8	0.05	202	b	b y	b y	b
8	4.5	1.00	4.5	1.00	Calm	Calm: SSW	0.3	0.02	145	b c f	f b Ci y	b y	b
9	4.5	1.00	4.5	1.00	Calm	Var.	1.0	0.02	154	b	b Ci y	b y c Rtl	Rtl bc b
10	4.4	0.98	4.4	0.98	Calm	Calm: SW	0.2	0.00	104	b c m	c Stcu m	c Frst t m	c m bc b mo
11	4.5	1.00	4.5	1.00	WSW	SW	0.8	0.08	240	b w mo	b c Cu Acu mo	bc b y	b y b
12	1.7	0.37	1.7	0.37	SW: WSW	SW	0.9	0.10	256	b c	bc Acu c Stcu y	c Stcu y	c b c
13	0.0	0.00	0.0	0.00	Calm: NNW	NE: Calm	0.3	0.02	183	c mo	c Nbst Cu b Rr	c Stcu	c
14	4.1	0.90	3.9	0.86	Calm	N: Calm	0.7	0.04	153	c bc b	b bc Acu Cu y	bc c Frcu y	bc
15	0.0	0.00	0.0	0.00	Calm	NW: ENE: Calm	0.5	0.03	175	b c	c bc Acu Cicu y	bc c y	c p c
16	0.0	0.00	0.0	0.00	N: NNW	NNW: N	1.3	0.16	278	c do	d do rrr o Nbst	ror c	c
17	4.5	1.00	4.5	1.00	N: NE	ENE: NE	1.4	0.20	301	c	c Acu Cu	c Stcu Acu bc b y	b y b w
18	4.5	1.00	4.5	1.00	NE	NE: ENE	2.0	0.22	318	b bc	b Ci Cu y	b y	b y
19	1.5	0.33	1.4	0.32	NE	ENE: NE	1.7	0.16	301	b c	cbc Cist so-hac Acu Stcu y	c Cist Acu so-ha c y	c y c
20	0.0	0.00	0.0	0.00	NE	NE	2.1	0.23	330	c bc c	c Stcu b Cu Nbst y	b Acu bc y	bc c do do c
21	4.5	1.00	4.5	1.00	NE	Calm: ESE	1.2	0.12	251	c	c Stcu bc Frcu y	b y	b w
22	0.0	0.00	0.0	0.00	SW: W	NW: Calm	0.9	0.04	202	b c w	c Acu Frcu Nbst y	c Nbst ro	ro r ido
23	1.9	0.41	1.5	0.32	NE	NNE: ESE	0.4	0.07	243	c do rrr c mo	c do ror Nbst c mo	c bc mo	b mo
24	..	..	..	..	NE: NNE	Calm: NW	0.2	0.03	195	b c mo	c Ast Nbst	c bc	c
25	1.7	0.37	1.7	0.37	NW: WNW	NW: W: WSW	3.3	0.27	327	c b	b c Frcu Nbst bc Cu y	bc Acu Cu c y	bc y c
26	1.8	0.40	1.6	0.35	WSW: WNW	NW: W	2.0	0.23	319	c b	b bc Frcu Stcu y	c p t l Stcu b y	b y c
27	4.0	0.90	4.0	0.90	W: Calm: WNW	WNW	0.6	0.07	227	c	c Frcu Nbst y	c bc y	bc y b
28	4.5	1.00	4.5	1.00	Calm	S: SSE	0.3	0.03	182	b c	c Stcu Cu Acu y	c Stcu Acu y	b
29	0.0	0.00	0.0	0.00	S: SSW	SSW: W: NW	1.8	0.22	286	b	b bc Acu Ci Cist y	b y	bc y c do
30	4.5	1.00	4.5	1.00	N: NNE	NNE: ESE: Calm	1.4	0.08	212	c	c b Frcu bc y	b c y	c b
Means	2.9	0.64	2.9	0.64	..	..	..	0.11	236				
No. of Col. for Ref.	19	20	21	22	23	24	25	26	27	28	29	30	31

The mean *Temperature of Evaporation* for the month was $56^{\circ}\cdot3$, being $1^{\circ}\cdot4$ higher than

The mean *Temperature of the Dew Point* for the month was $50^{\circ}\cdot8$, being equal to

The mean *Degree of Humidity* for the month was $65\cdot9$, being $7\cdot3$ less than

The mean *Elastic Force of Vapour* for the month was $0\cdot373$ in., being $0\cdot002$ in. less than

The mean amount of *Cloud* for the month (a clear sky being represented by 0 and an overcast sky by 10) was $5\cdot0$.

The mean proportion of *Sunshine* for the month (constant sunshine being represented by 1) was $0\cdot512$. The maximum daily amount of *Sunshine* was 15.4 hours on June 18.

The highest reading of the *Solar Radiation Thermometer* was $142^{\circ}\cdot2$ on June 11; and the lowest reading of the *Terrestrial Radiation Thermometer* was $35\cdot1$ on June 22.

The *Proportions of Wind* referred to the cardinal points were N.23, E.28, S.8, W.17, calm or nearly calm conditions, 24, the whole month being represented by 100.

The *Greatest Pressure of the Wind* in the month was 3.3 lbs. on the square foot on June 25. The mean daily *Horizontal Movement of the Air* for the month was 236 miles; the greatest daily value was 330 miles on June 20, and the least daily value was 104 miles on June 10.

Rain ($0\cdot005$ in. or over) fell on 6 days in the month, amounting to $0\cdot873$ in., as measured by gauge No.6 partly sunk below the ground; being $1\cdot185$ in. less than the average fall for the 65 years, 1841-1905.

} the average for the 65 years, 1841-1905.

TABLE XVII. - DAILY RESULTS OF THE METEOROLOGICAL OBSERVATIONS,

Main data table with columns: Month and Day 1940, Record of the Night Sky (Polaris, URSAE MINORIS), Wind as deduced from self-registering anemometers (OSLER'S, Robinson's), and Clouds and Weather (0h to 6h, 6h to 12h, 12h to 18h, 18h to 24h). Rows include daily observations from July 1 to July 31, means, and column reference numbers.

The mean Temperature of Evaporation for the month was 55°.6, being 2°.3 lower than the average for the 65 years, 1841-1905.
The mean Temperature of the Dew Point for the month was 51°.3, being 2°.8 lower than
The mean Degree of Humidity for the month was 71.7, being 1.5 less than
The mean Elastic Force of Vapour for the month was 0.360 in., being 0.041 in. less than
The mean amount of Cloud for the month (a clear sky being represented by 0 and an overcast sky by 10) was 7.1.
The mean proportion of Sunshine for the month (constant sunshine being represented by 1) was 0.394. The maximum daily amount of Sunshine was 13.5 hours on July 1.
The highest reading of the Solar Radiation Thermometer was 143°.7 on July 5; and the lowest reading of the Terrestrial Radiation Thermometer was 33°.9 on July 14.
The Proportions of Wind referred to the cardinal points were N.15, E.4, S.22, W.39, calm or nearly calm conditions, 20, the whole month being represented by 100.
The Greatest Pressure of the Wind in the month was 4.1 lbs. on the square foot on July 20. The mean daily Horizontal Movement of the Air for the month was 248 miles; the greatest daily value was 377 miles on July 20, and the least daily value was 136 miles on July 23.
Rain (0.005 in. or over) fell on 17 days in the month, amounting to 3.609 in., as measured by gauge No.6 partly sunk below the ground; being 1.210 in. greater than the average fall for the 65 years, 1841-1905.

TABLE XVII. - DAILY RESULTS OF THE METEOROLOGICAL OBSERVATIONS.

Table with columns for Month and Day 1940, Record of the Night Sky (Polaris, δ URSÆ MINORIS), Wind as deduced from self-registering anemometers (OSLER'S, Robin-son's), and Clouds and Weather (0h to 6h, 6h to 12h, 12h to 18h, 18h to 24h). Rows include daily data for Nov. 1-30 and a Means row.

The mean Temperature of Evaporation for the month was 43°·2, being 1°·3 higher than the average for the 65 years, 1841-1905. The mean Temperature of the Dew Point for the month was 40°·8, being 1°·1 higher than the average for the 65 years, 1841-1905. The mean Degree of Humidity for the month was 84·9, being 1·7 less than the average for the 65 years, 1841-1905. The mean Elastic Force of Vapour for the month was 0·255 in., being 0·009 in. greater than the average for the 65 years, 1841-1905. The mean amount of Cloud for the month (a clear sky being represented by 0 and an overcast sky by 10) was 6·7. The mean proportion of Sunshine for the month (constant sunshine being represented by 1) was 0·253. The maximum daily amount of Sunshine was 7·1 hours on November 1. The highest reading of the Solar Radiation Thermometer was 107°·7 on November 1; and the lowest reading of the Terrestrial Radiation Thermometer was 17°·2 on November 30. The Proportions of Wind referred to the cardinal points were N.14, E.3, S.34, W.37, calm or nearly calm conditions, 12, the whole month being represented by 100. The Greatest Pressure of the Wind in the month was 15·0 lbs. on the square foot on November 14. The mean daily Horizontal Movement of the Air for the month was 315 miles; the greatest daily value was 649 miles on November 12, and the least daily value was 134 miles on November 30. Rain (0·005 in. or over) fell on 20 days in the month, amounting to 6·864 in., as measured by gauge No. 6 partly sunk below the ground; being 4·844 in. greater than the average fall for the 65 years, 1841-1905.

TABLE XVII. - DAILY RESULTS OF THE METEOROLOGICAL OBSERVATIONS

Table with columns: Month and Day 1940, RECORD OF THE NIGHT SKY (Polaris, 8 URSE MINORIS), WIND AS DEDUCED FROM SELF-REGISTERING ANEMOMETER (OSLER'S, ROBINSON'S), and CLOUDS AND WEATHER (0h to 6h, 6h to 12h, 12h to 18h, 18h to 24h).

The mean Temperature of Evaporation for the month was 37°·4, being 1°·1 lower than the average for the 65 years, 1841-1905. The mean Temperature of the Dew Point for the month was 34°·6, being 1°·8 lower than the average for the 65 years, 1841-1905. The mean Degree of Humidity for the month was 83·3, being 4·2 less than the average for the 65 years, 1841-1905. The mean Elastic Force of Vapour for the month was 0·200 in., being 0·016 in. less than the average for the 65 years, 1841-1905. The mean amount of Cloud for the month (a clear sky being represented by 0 and an overcast sky by 10) was 7·6. The mean proportion of Sunshine for the month (constant sunshine being represented by 1) was 0·101. The maximum daily amount of Sunshine was 4·2 hours on December 17. The highest reading of the Solar Radiation Thermometer was 70°·8 on December 4; and the lowest reading of the Terrestrial Radiation Thermometer was 14·3 on December 1. The Proportions of Wind referred to the cardinal points were N.17, E.11, S.17, W.30, calm or nearly calm conditions, 25, the whole month being represented by 100. The Greatest Pressure of the Wind in the month was 17·5 lbs. on the square foot on December 6. The mean daily Horizontal Movement of the Air for the month was 278 miles; the greatest daily value was 630 miles on December 6, and the least daily value was 86 miles on December 25. The record of wind between December 6 and 22 is based on eye-readings of a Browning anemometer erected about three feet to the north of the Robinson anemometer for use while the latter was undergoing repair. Rain (0·005 in. or over) fell on 14 days in the month, amounting to 1·198 in., as measured by gauge No.6 partly sunk below the ground; being 0·629 in. less than the average fall for the 65 years, 1841-1905.

TABLE XX. - MONTHLY MEAN READING OF THE BAROMETER AT EVERY HOUR OF THE DAY AS DEDUCED FROM THE PHOTOGRAPHIC RECORDS

Table with 14 columns: Hour, Universal Time; January; February; March; April; May; June; July; August; September; October; November; December; Yearly Means. Rows include hourly barometer readings from 0h to 24h, means for 0h-23h and 1h-24h, and the number of days employed per month.

TABLE XXI. - MONTHLY MEAN TEMPERATURE OF THE AIR, AT EVERY HOUR OF THE DAY AS DEDUCED FROM THE AUTOGRAPHIC RECORDS

Table with 14 columns: Hour, Universal Time; January; February; March; April; May; June; July; August; September; October; November; December; Yearly Means. Rows include hourly air temperature readings from 0h to 24h, means for 0h-23h and 1h-24h, and the number of days employed per month.

TABLE XXVI. - READINGS OF THE THERMOMETERS IN THE STEVENSON SCREEN IN THE CHRISTIE ENCLOSURE (The readings of the maximum and minimum thermometers apply to the 24 hours ending 21^h)

Table with columns for Day of the Month, Dry-Bulb Thermometers (Maxi-mum, Mini-mum, 9^h, 12^h, 15^h, 21^h), and Wet-Bulb Thermometers (9^h, 12^h, 15^h, 21^h). Rows are organized by month: MAY, JUNE, JULY, and AUGUST. Each month includes daily temperature readings and a 'Means' row at the bottom of the month's data.

TABLE XXIX. - MEAN HOURLY MEASURES OF THE HORIZONTAL MOVEMENT OF THE AIR, IN EACH MONTH, AND GREATEST HOURLY MEASURES, AS DERIVED FROM THE RECORDS OF ROBINSON'S ANEMOMETER.*

Hour Ending	January	February	March	April	May	June	July	August	September	October	November	December	Mean for the Year
h	miles	miles	miles	miles	miles	miles	miles	miles	miles	miles	miles	miles	miles
1	11.0	11.1	12.2	10.8	9.0	9.0	9.3	10.3	10.7	11.3	13.0	11.4	10.8
2	10.6	10.6	12.0	10.8	8.7	8.8	8.8	9.9	10.4	10.8	13.2	11.1	10.5
3	10.9	9.9	11.8	10.6	7.8	8.5	8.6	9.6	10.0	10.0	13.1	11.0	10.1
4	10.7	10.4	12.1	10.6	7.6	8.9	8.8	9.8	10.0	10.2	12.6	10.9	10.2
5	10.8	10.3	12.1	11.3	7.8	8.6	8.8	9.4	10.5	10.5	12.6	10.9	10.3
6	10.6	10.0	12.6	10.8	7.7	8.6	8.7	9.3	10.4	10.1	12.7	10.7	10.2
7	11.3	10.6	12.5	10.6	7.8	8.7	8.8	9.5	10.6	10.1	12.6	10.9	10.3
8	10.7	10.1	12.9	10.8	8.1	8.9	9.3	9.8	10.3	10.3	12.9	10.8	10.4
9	10.8	10.2	13.4	11.8	8.5	9.1	9.4	10.0	10.3	10.8	13.6	11.1	10.7
10	11.1	10.7	14.4	12.0	9.3	9.1	10.3	10.2	10.8	10.7	13.1	11.1	11.1
11	11.6	10.9	14.3	12.3	9.9	10.0	11.0	10.2	11.8	11.3	13.1	11.7	11.5
12	12.4	11.3	14.9	13.2	10.2	10.3	11.5	10.8	12.8	12.2	13.8	11.6	12.1
13	12.1	11.4	15.3	13.4	10.6	10.9	12.1	11.8	13.0	12.8	14.4	12.7	12.5
14	12.0	11.8	14.8	13.1	11.2	11.0	11.9	12.0	13.2	12.8	13.7	13.2	12.6
15	12.0	12.1	15.6	12.8	11.4	11.2	12.6	12.4	13.5	13.3	14.1	13.0	12.8
16	11.6	12.1	15.1	12.3	11.2	11.3	12.3	11.7	13.1	13.0	12.5	12.3	12.4
17	11.4	11.5	14.7	12.9	11.2	11.1	12.0	12.2	12.4	12.2	12.5	12.4	12.2
18	11.6	12.0	14.3	12.8	11.2	11.0	12.4	11.8	12.4	12.0	12.6	11.9	12.2
19	11.6	11.2	13.6	11.8	10.7	11.6	11.5	12.0	12.0	11.9	13.2	11.4	11.9
20	11.6	11.4	13.3	12.7	10.5	11.0	10.8	11.3	12.0	11.6	13.2	11.3	11.7
21	10.7	11.3	13.0	11.3	10.4	10.4	10.3	11.6	11.3	11.2	13.5	11.6	11.4
22	11.3	10.8	12.5	11.3	9.9	9.6	9.6	11.6	11.1	10.8	13.2	11.5	11.1
23	10.9	11.0	12.0	10.6	9.6	9.5	9.8	11.2	11.0	10.9	12.7	11.4	10.9
24	10.9	11.1	11.8	10.9	9.1	9.3	9.3	10.6	10.7	11.1	12.6	11.6	10.7
Means	11.3	11.0	13.4	11.7	9.6	9.9	10.3	10.8	11.4	11.3	13.1	11.6	11.3
Greatest Hourly Measures	23	22	31	29	18	20	22	23	28	30	34	36	..

* The measures are derived from the motion of the cups by the formula $V = 2v + 4$; where v is the hourly motion of the cups in miles. See Introduction p.xvi.

