/



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TERRESTRIAL MAGNETISM

# DISTRIBUTION OF THE MAGNETIC DECLINATION IN THE UNITED STATES FOR JANUARY 1, 1915



## WITH ISOGONIC CHART AND SECULAR CHANGE TABLES

BY

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## PREFACE TO SECOND EDITION.

Since the issue of the first edition of Special Publication No. 33, there has been a marked diminution in the rate of change of declination for the greater part of the country. In the New England States the average annual increase of west declination since 1915 has been only about 4′ as compared with 6′ in the previous decade. In Oregon the average annual increase of east declination since 1915 has been less than 1′ as compared with about 3′ between 1910 and 1915. This change is shown in more detail in the following table of annual mean values for the observatories at Cheltenham, Md.; Tucson, Ariz.; Vieques, P. R.; and Toronto, Canada:

| Year. | Cheltenham. | Tucson. | Porto Rico. | Toronto. |
|---|---|---|---|---|
| | ° ′ | ° ′ | ° ′ | ° ′ |
| 1910 | 5 41.4 W | 13 25.8 E | 2 20.6 W | 6 03.9 W |
| 1911 | 45.6 | 29.7 | 29.9 | 09.0 |
| 1912 | 50.0 | 33.5 | 39.0 | 13.7 |
| 1913 | 54.6 | 37.0 | 2 49.6 | 18.4 |
| 1914 | 5 59.8 | 39.9 | 3 00.4 | 23.8 |
| 1915 | 6 04.0 | 42.5 | 10.1 | 28.5 |
| 1916 | 07.7 | 44.4 | 19.2 | 33.4 |
| 1917 | 10.3 | 46.1 | 26.9 | 36.2 |
| 1918 | 12.4 | 47.0 | 34.1 | 38.3 |
| 1919 | 15.0 | 47.8 | 40.0 | |

As soon as sufficient data regarding these changes have been secured, the secular change tables will be extended to 1920 and an isogonic chart for that date will be prepared.

As the supply of the first edition of Special Publication No. 33 has been exhausted, this revised edition has been prepared to meet the continued demand for the information which it contains. The changes are confined to the values of annual change at the bottom of the secular change tables and the lines of equal annual change on the isogonic chart. These changes are based on observations at repeat stations in 1917, 1918, and 1919, and the resulting values of annual change refer approximately to the average for the period 1913–1919. A large number of repeat stations were occupied by Canadian observers in 1918 and their results have been a very valuable supplement to those in this country in fixing the position and direction of the lines of equal annual change along our northern border.

# DISTRIBUTION OF THE MAGNETIC DECLINATION IN THE UNITED STATES FOR JANUARY 1, 1915, WITH ISOGONIC CHART AND SECULAR CHANGE TABLES.

By DANIEL L. HAZARD, *Assistant Chief, Division of Terrestrial Magnetism.*

## INTRODUCTION.

The plan for the magnetic survey of the United States which began in 1899 was laid down in Appendix 10, Report for 1899, as follows: "To make first a general magnetic survey of the country with stations about 30 to 40 miles apart, then, as opportunities present themselves, to add stations in the magnetically disturbed areas." In regions where the distribution of magnetism is fairly regular, comparatively few additional stations will be needed, while in magnetically disturbed areas the number of stations must be governed by the character and extent of the disturbance. The plan also contemplated observations at a sufficient number of "repeat" stations to furnish the data needed to refer the results to a common epoch. This plan has been followed with only slight modifications, and the work has reached the stage where the filling in is in progress. Observations have been made at a great majority of the county seats and a number of areas of marked local disturbance have been examined in more or less detail.

It is customary to represent graphically the results of a magnetic survey by means of isomagnetic charts, maps on which lines are drawn through places where the values of a particular magnetic element are the same. In the case of the magnetic declination or variation of compass, the map showing the lines of equal magnetic declination is called an isogonic chart. In the preparation of such a chart all of the results must be reduced to a common epoch by means of the secular-change data derived from the observations at "repeat" stations.

In order that the results as represented on the isogonic chart may be used for other dates than the epoch of the chart, secular change tables must be prepared based on the results of observations at repeat stations. Under present conditions it is impossible to predict with accuracy for even a few years in advance of observation what the secular change of the magnetic declination will be, and secular-change tables must therefore be revised and extended from time to time as additional data become available.

It is now four years since Special Publication No. 9, Distribution of the Magnetic Declination in the United States for January 1, 1910,

with Isogonic Chart and Secular Change Tables, was issued, and the supply is exhausted. During that time the results of observations at more than 1,000 new stations and 200 repeat stations in the United States and adjacent part of Canada have become available. The present publication contains an isogonic chart for the epoch January 1, 1915, and secular-change tables brought up to that date by means of the observations at repeat stations to the end of June, 1915.

## AVAILABLE DATA.

At the beginning of the magnetic survey of the United States in 1899 results were available for about 1,000 stations in the United States and adjacent portions of other countries. By the end of 1906 this number had increased to about 4,000, in 1911 to 4,800, and in the construction of the present chart about 5,800 land values of declination have been used. A large majority of them are the results of observations by this Bureau to the end of June, 1915. In addition use has been made of results obtained by the United States Lake Survey in the United States and Canada; by the Department of Terrestrial Magnetism of the Carnegie Institution of Washington in the United States, Canada, Mexico, Central America, and the West Indies; by observers of the National Observatory of Mexico; by Canadian officials; by Dr. L. A. Bauer in his magnetic survey of Maryland under the auspices of the Maryland Geological Survey; by Prof. F. E. Nipher in Missouri; at the expense of the "Bache Fund" of the National Academy of Sciences; by officers of the United States Navy in Mexico; and by United States Army engineers in exploratory surveys in the southwestern part of the country. With very few exceptions the observations have been made by experienced observers with approved instruments. For the extension of the isogonic lines over the adjacent waters, use has been made of the results of observations on the vessels of this Bureau and on the *Carnegie* of the Department of Terrestrial Magnetism of the Carnegie Institution of Washington. The results of observations to the end of 1906 were collected and published in United States Magnetic Tables and Magnetic Charts for 1905. The later results by this Bureau have been published year by year, and nearly all of the results by other institutions have been published in some form. All of the results on which the 1915 isogonic chart is based will be published collectively in the near future in United States Magnetic Tables and Magnetic Charts for 1915.

The following table gives a comparison of the number of declination results in each State used in the construction of the isogonic charts of 1905, 1910, and 1915, the number of repeat stations occupied between July 1, 1911, and June 30, 1915, and the density of distribution, as shown by the average number of square miles per station.

It will be seen that the average for the whole United States is one magnetic station for each 628 square miles, but this quantity varies greatly in different States, and to a less degree in different portions of a State. East of the Mississippi there is on the average one station for each 339 square miles, whereas west of that river there is only one station for each 959 square miles.

*Distribution of declination results.*

| State. | Declination results. | | | Repeat stations, 1911–1915. | Area in square miles. | Square miles per station. |
|---|---|---|---|---|---|---|
| | 1905 chart. | 1910 chart. | 1915 chart. | | | |
| Alabama | 40 | 46 | 88 | 7 | 51279 | 583 |
| Arizona | 79 | 84 | 84 | 2 | 113810 | 1355 |
| Arkansas | 39 | 51 | 84 | 5 | 52525 | 625 |
| California | 133 | 135 | 139 | 8 | 155652 | 1120 |
| Colorado | 62 | 62 | 76 | 4 | 103658 | 1364 |
| Connecticut | 33 | 42 | 45 | 1 | 4820 | 109 |
| Delaware | 13 | 14 | 41 | 2 | 1965 | 48 |
| District of Columbia | 4 | 4 | 7 | 1 | 60 | 9 |
| Florida | 73 | 76 | 95 | 8 | 54861 | 577 |
| Georgia | 71 | 84 | 172 | 10 | 58725 | 341 |
| Idaho | 32 | 32 | 31 | 0 | 83354 | 2689 |
| Illinois | 39 | 104 | 115 | 4 | 56043 | 487 |
| Indiana | 32 | 76 | 91 | 2 | 36045 | 396 |
| Iowa | 45 | 91 | 144 | 4 | 55586 | 386 |
| Kansas | 117 | 118 | 118 | 2 | 81774 | 693 |
| Kentucky | 75 | 99 | 127 | 4 | 40181 | 316 |
| Louisiana | 95 | 95 | 99 | 3 | 45409 | 459 |
| Maine | 56 | 72 | 73 | 2 | 29895 | 410 |
| Maryland | 153 | 154 | 154 | 1 | 9941 | 65 |
| Massachusetts | 50 | 54 | 62 | 4 | 8039 | 130 |
| Michigan | 116 | 161 | 169 | 1 | 57480 | 340 |
| Minnesota | 52 | 106 | 160 | 5 | 80858 | 505 |
| Mississippi | 42 | 44 | 88 | 7 | 46362 | 527 |
| Missouri | 166 | 192 | 206 | 3 | 68727 | 334 |
| Montana | 61 | 61 | 68 | 1 | 146201 | 2150 |
| Nebraska | 64 | 92 | 103 | 2 | 76808 | 746 |
| Nevada | 63 | 63 | 63 | 0 | 109821 | 1743 |
| New Hampshire | 11 | 19 | 31 | 0 | 9031 | 291 |
| New Jersey | 41 | 50 | 79 | 1 | 7514 | 95 |
| New Mexico | 71 | 72 | 72 | 2 | 122503 | 1701 |
| New York | 90 | 150 | 171 | 4 | 47654 | 279 |
| North Carolina | 119 | 122 | 133 | 7 | 48740 | 366 |
| North Dakota | 35 | 47 | 54 | 3 | 70183 | 1300 |
| Ohio | 101 | 104 | 109 | 2 | 40740 | 374 |
| Oklahoma | 36 | 56 | 80 | 6 | 69414 | 868 |
| Oregon | 75 | 77 | 85 | 3 | 95607 | 1125 |
| Pennsylvania | 80 | 88 | 111 | 7 | 44832 | 404 |
| Rhode Island | 11 | 11 | 11 | 0 | 1067 | 97 |
| South Carolina | 47 | 48 | 62 | 2 | 30495 | 492 |
| South Dakota | 33 | 46 | 65 | 5 | 76808 | 1184 |
| Tennessee | 56 | 88 | 112 | 8 | 41687 | 372 |
| Texas | 183 | 192 | 275 | 14 | 262398 | 954 |
| Utah | 38 | 38 | 43 | 3 | 82184 | 1911 |
| Vermont | 13 | 18 | 28 | 3 | 9124 | 326 |
| Virginia | 119 | 133 | 172 | 8 | 40262 | 234 |
| Washington | 92 | 98 | 113 | 3 | 66836 | 591 |
| West Virginia | 58 | 68 | 75 | 1 | 24022 | 320 |
| Wisconsin | 47 | 85 | 107 | 5 | 55256 | 516 |
| Wyoming | 47 | 47 | 47 | 0 | 97594 | 2076 |
| Total United States | 3207 | 3869 | 4737 | 180 | 2973890 | 628 |
| Canada | 488 | 618 | 788 | | | |
| Mexico | 230 | 230 | 230 | | | |
| West Indies | 61 | 67 | 75 | | | |
| Grand total | 3986 | 4784 | 5830 | | | |

Although the Canadian Government has made steady progress in the magnetic survey of that country, especially of the southern part, since its inception by the Department of Terrestrial Magnetism of the Carnegie Institution of Washington in 1906, the number of stations is not yet sufficient to give more than an approximate location of the isogonic lines in a region where there is so much local disturbance.

## REDUCTION TO EPOCH.

The secular change of declination up to 1905 was discussed so thoroughly in 1906 that it has been decided to accept as correct the reduction to January 1, 1905, of observations made prior to January 1, 1907, as published in United States Magnetic Tables and Magnetic Charts for 1905. After the new secular-change tables had been prepared in the manner explained below, the total change of declination between 1905 and 1915 was derived for each region given in the tables, and these values were plotted on a small-sized map of the United States. Lines of equal change were drawn, and it was then easy to scale off the change between 1905 and 1915 for each of the results given in the 1905 tables.

For each region given in the secular-change tables the average annual change between 1910 and 1915 was derived and these average values were plotted on a small-sized map of the United States. Lines of equal annual change were then drawn to conform approximately to the plotted values. The reduction to 1915 of observations made subsequent to 1906 was performed with the aid of this map. These lines of equal annual change are shown in blue on the isogonic chart. While they are more nearly applicable to the middle of the interval—i. e., 1912.5—they are approximately correct for 1915 and are the best values at present available for subsequent years.

A great majority of the results utilized have been obtained since 1899, when the systematic magnetic survey of the United States was begun, and very few refer to an earlier date than 1870, so that the uncertainty in the reduction to epoch is small.

## CONSTRUCTION OF THE ISOGONIC CHART.

The isogonic chart has been constructed by the graphical method, as in the past. The reduced values of declination were plotted on a large-sized map of the United States and the lines of equal magnetic declination were drawn free-hand to conform to the plotted values. As the number of stations in a given area becomes greater this process usually becomes more difficult, and in greatly disturbed areas the sinuosities of the isogonic lines are an indication of disturbance rather than an accurate representation of the distribution of declination. On the present chart it was found impossible in many places

to represent the large local disturbances by continuous lines and the plan was adopted of representing a disturbed area of limited extent by a small closed curve, and of entering on the chart the isolated abnormal values which differ by more than a degree from the normal value for the locality. These values are given in degrees and tenths, the decimal point indicating the location of the station.

## LINES OF EQUAL ANNUAL CHANGE.

The lines of equal annual change, shown in blue on the isogonic chart, were derived in the manner explained above. For the eastern part of the country their distribution has not changed materially since 1910. At the Porto Rico magnetic observatory west declination has been increasing more than 10′ a year since 1912 and a recent discussion of the secular change of declination in the West Indies in connection with the construction of an isogonic chart of that region indicates that the annual change is two or three minutes greater than that in the Barbados. On the Pacific coast there has been a decided change in the location of the lines of equal annual change, corresponding to a general decrease in the rate of change.

The north end of the compass needle is moving to the westward at all places east of the line of no annual change, and to the eastward at all places west of that line.

(*a*) In the part of the United States east of the agonic line (line of no declination), west declination is increasing at an annual rate of from 2′ to 6′.

(*b*) In the region between the agonic line and the line of no annual change, east declination is decreasing at an annual rate of from 0 to 2′.

(*c*) In the region west of the line of no annual change, east declination is increasing at an annual rate of from 0 to 4′.

## SECULAR CHANGE TABLES.

On the succeeding pages will be found tables showing the secular change of the magnetic declination for one or more places in each State from 1750 or the date of the earliest observations to 1915. They are based on similar tables which accompanied the isogonic chart for 1910, in Special Publication No. 9, with only such modifications as were needed to extend them to 1915, and represent more closely the secular motion since 1900 as developed by a rediscussion of the secular change since 1875.

A graphical method was employed in constructing the tables. The results at all the repeat stations in a given region were combined to obtain a curve representing as nearly as possible the average secular change for the region. While it is probable that the secular change

of declination is affected somewhat by local conditions—e. g., by the presence of local disturbance—our observational data are not as yet sufficiently extensive or detailed to permit more than an approximate representation of the average conditions, and these appear to vary with comparative uniformity in passing across the country. Before finally adopting the secular change curve for a particular region, therefore, a comparison was made with the curves for adjoining regions as a basis for a final smoothing out. From these curves values at 10-year intervals to 1900 and 5-year intervals after that date were scaled and tabulated, showing the change of declination from each date to 1915. From these tables other similar ones were obtained by interpolation for the greater number of smaller areas for which it was desired to publish secular change tables. From these tables, in turn, others were prepared, showing the change of declination at some place near the center of each area, at which recent observations had been made.

From this it will be seen that while a table gives directly the declination at different times for but one place in a specified region, it represents with almost the same accuracy the change in declination at any place in the limited area to which the table refers. For a place lying near the border of the specified region a somewhat better result may be obtained by interpolating between the tables for that region and the adjoining one, as explained in example (2) given below.

## USE OF THE SECULAR CHANGE TABLES.

Whenever a surveyor is called upon to redetermine the boundary lines of a tract of land run out by compass at some previous date and can find in the vicinity a well-defined line known to have been established with the same compass at about the same time as the lines of the tract in question, he can not do better than determine the amount of change in the compass bearing of that well-defined line and use it to obtain the present bearings of the boundary lines to be reestablished. In this way he will eliminate possible errors in the two compasses used. Only in the absence of such definite information is the use of the following tables recommended.

In using these tables the surveyor must bear in mind the uncertainties incident to the use of the compass and should not be surprised if, for example, the change in declination since the early part of the nineteenth century, as given by the tables, differs by half a degree or even more from the value indicated by his own retracing of old lines. Even at the present time some compasses are in error by as much as a quarter of a degree, owing to imperfect construction or lack of proper care, and 100 years ago the state of affairs was still worse. The tables are intended to give the actual change in the magnetic declination, eliminating as far as possible the errors of

individual instruments, but they are only approximate and the earlier portions are less reliable on account of the inferior character and limited amount of the data on which they are based.

The figures on any line refer to the 1st day of January of the year given in the first column. A value for any other date must be obtained by interpolation from the tabular quantities. In this operation it is convenient to express the month and day as a fraction of the year, as follows:

*Month and day expressed as a fraction of a year.*

| | |
|---|---|
| Jan. 19 to Feb. 24=0.1 | July 21 to Aug. 25=0.6 |
| Feb. 25 to Apr. 1=0.2 | Aug. 26 to Oct. 1=0.7 |
| Apr. 2 to May 8=0.3 | Oct. 2 to Nov. 7=0.8 |
| May 9 to June 13=0.4 | Nov. 8 to Dec. 13=0.9 |
| June 14 to July 20=0.5 | Dec. 14 to Dec. 31=1.0 |

The use of the tables may best be explained by a few examples.

(1) What was the change in declination in eastern Alabama between June 1, 1795, and August 10, 1915?

In the table for Ashland, eastern Alabama, the values for 1790 and 1800 are 5° 28′ E. and 5° 49′ E., respectively, showing an average annual increase of 2′.1. Hence the value for June 1, 1795, would be 5° 28′ E. + (2′.1 × 5.4) = 5° 39′ E. The table gives for 1915 the value 2° 58′ E. with an annual increase of 1′.0. Hence the value for August 10, 1915, would be 2° 59′ E. Therefore the north end of the compass needle pointed 2° 40′ more to the east on June 1, 1790, than it did on August 10, 1915.

(2) The magnetic declination at New Castle, Pa., on November 15, 1902, was 2° 55′ W. What was it at the same place in January, 1810?

New Castle lies near the boundary between western Pennsylvania and eastern Ohio. From the table for western Pennsylvania are derived the values 0° 38′ E. for January, 1810, and 4° 05′ W. for November, 1902, showing a change of 4° 43′ in the interval. The corresponding values for eastern Ohio are 2° 16′ E. and 2° 06′ W., showing a change of 4° 22′. The mean of these two values, 4° 43′ and 4° 22′, applies to New Castle. Hence the needle pointed 4° 33′ more to the east at New Castle in January, 1810, than it did in November, 1902, and the declination at the earlier date was 1° 38′ E.

(3) A four-sided piece of land at Santa Barbara, Cal., was surveyed in February, 1831, and the bearings recorded as follows: N. 20° 15′ W., N. 75° 30′ E., S. 18° 45′ E., and S. 78° 00′ W. What bearings should be used in order to retrace the lines in March, 1912?

From the table for California south, Mojave, the value for February, 1831, is 13° 26′ E. and for March, 1912, 15° 56′ E., showing an increase of 2° 30′ in the interval. The desired bearings are, therefore, N. 22° 45′ W., N. 73° 00′ E., S. 21° 15′ E., and S. 75° 30′ W.

*Secular Change of the Magnetic Declination in the United States.*

| Region. | Alabama, east. | Alabama, west. | Arizona, east. | Arizona, west. | Arkansas, east. | Arkansas, west. | California, southeast. | California, south. |
|---|---|---|---|---|---|---|---|---|
| Place | Ashland | Tuscaloosa | Holbrook | Prescott | Augusta | Danville | Bagdad | Mojave |
| Latitude | ° ′ 33 16 | ° ′ 33 12 | ° ′ 34 55 | ° ′ 34 34 | ° ′ 35 17 | ° ′ 35 05 | ° ′ 34 35 | ° ′ 35 03 |
| Longitude | 85 51 | 87 33 | 110 10 | 112 30 | 91 22 | 93 25 | 115 53 | 118 10 |
| | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ |
| 1750 | 3 18 E | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| 1760 | 3 54 | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| 1770 | 4 30 | 5 31 E | ..... | ..... | ..... | ..... | ..... | ..... |
| 1780 | 5 01 | 6 02 | ..... | ..... | ..... | ..... | ..... | 10 38 E |
| 1790 | 5 28 | 6 29 | ..... | ..... | ..... | ..... | ..... | 11 12 |
| 1800 | 5 49 | 6 51 | ..... | ..... | 7 19 E | ..... | ..... | 11 46 |
| 1810 | 6 03 | 7 08 | ..... | ..... | 7 41 | ..... | ..... | 12 21 |
| 1820 | 6 09 | 7 16 | ..... | ..... | 7 54 | ..... | ..... | 12 53 |
| 1830 | 6 06 | 7 16 | ..... | ..... | 8 01 | 9 20 E | 13 06 E | 13 23 |
| 1840 | 5 55 | 7 09 | ..... | ..... | 7 58 | 9 20 | 13 32 | 13 50 |
| 1850 | 5 37 | 6 55 | 13 32 E | 13 19 E | 7 47 | 9 12 | 13 52 | 14 11 |
| 1860 | 5 12 | 6 34 | 13 43 | 13 33 | 7 28 | 8 58 | 14 07 | 14 27 |
| 1870 | 4 44 | 6 07 | 13 46 | 13 40 | 7 06 | 8 39 | 14 16 | 14 38 |
| 1880 | 4 06 | 5 31 | 13 39 | 13 40 | 6 30 | 8 09 | 14 26 | 14 54 |
| 1890 | 3 25 | 4 49 | 13 24 | 13 35 | 5 53 | 7 34 | 14 24 | 14 54 |
| 1900 | 2 58 | 4 24 | 13 29 | 13 42 | 5 28 | 7 12 | 14 33 | 15 04 |
| 1905 | 2 55 | 4 23 | 13 41 | 14 01 | 5 28 | 7 12 | 14 52 | 15 24 |
| 1910 | 2 55 | 4 26 | 14 04 | 14 25 | 5 34 | 7 21 | 15 17 | 15 49 |
| 1915 | 2 58 E | 4 31 E | 14 21 E | 14 42 E | 5 42 E | 7 32 E | 15 34 E | 16 06 E |
| Annual change in 1917 | 1′.0 incr. | 1′.2 incr. | 1′.7 incr. | 1′.7 incr. | 1′.4 incr. | 1′.5 incr. | 1′.6 incr. | 1′.5 incr. |

| Region. | California, middle. | California, north. | Colorado, east. | Colorado, west. | Connecticut. | Delaware. | District of Columbia. | Florida, south. |
|---|---|---|---|---|---|---|---|---|
| Place | Modesto | Redding | Pueblo | Ouray | Hartford | Dover | Washington | Miami |
| Latitude | ° ′ 37 38 | ° ′ 40 36 | ° ′ 38 14 | ° ′ 38 01 | ° ′ 41 45 | ° ′ 39 09 | ° ′ 38 55 | ° ′ 25 46 |
| Longitude | 120 59 | 122 24 | 104 38 | 107 41 | 72 40 | 75 31 | 77 02 | 80 11 |
| | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ |
| 1750 | ..... | ..... | ..... | ..... | 5 45 W | 3 23 W | 1 41 W | 4 25 E |
| 1760 | ..... | ..... | ..... | ..... | 5 16 | 2 46 | 1 02 | 4 55 |
| 1770 | ..... | ..... | ..... | ..... | 4 55 | 2 16 | 0 28 | 5 20 |
| 1780 | 12 21 E | 14 07 E | ..... | ..... | 4 43 | 1 52 | 0 01 W | 5 40 |
| 1790 | 12 47 | 14 35 | ..... | ..... | 4 41 | 1 37 | 0 19 E | 5 51 |
| 1800 | 13 16 | 15 04 | ..... | ..... | 4 49 | 1 33 | 0 28 | 5 55 |
| 1810 | 13 45 | 15 34 | ..... | ..... | 5 06 | 1 37 | 0 28 | 5 51 |
| 1820 | 14 14 | 16 04 | ..... | ..... | 5 32 | 1 52 | 0 19 E | 5 40 |
| 1830 | 14 41 | 16 33 | ..... | ..... | 6 05 | 2 16 | 0 01 W | 5 20 |
| 1840 | 15 06 | 17 01 | ..... | ..... | 6 45 | 2 46 | 0 28 | 4 55 |
| 1850 | 15 29 | 17 26 | 13 45 E | 15 03 E | 7 29 | 3 23 | 1 02 | 4 25 |
| 1860 | 15 49 | 17 47 | 13 48 | 15 11 | 8 07 | 4 03 | 1 41 | 3 53 |
| 1870 | 16 04 | 18 06 | 13 44 | 15 12 | 8 41 | 4 41 | 2 21 | 3 18 |
| 1880 | 16 08 | 18 15 | 13 29 | 15 00 | 9 22 | 5 20 | 3 00 | 2 43 |
| 1890 | 16 12 | 18 20 | 12 58 | 14 36 | 9 47 | 5 51 | 3 36 | 2 13 |
| 1900 | 16 34 | 18 40 | 12 51 | 14 35 | 10 21 | 6 29 | 4 11 | 1 44 |
| 1905 | 16 54 | 19 00 | 13 02 | 14 48 | 10 41 | 6 48 | 4 29 | 1 36 |
| 1910 | 17 16 | 19 22 | 13 17 | 15 06 | 11 09 | 7 13 | 4 51 | 1 31 |
| 1915 | 17 32 E | 19 37 E | 13 32 E | 15 21 E | 11 38 W | 7 37 W | 5 13 W | 1 31 E |
| Annual change in 1917 | 1′.0 incr. | 0′.8 incr. | 1′.0 incr. | 1′.0 incr. | 4′.0 incr. | 3′.2 incr. | 3′.0 incr. | 0.0 |

*Secular Change of the Magnetic Declination in the United States*—Continued.

| Region. | Florida, middle. | Florida, northeast. | Florida, northwest. | Georgia, east. | Georgia, west. | Idaho, southeast. | Idaho, southwest. | Idaho north. |
|---|---|---|---|---|---|---|---|---|
| Place | Bartow | Jacksonville | Tallahassee | Millen | Americus | Pocatello | Boise | Pierce |
| | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° |
| Latitude | 27 53 | 30 20 | 30 26 | 32 48 | 32 05 | 42 52 | 43 37 | 46 29 |
| Longitude | 81 51 | 81 39 | 84 18 | 82 00 | 84 13 | 112 26 | 116 12 | 115 48 |
| | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ |
| 1750 | 3 29 E | 2 26 E | 3 04 E | 2 20 E | 3 17 E | ..... | ..... | ..... |
| 1760 | 4 03 | 3 03 | 3 41 | 2 57 | 3 54 | ..... | ..... | ..... |
| 1770 | 4 33 | 3 39 | 4 16 | 3 32 | 4 29 | ..... | ..... | ..... |
| 1780 | 4 59 | 4 11 | 4 48 | 4 03 | 5 01 | ..... | ..... | ..... |
| 1790 | 5 17 | 4 36 | 5 14 | 4 27 | 5 27 | ..... | ..... | ..... |
| 1800 | 5 29 | 4 54 | 5 34 | 4 43 | 5 46 | ..... | ..... | ..... |
| 1810 | 5 31 | 5 03 | 5 46 | 4 51 | 5 56 | ..... | ..... | ..... |
| 1820 | 5 25 | 5 03 | 5 50 | 4 49 | 5 58 | ..... | ..... | ..... |
| 1830 | 5 11 | 4 54 | 5 45 | 4 39 | 5 52 | ..... | ..... | ..... |
| 1840 | 4 49 | 4 36 | 5 32 | 4 20 | 5 36 | ..... | ..... | 20 13 E |
| 1850 | 4 22 | 4 11 | 5 12 | 3 53 | 5 13 | 17 42 E | 18 00 E | 20 39 |
| 1860 | 3 50 | 3 39 | 4 45 | 3 21 | 4 44 | 17 56 | 18 30 | 20 59 |
| 1870 | 3 15 | 3 03 | 4 13 | 2 44 | 4 09 | 18 02 | 18 45 | 21 12 |
| 1880 | 2 37 | 2 24 | 3 34 | 2 06 | 3 30 | 17 56 | 18 45 | 21 09 |
| 1890 | 2 05 | 1 49 | 2 57 | 1 28 | 2 52 | 17 45 | 18 39 | 21 09 |
| 1900 | 1 35 | 1 18 | 2 29 | 0 56 | 2 23 | 17 53 | 18 51 | 21 23 |
| 1905 | 1 28 | 1 12 | 2 25 | 0 46 | 2 16 | 18 09 | 19 08 | 21 38 |
| 1910 | 1 22 | 1 05 | 2 22 | 0 40 | 2 13 | 18 28 | 19 31 | 21 58 |
| 1915 | 1 19 E | 0 59 E | 2 20 E | 0 35 E | 2 12 E | 18 42 E | 19 45 E | 22 11 E |
| Annual change in 1917 | 0′.2 incr. | 0′.0 | 1′.0 incr. | 0′.0 | 0′.4 incr. | 0′.4 incr. | 0′.4 incr. | 0′.0 |

| Region. | Illinois, east. | Illinois, west. | Indiana. | Iowa, east. | Iowa, west. | Kansas, east. | Kansas, west. | Kentucky, east. |
|---|---|---|---|---|---|---|---|---|
| Place | Kankakee | Rushville | Indianapolis | Walker | Sac City | Emporia | Ness City | Manchester |
| | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ |
| Latitude | 41 07 | 40 08 | 39 48 | 42 17 | 42 25 | 38 25 | 38 28 | 37 10 |
| Longitude | 87 50 | 90 34 | 86 12 | 91 46 | 95 00 | 96 12 | 99 54 | 83 46 |
| | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ |
| 1750 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| 1760 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| 1770 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| 1780 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| 1790 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| 1800 | 6 16 E | 7 13 E | 4 44 E | ..... | ..... | ..... | ..... | 3 23 E |
| 1810 | 6 36 | 7 40 | 4 59 | ..... | ..... | ..... | ..... | 3 33 |
| 1820 | 6 46 | 8 00 | 5 04 | 8 54 E | 10 26 E | ..... | ..... | 3 34 |
| 1830 | 6 46 | 8 05 | 4 59 | 9 05 | 10 42 | ..... | ..... | 3 26 |
| 1840 | 6 36 | 8 03 | 4 44 | 9 06 | 10 49 | ..... | ..... | 3 09 |
| 1850 | 6 16 | 7 49 | 4 21 | 8 56 | 10 45 | 11 32 E | 12 23 E | 2 46 |
| 1860 | 5 49 | 7 27 | 3 50 | 8 37 | 10 32 | 11 26 | 12 22 | 2 15 |
| 1870 | 5 21 | 7 02 | 3 20 | 8 10 | 10 10 | 11 13 | 12 11 | 1 38 |
| 1880 | 4 45 | 6 24 | 2 45 | 7 30 | 9 34 | 10 48 | 11 53 | 0 57 |
| 1890 | 4 04 | 5 42 | 2 05 | 6 45 | 8 51 | 10 12 | 11 20 | 0 15 E |
| 1900 | 3 29 | 5 11 | 1 28 | 6 14 | 8 25 | 9 54 | 11 09 | 0 17 W |
| 1905 | 3 22 | 5 08 | 1 18 | 6 12 | 8 27 | 9 57 | 11 15 | 0 26 |
| 1910 | 3 16 | 5 08 | 1 08 | 6 13 | 8 33 | 10 06 | 11 26 | 0 34 |
| 1915 | 3 11 E | 5 08 E | 1 00 E | 6 14 E | 8 39 E | 10 15 E | 11 38 E | 0 41 W |
| Annual change in 1917 | 0′.8 decr. | 0′.5 decr. | 1′.2 decr. | 0′.6 decr. | 0′.4 decr. | 0′.8 incr. | 0′.8 incr. | 1′.0 incr. |

*Secular Change of the Magnetic Declination in the United States*—Continued.

| Region. | Kentucky, middle. | Kentucky, west. | Louisiana. | Maine, northeast. | Maine, middle. | Maine, southwest. | Maryland. | Massachusetts, east. |
|---|---|---|---|---|---|---|---|---|
| Place | Louisville | Princeton | Winfield | Eastport | Bangor | Portland | Baltimore | Boston |
| Latitude | ° ′<br>38 14 | ° ′<br>37 07 | ° ′<br>31 57 | ° ′<br>44 55 | ° ′<br>44 48 | ° ′<br>43 39 | ° ′<br>39 18 | ° ′<br>42 20 |
| Longitude | 85 42 | 87 53 | 92 36 | 67 00 | 68 48 | 70 17 | 76 35 | 71 01 |
| | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ |
| 1750 | ..... | ..... | ..... | 12 22 W | 10 45 W | 8 50 W | 3 05 W | 7 46 W |
| 1760 | ..... | ..... | ..... | 12 10 | 10 29 | 8 31 | 2 26 | 7 19 |
| 1770 | ..... | ..... | ..... | 12 10 | 10 27 | 8 26 | 1 52 | 7 00 |
| 1780 | ..... | ..... | ..... | 12 22 | 10 33 | 8 26 | 1 25 | 6 50 |
| 1790 | ..... | ..... | ..... | 12 43 | 10 46 | 8 31 | 1 05 | 6 50 |
| 1800 | 4 36 E | 6 29 E | 8 16 E | 13 15 | 11 11 | 8 50 | 0 56 | 7 01 |
| 1810 | 4 50 | 6 47 | 8 37 | 13 55 | 11 45 | 9 18 | 0 56 | 7 20 |
| 1820 | 4 55 | 6 56 | 8 53 | 14 40 | 12 26 | 9 54 | 1 05 | 7 47 |
| 1830 | 4 51 | 6 56 | 9 01 | 15 29 | 13 10 | 10 34 | 1 25 | 8 22 |
| 1840 | 4 38 | 6 47 | 9 00 | 16 19 | 13 55 | 11 13 | 1 52 | 9 04 |
| 1850 | 4 18 | 6 29 | 8 52 | 17 15 | 14 43 | 11 54 | 2 26 | 9 48 |
| 1860 | 3 48 | 6 01 | 8 36 | 18 00 | 15 26 | 12 34 | 3 05 | 10 28 |
| 1870 | 3 14 | 5 31 | 8 12 | 18 30 | 15 56 | 13 04 | 3 45 | 11 01 |
| 1880 | 2 32 | 4 47 | 7 38 | 18 50 | 16 23 | 13 38 | 4 24 | 11 30 |
| 1890 | 1 54 | 4 13 | 7 07 | 19 00 | 16 42 | 14 06 | 5 00 | 11 58 |
| 1900 | 1 27 | 3 51 | 6 45 | 19 16 | 17 03 | 14 32 | 5 35 | 12 33 |
| 1905 | 1 20 | 3 47 | 6 50 | 19 31 | 17 19 | 14 49 | 5 53 | 12 52 |
| 1910 | 1 15 | 3 44 | 7 00 | 20 01 | 17 49 | 15 19 | 6 15 | 13 22 |
| 1915 | 1 12 E | 3 45 E | 7 12 E | 20 31 W | 18 19 W | 15 49 W | 6 38 W | 13 52 W |
| Annual change in 1917 | 0′.6 decr. | 0′.0 | 2′.2 incr. | 3′.2 incr. | 3′.5 incr. | 3′.8 incr. | 3′.0 incr. | 4′.0 incr. |

| Region. | Massachusetts, west. | Michigan, north. | Michigan, southeast. | Michigan, southwest. | Minnesota, southeast. | Minnesota, southwest. | Minnesota, northeast. | Minnesota, northwest. |
|---|---|---|---|---|---|---|---|---|
| Place | Pittsfield | Marquette | Lapeer | Grand Haven | St. Paul | Marshall | Hibbing | Bagley |
| Latitude | ° ′<br>42 26 | ° ′<br>46 33 | ° ′<br>43 03 | ° ′<br>43 04 | ° ′<br>44 58 | ° ′<br>44 24 | ° ′<br>47 27 | ° ′<br>47 32 |
| Longitude | 73 16 | 87 22 | 83 20 | 86 12 | 93 06 | 95 51 | 92 56 | 95 23 |
| | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ |
| 1750 | 6 22 W | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| 1760 | 5 53 | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| 1770 | 5 32 | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| 1780 | 5 20 | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| 1790 | 5 18 | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| 1800 | 5 26 | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| 1810 | 5 43 | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| 1820 | 6 09 | 6 45 E | 2 35 E | 5 04 E | 11 35 E | ..... | 10 31 E | ..... |
| 1830 | 6 42 | 6 45 | 2 26 | 5 01 | 11 48 | ..... | 10 44 | 13 01 E |
| 1840 | 7 22 | 6 31 | 2 06 | 4 45 | 11 52 | 11 44 E | 10 46 | 13 08 |
| 1850 | 8 06 | 6 05 | 1 38 | 4 21 | 11 42 | 11 39 | 10 37 | 13 04 |
| 1860 | 8 44 | 5 28 | 1 02 | 3 49 | 11 24 | 11 26 | 10 16 | 12 48 |
| 1870 | 9 18 | 4 41 | 0 18 E | 3 09 | 10 56 | 11 03 | 9 41 | 12 20 |
| 1880 | 9 59 | 3 50 | 0 29 W | 2 22 | 10 19 | 10 32 | 8 59 | 11 43 |
| 1890 | 10 26 | 3 03 | 1 13 | 1 36 | 9 30 | 9 48 | 8 14 | 10 58 |
| 1900 | 10 59 | 2 26 | 1 46 | 1 03 | 8 55 | 9 16 | 7 39 | 10 27 |
| 1905 | 11 17 | 2 12 | 2 00 | 0 51 | 8 51 | 9 20 | 7 39 | 10 30 |
| 1910 | 11 46 | 2 04 | 2 15 | 0 40 | 8 50 | 9 24 | 7 41 | 10 36 |
| 1915 | 12 15 W | 1 53 E | 2 30 W | 0 29 E | 8 50 E | 9 28 E | 7 39 E | 10 38 E |
| Annual change in 1917 | 4′.0 incr. | 3′.0 decr. | 2′.7 incr. | 2′.3 decr. | 1′.2 decr. | 0′.9 decr. | 2′.2 decr. | 1′.8 decr. |

*Secular Change of the Magnetic Declination in the United States*—Continued.

| Region. | Mississippi, east. | Mississippi, west. | Missouri, east. | Missouri, west. | Montana, east. | Montana, middle. | Montana, west. | Nebraska, east. |
|---|---|---|---|---|---|---|---|---|
| Place | Meridian | Vicksburg | Hermann | Sedalia | Miles City | Lewistown | Ovando | Albion |
| | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ |
| Latitude | 32 23 | 32 21 | 38 42 | 38 43 | 46 24 | 47 04 | 47 02 | 41 41 |
| Longitude | 88 44 | 90 53 | 91 26 | 93 14 | 105 53 | 109 26 | 113 08 | 97 59 |
| | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ |
| 1750 | | | | | | | | |
| 1760 | | | | | | | | |
| 1770 | | | | | | | | |
| 1780 | | | | | | | | |
| 1790 | | | | | | | | |
| 1800 | 6 57 E | 7 50 E | | | | | | |
| 1810 | 7 16 | 8 11 | | | | | | |
| 1820 | 7 26 | 8 23 | 9 09 E | 9 51 E | | | | 12 26 E |
| 1830 | 7 29 | 8 28 | 9 16 | 9 57 | | | | 12 44 |
| 1840 | 7 24 | 8 25 | 9 15 | 9 57 | | 19 29 E | 20 21 E | 12 54 |
| 1850 | 7 12 | 8 15 | 9 03 | 9 51 | 17 38 E | 19 50 | 20 46 | 12 54 |
| 1860 | 6 54 | 7 59 | 8 43 | 9 36 | 17 46 | 20 04 | 21 05 | 12 46 |
| 1870 | 6 30 | 7 35 | 8 19 | 9 16 | 17 42 | 20 08 | 21 15 | 12 29 |
| 1880 | 5 56 | 7 04 | 7 40 | 8 41 | 17 25 | 19 56 | 21 06 | 11 59 |
| 1890 | 5 13 | 6 22 | 7 01 | 8 01 | 16 56 | 19 35 | 20 56 | 11 22 |
| 1900 | 4 51 | 6 00 | 6 31 | 7 37 | 16 52 | 19 38 | 21 07 | 11 01 |
| 1905 | 4 50 | 6 02 | 6 30 | 7 39 | 17 04 | 19 51 | 21 21 | 11 06 |
| 1910 | 4 54 | 6 08 | 6 31 | 7 45 | 17 18 | 20 07 | 21 39 | 11 15 |
| 1915 | 5 01 E | 6 16 E | 6 34 E | 7 51 E | 17 30 E | 20 20 E | 21 52 E | 11 25 E |
| Annual change in 1917 | 1′.6 incr. | 1′.8 incr. | 0′.2 incr. | 0′.4 incr. | 0′.5 decr. | 0′.3 decr. | 0′.1 decr. | 0′.1 incr. |

| Region. | Nebraska, middle. | Nebraska, west. | Nevada, east. | Nevada, west. | New Hampshire. | New Jersey. | New Mexico, east. | New Mexico, west. |
|---|---|---|---|---|---|---|---|---|
| Place | Valentine | Alliance | Elko | Hawthorne | Hanover | Trenton | Santa Rosa | Laguna |
| | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ |
| Latitude | 42 52 | 42 06 | 40 51 | 38 32 | 43 43 | 40 15 | 34 56 | 35 03 |
| Longitude | 100 34 | 102 51 | 115 46 | 118 38 | 72 17 | 74 48 | 104 41 | 107 24 |
| | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ |
| 1750 | | | | | 8 00 W | 4 43 W | | |
| 1760 | | | | | 7 26 | 4 04 | | |
| 1770 | | | | | 7 01 | 3 31 | | |
| 1780 | | | | | 6 45 | 3 06 | | |
| 1790 | | | | | 6 40 | 2 50 | | |
| 1800 | | | | | 6 47 | 2 45 | | |
| 1810 | | | | | 7 04 | 2 50 | | |
| 1820 | | | | | 7 30 | 3 06 | | |
| 1830 | | | | | 8 09 | 3 31 | | |
| 1840 | | | | | 8 54 | 4 04 | | |
| 1850 | 14 08 E | 15 26 E | 17 20 E | 16 15 E | 9 44 | 4 43 | 12 43 E | 13 26 E |
| 1860 | 14 04 | 15 26 | 17 36 | 16 36 | 10 29 | 5 22 | 12 47 | 13 33 |
| 1870 | 13 51 | 15 17 | 17 41 | 16 51 | 11 06 | 6 01 | 12 43 | 13 34 |
| 1880 | 13 22 | 14 49 | 17 44 | 16 59 | 11 36 | 6 41 | 12 25 | 13 22 |
| 1890 | 12 48 | 14 19 | 17 38 | 17 01 | 11 59 | 7 11 | 12 00 | 13 02 |
| 1900 | 12 33 | 14 09 | 17 49 | 17 16 | 12 34 | 7 46 | 11 54 | 13 02 |
| 1905 | 12 40 | 14 17 | 18 04 | 17 32 | 12 44 | 8 07 | 12 10 | 13 15 |
| 1910 | 12 50 | 14 30 | 18 27 | 17 57 | 13 14 | 8 33 | 12 29 | 13 36 |
| 1915 | 13 02 E | 14 43 E | 18 43 E | 18 13 E | 13 44 W | 8 59 W | 12 45 E | 13 53 E |
| Annual change in 1917 | 0′.2 incr. | 0′.3 incr. | 0′.9 incr. | 0′.9 incr. | 4′.0 incr. | 3′.8 incr. | 1′.6 incr. | 1′.6 incr. |

*Secular Change of the Magnetic Declination in the United States*—Continued.

| Region. | New York, east. | New York, middle. | New York, west. | North Carolina, east. | North Carolina, middle. | North Carolina, west. | North Dakota, east. | North Dakota, middle. |
|---|---|---|---|---|---|---|---|---|
| Place | Albany | Elmira | Buffalo | Newbern | Greensboro | Asheville | Jamestown | Bismarck |
| Latitude | 42 40 | 42 07 | 42 54 | 35 07 | 36 04 | 35 35 | 46 53 | 46 48 |
| Longitude | 73 45 | 76 50 | 78 54 | 77 03 | 79 49 | 82 32 | 98 42 | 100 47 |
| 1750 | 7 41 W | 4 40 W | ..... | 0 18 W | 1 14 E | ..... | ..... | ..... |
| 1760 | 6 59 | 3 57 | ..... | 0 18 E | 1 50 | ..... | ..... | ..... |
| 1770 | 6 23 | 3 18 | ..... | 0 50 | 2 24 | ..... | ..... | ..... |
| 1780 | 5 56 | 2 46 | 1 52 W | 1 17 | 2 53 | ..... | ..... | ..... |
| 1790 | 5 40 | 2 24 | 1 24 | 1 35 | 3 14 | ..... | ..... | ..... |
| 1800 | 5 34 | 2 13 | 1 08 | 1 44 | 3 26 | 4 06 E | ..... | ..... |
| 1810 | 5 40 | 2 13 | 1 01 | 1 44 | 3 29 | 4 12 | ..... | ..... |
| 1820 | 5 56 | 2 24 | 1 08 | 1 35 | 3 23 | 4 09 | ..... | ..... |
| 1830 | 6 23 | 2 46 | 1 24 | 1 16 | 3 07 | 3 57 | 14 02 E | ..... |
| 1840 | 6 59 | 3 18 | 1 52 | 0 50 | 2 43 | 3 35 | 14 12 | ..... |
| 1850 | 7 45 | 3 57 | 2 26 | 0 17 E | 2 12 | 3 07 | 14 12 | 16 23 E |
| 1860 | 8 31 | 4 46 | 3 10 | 0 19 W | 1 38 | 2 35 | 14 02 | 16 18 |
| 1870 | 9 10 | 5 23 | 3 49 | 1 00 | 1 00 | 1 57 | 13 44 | 16 04 |
| 1880 | 9 57 | 6 16 | 4 40 | 1 40 | 0 20 E | 1 17 | 13 15 | 15 38 |
| 1890 | 10 18 | 6 57 | 5 22 | 2 16 | 0 17 W | 0 41 | 12 32 | 14 58 |
| 1900 | 10 56 | 7 32 | 5 57 | 2 52 | 0 51 | 0 09 E | 12 09 | 14 40 |
| 1905 | 11 11 | 7 50 | 6 11 | 3 08 | 1 04 | 0 02 W | 12 17 | 14 50 |
| 1910 | 11 37 | 8 12 | 6 32 | 3 25 | 1 19 | 0 13 | 12 25 | 15 00 |
| 1915 | 12 05 W | 8 37 W | 6 53 W | 3 42 W | 1 34 W | 0 23 W | 12 32 E | 15 09 E |
| Annual change in 1917 | 4′.0 incr. | 4′.0 incr. | 3′.5 incr. | 2′.4 incr. | 1′.8 incr. | 1′.0 incr. | 1′.2 decr. | 1′.0 decr. |

| Region. | North Dakota, west. | Ohio, east. | Ohio, west. | Oklahoma, east. | Oklahoma, west. | Oregon, east. | Oregon, west. | Pennsylvania, east. |
|---|---|---|---|---|---|---|---|---|
| Place | Dickinson | Canton | Urbana | Okmulgee | Enid | Sumpter | Detroit | Wilkes-Barre |
| Latitude | 46 53 | 40 49 | 40 06 | 35 38 | 36 25 | 44 45 | 44 43 | 41 13 |
| Longitude | 102 46 | 81 24 | 83 44 | 95 56 | 97 54 | 118 13 | 122 08 | 75 54 |
| 1750 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 4 43 W |
| 1760 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 3 59 |
| 1770 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 3 19 |
| 1780 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 2 46 |
| 1790 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 2 26 |
| 1800 | ..... | 2 07 E | 4 11 E | ..... | ..... | ..... | 16 05 E | 2 17 |
| 1810 | ..... | 2 16 | 4 23 | ..... | ..... | ..... | 16 43 | 2 18 |
| 1820 | ..... | 2 14 | 4 24 | ..... | ..... | ..... | 17 22 | 2 31 |
| 1830 | ..... | 2 02 | 4 16 | ..... | ..... | ..... | 18 01 | 2 53 |
| 1840 | ..... | 1 41 | 3 58 | ..... | ..... | ..... | 18 38 | 3 24 |
| 1850 | 17 40 E | 1 12 | 3 32 | 10 13 E | 11 14 E | 19 15 E | 19 12 | 4 02 |
| 1860 | 17 40 | 0.36 E | 2 59 | 10 04 | 11 11 | 19 40 | 19 41 | 4 42 |
| 1870 | 17 30 | 0 00 | 2 25 | 9 49 | 10 59 | 19 58 | 20 06 | 5 21 |
| 1880 | 17 07 | 0 41 W | 1 47 | 9 31 | 10 36 | 20 09 | 20 20 | 6 02 |
| 1890 | 16 30 | 1 20 | 1 08 | 9 05 | 10 09 | 20 11 | 20 30 | 6 36 |
| 1900 | 16 18 | 1 57 | 0 31 | 8 40 | 9 49 | 20 26 | 20 50 | 7 13 |
| 1905 | 16 30 | 2 13 | 0 18 | 8 43 | 9 55 | 20 44 | 21 09 | 7 33 |
| 1910 | 16 42 | 2 30 | 0 05 E | 8 53 | 10 08 | 21 07 | 21 33 | 7 58 |
| 1915 | 16 53 E | 2 47 W | 0 08 W | 9 03 E | 10 21 E | 21 21 E | 21 47 E | 8 22 W |
| Annual change in 1917 | 0′.8 decr. | 2′.2 incr. | 1′.9 incr. | 1′.4 incr. | 1′.4 incr. | 0′.4 incr. | 0′.4 incr. | 3′.0 incr. |

*Secular Change of the Magnetic Declination in the United States*—Continued.

| Region. | Pennsylvania, middle. | Pennsylvania, west. | Rhode Island. | South Carolina, east. | South Carolina, west. | South Dakota, east. | South Dakota, middle. | South Dakota, west. |
|---|---|---|---|---|---|---|---|---|
| Place | Lockhaven | Indiana | Newport | Marion | Aiken | Huron | Murdo | Rapid City |
| Latitude | 41 09 | 40 39 | 41 30 | 34 11 | 33 34 | 44 21 | 43 54 | 44 05 |
| Longitude | 77 26 | 79 12 | 71 20 | 79 24 | 81 44 | 98 10 | 100 43 | 103 12 |
| 1750 | | | 7 04 W | 1 09 E | 2 19 E | | | |
| 1760 | | | 6 37 | 1 46 | 2 56 | | | |
| 1770 | | | 6 18 | 2 19 | 3 31 | | | |
| 1780 | 2 03 W | 0 07 W | 6 08 | 2 47 | 4 01 | | | |
| 1790 | 1 40 | 0 17 E | 6 08 | 3 08 | 4 24 | | | |
| 1800 | 1 26 | 0 32 | 6 19 | 3 19 | 4 39 | | | |
| 1810 | 1 23 | 0 38 | 6 38 | 3 24 | 4 45 | | | |
| 1820 | 1 32 | 0 32 | 7 05 | 3 16 | 4 42 | | | |
| 1830 | 1 52 | 0 16 E | 7 40 | 3 02 | 4 30 | | | |
| 1840 | 2 22 | 0 09 W | 8 22 | 2 39 | 4 09 | 13 11 E | | |
| 1850 | 2 59 | 0 42 | 9 06 | 2 08 | 3 42 | 13 11 | 15 00 E | 16 26 E |
| 1860 | 3 39 | 1 20 | 9 46 | 1 34 | 3 08 | 13 02 | 14 55 | 16 26 |
| 1870 | 4 19 | 1 59 | 10 19 | 0 55 | 2 31 | 12 45 | 14 42 | 16 16 |
| 1880 | 4 59 | 2 39 | 10 50 | 0 17 E | 1 53 | 12 20 | 14 17 | 15 50 |
| 1890 | 5 39 | 3 18 | 11 17 | 0 22 W | 1 16 | 11 40 | 13 40 | 15 17 |
| 1900 | 6 17 | 3 55 | 11 52 | 0 58 | 0 42 | 11 13 | 13 21 | 15 07 |
| 1905 | 6 36 | 4 13 | 12 11 | 1 12 | 0 32 | 11 23 | 13 31 | 15 15 |
| 1910 | 6 59 | 4 33 | 12 40 | 1 24 | 0 22 | 11 32 | 13 41 | 15 26 |
| 1915 | 7 22 W | 4 53 W | 13 10 W | 1 36 W | 0 14 E | 11 41 E | 13 51 E | 15 38 E |
| Annual change in 1917 | 3′.2 incr. | 3′.0 incr. | 4′.0 incr. | 1′.2 incr. | 0′.8 decr. | 0′.5 decr. | 0′.3 decr. | 0′.1 decr. |

| Region. | Tennessee, east. | Tennessee, middle. | Tennessee, west. | Texas, east. | Texas, middle. | Texas, west. | Texas, northwest. | Utah. |
|---|---|---|---|---|---|---|---|---|
| Place | Knoxville | Shelbyville | Huntingdon | Houston | San Antonio | Pecos | Floydada | Manti |
| Latitude | 35 56 | 35 30 | 36 00 | 29 47 | 29 29 | 31 26 | 33 59 | 39 16 |
| Longitude | 83 57 | 86 29 | 88 23 | 95 21 | 98 32 | 103 33 | 101 15 | 111 40 |
| 1750 | | | | | | | | |
| 1760 | | | | | | | | |
| 1770 | | | | | | | | |
| 1780 | | | | | | | | |
| 1790 | | | | | | | | |
| 1800 | 3 40 E | 6 12 E | 7 01 E | | | | | |
| 1810 | 3 49 | 6 26 | 7 18 | | | | | |
| 1820 | 3 48 | 6 30 | 7 26 | 8 59 E | | | | |
| 1830 | 3 38 | 6 26 | 7 26 | 9 14 | 9 33 E | 10 43 E | | |
| 1840 | 3 19 | 6 14 | 7 18 | 9 23 | 9 45 | 10 57 | | |
| 1850 | 2 54 | 5 54 | 7 01 | 9 23 | 9 50 | 11 05 | 11 15 E | 16 27 E |
| 1860 | 2 21 | 5 28 | 6 37 | 9 16 | 9 45 | 11 04 | 11 17 | 16 40 |
| 1870 | 1 45 | 4 55 | 6 07 | 8 54 | 9 33 | 10 57 | 11 10 | 16 45 |
| 1880 | 1 05 | 4 18 | 5 31 | 8 23 | 9 13 | 10 45 | 10 55 | 16 40 |
| 1890 | 0 30 E | 3 42 | 4 55 | 7 52 | 8 43 | 10 21 | 10 24 | 16 25 |
| 1900 | 0 01 W | 3 12 | 4 26 | 7 41 | 8 40 | 10 15 | 10 16 | 16 30 |
| 1905 | 0 10 | 3 05 | 4 22 | 7 51 | 8 54 | 10 27 | 10 27 | 16 44 |
| 1910 | 0 19 | 3 00 | 4 20 | 8 06 | 9 11 | 10 45 | 10 43 | 17 05 |
| 1915 | 0 25 W | 2 58 E | 4 22 E | 8 21 E | 9 28 E | 11 03 E | 10 58 E | 17 21 E |
| Annual change in 1917 | 0′.4 incr. | 0′.0 | 0′.6 incr. | 2′.2 incr. | 2′.2 incr. | 2′.2 incr. | 1′.6 incr. | 1′.0 incr. |

*Secular Change of the Magnetic Declination in the United States*—Continued.

| Region. | Vermont. | Virginia, east. | Virginia, middle. | Virginia, west. | Washington, east. | Washington, west. | West Virginia. |
|---|---|---|---|---|---|---|---|
| Place | Rutland | Richmond | Lynchburg | Wytheville | Wilson Creek | Seattle | Sutton |
| Latitude | 43 37 | 37 33 | 37 24 | 36 57 | 47 26 | 47 33 | 38 39 |
| Longitude | 72 58 | 77 28 | 79 08 | 81 04 | 119 00 | 122 15 | 80 43 |
| 1750 | 7 34 W | 1 13 W | | | | | |
| 1760 | 7 00 | 0 37 | 0 06 W | | | | |
| 1770 | 6 35 | 0 05 W | 0 28 E | | | | |
| 1780 | 6 19 | 0 20 E | 0 57 | | | 17 11 E | |
| 1790 | 6 14 | 0 38 | 1 19 | | | 17 44 | 1 29 E |
| 1800 | 6 21 | 0 47 | 1 32 | 2 48 E | | 18 19 | 1 44 |
| 1810 | 6 38 | 0 47 | 1 37 | 2 55 | | 18 56 | 1 51 |
| 1820 | 7 04 | 0 38 | 1 32 | 2 52 | | 19 33 | 1 48 |
| 1830 | 7 39 | 0 20 E | 1 19 | 2 43 | | 20 08 | 1 36 |
| 1840 | 8 20 | 0 05 W | 0 57 | 2 24 | | 20 41 | 1 15 |
| 1850 | 9 04 | 0 36 | 0 31 E | 1 59 | 21 15 E | 21 11 | 0 47 |
| 1860 | 9 50 | 1 12 | 0 04 W | 1 26 | 21 36 | 21 37 | 0 12 E |
| 1870 | 10 30 | 1 51 | 0 43 | 0 48 | 21 51 | 21 58 | 0 26 W |
| 1880 | 11 10 | 2 29 | 1 23 | 0 08 E | 21 55 | 22 11 | 1 07 |
| 1890 | 11 33 | 3 06 | 2 00 | 0 32 W | 22 05 | 22 24 | 1 45 |
| 1900 | 12 08 | 3 40 | 2 34 | 1 05 | 22 21 | 22 46 | 2 21 |
| 1905 | 12 18 | 3 55 | 2 50 | 1 18 | 22 37 | 23 06 | 2 37 |
| 1910 | 12 48 | 4 13 | 3 07 | 1 30 | 22 59 | 23 32 | 2 54 |
| 1915 | 13 18 W | 4 33 W | 3 24 W | 1 42 W | 23 12 E | 23 45 E | 3 11 W |
| Annual change in 1917 | 4′.0 incr. | 2′.7 incr. | 2′.1 incr. | 1′.5 incr. | 0′.0 | 0′.0 | 2′.0 incr. |

| Region. | Wisconsin, east. | Wisconsin, west. | Wyoming, east. | Wyoming, west. |
|---|---|---|---|---|
| Place | Shawamo | Stanley | Douglas | Green River |
| Latitude | 44 47 | 44 57 | 42 44 | 41 32 |
| Longitude | 88 37 | 90 56 | 105 22 | 109 28 |
| 1750 | | | | |
| 1760 | | | | |
| 1770 | | | | |
| 1780 | | | | |
| 1790 | | | | |
| 1800 | | | | |
| 1810 | | | | |
| 1820 | 7 24 E | 8 54 E | | |
| 1830 | 7 27 | 9 03 | | |
| 1840 | 7 18 | 9 00 | | |
| 1850 | 6 58 | 8 46 | 15 50 E | 16 46 E |
| 1860 | 6 29 | 8 22 | 15 58 | 16 59 |
| 1870 | 5 52 | 7 50 | 15 58 | 17 03 |
| 1880 | 5 03 | 7 06 | 15 48 | 16 51 |
| 1890 | 4 19 | 6 20 | 15 18 | 16 31 |
| 1900 | 3 44 | 5 45 | 15 14 | 16 37 |
| 1905 | 3 34 | 5 37 | 15 26 | 16 50 |
| 1910 | 3 27 | 5 34 | 15 42 | 17 09 |
| 1915 | 3 20 E | 5 31 E | 15 55 E | 17 23 E |
| Annual change in 1917 | 2′.0 decr. | 1′.6 decr. | 0′.3 incr. | 0′.4 incr. |

# LINES OF EQUAL MAGNETIC DECLINATION AND OF EQUAL ANNUAL CHANGE IN THE UNITED STATES FOR 1915

THIRD EDITION

EAST DECLINATION

WEST DECLINATION

Annual Change

U. S. Coast and Geodetic Survey

E. Lester Jones, Superintendent.

*The lines of equal magnetic declination (red lines) apply to January 1, 1915. East of the line marked 0° (agonic line) the north end of the compass needle points west of north, west of that line it points east of north.*

*The north end of the compass needle is moving to the westward for places east of the line of no change and to the eastward for places west of that line at an annual rate indicated by the lines of equal annual change (blue lines).*

Statute Miles

Kilometers

West from Greenwich

NORRIS PETERS, INC., LITHO., WASHINGTON, D. C.