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51. *The Non-dipole Part of the Earth's Magnetic Field.*

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Summary

The non-dipole parts of the earth's magnetic field were synthesized from spherical harmonic coefficients for various epochs, going back to the 16th century. Time variations in the non-dipole fields were then examined.

The distribution of the non-dipole field in the northern hemisphere seems to have undergone a great change in the 18th century. Since then, the main features of the non-dipole field have remained nearly the same. Examination of individual non-dipole anomalies revealed the existence of three types of regional anomalies. One is the anomaly drifting westwards. The second one is that staying nearly at the same place but changing its intensity. The third type is the anomaly standing still with constant intensity. It has been revealed that only a few anomalies belong to the first type and that most of the anomalies remain at the same position and belong to the second or third type anomaly.

1. Introduction

It has long been noticed that there is a close relationship between the geomagnetic secular variations and the non-dipole parts of the earth's magnetic field. Recent analyses for the last several decades data revealed that the westward drift of the non-dipole field contributes to causing a considerable part of the observed secular change[1),2),3)]. Examining the archeomagnetic data as well as the old records of magnetic measurements, it was also confirmed that the westward drift had been noticeable over

1) T. YUKUTAKE, "The Westward Drift of Magnetic Field of the Earth," *Bull. Earthq. Res. Inst.*, **40** (1962), 1-65.

2) T. NAGATA, "The Main Aspects of Geomagnetic Secular Variation—Westward Drift and Non-drifting Component," *Proc. Benedum Earth Mag. Symp.*, (1962), 39-55.

3) N. V. ADAM, N. P. BEN'KOVA, V. P. ORLOV and L. O. TYURMINA, "Western Drift of the Geomagnetic Field," *Geomag. Aeron.*, **4** (1964), 434-441 (English).

Table 1. Spherical harmonic analyses of the

Epoch	Author	(n_{max}, m_{max})[a]	Data[b]
1550 AD	Fritsche	(6, 5)	(X, Y) from observed D and approximate H
1600	Fritsche	(6, 5)	(X, Y) from observed D and approximate H
1650	Fritsche	(6, 5)	(X, Y) from observed D and approximate H
1700	Fritsche	(6, 5)	(X, Y) from observed D and approximate H
1780	Fritsche	(6, 5)	(X, Y)
1780	Carlheim-Gyllensköld	(4, 4)	(X, Y, Z) from observed D, I and approximate H
1829	Erman and Petersen	(4, 4)	(X, Y, Z)
1839	Gauss[c]	(4, 4)	(X, Y, Z)
1845	Adams	(6, 6)	(X, Y, Z)
1885	Schmidt[c]	(6, 4)	(X, Y, Z)
1922	Dyson and Furner	(6, 6)	(X, Y)
1945	Vestine et al.	(6, 6)	(X, Y) and (Z)
1955	Finch and Leaton	(6, 6)	(X, Y)
1965	Leaton et al.	(8, 8)	(X, Y)

a) The maximum degree and order of the harmonic series.
b) Components on which the analyses were based. X and Y without any comments
c) Cited by Mauersberger (see also footnote).

earth's magnetic field employed for this study.

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H. Fritsche, "Ueber die Bestimmung der Coefficienten der Gaussischen allgemeinen Theorie des Erdmagnetismus für das Jahr 1885 und über den Zusammenhang der drei Erdmagnetischen Elemente untereinander." St. Petersburg 1897.
"Die Elemente des Erdmagnetismus für die Epochen 1600, 1650, 1700, 1780, 1842, und 1885, und ihre säcularen Aenderungen, berechnet mit Hülfe der aus allen brauchbaren Beobachtungen abgeleiteten Coefficienten der Gaussischen 'allgemeinen Theorie des Erdmagnetismus'." St. Petersburg 1897.
"Die Elemente des Erdmagnetismus und ihre säcularen Aenderungen während des Zeitraumes 1550 bis 1915." St. Petersburg 1900.
"Atlas des Erdmagnetismus für die Epochen 1600, 1700, 1780, 1842 und 1915." Riga 1903.

V. Carlheim-Gyllensköld, "Sur la forme analytique de l'attraction magnétique de la terre, exprimée en fonction der temps," Astronomiska Iakttagelser och Undersöknigar, Stockholms Observat., 5 (1896), 1-36.

A. Erman und H. Petersen, "Die Grundlagen der Gaussischen Theorie und die Erscheinungen des Erdmagnetismus im Jahre 1829," Berlin 1874.

G. F. Gauss, "Allgemeine Theorie des Erdmagnetismus, Resultate aus den Beobachtungen des Göttinger Magnetischen Vereins im Jahre 1838," Göttingen und Leipzig 1839.

W. G. Adams, "An account of the late Professor John Couch Adams's determination of the Gaussian magnetic constants," British Association Advanc. Sci., Bristol meeting 1898, International Conference on Terr. Mag. and Atm. Elect., pp. 22-49.

A. Schmidt, "Mathematische Entwicklungen zur allgemeinen Theorie des Erdmagnetismus," Archiv Deutsch. Seewarte XII, Nr. 3, Hamburg 1889.

E. Dyson and H. Furner, "The earth's magnetic potential," Mon. Not. Roy. Astr. Soc. London, Geophys. Suppl. **1** (1923), 76-88.

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A. B. Kahle, J. W. Kern and E. H. Vestine, "Spherical harmonic analyses for the spheroidal earth (II)," Jour, Geomag. Geoelect., **18** (1966), 349-354.

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B. R. Leaton, S. R. C. Malin and M. J. Evans, "An analytical representation of the estimated geomagnetic field and its secular change for the epoch 1965.0." Jour. Geomag. Geoelect., **17** (1965), 187-194.

were computed from observed H and D.

the historic past[4),5)]. This fairly long lasting drift in the secular change can be expected only when the non-dipole fields have been persisting more than several hundred years. Theoretical investigation also gives a few thousand years of a free decay time of the non-dipole fields, when the effect of the fluidal motion in the earth's core is ignored[6)]. The long decay time of the non-dipole field obtained above suggests that old maps of the non-dipole field, if constructed by any means, should preserve the main features of the distribution of the present magnetic field, only displaced in the east west direction.

We have a number of spherical harmonic analyses of the geomagnetic field for the last several hundred years, from which the magnetic field for the past epoch can be synthesized. It has recently been ascertained that the non-dipole field thus synthesized from the spherical harmonic coefficients can well approximate the charted field, i.e. with an uncertainty less than 10% for the analyses of the 20th century and about 20% for those of the 19th century[7)].

In this paper, the non-dipole fields are synthesized going back to the 17th century, and the time variations in the individual features of the non-dipole field are examined.

2. Spherical harmonic analyses of the geomagnetic field in the past

Since the beginning of the 19th century, spherical harmonic analyses of the geomagnetic field have repeatedly been conducted. They were reviewed by Mauersberger[8)] so exhaustively that it does not seem necessary to reproduce here the details of the analyses. For the magnetic field before 1829, on the other hand, we have very few analyses, because the reliable data of the absolute field intensity are hardly availble

4) S. P. BURLATSKAYA, T. B. NECHAEVA and G. N. PETROVA, "The Westward Drift of the Secular Variation of Magnetic Inclination and Variation of the Earth's Magnetic Moment according to 'Archeomagnetic' Data," *Izv. Earth Phys. Ser.*, **6** (1965), 230-385 (English).

5) T. YUKUTAKE, "The Westward Drift of the Earth's Magnetic Field in Historic Times," *Jour. Geomag. Geoelectr.*, **19** (1967), 103-116.

6) T. YUKUTAKE, "Free Decay of Non-dipole Components of the Geomagnetic Field," *Phys. Earth Planetary Inter.*, **1** (1968), 93-96.

7) T. YUKUTAKE, "Synthesis of the Non-dipole Components of the Earth's Magnetic Field from Spherical Harmonic Coefficients." *Bull. Earthq. Res. Inst.*, **46** (1968), 385-403.

8) P. MAUERSBERGER, "Mathematische Beschreibung und Statistische Untersuchung des Hauptfeldes und der Säkularvariation," in: G. FANSELAU (Editor), *Geomagnetismus und Aeronomie.* VEB Deutscher Verlag der Wiss., Berlin, **3** (1959), 95-213.

Table 2. Gauss-Schmidt coefficients of the main field analyses for the 16th to the 18th century. In the unit of gammas.

		Fritsche 1550		Fritsche 1600		Fritsche 1650		Fritsche 1700		Fritsche 1780		Carlheim-Gyllensköld 1780	
n	m	g_n^m	h_n^m	g_n^m	h_n^m	g_n^m	h_n^m	g_n^m	h_n^m	g_n^m	h_n^m	g_n^m	h_n^m
1	0	−32278		−32316		−32363		−32365		−31985		−31922	
1	1	−2629	977	−2797	1676	−3007	2550	−3141	4089	−3552	5698	−4725	4485
2	0	−172		−205		−247		−294		−335		407	
2	1	1660	1660	1746	1290	1854	1189	2021	751	2447	109	2104	2104
2	2	−1543	−2786	−2130	−2250	−2143	−1581	−1610	−542	−806	818	−783	1456
3	0	735		632		746		787		906		655	
3	1	−259	−502	−221	−509	−174	−519	−234	−483	−420	−386	−1098	−621
3	2	533	−226	565	−105	606	45	873	197	1383	221	1043	167
3	3	482	−317	276	−156	18	47	−156	215	−276	596	−1000	601
4	0	616		595		570		563		493		240	
4	1	156	118	226	0	313	−148	383	−78	928	−180	1080	−542
4	2	728	−620	603	−527	447	−411	488	−581	542	−374	13	−258
4	3	397	57	340	−93	269	−280	98	−304	−131	−285	−283	−96
4	4	134	−354	77	−288	7	−206	−164	−208	−158	−272	−74	−403
5	0	33		28		22		55		180			
5	1	280	20	257	−76	229	−197	175	−180	210	−231		
5	2	190	−22	243	−16	309	−8	328	−111	320	−72		
5	3	−117	−211	−127	−124	−140	−16	−69	31	24	37		
5	4	18	−112	9	−118	−1	−125	−11	−71	−9	−14		
5	5	73	402	190	271	336	107	161	−53	21	−70		
6	0	77		68		57		57		76			
6	1	33	−6	40	−1	25	5	3	2	89	−25		
6	2	−133	−138	−110	−81	−83	−10	−98	−34	−44	−0		
6	3	−59	−40	−75	−47	−95	−36	−101	−48	−176	−10		
6	4	−110	91	−63	45	−4	−12	−43	−17	12	−3		
6	5	45	96	73	335	−30	336	−100	289	26	48		

in the 18th century. However, it is not impossible to calculate the spherical harmonic coefficients from the magnetic declination and the inclination only, when the approximate values of the field intensity are known. Assuming that the horizontal intensity had not changed appreciably during the period concerned and taking the field intensity at 1829 as the first approximation, Carlheim-Gyllensköld computed the harmonic coefficients for 1780 by a perturbation method from the observed values of the declination and the inclination[9]. He repeated the procedure and obtained the harmonic series for various epochs, extrapolating back to 1538. Following the similar procedure, Fritsche calculated the harmonic coefficients for the epochs 1550, 1600, 1650 and 1780[10),11),12),13)].

Although it is not very certain how far these analyses that have no basis on the observation of absolute field intensity can approximate the actual fields for the respective epochs, they were tentatively used in this paper for investigating the main features of the time varying non-dipole fields.

Spherical harmonic analyses employed in this study are listed in in Table 1, along with the original references. In Table 2, the Gauss-Schmidt coefficients for old epochs obtained by Fritsche and Carlheim-Gyllensköld are listed.

3. Synthesis of the non-dipole field

When the Gauss-Schmidt coefficients are given, the north (X), the east (Y) and the vertical downward components (Z) of the non-dipole field are computed by the equation,

9) V. CARLHEIM-GYLLENSKÖLD, "Sur la Forme Analytique de l'Attraction Magnétique de la Terre, Exprimée en Fonction du Temps," *Astronomiska Iakttagelser och Undersökningar, Stockholms Observat.*, **5** (1896) 5, 1-36.

10) H, FRITSCHE, *Ueber die Bestimmung der Coefficienten der Gaussischen Allgemeinen Theorie des Erdmagnetismus für das Jahr 1885 und über den Zusammenhang der drei Erdmagnetischen Elemente Untereinander* (St Petersburg 1897).

11) H. FRITSCHE, *Die Elemente des Erdmagnetismus für die Epochen 1600, 1650, 1700, 1780, 1842 und 1885, und Ihre Säcularen Aenderungen, Berechnet mit Hülfe der aus Allen Brauchbaren Beobachtungen Abgeleiteten Coefficienten der Gaussischen 'Allgemeinen Theorie des Erdmagnetismus'* (St Petersburg 1897).

12) H. FRITSCHE, *Die Elemente des Erdmagnetismus und Ihre Säcularen Aenderungen während des Zeitraumes 1550 bis 1915* (St Petersburg 1900).

13) H. FRITSCHE, *Atlas des Erdmagnetismus für die Epochen 1600, 1700, 1780, 1842 und 1915* (Riga 1903).

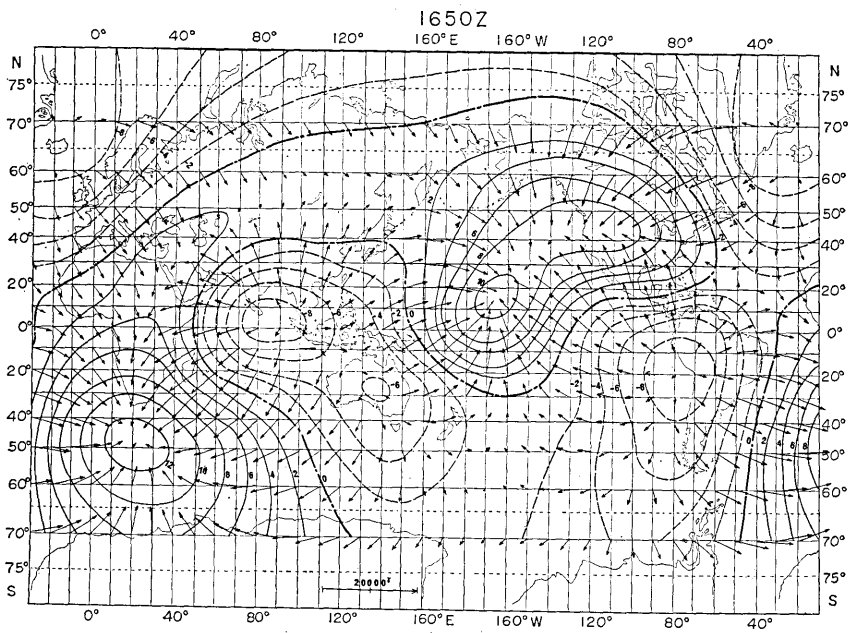

Fig. 1(a). Non-dipole field for 1650 based on Fritsche's analysis. The vertical component.

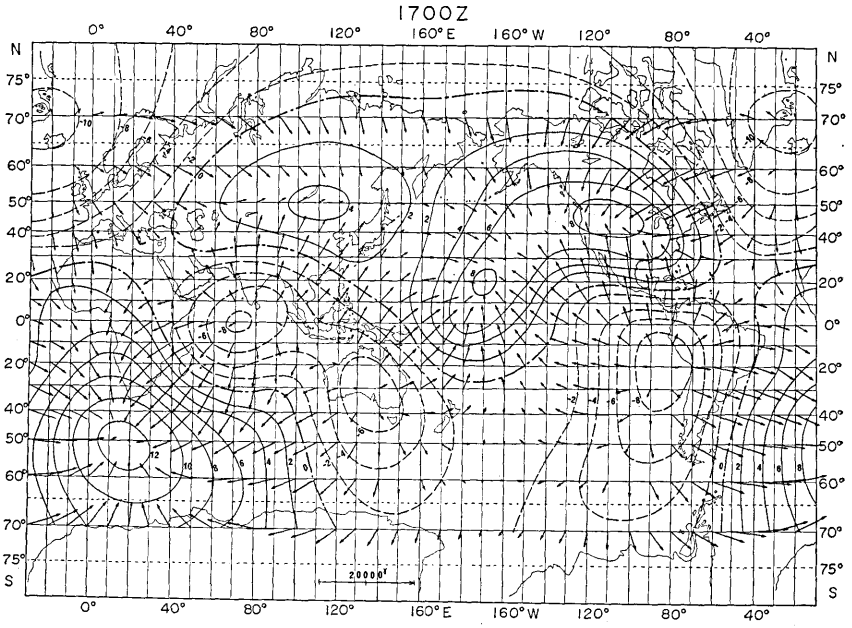

Fig. 1(b). Non-dipole field for 1700 based on Fritsche's analysis. The contours give the vertical component at intervals of 2000 γ. The arrows give the horizontal component.

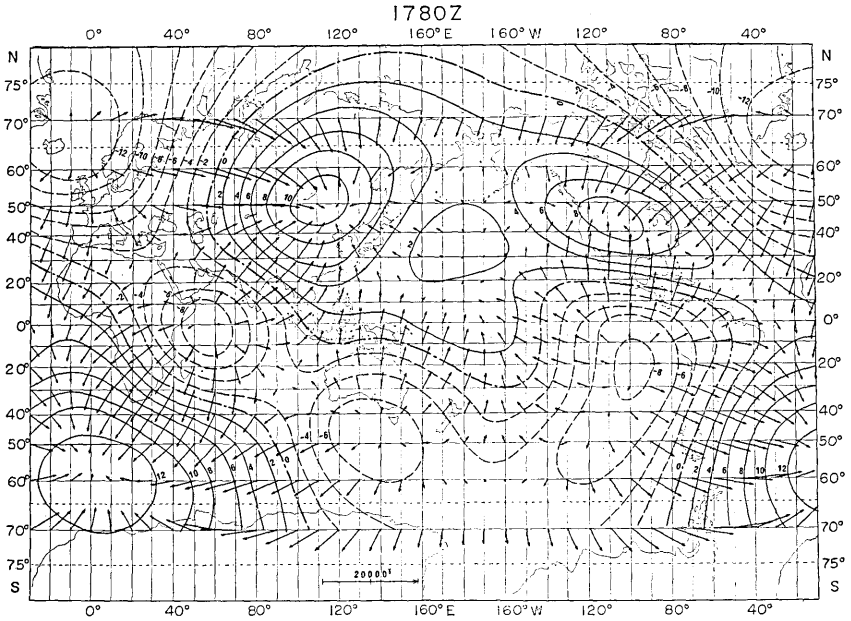

Fig. 1(c). Non-dipole field for 1780 based on Fritsche's analysis. The vertical component.

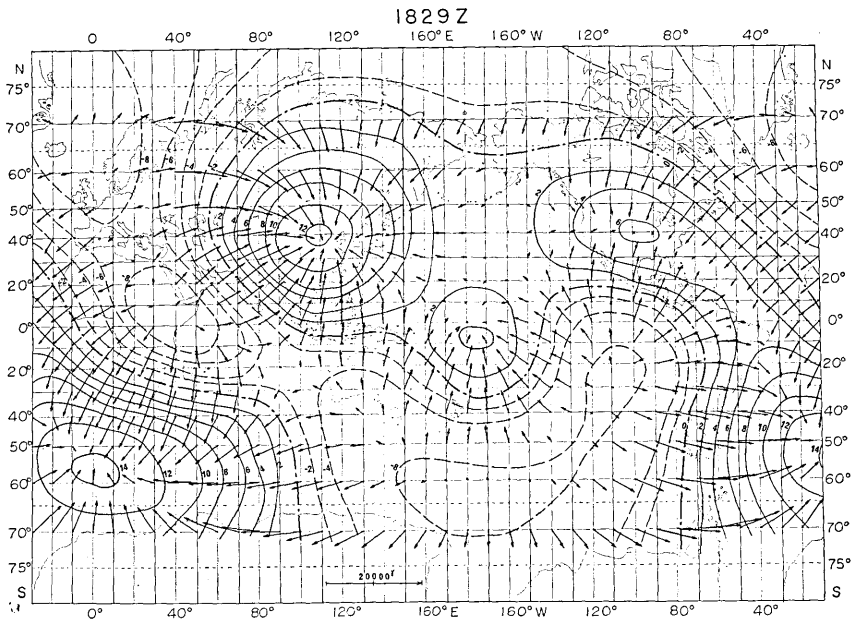

Fig. 1(d). Non-dipole field for 1829 based on Erman and Petersen's analysis. The contours give the vertical component at intervals of 2000 γ. The arrows give the horizontal component.

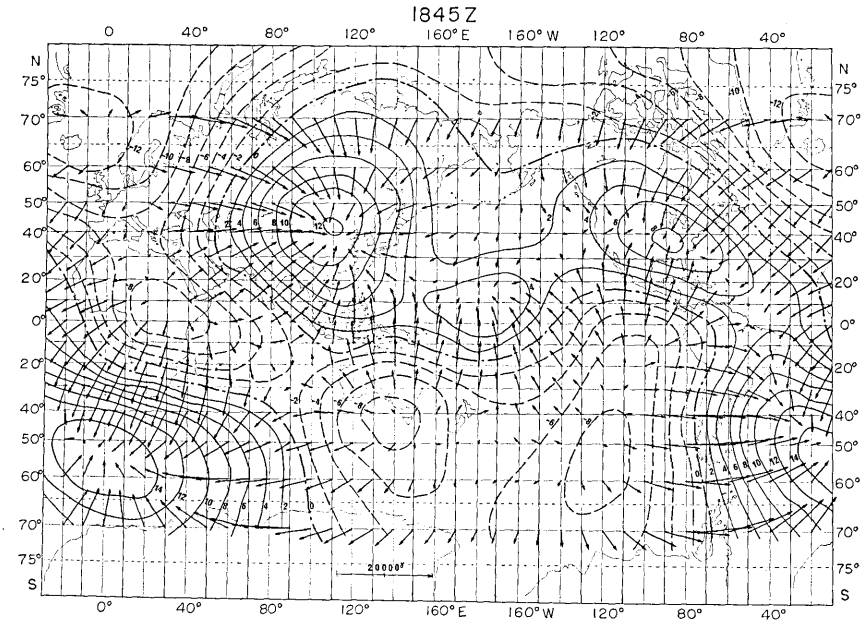

Fig. 1(e). Non-dipole field for 1845 based on Adams' analysis. The vertical component.

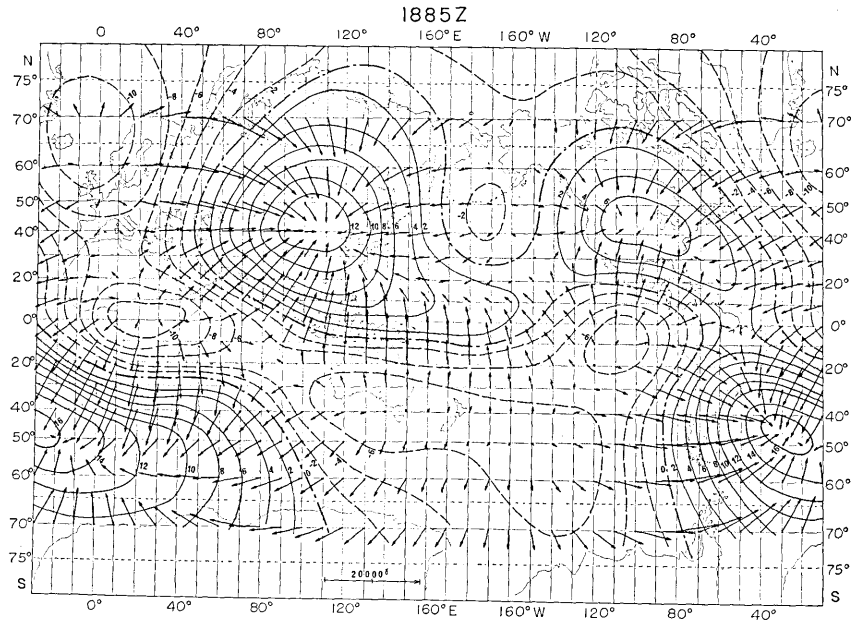

Fig. 1(f). Non-dipole field for 1885 based on Schmidt's analysis. The contours give the vertical component at intervals of 2000 γ. The arrows give the horizontal component.

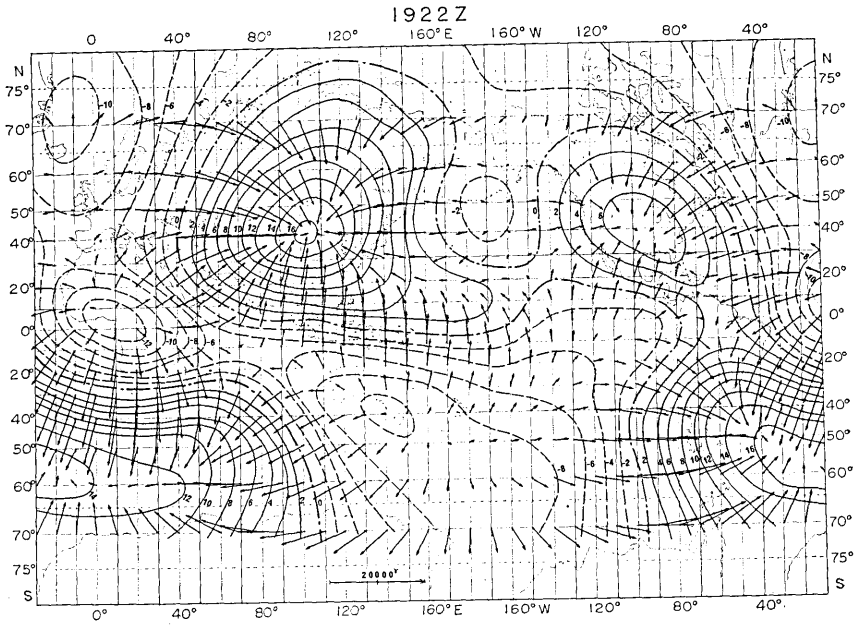

Fig. 1(g). Non-dipole field for 1922 based on Dyson and Furner's analysis. The vertical component.

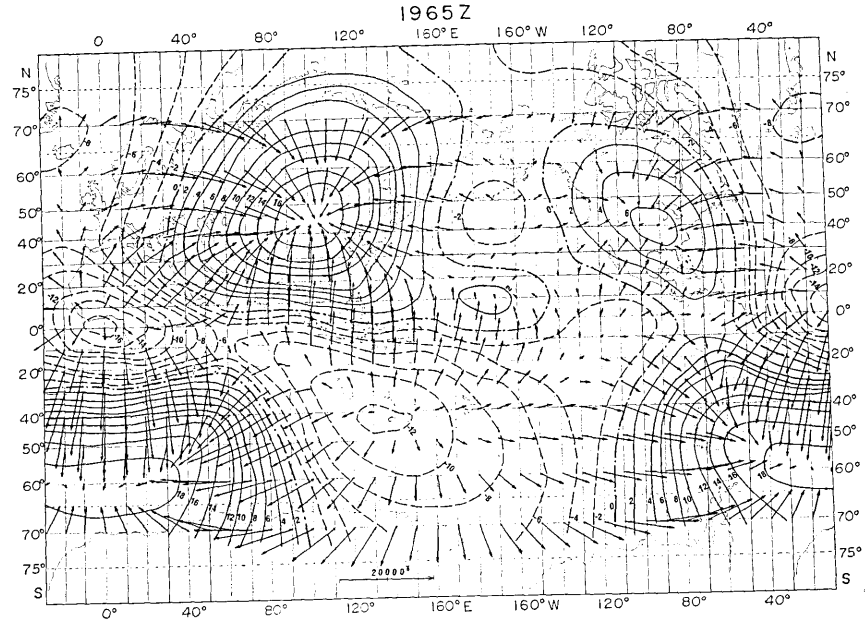

Fig. 1(h). Non-dipole field for 1965 based on Leaton et al.'s analysis. The contours give the vertical component at intervals of 2000 γ. The arrows give the horizontal component.

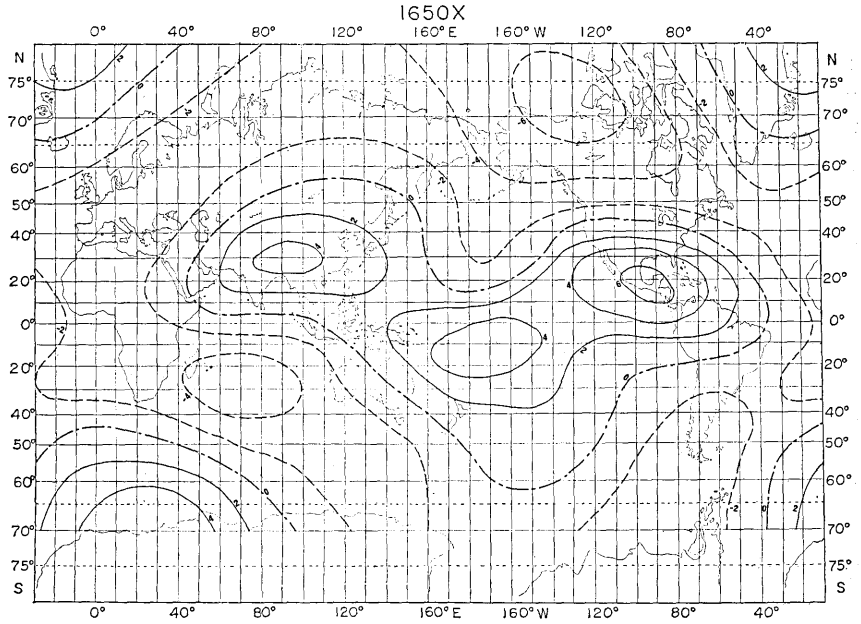

Fig. 2(a). Non-dipole field for 1650 based on Fritsche's analysis. The north component, contour interval 2000 γ.

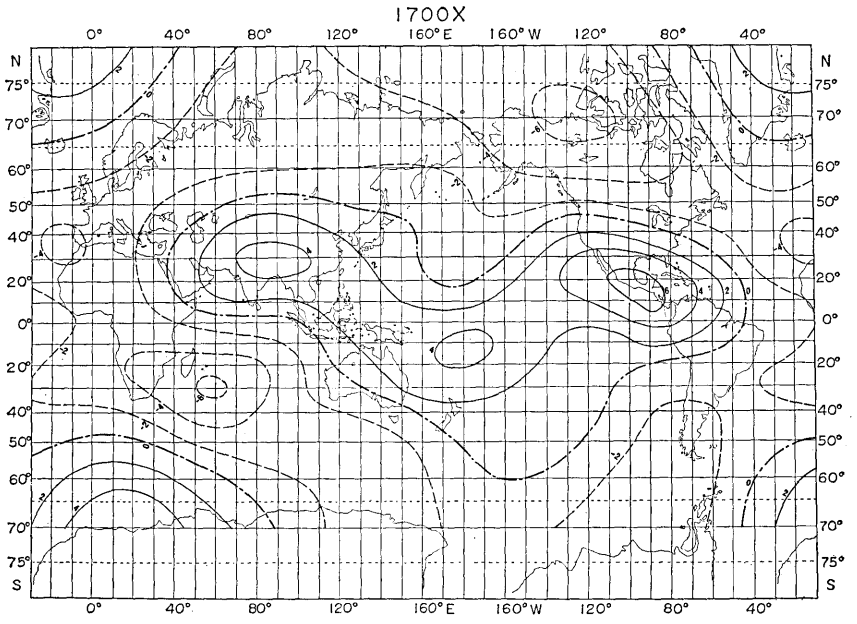

Fig. 2(b). Non-dipole field for 1700 based on Fritsche's analysis. The north component, cotour interval 2000 γ.

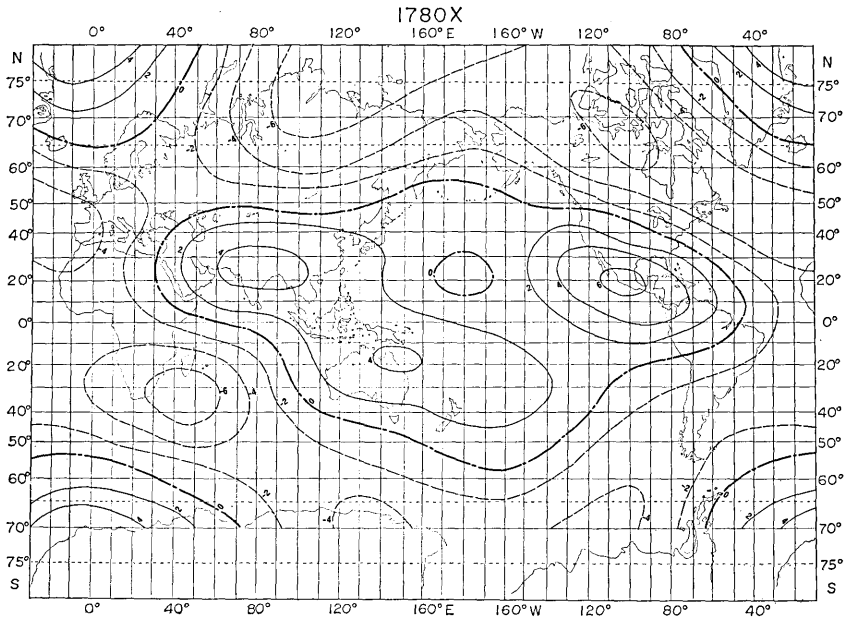

Fig. 2(c). Non-dipole field for 1780 based on Fritche's analysis. The north component, contour interval 2000 γ.

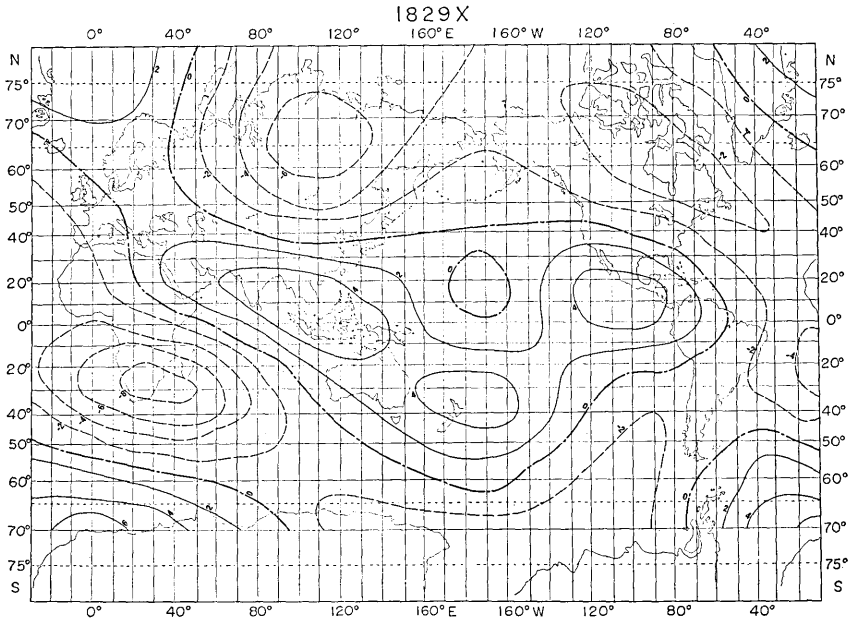

Fig. 2(d). Non-dipole field for 1829 based on Erman and Petersen's analysis. The north component, contour interval 2000 γ.

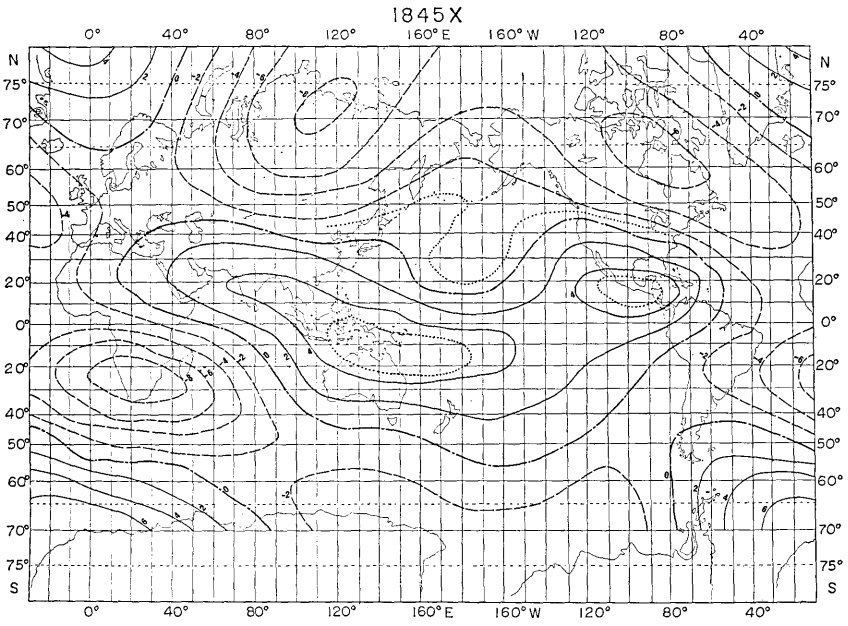

Fig. 2(e). Non-dipole field for 1845 based on Adams' analysis. The north component, contour interval 2000 γ.

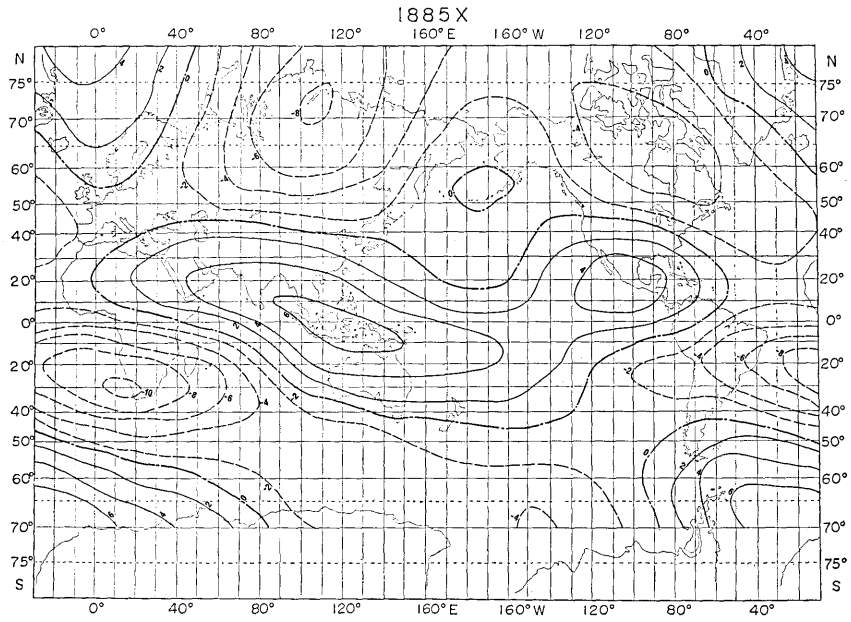

Fig. 2(f). Non-dipole field for 1885 based on Schmidt's analysis. The north component, contour interval 2000 γ.

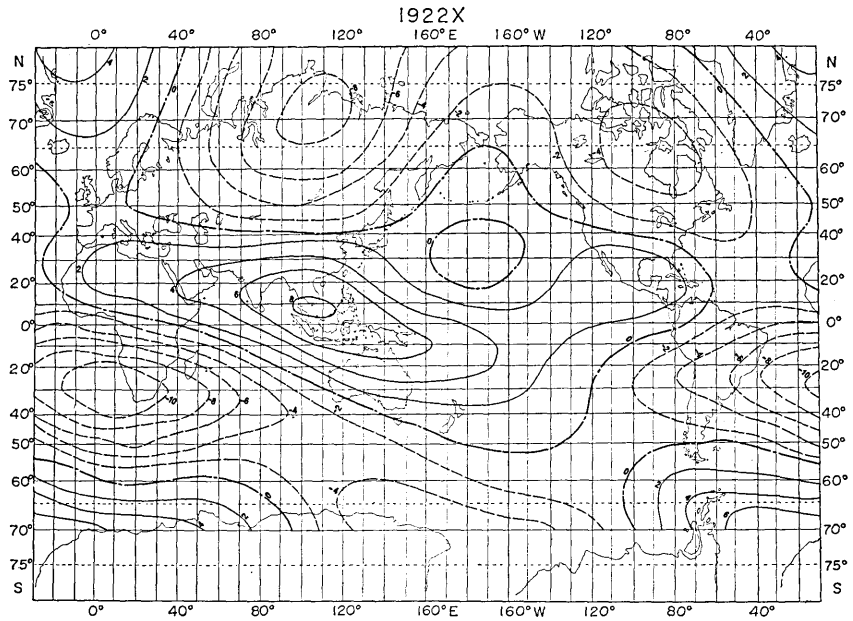

Fig. 2(g). Non-dipole field for 1922 based on Dyson and Furner's analysis. The north component, contour interval 2000 γ.

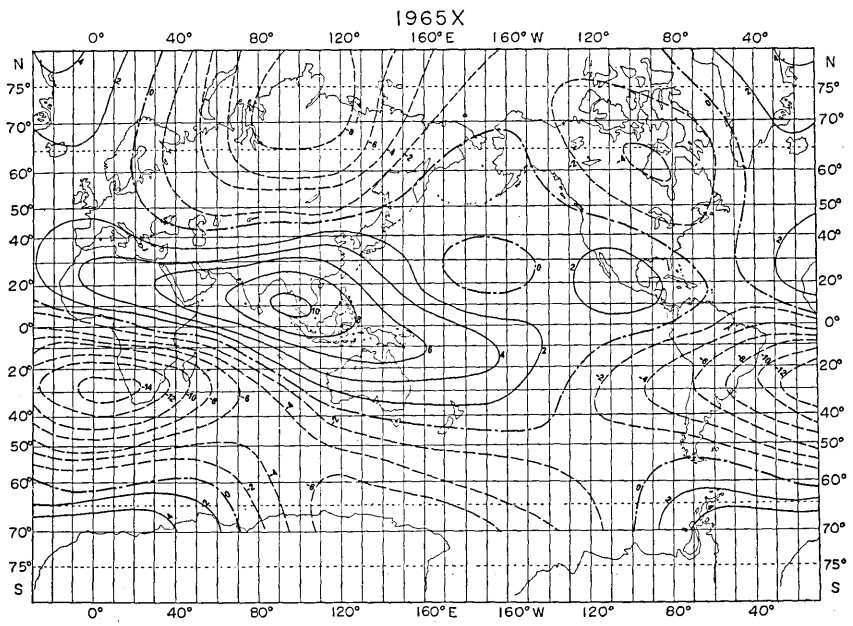

Fig. 2(h). Non-dipole field for 1965 based on Leaton et al's analysis. The north component, contour interval 2000 γ.

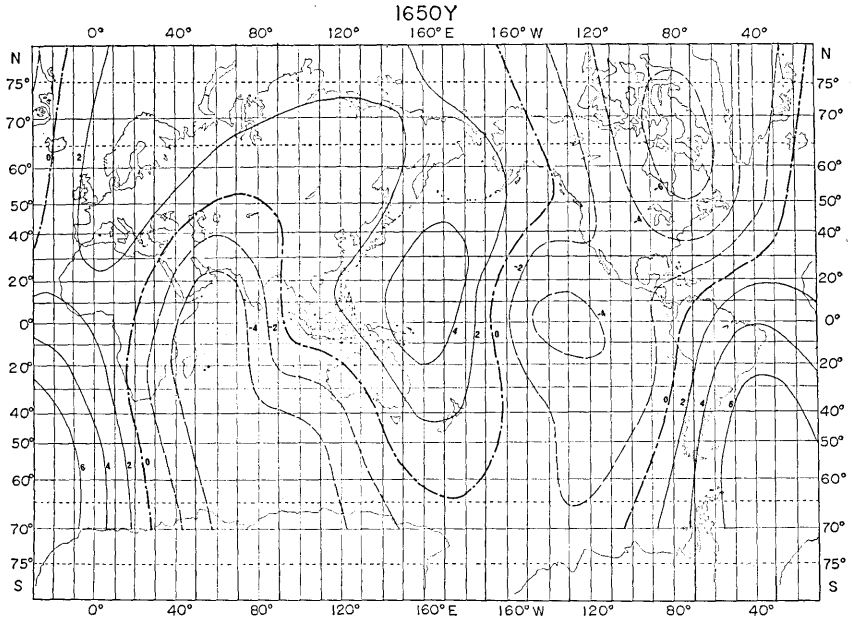

Fig. 3(a). Non-dipole field for 1650 based on Fritsche's analysis. The east component, contour interval 2000 γ.

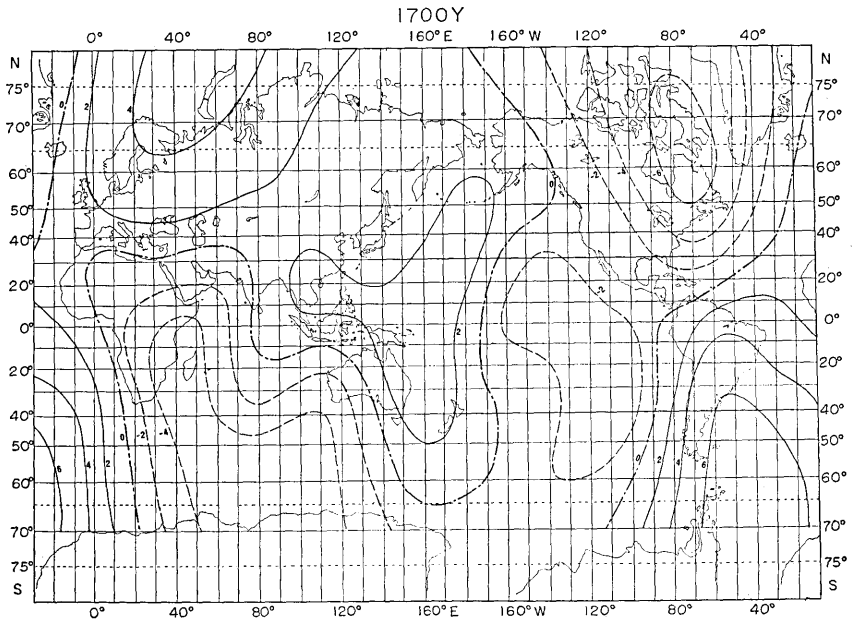

Fig. 3(b). Non-dipole field for 1700 based on Fritche's analysis. The east component, contour interval 2000 γ.

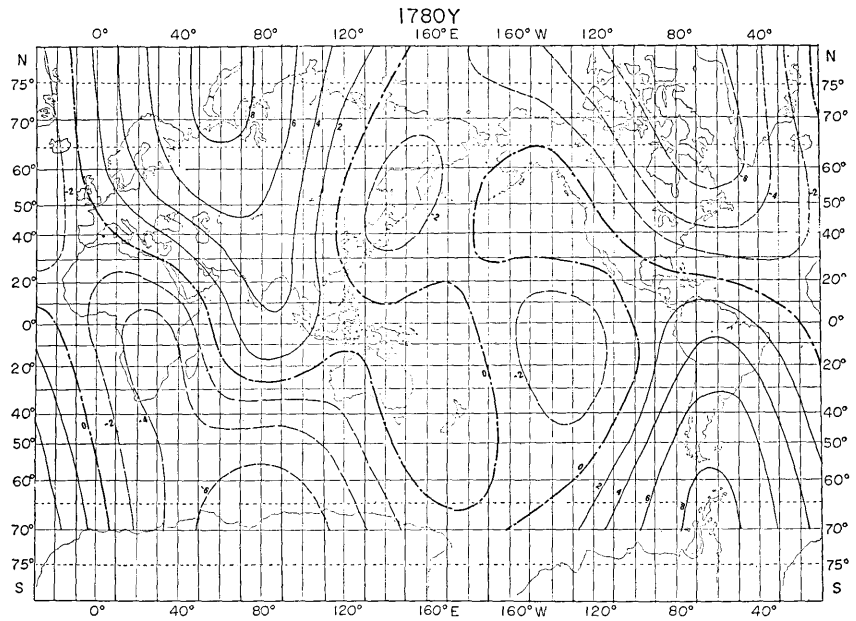

Fig. 3(c). Non-dipole field for 1780 based on Fritsche's analysis. The east component, contour interval 2000 γ.

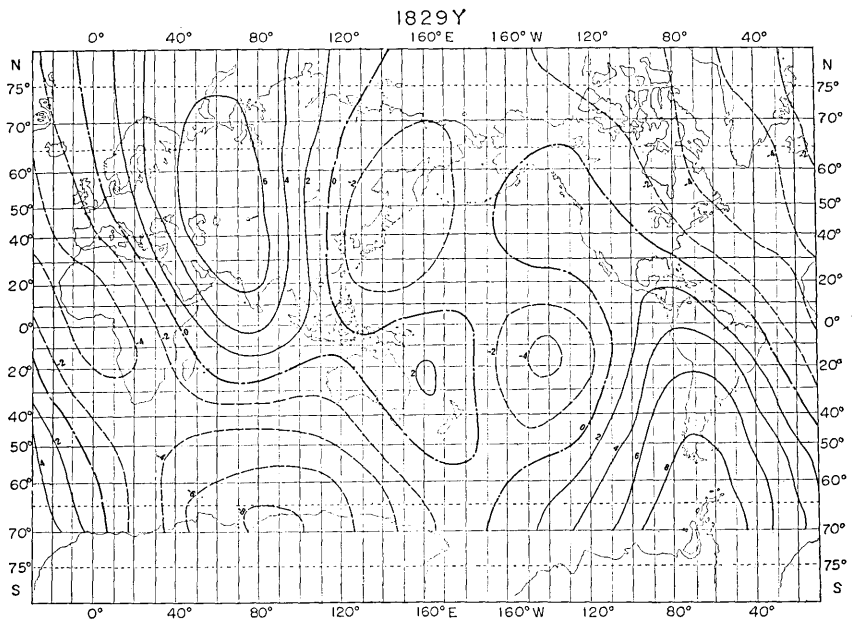

Fig. 3(d). Non-dipole field for 1829 based on Erman and Petersen's analysis. The east component, contour interval 2000 γ.

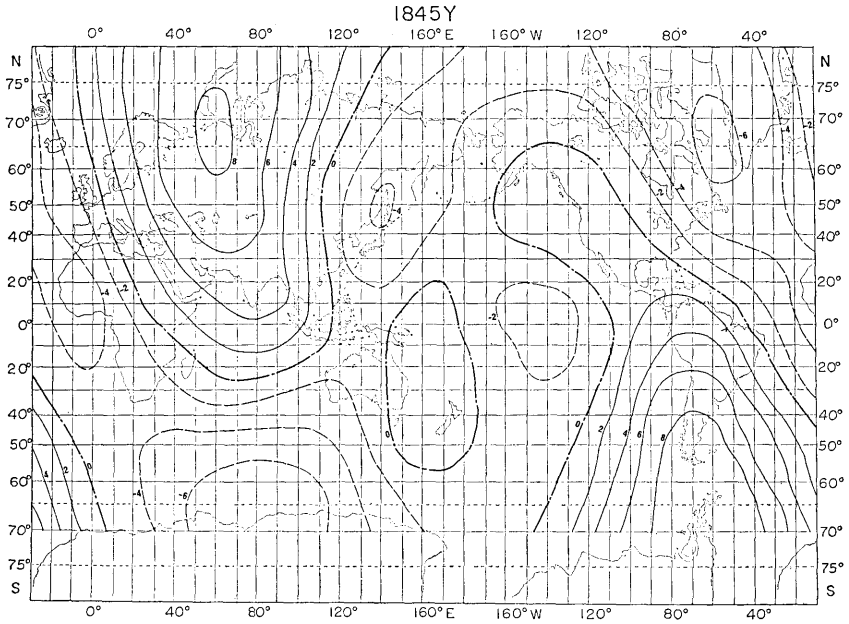

Fig. 3(e). Non-dipole field for 1845 based on Adams' analysis. The east component, contour interval 2000 γ.

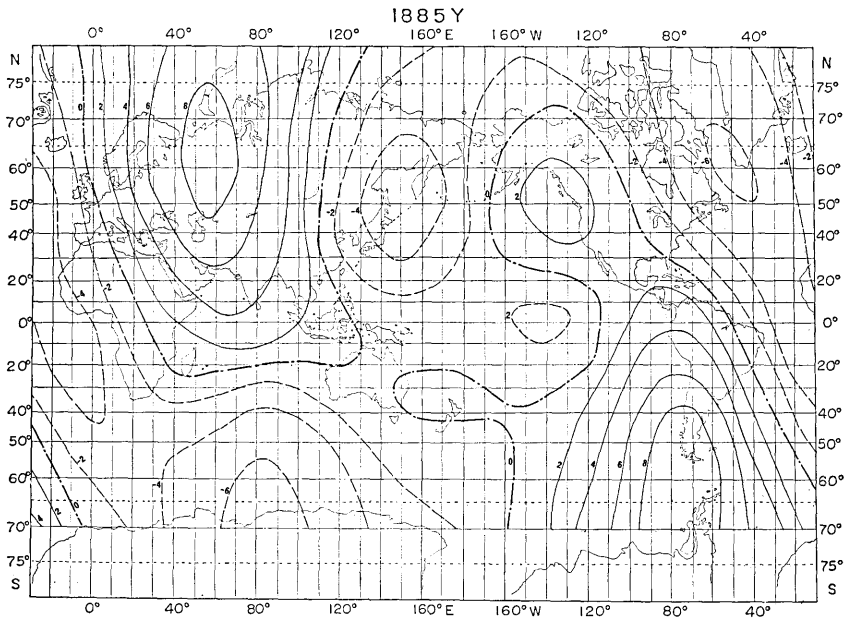

Fig. 3(f). Non-dipole field for 1885 based on Schmidt's analysis. The east component, contour interval 2000 γ.

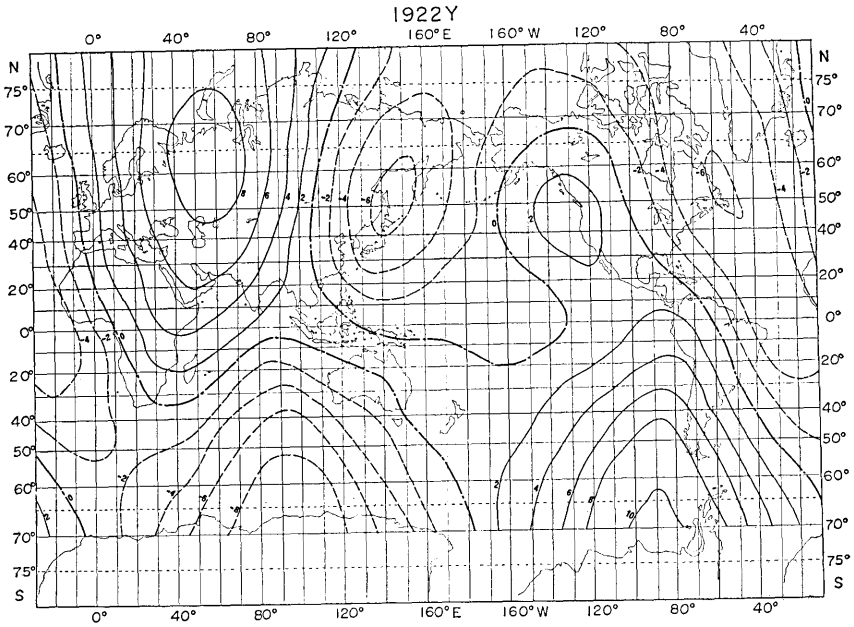

Fig. 3(g). Non-dipole field for 1922 based on Dyson and Furner's analysis. The east component, contour interval 2000 γ.

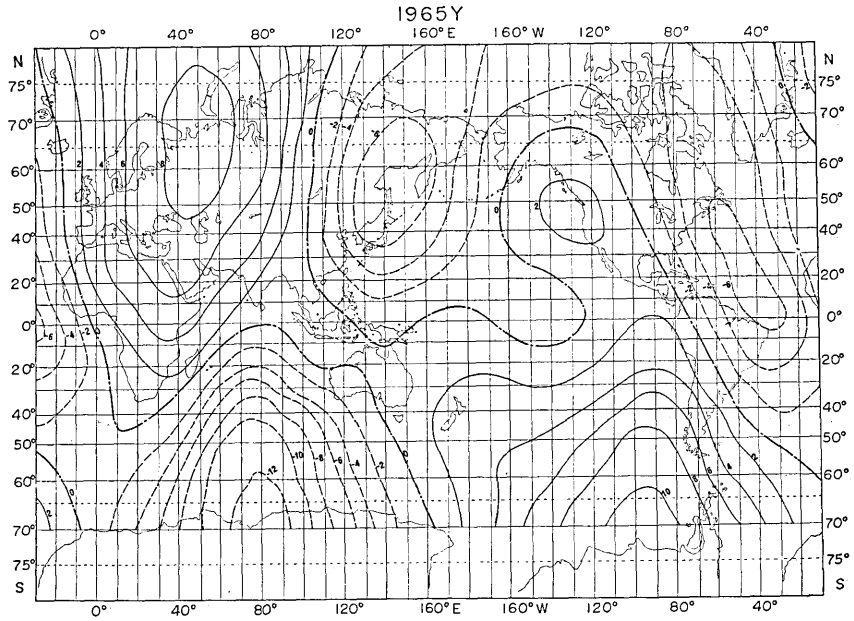

Fig. 3(h). Non-dipole field for 1965 based on Leaton et al.'s analysis. The east componet, contour interval 2000 γ.

$$X=\sum_{n=2}^{N}\sum_{m=0}^{n}(g_n^m\cos m\lambda+h_n^m\sin m\lambda)\frac{dP_n^m(\theta)}{d\theta},$$

$$Y=-\frac{1}{\sin\theta}\sum_{n=2}^{N}\sum_{m=0}^{n}m(-g_n^m\sin m\lambda+h_n^m\cos m\lambda)P_n^m(\theta),$$

$$Z=-\sum_{n=2}^{N}(n+1)\sum_{m=0}^{n}(g_n^m\cos m\lambda+h_n^m\sin m\lambda)P_n^m(\theta),$$

where $P_n^m(\theta)$ is Schmidt's half-normalized spherical function of degree n and order m, and N is the maximum degree employed for the analysis. θ and λ denote the colatitude and the east longitude respectively. For the analyses in the previous section, the non-dipole components were synthesized at 5° intervals in the longitude and 10° intervals in the latitude. The results for the epochs 1700, 1829, 1885 and 1965 are tabulated in Tables 3 to 6. The contours of the three components have been drawn through points spaced at 10° intervals of longitude and latitude by plotting the synthesized results. Several examples are shown in Figs. 1, 2 and 3. Fig. 1 shows the contours of the vertical components drawn at $2000\,\gamma$ intervals, and the arrows representing the horizontal components. Figs. 2 and 3 show the contours of the north and the east components at $2000\,\gamma$ intervals.

In Figs. 1 to 3 it is seen that several regional anomalies of continental size cover the whole earth. The distribution of the anomalies have remained roughly the same since 1780, indicating that the non-dipole fields are fairly long-lived. However, minor features of the non-dipole fields have, of course, been subjected to change with time. We can deduce fairly detailed variations in the non-dipole fields from the results of the syntheses shown in Figs. 1 to 3, though the period of observation is not sufficiently long as yet to bring the whole nature of the geomagnetic secular variation into light.

The vertical component anomalies

In 1965, there were four positive anomalies, three large and one small, and five negatives, two large and the other three smaller.

African negative anomaly

The anomaly with its center at about 0°E, 0°N in the Gulf of Guinea extends radially about 40° in angular distance. The minimum intensity is now about $-16300\,\gamma$. In 1650, the center of the anomaly

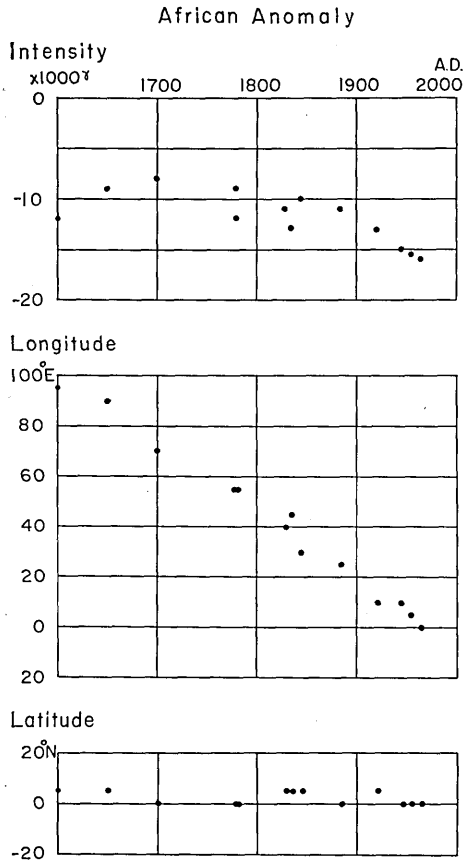

Fig. 4. Time variation in the intensity and the location of the African negative anomaly (the vertical component). From the top, the intensity at the center of the anomaly, the longitnde and the latitude of the center.

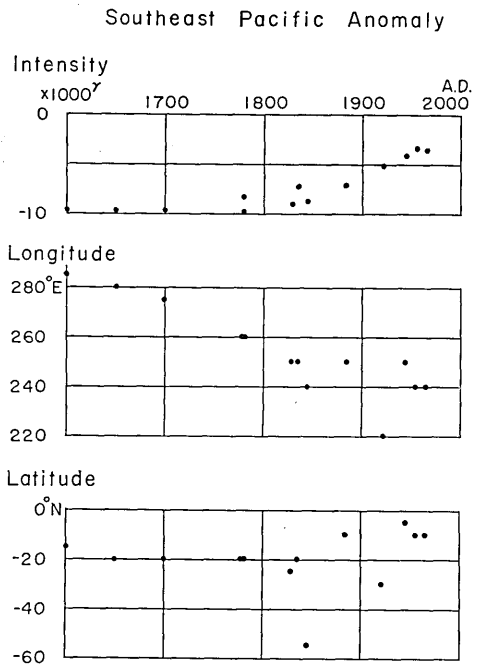

Fig. 5. Time variation in the intensity and the location of the negative anomaly in the Southeast Pacific (the vertical component). From the top, the intensity at the center of the anomaly, the longitude and the latitude of the center.

was located at about 90°E, 5°N in the East Indian Ocean, the intensity being about $-9300\,\gamma$. The intensity and the location of the center at various epochs are read on the diagrams in Fig. 1 and plotted in Fig. 4. It is noted that, since the 17th century, the center of the anomaly has been drifting westwards along the equator at a rate of 0.28°/year. During the period, the absolute intensity has increased more than fifty percent at the center.

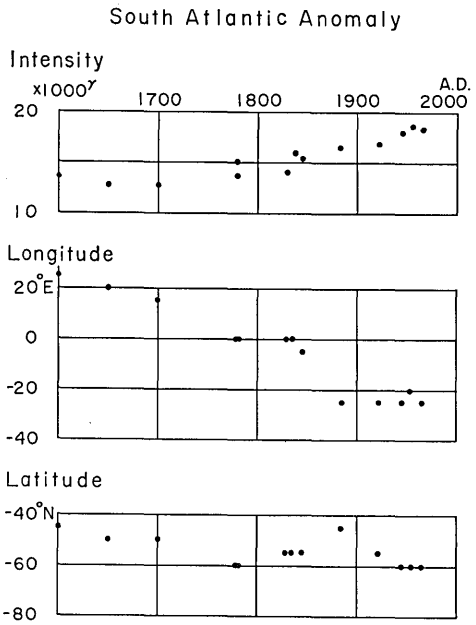

Fig. 6. Time variation in the intensity and the location of the South Atlantic positive anomaly (the vertical component). From the top, the intensity at the center of the anomaly, the longitude and the latitude of the center.

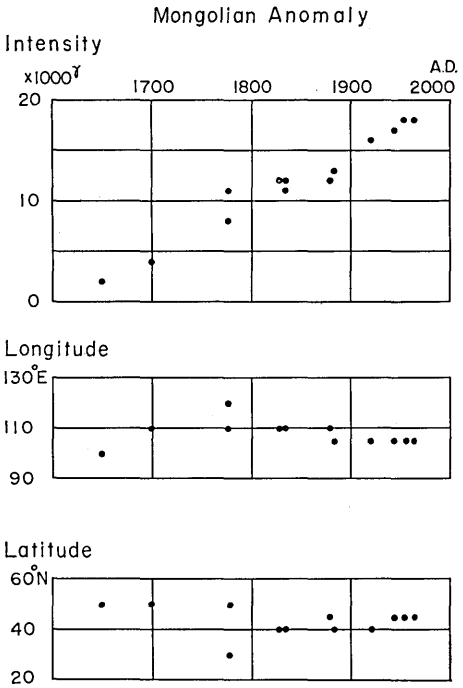

Fig. 7. Time variation in the intensity and the location of the Mongolian positive anomaly (the vertical component). From the top, the intensity at the center of the anomaly, the longitude and the latitude of the center.

Negative anomaly in the Southeast Pacific

The center is now located at about 240°E, 10°S with an intensity of about $-3700\,\gamma$. In 1650 the center was at about 280°E, 20°S and the intensity was $-9800\,\gamma$. The extension of the anomaly was about 40° in angular distance in radius. The anomaly seems to have moved westwards with a velocity of approximately 0.16°/year. Until the end of the 18th century, the intensity had remained constant (about $-10000\,\gamma$), but since the beginning of the 19th century the absolute value of the intensity has been decreasing with a rate of approximately $50\,\gamma$/year. Since the anomaly began to change its intensity, its movement has become fairly irregular.

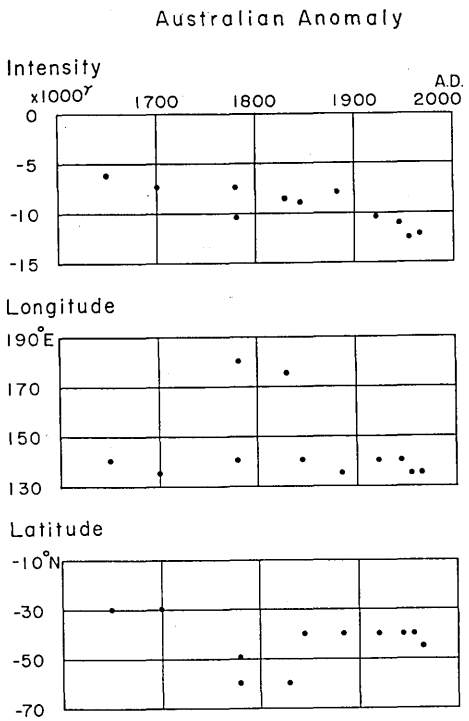

Fig. 8. Time variation in the intensity and the location of the Australian negative anomaly (the vertical component). From the top, the intensity at the center of the anomaly, the longitude and the latitude of the center.

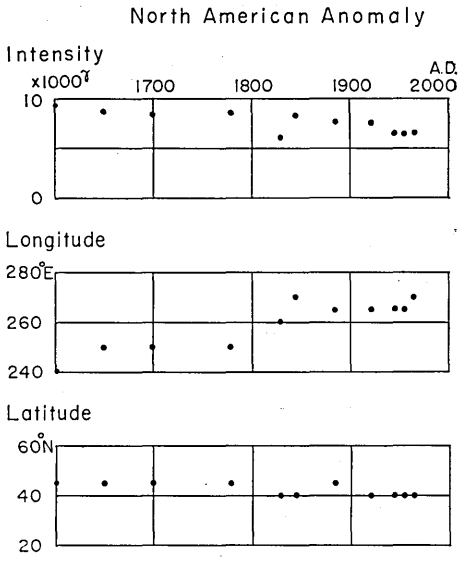

Fig. 9. Time variation in the intensity and the location of the North American positive anomaly (the vertical component). From the top, the intensity at the center, the longitude and the latitude of the center.

South Atlantic positive anomaly

This is an extremely large anomaly covering a very wide area from 120°W to 90°E. Most parts of the South American Continent, almost half of the South Atlantic and a part of the Indian Ocean are dominated by this positive anomaly. A positive ridge with an intensity stronger than 18000γ runs from east to west over 60° in angular distance along a parallel around 60°S. It might be better to divide this into two positive anomalies of approximately equal intensity, situated at 60°S, 330°E and at 60°S, 15°E. Figs. 1 (a) to (h) indicate that merely a single anomaly existed until 1885, showing a clear westward drifting. At the beginning of the 20th century, a new one seems to have been added at 60°S, 15°E, and continued growing. The intensity and the

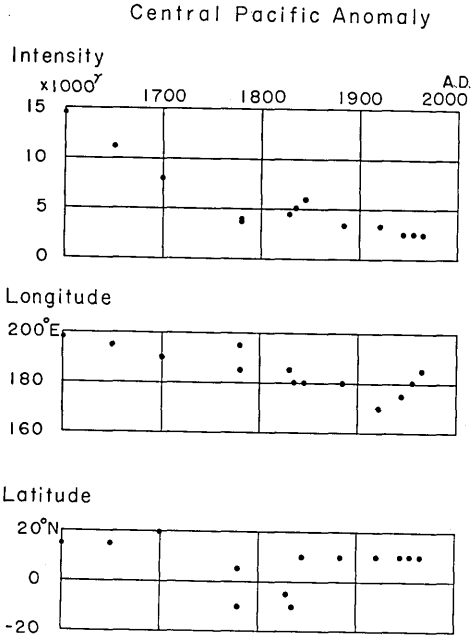

Fig. 10. Time variation in the intensity and the location of the Central Pacific positive anomaly (the vertical component). From the top, the intensity at the center, the longitude and the latitude of the center.

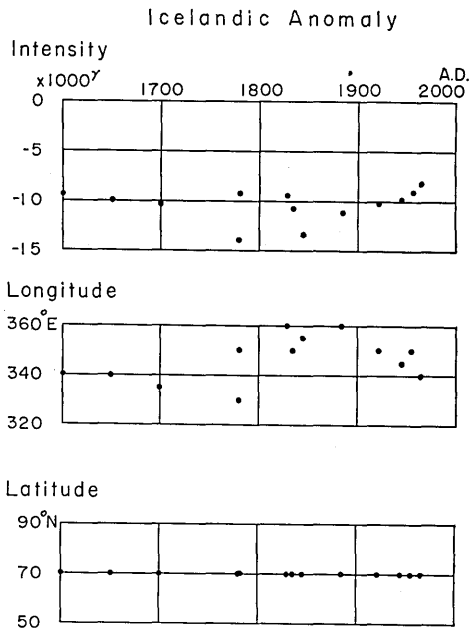

Fig. 11. Time variation in the intensity and the location of the Icelandic negative anomaly (the vertical component). From the top, the intensity at the center, the longitude and the latitude of the center.

locality of the center of the drifting part are read on the diagrams and plotted in Fig. 6. The drift rate is approximately 0.15°/year. The intensity started to increase at the beginning of the 18th century and is still increasing at a mean rate of 23 γ/year. Because of scarce measurements in the high latitudes, particularly in the old times, the quantitative estimates about this anomaly are not accurate. Detailed investigation is left to the future.

Mongolian positive anomaly

The anomaly has its center at about 105°E, 45°N, covering the whole of the Asian Continent (approximetely 35° extension in radius). The intensity of the anomaly is now about 18000 γ at its center. The anomaly had not existed until the end of the 16th century. It seems to have appeared gradually at the beginning of the 17th century. Since

then, standing almost at the same locality, it has been increasing its intensity linearly at a rate of about 53 γ/year (Fig. 7).

Australian negative anomaly

The center of the anomaly is now at 135°E, 45°S. It does not seem to have changed its location appreciably since the 17th century. The anomaly extends approximately 40° in angular distance with the intensity of $-12500\,\gamma$ at present. As is shown in Fig. 8, the absolute intensity at the center has been increasing at a rate of 18 γ/year.

North American positive anomaly

The anomaly covers almost the whole continent of North America, the intensity being about 6500 γ. The center of the anomaly has been located at the same place (265°E, 40°N) since the beginning of the 19th century, though the location in the 17th century was at about 250°E, 45°N. In spite of the change in the location of the center, it is noted in Fig. 1 that the whole area of the North American Continent has been dominated by this positive anomaly. This apparent shift of the center seems to have been caused by another positive anomaly which had been superposed on the anomaly during the period from the 17th to the 18th century. The change in the intensity is very slight, less than 4000 γ decrease, if it had changed, during the last 400 years.

Central Pacific positive anomaly

This anomaly is somewhat weaker in intensity and smaller in size compared with the anomalies previously described. The maximum intensity is merely 2500 γ at the center, the mean radius of the anomaly being about 15° in angular distance. In 1550, there existed a very intense anomaly at around 200°E, 15°N, the maximum intensity being 15000 γ. In 1700, the center of the anomaly reached 190°E, 20°N, and the intensity decreased to 8000 γ. The drift velocity was about 0.07°/year during the period and the mean rate of change in the intensity about $-50\,\gamma$/year. Around 1780, the anomaly ceased to decrease its intensity and the movement stopped. Since then the center has been staying nearly at the same place (180°E, 10°N) and the intensity remains constant (about 2500 γ). The extent of the anomaly was definitely larger before 1780 than that of later epochs. The latitude of the center seems to have changed suddenly from 15-20°N to 10°N at this period. All these tempt us to imagine that there exists an unchanging part which is of

relatively small size, and that the anomaly after 1780 represents the major features of this time invariant anomaly. The strong anomaly before 1780, which had also modified the shape and intensity of the North American positive one, was probably another anomaly which dominated the North Pacific and concealed the time invariant part.

North Pacific negative anomaly

In Fig. 1, there exists an area in the North Pacific where the intensity is always small relative to the surrounding area. The anomaly covers most of Alaska and the Aleutian Islands and extends to the Hawaiian Islands. The mean radius of the anomaly is about 25° in angular distance, and the intensity is $-2900\,\gamma$. This is very similar to the positive anomaly in the Central Pacific in size and the absolute intensity, though the sign of the intensity is different. It is interesting to note that the boundary between the two anomalies runs somewhere near the Hawaiian ridge.

Icelandic negative anomaly

Although the detailed structure of the geomagnetic field at high latitudes is not certainly known owing to paucity of the data, Figs. 1 (a) to (h) show that most of the North Atlantic is covered by a negative anomaly with its center near Iceland. The intensity at the center has been approximately constant since the 17th century, being about $-10000\,\gamma$. It is not very certain whether or not the anomaly has changed its locality during the period, but the center of the anomaly read from Fig. 1 remains nearly at the same place (Fig. 11).

On examining Figs. 1 (a) to (h), it can be noticed that the distribution of the vertical component of the non-dipole field after 1780 is vastly different from that in the 17th century. The non-dipole field seems to have undergone a drastic change during the 18th century. Most conspicuous events which took place in the century were the appearance of the Mongolian positive anomaly and the very rapid reduction in the intensity of the Central Pacific positive anomaly. It is not certainly known whether the two phenomena are related to each other or not.

Two different turbulent motions of fluid in the earth's core corresponding to the anomalies might have grown up or decayed independently, or a turbulence producing the Central Pacific anomaly might have stirred up another turbulence, in the course of its rapid disappearance, to cause the Mongolian anomaly. Another possible illustration

of the coincidence between the appearance and the disappearance of the two positive anomalies is a passage of a positive anomaly across a stationary negative anomaly. As was described before, there exists a negative anomaly remaining stationary in the North Pacific. When a positive anomaly drifting westwards passes behind the negative one without interaction, it may be observed on the earth's surface as if one positive anomaly disappeared at the east rim of the negative anomaly and the other one were generated at the opposite side.

The north component anomalies

Figs. 2 (a) to (h) show the non-dipole northerly components from 1650 to 1965. It can be noticed that there are several foci of positive and negative signs forming pairs in the meridional directions. In the Asian Continent, there is a strong negative anomaly in the north and an intense positive one in the south. The pair of these anomalies corresponds to the Mongolian positive anomaly of the vertical component. Similarly a pair of negative and positive anomalies in North America corresponds to the North American positive anomaly in the vertical component. The African positive anomaly of the vertical component produces a positive anomaly of the north component in the northern half of the African Continent and a negative one in the south. This pair of anomalies is also noted to have continued drifting westward since the 17th century. In the Central Pacific, there is a relatively narrow area where the northerly component is always negative. This is due to the pair of negative and positive anomalies of the vertical component constantly existing in the Pacific.

The east component anomalies

In Figs. 3 (a) to (h), the distributions of the non-dipole easterly components from 1650 to 1965 are shown. As in the case of the vertical component, a great change in the configuration is seen in the 18th century. Since then the main features remain almost the same. Positive and negative anomalies form ridges and dales which run in the meridional direction and appear alternately from west to east. A negative anomaly exists at the eastern end of the Asian Continent with its center at about 145°E, 55°N in 1965. A positive one covers the east of Europe and the western part of the Asian Continent having its center around 50°E, 65°N. These anomalies in a pair correspond to the Mongolian positive anomaly of the vertical component. The North American

Continent is divided into two parts, the western half dominated by a positive anomaly and the eastern half covered by a negative one. These correspond to the North American positive anomaly in the vertical component. There is a negative region in the Central Pacific all through the period of observation. This is consistent with the Central Pacific positive anomaly of the vertical component.

4. Non-dipole fields along parallels

In the previous section, examining the non-dipole fields from 1650 to 1965, two characteristic features of the geomagnetic secular variations were pointed out. One is the drastic change in the configuration which took place in the northern hemisphere during the period from 1700 to 1780. The other is the existence of two types of anomalies, the westerly drifting ones and the stationary anomalies. These features can be more clearly seen when a profile of the non-dipole field is drawn along a parallel circle and its change with time is examined.

Figs. 12 (a) to (c) show the distributions of the non-dipole vertical components along parallel of 40°N, the equator and 20°S respectively. In each figure, magnetic profiles at different epochs are compared. Distances between the zero lines of the vertical force for different epochs are taken nearly in proportion to the corresponding time intervals. Similarly Figs. 13 and 14 show the profiles of the north and the east components respectively.

In Fig. 12 (a), it is seen that the non-dipole vertical component along the 40°N parallel has changed its distribution markedly during the period 1700 to 1780. As regards the non-dipole field after 1780, two large positive anomalies are noted around 100°E and 260°E, corresponding to the Mongolian positive anomaly and the North American one respectively. Both occupy nearly the same location during the whole period of observation. Particularly the North American anomaly around 260°E is observed to have been existing at the same place since 1550, while the Mongolian anomaly near 100°E which did not exist at 1550 was generated about 1600 and since then it has continued growing. A negative anomaly which was at about 20°E at the beginning of the 19th century, drifted westwards with a mean velocity of 0.21°/year, and arrived at 20°W in 1965. On the profile along the equator, no influence of the Mongolian and the North American anomaly is observable, but now the Central Pacific positive anomaly contributes to produce an

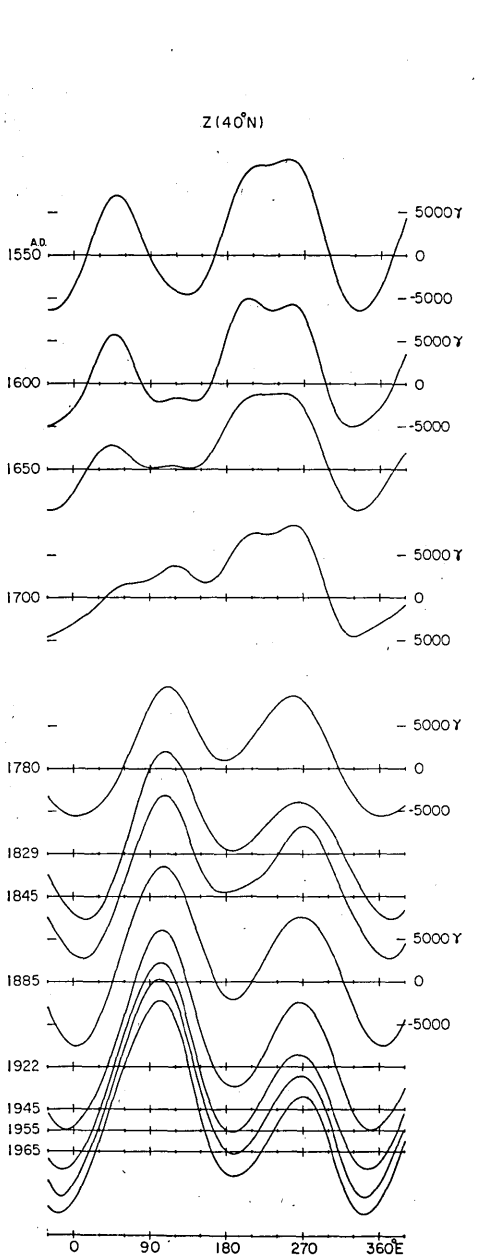

Fig. 12(a). The non-dipole vertical field along 40°N circle.

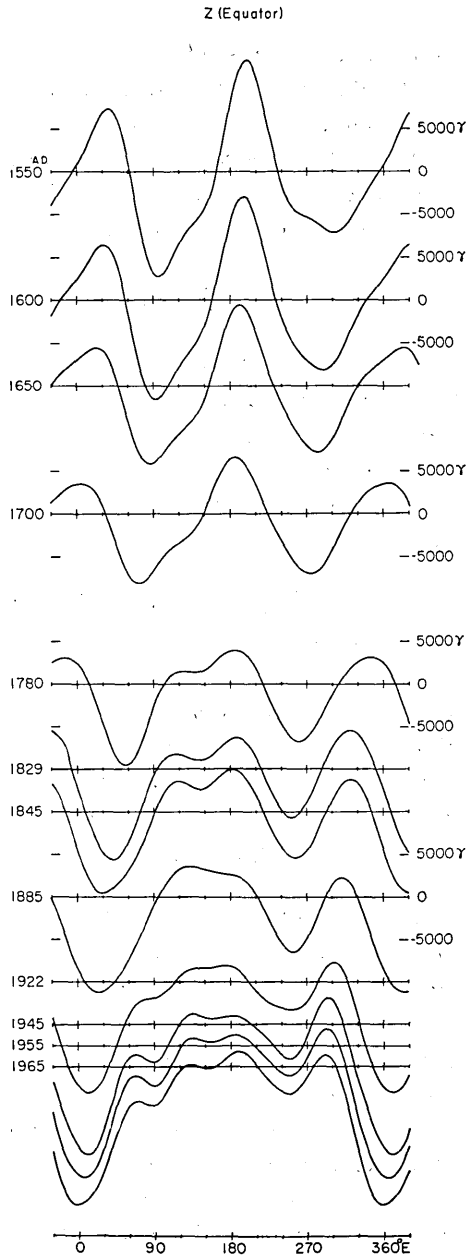

Fig. 12(b). The non-dipole vertical field along the equator.

Fig. 12. The non-dipole vertical component along parallels for various epochs. Distances between the zero lines for different epochs are taken nearly in proportion to the corresponding time interval.

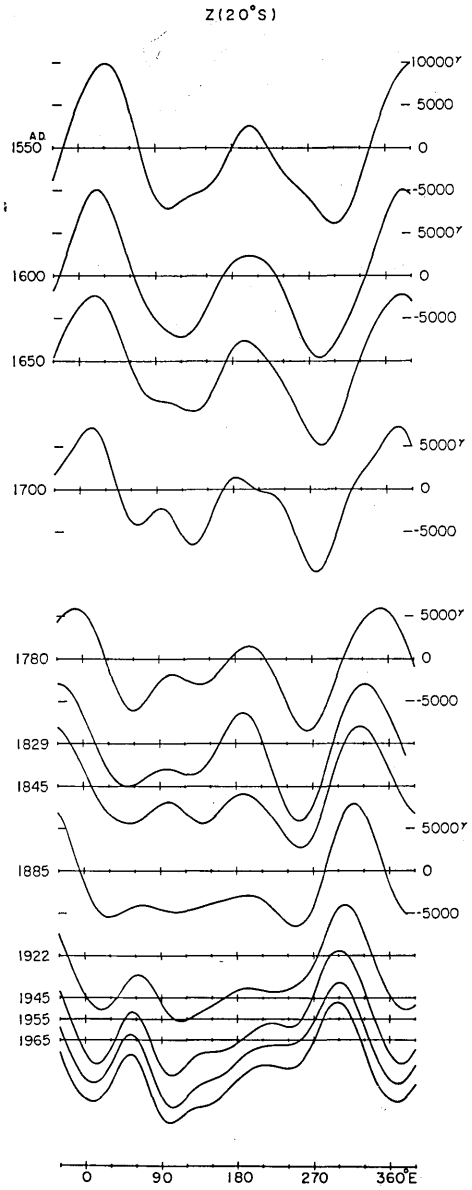

Fig. 12(c). The non-dipole vertical field along 20°S circle.

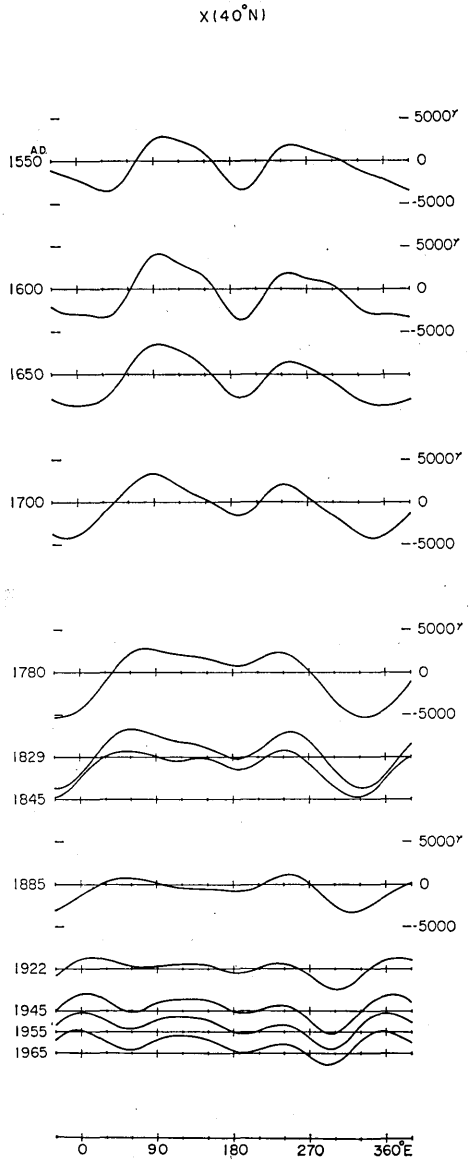

Fig. 13(a). The non-dipole north component along 40°N circle.

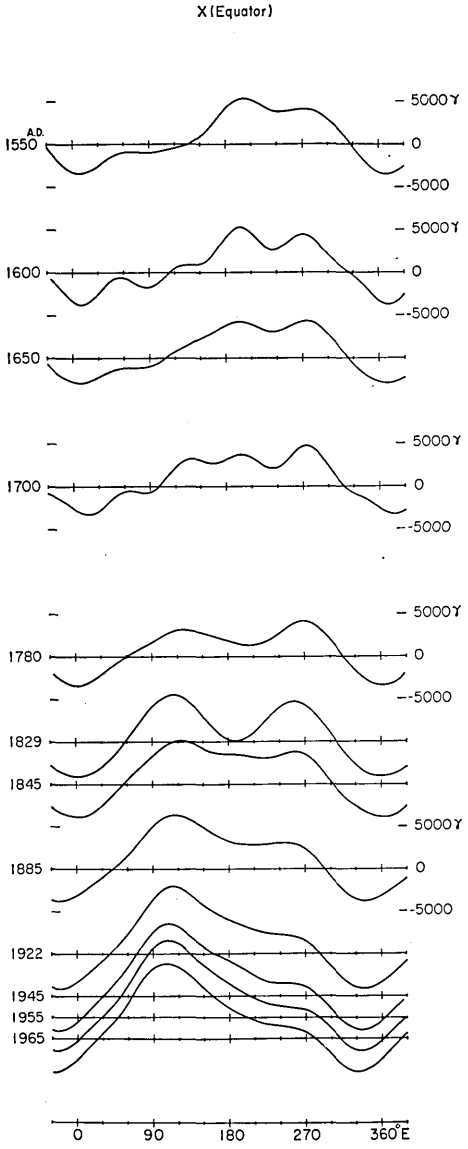

Fig. 13(b). The non-dipole north component along the equator.

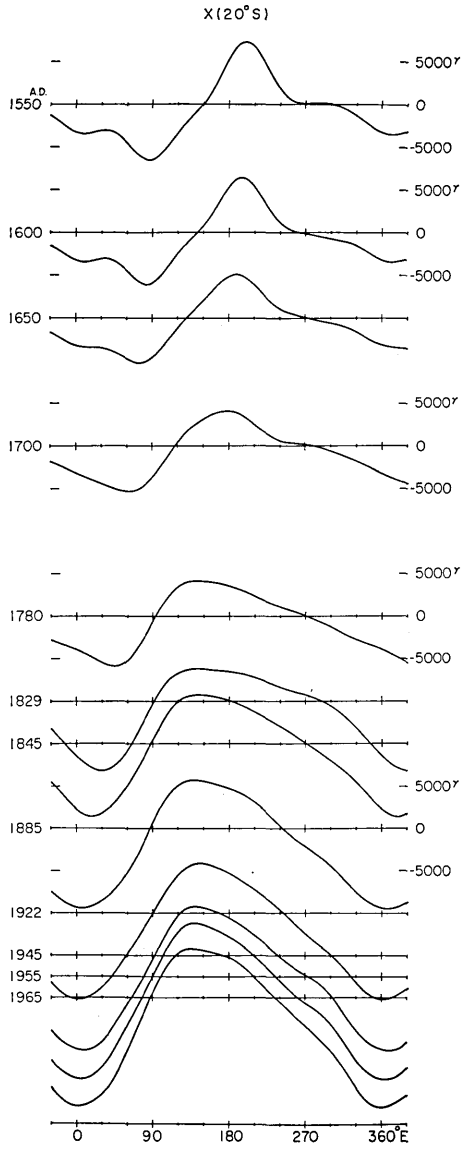

Fig. 13(c). The non-dipole north component along 20°S circle.

Fig. 13. The non-dipole north component along parallels for various epochs. Distances between the zero lines for different epochs are taken nearly in proportion to the corresponding time interval.

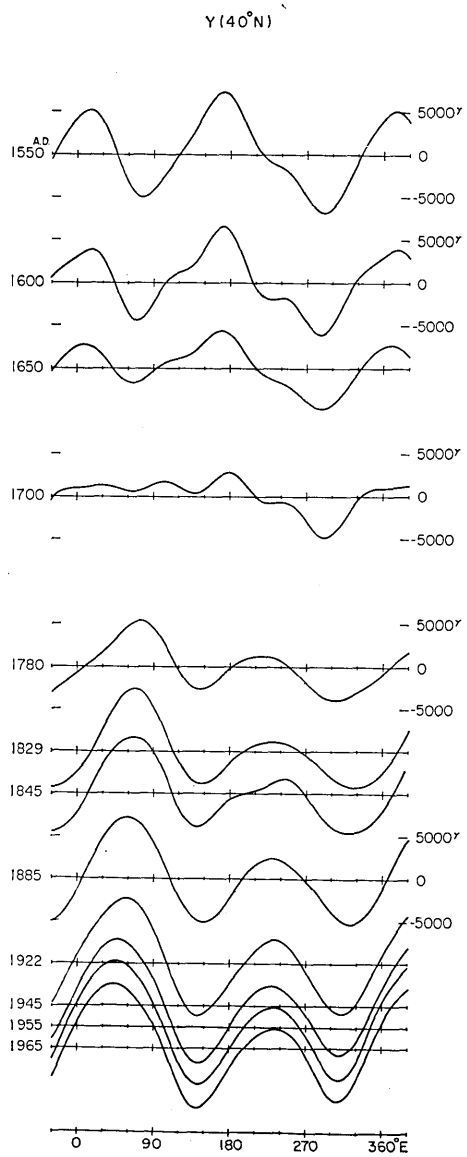

Fig. 14(a). The non-dipole east component along 40°N circle.

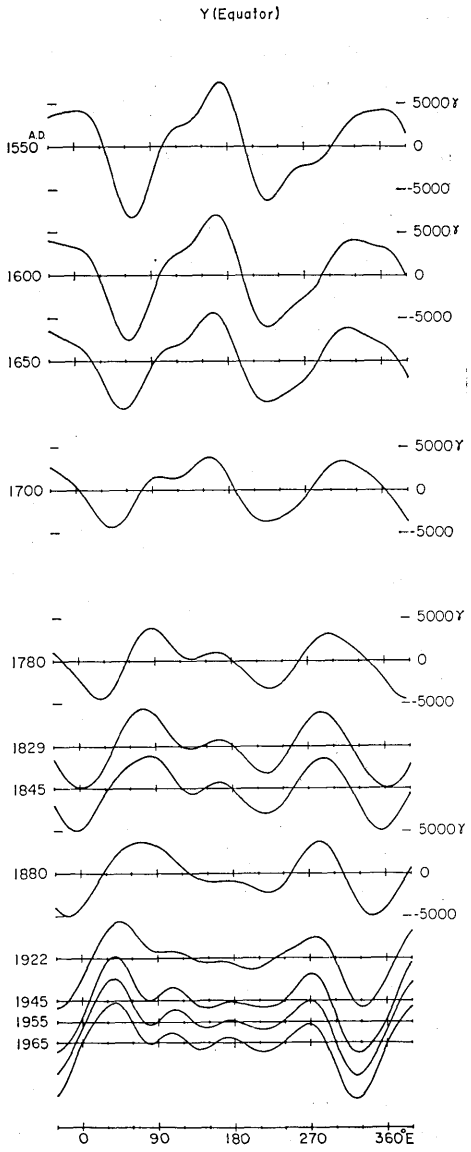

Fig. 14(b). The non-dipole east component along the equator.

Fig. 14. The non-dipole east component along parallels for various epochs. Distances between the zero lines for different epochs are taken nearly in proportion to the corresponding time interval.

anomaly around 190°E. There is a positive anomaly around 290°E and a negative one around 0°E in 1965, the latter being the African negative anomaly. These can be traced back in Fig. 12 (b) to the positive anomaly around 40°E and the negative at about 100°E in 1550. During the period both have continued drifting westwards with a velocity of 0.26°/year.

As for the profile along the circle of the 20°S parallel the variation in the non-dipole field is quite similar to that for the equator. The Central Pacific anomaly has still influence on the distributions near 200°E. We see a positive anomaly around 300°E in 1965 corresponding to one at nearly the same longitude on the equator but with much stronger intensity. An extension of the African negative anomaly can be observed around 10°E in 1965. These positive and negative anomalies have been drifting with velocities similar to those on the equator. Another positive is observed around 55°E in 1965. This is due to the large positive anomaly having its center in the South Indian Ocean. It is noted that this anomaly has also been drifting with a velocity of 0.21°/year.

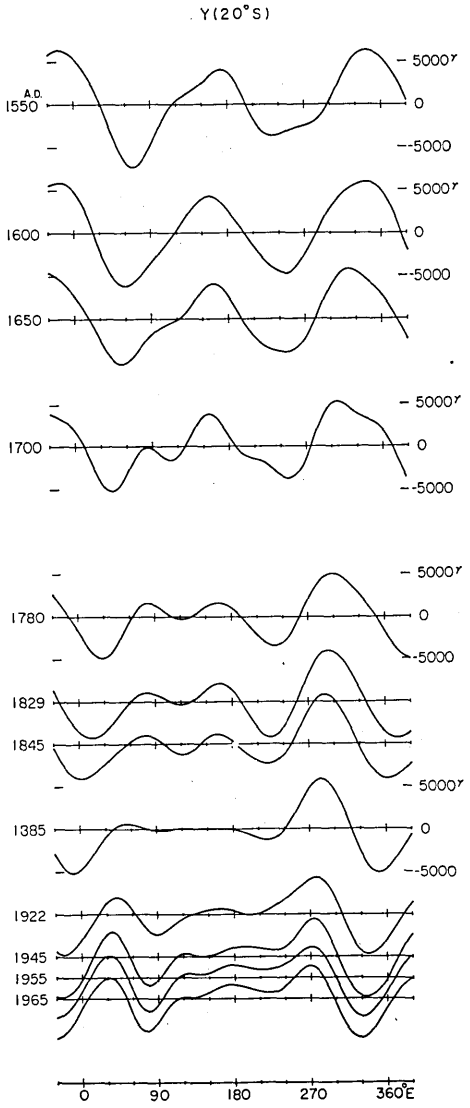

Fig. 14(c). The non-dipole east component along 20°S circle.

As for the variation in the other component of the non-dipole field, the results derived are completely consistent with those for the vertical force. In Fig. 14 (a), for example, a positive and a negative anomaly in the east

component are seen, in 1965, around 40°E and 140°E respectively. This pair is noted to have appeared around 1600 and has continued growing, indicating that these are caused by the Mongolian positive vertical anomaly. Corresponding to the North American anomaly in the vertical component, a pair of positive and negative anomalies in the east component, can be seen around 230°E and 310°E. A strong positive anomaly at about 170°E, which disappeared before 1780, corresponds to the Central Pacific positive anomaly of the vertical force that decreased its intensity very rapidly. For the other parallel circles, the correspondence between the different components is much clearer. It should be pointed out, however, that the westward drift is far more noticeable for the east component than any other component. The Mongolian anomaly, for example, has displaced its center westward about 25° during the period from 1600 to 1965 when the vertical force is examined carefully, but a positive anomaly of the east component has drifted approximately 60° during the period. This probably suggests that the Mongolian anomaly is composed of two anomalies, the stationary one and the drifting one, and that the drifting one is more clearly represented in the east component.

5. Classification of the non-dipole field anomalies

The anomalies due to the non-dipole field are largely classified into two groups, the anomalies drifting westwards and those staying stationarily nearly at the same place. The second group can further be divided into two. One is the anomaly standing still at the same locality but changing its intensity. The other is that standing still without change in intensity. The anomalies are classified by the vertical component into the above three groups as follows.

The drifting anomaly

The African negative anomaly, the Southeast Pacific negative, and the South Atlantic positive anomalies belong to this group. All those anomalies have radial extension of about 40° in angular distance. The apparent drift velocity is different for each anomaly. The African one has a velocity of 0.28°/year, the Southeast Pacific one 0.16°/year and the South Atlantic anomaly 0.15°/year. Another feature common to this group is that they have changed their intensities with mean rates of 20 to 23 γ/year.

The standing anomaly with its intensity changing

The Mongolian positive anomaly, the Australian negative and possibly the North American positive anomaly belong to this classification. These anomalies, of which the radial extensions are 30° to 40° in angular distance, are nearly the same in size as the drifting ones. The intensities are not very different either from those of drifting anomalies, but the rate of change in the intensity markedly differs from the other group. Even within this group, the rate of change is very diverse. The Mongolian anomaly has changed its intensity at such a large rate as 53 γ/year during the last 300 years, while the rate of change in the intensity of the North American anomaly is less than 10 γ/year.

The anomaly standing still with constant intensity

The Central Pacific positive anomaly, the North Pacific negative one and the Icelandic negative anomaly belong to this group. These are definitely smaller in size than the other two types of the anomaly, having radius from 15° to 25° in angular distance.

The origin of the non-dipole fields has so far been ascribed either to the hydromagnetic turbulences at the surface of the liquid core[14),15)] or to the hydromagnetic waves within the core [16),17)], which drift westwards relative to the solid mantle. However, the existence of the three different types of anomalies in the non-dipole field suggests that the non-dipole field should be caused by a few different mechanisms. The current explanation seems only applicable to the drifting anomalies, which are presumably originated from a somewhat deeper part of the core. Standing anomalies that change intensities are likely to be caused very near the surface of the core possibly by the inhomogeneous nature of the bottom of the mantle, which could produce a turbulent layer within the core and might cause the anomalies fixed to the mantle through the hydromagnetic process within the layer.

The anomalies somewhat smaller in size with constant intensity seem

14) W. M. ELSASSER, "The Earth's Interior and Geomagnetism," *Rev. Med. Phys.*, **22** (1950), 1-35.

15) E. C. BULLARD, C. FREEDMAN, H. GELLMAM and J. NIXON, "The Westward Drift of the Earth's Magnetic Field," *Phil. Trans. Roy. Soc. London*, **A**, **243** (1950), 67-92.

16) W. V. R. MALKUS, "Precessional Torques as the Cause of Geomagnetism," *Jour. Geophs. Res.*, **68** (1963), 2871-2886.

17) R. HIDE, "Free Hydromagnetic Oscillations of the Earth's Core and the Theory of the Geomagnetic Secular Variation," *Phil. Trans. Roy, Soc. London* **A**, **259** (1966), 615-650.

to have different sources from the other two types of changing intensity. The characteristic features of the third type anomaly are that they are smaller in size than the other two, and secondly that their intensities, though weak, have been kept nearly constant all through the period of observation. When the distance between the adjacent anomalies is very short, it is difficult to seek for their origin within the core. The minimum distance of core origin can be set up by computing the magnetic field produced by a horinzontal dipole at the core surface. A simple calculation gives 26° as this minimum distance. On the other hand, when the nearest neighbouring anomalies, the North Pacific negative and the Central Pacific positive, are taken, the distance between the anomalies is 35°. Consequently, the smallness in size and the closeness of distribution between the third type anomalies do not necessarily exclude the possibility that these are of the core origin. However, the smaller size anomalies are theoretically expected to have shorter decay time than bigger anomalies. This is obviously contradictory to the present observational results because the large anomalies belonging to the first two groups change their intensity more rapidly. It should also be noted that no interaction is observed when the drifting anomalies pass through the third type ones. Therefore, the sources of the third type anomalies are supposedly ascribable to the solid part of the earth rather than to the liquid core. A careful reexamination seems necessary of regional anomalies on continental scale originated in the crust or the upper mantle, which have so far been overlooked due to the difficulty in discriminating the time invariant parts from the time changing non-dipole fields.

Coexistence of the drifting and the standing anomalies, revealed in this study, may give a certain clue to a controversial problem on the drift velocity of the earth's magnetic field. When the westward drift of the rate of change in the geomagnetic field or the movement of any other specific features of the earth's field such as the maximum deviation of declination are examined, the drift velocity of more than 0.3°/year has been obtained[18),19)]. On the other hand, examination of the non-dipole field gives approximately 0.2°/year as the mean drift

18) E. C. BULLARD, C. FREEDMAN, H. GELLMAN and J. NIXON, "The Westward Drift of the Earth's Magnetic Field," *Phil. Trans. Roy. Soc. London*, **A**, **243** (1950), 67-92.

19) T. YUKUTAKE, "The Westward Drift of the Earth's Magnetic Field in Historic Times," *Jour. Geomag. Geoelectr.*, **19** (1967), 103-116.

velocity[20),21),22),23)]. The difference in the velocities has been considered significant beyond the errors of analyses, but no definite explanation has been given to this problem. When the non-dipole field is assumed to drift westwards uniformly as a whole, the drift velocity obtained is the mean rate of drift of the drifting anomalies and the standing ones, and is always smaller than the actual velocity of the drifting features. Therefore the drift velocities obtained from the rate of change in the geomagnetic field seem to give more accurate values for the drifting parts of the non-dipole fields.

We would like to express our thanks to Mr. T. Kuboki and other members of the Kakioka Magnetic Observatory who kindly supplied us with micro-film copies of old publications in the observatory library. Computations were performed on a HITAC 5020E at the Computer Center, University of Tokyo, and on an IBM 7090 at the IBM Data Processing Center through the Project UNICON.

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51. 地球磁場の非双極子部分

地震研究所 行武毅 立中ひろ子

地球磁場の球函数解析は，既に 1550 年の磁場分布に対して Fritsche が実施している．この報告では，展開係数より逆に非双極子磁場を合成して，その時間変化を調べた．

非双極子磁場は，数箇の正負の磁気異常よりなるが，その時間変化の様子から次の 3 種類に分類される．

a) 西方移動する異常（例：アフリカの負の異常）

b) 強さを変えながら，同一箇所に停滞している異常（例：蒙古の正の異常）

c) 強さが一定で，同一場所に静止している異常（例：太平洋の正負の異常）

従来は，非双極子磁場全体が西方移動すると考えられていたが，大部分の異常は同一場所に停滞し，移動するのはごく一二の異常に限られることが明かになった．

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20) *loc. cit.*, 18)

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Table 3-a. Non-dipole field, north component for 1700, in the unit of γ (Fritsche's analysis).

lat. / E long.	80°N	70°	60°	50°	40°	30°	20°	10°	0°	10°	20°	30°	40°	50°	60°	70°	80°S
0°	3184	714	-1685	-3307	-3929	-3757	-3210	-2721	-2596	-2877	-3241	-3087	-1881	391	3045	5015	5531
5°	2944	458	-1790	-3169	-3608	-3439	-3088	-2868	-2925	-3220	-3470	-3176	-1873	462	3192	5259	5832
10°	2657	174	-1887	-2990	-3222	-3043	-2880	-2927	-3178	-3514	-3685	-3286	-1915	462	3254	5415	6058
15°	2330	-131	-1977	-2781	-2793	-2581	-2575	-2864	-3312	-3732	-3889	-3442	-2035	374	3225	5481	6209
20°	1969	-449	-2059	-2556	-2336	-2063	-2165	-2654	-3301	-3857	-4083	-3658	-2250	186	3101	5456	6284
25°	1582	-773	-2133	-2321	-1863	-1497	-1650	-2291	-3136	-3888	-4271	-3944	-2566	-102	2887	5344	6282
30°	1177	-1097	-2198	-2080	-1382	-891	-1039	-1786	-2831	-3835	-4458	-4292	-2969	-474	2594	5153	6207
35°	759	-1415	-2252	-1833	-892	-251	-352	-1173	-2421	-3722	-4644	-4683	-3431	-904	2239	4889	6062
40°	335	-1722	-2291	-1576	-393	412	380	-499	-1957	-3580	-4827	-5085	-3908	-1357	1844	4564	5850
45°	-89	-2015	-2313	-1307	117	1085	1121	176	-1499	-3441	-4999	-5459	-4351	-1792	1431	4189	5577
50°	-507	-2288	-2316	-1022	635	1754	1832	796	-1102	-3334	-5149	-5761	-4708	-2170	1024	3774	5248
55°	-915	-2540	-2300	-724	1156	2397	2475	1310	-807	-3273	-5259	-5952	-4937	-2460	639	3330	4871
60°	-1308	-2769	-2267	-419	1666	2993	3018	1688	-637	-3261	-5309	-6003	-5012	-2644	288	2864	4452
65°	-1682	-2975	-2224	-121	2145	3520	3443	1917	-588	-3283	-5281	-5897	-4922	-2718	-26	2385	3997
70°	-2035	-3157	-2177	154	2572	3957	3741	2010	-633	-3307	-5157	-5635	-4682	-2696	-308	1895	3516
75°	-2364	-3317	-2133	389	2922	4286	3918	1999	-725	-3297	-4924	-5233	-4322	-2605	-567	1399	3014
80°	-2667	-3454	-2100	567	3175	4499	3991	1931	-806	-3210	-4578	-4722	-3888	-2480	-820	900	2499
85°	-2943	-3569	-2083	676	3314	4591	3982	1854	-820	-3010	-4121	-4140	-3430	-2359	-1080	399	1979
90°	-3191	-3662	-2083	710	3336	4569	3919	1816	-717	-2673	-3566	-3531	-3000	-2279	-1361	-99	1460
95°	-3412	-3733	-2099	672	3246	4445	3826	1848	-472	-2191	-2934	-2932	-2636	-2264	-1667	-589	951
100°	-3605	-3781	-2124	574	3058	4237	3720	1963	-81	-1576	-2249	-2374	-2363	-2326	-1999	-1063	458
105°	-3773	-3805	-2150	433	2797	3965	3610	2154	433	-859	-1539	-1876	-2185	-2458	-2345	-1512	-14
110°	-3916	-3806	-2168	272	2490	3650	3495	2393	1024	-86	-834	-1441	-2090	-2640	-2689	-1924	-456
115°	-4037	-3783	-2169	113	2166	3310	3366	2639	1634	693	-155	-1061	-2047	-2841	-3006	-2288	-866
120°	-4140	-3739	-2146	-26	1848	2957	3205	2844	2199	1426	477	-719	-2018	-3020	-3272	-2592	-1238
125°	-4227	-3680	-2097	-133	1555	2597	2998	2965	2664	2069	1051	-391	-1962	-3140	-3462	-2827	-1570
130°	-4302	-3610	-2027	-204	1291	2234	2729	2971	2990	2594	1564	-57	-1844	-3167	-3556	-2986	-1860
135°	-4370	-3538	-1944	-248	1054	1864	2392	2848	3162	2990	2017	299	-1640	-3081	-3543	-3065	-2108
140°	-4333	-3473	-1861	-278	833	1482	1991	2606	3189	3267	2418	685	-1344	-2876	-3420	-3066	-2315
145°	-4496	-3426	-1796	-315	611	1087	1542	2275	3105	3446	2773	1093	-966	-2562	-3196	-2995	-2484
150°	-4561	-3406	-1765	-380	371	678	1071	1901	2958	3561	3089	1511	-531	-2162	-2888	-2862	-2619
155°	-4632	-3421	-1783	-491	102	263	610	1537	2803	3647	3371	1913	-76	-1711	-2517	-2680	-2725
160°	-4710	-3477	-1861	-660	-200	-144	197	1237	2693	3734	3617	2272	361	-1244	-2112	-2465	-2807
165°	-4796	-3578	-2004	-887	-527	-520	-131	1043	2662	3841	3821	2562	743	-798	-1700	-2234	-2873
170°	-4889	-3724	-2208	-1164	-859	-838	-346	981	2729	3970	3974	2762	1042	-401	-1305	-2003	-2927
175°	-4988	-3913	-2465	-1471	-1169	-1070	-426	1056	2884	4109	4063	2861	1244	-72	-948	-1787	-2978
180°	-5091	-4137	-2760	-1780	-1421	-1185	-365	1252	3099	4232	4076	2858	1351	183	-641	-1600	-3029
185°	-5194	-4389	-3076	-2062	-1580	-1163	-167	1535	3328	4304	4005	2766	1376	369	-393	-1452	-3086
190°	-5292	-4660	-3393	-2289	-1617	-987	153	1862	3519	4292	3845	2604	1346	496	-206	-1350	-3154
195°	-5381	-4937	-3695	-2438	-1514	-657	571	2190	3626	4169	3601	2397	1287	581	-78	-1301	-3233
200°	-5455	-5212	-3970	-2499	-1266	-183	1061	2479	3616	3921	3282	2173	1227	640	-8	-1306	-3326
205°	-5509	-5475	-4211	-2475	-888	412	1595	2709	3479	3553	2907	1953	1183	682	8	-1366	-3433
210°	-5535	-5717	-4416	-2379	-409	1094	2150	2875	3230	3099	2498	1752	1164	709	-29	-1479	-3550
215°	-5529	-5930	-4590	-2237	128	1822	2707	2992	2907	2573	2081	1575	1161	715	-121	-1641	-3677
220°	-5485	-6108	-4741	-2081	673	2550	3254	3089	2567	2054	1680	1419	1158	687	-268	-1849	-3808
225°	-5398	-6245	-4876	-1946	1173	3236	3785	3207	2273	1589	1318	1271	1129	606	-473	-2095	-3937
230°	-5265	-6336	-5003	-1861	1582	3841	4296	3382	2087	1226	1010	1115	1045	456	-736	-2369	-4058
235°	-5080	-6371	-5125	-1848	1865	4335	4783	3642	2052	1002	763	932	883	223	-1053	-2661	-4164
240°	-4843	-6355	-5241	-1916	2001	4696	5238	4000	2191	932	580	710	628	-95	-1416	-2957	-4248
245°	-4553	-6272	-5342	-2062	1988	4916	5649	4444	2497	1012	451	441	280	-491	-1808	-3242	-4300
250°	-4209	-6120	-5416	-2269	1837	4994	5998	4942	2933	1213	366	135	-116	-911	-2210	-3500	-4314
255°	-3813	-5895	-5447	-2510	1571	4936	6260	5442	3438	1489	308	-203	-623	-1421	-2596	-3714	-4282
260°	-3369	-5593	-5420	-2754	1233	4755	6409	5881	3939	1785	261	-550	-1111	-1891	-2938	-3868	-4198
265°	-2881	-5215	-5319	-2970	849	4465	6418	6193	4356	2015	210	-882	-1569	-2308	-3209	-3946	-4056
270°	-2356	-4765	-5135	-3131	453	4080	6266	6323	4622	2220	144	-1176	-1956	-2637	-3386	-3938	-3853
275°	-1802	-4249	-4866	-3221	70	3614	5939	6231	4686	2273	56	-1412	-2242	-2851	-3452	-3834	-3585
280°	-1228	-3680	-4518	-3234	-289	3078	5438	5901	4529	2189	-56	-1580	-2411	-2936	-3398	-3631	-3254
285°	-643	-3072	-4104	-3179	-619	2482	4776	5347	4158	1973	-190	-1677	-2461	-2892	-3224	-3330	-2859
290°	-60	-2443	-3646	-3074	-930	1834	3979	4605	3608	1646	-341	-1715	-2409	-2733	-2939	-2936	-2405
295°	512	-1814	-3171	-2943	-1235	1147	3085	3732	2936	1245	-505	-1711	-2281	-2484	-2561	-2457	-1897
300°	1060	-1203	-2705	-2815	-1548	431	2141	2797	2208	809	-675	-1690	-2115	-2175	-2109	-1907	-1340
305°	1573	-632	-2276	-2717	-1882	-297	1193	1867	1489	378	-850	-1676	-1916	-1841	-1608	-1300	-745
310°	2043	-117	-1905	-2667	-2243	-1019	287	1002	834	-17	-1027	-1691	-1806	-1511	-1080	-651	-118
315°	2460	327	-1609	-2677	-2627	-1712	-539	245	276	-359	-1207	-1750	-1715	-1206	-546	23	528
320°	2817	690	-1395	-2745	-3021	-2354	-1260	-383	-172	-644	-1394	-1857	-1682	-939	-21	707	1185
325°	3108	967	-1263	-2861	-3405	-2922	-1861	-882	-520	-885	-1591	-2010	-1700	-712	485	1386	1840
330°	3329	1155	-1207	-3005	-3752	-3395	-2339	-1269	-797	-1102	-1801	-2194	-1795	-517	964	2047	2482
335°	3478	1257	-1214	-3155	-4036	-3757	-2702	-1573	-1040	-1320	-2024	-2391	-1824	-345	1413	2678	3102
340°	3555	1277	-1269	-3287	-4232	-3998	-2963	-1832	-1286	-1561	-2260	-2582	-1886	-184	1828	3267	3689
345°	3561	1224	-1356	-3379	-4322	-4113	-3134	-2068	-1563	-1841	-2505	-2751	-1922	-26	2206	3805	4233
350°	3498	1106	-1462	-3416	-4300	-4106	-3229	-2298	-1882	-2162	-2754	-2889	-1928	129	2540	4281	4727
355°	3371	933	-1574	-3392	-4165	-3983	-3255	-2521	-2235	-2515	-3001	-2998	-1908	273	2824	4687	5161

Table 3-b. Non-dipole field, east component for 1700, in the unit of γ (Fritsche's analysis).

lat. / E long.	80°N	70°	60°	50°	40°	30°	20°	10°	0°	10°	20°	30°	40°	50°	60°	70°	80°S
0°	1719	2273	2297	1787	956	163	-254	-141	418	1174	1875	2400	2784	3128	3462	3673	3553
5°	2249	2799	2711	2021	988	5	-578	-605	-164	493	1111	1568	1902	2222	2577	2874	2915
10°	2734	3255	3056	2220	1037	-96	-846	-1064	-826	-348	146	548	881	1234	1647	2043	2247
15°	3170	3639	3336	2387	1104	-144	-1062	-1516	-1550	-1315	-971	-610	-234	198	697	1196	1559
20°	3554	3952	3550	2521	1176	-158	-1241	-1955	-2299	-2338	-2155	-1819	-1372	-838	-245	351	862
25°	3883	4195	3701	2613	1234	-165	-1400	-2370	-3020	-3325	-3291	-2971	-2449	-1819	-1149	-476	167
30°	4156	4368	3789	2656	1257	-191	-1555	-2742	-3648	-4172	-4258	-3951	-3380	-2694	-1986	-1269	-518
35°	4373	4476	3815	2644	1229	-254	-1709	-3044	-4119	-4782	-4947	-4662	-4091	-3418	-2734	-2014	-1182
40°	4536	4522	3784	2577	1146	-359	-1855	-3245	-4376	-5080	-5277	-5035	-4537	-3963	-3376	-2700	-1818
45°	4645	4512	3702	2461	1015	-491	-1970	-3316	-4381	-5027	-5216	-5048	-4703	-4323	-3908	-3322	-2416
50°	4703	4450	3578	2310	859	-623	-2025	-3230	-4121	-4628	-4785	-4728	-4615	-4514	-4332	-3873	-2972
55°	4713	4343	3422	2144	708	-717	-1984	-2973	-3616	-3935	-4056	-4150	-4332	-4568	-4661	-4352	-3478
60°	4679	4197	3245	1982	594	-731	-1817	-2546	-2911	-3037	-3141	-3423	-3938	-4535	-4912	-4760	-3931
65°	4605	4018	3056	1845	548	-634	-1508	-1969	-2075	-2047	-2178	-2675	-3525	-4467	-5105	-5097	-4326
70°	4495	3813	2864	1743	588	-408	-1057	-1280	-1192	-1087	-1302	-2029	-3184	-4413	-5257	-5366	-4661
75°	4353	3585	2671	1681	717	-58	-487	-531	-348	-268	-629	-1584	-2982	-4409	-5381	-5569	-4934
80°	4184	3340	2479	1651	919	389	159	219	382	330	-234	-1397	-2954	-4470	-5481	-5703	-5144
85°	3993	3081	2283	1639	1163	887	825	909	945	666	-138	-1475	-3097	-4590	-5551	-5769	-5291
90°	3784	2813	2079	1622	1407	1375	1445	1486	1316	748	-309	-1772	-3370	-4741	-5580	-5765	-5376
95°	3563	2539	1863	1577	1604	1794	1961	1917	1501	627	-666	-2200	-3698	-4876	-5548	-5686	-5401
100°	3333	2264	1631	1486	1715	2089	2327	2188	1536	387	-1094	-2644	-3991	-4941	-5434	-5533	-5369
105°	3099	1994	1384	1335	1714	2227	2521	2309	1479	131	-1465	-2980	-4155	-4883	-5218	-5304	-5284
110°	2865	1735	1128	1128	1594	2201	2546	2312	1398	-40	-1664	-3102	-4112	-4659	-4887	-5003	-5151
115°	2634	1493	875	877	1373	2032	2435	2247	1363	-44	-1604	-2935	-3811	-4246	-4439	-4635	-4975
120°	2410	1278	639	609	1087	1767	2242	2168	1426	170	-1248	-2455	-3242	-3644	-3882	-4212	-4763
125°	2194	1095	441	359	789	1470	2030	2129	1619	605	-610	-1688	-2434	-2879	-3236	-3747	-4523
130°	1989	952	298	166	538	1213	1866	2171	1944	1225	244	-710	-1454	-2002	-2533	-3258	-4262
135°	1795	852	226	65	390	1060	1803	2312	2371	1953	1209	370	-395	-1078	-1812	-2764	-3988
140°	1611	797	235	80	383	1055	1872	2546	2847	2691	2158	1425	636	-180	-1115	-2286	-3709
145°	1437	785	329	222	536	1215	2071	2844	3301	3331	2965	2329	1538	621	-482	-1842	-3431
150°	1269	811	500	483	838	1522	2371	3152	3656	3776	3524	2984	2229	1267	51	-1450	-3160
155°	1105	867	732	838	1252	1927	2711	3403	3842	3957	3768	3326	2656	1719	460	-1123	-2902
160°	940	940	1002	1247	1719	2357	3013	3529	3807	3840	3675	3343	2804	1962	730	-869	-2660
165°	772	1017	1282	1659	2168	2726	3197	3470	3525	3431	3274	3064	2693	2002	861	-692	-2437
170°	594	1081	1542	2025	2524	2951	3188	3184	3001	2779	2636	2559	2381	1867	861	-591	-2232
175°	401	1127	1754	2297	2727	2964	2937	2660	2268	1957	1855	1919	1929	1597	749	-559	-2045
180°	196	1132	1895	2442	2735	2731	2427	1914	1386	1057	1038	1244	1413	1239	548	-587	-1872
185°	-33	1090	1950	2444	2538	2252	1679	993	425	167	277	616	900	835	282	-664	-1711
190°	-286	993	1910	2304	2153	1566	751	-31	-537	-635	-358	95	436	421	-25	-775	-1557
195°	-564	836	1779	2043	1628	744	-271	-1072	-1430	-1301	-834	-296	42	20	-351	-905	-1403
200°	-869	617	1564	1693	1027	-119	-1281	-2042	-2196	-1812	-1159	-571	-285	-359	-680	-1040	-1244
205°	-1199	338	1279	1294	426	-921	-2175	-2860	-2802	-2177	-1371	-770	-569	-718	-997	-1165	-1074
210°	-1554	0	937	884	-107	-1573	-2864	-3466	-3234	-2430	-1529	-951	-845	-1062	-1292	-1265	-886
215°	-1930	-390	552	496	-518	-2006	-3286	-3825	-3500	-2617	-1699	-1173	-1148	-1399	-1554	-1328	-675
220°	-2323	-829	131	146	-780	-2189	-3416	-3935	-3621	-2781	-1931	-1479	-1499	-1730	-1770	-1340	-435
225°	-2728	-1309	-314	-164	-895	-2130	-3270	-3817	-3629	-2956	-2253	-1884	-1901	-2044	-1926	-1290	-162
230°	-3139	-1825	-791	-447	-896	-1876	-2900	-3518	-3551	-3150	-2658	-2369	-2330	-2319	-2005	-1168	146
235°	-3549	-2368	-1300	-731	-837	-1503	-2385	-3098	-3413	-3348	-3101	-2880	-2737	-2523	-1988	-966	490
240°	-3950	-2930	-1845	-1046	-786	-1105	-1819	-2620	-3227	-3512	-3511	-3338	-3059	-2614	-1856	-677	871
245°	-4333	-3501	-2429	-1426	-810	-773	-1293	-2140	-2995	-3588	-3799	-3651	-3224	-2552	-1594	-298	1287
250°	-4689	-4068	-3049	-1892	-964	-586	-881	-1703	-2709	-3518	-3877	-3730	-3166	-2301	-1189	168	1734
255°	-5010	-4617	-3695	-2452	-1279	-592	-631	-1332	-2355	-3252	-3676	-3508	-2838	-1840	-641	717	2206
260°	-5285	-5131	-4349	-3095	-1757	-803	-557	-1032	-1920	-2760	-3159	-2953	-2223	-1168	42	1337	2697
265°	-5506	-5591	-4984	-3789	-2366	-1192	-639	-788	-1398	-2043	-2331	-2078	-1338	-304	841	2014	3199
270°	-5666	-5978	-5569	-4489	-3048	-1699	-828	-576	-793	-1132	-1244	-938	-234	710	1727	2730	3702
275°	-5758	-6275	-6066	-5135	-3727	-2242	-1057	-367	-123	-90	14	373	1008	1816	2662	3462	4195
280°	-5775	-6464	-6441	-5666	-4319	-2730	-1253	-131	581	1002	1330	1738	2291	2945	3604	4187	4668
285°	-5714	-6532	-6662	-6028	-4745	-3079	-1354	148	1279	2048	2582	3036	3515	4028	4509	4881	5110
290°	-5573	-6470	-6706	-6178	-4948	-3226	-1315	476	1927	2964	3657	4155	4588	4999	5338	5521	5509
295°	-5352	-6275	-6562	-6093	-4894	-3140	-1119	842	2481	3677	4474	5015	5443	5808	6056	6087	5856
300°	-5054	-5950	-6231	-5774	-4586	-2826	-778	1225	2909	4149	4987	5573	6042	6426	6640	6562	6142
305°	-4682	-5501	-5729	-5242	-4053	-2320	-330	1592	3190	4369	5198	5830	6381	6840	7075	6932	6358
310°	-4243	-4944	-5079	-4531	-3353	-1688	167	1907	3321	4364	5146	5826	6487	7060	7357	7188	6499
315°	-3744	-4295	-4316	-3723	-2559	-1009	647	2139	3312	4183	4901	5627	6406	7108	7488	7325	6560
320°	-3195	-3576	-3480	-2850	-1749	-364	1048	2263	3186	3889	4548	5315	6197	7015	7478	7341	6537
325°	-2607	-2808	-2607	-1978	-993	177	1319	2265	2974	3547	4166	4964	5915	6810	7338	7238	6430
330°	-1989	-2015	-1736	-1156	-347	566	1431	2146	2704	3209	3817	4629	5600	6519	7080	7018	6238
335°	-1353	-1217	-896	-420	160	781	1380	1916	2399	2904	3529	4336	5274	6157	6713	6689	5965
340°	-711	-434	-110	212	518	832	1184	1595	2074	2633	3296	4077	4932	5727	6245	6256	5614
345°	-73	318	607	737	744	747	877	1207	1727	2372	3078	3812	4549	5221	5681	5727	5190
350°	551	1027	1248	1162	866	574	505	776	1347	2076	2813	3484	4088	4627	5025	5113	4700
355°	1151	1681	1811	1506	925	364	115	322	917	1692	2432	3031	3510	3932	4283	4424	4151

Table 3-c. Non-dipole field, vertical component for 1700, in the unit of γ (Fritsche's analysis).

lat. / E long.	80°N	70°	60°	50°	40°	30°	20°	10°	0°	10°	20°	30°	40°	50°	60°	70°	80°S
0°	-8436	-9328	-8296	-5904	-3045	-478	1107	2611	3460	4472	6084	8299	10173	11551	10704	7966	4329
5°	-8255	-8891	-7686	-5342	-2761	-553	1110	2368	3512	4884	6745	9029	11151	12145	11211	8319	4526
10°	-8042	-8395	-7012	-4734	-2460	-644	758	2022	3406	5091	7171	9522	11609	12550	11573	8641	4687
15°	-7802	-7850	-6287	-4082	-2122	-711	392	1582	3099	5000	7251	9684	11789	12741	11782	8839	4810
20°	-7539	-7268	-5524	-3390	-1732	-722	41	1051	2554	4545	6917	9454	11654	12702	11834	8942	4893
25°	-7257	-6659	-4735	-2665	-1287	-666	-287	425	1752	3694	6130	8810	11198	12437	11732	8952	4938
30°	-6959	-6033	-3933	-1919	-798	-554	-601	-301	699	2469	4923	7789	10448	11963	11487	8870	4943
35°	-6651	-5401	-3133	-1171	-288	-416	-925	-1126	-568	940	3388	6474	9468	11316	11114	8704	4911
40°	-6336	-4770	-2348	-441	209	-290	-1288	-2011	-1983	-772	1666	4992	8345	10544	10632	8458	4842
45°	-6018	-4150	-1591	250	659	-221	-1716	-3025	-3455	-2519	-72	3493	7180	9698	10063	8142	4739
50°	-5702	-3549	-873	882	1032	-211	-2223	-4039	-4878	-4141	-1651	2123	6070	8830	9429	7762	4603
55°	-5390	-2973	-203	1443	1311	-364	-2800	-5029	-6144	-5491	-2921	1005	5094	7981	8747	7327	4438
60°	-5085	-2429	413	1928	1494	-582	-3415	-5932	-7159	-6459	-3778	216	4300	7175	8032	6845	4247
65°	-4792	-1920	971	2341	1599	-859	-4015	-6681	-7854	-6987	-4184	-223	3697	6420	7292	6323	4032
70°	-4511	-1452	1471	2693	1654	-1144	-4534	-7215	-8193	-7077	-4170	-353	3253	5704	6530	5768	3797
75°	-4246	-1026	1915	2999	1701	-1372	-4903	-7488	-8183	-6789	-3830	-269	2904	4999	5743	5187	3546
80°	-3998	-645	2303	3274	1779	-1481	-5059	-7478	-7867	-6233	-3308	-100	2565	4269	4930	4587	3282
85°	-3769	-312	2637	3531	1919	-1426	-4965	-7190	-7318	-5546	-2767	10	2146	3480	4087	3973	3009
90°	-3558	-26	2916	3775	2137	-1182	-4611	-6655	-6627	-4868	-2363	-67	1569	2603	3216	3353	2731
95°	-3368	211	3139	4002	2430	-760	-4023	-5930	-5890	-4323	-2218	-426	785	1625	2322	2740	2451
100°	-3199	399	3301	4200	2772	-197	-3256	-5088	-5190	-3992	-2398	-1103	-219	555	1419	2138	2172
105°	-3049	539	3398	4349	3121	440	-2388	-4206	-4585	-3904	-2903	-2078	-1408	-579	527	1559	1898
110°	-2919	633	3425	4426	3425	1073	-1510	-3354	-4102	-4034	-3665	-3267	-2711	-1728	-330	1013	1632
115°	-2808	683	3381	4411	3633	1621	-705	-2583	-3730	-4301	-4563	-4544	-4028	-2828	-1119	510	1376
120°	-2714	694	3267	4289	3703	2022	-36	-1919	-3429	-4604	-5145	-5756	-5242	-3814	-1815	59	1132
125°	-2636	672	3090	4058	3616	2236	464	-1360	-3135	-4807	-6152	-6753	-6242	-4621	-2389	-332	902
130°	-2573	624	2863	3730	3377	2264	799	-871	-2773	-4800	-6548	-7409	-6936	-5199	-2823	-660	688
135°	-2522	559	2601	3333	3018	2142	1009	-411	-2276	-4498	-6544	-7644	-7268	-5519	-3107	-922	489
140°	-2483	486	2335	2908	2597	1937	1165	92	-1596	-3864	-6111	-7438	-7226	-5574	-3240	-1120	306
145°	-2453	415	2083	2502	2187	1739	1350	691	-713	-2915	-5287	-6830	-6839	-5386	-3233	-1258	138
150°	-2431	355	1873	2168	1868	1641	1647	1428	355	-1720	-4166	-5912	-6176	-4994	-3108	-1344	-17
155°	-2415	311	1728	1953	1711	1725	2119	2318	1558	-387	-2884	-4809	-5333	-4458	-2892	-1389	-158
160°	-2405	299	1668	1891	1767	2045	2796	3340	2814	953	-1593	-3664	-4414	-3841	-2617	-1403	-288
165°	-2400	314	1703	2003	2059	2613	3666	4442	4025	2165	-439	-2607	-3519	-3207	-2317	-1400	-409
170°	-2400	360	1837	2290	2577	3402	4674	5541	5089	3138	466	-1740	-2730	-2613	-2022	-1391	-523
175°	-2405	437	2065	2732	3279	4339	5726	6539	5912	3792	1056	-1119	-2098	-2099	-1760	-1389	-631
180°	-2416	540	2373	3297	4098	5324	6706	7329	6425	4095	1321	-755	-1641	-1691	-1551	-1402	-734
185°	-2435	664	2743	3910	4953	6243	7492	7819	6589	4062	1302	-611	-1348	-1398	-1408	-1439	-835
190°	-2462	801	3153	4611	5759	6986	7975	7941	6398	3745	1077	-623	-1187	-1215	-1341	-1506	-934
195°	-2499	942	3580	5267	6448	7467	8082	7662	5882	3224	743	-710	-1113	-1131	-1351	-1605	-1031
200°	-2550	1076	4002	5871	6970	7638	7784	6992	5095	2585	395	-799	-1085	-1131	-1438	-1739	-1126
205°	-2615	1191	4400	6399	7308	7498	7104	5983	4109	1908	101	-839	-1074	-1203	-1599	-1905	-1218
210°	-2698	1286	4757	6842	7475	7093	6117	4719	3001	1248	-107	-816	-1074	-1343	-1828	-2102	-1307
215°	-2799	1341	5063	7204	7513	6509	4937	3309	1841	626	-241	-753	-1101	-1553	-2121	-2323	-1390
220°	-2922	1350	5306	7498	7480	5856	3699	1871	688	33	-356	-709	-1188	-1841	-2472	-2564	-1465
225°	-3068	1306	5480	7738	7440	5249	2511	511	-419	-567	-531	-762	-1382	-2217	-2873	-2814	-1530
230°	-3238	1201	5576	7936	7447	4791	1591	-672	-1458	-1226	-856	-993	-1727	-2688	-3313	-3065	-1582
235°	-3434	1027	5586	8098	7538	4551	923	-1626	-2423	-1991	-1408	-1469	-2253	-3252	-3777	-3305	-1617
240°	-3654	780	5497	8213	7717	4556	577	-2323	-3316	-2895	-2228	-2219	-2968	-3897	-4247	-3522	-1634
245°	-3900	454	5297	8261	7960	4784	538	-2772	-4143	-3940	-3314	-3229	-3846	-4591	-4697	-3704	-1629
250°	-4170	48	4972	8207	8212	5166	745	-3009	-4904	-5091	-4607	-4436	-4829	-5293	-5101	-3837	-1598
255°	-4462	-440	4507	8011	8398	5605	1103	-3087	-5587	-6277	-6003	-5733	-5832	-5944	-5427	-3908	-1540
260°	-4775	-1008	3893	7631	8434	5984	1501	-3066	-6172	-7400	-7363	-6984	-6754	-6484	-5644	-3906	-1452
265°	-5104	-1650	3121	7035	8242	6192	1832	-2999	-6628	-8350	-8535	-8044	-7486	-6850	-5725	-3821	-1333
270°	-5445	-2359	2205	6201	7767	6141	2011	-2928	-6918	-9020	-9378	-8782	-7936	-6991	-5646	-3646	-1181
275°	-5796	-3123	1147	5130	6980	5782	1986	-2869	-7009	-9326	-9783	-9097	-8034	-6868	-5392	-3375	-997
280°	-6150	-3928	-27	3843	5894	5111	1749	-2823	-6876	-9221	-9694	-8940	-7746	-6466	-4958	-3009	-781
285°	-6502	-4757	-1284	2384	4556	4172	1333	-2768	-6510	-8704	-9114	-8316	-7079	-5789	-4347	-2549	-534
290°	-6846	-5589	-2585	817	3046	3047	804	-2674	-5920	-7818	-8104	-7284	-6076	-4864	-3573	-2002	-259
295°	-7178	-6405	-3885	-785	1467	1848	248	-2504	-5139	-6649	-6773	-5945	-4811	-3736	-2656	-1375	43
300°	-7490	-7184	-5138	-2340	-74	690	-242	-2231	-4212	-5307	-5258	-4424	-3376	-2457	-1625	-681	367
305°	-7779	-7906	-6300	-3775	-1473	-318	-590	-1839	-3201	-3910	-3702	-2852	-1866	-1087	-509	68	710
310°	-8038	-8554	-7332	-5025	-2648	-1096	-744	-1330	-2166	-2566	-2228	-1340	-363	321	662	858	1066
315°	-8263	-9112	-8203	-6046	-3548	-1599	-686	-724	-1166	-1358	-925	33	1066	1722	1859	1674	1433
320°	-8451	-9568	-8894	-6812	-4152	-1823	-434	-56	-246	-330	166	1229	2390	3084	3057	2500	1803
325°	-8599	-9916	-9394	-7320	-4475	-1805	-37	625	566	511	1054	2254	3601	4389	4236	3324	2173
330°	-8705	-10150	-9703	-7585	-4555	-1607	436	1270	1258	1195	1785	3149	4715	5630	5378	4131	2537
335°	-8767	-10269	-9828	-7635	-4452	-1309	904	1833	1837	1772	2432	3972	5760	6805	6469	4908	2890
340°	-8784	-10278	-9785	-7508	-4228	-991	1297	2277	2315	2302	3069	4785	6767	7916	7495	5644	3226
345°	-8759	-10180	-9591	-7241	-3940	-720	1560	2579	2712	2831	3753	5631	7753	8961	8446	6327	3543
350°	-8691	-9983	-9266	-6868	-3633	-539	1663	2731	3037	3383	4505	6523	8720	9929	9307	6948	3835
355°	-8582	-9696	-8828	-6417	-3333	-462	1605	2737	3292	3946	5305	7433	9642	10801	10064	7497	4098

Table 4-a. Non-dipole field, north component for 1829, in the unit of γ (Erman-Petersen's analysis).

lat. / E long.	80°N	70°	60°	50°	40°	30°	20°	10°	0°	10°	20°	30°	40°	50°	60°	70°	80°S
0°	3154	1964	309	-1012	-1760	-2065	-2321	-2942	-1082	-5177	-6191	-6402	-4717	-1500	2571	6383	8788
5°	3395	2021	530	-620	-1238	-1501	-1836	-2651	-1060	-5732	-6966	-6976	-5264	-1913	2342	6328	8847
10°	3267	2001	685	-259	-705	-893	-1286	-2289	-1970	-5926	-7383	-7593	-5778	-2319	2089	6217	8830
15°	3069	1893	764	56	-182	-262	-690	-1868	-3815	-6051	-7728	-7963	-6239	-2700	1823	6036	8710
20°	2805	1699	760	310	312	371	-67	-1401	-3597	-6099	-7987	-8336	-6629	-3010	1553	5818	8577
25°	2476	1419	669	490	756	983	564	-897	-3316	-6061	-8143	-8601	-6931	-3329	1289	5600	8346
30°	2087	1056	486	585	1134	1551	1186	-368	-2973	-5928	-8184	-8753	-7132	-3556	1035	5315	8019
35°	1615	614	210	587	1428	2065	1780	176	-2570	-5695	-8097	-8770	-7221	-3714	797	4997	7689
40°	1156	102	-154	490	1627	2499	2333	726	-2109	-5357	-7875	-8647	-7194	-3799	578	4649	7269
45°	627	-471	-601	294	1725	2847	2834	1274	-1593	-4912	-7516	-8382	-7049	-3812	378	4274	6795
50°	70	-1094	-1121	-4	1718	3100	3274	1813	-1026	-4361	-7021	-7980	-6792	-3738	195	3871	6270
55°	-508	-1752	-1701	-371	1612	3259	3648	2338	-415	-3720	-6400	-7448	-6430	-3641	28	3451	5699
60°	-1095	-2430	-2324	-816	1415	3327	3957	2842	232	-2992	-5665	-6802	-5978	-3473	-129	3007	5088
65°	-1680	-3111	-2970	-1313	1143	3313	4202	3322	904	-2195	-4837	-6062	-5453	-3265	-280	2543	4442
70°	-2254	-3779	-3619	-1840	814	3232	4389	3774	1587	-1350	-3939	-5251	-4873	-3029	-428	2062	3767
75°	-2806	-4415	-4247	-2373	452	3098	4524	4192	2266	-480	-2998	-4395	-4261	-2778	-578	1567	3068
80°	-3326	-5004	-4834	-2887	79	2929	4614	4572	2925	390	-2044	-3522	-3635	-2521	-731	1062	2353
85°	-3806	-5531	-5357	-3356	-282	2743	4666	4907	3545	1233	-1105	-2656	-3014	-2270	-890	551	1628
90°	-4239	-5982	-5798	-3760	-607	2555	4686	5192	4109	2023	-209	-1822	-2414	-2029	-1051	42	900
95°	-4619	-6347	-6141	-4079	-881	2378	4677	5418	4598	2738	620	-1039	-1845	-1802	-1212	-461	175
100°	-4940	-6617	-6376	-4300	-1088	2221	4640	5577	4996	3356	1361	-420	-1315	-1589	-1367	-950	-539
105°	-5200	-6790	-6493	-4414	-1222	2088	4573	5660	5290	3861	2007	325	-825	-1381	-1509	-1417	-1236
110°	-5399	-6863	-6498	-4419	-1280	1980	4474	5661	5469	4243	2542	895	-372	-1181	-1630	-1855	-1910
115°	-5536	-6841	-6389	-4319	-1266	1891	4336	5571	5526	4498	2968	1392	51	-971	-1721	-2256	-2556
120°	-5611	-6729	-6175	-4124	-1189	1816	4154	5387	5459	4625	3290	1823	453	-715	-1774	-2613	-3167
125°	-5636	-6537	-5870	-3818	-1062	1712	3921	5107	5271	4632	3516	2200	845	-494	-1781	-2923	-3739
130°	-5609	-6277	-5490	-3508	-901	1661	3633	4735	4970	4530	3659	2535	1237	-208	-1737	-3184	-4270
135°	-5538	-5962	-5056	-3125	-722	1563	3290	4277	4570	4336	3736	2841	1639	116	-1611	-3386	-4755
140°	-5429	-5608	-4586	-2719	-541	1439	2895	3746	4087	4068	3763	3129	2035	479	-1492	-3538	-5194
145°	-5291	-5230	-4103	-2312	-372	1286	2455	3157	3511	3716	3751	3406	2386	878	-1296	-3611	-5586
150°	-5132	-4816	-3626	-1921	-227	1105	1992	2533	2966	3393	3723	3677	2929	1304	-1061	-3699	-5931
155°	-4958	-4469	-3171	-1562	-113	900	1493	1898	2377	3029	3682	3941	3373	1711	-800	-3719	-6228
160°	-4778	-4113	-2762	-1218	-33	681	1010	1281	1807	2675	3638	4194	3805	2181	-527	-3709	-6481
165°	-4597	-3791	-2404	-987	15	462	557	709	1280	2316	3595	4425	4207	2593	-259	-3679	-6689
170°	-4422	-3513	-2110	-784	36	259	158	212	821	2056	3552	4623	4558	2960	-11	-3639	-6856
175°	-4257	-3285	-1886	-639	38	88	-163	-186	452	1818	3507	4773	4836	3258	192	-3598	-6982
180°	-4107	-3112	-1731	-549	31	-32	-382	-161	189	1637	3457	4861	5023	3468	342	-3565	-7071
185°	-3973	-2998	-1655	-512	23	-87	-484	-597	44	1517	3396	4874	5100	3572	423	-3546	-7123
190°	-3856	-2941	-1646	-520	25	-67	-456	-585	22	1459	3318	4803	5055	3558	427	-3546	-7140
195°	-3757	-2939	-1701	-568	42	35	-295	-422	124	1461	3220	4640	4882	3421	349	-3568	-7122
200°	-3674	-2987	-1815	-648	78	218	-5	-115	342	1517	3098	4386	4581	3161	190	-3611	-7068
205°	-3605	-3079	-1979	-756	135	476	403	322	665	1621	2952	4046	4160	2787	-45	-3672	-6978
210°	-3546	-3208	-2185	-886	207	796	909	867	1076	1763	2784	3630	3635	2312	-311	-3745	-6850
215°	-3493	-3364	-2424	-1036	289	1161	1487	1494	1553	1935	2598	3153	3025	1739	-692	-3821	-6683
220°	-3443	-3538	-2686	-1204	371	1547	2106	2169	2071	2124	2398	2633	2358	1151	-1069	-3892	-6474
225°	-3389	-3720	-2964	-1387	441	1929	2731	2858	2603	2321	2192	2093	1661	519	-1455	-3944	-6221
230°	-3327	-3901	-3247	-1585	486	2282	3328	3525	3122	2511	1986	1554	966	-110	-1827	-3966	-5921
235°	-3251	-4070	-3528	-1799	496	2581	3862	4135	3602	2690	1786	1037	301	-701	-2162	-3946	-5572
240°	-3158	-4219	-3798	-2026	459	2804	4303	4656	4018	2839	1598	560	-308	-1239	-2440	-3874	-5172
245°	-3041	-4338	-4051	-2265	368	2931	4626	5063	4348	2950	1421	140	-837	-1690	-2611	-3739	-4721
250°	-2899	-4421	-4277	-2514	217	2951	4812	5333	4576	3015	1261	-215	-1272	-2011	-2758	-3535	-4219
255°	-2727	-4460	-4472	-2768	6	2857	4850	5451	4688	3025	1118	-499	-1601	-2280	-2776	-3258	-3666
260°	-2523	-4451	-4628	-3023	-263	2647	4734	5419	4679	2973	980	-713	-1824	-2402	-2691	-2905	-3065
265°	-2286	-4390	-4741	-3272	-583	2328	4471	5229	4545	2856	847	-862	-1943	-2411	-2505	-2478	-2118
270°	-2017	-4275	-4806	-3508	-915	1911	4069	4893	4291	2671	709	-957	-1969	-2314	-2225	-1982	-1732
275°	-1716	-4104	-4819	-3725	-1337	1410	3547	4426	3924	2417	561	-1010	-1917	-2125	-1860	-1423	-1010
280°	-1384	-3878	-4779	-3915	-1746	847	2926	3816	3458	2099	393	-1037	-1805	-1861	-1425	-813	-261
285°	-1026	-3601	-4685	-4071	-2157	241	2231	3177	2907	1720	198	-1056	-1657	-1546	-937	-162	508
290°	-645	-3275	-4537	-4187	-2556	-383	1490	2445	2292	1286	-30	-1082	-1493	-1200	-414	517	1289
295°	-245	-2906	-4337	-4258	-2927	-1004	729	1676	1631	808	-295	-1131	-1337	-847	123	1209	2073
300°	166	-2501	-4089	-4280	-3257	-1599	-23	898	944	293	-600	-1218	-1209	-510	654	1899	2850
305°	583	-2066	-3796	-4249	-3536	-2148	-742	136	253	-218	-947	-1351	-1126	-209	1163	2574	3612
310°	998	-1611	-3464	-4166	-3752	-2634	-1405	-588	-425	-804	-1335	-1546	-1104	40	1631	3221	4349
315°	1405	-1144	-3099	-4029	-3898	-3040	-1991	-1252	-1073	-1366	-1762	-1802	-1154	221	2045	3826	5052
320°	1794	-675	-2708	-3840	-3968	-3353	-2484	-1810	-1677	-1924	-2224	-2122	-1283	325	2394	4381	5713
325°	2160	-215	-2300	-3602	-3957	-3566	-2871	-2338	-2225	-2470	-2719	-2506	-1493	346	2671	4876	6325
330°	2494	228	-1882	-3317	-3864	-3670	-3144	-2737	-2709	-2997	-3239	-2952	-1784	283	2869	5306	6881
335°	2788	642	-1464	-2991	-3688	-3663	-3297	-3031	-3123	-3499	-3779	-3453	-2150	139	2990	5665	7375
340°	3036	1018	-1054	-2631	-3433	-3544	-3328	-3218	-3463	-3972	-4332	-4000	-2583	-82	3034	5951	7803
345°	3232	1347	-661	-2243	-3104	-3316	-3239	-3298	-3728	-4410	-4890	-4582	-3072	-369	3006	6164	8160
350°	3369	1619	-297	-1836	-2708	-2987	-3035	-3274	-3919	-4810	-5443	-5187	-3602	-711	2914	6303	8445
355°	3445	1827	30	-1422	-2256	-2565	-2725	-3153	-4036	-5167	-5982	-5799	-4156	-1093	2765	6377	8654

Table 4-b. Non-dipole field, east component for 1829, in the unit of γ (Erman-Petersen's analysis).

lat. / E long.	80°N	70°	60°	50°	40°	30°	20°	10°	0°	10°	20°	30°	40°	50°	60°	70°	80°S
0°	790	202	-558	-1459	-2433	-3381	-4182	-4717	-4894	-4666	-4047	-3112	-1990	-840	180	940	1360
5°	1392	958	252	-690	-1782	-2891	-3869	-4571	-4895	-4794	-4292	-3477	-2484	-1468	-570	103	501
10°	1988	1722	1094	139	-1035	-2273	-3396	-4244	-4704	-4733	-4364	-3695	-2865	-2018	-1277	-717	-357
15°	2568	2480	1951	1016	-203	-1530	-2766	-3736	-4321	-4484	-4266	-3771	-3136	-2492	-1937	-1513	-1206
20°	3122	3218	2807	1924	699	-676	-1988	-3054	-3755	-4057	-4008	-3714	-3305	-2894	-2550	-2280	-2040
25°	3642	3920	3643	2843	1652	272	-1080	-2218	-3024	-3470	-3608	-3540	-3384	-3231	-3117	-3015	-2851
30°	4116	4570	4439	3749	2631	1286	-70	-1254	-2156	-2751	-3091	-3271	-3391	-3512	-3640	-3715	-3632
35°	4538	5154	5173	4615	3604	2332	1007	-201	-1189	-1936	-2491	-2935	-3343	-3750	-4124	-4375	-4379
40°	4900	5658	5825	5414	4537	3371	2105	896	-167	-1067	-1843	-2558	-3262	-3954	-4571	-4994	-5084
45°	5194	6068	6374	6117	5393	4358	3177	1985	858	-190	-1186	-2174	-3169	-4137	-4984	-5570	-5742
50°	5417	6374	6802	6695	6134	5247	4169	3011	1833	647	-562	-1810	-3081	-4307	-5365	-6098	-6349
55°	5564	6567	7091	7124	6725	5992	5031	3921	2706	1398	-6	-1493	-3015	-4471	-5715	-6576	-6899
60°	5633	6641	7229	7380	7132	6554	5715	4665	3430	2022	451	-1244	-2982	-4634	-6033	-7001	-7389
65°	5625	6594	7208	7448	7332	6899	6182	5203	3969	2488	786	-1076	-2988	-4795	-6315	-7368	-7814
70°	5540	6427	7025	7318	7308	7004	6406	5507	4295	2776	985	-996	-3032	-4951	-6558	-7674	-8172
75°	5382	6144	6684	6990	7054	6858	6373	5563	4399	2880	1049	-998	-3108	-5092	-6752	-7913	-8460
80°	5156	5753	6192	6471	6574	6464	6084	5373	4285	2808	987	-1071	-3202	-5209	-6892	-8082	-8675
85°	4868	5265	5565	5779	5888	5840	5558	4958	3972	2580	822	-1193	-3296	-5289	-6970	-8178	-8817
90°	4525	4695	4824	4938	5022	5017	4828	4349	3406	2230	585	-1337	-3370	-5316	-6977	-8196	-8885
95°	4138	4061	3992	3979	4016	4038	3938	3595	2901	1802	312	-1475	-3402	-5276	-6906	-8136	-8879
100°	3714	3381	3100	2942	2914	2953	2945	2749	2241	1342	45	-1573	-3369	-5158	-6753	-7998	-8801
105°	3265	2676	2178	1867	1766	1819	1906	1873	1571	898	-178	-1605	-3255	-4953	-6516	-7783	-8653
110°	2801	1966	1258	797	625	695	883	1024	945	516	-323	-1547	-3046	-4657	-6195	-7494	-8438
115°	2331	1272	371	-226	-460	-366	-67	255	409	232	-366	-1385	-2739	-4272	-5797	-7138	-8159
120°	1866	613	-453	-1165	-1443	-1313	-898	-389	-3	70	-291	-1117	-2337	-3805	-5331	-6721	-7821
125°	1414	6	-1190	-1986	-2287	-2108	-1571	-879	-269	41	-101	-749	-1853	-3272	-4808	-6254	-7430
130°	983	-536	-1818	-2664	-2964	-2723	-2064	-1200	-385	139	193	-302	-1309	-2692	-4246	-5746	-6991
135°	580	-1000	-2323	-3182	-3455	-3145	-2371	-1354	-361	345	563	196	-733	-2090	-3663	-5211	-6509
140°	209	-1379	-2696	-3529	-3756	-3372	-2498	-1356	-223	624	971	704	-161	-1495	-3079	-4658	-5992
145°	-125	-1669	-2932	-3706	-3870	-3418	-2466	-1237	-9	935	1373	1182	370	-936	-2514	-4101	-5445
150°	-421	-1871	-3036	-3722	-3813	-3303	-2306	-1035	236	1230	1721	1585	823	-440	-1987	-3551	-4873
155°	-678	-1987	-3016	-3590	-3606	-3059	-2055	-794	465	1458	1968	1871	1166	-33	-1513	-3015	-4283
160°	-898	-2024	-2881	-3331	-3277	-2720	-1753	-558	633	1577	2074	2008	1370	268	-1106	-2503	-3678
165°	-1083	-1991	-2659	-2970	-2858	-2322	-1441	-367	701	1552	2011	1970	1420	448	-772	-2018	-3063
170°	-1236	-1901	-2358	-2534	-2380	-1899	-1151	-252	642	1362	1762	1719	1308	507	-514	-1563	-2441
175°	-1362	-1764	-2005	-2049	-1874	-1482	-911	-234	443	1001	1328	1319	1012	419	-327	-1137	-1814
180°	-1466	-1597	-1619	-1541	-1366	-1094	-736	-319	108	480	727	790	640	289	-204	-737	-1186
185°	-1553	-1412	-1222	-1036	-879	-751	-632	-501	-345	-171	-7	106	132	51	-128	-356	-555
190°	-1630	-1225	-834	-553	-430	-461	-595	-760	-883	-911	-828	-656	-440	-235	-81	13	75
195°	-1703	-1047	-472	-110	-31	-224	-611	-1068	-1463	-1686	-1678	-1442	-1031	-534	-42	379	706
200°	-1776	-892	-152	278	312	-36	-659	-1388	-2035	-2436	-2494	-2192	-1591	-810	12	752	1335
205°	-1854	-770	114	602	595	113	-715	-1680	-2546	-3102	-3214	-2847	-2068	-1024	103	1140	1964
210°	-1942	-688	316	855	821	234	-755	-1908	-2917	-3626	-3778	-3352	-2418	-1144	252	1553	2591
215°	-2042	-655	446	1033	989	339	-757	-2036	-3197	-3961	-4138	-3662	-2603	-1141	476	1996	3215
220°	-2157	-673	501	1134	1104	437	-702	-2043	-3265	-4073	-4259	-3744	-2594	-995	787	2475	3833
225°	-2289	-746	479	1158	1169	535	-583	-1913	-3134	-3943	-4121	-3580	-2376	-695	1192	2990	4443
230°	-2436	-873	381	1106	1185	634	-396	-1646	-2804	-3571	-3725	-3168	-1947	-239	1689	3540	5042
235°	-2598	-1052	209	982	1154	732	-150	-1254	-2290	-2973	-3085	-2524	-1320	364	2274	4119	5624
240°	-2772	-1280	-32	789	1074	822	143	-758	-1620	-2182	-2236	-1676	-520	1094	2934	4721	6184
245°	-2955	-1549	-334	532	916	895	461	-190	-835	-1243	-1223	-669	419	1927	3650	5333	6716
250°	-3141	-1854	-689	216	769	939	779	412	17	-211	-101	446	1452	2828	4401	5944	7214
255°	-3332	-2184	-1087	-150	541	943	1072	1009	884	852	1061	1610	2529	3758	5161	6538	7671
260°	-3515	-2531	-1518	-559	264	894	1314	1559	1712	1888	2207	2764	3599	4680	5902	7100	8079
265°	-3687	-2883	-1968	-1002	-60	785	1483	2027	2453	2837	3274	3848	4611	5552	6598	7613	8430
270°	-3840	-3230	-2425	-1466	-425	611	1562	2382	3065	3651	4207	4812	5519	6338	7222	8064	8720
275°	-3970	-3559	-2875	-1941	-825	370	1540	2603	3516	4288	4964	5610	6283	7006	7751	8436	8940
280°	-4069	-3861	-3305	-2412	-1251	66	1412	2675	3785	4722	5512	6210	6872	7528	8165	8719	9085
285°	-4132	-4123	-3701	-2867	-1690	-293	1179	2595	3860	4935	5830	6588	7263	7886	8450	8902	9152
290°	-4153	-4336	-4051	-3292	-2131	-698	850	2367	3743	4925	5911	6737	7446	8068	8595	8979	9136
295°	-4128	-4491	-4344	-3675	-2560	-1135	438	2002	3443	4699	5761	6656	7419	8070	8596	8944	9036
300°	-4052	-4580	-4568	-4004	-2964	-1589	-42	1519	2979	4275	5395	6358	7189	7896	8453	8798	8851
305°	-3922	-4596	-4715	-4267	-3331	-2044	-571	939	2375	3679	4837	5864	6774	7557	8171	8542	8582
310°	-3737	-4535	-4778	-4456	-3648	-2487	-1129	286	1659	2940	4118	5202	6195	7068	7760	8180	8230
315°	-3495	-4393	-4752	-4564	-3905	-2901	-1696	-414	862	2093	3272	4405	5480	6450	7234	7719	7799
320°	-3197	-4169	-4634	-4586	-4093	-3274	-2252	-1134	17	1174	2338	3508	4660	5728	6608	7170	7293
325°	-2844	-3863	-4423	-4516	-4206	-3592	-2780	-1849	-846	220	1353	2549	3768	4927	5900	6541	6718
330°	-2439	-3477	-4118	-4353	-4236	-3845	-3259	-2535	-1694	-733	357	1564	2837	4074	5130	5845	6080
335°	-1985	-3014	-3721	-4097	-4178	-4020	-3674	-3166	-2498	-1651	-616	589	1899	3194	4316	5095	5386
340°	-1489	-2481	-3238	-3747	-4027	-4107	-4006	-3720	-3227	-2501	-1530	-342	983	2312	3477	4302	4645
345°	-956	-1883	-2672	-3305	-3780	-4097	-4239	-4173	-3856	-3253	-2355	-1201	116	1451	2629	3479	3863
350°	-393	-1230	-2031	-2773	-3433	-3978	-4355	-4503	-4358	-3879	-3064	-1962	-680	628	1789	2637	3049
355°	192	-531	-1323	-2156	-2984	-3742	-4341	-4690	-4711	-4357	-3633	-2604	-1387	-139	969	1788	2212

Table 4-c. Non-dipole field, vertical component for 1829, in the unit of γ (Erman-Petersen's analysis).

lat. / E long.	80°N	70°	60°	50°	40°	30°	20°	10°	0°	10°	20°	30°	40°	50°	60°	70°	80°S
0°	-8173	-9462	-9493	-8479	-6971	-5538	-4154	-3538	-2259	-15	3326	7473	11424	13934	13969	11179	6118
5°	-8099	-9356	-9437	-8587	-7357	-6279	-5553	-4912	-3749	-1160	2160	6665	10994	13811	14030	11293	6191
10°	-7992	-9161	-9247	-8536	-7588	-6893	-6566	-6211	-5230	-2892	955	5796	10477	13584	13984	11320	6217
15°	-7852	-8888	-8921	-8318	-7645	-7318	-7148	-7472	-6642	-4284	-210	4901	9898	13265	13837	11260	6194
20°	-7681	-8530	-8467	-7928	-7511	-7612	-8154	-8547	-7924	-5578	-1378	4016	9279	12867	13591	11115	6121
25°	-7480	-8096	-7880	-7363	-7171	-7655	-8639	-9411	-9018	-6719	-2114	3171	8610	12399	13253	10886	6006
30°	-7252	-7590	-7170	-6624	-6615	-7451	-8862	-10015	-9871	-7661	-3310	2391	7991	11868	12827	10575	5843
35°	-7001	-7021	-6347	-5718	-5810	-6988	-8792	-10316	-10440	-8363	-4036	1702	7354	11282	12314	10185	5634
40°	-6730	-6398	-5422	-4654	-4848	-6251	-8108	-10287	-10692	-8799	-4573	1108	6721	10642	11718	9719	5383
45°	-6443	-5731	-4412	-3450	-3650	-5243	-7704	-9914	-10615	-8956	-4915	615	6106	9950	11043	9180	5090
50°	-6145	-5031	-3335	-2127	-2269	-3983	-6690	-9202	-10209	-8838	-5065	216	5495	9204	10289	8571	4760
55°	-5838	-4313	-2214	-715	-736	-2500	-5392	-8175	-9498	-8465	-5011	-102	4883	8403	9459	7898	4393
60°	-5529	-3589	-1072	752	910	-837	-3855	-6876	-8520	-7872	-4872	-359	4260	7544	8557	7163	3994
65°	-5221	-2872	64	2238	2620	948	-2139	-5364	-7332	-7106	-4596	-580	3611	6625	7587	6375	3566
70°	-4919	-2177	1169	3701	4338	2792	-317	-3713	-6000	-6227	-4255	-793	2927	5645	6554	5538	3113
75°	-4628	-1517	2215	5097	6007	4620	1533	-2004	-4602	-5295	-3895	-1023	2195	4607	5466	4660	2638
80°	-4350	-905	3177	6386	7566	6360	3325	-322	-3211	-4373	-3559	-1295	1411	3513	4332	3750	2146
85°	-4090	-351	4032	7528	8960	7938	4979	1251	-1910	-3519	-3282	-1623	574	2375	3162	2817	1641
90°	-3850	136	4760	8488	10137	9291	6121	2641	-753	-2780	-3093	-2016	-310	1203	1972	1870	1129
95°	-3634	516	5343	9239	11055	10361	7591	3790	208	-2187	-3001	-2472	-1229	16	775	919	612
100°	-3442	877	5772	9759	11685	11119	8416	4658	942	-1757	-3017	-2978	-2161	-1166	-411	-25	97
105°	-3277	1123	6040	10038	12009	11533	8963	5226	1440	-1488	-3116	-3511	-3082	-2318	-1569	-951	-413
110°	-3138	1287	6148	10075	12024	11603	9140	5497	1712	-1358	-3273	-4038	-3959	-3416	-2680	-1819	-913
115°	-3027	1368	6101	9880	11744	11345	8996	5494	1790	-1332	-3450	-4522	-4760	-4433	-3727	-2710	-1399
120°	-2941	1374	5910	9471	11194	10790	8569	5261	1717	-1365	-3601	-4923	-5451	-5344	-4691	-3523	-1867
125°	-2881	1309	5591	8875	10411	9985	7911	4852	1551	-1402	-3680	-5199	-6001	-6129	-5567	-4281	-2314
130°	-2845	1184	5165	8126	9443	8987	7086	4332	1350	-1392	-3643	-5319	-6387	-6769	-6336	-4978	-2736
135°	-2830	1008	4656	7263	8342	7860	6160	3766	1173	-1287	-3454	-5257	-6591	-7256	-6993	-5609	-3129
140°	-2834	792	4087	6328	7166	6670	5201	3215	1069	-1051	-3091	-5001	-6608	-7585	-7535	-6171	-3493
145°	-2855	548	3487	5363	5970	5478	4271	2731	1076	-665	-2519	-4554	-6443	-7761	-7964	-6662	-3825
150°	-2891	289	2880	4408	4806	4343	3421	2351	1211	-127	-1810	-3935	-6117	-7796	-8286	-7083	-4123
155°	-2938	24	2291	3503	3723	3311	2689	2097	1476	513	-994	-3179	-5637	-7712	-8510	-7435	-4386
160°	-2994	-235	1741	2680	2757	2418	2098	1970	1850	1306	-62	-2335	-5103	-7533	-8648	-7722	-4613
165°	-3057	-479	1250	1965	1938	1686	1654	1957	2296	2110	896	-1461	-4501	-7292	-8715	-7917	-4804
170°	-3125	-701	833	1379	1287	1126	1352	2029	2765	2888	1808	-623	-3911	-7020	-8729	-8116	-4959
175°	-3197	-895	499	934	811	737	1173	2148	3199	3569	2599	112	-3374	-6751	-8705	-8233	-5077
180°	-3270	-1056	255	636	512	509	1090	2268	3536	4083	3198	680	-2943	-6517	-8659	-8303	-5159
185°	-3345	-1184	102	484	383	423	1074	2346	3722	4368	3515	1029	-2659	-6343	-8601	-8331	-5205
190°	-3420	-1278	39	472	410	460	1094	2312	3709	4375	3592	1117	-2551	-6249	-8550	-8320	-5215
195°	-3497	-1340	59	587	575	595	1122	2226	3469	4075	3314	923	-2637	-6247	-8502	-8271	-5189
200°	-3574	-1374	153	815	858	806	1138	1983	2991	3462	2705	441	-2920	-6338	-8464	-8187	-5128
205°	-3653	-1386	307	1135	1237	1073	1129	1611	2282	2553	1788	-301	-3385	-6515	-8431	-8066	-5033
210°	-3735	-1381	509	1527	1689	1380	1092	1123	1371	1388	601	-1275	-4005	-6761	-8397	-7907	-4903
215°	-3821	-1367	742	1969	2193	1715	1034	548	314	28	-783	-2421	-4739	-7053	-8351	-7708	-4738
220°	-3913	-1352	990	2438	2729	2069	967	-76	-831	-1450	-2293	-3672	-5535	-7358	-8279	-7464	-4540
225°	-4011	-1344	1235	2912	3275	2438	910	-702	-2000	-2958	-3839	-4948	-6337	-7642	-8164	-7172	-4308
230°	-4119	-1352	1461	3369	3815	2817	883	-1280	-3109	-4405	-5326	-6169	-7083	-7868	-7989	-6827	-4044
235°	-4236	-1383	1651	3789	4332	3203	906	-1763	-4087	-5705	-6661	-7254	-7713	-7998	-7738	-6426	-3747
240°	-4364	-1445	1791	4151	4808	3593	996	-2110	-4872	-6777	-7773	-8132	-8174	-7999	-7394	-5963	-3420
245°	-4505	-1544	1868	4440	5228	3980	1165	-2289	-5412	-7560	-8586	-8744	-8419	-7843	-6946	-5138	-3063
250°	-4658	-1685	1871	4639	5578	4356	1415	-2282	-5673	-8008	-9054	-9044	-8415	-7508	-6383	-4819	-2677
255°	-4825	-1872	1791	4735	5843	4711	1743	-2083	-5641	-8098	-9151	-9007	-8140	-6982	-5701	-4195	-2263
260°	-5004	-2108	1621	4719	6011	5030	2135	-1700	-5320	-7831	-8872	-8625	-7588	-6259	-4899	-3479	-1830
265°	-5197	-2393	1358	4584	6072	5298	2574	-1157	-4732	-7224	-8232	-7909	-6765	-5315	-3980	-2704	-1373
270°	-5401	-2727	1002	4327	6015	5500	3033	-486	-3916	-6319	-7267	-6890	-5693	-4254	-2954	-1877	-898
275°	-5615	-3108	555	3948	5837	5619	3486	273	-2920	-5169	-6028	-5609	-4405	-3007	-1832	-1004	-409
280°	-5838	-3531	22	3450	5534	5642	3902	1074	-1805	-3838	-4580	-4121	-2940	-1631	-632	-93	91
285°	-6068	-3991	-588	2841	5108	5559	4254	1870	-632	-2398	-2992	-2488	-1348	-159	627	845	598
290°	-6301	-4482	-1266	2131	4561	5361	4517	2616	536	-923	-1339	-777	321	1373	1925	1800	1107
295°	-6535	-4996	-1999	1335	3911	5047	4670	3270	1640	518	306	947	2012	2929	3238	2759	1615
300°	-6766	-5524	-2773	468	3162	4616	4695	3798	2626	1860	1877	2622	3677	4473	4546	3713	2115
305°	-6992	-6055	-3572	-450	2331	4074	4584	4170	3449	3045	3311	4190	5267	5970	5824	4648	2605
310°	-7209	-6582	-4379	-1401	1435	3430	4331	4365	4073	4028	4560	5604	6742	7389	7055	5554	3079
315°	-7413	-7092	-5179	-2365	493	2694	3934	4368	4472	4773	5581	6824	8067	8703	8218	6421	3533
320°	-7601	-7577	-5954	-3320	-476	1879	3398	4173	4627	5255	6348	7821	9216	9892	9299	7237	3962
325°	-7769	-8025	-6687	-4247	-1452	1000	2728	3778	4531	5460	6843	8577	10172	10938	10284	7996	4364
330°	-7915	-8428	-7363	-5126	-2417	72	1937	3188	4183	5384	7059	9083	10923	11831	11163	8688	4733
335°	-8034	-8777	-7967	-5940	-3353	-889	1034	2411	3591	5033	7000	9340	11467	12564	11929	9308	5067
340°	-8126	-9063	-8486	-6672	-4211	-1865	38	1464	2769	4422	6680	9358	11808	13136	12576	9851	5363
345°	-8187	-9280	-8908	-7306	-5063	-2840	-1035	365	1740	3574	6120	9154	11957	13552	13103	10311	5618
350°	-8216	-9422	-9222	-7827	-5806	-3792	-2160	-857	533	2520	5349	8751	11929	13817	13509	10688	5830
355°	-8211	-9484	-9420	-8222	-6448	-4700	-3310	-2172	-815	1299	4404	8180	11744	13940	13797	10977	5997

Table 5-a. Non-dipole field, north component for 1885, in the unit of γ (Schmidt's analysis).

lat. / E long.	80°N	70°	60°	50°	40°	30°	20°	10°	0°	10°	20°	30°	40°	50°	60°	70°	80°S
0°	4688	2856	795	-1111	-1283	-415	267	-481	-3050	-6586	-9360	-9714	-7036	-2159	3062	6766	8038
5°	4586	2839	578	-911	-961	1	717	-73	-2750	-6444	-9413	-9979	-7486	-2703	2569	6462	7979
10°	4390	2711	568	-767	-660	419	1178	359	-2428	-6262	-9394	-10141	-7822	-3156	2113	6136	7860
15°	4101	2471	466	-681	-386	831	1642	778	-2094	-6046	-9306	-10195	-8034	-3505	1708	5797	7688
20°	3722	2124	271	-655	-140	1232	2101	1205	-1754	-5801	-9150	-10143	-8119	-3746	1359	5452	7466
25°	3259	1674	-12	-688	74	1619	2552	1625	-1408	-5524	-8926	-9985	-8083	-3882	1065	5102	7198
30°	2720	1131	-376	-776	257	1988	2991	2040	-1053	-5212	-8630	-9726	-7935	-3925	820	4750	6887
35°	2112	505	-813	-914	409	2336	3414	2448	-684	-4856	-8261	-9372	-7691	-3893	613	4392	6536
40°	1448	-191	-1312	-1098	530	2660	3818	2853	-294	-4446	-7812	-8930	-7368	-3807	429	4024	6149
45°	739	-943	-1861	-1319	620	2955	4199	3252	126	-3971	-7278	-8407	-6986	-3688	252	3643	5728
50°	-2	-1733	-2445	-1571	679	3216	4552	3648	582	-3424	-6657	-7811	-6563	-3559	68	3244	5277
55°	-762	-2544	-3051	-1846	709	3439	4871	4038	1078	-2798	-5947	-7148	-6114	-3437	-138	2823	4298
60°	-1526	-3358	-3662	-2135	709	3618	5150	4419	1612	-2092	-5149	-6429	-5655	-3339	-374	2378	4295
65°	-2280	-4156	-4263	-2429	680	3750	5382	4783	2180	-1311	-4270	-5660	-5195	-3273	-646	1910	3772
70°	-3011	-4921	-4838	-2720	625	3831	5562	5124	2772	-466	-3322	-4854	-4742	-3243	-953	1422	3233
75°	-3701	-5633	-5371	-2998	545	3859	5684	5432	3374	425	-2321	-4021	-4300	-3247	-1292	918	2683
80°	-4348	-6277	-5846	-3253	447	3834	5743	5696	3969	1340	-1288	-3173	-3871	-3278	-1653	405	2125
85°	-4932	-6836	-6249	-3475	334	3758	5739	5907	4537	2251	-250	-2327	-3455	-3326	-2024	-108	1567
90°	-5415	-7297	-6568	-3655	212	3635	5669	6056	5057	3132	769	-1496	-3051	-3380	-2391	-610	1011
95°	-5881	-7650	-6791	-3784	88	3468	5535	6136	5512	3954	1739	-698	-2659	-3427	-2738	-1093	464
100°	-6233	-7886	-6910	-3855	-32	3265	5339	6141	5883	4691	2635	53	-2279	-3454	-3051	-1546	-71
105°	-6498	-8001	-6920	-3863	-142	3029	5086	6070	6161	5322	3434	742	-1913	-3454	-3318	-1960	-588
110°	-6675	-7992	-6818	-3804	-238	2768	4781	5923	6336	5833	4121	1357	-1562	-3418	-3529	-2330	-1085
115°	-6765	-7863	-6605	-3678	-317	2485	4428	5704	6408	6217	4682	1888	-1230	-3344	-3679	-2649	-1558
120°	-6771	-7620	-6287	-3487	-378	2185	4035	5418	6381	6472	5115	2331	-919	-3231	-3765	-2917	-2006
125°	-6698	-7271	-5873	-3236	-423	1870	3607	5076	6264	6606	5422	2684	-631	-3083	-3789	-3134	-2427
130°	-6555	-6830	-5375	-2934	-454	1543	3151	4686	6070	6633	5613	2951	-375	-2905	-3757	-3302	-2821
135°	-6351	-6314	-4810	-2593	-475	1205	2673	4261	5815	6569	5702	3138	-146	-2704	-3675	-3425	-3188
140°	-6096	-5741	-4197	-2226	-493	859	2182	3814	5516	6435	5707	3257	55	-2488	-3553	-3512	-3529
145°	-5801	-5131	-3558	-1846	-511	507	1686	3357	5192	6253	5649	3320	230	-2263	-3403	-3568	-3845
150°	-5480	-4507	-2915	-1470	-534	155	1195	2905	4860	6011	5546	3340	382	-2036	-3233	-3602	-4137
155°	-5144	-3891	-2291	-1112	-561	-190	722	2470	4533	5816	5416	3331	514	-1812	-3056	-3621	-4407
160°	-4805	-3304	-1709	-786	-602	-518	281	2066	4223	5591	5273	3304	633	-1596	-2879	-3634	-4656
165°	-4476	-2766	-1188	-502	-645	-815	-113	1705	3939	5373	5125	3268	741	-1390	-2710	-3645	-4885
170°	-4166	-2296	-748	-270	-689	-1068	-444	1399	3686	5165	4976	3228	842	-1196	-2556	-3661	-5094
175°	-3884	-1908	-401	-96	-727	-1261	-693	1158	3467	4965	4825	3185	937	-1018	-2421	-3684	-5284
180°	-3638	-1614	-159	19	-751	-1376	-844	993	3282	4769	4667	3136	1024	-855	-2307	-3717	-5452
185°	-3431	-1421	-26	75	-751	-1399	-884	911	3131	4568	4494	3074	1100	-712	-2216	-3760	-5598
190°	-3268	-1332	-5	74	-719	-1319	-801	917	3011	4357	4295	2992	1158	-590	-2149	-3811	-5718
195°	-3147	-1345	-91	24	-648	-1128	-589	1014	2922	4127	4060	2879	1192	-493	-2105	-3866	-5810
200°	-3068	-1456	-277	-71	-534	-825	-249	1202	2860	3874	3783	2726	1193	-425	-2082	-3921	-5869
205°	-3027	-1655	-552	-201	-377	-416	211	1474	2824	3598	3458	2524	1153	-388	-2076	-3969	-5892
210°	-3019	-1930	-903	-361	-182	86	777	1823	2812	3299	3084	2267	1067	-384	-2083	-4003	-5874
215°	-3035	-2264	-1313	-543	15	660	1426	2233	2822	2981	2665	1955	930	-413	-2096	-4015	-5808
220°	-3068	-2641	-1764	-743	290	1280	2130	2688	2851	2652	2207	1590	742	-472	-2109	-3993	-5692
225°	-3107	-3042	-2241	-955	536	1914	2855	3164	2894	2319	1722	1179	509	-555	-2109	-3930	-5520
230°	-3144	-3448	-2725	-1178	763	2526	3564	3637	2915	1990	1222	734	239	-652	-2088	-3815	-5288
235°	-3168	-3839	-3199	-1411	958	3082	4217	4080	2996	1672	721	257	-56	-751	-2031	-3639	-4994
240°	-3169	-4200	-3650	-1652	1095	3546	4780	4466	3035	1370	232	-205	-361	-838	-1927	-3392	-4635
245°	-3139	-4512	-4064	-1901	1160	3891	5218	4770	3050	1084	-235	-667	-657	-896	-1763	-3079	-4211
250°	-3069	-4763	-4429	-2157	1141	4092	5506	4969	3028	811	-672	-1104	-929	-909	-1528	-2666	-3722
255°	-2953	-4940	-4737	-2419	1030	4136	5625	5046	2955	546	-1076	-1505	-1160	-865	-1215	-2179	-3171
260°	-2786	-5035	-4980	-2684	825	4017	5568	4988	2818	278	-1448	-1862	-1339	-753	-818	-1611	-2562
265°	-2565	-5042	-5153	-2948	532	3741	5337	4793	2608	-3	-1795	-2174	-1459	-566	-339	-967	-1900
270°	-2289	-4959	-5251	-3203	162	3321	4942	4462	2317	-308	-2125	-2443	-1518	-307	218	-254	-1193
275°	-1958	-4783	-5274	-3442	-269	2783	4407	4008	1944	-650	-2451	-2678	-1523	17	840	514	-450
280°	-1574	-4520	-5220	-3656	-739	2154	3761	3448	1491	-1035	-2785	-2891	-1485	392	1512	1322	319
285°	-1143	-4173	-5091	-3836	-1224	1471	3038	2808	969	-1467	-3138	-3096	-1423	797	2210	2151	1103
290°	-669	-3750	-4890	-3972	-1700	769	2276	2118	392	-1948	-3520	-3311	-1358	1206	2910	2982	1890
295°	-162	-3261	-4620	-4056	-2142	81	1516	1408	-222	-2470	-3939	-3552	-1316	1590	3583	3793	2668
300°	370	-2717	-4289	-4082	-2529	-549	793	711	-848	-3024	-4396	-3833	-1321	1918	4200	4563	3426
305°	916	-2131	-3904	-4044	-2842	-1103	110	59	-1463	-3594	-4888	-4167	-1395	2163	4735	5271	4151
310°	1467	-1517	-3474	-3942	-3069	-1556	-410	-520	-2042	-4163	-5410	-4500	-1557	2300	5164	5900	4834
315°	2009	-890	-3010	-3779	-3203	-1893	-855	-1005	-2560	-4710	-5950	-4812	-1820	2310	5468	6436	5164
320°	2531	-266	-2524	-3558	-3241	-2107	-1166	-1378	-2999	-5217	-6494	-5520	-2187	2184	5637	6867	6035
325°	3021	339	-2029	-3289	-3188	-2199	-1344	-1631	-3342	-5665	-7027	-6073	-2655	1921	5666	7189	6539
330°	3467	910	-1540	-2982	-3052	-2175	-1394	-1760	-3582	-6042	-7533	-6656	-3212	1529	5559	7400	6972
335°	3859	1432	-1071	-2651	-2846	-2048	-1324	-1769	-3715	-6336	-7998	-7253	-3839	1024	5326	7503	7332
340°	4186	1891	-638	-2309	-2583	-1831	-1149	-1669	-3744	-6544	-8409	-7842	-4510	433	4987	7507	7617
345°	4439	2273	-252	-1971	-2281	-1543	-884	-1473	-3678	-6666	-8755	-8401	-5196	-215	4565	7421	7828
350°	4611	2567	72	-1650	-1954	-1200	-549	-1198	-3530	-6707	-9031	-8912	-5865	-885	4085	7259	7967
355°	4695	2764	324	-1360	-1617	-819	-159	-861	-3315	-6677	-9233	-9355	-6488	-1544	3576	7036	8036

Table 5-b. Non-dipole field, east component for 1885, in the unit of γ (Schmidt's analysis).

lat. / E long.	80°N	70°	60°	50°	40°	30°	20°	10°	0°	10°	20°	30°	40°	50°	60°	70°	80°S
0°	1187	645	111	-461	-1112	-1847	-2621	-3363	-4004	-4484	-4735	-4671	-4200	-3279	-1979	-515	799
5°	1982	1671	1224	631	-107	-918	-1819	-2636	-3336	-3877	-4223	-4317	-4076	-3434	-2409	-1145	97
10°	2765	2691	2312	1736	925	-8	-959	-1833	-2569	-3149	-3572	-3815	-3810	-3469	-2751	-1723	-587
15°	3522	3685	3137	2827	1953	940	-77	-991	-1747	-2352	-2841	-3228	-3458	-3425	-3026	-2254	-1249
20°	4238	4631	4484	3876	2948	1868	797	-146	-914	-1539	-2092	-2618	-3079	-3345	-3260	-2747	-1886
25°	4901	5508	5459	4857	3885	2719	1637	674	-105	-755	-1378	-2045	-2725	-3370	-3476	-3207	-2493
30°	5498	6297	6338	5745	4739	3562	2421	1444	650	-37	-745	-1557	-2444	-3235	-3694	-3641	-3070
35°	6019	6981	7101	6519	5490	4287	3132	2147	1332	588	-224	-1190	-2267	-3267	-3931	-4055	-3613
40°	6453	7545	7729	7160	6121	4910	3759	2773	1929	1107	167	-962	-2214	-3381	-4195	-4451	-4120
45°	6792	7975	8207	7652	6617	5420	4291	3313	2433	1513	423	-878	-2287	-3578	-4487	-4829	-4590
50°	7031	8263	8523	7983	6968	5808	4722	3764	2815	1812	554	-925	-2475	-3850	-4802	-5186	-5020
55°	7166	8400	8668	8144	7165	6066	5047	4123	3167	2014	578	-1079	-2753	-4177	-5129	-5518	-5407
60°	7195	8385	8637	8130	7201	6189	5259	4387	3403	2132	521	-1306	-3086	-4531	-5450	-5817	-5749
65°	7119	8216	8431	7940	7081	6172	5354	4553	3558	2183	411	-1569	-3435	-4879	-5746	-6075	-6045
70°	6941	7899	8053	7576	6797	6013	5328	4618	3633	2181	277	-1830	-3759	-5189	-5996	-6285	-6292
75°	6665	7441	7509	7033	6355	5712	5176	4577	3631	2138	142	-2053	-4023	-5429	-6180	-6438	-6488
80°	6300	6853	6813	6353	5763	5271	4898	4430	3552	2062	26	-2213	-4194	-5574	-6283	-6528	-6634
85°	5855	6149	5980	5520	5030	4698	4496	4174	3397	1958	-60	-2291	-4254	-5605	-6292	-6551	-6729
90°	5340	5347	5030	4563	4174	4003	3977	3815	3167	1828	-112	-2279	-4193	-5515	-6204	-6506	-6773
95°	4768	4467	3987	3506	3216	3204	3353	3359	2866	1673	-130	-2179	-4013	-5301	-6018	-6394	-6767
100°	4152	3532	2879	2376	2180	2323	2644	2820	2501	1493	-121	-2004	-3725	-4983	-5713	-6220	-6714
105°	3507	2567	1735	1206	1097	1387	1873	2218	2085	1289	-96	-1770	-3351	-4571	-5391	-5990	-6617
110°	2847	1596	588	28	2	430	1070	1578	1632	1064	-64	-1498	-2916	-4091	-4980	-5714	-6478
115°	2187	645	-530	-1120	-1070	-513	269	928	1162	825	-34	-1210	-2450	-3570	-4529	-5404	-6302
120°	1541	-261	-1587	-2202	-2082	-1107	-196	298	698	581	-13	-928	-1980	-3038	-4059	-5069	-6091
125°	922	-1098	-2549	-3182	-2996	-2214	-1192	-283	262	343	-4	-667	-1532	-2519	-3591	-4721	-5851
130°	311	-1841	-3389	-4028	-3779	-2905	-1789	-787	-126	122	-6	-440	-1125	-2036	-3143	-4372	-5585
135°	-192	-2483	-4081	-4731	-4404	-3452	-2263	-1191	-417	-69	-17	-252	-774	-1607	-2729	-4029	-5296
140°	-667	-2998	-4607	-5209	-4818	-3836	-2599	-1490	-692	-222	-32	-105	-486	-1241	-2361	-3699	-4986
145°	-1080	-3380	-4950	-5507	-5097	-4019	-2792	-1671	-855	-331	-16	1	-263	-945	-2013	-3387	-4659
150°	-1427	-3621	-5106	-5597	-5119	-4000	-2816	-1730	-911	-398	-51	80	-100	-717	-1778	-3095	-4315
155°	-1706	-3731	-5074	-5481	-5008	-3970	-2776	-1734	-964	-427	-56	130	9	-552	-1563	-2822	-3955
160°	-1920	-3701	-4863	-5171	-4688	-3708	-2603	-1650	-910	-429	-54	158	75	-440	-1391	-2566	-3580
165°	-2071	-3555	-4488	-4686	-4211	-3328	-2357	-1521	-896	-422	-52	170	107	-371	-1254	-2320	-3188
170°	-2166	-3299	-3971	-4052	-3609	-2863	-2067	-1387	-856	-422	-60	166	113	-333	-1141	-2078	-2778
175°	-2212	-2951	-3330	-3302	-2913	-2315	-1766	-1269	-811	-419	-87	146	103	-312	-1039	-1831	-2349
180°	-2219	-2542	-2626	-2473	-2162	-1806	-1482	-1191	-882	-518	-144	108	81	-298	-936	-1577	-1900
185°	-2196	-2087	-1865	-1604	-1392	-1278	-1236	-1170	-980	-639	-237	51	54	-278	-819	-1300	-1428
190°	-2155	-1615	-1092	-735	-637	-785	-1011	-1212	-1113	-816	-368	-25	27	-243	-677	-995	-933
195°	-2107	-1152	-343	98	70	-311	-903	-1312	-1362	-1042	-536	-117	6	-182	-498	-652	-415
200°	-2062	-720	349	859	706	33	-817	-1451	-1618	-1301	-728	-218	0	-85	-271	-267	129
205°	-2030	-343	935	1520	1250	343	-770	-1614	-1881	-1569	-925	-312	20	59	13	166	695
210°	-2020	-10	1419	2058	1688	587	-713	-1762	-2123	-1812	-1103	-383	80	260	360	651	1283
215°	-2039	175	1811	2456	2016	775	-714	-1863	-2299	-1995	-1232	-406	195	530	779	1189	1889
220°	-2094	288	2030	2701	2230	916	-659	-1886	-2371	-2081	-1277	-356	385	879	1272	1778	2509
225°	-2187	295	2098	2801	2336	1022	-560	-1805	-2316	-2037	-1209	-209	666	1316	1810	2415	3139
230°	-2319	193	2015	2748	2338	1102	-403	-1600	-2101	-1837	-1003	59	1052	1844	2481	3093	3770
235°	-2491	-16	1787	2553	2216	1161	-183	-1267	-1728	-1468	-641	461	1552	2466	3188	3803	4397
240°	-2699	-325	1425	2229	2068	1210	97	-814	-1195	-931	-120	1002	2167	3174	3950	4532	5009
245°	-2937	-722	943	1791	1813	1236	420	-263	-528	-244	550	1676	2887	3956	4749	5265	5598
250°	-3200	-1195	362	1256	1489	1236	763	352	237	562	1342	2461	3694	4790	5566	5986	6153
255°	-3479	-1725	-298	643	1103	1198	1096	986	1050	1137	2217	3323	4556	5646	6373	6674	6661
260°	-3764	-2294	-1011	-29	660	1107	1381	1588	1851	2326	3119	4214	5431	6489	7142	7309	7121
265°	-4046	-2883	-1760	-710	167	950	1592	2106	2579	3161	3989	5078	6269	7277	7839	7871	7515
270°	-4312	-3471	-2514	-1471	-371	711	1687	2491	3173	3878	4759	5853	7016	7964	8434	8340	7836
275°	-4553	-4037	-3252	-2203	-946	391	1644	2702	3580	4415	5365	6477	7616	8508	8895	8698	8078
280°	-4756	-4561	-3931	-2917	-1547	-21	1447	2709	3759	4721	5750	6892	8018	8867	9195	8930	8233
285°	-4912	-5026	-4589	-3595	-2162	-516	1091	2499	3684	4761	5871	7053	8181	9009	9312	9025	8298
290°	-5011	-5414	-5148	-4217	-2775	-1083	592	2076	3350	4518	5702	6929	8074	8911	9232	8976	8269
295°	-5045	-5710	-5610	-4766	-3367	-1699	-36	1459	2771	3996	5237	6506	7681	8563	8952	8782	8147
300°	-5006	-5902	-5960	-5221	-3917	-2339	-757	684	1980	3220	4491	5795	7018	7971	8471	8445	7932
305°	-4889	-5980	-6185	-5576	-4400	-2968	-1528	-201	1024	2231	3503	4826	6100	7155	7816	7976	7630
310°	-4691	-5936	-6275	-5805	-4795	-3551	-2302	-1138	-33	1100	2328	3648	4972	6148	7000	7388	7215
315°	-4409	-5767	-6223	-5900	-5078	-4054	-3029	-2067	-1124	-112	1036	2327	3692	4997	6060	6700	6784
320°	-4045	-5471	-6026	-5830	-5229	-4443	-3663	-2928	-2179	-1325	-293	939	2328	3756	5033	5932	6256
325°	-3601	-5050	-5683	-5651	-5231	-4690	-4163	-3667	-3132	-2464	-1579	-435	954	2485	3959	5108	5671
330°	-3080	-4509	-5196	-5298	-5081	-4776	-4495	-4238	-3926	-3459	-2745	-1715	-358	1243	2881	4232	5038
335°	-2488	-3856	-4573	-4796	-4768	-4687	-4610	-4610	-4516	-4255	-3723	-2832	-1541	85	1838	3381	4369
340°	-1835	-3100	-3824	-4152	-4296	-4421	-4587	-4766	-4874	-4811	-4465	-3729	-2540	-942	862	2527	3672
345°	-1129	-2256	-2963	-3378	-3676	-3985	-4341	-4702	-4990	-5105	-4937	-4367	-3315	-1804	-20	1698	2958
350°	-382	-1338	-2006	-2490	-2924	-3395	-3914	-4431	-4867	-5135	-5129	-4730	-3847	-2481	-791	909	2236
355°	394	-365	-974	-1509	-2060	-2673	-3331	-3974	-4528	-4918	-5052	-4823	-4136	-2970	-1443	170	1514

Table 5-c. Non-dipole field, vertical component for 1885, in the unit of γ (Schmidt's analysis).

lat / E long.	80°N	70°	60°	50°	40°	30°	20°	10°	0°	10°	20°	30°	40°	50°	60°	70°	80°S
0°	-8859	-11173	-11376	-9721	-7547	-6311	-6747	-8028	-8176	-6160	-1526	5132	11173	14323	13575	9657	4481
5°	-8777	-11019	-11249	-9647	-7591	-6596	-7262	-8816	-9502	-7654	-2793	3920	10169	13658	13291	9661	4578
10°	-8645	-10798	-10929	-9339	-7402	-6617	-7555	-9381	-10299	-8612	-3833	2895	9277	13020	12969	9608	4642
15°	-8464	-10424	-10420	-8806	-6971	-6409	-7625	-9725	-10854	-9311	-4616	2086	8526	12431	12621	9505	4671
20°	-8235	-9930	-9729	-8054	-6320	-5979	-7478	-9812	-11166	-9749	-5138	1502	7924	11898	12262	9356	4668
25°	-7962	-9325	-8868	-7099	-5453	-5341	-7127	-9715	-11247	-9937	-5411	1126	7458	11417	11884	9162	4633
30°	-7649	-8619	-7850	-5958	-4395	-4516	-6588	-9452	-11111	-9902	-5477	923	7099	10971	11485	8925	4567
35°	-7300	-7823	-6697	-4656	-3179	-3526	-5880	-8980	-10792	-9680	-5373	811	6807	10533	11056	8645	4472
40°	-6920	-6951	-5429	-3219	-1806	-2393	-5025	-8318	-10307	-9310	-5161	823	6529	10077	10586	8322	4348
45°	-6516	-6019	-4072	-1678	-333	-1150	-4042	-7575	-9683	-8831	-4890	808	6214	9565	10061	7955	4198
50°	-6093	-5045	-2652	-66	1215	183	-2951	-6679	-8941	-8278	-4611	739	5814	8968	9471	7542	4022
55°	-5659	-4045	-1199	1581	2806	1574	-1771	-5675	-8109	-7683	-4366	572	5290	8262	8806	7086	3822
60°	-5219	-3040	258	3234	4405	2996	-531	-4581	-7195	-7068	-4183	275	4613	7432	8062	6586	3600
65°	-4781	-2049	1688	4850	5975	4417	734	-3414	-6218	-6418	-4080	-168	3780	6474	7241	6018	3359
70°	-4352	-1089	3061	6395	7481	5808	2053	-2194	-5191	-5832	-4058	-751	2790	5396	6319	5374	3100
75°	-3937	-180	4348	7832	8888	7135	3314	-917	-4137	-5226	-4110	-1459	1669	4216	5308	4872	2826
80°	-3543	662	5519	9129	10159	8363	4589	302	-3067	-4630	-4217	-2257	451	2962	4107	4219	2539
85°	-3176	1421	6551	10253	11261	9460	5755	1519	-2001	-4016	-4358	-3107	-820	1671	3395	3615	2242
90°	-2839	2083	7419	11174	12163	10391	6807	2672	-971	-3476	-4507	-3964	-2093	383	2386	2977	1937
95°	-2538	2637	8105	11870	12836	11127	7711	3725	5	-2925	-4643	-4783	-3318	-863	1403	2346	1626
100°	-2275	3075	8594	12319	13258	11639	8436	4616	900	-2400	-4747	-5527	-4419	-2028	469	1731	1313
105°	-2053	3390	8876	12509	13413	11909	8957	5307	1688	-1910	-4808	-6163	-5419	-3079	-399	1138	1000
110°	-1872	3581	8947	12431	13293	11921	9256	5985	2350	-1466	-4820	-6673	-6289	-3994	-1183	575	687
115°	-1734	3649	8809	12095	12897	11682	9327	6371	2872	-1078	-4786	-7047	-6956	-4757	-1876	45	378
120°	-1637	3598	8471	11503	12236	11193	9175	6563	3218	-755	-4711	-7286	-7445	-5363	-2472	-419	74
125°	-1580	3436	7947	10678	11332	10475	8818	6572	3383	-501	-4605	-7404	-7766	-5817	-2974	-906	-225
130°	-1559	3174	7259	9617	10215	9560	8282	6421	3587	-316	-4481	-7415	-7935	-6130	-3386	-1328	-517
135°	-1573	2827	6433	8416	8927	8489	7607	6112	3583	-194	-4347	-7343	-7978	-6323	-3721	-1717	-802
140°	-1617	2411	5500	7119	7514	7310	6835	5772	3197	-121	-4212	-7209	-7920	-6419	-3990	-2078	-1079
145°	-1686	1943	4496	5744	6032	6074	6016	5352	3359	-92	-4078	-7033	-7792	-6442	-4210	-2416	-1347
150°	-1776	1443	3459	4285	4538	4837	5195	4921	3199	-82	-3949	-6832	-7618	-6418	-4396	-2736	-1607
155°	-1882	932	2429	2883	3089	3651	4417	4513	3013	-77	-3819	-6620	-7421	-6369	-4563	-3043	-1857
160°	-2000	428	1443	1563	1741	2563	3715	4154	2910	-64	-3688	-6403	-7219	-6314	-4721	-3342	-2098
165°	-2124	-19	538	373	544	1611	3116	3856	2808	-37	-3550	-6188	-7024	-6270	-4890	-3636	-2328
170°	-2251	-181	-253	-611	-459	832	2632	3622	2736	4	-3406	-5977	-6845	-6216	-5069	-3928	-2517
175°	-2377	-863	-901	-1452	-1236	236	2264	3439	2680	52	-3259	-5772	-6686	-6218	-5266	-4218	-2753
180°	-2499	-1174	-1391	-2025	-1767	-167	2001	3285	2615	87	-3117	-5576	-6550	-6281	-5481	-4505	-2916
185°	-2611	-1410	-1709	-2319	-2042	-381	1821	3130	2510	87	-2994	-5391	-6436	-6342	-5714	-4788	-3123
190°	-2723	-1568	-1815	-2420	-2061	-420	1707	2910	2331	23	-2908	-5231	-6317	-6428	-5959	-5062	-3282
195°	-2823	-1647	-1801	-2215	-1817	-306	1621	2682	2015	-134	-2880	-5107	-6283	-6531	-6209	-5322	-3422
200°	-2916	-1653	-1599	-1813	-1414	-61	1510	2328	1622	-411	-2929	-5021	-6213	-6651	-6455	-5561	-3539
205°	-3002	-1591	-1216	-1213	-798	277	1311	1862	1017	-825	-3071	-4991	-6229	-6776	-6686	-5771	-3631
210°	-3084	-1479	-772	-478	-36	688	1311	1280	317	-1385	-3325	-5024	-6236	-6891	-6888	-5943	-3696
215°	-3164	-1321	-205	408	833	1116	1115	591	-554	-2081	-3680	-5115	-6258	-6984	-7015	-6069	-3731
220°	-3245	-1114	421	1372	1767	1627	919	-176	-1535	-2892	-4129	-5258	-6284	-7039	-7113	-6138	-3733
225°	-3330	-956	1071	2366	2725	2136	739	-583	-2578	-3778	-4615	-5435	-6295	-7036	-7164	-6141	-3700
230°	-3423	-777	1709	3315	3670	2602	539	-1778	-3623	-4686	-5189	-5618	-6268	-6953	-7090	-6069	-3631
235°	-3527	-625	2301	4266	4567	3078	375	-2301	-4602	-5553	-5710	-5768	-6172	-6766	-6905	-5941	-3524
240°	-3646	-516	2815	5090	5387	3510	279	-3106	-5413	-6309	-6150	-5838	-5970	-6447	-6593	-5669	-3377
245°	-3782	-464	3224	5781	6105	3985	275	-3530	-6082	-6885	-6416	-5777	-5625	-5972	-6140	-5330	-3192
250°	-3939	-482	3505	6321	6702	4411	384	-3737	-6463	-7221	-6540	-5537	-5100	-5319	-5535	-4894	-2968
255°	-4117	-579	3639	6679	7161	4813	611	-3701	-6518	-7270	-6381	-5072	-4363	-4470	-4773	-4360	-2706
260°	-4317	-762	3616	6847	7470	5182	963	-3423	-6321	-7002	-5931	-4348	-3301	-3413	-3852	-3732	-2408
265°	-4541	-1034	3429	6817	7623	5507	1414	-2912	-5789	-6412	-5182	-3318	-2172	-2149	-2778	-3014	-2078
270°	-4788	-1396	3077	6588	7611	5771	1938	-2207	-4981	-5520	-4134	-2074	-712	-688	-1562	-2215	-1717
275°	-5056	-1845	2567	6165	7431	5953	2495	-1361	-3962	-4371	-2820	-549	967	948	-221	-1318	-1331
280°	-5343	-2376	1907	5558	7091	6034	3037	-412	-2797	-3032	-1296	1181	2826	2725	1210	-424	-923
285°	-5646	-2979	1113	4782	6584	5989	3513	472	-1576	-1588	362	3049	4807	4596	2711	538	-499
290°	-5962	-3645	202	3856	5919	5801	3870	1301	-392	-136	2062	4975	6841	6508	4210	1522	-64
295°	-6285	-4360	-805	2800	5107	5453	4062	1980	661	1224	3705	6863	8846	8399	5761	2508	376
300°	-6612	-5110	-1885	1640	4160	4938	4055	2437	1501	2391	5189	8619	10740	10206	7231	3179	816
305°	-6937	-5880	-3012	402	3098	4255	3823	2628	2058	3291	6421	10147	12442	11869	8621	4115	1250
310°	-7255	-6653	-4161	-884	1942	3411	3360	2525	2286	3819	7322	11369	13879	13332	9887	5301	1673
315°	-7559	-7413	-5305	-2189	721	2134	2672	2121	2161	4026	7836	12219	14992	14552	11006	6121	2080
320°	-7844	-8143	-6417	-3479	-535	1313	1781	1433	1684	3806	7932	12661	15744	15496	11954	6865	2467
325°	-8105	-8826	-7472	-4724	-1790	179	733	491	882	3203	7608	12681	16118	16150	12720	7524	2829
330°	-8336	-9448	-8443	-5892	-3006	-1016	-132	-644	-198	2256	6893	12297	16122	16513	13300	8092	3163
335°	-8532	-9993	-9309	-6951	-4148	-2195	-1657	-1919	-1491	1025	5840	11551	15786	16602	13698	8567	3467
340°	-8689	-10448	-10046	-7874	-5177	-3313	-2882	-3263	-2921	-411	4524	10510	15160	16449	13927	8951	3739
345°	-8803	-10802	-10636	-8633	-6059	-4323	-4052	-4606	-4410	-1966	3034	9255	14311	16094	14006	9245	3977
350°	-8871	-11046	-11062	-9206	-6764	-5186	-5114	-5884	-5878	-3547	1167	7879	13312	15588	13957	9457	4180
355°	-8890	-11171	-11312	-9574	-7266	-5868	-6023	-7010	-7253	-5071	-82	6476	12242	14981	13805	9592	4318

Table 6-a. Non-dipole field, north component for 1965, in the unit of γ (Leaton et al.'s analysis).

lat. / E long.	80°N	70°	60°	50°	40°	30°	20°	10°	0°	10°	20°	30°	40°	50°	60°	70°	80°S
0°	3638	2213	1235	1435	2663	4104	4446	2364	-2415	-8364	-12893	-14136	-11932	-7216	-1049	5363	10265
5°	3289	1911	968	1211	2543	4176	4762	2868	-1900	-8044	-12854	-14267	-12032	-7182	-954	5378	10140
10°	2862	1526	632	927	2364	4197	5046	3365	-1364	-7675	-12735	-14292	-12009	-7030	-783	5395	9947
15°	2360	1066	239	595	2141	4183	5308	3851	-830	-7280	-12546	-14203	-11854	-6765	-551	5400	9682
20°	1791	536	-205	226	1887	4145	5552	4316	-311	-6870	-12283	-13987	-11560	-6397	-282	5377	9342
25°	1159	-57	-690	-167	1615	4089	5774	4753	186	-6438	-11929	-13629	-11129	-5948	-3	5305	8924
30°	474	-705	-1209	-571	1337	4020	5967	5152	666	-5966	-11464	-13121	-10572	-5447	254	5167	8424
35°	-256	-1403	-1753	-975	1068	3942	6128	5515	1114	-5429	-10867	-12464	-9915	-4931	453	4943	7841
40°	-1020	-2140	-2316	-1366	822	3868	6264	5852	1641	-4800	-10129	-11674	-9196	-4444	564	4619	7174
45°	-1809	-2909	-2891	-1734	616	3816	6394	6186	2184	-4064	-9254	-10783	-8461	-4028	556	4183	6427
50°	-2610	-3700	-3471	-2068	469	3813	6546	6544	2791	-3217	-8265	-9832	-7754	-3719	411	3629	5602
55°	-3410	-4501	-4050	-2363	396	3883	6751	6951	3471	-2273	-7192	-8863	-7114	-3540	120	2959	4706
60°	-4197	-5300	-4621	-2614	406	4047	7033	7419	4218	-1256	-6074	-7909	-6563	-3509	-313	2182	3747
65°	-4958	-6081	-5174	-2819	502	4312	7398	7945	5010	-201	-4941	-6989	-6101	-3586	-872	1311	2735
70°	-5678	-6827	-5702	-2981	673	4665	7831	8503	5811	855	-3815	-6102	-5710	-3769	-1529	369	1683
75°	-6315	-7522	-6190	-3101	901	5078	8297	9052	6577	1880	-2708	-5234	-5356	-4009	-2246	-620	605
80°	-6917	-8146	-6625	-3184	1159	5507	8743	9511	7266	2848	-1619	-4361	-4999	-4260	-2984	-1627	-485
85°	-7470	-8678	-6990	-3231	1421	5902	9112	9918	7843	3743	-548	-3464	-4603	-4479	-3701	-2624	-1572
90°	-7906	-9102	-7267	-3239	1659	6216	9354	10116	8285	4553	503	-2534	-4147	-4631	-4361	-3584	-2610
95°	-8247	-9399	-7436	-3205	1854	6411	9432	10202	8584	5273	1525	-1579	-3623	-4695	-4936	-4482	-3676
100°	-8485	-9555	-7481	-3121	1998	6467	9330	10087	8747	5899	2494	-628	-3052	-4667	-5407	-5298	-4665
105°	-8618	-9562	-7389	-2977	2088	6379	9052	9815	8788	6425	3384	283	-2457	-4552	-5763	-6017	-5598
110°	-8644	-9415	-7152	-2766	2132	6158	8620	9116	8726	6846	4161	1109	-1872	-4366	-6003	-6628	-6463
115°	-8567	-9116	-6768	-2484	2140	5825	8064	8919	8577	7155	4798	1815	-1332	-4128	-6132	-7129	-7251
120°	-8391	-8674	-6247	-2133	2122	5405	7419	8355	8356	7348	5279	2378	-858	-3859	-6161	-7518	-7964
125°	-8125	-8103	-5601	-1721	2087	4923	6715	7716	8071	7425	5601	2792	-464	-3575	-6103	-7801	-8589
130°	-7778	-7424	-4864	-1264	2039	4402	5979	7108	7727	7390	5775	3069	-149	-3287	-5973	-7984	-9129
135°	-7363	-6662	-4057	-784	1974	3856	5229	6453	7332	7257	5824	3231	97	-3004	-5786	-8079	-9583
140°	-6894	-5845	-3217	-305	1889	3296	4477	5788	6894	7017	5781	3309	289	-2730	-5557	-8096	-9952
145°	-6387	-5004	-2379	148	1774	2727	3734	5123	6428	6786	5679	3333	410	-2467	-5298	-8046	-10238
150°	-5857	-4169	-1577	551	1626	2151	3005	4465	5951	6501	5550	3329	565	-2217	-5022	-7913	-10416
155°	-5320	-3368	-841	888	1441	1583	2298	3827	5483	6216	5417	3314	671	-1980	-4737	-7796	-10578
160°	-4789	-2626	-193	1148	1224	1024	1623	3221	5039	5951	5293	3295	763	-1759	-4451	-7616	-10639
165°	-4279	-1966	319	1330	986	492	995	2658	4630	5710	5180	3273	843	-1552	-4171	-7412	-10632
170°	-3801	-1402	775	1438	745	9	430	2150	4261	5489	5068	3240	909	-1359	-3899	-7190	-10562
175°	-3363	-948	1082	1483	521	-402	-52	1709	3928	5272	4939	3186	961	-1179	-3640	-6956	-10430
180°	-2974	-610	1270	1477	336	-716	-428	1342	3622	5039	4770	3099	996	-1011	-3391	-6714	-10241
185°	-2636	-389	1346	1432	207	-914	-682	1058	3335	4768	4541	2967	1012	-857	-3164	-6467	-9996
190°	-2351	-281	1317	1361	145	-983	-803	860	3060	4443	4239	2784	1005	-718	-2953	-6216	-9697
195°	-2124	-287	1192	1269	154	-922	-787	750	2794	4061	3859	2547	970	-602	-2765	-5961	-9345
200°	-1956	-390	982	1159	226	-741	-644	725	2540	3631	3412	2257	901	-517	-2601	-5700	-8939
205°	-1813	-580	695	1030	348	-461	-391	776	2306	3170	2915	1921	791	-472	-2464	-5430	-8481
210°	-1718	-844	344	879	503	-106	-52	894	2099	2702	2391	1547	633	-477	-2354	-5147	-7969
215°	-1655	-1164	-61	702	672	295	347	1064	1927	2251	1864	1144	421	-535	-2268	-4844	-7405
220°	-1612	-1523	-509	497	836	717	779	1269	1791	1833	1350	716	153	-646	-2199	-4514	-6786
225°	-1581	-1901	-986	260	980	1134	1221	1496	1688	1454	858	269	-167	-805	-2135	-4148	-6116
230°	-1552	-2288	-1480	-9	1089	1528	1654	1728	1610	1111	385	-197	-533	-996	-2062	-3739	-5393
235°	-1513	-2657	-1971	-308	1151	1879	2058	1951	1545	793	-74	-679	-933	-1200	-1961	-3278	-4621
240°	-1456	-2991	-2455	-635	1154	2165	2414	2152	1481	487	-530	-1178	-1350	-1395	-1818	-2762	-3804
245°	-1373	-3276	-2906	-985	1087	2367	2703	2316	1407	181	-992	-1687	-1766	-1560	-1617	-2186	-2945
250°	-1255	-3495	-3310	-1349	941	2462	2901	2428	1314	-131	-1461	-2200	-2164	-1676	-1351	-1555	-2052
255°	-1098	-3635	-3619	-1715	716	2435	2987	2473	1196	-451	-1937	-2709	-2531	-1733	-1019	-873	-1131
260°	-899	-3685	-3908	-2067	419	2278	2915	2437	1047	-777	-2413	-3206	-2861	-1732	-629	-151	-191
265°	-651	-3640	-4072	-2382	67	1998	2769	2309	859	-1110	-2882	-3686	-3155	-1684	-197	594	757
270°	-366	-3495	-4126	-2637	-311	1615	2466	2084	627	-1449	-3343	-4148	-3424	-1608	253	1315	1703
275°	-36	-3252	-4063	-2806	-675	1167	2058	1766	342	-1802	-3796	-4598	-3683	-1531	693	2081	2636
280°	331	-2916	-3880	-2868	-987	702	1579	1365	-1	-2179	-4250	-5044	-3952	-1485	1092	2781	3515
285°	728	-2497	-3580	-2809	-1206	272	1076	901	-405	-2591	-4715	-5499	-4253	-1497	1422	3425	4420
290°	1116	-2008	-3174	-2623	-1305	-74	598	412	-864	-3051	-5206	-5979	-4603	-1591	1660	3996	5252
295°	1577	-1468	-2681	-2316	-1265	-296	195	-72	-1367	-3564	-5737	-6494	-5011	-1782	1788	4383	6032
300°	2009	-891	-2123	-1908	-1087	-367	-93	-510	-1892	-4133	-6319	-7055	-5493	-2077	1809	4877	6753
305°	2432	-310	-1530	-1423	-783	-280	-231	-862	-2413	-4750	-6958	-7668	-6038	-2469	1699	5178	7411
310°	2832	264	-930	-895	-379	-38	-203	-1094	-2899	-5401	-7653	-8331	-6641	-2916	1497	5388	8003
315°	3200	807	-352	-357	93	337	-6	-1186	-3322	-6065	-8395	-9039	-7288	-3487	1211	5518	8526
320°	3525	1300	177	158	597	817	316	-1128	-3657	-6716	-9161	-9776	-7960	-4067	866	5579	8980
325°	3795	1728	637	621	1098	1361	825	-926	-3885	-7323	-9934	-10524	-8639	-4658	490	5587	9366
330°	4004	2078	1012	1012	1565	1931	1389	-601	-3998	-7855	-10672	-11258	-9300	-5233	110	5559	9684
335°	4112	2339	1292	1317	1971	2383	1994	-183	-3990	-8281	-11340	-11950	-9924	-5768	-248	5511	9938
340°	4205	2506	1472	1527	2297	2983	2595	298	-3866	-8577	-11908	-12577	-10193	-6241	-560	5457	10128
345°	4188	2577	1552	1640	2531	3104	3155	810	-3632	-8729	-12351	-13119	-10089	-6636	-808	5409	10255
350°	4089	2550	1535	1658	2667	3731	3653	1333	-3302	-8734	-12659	-13561	-11401	-6936	-976	5376	10321
355°	3905	2427	1427	1587	2708	3961	4081	1852	-2890	-8604	-12835	-13901	-11719	-7132	-1058	5361	10325

Table 6-b. Non-dipole field, east component for 1965, in the unit of γ (Leaton et al.'s analysis.)

lat. / E long.	80°	70°	60°	50°	40°	30°	20°	10°	0°	10°	20°	30°	40°	50°	60°	70°	80°S
0°	3879	3618	3452	3351	3188	2812	2121	1144	83	-741	-1070	-905	-537	-349	-541	-1026	-1560
5°	4564	4466	4346	4257	4122	3789	3132	2158	1058	153	-296	-287	-130	-237	-815	-1704	-2529
10°	5210	5267	5178	5084	4955	4637	3986	3008	1897	961	437	296	214	-218	-1175	-2427	-3497
15°	5807	6010	5942	5825	5681	5356	4698	3719	2623	1695	1115	808	449	-331	-1647	-3204	-4460
20°	6343	6685	6629	6475	6296	5950	5286	4325	3268	2361	1712	1201	523	-616	-2250	-4039	-5414
25°	6810	7283	7235	7029	6796	6423	5765	4844	3841	2941	2183	1416	385	-1102	-2996	-4929	-6349
30°	7199	7795	7753	7484	7179	6771	6133	5270	4317	3388	2462	1389	-8	-1807	-3882	-5865	-7259
35°	7502	8211	8178	7836	7410	6984	6367	5565	4639	3628	2475	1064	-682	-2729	-4893	-6833	-8132
40°	7713	8522	8502	8083	7574	7048	6434	5670	4733	3587	2464	413	-1634	-3845	-6001	-7811	-8957
45°	7827	8721	8719	8221	7581	6951	6302	5534	4539	3218	1511	-549	-2824	-5104	-7162	-8772	-9722
50°	7838	8797	8819	8247	7462	6690	5956	5134	4041	2527	557	-1754	-4173	-6435	-8322	-9685	-10416
55°	7745	8744	8792	8158	7222	6279	5414	4495	3283	1591	-593	-3082	-5566	-7745	-9422	-10519	-11021
60°	7547	8554	8627	7947	6871	5747	4725	3691	2372	548	-1782	-4378	-6873	-8939	-10399	-11242	-11537
65°	7245	8221	8313	7607	6419	5133	3966	2837	1457	-430	-2833	-5481	-7962	-9922	-11197	-11821	-11944
70°	6842	7742	7839	7129	5874	4478	3218	2055	689	-1178	-3586	-6252	-8727	-10621	-11770	-12213	-12237
75°	6345	7119	7198	6502	5240	3816	2553	1417	187	-1580	-3938	-6608	-9100	-10986	-12084	-12483	-12410
80°	5759	6356	6386	5719	4511	3162	2008	1067	3	-1595	-3863	-6529	-9068	-11003	-12129	-12533	-12459
85°	5097	5464	5405	4773	3687	2511	1583	906	111	-1271	-3420	-6070	-8663	-10687	-11906	-12394	-12383
90°	4369	4457	4269	3668	2751	1843	1239	902	118	-723	-2728	-5332	-7962	-10082	-11439	-12074	-12184
95°	3589	3358	2998	2416	1702	1130	916	957	792	-101	-1940	-4447	-7060	-9252	-10760	-11587	-11868
100°	2774	2192	1624	1043	548	346	551	967	1099	438	-1199	-3540	-6056	-8265	-9911	-10952	-11439
105°	1910	991	188	-110	-689	-517	95	853	1241	796	-610	-2709	-5038	-7189	-8939	-10195	-10908
110°	1105	-210	-1259	-1889	-1967	-1445	-168	576	1170	925	-220	-2009	-4064	-6084	-7889	-9342	-10285
115°	285	-1375	-2662	-3329	-3229	-2400	-1117	117	901	844	-18	-1449	-3171	-4996	-6803	-8420	-9579
120°	-503	-2469	-3967	-4664	-4407	-3322	-1804	-379	498	619	48	-1006	-2367	-3957	-5716	-7453	-8805
125°	-1213	-3457	-5121	-5827	-5431	-4144	-2457	-925	51	342	53	-641	-1619	-2988	-4638	-6166	-7973
130°	-1921	-4312	-6078	-6760	-6237	-4798	-3001	-1403	-349	100	65	-313	-1005	-2099	-3651	-5478	-7096
135°	-2526	-5009	-6801	-7423	-6779	-5230	-3372	-1713	-626	-12	132	8	-426	-1298	-2709	-4507	-6184
140°	-3050	-5533	-7277	-7791	-7031	-5408	-3531	-1898	-739	-51	275	332	95	-584	-1842	-3564	-5248
145°	-3486	-5877	-7492	-7862	-6993	-5329	-3467	-1853	-681	68	488	658	560	41	-1054	-2659	-4296
150°	-3833	-6010	-7456	-7654	-6688	-5017	-3201	-1637	-478	287	744	973	970	592	-342	-1797	-3338
155°	-4091	-6031	-7188	-7201	-6163	-4521	-2784	-1291	-183	559	1011	1263	1327	1069	298	-980	-2379
160°	-4263	-5864	-6721	-6550	-5473	-3906	-2283	-896	141	831	1257	1519	1637	1485	873	-207	-1424
165°	-4356	-5560	-6090	-5752	-4686	-3212	-1774	-517	425	1055	1457	1735	1908	1851	1391	523	-480
170°	-4378	-5143	-5336	-4860	-3856	-2592	-1323	-226	611	1191	1591	1913	2148	2178	1863	1216	452
175°	-4310	-4641	-4502	-3922	-3033	-2003	-979	-69	661	1216	1661	2053	2363	2474	2297	1876	1368
180°	-4253	-4082	-3626	-2978	-2248	-1499	-760	-62	565	1126	1657	2158	2554	2743	2701	2510	2266
185°	-4130	-3493	-2744	-2060	-1521	-1082	-655	-187	341	937	1590	2226	2719	2988	3082	3123	3115
190°	-3981	-2906	-1889	-1190	-853	-735	-631	-399	33	678	1472	2254	2850	3207	3446	3721	4001
195°	-3826	-2310	-1087	-386	-217	-430	-637	-637	-300	392	1318	2241	2942	3402	3801	4310	4834
200°	-3670	-1821	-362	340	309	-142	-626	-838	-597	121	1149	2187	2994	3576	4155	4896	5642
205°	-3524	-1368	266	977	814	150	-563	-957	-812	-99	984	2102	3012	3739	4518	5482	6420
210°	-3398	-997	782	1514	1265	449	-434	-972	-918	-243	843	2001	3013	3908	4900	6072	7167
215°	-3300	-719	1173	1940	1651	749	-245	-885	-913	-302	744	1919	3027	4105	5314	6667	7877
220°	-3233	-544	1430	2247	1970	1033	-15	-717	-811	-275	707	1879	3087	4354	5767	7264	8516
225°	-3202	-475	1545	2424	2200	1286	232	-493	-633	-167	749	1919	3229	4676	6264	7860	9168
230°	-3206	-515	1518	2467	2331	1491	481	-231	-396	19	888	2068	3480	5086	6805	8445	9736
235°	-3244	-658	1349	2371	2367	1650	721	52	-106	284	1133	2345	3855	5584	7378	9008	10243
240°	-3312	-897	1043	2136	2294	1752	961	368	238	629	1488	2749	4345	6154	7964	9533	10682
245°	-3404	-1222	610	1764	2109	1793	1191	714	635	1048	1937	3257	4922	6763	8534	10001	11046
250°	-3513	-1618	64	1259	1805	1760	1399	1077	1072	1519	2447	3822	5531	7363	9052	10393	11326
255°	-3629	-2065	-578	628	1372	1625	1550	1424	1513	1998	2961	4377	6104	7893	9477	10688	11518
260°	-3741	-2545	-1290	-116	801	1355	1591	1692	1896	2424	3408	4814	6563	8292	9771	10869	11616
265°	-3845	-3032	-2046	-953	87	913	1460	1806	2141	2719	3712	5144	6836	8504	9899	10920	11616
270°	-3923	-3504	-2813	-1854	-760	277	1102	1690	2177	2808	3803	5211	6867	8487	9836	10832	11516
275°	-3966	-3935	-3555	-2781	-1713	-554	485	1291	1933	2633	3631	5006	6621	8217	9572	10601	11317
280°	-3965	-4302	-4233	-3681	-2726	-1547	-384	592	1383	2467	3476	4518	6097	7696	9110	10231	11019
285°	-3910	-4583	-4809	-4511	-3733	-2638	-1454	-377	541	2119	2455	3770	5323	6950	8468	9733	10628
290°	-3794	-4758	-5249	-5201	-4657	-3737	-2637	-1542	-538	434	1513	2816	4352	6025	7677	9121	10148
295°	-3612	-4814	-5525	-5714	-5420	-4743	-3823	-2802	-1765	-715	421	1728	3256	4981	6780	8419	9587
300°	-3359	-4740	-5616	-6002	-5956	-5561	-4897	-4037	-3037	-1934	-737	589	2116	3887	5823	7648	8953
305°	-3033	-4532	-5513	-6043	-6218	-6114	-5756	-5133	-4240	-3126	-1872	-515	1011	2812	4854	6836	8255
310°	-2636	-4191	-5217	-5834	-6181	-6353	-6324	-5993	-5272	-4192	-2898	-1510	13	1816	3918	6005	7501
315°	-2170	-3725	-4739	-5387	-5859	-6263	-6553	-6540	-6041	-5046	-3714	-2334	-826	949	3052	5178	6701
320°	-1640	-3143	-4100	-4730	-5270	-5857	-6127	-6727	-6480	-5619	-4350	-2944	-1468	242	2284	4371	5862
325°	-1051	-2460	-3326	-3902	-4463	-5170	-5960	-6536	-6547	-5864	-4682	-3317	-1898	-287	1630	3597	4993
330°	-413	-1695	-2418	-2947	-3488	-4252	-5186	-5978	-6234	-5765	-4727	-3452	-2118	-639	1094	2862	4099
335°	266	-861	-1496	-1908	-2399	-3162	-4160	-5096	-5568	-5338	-4501	-3364	-2246	-826	670	2166	3185
340°	974	13	-500	-825	-1249	-1962	-2951	-3962	-4615	-4636	-4042	-3086	-2008	-873	342	1505	2256
345°	1701	916	514	268	-81	-712	-1610	-2671	-3469	-3738	-3409	-2658	-1741	-811	87	869	1315
350°	2436	1829	1522	1342	1067	531	-111	-1328	-2239	-2735	-2664	-2124	-1381	-677	-124	245	364
355°	3165	2734	2507	2375	2164	1718	963	-31	-1029	-1715	-1869	-1528	-967	-509	-322	-382	-595

Table 6-c. Non-dipole field, vertical component for 1965, in the unit of γ (Leaton et al.'s analysis).

lat. / E long.	80°N	70°	60°	50°	40°	30°	20°	10°	0°	10°	20°	30°	40°	50°	60°	70°	80°S
0°	-6853	-7779	-7136	-6076	-5895	-7450	-10760	-14523	-16268	-13821	-7069	1871	10260	16233	18799	17299	11823
5°	-6648	-7105	-6611	-5384	-5031	-6480	-9849	-13885	-16040	-13941	-7286	1812	10417	16459	18921	17286	11768
10°	-6401	-6944	-5973	-4563	-4017	-5335	-8743	-13044	-15606	-13852	-7298	1935	10711	16749	19027	17206	11658
15°	-6116	-6400	-5229	-3627	-2870	-4051	-7500	-12065	-15014	-13572	-7101	2245	11125	17073	19090	17019	11493
20°	-5795	-5777	-4386	-2588	-1623	-2659	-6152	-10976	-14278	-13094	-6683	2734	11625	17384	19077	16803	11270
25°	-5441	-5082	-3452	-1457	-290	-1180	-4715	-9775	-13377	-12397	-6013	3372	12158	17629	18953	16456	10991
30°	-5058	-4318	-2430	-242	1118	367	-3192	-8444	-12285	-11472	-5206	4101	12617	17740	18680	15995	10656
35°	-4650	-3494	-1327	1045	2579	1962	-1590	-6974	-10996	-10342	-4239	4822	12997	17647	18219	15412	10265
40°	-4222	-2616	-150	2398	4076	3579	65	-5388	-9551	-9088	-3258	5408	13098	17279	17539	14698	9821
45°	-3779	-1693	1096	3807	5587	5184	1724	-3755	-8047	-7840	-2417	5716	12845	16576	16616	13852	9325
50°	-3327	-735	2400	5262	7094	6732	3313	-2182	-6625	-6763	-1878	5612	12152	15496	15439	12873	8781
55°	-2871	246	3750	6754	8578	8181	4751	-790	-5432	-6009	-1775	5003	10969	14025	14011	11770	8194
60°	-2419	1215	5130	8267	10021	9492	5965	316	-4588	-5684	-2178	3859	9298	12182	12350	10555	7568
65°	-1975	2216	6519	9785	11406	10611	6911	1078	-4142	-5808	-3068	2227	7197	10015	10191	9215	6911
70°	-1548	3171	7891	11283	12721	11621	7587	1505	-4058	-6102	-4335	228	4773	7605	8189	7862	6229
75°	-1144	4080	9213	12728	13947	12410	8032	1671	-4218	-7009	-5796	-1962	2170	5019	6375	6431	5530
80°	-768	4923	10449	14080	15063	13116	8311	1695	-4454	-7726	-7241	-4147	-455	2458	4237	4980	4821
85°	-427	5678	11557	15291	16040	13666	8502	1710	-4594	-8259	-8471	-6149	-2954	-64	2129	3535	4110
90°	-125	6325	12497	16307	16838	14093	8666	1823	-4505	-8468	-9319	-7832	-5209	-2125	107	2123	3405
95°	132	6846	13228	17072	17410	14388	8836	2094	-4125	-8299	-9817	-9129	-7143	-4555	-1780	769	2713
100°	341	7225	13714	17532	17701	14519	9003	2519	-3475	-7788	-9905	-10039	-8721	-6107	-3193	-508	2042
105°	500	7452	13927	17643	17672	14444	9127	3039	-2641	-7012	-9706	-10612	-9919	-7960	-5007	-1689	1399
110°	608	7520	13850	17378	17276	14117	9145	3559	-1763	-6206	-9315	-10928	-10860	-9211	-6308	-2762	788
115°	664	7430	13481	16726	16498	13504	8993	3977	-962	-5419	-8943	-11074	-11499	-10176	-7391	-3721	214
120°	670	7188	12831	15700	15344	12590	8623	4211	-345	-4784	-8589	-11116	-11911	-10877	-8262	-4560	-317
125°	629	6804	11925	14339	13851	11390	8017	4218	36	-4350	-8325	-11099	-12138	-11344	-8935	-5280	-804
130°	544	6298	10801	12700	12080	9950	7193	3998	184	-4106	-8149	-11035	-12209	-11608	-9426	-5881	-1214
135°	420	5689	9510	10859	10117	8342	6205	3595	147	-4002	-8023	-10922	-12150	-11702	-9756	-6379	-1635
140°	263	5001	8106	8902	8060	6657	5130	3085	-4	-3963	-7899	-10749	-11979	-11654	-9948	-6771	-1977
145°	78	4269	6651	6918	6011	4995	4061	2557	-156	-3913	-7731	-10505	-11717	-11495	-10021	-7070	-2269
150°	-129	3512	5202	4992	4066	3448	3085	2097	-253	-3793	-7489	-10190	-11382	-11252	-10005	-7281	-2511
155°	-351	2759	3814	3198	2304	2090	2275	1775	-229	-3566	-7162	-9812	-10993	-10945	-9910	-7422	-2704
160°	-582	2035	2534	1597	782	971	1672	1628	-59	-3221	-6755	-9384	-10565	-10591	-9754	-7492	-2849
165°	-817	1361	1399	231	-468	107	1281	1656	219	-2785	-6288	-8919	-10110	-10210	-9551	-7501	-2945
170°	-1050	754	438	-877	-1438	-514	1083	1822	653	-2285	-5784	-8428	-9629	-9799	-9308	-7455	-2994
175°	-1277	228	-332	-1716	-2138	-927	1013	2056	1085	-1777	-5269	-7913	-9122	-9365	-9033	-7358	-2997
180°	-1496	-210	-904	-2290	-2593	-1178	1005	2277	1166	-1316	-4767	-7377	-8584	-8906	-8729	-7212	-2954
185°	-1703	-555	-1278	-2612	-2830	-1316	991	2401	1717	-956	-4300	-6821	-8012	-8424	-8398	-7020	-2866
190°	-1898	-808	-1462	-2699	-2878	-1377	921	2371	1783	-735	-3887	-6252	-7411	-7922	-8041	-6781	-2732
195°	-2080	-973	-1470	-2574	-2760	-1385	773	2159	1637	-673	-3542	-5682	-6791	-7404	-7658	-6494	-2554
200°	-2249	-1059	-1320	-2258	-2491	-1341	553	1778	1292	-769	-3276	-5131	-6171	-6880	-7247	-6155	-2331
205°	-2408	-1075	-1034	-1777	-2085	-1237	294	1273	790	-999	-3094	-4631	-5576	-6357	-6805	-5762	-2064
210°	-2557	-1036	-637	-1156	-1551	-1058	37	706	190	-1328	-2999	-4198	-5026	-5880	-6325	-5310	-1753
215°	-2700	-955	-157	-422	-903	-792	-177	138	-445	-1718	-2985	-3851	-4535	-5325	-5796	-4792	-1398
220°	-2840	-850	378	394	-160	-436	-321	-385	-1063	-2133	-3011	-3591	-4099	-4802	-5205	-4204	-1001
225°	-2979	-737	937	1258	655	1	-385	-837	-1693	-2544	-3148	-3404	-3699	-4245	-4531	-3538	-562
230°	-3122	-633	1489	2137	1515	507	-371	-1207	-2135	-2929	-3276	-3252	-3294	-3620	-3763	-2791	-83
235°	-3270	-553	2005	2995	2391	1065	-281	-1492	-2559	-3264	-3385	-3081	-2829	-2888	-2874	-1959	433
240°	-3428	-513	2455	3797	3255	1661	-115	-1683	-2889	-3518	-3424	-2826	-2212	-2006	-1849	-1040	985
245°	-3597	-527	2812	4509	4081	2290	140	-1756	-3096	-3652	-3336	-2418	-1474	-940	-679	-38	1568
250°	-3779	-604	3052	5097	4839	2944	503	-1674	-3138	-3621	-3069	-1804	-482	330	638	1012	2179
255°	-3976	-755	3154	5529	5499	3611	990	-1405	-2975	-3386	-2584	-948	755	1807	2092	2190	2811
260°	-4186	-983	3102	5776	6025	4264	1596	-930	-2582	-2924	-1870	147	2223	3469	3662	3392	3461
265°	-4411	-1291	2885	5830	6373	4856	2285	-269	-1967	-2216	-918	1448	3877	5272	5315	4631	4122
270°	-4649	-1678	2499	5611	6497	5319	2981	513	-1182	-1399	126	2883	5643	7152	7010	5887	4788
275°	-4897	-2137	1948	5166	6352	5571	3581	1309	-320	-466	1266	4359	7428	9034	8698	7138	5451
280°	-5153	-2660	1244	4475	5906	5533	3964	1984	493	443	2367	5769	9128	10835	10332	8363	6107
285°	-5413	-3236	408	3555	5147	5144	4020	2400	1120	1208	3325	7011	10649	12482	11863	9541	6748
290°	-5673	-3848	-533	2438	4089	4377	3668	2440	1437	1719	4012	7998	11912	13910	13252	10653	7368
295°	-5928	-4480	-1544	1172	2778	3246	2875	2026	1348	1885	4447	8671	12864	15076	14471	11684	7962
300°	-6174	-5115	-2585	-182	1283	1808	1663	1135	797	1649	4498	9002	13483	15959	15500	12621	8521
305°	-6405	-5733	-3617	-1556	-305	156	97	-209	-224	990	4182	8994	13776	16562	16338	13464	9051
310°	-6617	-6317	-4599	-2882	-1890	-1598	-1717	-1933	-1682	-77	3520	8677	13778	16908	16990	14205	9539
315°	-6804	-6850	-5497	-4098	-3379	-3336	-3658	-3933	-3502	-1501	2555	8104	13541	17036	17475	14846	9984
320°	-6963	-7317	-6279	-5153	-4693	-4951	-5598	-6083	-5578	-3202	1356	7341	13130	16996	17820	15394	10385
325°	-7090	-7706	-6925	-6009	-5774	-6354	-7416	-8242	-7777	-5072	5	6459	12612	16843	18054	15856	10739
330°	-7181	-8008	-7418	-6648	-6587	-7480	-9005	-10268	-9950	-6984	-1404	5532	12052	16631	18209	16240	11045
335°	-7233	-8216	-7752	-7060	-7116	-8287	-10278	-12031	-11948	-8811	-2780	4626	11508	16409	18315	16555	11302
340°	-7243	-8326	-7926	-7250	-7364	-8757	-11173	-13421	-13639	-10436	-4041	3795	11026	16218	18399	16809	11509
345°	-7211	-8337	-7944	-7230	-7344	-8887	-11657	-14366	-14932	-11773	-5125	3082	10641	16089	18479	17009	11666
350°	-7136	-8248	-7812	-7016	-7076	-8693	-11726	-14841	-15784	-12778	-5996	2514	10376	16043	18571	17157	11771
355°	-7016	-8061	-7540	-6625	-6585	-8201	-11409	-14872	-16210	-13449	-6642	2107	10247	16091	18678	17255	11823