

TIME-LATITUDE DISTRIBUTION OF GREEN CORONA BRIGHTNESS DURING SOLAR CYCLES 18, 19 AND 20

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ABSTRACT. Tables giving the time-latitude distribution of the green emission corona (Fe XIV 530.3 nm) brightness are presented. For each of the 402 Bartels rotations in the period of 1947-1976 the averaged coronal intensities were calculated for each 5° of solar latitude. The coronal activities in the northern and southern hemispheres are separated. Previous results obtained from the original data are shortly summarized.

ВРЕМЕННО-ШИРОТНОЕ РАСПРЕДЕЛЕНИЕ ЗЕЛЕННОЙ ЭМИССИОННОЙ КОРОНЫ ДЛЯ СОЛНЕЧНЫХ ЦИКЛОВ 18, 19 И 20. Приводятся таблицы временно-широтного распределения яркости зеленой эмиссионной короны. Для каждого из 402 бартелсовских оборотов за период 1947-1976 вычислены усредненные интенсивности для каждой 5° гелиографической широты. То-же самое сделано для периодов охватывающих шесть бартелсовских оборотов. Корональная активность в северном и южном полушариях выражена отдельно. Перечислены результаты полученные на базе оригинальных данных.

ČASOVO-ŠÍRKOVÉ ROZDELENIE JASNOSTI ZELENEJ EMISNEJ KORÓNY POČAS 18., 19. A 20. SLNEČNÉHO CYKLU. Publikujeme tabuľky časovo-šírkového rozdelenia jasnosti zelenej emisnej koróny. Pre každú zo 402 bartelsovských rotácií za obdobie 1947-1976 sú vypočítané priemerne intenzity koróny pre každých 5° heliografickej šírky. To isté sme urobili pre obdobia zahrňujúce šesť bartelsovských rotácií. Koronálna aktivita na severnej a južnej pologuli Slnka je vyjadrená oddelene. Krátko sumarizujeme naše predošlé výsledky, získané z pôvodných pozorovacích údajov.

Inspired by our own observations of the intensity of the green emission corona (Fe XIV 503.3nm) made at the Mt. Lomnický Štít Observatory since 1965 and dissatisfied by relatively large gaps in the series of these observations owing to unfavourable weather, we attempted to use all the observations of the green emission corona as they were successively published during the years 1947-1976 in the Quarterly Bulletin on Solar Activity by a net of some 6-9 coronal stations.

To be able to do this, it was first necessary to homogenize the data of different stations, because there are substantial differences in the methods of observation (visual, photographic with a radial slit, photographic with a circular slit, photoelectric) and also the height above the sun's limb at which the observations are made at the different stations is not the same - it usually changes from 40 to 60 seconds of arc. Some remarks on the summary use of existing green emission corona observations were published by Sýkora (1970). It was found that, above all, systematic errors in position of the zero point and the non-linearity of the position angle scales, the instability of photometric scales and also the differences in the threshold of measurements at different stations should be avoided when the data of different coronal observatories are used together. This procedure was carried out.

Since the longest and the most homogeneous set of observations was available from Pic du Midi, we have chosen this station as the reference and all the data were reduced to its photometric and position angle scales. This also means that the final data refer to the height of one minute of arc above the sun's limb and, at the same time, the reduced intensities are expressed in millionths of the energy radiated from the centre of the sun's disk in a 0.1 nm strip of the spectrum near the emission coronal line (the so-called absolute coronal unit).

In reducing the data, we restricted ourselves to $\pm 60^\circ$ of heliographic latitude. This means that we omitted the polar data which are connected with solar activity only little, including their variation during solar cycles. Thus, any conclusions based on our reduced data relate to the "active corona" which, of course, does not exclude the possibility of studying the behaviour of very quiet regions within the limits of $\pm 60^\circ$ of latitude, as well. The relation of the final data to the activity is a little more forced by a fact shown in Figure 8 (Sýkora, 1970), i.e. the Pic du Midi photometric scale is "more sensitive" to activity than the scales of the other stations.

The reduction procedure was described in more detail in (Sýkora, 1975). Originally, the reduced intensities for the east and west limbs of the sun for each day were obtained in steps of 5° of latitude. These extensive original data have never been published, but they were the source for a good number of papers. In the abovementioned paper (Sýkora, 1975), for example, special synoptic tables for Bartels rotations Nos. 1556-1872 (years 1947-1970) are presented. A certain coronal index was calculated for rectangles 40° (three days) in longitude and 20° in latitude. On the whole, 54 such values are given for each rotation. These data were used to study some large-scale and long-termed characteristics of the corona including the rotational properties of the large-scale solar corona (Sýkora, 1971a; Antonucci, 1974; Antonucci and Svalgaard, 1974, 1976; Antonucci and Doderro, 1977). As the main results, "active longitudes" and small differential rotation of the corona have been indicated.

Several papers, based on our original data, were related to the study of some coronal responses to the large-scale and long-termed phenomena in the lower layers of the

sun's atmosphere, especially those of the photospheric magnetic fields (Sýkora, 1969, 1971b, 1979; Ambrož et al., 1971; Bumba and Sýkora, 1972a, 1972b, 1973, 1974, 1976; Bumba et al., 1972, 1973).

Lately, some interesting results on the longitudinal and latitudinal distribution of the green emission corona brightness through the solar cycles have been graphically presented. The N-S asymmetry and the existence and reality of two maxima of activity during the 11-year solar cycles was also discussed (Sýkora, 1980).

We have also found it possible to use our data to construct synoptic charts for the identification or morphological studies of coronal holes or of features which are sufficiently related to them on one hand and of active coronal phenomena on the other hand (Letfus et al., 1980). Atlas of the green corona synoptic charts for period 1947-1976 have lately been published (Letfus and Sýkora, 1982). It contains 402 charts covering Bartels rotations Nos. 1556-1957.

We thought it necessary to enumerate our abovementioned results which were obtained by using the data, a modified form of which we present in this paper expecting them to be still useful and helpful to those working on various large-scale, long-termed and statistical analyses of the different solar activity phenomena and of the solar cycles.

Nevertheless, the observational data on green emission corona have been published in the Quarterly Bulletin on Solar Activity some years before 1947, we decided to begin our reduction of the data with this year because the number of days without any observation was already fairly low after this date. In the 1970's the observational coverage of the days became somewhat similar to that in the 1940's, because the most productive observatories (Sacramento Peak, Climax, Pic du Midi) interrupted publication of their data and in some cases even stopped routine observations of the monochromatic corona completely.

The data presented here are arranged into blocks of six Bartels rotations. In the first column, the heliographic latitude is given. The data in the next six columns represent rather highly averaged and modified original data for six Bartels rotations, the number of which are given in the heading together with the first day of the first rotation and the last day of the sixth rotation.

The averaging and modifying of the original data consisted firstly in reducing the data of all corona stations (observations of Pic du Midi, Kislovodsk, Lomnický Štít, Climax, Sacramento Peak, Norikura, Wendelstein, Arosa and Alma Ata were used in turn) to the photometric scale of Pic du Midi, as described in more detail in (Sýkora, 1970, 1975). This procedure yielded the data separated for the east and west limbs. Secondly, we calculated the coronal intensities for the central meridian as an average of the values when the proper meridian passed the east limb and, 14 days later, the west limb. After this the data for the missing days were interpolated (about 3% of the data) so that there would be one value for each day and each 5° of latitude. Such data were then the source for drawing the abovementioned atlas of the green coronal emission (Letfus and Sýkora, 1982).

The daily data were further averaged for 27 days and as a result we have one value for each 5° of latitude in each Bartels rotation. We present these data in this paper. In the last column of our tables the data are further averaged for the six rotations as a whole. The last three lines give the average values for the northern ($+60^\circ$ to 0° , inclusive) and southern (0° to -60° , inclusive) hemispheres and also the total value (T) for the sun within the limits of $\pm 60^\circ$ of its latitude.

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Latitude	Rotation No.					Latitude	Rotation No.					Average 1562-1567		
	1556 Jan. 21, 1947	1557 1947 - July 1,	1558 1947 - July 1,	1559 1947 - July 1,	1560 1947 - July 1,		1561 1947 - July 1,	1562 July 2,	1563 July 2,	1564 1947 - Dec. 10,	1565 1947 - Dec. 10,		1566 1947 - Dec. 10,	1567 1947 - Dec. 10,
+60	41	34	26	43	29	24	33	20	25	38	38	28	26	29
55	46	38	27	52	30	28	37	24	32	50	50	41	29	38
50	52	38	34	54	31	30	40	27	43	71	63	46	31	47
45	58	50	36	71	35	34	47	34	62	82	78	65	31	59
40	63	75	47	61	45	41	55	51	76	87	68	71	38	65
35	76	94	47	51	53	65	64	69	89	97	66	64	56	74
30	89	110	40	33	51	87	68	83	105	90	55	55	64	75
25	100	102	36	35	52	108	72	95	111	90	47	52	70	78
20	100	85	37	52	59	118	75	102	112	86	48	56	70	79
15	93	81	37	88	89	110	83	93	106	98	63	71	76	85
10	81	76	43	116	93	94	84	81	93	121	91	101	95	97
+5	68	74	53	102	89	73	77	74	87	135	106	110	112	104
0	58	78	79	101	89	64	78	60	74	133	127	143	132	112
-5	66	81	90	75	95	67	79	69	75	124	111	128	130	106
10	86	96	81	61	104	89	86	78	84	110	102	122	109	101
15	102	107	69	57	106	96	90	91	95	86	83	106	99	93
20	105	103	49	49	101	85	82	93	90	85	60	84	92	84
25	104	103	46	40	100	79	79	87	85	87	61	79	104	84
30	98	102	60	40	101	70	79	76	73	97	69	84	117	86
35	87	87	67	43	78	53	69	67	64	91	84	103	110	87
40	67	71	79	45	59	41	60	52	58	84	87	102	83	78
45	56	61	62	50	47	37	52	35	44	71	79	85	87	67
50	41	54	61	47	42	29	46	27	36	54	59	78	86	57
55	32	46	57	40	34	26	39	25	28	50	38	70	74	48
-60	27	38	52	34	30	26	35	19	20	53	49	62	71	46
	N	71	72	41	66	57	63	N	63	78	91	69	69	72
	S	71	79	66	52	76	67	S	60	64	87	78	96	81
	T	72	75	53	58	66	64	T	61	71	87	71	80	75

Latitude	Rotation No.										Latitude	Rotation No.										Average 1574-1579
	1568-1573					1574-1579						1576-1577					1578-1579					
	Dec. 11, 1947 - May 20, 1948					May 21, 1948 - Oct. 29, 1948						May 21, 1948 - Oct. 29, 1948					May 21, 1948 - Oct. 29, 1948					
+60	26	32	19	21	18	21	18	23	17	18	19	20	16	17	18	19	20	16	17	18		
55	34	36	24	23	18	23	18	26	18	19	20	20	16	18	19	20	20	16	18	19		
50	36	40	24	28	18	27	18	29	21	21	23	22	18	20	21	23	22	18	20	21		
45	49	43	29	30	31	20	34	34	27	26	27	26	20	24	25	26	26	20	24	25		
40	50	49	30	34	23	34	23	37	39	31	35	28	26	28	31	35	28	26	28	31		
35	54	57	39	43	40	26	43	43	48	38	39	35	36	37	39	39	35	36	37	39		
30	65	71	43	43	48	33	51	51	48	47	47	43	43	47	47	47	43	43	47	47		
25	87	81	54	47	61	44	62	62	64	64	64	56	55	65	60	56	55	65	65	60		
20	101	78	57	56	73	53	70	70	74	69	71	63	74	75	71	63	74	75	75	71		
15	109	71	64	58	73	60	73	73	83	73	81	72	85	90	81	72	85	90	81	81		
10	98	68	55	56	67	64	68	68	83	73	71	63	76	90	76	63	76	90	76	76		
+5	81	65	53	47	61	61	61	61	65	64	55	52	62	85	64	55	62	85	64	64		
0	78	66	48	41	54	57	57	57	60	52	49	52	55	86	52	49	52	55	86	59		
-5	84	72	54	62	67	59	66	66	65	54	58	60	62	85	65	54	60	62	85	64		
10	99	87	69	96	71	66	81	81	76	63	70	71	72	99	76	63	70	71	72	99		
15	106	90	77	101	73	69	86	86	85	68	75	73	76	99	85	68	75	73	76	99		
20	105	97	72	90	69	53	81	81	83	59	69	69	81	91	83	59	69	69	81	91		
25	98	92	61	76	60	52	73	73	71	53	53	60	76	79	71	53	53	60	76	79		
30	95	84	58	58	44	50	65	65	55	41	40	45	59	65	55	41	40	45	59	65		
35	85	65	49	41	35	41	53	53	44	34	34	35	46	58	44	34	34	35	46	58		
40	72	54	46	32	30	36	45	45	35	26	26	29	35	50	35	26	26	29	35	50		
45	66	49	43	31	28	29	41	41	29	21	22	25	32	46	29	21	22	25	32	46		
50	62	45	37	31	25	23	37	37	26	20	20	23	27	38	26	20	20	23	27	38		
55	53	44	33	27	25	19	34	34	25	18	20	23	26	32	25	18	20	23	26	32		
-60	43	45	30	27	26	19	32	32	25	18	22	23	27	27	25	18	22	23	27	27		
	N	67	58	41	41	47	49	49			N	50	46	46	46	46	46	42	45	52	47	
	S	80	68	52	55	47	58	58			S	52	41	43	43	41	43	45	52	66	50	
	T	73	63	47	48	47	40	40			T	50	43	44	44	43	44	43	48	48	48	

Latitude	Rotation No.					Latitude	Rotation No.					Average 1610-1615		
	1604 Aug. 9, 1950	1605 Jan. 17, 1951	1606 Jan. 17, 1951	1607 Jan. 17, 1951	1608 Jan. 17, 1951		1609 Jan. 17, 1951	1610 Jan. 18, 1951	1611 Jan. 18, 1951	1612 Jan. 18, 1951	1613 Jan. 18, 1951		1614 Jan. 18, 1951	1615 Jan. 18, 1951
+60	25	20	16	17	24	11	19	17	17	18	13	18	18	17
55	30	25	19	19	28	16	23	20	22	21	16	19	22	20
50	34	27	20	22	29	24	26	25	21	25	22	18	24	23
45	40	28	20	26	30	29	29	29	26	26	26	18	27	25
40	44	32	25	29	35	36	34	32	27	31	28	25	32	29
35	54	38	31	39	42	46	42	41	32	37	30	30	40	35
30	64	49	42	46	56	55	52	56	35	49	42	41	50	46
25	77	65	54	62	70	67	66	64	44	58	62	51	64	57
20	88	86	67	74	73	82	78	71	49	76	90	68	68	70
15	96	95	75	81	77	78	84	79	57	85	106	78	71	79
10	83	81	75	68	75	70	75	75	59	76	94	81	67	75
+5	68	61	65	60	61	58	62	69	50	57	75	69	63	64
0	65	56	64	61	55	57	60	59	44	46	49	75	62	56
-5	72	58	71	67	54	66	65	75	49	51	58	60	60	59
10	77	59	64	67	60	74	67	86	56	57	66	68	57	65
15	86	64	60	60	62	73	68	74	65	54	59	58	54	61
20	72	58	50	57	60	66	61	61	57	38	41	43	49	48
25	57	46	38	41	40	48	45	45	41	31	29	39	44	38
30	41	32	29	31	31	36	33	36	32	31	25	31	35	32
35	32	23	24	26	25	28	26	22	27	25	20	26	27	25
40	28	20	19	21	21	25	22	19	21	21	17	23	23	21
45	23	18	16	18	17	24	19	17	18	18	16	19	19	18
50	20	17	17	16	14	16	17	17	18	18	15	19	17	17
55	16	15	14	14	11	14	14	14	17	18	15	16	17	16
-60	16	14	14	13	11	12	13	14	15	18	13	14	15	15
	N 59	51	44	46	50	48	50	N 49	37	46	50	45	47	46
	S 47	37	37	38	35	41	39	S 41	35	33	29	38	37	36
	T 52	43	40	41	42	44	44	T 45	36	39	41	40	41	40

Latitude	Rotation No.				Latitude	Rotation No.				Average 1622-1627							
	1616 June 29, 1951	1617 June 29, 1951	1618 1951 - Dec. 7,	1619 - Dec. 7, 1951		1620	1621	1622 Dec. 8, 1951	1623 - May 17, 1952		1624	1625 May 17, 1952	1626	1627			
+60	16	23	21	21	21	24	21	24	21	21	20	20	23	23	21	17	21
55	16	21	20	21	26	22	21	22	21	21	21	23	26	29	27	18	24
50	18	21	20	24	29	26	23	26	23	23	21	25	27	29	32	21	26
45	21	26	24	27	29	34	27	34	27	27	22	27	30	32	33	20	27
40	25	30	29	34	33	39	32	39	32	32	26	30	34	34	33	21	30
35	28	38	32	40	40	45	37	45	37	37	33	30	31	33	31	21	30
30	37	46	39	47	50	53	45	53	45	45	42	34	32	35	33	25	34
25	43	54	51	55	65	64	55	64	55	55	68	39	38	37	37	36	43
20	48	61	62	68	79	69	65	69	65	65	80	55	48	44	42	44	52
15	51	70	73	84	91	80	75	80	75	75	88	67	54	56	48	50	61
10	55	74	84	101	96	84	82	84	82	82	83	60	53	63	56	54	62
+5	52	62	80	98	79	74	74	74	74	74	75	60	49	54	62	61	60
0	47	53	72	78	65	56	62	56	62	62	53	54	41	55	62	56	54
-5	51	57	68	74	65	58	62	58	62	62	61	46	38	60	72	56	56
10	59	64	68	67	57	54	62	54	62	62	53	44	36	50	71	53	51
15	54	65	60	53	52	48	55	48	55	55	42	41	35	42	61	45	44
20	43	58	50	46	41	38	46	38	46	46	46	36	31	35	52	36	39
25	33	45	36	36	32	34	36	34	36	36	45	31	28	31	41	28	34
30	27	34	28	31	25	29	29	29	29	29	32	27	21	28	33	24	28
35	21	24	23	26	21	26	24	26	24	24	24	23	19	26	28	21	24
40	17	19	20	22	18	24	20	24	20	20	20	20	18	24	25	21	21
45	15	16	18	20	16	20	18	20	18	18	16	18	20	24	25	21	21
50	14	15	18	18	15	18	16	18	16	16	16	18	21	23	24	21	21
55	14	16	16	17	14	18	16	18	16	16	16	18	19	24	22	18	20
-60	13	17	16	16	14	17	16	17	16	16	16	16	17	18	20	18	18
	N	35	45	47	54	54	48	52	48	48	N	49	40	37	40	34	40
	S	31	37	38	39	33	36	34	36	36	S	34	30	26	34	41	33
	T	33	40	41	45	43	41	42	41	41	T	41	34	32	36	40	36

Latitude	Rotation No.				Latitude	Rotation No.				Average 1634-1639		
	1628 May 18, 1952	1630 1952 - Oct. 26, 1952	1631 1632	1633 1633		1634 Oct. 27, 1952	1635 1636 - Apr. 6, 1953	1637 1638	1639 1639			
+60	13	14	12	13	15	16	14	16	19	15	17	17
55	15	16	12	13	17	18	15	19	20	18	19	19
50	16	17	12	14	18	20	16	20	21	21	21	20
45	17	18	13	14	16	21	17	20	21	21	20	20
40	17	19	13	15	16	21	17	21	21	24	21	21
35	18	21	15	18	21	24	20	24	22	27	24	24
30	19	25	19	23	28	32	24	30	25	34	28	28
25	23	34	23	32	38	42	32	37	34	44	33	34
20	27	44	32	43	48	53	41	50	47	55	37	41
15	34	42	38	54	56	60	47	60	53	60	43	46
10	38	42	44	56	59	59	50	58	56	61	45	47
+5	44	46	45	55	55	54	50	47	53	59	47	45
0	40	48	46	49	53	48	47	40	46	51	41	40
-5	39	59	50	51	59	44	50	37	46	49	42	39
10	43	54	49	57	51	41	49	40	47	48	42	39
15	36	46	42	48	42	36	42	34	39	45	36	34
20	29	35	34	40	33	29	33	27	31	31	27	26
25	26	28	29	29	26	22	27	23	23	23	20	20
30	22	20	20	20	17	18	20	19	20	20	16	17
35	20	18	15	16	17	15	17	16	16	17	13	15
40	18	17	13	15	15	13	15	14	16	16	15	15
45	17	18	12	15	15	12	15	14	16	16	15	15
50	17	17	11	13	14	11	14	14	15	17	16	15
55	16	16	12	10	11	10	13	12	14	15	14	13
-60	15	15	11	8	8	8	11	10	12	11	10	11
	N 25	30	25	31	34	36	30	N 34	34	38	31	31
	S 26	30	26	29	28	24	27	S 23	26	28	24	23
	T 25	29	25	29	30	29	28	T 28	29	32	26	26

Latitude	Rotation No.				Latitude	Rotation No.				Average 1658-1663						
	1652 Feb. 25, 1954	1653 1954 - Aug. 5, 1954	1654 1954 - Aug. 5, 1954	1655 1954 - Aug. 5, 1954		1656 1954 - Aug. 5, 1954	1657 1954 - Aug. 5, 1954	1658 Aug. 6, 1954	1659 1954 - Jan. 14, 1955		1660 1954 - Jan. 14, 1955	1661 1954 - Jan. 14, 1955	1662 1954 - Jan. 14, 1955	1663 1954 - Jan. 14, 1955	Average 1658-1663	
+60	11	11	11	11	10	8	10	10	10	19	17	18	16	15		
55	12	12	13	13	11	10	12	11	10	18	18	19	17	16		
50	13	14	14	14	12	11	13	12	11	19	20	21	19	17		
45	14	14	15	14	12	13	14	12	12	21	24	27	23	20		
40	15	14	16	14	12	13	14	13	13	29	29	30	26	23		
35	14	14	16	14	12	12	14	13	15	36	31	31	30	26		
30	14	14	15	14	12	12	14	16	16	25	31	34	27	25		
25	14	13	14	14	11	11	13	17	15	19	27	26	23	21		
20	14	13	14	13	11	11	13	12	12	14	19	19	16	15		
15	15	13	13	13	11	12	13	10	10	15	18	16	14	14		
10	14	14	13	13	11	14	13	9	9	15	18	15	11	13		
+5	15	14	12	12	11	12	13	8	9	13	15	13	10	11		
0	14	17	12	12	11	11	13	8	7	10	14	12	10	10		
-5	15	20	12	12	11	10	13	8	7	9	13	13	10	10		
10	18	20	12	13	11	9	14	9	8	7	14	13	10	10		
15	17	15	13	13	11	9	13	9	9	10	17	14	11	12		
20	16	14	13	13	11	9	13	11	10	12	20	16	14	14		
25	16	15	13	13	11	9	13	11	12	16	23	20	20	17		
30	16	14	13	13	12	10	13	13	11	20	28	23	23	20		
35	16	14	14	13	12	11	13	13	11	20	29	29	24	21		
40	16	14	14	13	12	11	13	11	10	17	23	32	22	19		
45	16	15	14	14	11	11	14	10	9	15	18	26	18	16		
50	15	14	14	13	11	10	13	10	10	8	11	16	19	13		
55	13	13	13	12	11	9	12	9	8	10	15	16	13	12		
-60	12	11	12	11	10	9	11	7	7	8	13	14	11	10		
	N	14	14	14	13	11	12		N	12	11	19	22	19	17	
	S	15	15	13	13	11	10		S	10	9	13	19	19	15	14
	T	15	14	13	13	11	11		T	11	10	16	20	21	17	16

Latitude	Rotation No. 1664-1669 Jan. 15, 1955 - June 25, 1955					Latitude	Rotation No. 1670-1675 June 26, 1955 - Dec. 4, 1955					Average 1670-1675	
	1664	1665	1666	1667	1668		1669	1670	1671	1672	1673		1674
+60	25	30	22	16	21	30	24	17	13	14	17	15	15
55	27	33	25	18	24	34	27	22	15	16	19	18	18
50	36	37	29	22	27	39	32	25	17	17	22	19	26
45	38	42	34	25	31	42	35	28	22	20	28	21	31
40	41	50	38	28	39	42	40	36	30	23	36	28	36
35	46	53	38	31	50	54	45	45	37	33	43	48	46
30	48	50	36	34	53	64	48	53	35	40	53	64	61
25	42	41	32	34	55	57	44	50	38	37	52	64	59
20	38	34	29	29	47	45	37	36	25	26	42	45	57
15	25	28	25	18	29	28	26	24	14	16	30	29	42
10	17	20	18	15	17	18	18	16	10	11	16	17	24
+5	16	14	12	12	14	16	14	13	8	9	9	11	17
0	14	13	11	10	12	16	13	12	8	8	8	9	14
-5	14	13	12	10	12	16	13	14	9	8	8	9	12
10	17	16	12	10	12	17	14	18	10	10	11	10	15
15	20	18	14	13	14	23	17	18	12	14	16	17	20
20	28	20	16	18	17	33	22	24	22	26	24	31	29
25	39	25	18	21	27	34	27	30	36	37	35	45	38
30	40	30	19	23	36	39	31	33	33	31	35	43	42
35	36	29	21	19	38	36	30	36	28	22	28	30	34
40	31	25	20	18	29	30	26	32	19	17	23	19	25
45	26	22	20	17	25	22	22	25	15	16	17	13	21
50	22	21	19	15	20	19	19	19	12	12	13	11	19
55	19	18	17	13	18	18	17	18	12	12	11	10	15
-60	17	16	14	11	16	16	15	17	10	10	10	9	15
	N 32	34	27	22	32	37	31	N 29	21	21	29	30	34
	S 25	20	16	15	21	25	20	S 22	17	17	18	20	23
	T 29	28	22	19	27	32	26	T 26	20	19	24	25	29

Latitude	Rotation No.				Latitude	Rotation No.				Average 1682-1687							
	1676 Dec. 5, 1955	1677 Dec. 5, 1955	1678 May 14, 1956	1679 May 14, 1956		1680	1681	1682 May 15, 1956	1683 May 15, 1956		1684 Oct. 23, 1956	1685 Oct. 23, 1956	1686	1687	1682-1687		
+60	33	24	26	31	31	29	29	29	29	+60	29	27	26	27	30	29	28
55	34	23	28	31	31	34	30	30	30	55	31	31	30	36	36	36	33
50	33	26	36	37	43	43	36	36	36	50	37	35	35	47	48	45	41
45	39	34	45	50	60	57	48	48	48	45	47	48	46	54	56	55	51
40	54	47	56	60	74	69	60	60	60	40	62	59	61	68	69	71	65
35	75	75	64	72	100	90	79	79	79	35	70	75	75	74	86	86	78
30	101	85	73	84	102	89	89	89	89	30	72	79	80	85	103	96	86
25	109	85	75	88	102	95	92	92	92	25	79	88	83	82	107	100	90
20	94	75	62	81	89	84	81	81	81	20	76	69	74	69	88	89	78
15	56	48	45	60	68	63	57	57	57	15	57	51	60	55	61	68	59
10	27	25	26	33	40	38	32	32	32	10	36	30	40	43	45	45	40
+5	17	16	19	22	23	24	20	20	20	+5	23	23	28	28	30	32	27
0	13	11	14	18	17	20	16	16	16	0	18	21	23	22	26	26	23
-5	13	11	15	17	15	21	15	15	15	-5	21	25	26	22	33	30	26
10	16	14	18	20	21	29	20	20	20	10	30	32	38	32	46	39	36
15	31	22	33	33	37	47	34	34	34	15	47	47	53	45	71	61	54
20	53	39	50	52	55	73	54	54	54	20	72	68	71	58	86	79	72
25	72	52	54	61	65	78	64	64	64	25	77	86	74	69	94	86	81
30	78	60	54	57	60	73	64	64	64	30	72	84	63	65	82	83	75
35	68	58	48	45	52	54	54	54	54	35	59	65	54	60	71	70	63
40	49	42	39	33	39	45	41	41	41	40	40	52	47	49	59	61	51
45	35	31	30	26	30	35	31	31	31	45	35	44	40	38	47	45	42
50	26	24	23	22	30	26	25	25	25	50	30	75	33	30	37	35	40
55	23	22	21	21	21	26	22	22	22	55	27	32	30	27	30	28	29
-60	23	21	22	21	21	24	22	22	22	-60	29	33	29	28	32	29	30
	N 53	44	44	51	60	57	51	51	51		N 49	49	51	53	60	60	54
	S 38	31	32	33	36	42	36	36	36		S 43	51	45	42	55	52	48
	T 47	39	39	43	49	51	45	45	45		T 47	51	49	49	59	59	52

Latitude	Rotation No.					Latitude	Rotation No.					Average 1694-1699		
	1688 Oct. 24, 1956	1689 1690	1691 - Apr. 3, 1957	1692	1693		1694 Apr. 4, 1957	1695	1696	1697	1698		1699 Sept. 12, 1957	
+60	31	30	28	34	32	29	31	29	26	25	23	24	23	25
55	39	37	35	42	37	33	37	33	29	30	26	26	25	28
50	51	44	41	48	41	36	44	39	33	35	30	31	30	33
45	59	50	44	57	47	42	50	48	43	41	33	37	35	40
40	71	59	51	64	53	50	58	56	53	50	45	49	49	50
35	78	72	69	75	59	61	69	69	65	63	55	65	61	63
30	88	87	77	92	69	69	80	78	74	77	69	75	73	74
25	91	100	81	95	71	76	86	87	82	87	72	79	79	81
20	93	92	93	97	77	77	88	87	88	83	72	76	79	81
15	75	85	81	88	81	74	81	83	73	72	75	71	78	75
10	50	59	58	67	69	67	62	71	67	66	70	60	72	68
+5	36	40	42	48	55	50	45	55	56	56	52	47	55	54
0	32	37	36	38	42	39	37	46	48	50	46	42	43	46
-5	39	49	42	41	46	41	43	52	53	54	48	49	49	51
10	58	67	62	61	64	59	62	69	71	73	74	64	58	68
15	74	90	87	87	85	86	85	99	91	105	93	74	70	89
20	92	109	103	102	103	106	103	108	106	120	105	79	83	100
25	101	119	95	96	106	104	104	102	109	120	107	84	87	102
30	88	107	91	84	104	89	94	91	94	106	95	79	85	92
35	73	89	86	68	96	76	81	75	76	88	88	73	81	80
40	62	80	77	69	79	68	73	65	64	77	64	70	71	69
45	50	64	57	69	76	58	62	62	66	66	55	58	63	62
50	41	53	47	57	65	51	52	47	54	56	46	50	49	50
55	38	40	39	47	52	42	43	42	38	47	44	42	44	43
-60	32	33	34	39	42	35	36	41	34	40	40	40	42	40
	N 61	61	57	65	56	54	59	N 60	57	57	51	52	54	55
	S 60	72	66	66	74	66	67	S 69	70	77	70	62	63	69
	T 62	68	62	67	66	61	64	T 65	64	67	61	58	59	63

Latitude	Rotation No.					Latitude	Rotation No.					Average 1718-1723	
	Aug. 3, 1958 - Jan. 11, 1959						Jan. 12, 1959 - June 22, 1959						
	1712	1713	1714	1715	1716		1717	1718	1719	1720	1721		1722
+60	23	24	20	19	16	20	16	14	20	19	22	22	19
55	32	29	24	26	23	26	20	17	23	23	24	24	22
50	41	39	32	38	31	31	27	23	31	32	27	26	28
45	48	46	44	48	41	36	32	33	43	42	39	32	37
40	56	57	53	61	50	41	39	41	58	61	52	45	49
35	64	69	63	69	57	52	48	57	78	77	63	56	63
30	72	77	76	75	57	72	68	70	86	89	80	66	77
25	89	92	91	84	65	82	85	81	98	102	91	77	89
20	77	89	100	83	76	93	92	85	92	112	101	85	95
15	71	79	91	84	78	84	86	81	96	109	99	91	94
10	69	69	82	74	71	78	79	69	87	95	88	73	82
+5	61	59	69	67	66	71	74	60	71	67	70	62	67
0	54	56	65	67	71	68	68	55	63	61	62	54	61
-5	60	61	81	86	82	76	73	52	59	57	65	61	61
10	68	67	92	97	91	84	77	56	65	63	68	68	66
15	73	70	92	99	86	84	77	60	69	66	64	71	68
20	70	72	79	78	74	76	67	56	65	67	60	60	63
25	58	72	72	69	61	64	56	45	53	59	46	50	52
30	54	58	64	57	52	45	43	39	52	46	41	42	44
35	43	50	54	47	42	39	34	37	38	40	33	33	36
40	35	38	44	40	35	34	31	32	35	34	27	28	31
45	27	33	35	34	34	33	29	27	28	28	23	24	27
50	27	29	28	26	25	31	28	24	26	29	22	21	25
55	24	27	24	26	20	28	23	21	24	25	19	18	22
-60	24	29	25	27	21	25	22	23	23	25	18	19	22
	N	58	60	62	61	54	56	53	65	68	63	55	60
	S	47	51	58	58	51	48	41	46	46	42	42	44
	T	53	56	60	59	53	52	46	55	57	52	48	52

Latitude	Rotation No. June 23, 1959 - Dec. 1, 1959				Average 1724-1729	Rotation No. Dec. 2, 1959 - May 11, 1960				Average 1730-1735				
	1724	1725	1726	1727		1728	1729	1730	1731		1732	1733	1734	1735
+60	22	20	29	23	26	22	24	26	33	32	27	30	38	31
55	24	22	27	27	27	23	25	27	31	31	32	35	36	32
50	26	24	28	32	31	35	29	30	48	40	35	35	39	38
45	35	30	35	37	42	42	37	41	56	54	39	38	41	45
40	42	39	44	48	51	53	46	44	59	65	48	40	50	51
35	58	53	55	63	62	64	59	52	67	83	62	60	61	64
30	74	63	68	70	69	71	69	69	88	111	75	72	77	82
25	72	76	77	76	70	73	74	81	103	122	93	71	97	95
20	85	82	93	80	72	75	81	91	96	129	100	81	102	100
15	94	84	105	87	75	78	87	88	103	132	94	92	101	102
10	85	88	105	86	79	84	88	87	102	124	94	90	93	98
+5	74	67	87	71	78	78	76	77	86	107	88	89	82	88
0	61	56	69	61	68	71	64	63	68	89	77	77	74	75
-5	58	55	64	62	68	68	63	60	64	81	75	84	84	75
10	67	55	67	72	73	67	67	65	66	83	76	95	93	80
15	69	58	65	69	72	64	66	64	71	94	74	85	94	80
20	64	61	65	65	59	62	63	60	53	85	62	78	73	69
25	61	57	55	54	47	46	53	54	39	79	52	72	55	59
30	55	48	48	44	38	33	44	43	37	60	39	57	41	46
35	46	41	35	36	28	27	36	35	28	40	29	33	31	33
40	36	32	27	27	25	24	29	27	20	27	25	24	25	25
45	28	23	20	24	19	17	22	22	16	20	20	22	22	20
50	23	18	18	20	17	14	18	17	14	16	15	16	22	17
55	18	19	18	17	16	13	17	14	13	16	15	15	20	16
-60	19	16	17	15	16	13	16	14	12	16	14	16	19	15
	N 58	54	63	59	58	59	58	N 60	72	86	66	62	69	69
	S 47	41	44	44	42	40	43	S 41	39	54	44	52	50	47
	T 52	47	53	51	49	49	50	T 50	55	69	54	56	59	57

Latitude	Rotation No.					Latitude	Rotation No.					Average 1742-1747		
	1736	1737	1738	1739	1740		1741	1742	1743	1744	1745		1746	1747
	May 12, 1960 - Oct. 20, 1960						Oct. 21, 1960 - March 31, 1961						Average 1742-1747	
+60	47	36	34	43	46	39	41	30	36	45	37	36	36	37
55	44	35	38	40	48	43	41	32	39	42	43	38	33	38
50	42	34	39	40	44	47	41	36	42	41	44	37	33	39
45	42	42	45	45	50	52	46	39	54	43	38	44	37	43
40	53	47	56	55	65	57	56	52	55	48	43	50	44	49
35	62	64	64	64	78	70	67	63	69	60	54	64	50	60
30	78	81	74	81	95	83	82	79	78	71	65	65	56	69
25	96	91	92	92	98	83	92	84	82	77	75	69	63	75
20	93	106	97	96	93	85	95	82	73	75	83	73	60	74
15	98	111	98	102	97	77	97	73	75	75	77	70	66	73
10	98	100	89	91	107	74	93	64	78	68	70	67	73	70
+5	89	94	83	75	92	71	84	58	73	61	63	64	78	66
0	78	80	76	68	87	69	76	57	70	57	58	65	66	62
-5	82	89	75	72	99	73	82	59	65	54	62	66	67	62
10	83	95	82	77	111	84	89	70	59	59	73	69	71	67
15	83	93	79	70	93	87	84	70	63	59	69	59	66	64
20	67	77	67	62	80	79	72	61	57	51	46	48	55	53
25	51	60	54	47	59	63	56	47	49	37	40	39	42	42
30	35	40	38	30	40	43	38	34	34	30	33	32	32	33
35	27	30	27	22	31	31	28	24	26	27	27	25	27	26
40	21	22	21	20	24	25	22	20	20	20	23	20	23	22
45	19	20	21	18	23	21	20	17	19	20	21	19	23	20
50	18	20	21	16	21	20	19	15	15	15	17	15	22	17
55	18	18	21	15	20	19	19	15	13	15	18	17	19	16
-60	17	20	22	17	21	21	20	14	11	17	18	17	21	16
	N 71	71	68	69	77	65	70	N 58	63	59	58	57	53	58
	S 46	51	46	41	55	49	48	S 39	39	36	39	38	41	38
	T 58	60	57	54	65	57	58	T 48	50	47	48	47	47	47

Latitude	Rotation No.										Average 1754-1759			
	1748-1753					1754-1759								
	1748 Apr. 1, 1961	1749	1750	1751	1752 Sept. 9, 1961	1754 Sept. 10, 1961	1755	1756	1757	1758		1759		
+60	32	30	26	25	30	33	29	38	28	25	28	28	23	28
55	32	33	30	29	31	33	31	35	29	26	28	27	23	28
50	33	32	29	28	29	30	30	30	26	25	27	25	20	26
45	33	32	30	30	31	34	32	35	28	27	28	24	21	27
40	39	36	33	32	38	38	36	36	33	28	29	26	23	29
35	45	38	37	36	46	42	41	42	38	34	34	28	24	33
30	43	40	40	42	51	52	45	50	45	43	41	35	30	41
25	47	46	47	55	57	64	53	65	56	54	51	42	37	51
20	47	54	55	65	72	80	62	84	67	63	61	50	42	61
15	55	58	64	71	70	86	67	89	84	65	68	60	48	69
10	57	64	62	74	74	86	70	78	83	60	65	56	59	67
+5	59	59	65	80	68	82	69	77	71	50	56	49	59	61
0	58	55	67	71	67	83	67	66	55	50	52	40	46	52
-5	55	52	64	65	61	80	63	62	49	41	49	38	37	46
10	61	53	61	67	60	79	64	60	46	38	39	35	34	43
15	58	45	57	60	56	69	58	61	42	41	29	30	29	39
20	54	42	49	48	52	57	50	49	37	33	26	24	24	32
25	40	29	39	35	37	46	38	39	27	29	25	22	21	27
30	31	23	28	29	28	38	30	30	22	24	21	17	17	22
35	25	22	22	23	23	31	24	25	18	19	18	15	15	18
40	24	20	23	20	20	26	22	23	16	18	15	15	15	17
45	19	21	24	18	21	22	21	21	15	17	14	12	13	15
50	17	19	20	18	19	22	19	20	15	14	15	12	13	15
55	16	19	19	18	20	21	19	19	14	15	14	12	12	14
-60	15	20	20	17	19	21	19	19	13	15	14	13	11	14
N	45	44	45	49	51	57	49	56	49	42	44	36	35	44
S	36	32	38	38	37	46	38	38	28	27	25	22	22	27
T	40	38	40	42	43	50	43	46	38	34	34	29	28	35

Latitude	Rotation No.					Latitude	Rotation No.					Average 1766-1771	
	1760-1765						1770-1771						
	1760	1761	1762	1763	1764		1765	1766	1767	1768	1769		1770
	Feb. 19, 1962 - July 30, 1962						July 31, 1962 - Jan. 8, 1963						
+60	20	23	20	21	20	31	29	23	20	20	22	17	22
55	20	23	20	21	17	27	28	24	21	17	21	16	21
50	19	24	24	18	18	25	28	24	20	18	21	19	22
45	18	24	25	20	21	28	28	23	23	23	24	22	24
40	19	24	25	20	21	31	28	29	28	25	27	26	27
35	18	24	24	25	26	39	35	31	31	32	27	31	31
30	24	27	30	33	35	45	40	37	37	39	32	36	37
25	31	37	41	43	46	51	45	44	45	47	40	41	44
20	37	49	55	61	61	64	49	50	55	54	51	50	52
15	45	52	60	77	66	67	60	49	64	63	57	48	57
10	46	56	66	77	71	68	63	54	67	65	57	41	58
+5	45	52	51	60	61	67	63	57	62	62	56	37	56
0	36	47	50	45	53	56	52	53	51	54	45	31	48
-5	33	39	45	42	51	57	42	46	46	45	37	32	41
10	36	41	42	41	48	59	43	47	46	55	39	32	44
15	33	39	35	37	42	52	38	44	49	52	40	30	42
20	28	33	28	36	31	42	32	36	43	46	37	27	37
25	20	23	23	24	27	27	27	28	29	32	29	21	28
30	17	17	18	19	20	24	22	23	24	23	21	17	22
35	16	17	15	14	15	21	19	20	20	19	16	14	18
40	14	14	14	12	15	19	18	17	16	16	12	13	15
45	12	12	12	11	12	17	15	15	14	14	12	9	13
50	11	12	13	10	10	18	16	15	13	12	11	11	13
55	9	11	10	9	10	16	15	13	12	12	12	11	13
-60	9	10	9	9	9	15	15	12	12	13	10	11	12
	N	29	36	38	40	46	N	42	38	40	40	37	38
	S	21	24	24	24	26	S	27	28	29	30	25	27
	T	25	29	30	31	32	T	34	33	34	34	30	32

Latitude	Rotation No.					Latitude	Rotation No.					Average 1778-1783			
	1772 Jan. 9, 1963	1773 1774	1775 June 19, 1963	1776 1777	1777 1778		1779 June 20, 1963	1780 1781	1782 Nov. 28, 1963	1783	1783				
+60	22	18	17	19	24	24	24	21	22	20	22	22	25	24	23
55	23	20	20	23	23	24	24	22	22	23	24	24	24	23	23
50	23	22	24	23	24	22	22	23	24	22	24	25	22	25	24
45	25	23	25	23	24	25	24	24	22	22	22	27	24	25	24
40	24	22	29	25	26	25	25	25	22	22	22	27	25	27	25
35	26	25	28	28	29	26	27	27	30	30	23	27	26	29	27
30	27	24	29	30	31	28	28	28	34	32	33	29	29	36	32
25	33	27	39	40	41	35	36	36	38	39	32	35	33	43	37
20	40	32	46	51	50	46	44	44	50	46	40	36	37	46	43
15	51	43	56	55	65	54	54	54	57	59	48	42	48	55	52
10	51	41	49	48	71	68	55	55	62	65	48	48	57	53	56
+5	39	43	36	35	47	62	44	44	47	52	45	49	49	46	48
0	31	33	25	36	39	40	34	34	36	30	36	45	42	40	38
-5	26	21	21	29	38	35	28	28	24	23	29	44	39	37	33
10	26	17	17	25	39	34	26	26	24	21	32	50	37	39	34
15	23	18	19	26	39	39	27	27	25	24	29	37	35	33	31
20	21	17	19	26	31	37	25	25	23	22	22	24	23	25	23
25	16	16	15	22	25	28	20	20	21	20	19	18	18	19	19
30	16	14	15	18	19	20	17	17	17	16	17	18	15	17	17
35	14	13	13	17	16	21	16	16	17	17	17	15	12	15	16
40	13	12	14	15	14	16	14	14	16	16	15	15	11	12	14
45	13	11	12	14	15	17	14	14	19	14	13	16	11	12	14
50	12	11	11	14	14	12	12	12	16	14	14	15	10	11	13
55	11	11	10	14	11	13	12	12	14	13	12	13	10	10	12
-60	10	11	10	11	9	12	11	11	12	13	12	12	9	9	11
	N 32	29	33	34	38	37	34	34	N 36	36	32	34	34	36	35
	S 18	16	15	21	24	25	20	20	S 20	19	21	25	21	21	21
	T 25	22	24	27	31	31	27	27	T 28	27	26	29	27	28	28

Latitude	Rotation No.				Latitude	Rotation No.				Average 1790-1795						
	1784 Nov. 29, 1963	1785 29, 1963	1786-1787 May 8, 1964	1788 1789		1784-1789 Average	1790 May 9, 1964	1791 19	1792 19		1793 17, 1964	1794 19	1795 20			
+60	25	27	24	19	19	16	22	21	19	19	19	20	20			
55	26	28	26	20	19	23	23	19	20	20	20	21	20			
50	26	29	27	20	21	24	24	20	21	22	28	20	21			
45	27	27	29	23	25	21	25	20	21	23	20	21	22			
40	29	30	27	22	23	20	25	18	21	24	21	21	22			
35	34	34	28	21	23	21	27	21	22	29	24	24	24			
30	34	35	25	26	25	19	27	22	27	27	28	19	25			
25	40	36	26	26	21	29	29	26	27	24	24	19	23			
20	40	36	25	26	34	24	31	30	25	21	20	17	21			
15	46	37	26	35	45	29	36	31	26	19	19	13	20			
10	45	37	31	43	60	35	42	30	25	20	20	16	21			
+5	38	35	30	41	53	35	39	25	23	17	18	15	19			
0	35	32	26	32	38	31	32	24	22	15	15	15	18			
-5	35	27	26	33	29	28	30	19	18	15	13	10	15			
10	33	27	23	29	27	25	27	19	16	13	13	9	14			
15	29	24	21	23	23	18	23	19	16	13	11	9	14			
20	22	21	18	15	18	16	18	16	15	13	11	8	13			
25	18	18	15	16	15	16	16	13	14	12	11	7	12			
30	16	16	14	14	12	14	14	12	15	12	10	9	11			
35	15	15	14	14	12	13	14	14	14	15	11	7	11			
40	14	14	13	13	14	13	14	10	15	11	10	9	11			
45	13	14	13	13	12	12	13	11	13	11	12	8	11			
50	12	13	11	12	12	11	12	13	12	10	11	7	11			
55	11	13	12	12	12	12	12	14	12	10	10	7	10			
-60	11	10	11	11	12	11	11	11	13	10	10	7	10			
	N	34	33	27	27	32	24	29	N	24	23	22	20	18	20	21
	S	20	19	17	18	18	17	18	S	15	15	12	11	9	12	12
	T	27	25	22	22	24	20	23	T	19	19	17	16	13	16	16

Latitude	Rotation No.				Average 1796-1801	Latitude	Rotation No.				Average 1802-1807				
	1796 Oct. 18,	1797 1964 -	1798 March 28,	1800 1965			1801	1802 March 29,	1803 1965 -	1804 Sept. 6,		1805 1965	1806 1965	1807	
+60	16	18	15	14	16	12	15	12	14	16	21	17	15	16	
55	20	20	18	13	16	11	16	11	12	14	20	22	18	17	
50	24	22	19	16	19	12	19	12	16	16	22	23	18	18	
45	25	22	25	19	20	14	21	14	19	19	26	28	21	22	
40	25	25	26	24	24	28	24	28	25	25	29	35	24	27	
35	26	27	28	26	28	18	26	18	35	27	35	41	33	31	
30	25	29	21	28	36	21	27	21	30	31	40	47	37	35	
25	22	27	21	28	42	21	27	21	25	27	31	38	44	34	
20	21	21	23	27	33	19	24	19	20	26	27	33	39	30	
15	21	19	17	17	25	15	19	15	15	17	22	28	32	23	
10	19	16	18	13	21	12	17	12	10	16	18	21	24	18	
+5	19	14	15	10	16	10	14	10	+5	13	19	19	18	16	
0	18	14	17	10	12	9	13	9	0	10	17	17	17	14	
-5	18	15	18	12	12	8	14	8	-5	7	13	15	16	12	
10	20	18	19	13	13	9	15	9	10	8	11	18	17	13	
15	15	16	20	12	11	10	14	10	15	8	12	17	19	13	
20	13	14	15	11	11	8	12	8	20	7	11	15	16	13	
25	11	12	13	8	11	8	11	8	25	7	11	17	16	14	
30	11	13	12	8	12	8	11	8	30	7	10	16	16	14	
35	10	12	13	9	10	8	10	8	35	8	10	15	16	13	
40	12	12	12	12	10	9	11	9	40	7	9	12	13	11	
45	9	11	11	8	11	9	10	9	45	7	9	12	13	11	
50	11	11	11	9	11	7	10	7	50	7	9	11	12	10	
55	10	11	12	9	10	6	10	6	55	7	7	11	10	9	
-60	11	10	13	9	9	6	10	6	-60	7	8	11	11	9	
	N 22	21	20	19	24	15	20	15		N 17	22	26	30	23	21
	S 13	13	14	10	11	8	12	8		S 9	10	14	15	13	11
	T 17	17	17	15	18	12	16	12		T 12	16	21	23	18	16

Latitude	Rotation No.				Latitude	Rotation No.				Average 1814-1819				
	1808 Sept. 7, 1965	1809 1810 Feb. 15, 1966	1811 1812 Feb. 15, 1966	1813 1813 Feb. 15, 1966		1814 1815 Feb. 16, 1966	1816 1817 July 27, 1966	1818 1819 July 27, 1966	1819					
+60	12	9	8	12	12	12	11	13	16	20	18	22	28	20
55	13	10	9	13	13	14	12	14	16	21	20	23	32	21
50	13	11	10	14	14	16	13	17	16	22	22	26	46	25
45	18	15	12	15	16	21	16	23	21	32	29	34	60	33
40	40	22	17	16	17	19	20	27	27	41	41	43	65	41
35	29	23	23	24	26	37	27	39	37	52	57	57	79	54
30	35	27	27	35	30	39	32	43	43	70	70	66	82	62
25	35	26	25	34	38	40	33	43	44	73	75	70	74	63
20	24	24	18	25	30	37	26	36	46	60	66	67	68	57
15	18	17	14	18	31	25	21	26	37	44	55	56	48	44
10	15	9	10	11	18	21	14	22	28	29	40	37	35	32
+5	12	6	8	7	12	17	10	18	20	21	25	26	23	22
0	10	6	6	5	9	12	8	15	14	15	15	19	16	16
-5	10	6	6	6	8	9	8	12	11	12	12	16	14	13
10	11	8	5	5	8	8	8	10	10	10	10	17	13	12
15	12	9	7	5	9	8	8	9	10	9	14	22	15	13
20	12	11	9	6	9	9	9	10	10	9	15	28	21	16
25	13	13	10	8	10	10	11	11	10	9	18	27	25	17
30	12	14	9	8	10	10	10	13	10	7	19	22	23	16
35	13	12	7	7	8	11	10	15	10	7	13	19	18	14
40	12	9	6	7	8	10	9	11	9	7	10	16	15	11
45	11	9	6	6	8	9	8	9	9	7	9	13	13	10
50	9	7	6	6	8	9	8	8	8	7	8	11	12	9
55	9	6	4	7	7	9	7	8	8	6	8	10	11	9
-60	9	6	4	6	7	8	7	7	7	6	8	10	10	8
	N 20	15	14	18	21	25	19	N 26	28	38	41	42	50	38
	S 11	9	7	6	8	9	9	S 11	10	9	12	18	16	13
	T 16	12	11	12	15	17	14	T 18	19	24	27	30	34	26

Latitude	Rotation No.					Latitude	Rotation No.					Average 1826-1831		
	1820	1821	1822	1823	1824		1825	1826	1827	1828	1829		1830	1831
	July 28, 1866 - Jan. 5, 1967						Jan. 6, 1967 - June 16, 1967						Average 1826-1831	
+60	36	31	30	25	27	30	30	27	26	29	26	25	22	26
55	44	37	36	24	35	32	35	29	32	35	28	30	26	30
50	54	48	44	35	37	37	43	34	38	41	32	36	32	36
45	62	58	52	45	46	42	51	42	49	52	39	43	41	44
40	72	72	56	48	55	58	60	51	61	66	54	59	56	58
35	88	73	64	58	67	76	71	73	82	93	76	86	83	82
30	100	79	77	69	82	106	86	97	102	119	109	102	102	105
25	94	74	76	74	102	121	90	100	111	126	118	97	102	105
20	76	65	72	80	96	118	85	106	127	128	125	94	93	112
15	55	44	50	65	81	113	68	110	116	113	119	82	66	101
10	37	36	30	45	52	80	47	72	72	80	94	62	42	70
+5	28	29	24	34	41	51	35	45	42	45	54	42	30	43
0	18	22	23	27	40	48	30	35	29	33	39	33	24	32
-5	13	18	18	20	30	36	23	34	32	30	33	36	29	32
10	13	19	20	20	25	37	22	41	38	41	45	48	39	42
15	14	23	21	27	29	45	27	55	49	57	61	72	56	58
20	20	29	23	36	33	56	33	73	70	67	82	88	68	75
25	22	26	21	42	33	49	32	79	89	67	82	97	73	81
30	18	25	22	34	38	45	30	75	79	62	70	82	58	71
35	16	22	18	26	26	39	25	68	57	47	58	61	47	56
40	16	18	15	17	16	26	18	52	46	37	43	49	35	44
45	13	15	15	14	16	17	15	36	33	27	31	34	28	32
50	12	14	13	13	12	16	13	24	27	22	26	28	20	25
55	12	13	10	10	9	16	12	20	28	22	23	23	16	22
-60	10	12	11	9	11	16	12	20	28	22	23	23	16	22
	N 59	51	49	48	59	70	57	N 63	68	74	70	61	55	65
	S 15	20	18	23	24	34	22	S 47	46	41	47	52	39	45
	T 38	36	34	36	42	52	40	T 56	58	58	59	57	48	56

Latitude	Rotation No.										Average 1832-1837		
	1832-1837					1838-1843							
	1832 June 17, 1967	1833 June 17, 1967	1834 1835 - Nov. 25, 1967	1835 1836	1836 1837	1838 Nov. 26, 1967	1839 Nov. 26, 1967	1840 1841 - May 5, 1968	1841 1842	1842 1843		1843 1843	Average 1838-1843
+60	22	27	25	24	27	20	24	28	24	23	20	16	22
55	26	32	29	32	31	24	29	31	25	26	23	18	25
50	32	37	35	46	37	35	37	34	36	30	28	20	30
45	41	46	45	54	46	40	45	41	41	39	35	26	36
40	52	62	61	58	54	48	56	47	51	55	44	34	45
35	67	77	79	67	63	61	69	54	69	75	59	50	61
30	93	96	87	73	76	73	83	69	84	89	73	69	79
25	112	104	88	81	90	87	94	91	115	122	113	94	106
20	93	102	78	98	104	98	96	102	127	120	112	115	115
15	77	78	71	99	100	95	87	84	128	109	97	109	106
10	57	59	60	71	72	75	66	67	99	95	76	81	84
+5	35	42	43	43	49	53	44	48	78	84	60	62	66
0	26	32	33	32	35	39	33	36	59	64	52	49	51
-5	26	34	33	32	33	35	32	35	54	66	54	55	53
10	37	44	39	45	42	43	41	46	73	93	75	68	70
15	60	66	59	63	60	57	61	73	97	111	100	90	92
20	79	90	76	77	84	70	79	86	114	104	107	96	98
25	85	92	87	89	94	74	87	76	108	96	100	79	90
30	66	70	83	81	83	64	75	75	102	85	93	76	83
35	49	54	68	59	63	53	58	59	95	73	68	63	68
40	41	39	55	48	46	39	45	46	74	53	48	50	52
45	31	31	41	33	32	27	33	34	48	42	36	38	39
50	23	23	30	23	25	19	24	24	31	34	28	31	30
55	19	20	24	18	20	17	20	18	28	26	22	24	23
-60	18	20	22	15	19	16	18	15	24	22	22	20	21
	N	56	61	56	60	60	58	55	72	71	66	61	64
	S	43	47	50	47	49	43	48	70	67	62	57	59
	T	51	55	54	54	55	50	52	72	69	64	59	62

Latitude	Rotation No.					Latitude	Rotation No.					Average 1862-1867		
	1856 March 26, 1969	1857 March 26, 1969	1858 March 26, 1969	1859 Sept. 3, 1969	1860 Sept. 3, 1969		1861 Sept. 3, 1969	1862 Sept. 4, 1969	1863 Sept. 4, 1969	1864 Sept. 4, 1969	1865 Sept. 4, 1969		1866 Sept. 4, 1969	1867 Sept. 4, 1969
+60	18	18	21	20	19	18	19	18	15	14	13	12	10	14
55	21	20	23	25	23	22	22	22	22	18	16	14	13	16
50	25	21	25	29	27	27	26	26	22	22	18	15	13	18
45	34	28	29	34	30	35	32	32	31	28	26	22	18	24
40	44	34	36	40	34	40	38	38	34	29	32	26	27	30
35	59	41	38	48	42	45	46	46	36	35	44	38	48	40
30	76	52	50	58	49	48	56	56	44	46	58	56	71	55
25	89	61	60	68	62	66	68	68	60	61	71	75	82	69
20	93	77	67	94	76	88	83	83	76	77	97	79	83	85
15	83	72	87	102	83	107	89	89	89	83	88	82	79	93
10	71	69	92	99	80	107	86	86	82	81	82	77	73	78
+5	65	60	72	79	70	86	72	72	72	82	74	65	56	72
0	64	57	60	64	62	72	63	63	66	72	61	58	54	73
-5	61	53	61	67	65	76	64	64	80	82	61	62	52	83
10	69	71	77	82	84	92	79	79	95	92	68	74	70	104
15	75	77	77	87	91	103	85	85	101	91	74	74	71	96
20	66	67	75	80	81	86	76	76	91	90	67	65	60	76
25	59	53	62	66	62	69	62	62	70	74	58	50	43	63
30	53	42	43	44	40	49	45	45	55	51	44	35	36	59
35	47	31	32	37	32	43	37	37	45	43	36	28	26	40
40	38	30	26	29	25	31	30	30	32	32	32	26	20	30
45	34	22	23	23	22	28	25	25	25	24	26	20	15	22
50	26	19	21	21	20	24	22	22	22	17	20	14	12	18
55	20	16	19	16	19	21	19	19	19	15	16	11	10	14
-60	18	15	17	17	16	18	17	17	16	14	13	11	8	10
	N	57	47	51	58	51	59	54	N	50	50	52	48	50
	S	48	42	46	49	48	55	48	S	55	54	44	41	53
	T	52	44	48	53	49	56	51	T	52	51	49	44	51
														48

Latitude	Rotation No.				Latitude	Rotation No.				Average 1874-1879			
	1868-1873		1874-1879			1875-1877		1878-1879					
	1868 Febr. 13, 1970	1869 Febr. 13, 1970	1870 July 24, 1970	1871 July 24, 1970		1872 July 25, 1970	1873 July 25, 1970	1874 July 25, 1970	1875 July 25, 1970		1876 Jan. 2, 1971	1877 Jan. 2, 1971	1878 Jan. 2, 1971
+60	12	17	13	20	20	17	17	21	24	15	9	17	18
55	13	20	14	22	19	19	18	19	25	20	25	22	22
50	18	25	22	26	26	22	23	24	26	29	27	26	25
45	25	33	33	32	37	22	31	29	33	36	31	29	36
40	32	41	42	43	49	34	40	36	43	49	44	39	42
35	44	65	55	55	55	45	52	49	67	70	60	55	59
30	62	81	75	77	74	73	73	77	95	94	88	74	30
25	77	90	96	110	97	107	99	100	117	124	121	111	112
20	91	98	117	134	120	125	114	117	132	140	148	110	127
15	87	99	105	153	109	128	116	125	126	141	146	106	129
10	75	93	78	140	95	108	104	104	111	113	130	104	112
+5	63	83	68	104	82	91	82	99	81	98	105	88	94
0	68	90	68	92	82	77	80	86	71	87	87	83	82
-5	90	92	74	104	99	86	93	92	87	87	94	82	89
10	113	107	73	103	123	106	105	102	94	101	103	97	102
15	111	108	78	102	98	103	101	94	101	105	93	96	99
20	87	103	76	85	68	79	82	76	89	99	74	80	89
25	70	90	71	66	55	71	67	53	71	86	63	61	71
30	58	63	52	58	49	40	53	35	54	60	45	48	49
35	45	48	44	46	45	32	43	29	36	42	35	38	37
40	33	43	38	37	41	29	36	24	25	28	28	25	27
45	23	34	35	29	27	25	28	21	23	24	21	18	22
50	17	27	24	25	24	19	22	19	19	18	15	12	17
55	14	23	18	22	20	16	19	16	20	17	12	10	15
-60	13	18	18	16	18	15	16	14	16	17	11	8	13
	N 51	64	58	76	67	67	65	N 68	73	79	78	64	72
	S 57	65	51	60	58	54	57	S 51	54	59	52	51	55
	T 54	64	55	68	61	60	60	T 58	63	69	64	56	63

Latitude	Rotation No.					Latitude	Rotation No.					Average 1886-1891				
	1880 Jan. 3, 1971	1881 17	1882 17	1883 16	1884 14		1885 15	1886 June 14, 1971	1887 15	1888 24	1889 12		1890 11	1891 9		
+60	17	17	17	16	14	15	16	25	15	24	12	11	9	15		
55	20	23	21	22	18	17	21	20	16	22	11	13	8	15		
50	27	31	26	?	24	22	27	23	21	26	18	16	12	20		
45	29	41	31	34	31	23	32	26	23	31	19	16	12	21		
40	35	48	33	41	34	31	40	34	31	44	25	20	13	26		
35	47	68	43	58	39	36	49	40	36	39	35	27	20	33		
30	64	83	53	64	47	42	61	49	47	44	45	30	24	40		
25	84	97	68	87	68	55	78	65	59	60	58	45	31	53		
20	97	108	83	101	85	76	93	82	79	84	86	62	45	73		
15	110	130	90	116	94	83	104	109	120	101	110	67	50	93		
10	102	121	90	109	86	93	100	109	109	109	96	71	58	93		
+5	81	111	76	88	78	80	85	105	105	105	71	72	57	87		
0	81	88	78	78	61	81	79	93	90	94	75	62	66	80		
-5	85	93	80	81	70	82	82	87	94	95	88	68	69	84		
10	87	88	91	84	69	84	84	82	103	104	91	85	79	92		
15	85	86	95	82	70	60	81	66	104	121	99	77	65	91		
20	71	88	86	79	57	44	73	54	76	106	88	61	70	77		
25	48	72	71	62	46	44	58	39	65	75	80	47	47	60		
30	32	48	53	50	34	37	45	31	48	54	56	37	27	43		
35	25	38	39	40	24	26	32	24	34	41	48	30	22	39		
40	21	29	30	27	21	24	25	20	33	40	38	26	16	30		
45	16	21	21	21	17	19	19	18	31	29	22	20	12	22		
50	12	17	15	15	15	15	15	17	31	26	23	16	9	21		
55	10	13	15	13	12	12	13	14	25	27	20	15	6	18		
-60	11	12	13	10	11	13	11	14	19	18	25	19	6	17		
	N	61	74	55	67	52	60		N	59	58	60	51	39	31	50
	S	45	53	53	49	39	42		S	43	58	64	58	43	38	52
	T	52	63	53	58	45	45		T	49	57	61	54	41	33	50

Latitude	Rotation No.				Latitude	Rotation No.				Average 1898-1903				
	1892 Nov. 23,	1893 1894 1895	1896 1897	1897 1892-1897		1898 May 3, 1972 -	1899 Oct. 11, 1972	1900 1901	1902 1903		1903 1898-1903			
+60	16	10	15	17	18	15	15	14	21	15	19	19	18	
55	15	14	16	17	25	15	17	16	23	19	18	22	20	
50	18	15	18	29	24	16	19	17	24	22	23	22	22	
45	18	17	21	23	26	21	21	19	30	24	28	29	27	
40	21	16	22	40	33	25	26	40	23	35	28	38	33	
35	30	22	23	27	31	33	30	35	30	42	36	49	42	
30	39	29	30	48	54	44	39	30	38	52	52	60	54	
25	51	38	41	57	69	64	51	25	49	71	74	77	71	
20	62	58	46	78	82	68	64	20	63	82	98	89	89	
15	73	67	52	87	90	88	74	15	73	107	105	91	97	
10	75	66	51	101	84	90	75	10	71	114	107	88	101	
+5	60	58	59	92	92	93	73	+5	78	112	123	93	107	
0	57	58	66	97	84	95	75	0	90	109	119	98	109	
-5	73	76	74	102	96	100	85	-5	94	115	113	105	114	
10	92	108	92	111	102	100	101	10	97	130	109	121	119	
15	99	100	89	128	109	100	104	15	103	126	105	117	122	
20	79	91	76	103	102	84	89	20	78	109	93	95	100	
25	51	64	62	82	86	67	68	25	60	82	79	70	85	
30	33	44	40	68	72	55	51	30	48	58	56	55	64	
35	24	24	29	49	48	38	34	35	39	47	42	39	48	
40	17	17	21	38	42	28	26	40	31	34	26	32	35	
45	16	16	16	29	29	24	21	45	25	28	20	25	29	
50	14	15	16	23	27	19	18	50	20	20	16	20	22	
55	11	13	14	22	22	20	16	55	15	19	15	18	19	
-60	11	10	15	16	15	16	14	-60	15	19	14	16	17	
	N 41	36	35	55	55	51	45		N 45	63	63	59	64	61
	S 44	49	47	67	64	57	54		S 55	69	62	62	78	68
	T 42	42	40	59	58	53	48		T 48	64	60	59	70	63

Latitude	Rotation No.					Latitude	Rotation No.					Average 1910-1915			
	1904 Oct. 12,	1905 1906	1907 - March	1908 22,	1909 1973		1910 March 23,	1911 1973	1912 - Aug.	1913 31,	1914 1973		1915		
+60	15	10	13	15	17	18	15	14	14	12	21	17	15	16	
55	16	15	16	17	20	19	17	17	14	15	20	20	18	18	
50	17	20	14	16	19	19	17	20	20	18	22	24	20	21	
45	20	20	18	18	18	19	19	21	22	22	23	25	22	23	
40	23	23	21	22	24	22	22	25	27	25	30	28	26	27	
35	28	27	25	30	28	24	27	28	32	35	39	34	29	33	
30	41	36	36	45	44	36	40	36	38	43	50	39	38	41	
25	55	47	49	55	66	53	54	54	50	64	59	51	50	54	
20	67	62	58	72	83	71	69	58	61	74	75	68	57	65	
15	87	75	60	92	96	78	81	75	72	82	74	71	68	73	
10	96	92	59	97	103	83	86	75	72	71	73	71	65	71	
+5	94	92	67	89	106	75	87	64	66	69	80	75	60	69	
0	96	106	83	76	95	71	88	66	72	67	71	76	56	68	
-5	102	109	92	85	86	70	91	60	74	83	74	89	65	75	
10	109	107	95	92	95	81	96	66	78	76	75	76	59	71	
15	98	97	96	93	79	98	94	63	73	69	63	69	51	64	
20	92	83	78	93	82	84	86	67	65	61	56	65	46	59	
25	73	68	65	78	61	66	69	48	51	46	47	54	41	48	
30	58	46	47	52	51	48	50	41	43	42	38	48	34	41	
35	47	40	35	41	41	42	41	33	34	39	30	34	32	34	
40	37	33	31	29	35	34	33	30	33	34	25	31	30	31	
45	29	25	22	25	26	26	32	24	30	25	27	26	29	27	
50	24	22	18	19	22	18	21	20	25	24	26	21	24	24	
55	17	18	16	16	19	19	17	24	24	22	26	21	22	23	
-60	15	14	14	16	16	15	15	20	23	23	25	21	20	22	
	N	50	47	40	50	55	48	N	43	43	46	49	46	40	45
	S	61	59	53	55	54	56	S	43	48	47	45	49	39	45
	T	54	51	45	51	53	51	T	42	45	46	46	46	39	45

Latitude	Rotation No. 1928-1933				Latitude	Rotation No. 1934-1939				Average 1934-1939		
	1928 July 22, 1974	1929 1930 1931 Dec. 30, 1974	1932	1933		1934 Dec. 31, 1974	1935	1936	1937 June 10, 1975		1938	1939
+60	29	23	32	26	21	18	23	22	20	21	19	21
55	29	19	28	23	24	20	24	20	21	22	21	21
50	26	20	35	22	29	25	26	21	21	21	22	22
45	21	23	31	25	27	23	25	24	23	22	19	23
40	25	23	26	26	32	29	27	23	23	22	27	23
35	25	22	30	26	38	27	28	25	24	24	22	25
30	29	26	34	28	44	38	33	30	27	24	28	28
25	30	25	42	43	48	47	39	33	32	26	30	31
20	36	39	55	59	56	63	51	42	38	31	24	32
15	53	45	76	73	63	73	63	41	31	31	32	32
10	55	52	73	87	72	72	68	40	32	32	30	32
+5	67	65	81	95	75	78	77	40	31	37	27	33
0	83	76	98	95	75	76	85	43	31	35	31	34
-5	99	90	100	93	67	62	86	33	27	34	29	30
10	111	88	94	102	61	49	85	27	28	30	27	29
15	102	96	94	96	69	40	84	26	27	27	32	28
20	100	92	96	94	63	53	80	26	26	26	33	28
25	80	83	80	88	62	43	73	25	24	27	30	26
30	74	65	61	78	61	43	64	27	25	24	28	25
35	54	60	53	62	55	40	54	26	24	25	22	24
40	47	55	48	59	63	35	51	27	24	24	23	24
45	47	58	46	47	52	35	48	26	24	21	20	23
50	42	47	52	46	46	34	45	25	22	22	23	22
55	45	53	44	43	43	32	43	25	22	21	22	22
-60	43	45	41	46	42	25	41	22	20	19	24	21
	N 39	35	49	48	46	45	44					
	S 71	70	70	73	58	44	65	N 33	28	28	25	27
	T 54	52	58	59	52	43	53	S 28	25	26	26	26
								T 30	26	26	25	26
												24

Latitude	Rotation No.					Latitude	Rotation No.					Average 1946-1951		
	1940 June 11, 1975	1941 1975	1942 1975	1943 Nov. 19, 1975	1944 1975		1945 1975	1946 Nov. 20, 1975	1947 1975	1948 1975	1949 Apr. 29, 1976		1950 1976	1951 1976
+60	23	9	11	10	10	8	11	8	6	6	3	5	3	5
55	23	14	12	11	10	9	13	8	6	5	3	5	4	5
50	21	9	10	12	11	10	12	9	8	6	4	5	3	6
45	19	8	15	11	12	11	13	10	10	6	5	5	5	7
40	17	10	12	12	15	14	14	11	8	7	4	4	3	6
35	20	10	12	13	16	15	15	11	10	9	5	4	3	7
30	20	9	13	14	17	14	15	13	10	10	5	4	4	8
25	19	11	17	19	15	15	16	15	10	10	6	5	4	9
20	21	14	15	24	23	19	19	17	14	11	5	5	7	10
15	27	14	25	27	26	25	25	20	17	12	6	7	10	12
10	27	22	14	39	29	27	26	27	21	13	6	8	14	15
+5	35	26	39	43	31	26	33	30	19	14	9	9	14	16
0	35	25	42	44	33	31	35	30	20	14	8	9	16	16
-5	30	29	41	32	31	31	33	30	21	13	9	11	16	16
10	32	29	33	30	29	26	29	26	18	13	9	9	14	15
15	27	20	34	22	24	19	25	23	14	11	9	8	9	13
20	22	17	23	18	20	15	19	18	13	9	6	6	8	10
25	22	12	18	14	16	14	16	15	11	8	4	7	7	9
30	20	11	16	11	14	12	14	13	9	8	4	4	6	8
35	19	10	15	12	12	11	13	10	7	8	5	5	10	7
40	17	14	16	10	12	10	13	8	10	7	6	6	7	7
45	19	16	15	11	11	11	13	13	10	7	5	6	5	8
50	21	14	15	10	10	12	13	13	8	5	6	5	8	7
55	21	14	21	10	9	10	14	10	7	5	4	5	6	6
-60	18	12	21	10	9	11	14	9	6	4	4	4	5	5
	N 24	14	18	21	19	17	19	N 16	12	9	5	6	7	9
	S 23	17	24	18	18	16	17	S 17	12	9	6	7	9	10
	T 23	15	20	19	18	16	17	T 16	12	9	6	6	7	9

Latitude	Rotation No.					Average 1952-1957		
	1952 Apr. 30,	1953 1976	1954	1955 - Oct. 8,	1956 1976			
+60	3	3	4	3	6	4		
55	3	4	3	4	7	5		
50	3	3	4	4	6	5		
45	4	5	3	5	6	5		
40	4	5	7	7	8	7		
35	4	5	6	7	9	7		
30	4	4	10	9	12	10		
25	5	7	6	10	12	10		
20	7	9	4	11	13	10		
15	11	13	6	9	11	11		
10	15	13	9	8	12	12		
+5	20	26	9	6	11	12		
0	17	16	8	8	12	12		
-5	17	12	8	9	13	12		
10	19	13	7	7	11	12		
15	11	10	7	7	10	10		
20	9	9	8	6	6	8		
25	7	9	10	6	7	8		
30	6	6	9	5	7	7		
35	6	6	5	4	6	6		
40	6	6	6	5	5	6		
45	7	7	8	4	4	6		
50	6	3	7	4	5	5		
55	7	4	5	4	4	5		
-60	6	5	5	4	4	5		
	N	8	8	6	7	10	8	
	S	10	8	7	6	7	9	8
	T	8	8	7	6	8	11	8