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The Nautical Almanac for the Sun

from 1.5.2021

Original author:
Enno Rodegerdts

Enhancements:
Andrew Bauer

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DIP corrects for height of eye over the surface. This value has to be subtracted from the sextant altitude (H_s). The correction in degrees for height of eye in meters is given by the following formula:

$$d = 0.0293\sqrt{m}$$

This is the first correction (apart from index error) that has to be applied to the measured altitude.

The next correction is for refraction in the earth's atmosphere. As usual this table is correct for 10°C and a pressure of 1010 hPa. This correction has to be applied to apparent altitude (H_a). The exact values can be calculated by the following formula.

$$R_0 = \cot\left(H_a + \frac{7.31}{H_a + 4.4}\right)$$

For other than standard conditions, calculate a correction factor for R_0 by:

$$f = \frac{0.28P}{T + 273}$$

where P is the pressure in hectopascal and T is the temperature in °C.

Semidiameter has to be added for lower limb sights and subtracted for upper limb sights. The value for semidiameter is tabulated in the daily pages.

To correct your sextant altitude H_s do the following: Calculate H_a by

$$H_a = H_s + I - d$$

where I is the sextant's index error and d is DIP. Then calculate the observed altitude H_o by

$$H_o = H_a - R + P \pm SD$$

where R is refraction, P is parallax and SD is the semidiameter.

Sight reduction tables can be downloaded for the US government's internet pages. Search for HO-229 or HO-249. These values can also be calculated with two, relatively simple, formulas:

$$\sin H_c = \sin L \sin d + \cos L \cos d \cos LHA$$

and

$$\cos A = \frac{\sin d - \sin L \sin H_c}{\cos L \cos H_c}$$

where A is the azimuth angle, L is the latitude, d is the declination and LHA is the local hour angle. The azimuth (Z_n) is given by the following rule:

- if the LHA is greater than 180°, $\quad Z_n = A$
- if the LHA is less than 180°, $\quad Z_n = 360° - A$

01	GHA	Dec	04	GHA	Dec	07	GHA	Dec	10	GHA	Dec	13	GHA	Dec
0	180°43.1	N15°04.7	0	180°47.9	N15°58.0	0	180°51.5	N16°48.9	0	180°53.8	N17°37.4	0	180°54.7	N18°23.1
1	195°43.2	05.5	1	195°48.0	58.7	1	195°51.6	49.6	1	195°53.8	38.0	1	195°54.7	23.7
2	210°43.2	06.2	2	210°48.1	15°59.5	2	210°51.6	50.3	2	210°53.8	38.7	2	210°54.7	24.3
3	225°43.3	·· 07.0	3	225°48.1	16°00.2	3	225°51.6	·· 51.0	3	225°53.8	·· 39.3	3	225°54.8	·· 25.0
4	240°43.4	07.7	4	240°48.2	00.9	4	240°51.7	51.7	4	240°53.9	40.0	4	240°54.8	25.6
5	255°43.5	08.5	5	255°48.2	01.6	5	255°51.7	52.4	5	255°53.9	40.6	5	255°54.8	26.2
6	270°43.5	N15°09.2	6	270°48.3	N16°02.3	6	270°51.7	N16°53.1	6	270°53.9	N17°41.3	6	270°54.8	N18°26.8
7	285°43.6	10.0	7	285°48.3	03.1	7	285°51.8	53.8	7	285°53.9	41.9	7	285°54.8	27.4
8	300°43.7	10.7	8	300°48.4	03.8	8	300°51.8	54.4	8	300°53.9	42.6	8	300°54.8	28.0
9	315°43.8	·· 11.5	9	315°48.5	·· 04.5	9	315°51.9	·· 55.1	9	315°54.0	·· 43.2	9	315°54.8	·· 28.6
10	330°43.8	12.2	10	330°48.5	05.2	10	330°51.9	55.8	10	330°54.0	43.9	10	330°54.8	29.3
11	345°43.9	13.0	11	345°48.6	05.9	11	345°51.9	56.5	11	345°54.0	44.5	11	345°54.8	29.9
12	0°44.0	N15°13.7	12	0°48.6	N16°06.7	12	0°52.0	N16°57.2	12	0°54.0	N17°45.2	12	0°54.8	N18°30.5
13	15°44.1	14.5	13	15°48.7	07.4	13	15°52.0	57.9	13	15°54.0	45.8	13	15°54.8	31.1
14	30°44.1	15.3	14	30°48.7	08.1	14	30°52.1	58.5	14	30°54.1	46.5	14	30°54.8	31.7
15	45°44.2	·· 16.0	15	45°48.8	·· 08.8	15	45°52.1	·· 59.2	15	45°54.1	·· 47.1	15	45°54.8	·· 32.3
16	60°44.3	16.7	16	60°48.8	09.5	16	60°52.1	16°59.9	16	60°54.1	47.8	16	60°54.8	32.9
17	75°44.3	17.5	17	75°48.9	10.2	17	75°52.2	17°00.6	17	75°54.1	48.4	17	75°54.8	33.5
18	90°44.4	N15°18.2	18	90°49.0	N16°11.0	18	90°52.2	N17°01.3	18	90°54.1	N17°49.0	18	90°54.8	N18°34.1
19	105°44.5	19.0	19	105°49.0	11.7	19	105°52.2	02.0	19	105°54.2	49.7	19	105°54.8	34.7
20	120°44.6	19.7	20	120°49.1	12.4	20	120°52.3	02.6	20	120°54.2	50.3	20	120°54.8	35.3
21	135°44.6	·· 20.5	21	135°49.1	·· 13.1	21	135°52.3	·· 03.3	21	135°54.2	·· 51.0	21	135°54.8	·· 35.9
22	150°44.7	21.2	22	150°49.2	13.8	22	150°52.3	04.0	22	150°54.2	51.6	22	150°54.8	36.5
23	165°44.8	22.0	23	165°49.2	14.5	23	165°52.4	04.7	23	165°54.2	52.3	23	165°54.8	37.2
	SD.=15.9	d=0.8		SD.=15.9	d=0.7		SD.=15.9	d=0.7		SD.=15.8	d=0.7		SD.=15.8	d=0.6

02	GHA	Dec	05	GHA	Dec	08	GHA	Dec	11	GHA	Dec	14	GHA	Dec
0	180°44.8	N15°22.7	0	180°49.3	N16°15.3	0	180°52.4	N17°05.4	0	180°54.2	N17°52.9	0	180°54.8	N18°37.8
1	195°44.9	23.5	1	195°49.3	16.0	1	195°52.4	06.0	1	195°54.3	53.5	1	195°54.8	38.4
2	210°45.0	24.2	2	210°49.4	16.7	2	210°52.5	06.7	2	210°54.3	54.2	2	210°54.8	39.0
3	225°45.1	·· 25.0	3	225°49.4	·· 17.4	3	225°52.5	·· 07.4	3	225°54.3	·· 54.8	3	225°54.8	·· 39.6
4	240°45.1	25.7	4	240°49.5	18.1	4	240°52.5	08.1	4	240°54.3	55.5	4	240°54.8	40.2
5	255°45.2	26.5	5	255°49.5	18.8	5	255°52.6	08.7	5	255°54.3	56.1	5	255°54.8	40.8
6	270°45.3	N15°27.2	6	270°49.6	N16°19.5	6	270°52.6	N17°09.4	6	270°54.3	N17°56.7	6	270°54.8	N18°41.4
7	285°45.3	27.9	7	285°49.6	20.2	7	285°52.6	10.1	7	285°54.3	57.4	7	285°54.8	42.0
8	300°45.4	28.7	8	300°49.7	20.9	8	300°52.7	10.8	8	300°54.4	58.0	8	300°54.8	42.6
9	315°45.5	·· 29.4	9	315°49.7	·· 21.7	9	315°52.7	·· 11.4	9	315°54.4	·· 58.7	9	315°54.8	·· 43.2
10	330°45.5	30.2	10	330°49.8	22.4	10	330°52.7	12.1	10	330°54.4	59.3	10	330°54.8	43.8
11	345°45.6	30.9	11	345°49.8	23.1	11	345°52.8	12.8	11	345°54.4	17°59.9	11	345°54.7	44.4
12	0°45.7	N15°31.6	12	0°49.9	N16°23.8	12	0°52.8	N17°13.5	12	0°54.4	N18°00.6	12	0°54.7	N18°45.0
13	15°45.7	32.4	13	15°49.9	24.5	13	15°52.8	14.1	13	15°54.4	01.2	13	15°54.7	45.6
14	30°45.8	33.1	14	30°50.0	25.2	14	30°52.9	14.8	14	30°54.4	01.8	14	30°54.7	46.2
15	45°45.9	·· 33.9	15	45°50.0	·· 25.9	15	45°52.9	·· 15.5	15	45°54.5	·· 02.5	15	45°54.7	·· 46.7
16	60°45.9	34.6	16	60°50.1	26.6	16	60°52.9	16.2	16	60°54.5	03.1	16	60°54.7	47.3
17	75°46.0	35.3	17	75°50.1	27.3	17	75°53.0	16.8	17	75°54.5	03.7	17	75°54.7	47.9
18	90°46.1	N15°36.1	18	90°50.2	N16°28.0	18	90°53.0	N17°17.5	18	90°54.5	N18°04.4	18	90°54.7	N18°48.5
19	105°46.1	36.8	19	105°50.2	28.7	19	105°53.0	18.2	19	105°54.5	05.0	19	105°54.7	49.1
20	120°46.2	37.6	20	120°50.3	29.4	20	120°53.0	18.8	20	120°54.5	05.6	20	120°54.7	49.7
21	135°46.3	·· 38.3	21	135°50.3	·· 30.1	21	135°53.1	·· 19.5	21	135°54.5	·· 06.3	21	135°54.7	·· 50.3
22	150°46.3	39.0	22	150°50.4	30.8	22	150°53.1	20.2	22	150°54.5	06.9	22	150°54.7	50.9
23	165°46.4	39.8	23	165°50.4	31.5	23	165°53.1	20.8	23	165°54.6	07.5	23	165°54.7	51.5
	SD.=15.9	d=0.7		SD.=15.9	d=0.7		SD.=15.8	d=0.7		SD.=15.8	d=0.6		SD.=15.8	d=0.6

03	GHA	Dec	06	GHA	Dec	09	GHA	Dec	12	GHA	Dec	15	GHA	Dec
0	180°46.5	N15°40.5	0	180°50.5	N16°32.2	0	180°53.2	N17°21.5	0	180°54.6	N18°08.2	0	180°54.7	N18°52.1
1	195°46.5	41.2	1	195°50.5	32.9	1	195°53.2	22.2	1	195°54.6	08.8	1	195°54.7	52.7
2	210°46.6	42.0	2	210°50.6	33.6	2	210°53.2	22.8	2	210°54.6	09.4	2	210°54.7	53.3
3	225°46.7	·· 42.7	3	225°50.6	·· 34.3	3	225°53.2	·· 23.5	3	225°54.6	·· 10.0	3	225°54.6	·· 53.9
4	240°46.7	43.4	4	240°50.7	35.0	4	240°53.3	24.2	4	240°54.6	10.7	4	240°54.6	54.4
5	255°46.8	44.2	5	255°50.7	35.7	5	255°53.3	24.8	5	255°54.6	11.3	5	255°54.6	55.0
6	270°46.8	N15°44.9	6	270°50.7	N16°36.4	6	270°53.3	N17°25.5	6	270°54.6	N18°11.9	6	270°54.6	N18°55.6
7	285°46.9	45.6	7	285°50.8	37.1	7	285°53.4	26.2	7	285°54.6	12.6	7	285°54.6	56.2
8	300°47.0	46.4	8	300°50.8	37.8	8	300°53.4	26.8	8	300°54.6	13.2	8	300°54.6	56.8
9	315°47.0	·· 47.1	9	315°50.9	·· 38.5	9	315°53.4	·· 27.5	9	315°54.6	·· 13.8	9	315°54.6	·· 57.4
10	330°47.1	47.8	10	330°50.9	39.2	10	330°53.4	28.1	10	330°54.7	14.4	10	330°54.6	58.0
11	345°47.2	48.6	11	345°51.0	39.9	11	345°53.5	28.8	11	345°54.7	15.1	11	345°54.6	58.5
12	0°47.2	N15°49.3	12	0°51.0	N16°40.6	12	0°53.5	N17°29.5	12	0°54.7	N18°15.7	12	0°54.6	N18°59.1
13	15°47.3	50.0	13	15°51.0	41.3	13	15°53.5	30.1	13	15°54.7	16.3	13	15°54.6	18°59.7
14	30°47.3	50.7	14	30°51.1	42.0	14	30°53.5	30.8	14	30°54.7	16.9	14	30°54.5	19°00.3
15	45°47.4	·· 51.5	15	45°51.1	·· 42.7	15	45°53.6	·· 31.4	15	45°54.7	·· 17.5	15	45°54.5	·· 00.9
16	60°47.5	52.2	16	60°51.2	43.4	16	60°53.6	32.1	16	60°54.7	18.2	16	60°54.5	01.5
17	75°47.5	52.9	17	75°51.2	44.1	17	75°53.6	32.8	17	75°54.7	18.8	17	75°54.5	02.0
18	90°47.6	N15°53.7	18	90°51.3	N16°44.8	18	90°53.6	N17°33.4	18	90°54.7	N18°19.4	18	90°54.5	N19°02.6
19	105°47.6	54.4	19	105°51.3	45.5	19	105°53.7	34.1	19	105°54.7	20.0	19	105°54.5	03.2
20	120°47.7	55.1	20	120°51.3	46.2	20	120°53.7	34.7	20	120°54.7	20.6	20	120°54.5	03.8
21	135°47.8	·· 55.8	21	135°51.4	·· 46.9	21	135°53.7	·· 35.4	21	135°54.7	·· 21.3	21	135°54.5	·· 04.4
22	150°47.8	56.6	22	150°51.4	47.6	22	150°53.7	36.0	22	150°54.7	21.9	22	150°54.5	04.9
23	165°47.9	57.3	23	165°51.5	48.2	23	165°53.8	36.7	23	165°54.7	22.5	23	165°54.4	05.5
	SD.=15.9	d=0.7		SD.=15.9	d=0.7		SD.=15.8	d=0.7		SD.=15.8	d=0.6		SD.=15.8	d=0.6

16	GHA	Dec	19	GHA	Dec	22	GHA	Dec	25	GHA	Dec	28	GHA	Dec
0	180°54.4	N19°06.1	0	180°52.9	N19°46.1	0	180°50.1	N20°23.2	0	180°46.3	N20°57.0	0	180°41.3	N21°27.6
1	195°54.4	06.7	1	195°52.9	46.7	1	195°50.1	23.6	1	195°46.2	57.5	1	195°41.2	28.0
2	210°54.4	07.2	2	210°52.8	47.2	2	210°50.1	24.1	2	210°46.2	57.9	2	210°41.2	28.4
3	225°54.4	·· 07.8	3	225°52.8	·· 47.7	3	225°50.0	·· 24.6	3	225°46.1	·· 58.3	3	225°41.1	·· 28.8
4	240°54.4	08.4	4	240°52.8	48.3	4	240°50.0	25.1	4	240°46.0	58.8	4	240°41.0	29.2
5	255°54.4	09.0	5	255°52.7	48.8	5	255°49.9	25.6	5	255°46.0	59.2	5	255°40.9	29.6
6	270°54.3	N19°09.5	6	270°52.7	N19°49.3	6	270°49.9	N20°26.1	6	270°45.9	N20°59.7	6	270°40.8	N21°30.0
7	285°54.3	10.1	7	285°52.7	49.9	7	285°49.8	26.6	7	285°45.8	21°00.1	7	285°40.8	30.4
8	300°54.3	10.7	8	300°52.6	50.4	8	300°49.8	27.1	8	300°45.8	00.6	8	300°40.7	30.8
9	315°54.3	·· 11.3	9	315°52.6	·· 50.9	9	315°49.7	·· 27.6	9	315°45.7	·· 01.0	9	315°40.6	·· 31.2
10	330°54.3	11.8	10	330°52.6	51.5	10	330°49.7	28.0	10	330°45.6	01.4	10	330°40.5	31.6
11	345°54.3	12.4	11	345°52.5	52.0	11	345°49.6	28.5	11	345°45.6	01.9	11	345°40.5	32.0
12	0°54.3	N19°13.0	12	0°52.5	N19°52.5	12	0°49.6	N20°29.0	12	0°45.5	N21°02.3	12	0°40.4	N21°32.4
13	15°54.2	13.5	13	15°52.5	53.1	13	15°49.5	29.5	13	15°45.5	02.8	13	15°40.3	32.8
14	30°54.2	14.1	14	30°52.4	53.6	14	30°49.5	30.0	14	30°45.4	03.2	14	30°40.2	33.2
15	45°54.2	·· 14.7	15	45°52.4	·· 54.1	15	45°49.4	·· 30.5	15	45°45.3	·· 03.6	15	45°40.1	·· 33.6
16	60°54.2	15.2	16	60°52.4	54.6	16	60°49.4	31.0	16	60°45.3	04.1	16	60°40.1	34.0
17	75°54.2	15.8	17	75°52.3	55.2	17	75°49.3	31.4	17	75°45.2	04.5	17	75°40.0	34.3
18	90°54.2	N19°16.4	18	90°52.3	N19°55.7	18	90°49.3	N20°31.9	18	90°45.1	N21°05.0	18	90°39.9	N21°34.7
19	105°54.1	16.9	19	105°52.3	56.2	19	105°49.2	32.4	19	105°45.1	05.4	19	105°39.8	35.1
20	120°54.1	17.5	20	120°52.2	56.7	20	120°49.2	32.9	20	120°45.0	05.8	20	120°39.7	35.5
21	135°54.1	·· 18.1	21	135°52.2	·· 57.3	21	135°49.1	·· 33.4	21	135°44.9	·· 06.3	21	135°39.7	·· 35.9
22	150°54.1	18.6	22	150°52.2	57.8	22	150°49.1	33.8	22	150°44.9	06.7	22	150°39.6	36.3
23	165°54.1	19.2	23	165°52.1	58.3	23	165°49.0	34.3	23	165°44.8	07.1	23	165°39.5	36.7
	SD.=15.8	d=0.6		SD.=15.8	d=0.5		SD.=15.8	d=0.5		SD.=15.8	d=0.4		SD.=15.8	d=0.4

17	GHA	Dec	20	GHA	Dec	23	GHA	Dec	26	GHA	Dec	29	GHA	Dec
0	180°54.0	N19°19.8	0	180°52.1	N19°58.8	0	180°49.0	N20°34.8	0	180°44.7	N21°07.6	0	180°39.4	N21°37.1
1	195°54.0	20.3	1	195°52.1	59.3	1	195°48.9	35.3	1	195°44.7	08.0	1	195°39.3	37.5
2	210°54.0	20.9	2	210°52.0	19°59.9	2	210°48.9	35.7	2	210°44.6	08.4	2	210°39.3	37.8
3	225°54.0	·· 21.5	3	225°52.0	20°00.4	3	225°48.8	·· 36.2	3	225°44.5	·· 08.9	3	225°39.2	·· 38.2
4	240°54.0	22.0	4	240°52.0	00.9	4	240°48.8	36.7	4	240°44.5	09.3	4	240°39.1	38.6
5	255°54.0	22.6	5	255°51.9	01.4	5	255°48.7	37.2	5	255°44.4	09.7	5	255°39.0	39.0
6	270°53.9	N19°23.1	6	270°51.9	N20°01.9	6	270°48.7	N20°37.6	6	270°44.3	N21°10.2	6	270°38.9	N21°39.4
7	285°53.9	23.7	7	285°51.8	02.5	7	285°48.6	38.1	7	285°44.3	10.6	7	285°38.8	39.8
8	300°53.9	24.3	8	300°51.8	03.0	8	300°48.6	38.6	8	300°44.2	11.0	8	300°38.8	40.1
9	315°53.9	·· 24.8	9	315°51.8	·· 03.5	9	315°48.5	·· 39.1	9	315°44.1	·· 11.4	9	315°38.7	·· 40.5
10	330°53.8	25.4	10	330°51.7	04.0	10	330°48.5	39.5	10	330°44.1	11.9	10	330°38.6	40.9
11	345°53.8	25.9	11	345°51.7	04.5	11	345°48.4	40.0	11	345°44.0	12.3	11	345°38.5	41.3
12	0°53.8	N19°26.5	12	0°51.7	N20°05.0	12	0°48.3	N20°40.5	12	0°43.9	N21°12.7	12	0°38.4	N21°41.7
13	15°53.8	27.0	13	15°51.6	05.5	13	15°48.3	40.9	13	15°43.9	13.1	13	15°38.3	42.0
14	30°53.8	27.6	14	30°51.6	06.1	14	30°48.2	41.4	14	30°43.8	13.6	14	30°38.3	42.4
15	45°53.7	·· 28.2	15	45°51.5	·· 06.6	15	45°48.2	·· 41.9	15	45°43.7	·· 14.0	15	45°38.2	·· 42.8
16	60°53.7	28.7	16	60°51.5	07.1	16	60°48.1	42.4	16	60°43.6	14.4	16	60°38.1	43.2
17	75°53.7	29.3	17	75°51.5	07.6	17	75°48.1	42.8	17	75°43.6	14.8	17	75°38.0	43.5
18	90°53.7	N19°29.8	18	90°51.4	N20°08.1	18	90°48.0	N20°43.3	18	90°43.5	N21°15.3	18	90°37.9	N21°43.9
19	105°53.7	30.4	19	105°51.4	08.6	19	105°48.0	43.8	19	105°43.4	15.7	19	105°37.8	44.3
20	120°53.6	30.9	20	120°51.3	09.1	20	120°47.9	44.2	20	120°43.4	16.1	20	120°37.8	44.7
21	135°53.6	·· 31.5	21	135°51.3	·· 09.6	21	135°47.9	·· 44.7	21	135°43.3	·· 16.5	21	135°37.7	·· 45.0
22	150°53.6	32.0	22	150°51.3	10.1	22	150°47.8	45.1	22	150°43.2	16.9	22	150°37.6	45.4
23	165°53.6	32.6	23	165°51.2	10.7	23	165°47.7	45.6	23	165°43.2	17.4	23	165°37.5	45.8
	SD.=15.8	d=0.6		SD.=15.8	d=0.5		SD.=15.8	d=0.5		SD.=15.8	d=0.4		SD.=15.8	d=0.4

18	GHA	Dec	21	GHA	Dec	24	GHA	Dec	27	GHA	Dec	30	GHA	Dec
0	180°53.5	N19°33.1	0	180°51.2	N20°11.2	0	180°47.7	N20°46.1	0	180°43.1	N21°17.8	0	180°37.4	N21°46.2
1	195°53.5	33.7	1	195°51.1	11.7	1	195°47.6	46.5	1	195°43.0	18.2	1	195°37.3	46.5
2	210°53.5	34.2	2	210°51.1	12.2	2	210°47.6	47.0	2	210°42.9	18.6	2	210°37.2	46.9
3	225°53.5	·· 34.8	3	225°51.1	·· 12.7	3	225°47.5	·· 47.5	3	225°42.9	·· 19.0	3	225°37.2	·· 47.3
4	240°53.4	35.3	4	240°51.0	13.2	4	240°47.5	47.9	4	240°42.8	19.4	4	240°37.1	47.6
5	255°53.4	35.9	5	255°51.0	13.7	5	255°47.4	48.4	5	255°42.7	19.8	5	255°37.0	48.0
6	270°53.4	N19°36.4	6	270°50.9	N20°14.2	6	270°47.3	N20°48.8	6	270°42.6	N21°20.3	6	270°36.9	N21°48.4
7	285°53.4	37.0	7	285°50.9	14.7	7	285°47.3	49.3	7	285°42.6	20.7	7	285°36.8	48.7
8	300°53.3	37.5	8	300°50.9	15.2	8	300°47.2	49.8	8	300°42.5	21.1	8	300°36.7	49.1
9	315°53.3	·· 38.0	9	315°50.8	·· 15.7	9	315°47.2	·· 50.2	9	315°42.4	·· 21.5	9	315°36.6	·· 49.5
10	330°53.3	38.6	10	330°50.8	16.2	10	330°47.1	50.7	10	330°42.4	21.9	10	330°36.5	49.8
11	345°53.2	39.1	11	345°50.7	16.7	11	345°47.1	51.1	11	345°42.3	22.3	11	345°36.5	50.2
12	0°53.2	N19°39.7	12	0°50.7	N20°17.2	12	0°47.0	N20°51.6	12	0°42.2	N21°22.7	12	0°36.4	N21°50.6
13	15°53.2	40.2	13	15°50.6	17.7	13	15°46.9	52.0	13	15°42.1	23.1	13	15°36.3	50.9
14	30°53.2	40.8	14	30°50.6	18.2	14	30°46.9	52.5	14	30°42.1	23.6	14	30°36.2	51.3
15	45°53.1	·· 41.3	15	45°50.6	·· 18.7	15	45°46.8	·· 52.9	15	45°42.0	·· 24.0	15	45°36.1	·· 51.6
16	60°53.1	41.8	16	60°50.5	19.2	16	60°46.8	53.4	16	60°41.9	24.4	16	60°36.0	52.0
17	75°53.1	42.4	17	75°50.5	19.7	17	75°46.7	53.9	17	75°41.8	24.8	17	75°35.9	52.4
18	90°53.1	N19°42.9	18	90°50.4	N20°20.2	18	90°46.6	N20°54.3	18	90°41.8	N21°25.2	18	90°35.8	N21°52.7
19	105°53.0	43.5	19	105°50.4	20.7	19	105°46.6	54.8	19	105°41.7	25.6	19	105°35.7	53.1
20	120°53.0	44.0	20	120°50.3	21.2	20	120°46.5	55.2	20	120°41.6	26.0	20	120°35.7	53.4
21	135°53.0	·· 44.5	21	135°50.3	·· 21.7	21	135°46.5	·· 55.7	21	135°41.5	·· 26.4	21	135°35.6	·· 53.8
22	150°52.9	45.1	22	150°50.2	22.2	22	150°46.4	56.1	22	150°41.5	26.8	22	150°35.5	54.2
23	165°52.9	45.6	23	165°50.2	22.7	23	165°46.3	56.6	23	165°41.4	27.2	23	165°35.4	54.5
	SD.=15.8	d=0.5		SD.=15.8	d=0.5		SD.=15.8	d=0.5		SD.=15.8	d=0.4		SD.=15.8	d=0.4