

1994年11月3日 皆既日食の予報

(NASA Reference Publication 1318 より抜粋)

編集部

（概要）

1994年11月3日（木）、西半球の南半分で皆既日食が見られる。月の本影は南米大陸のペルー南部、チリ北部、ボリビア、パラグアイそしてブラジル南部を通る。皆既帯は南大西洋を横切り、アフリカ大陸の南方をまわり込む。その間、小さな Gough島を除いて、陸地にはかからない。そしてマダガスカル南方のインド洋上で日の入りとともに終わる。月の半影が通るより広い地域で、部分日食が見られる。南米、メキシコ南部と中米、そして赤道より南のアフリカなどの地域である。（図1、2）

（日食帯とそこでの見え方）

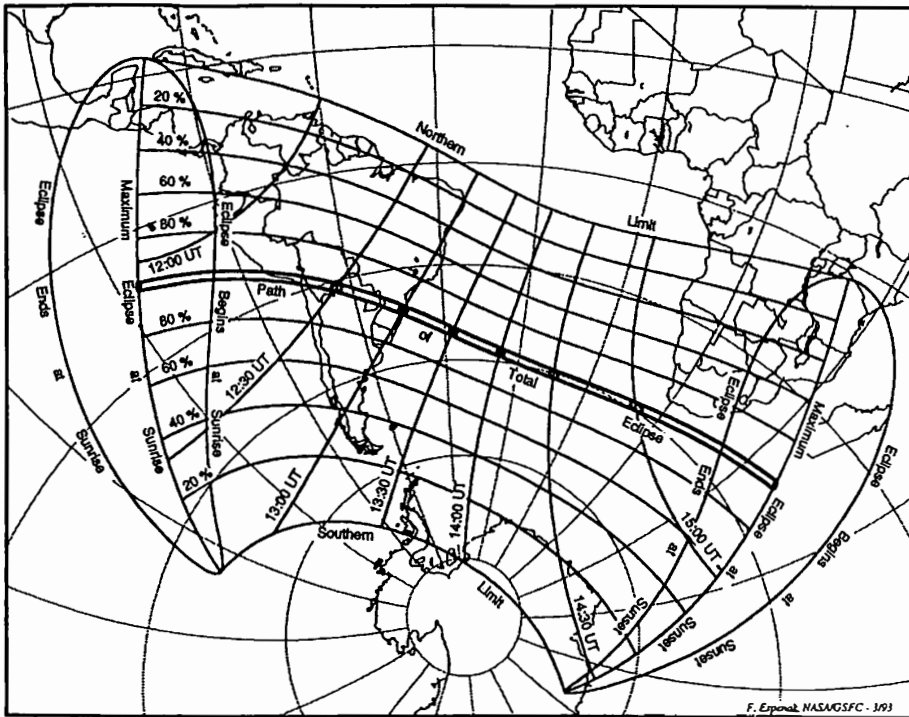
1991年以来、陸上で見られる最初の皆既食である今回の日食は、月が近地点に達するおよそ10時間前に起こる。皆既帯はペルーの西およそ2000 kmの太平洋上に始まる。日の出とともに本影が地表に投影されるとき（12:02 UT）、皆既帯の幅は135 km、皆既継続時間は1分52秒である。南東に進む本影は12:12 UT、ペルーの南海岸に上陸する（図3、4）。神秘的なナスカの地上絵は、わずかに皆既帯からはずれている。その後7分間、月の影はペルーの海岸線と平行して走る。ここでの皆既継続時間は2分45秒に達し、早朝の太陽は東の地平線から27度の高度にある。標高約2800mの Arequipa は北限界線の近くに位置し、12:15 UT、58秒間の皆既が見られる。海岸に下ったところの Mollendo は、中心線上に位置するが、頻繁に発生する海洋性の雲が2分51秒の皆既を覆い隠してしまうだろう。内陸に進む皆既帯は、12:20 UTごろにペルー・チリの国境を越え、アンデス西部に入るにつれて標高を高めていく。海拔1300mにある小さな町 Putreは中心線上にあり、ここでの継続時間は2分59秒、太陽高度は32度になる。

地表を秒速1402 kmで進む本影は、その後端がペルーからチリに入る前に、前端はチリとボリビアの国境を越えてしまう。幅175 kmの皆既帯が、ボリビア西部のアルチプラノ（大高原地帯）を横切る。その地域はほとんど3000~4000mの高地で、皆既帯は完全に砂漠気候の所を通る。残念なことに、この地域は宿泊施設がほとんどない上に、現地入りはきわめてむずかしい。もっと東、銀鉱山の町 Potosi は中心線の45 km北に位置し、2分43秒の皆既が見られる。12:30 UT、本影の先端はパラグアイの西部に入る。中心線上での継続時間は3分19秒。太陽高度は41度。本影のスピードは秒速1088 kmになる（図5）。Asuncionは南東に進んだ皆既帯の南限界線に位置し、12:43 UTには41秒の皆既が見られる。しかしこの時、中心線上では3分40秒の皆既が、高度49度で見られるはずだ。アルゼンチン北東部の狭い地域を通り過ぎた本影は、12:48 UT、ブラジル南部へと進む。Porto Alegreは皆既帯の南120 kmにあり、13:00 UTに食分0.966の部分食が見られる。中心線にある Criciuma では、4分2秒の皆既が高度59

度で見られるだろう。

ブラジルの東海岸に達した後、本影は南大西洋に出て、13:39 UTに食最大になる^(*)。この地点の継続時間は4分22秒に達し、太陽高度は69度。皆既帯の幅は189 km、本影の移動スピードは秒速0.673 kmになる。その後の皆既帯はずっと洋上を進み、たった一つの例外を除いて陸地にはかからない。Gough 島では、14:29 UTに高度53度で継続時間3分46秒の皆既が見られる。その後15:10 UTまでに、月の影は南アフリカの南の沖350 kmを通る。Cape Town では15:08 UTに、食分0.886というきわどい部分食が見られる。そして15:16 UT、マダガスカル以南750 kmのインド洋上で、ついに本影は日の入りとともに地表を離れる。3時間15分間に、月の影は14000 kmに長さにわたって地表を走り、地球表面の0.48%を覆うことになる。

Figure 2: Stereographic Projection Map of The Eclipse Path
Total Solar Eclipse of 3 Nov 1994



(*) 食最大は、月の本影の軸と地球の中心の距離が最小になるときに起こる。しかし、食最大の瞬間は食分が最大になる瞬間や（皆既の場合）継続時間最大のときとはわずかに異なる。がその違いは無視できるほどである。

Figure 4: THE ECLIPSE PATH IN WESTERN SOUTH AMERICA
 Total Solar Eclipse of 3 Nov 1994

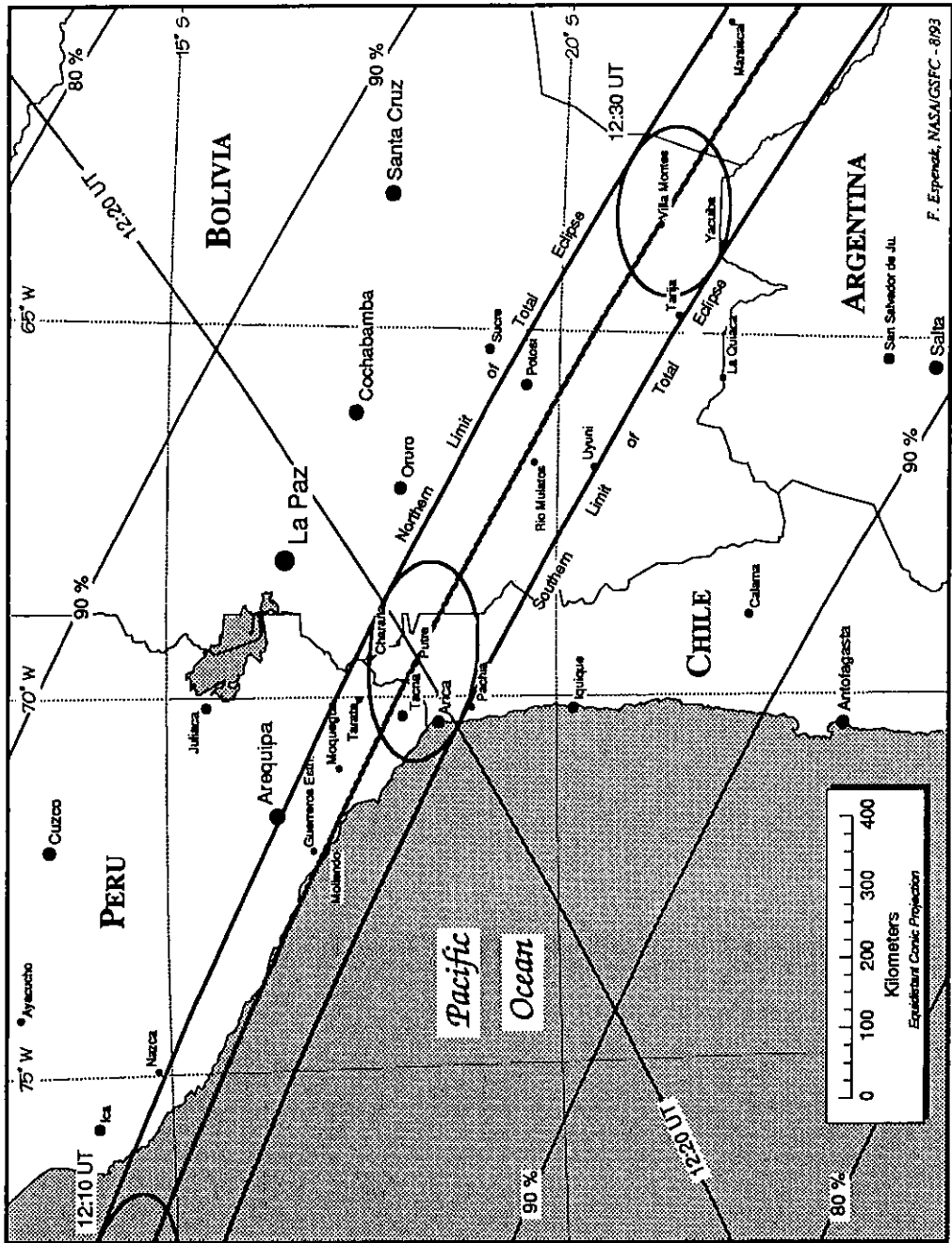
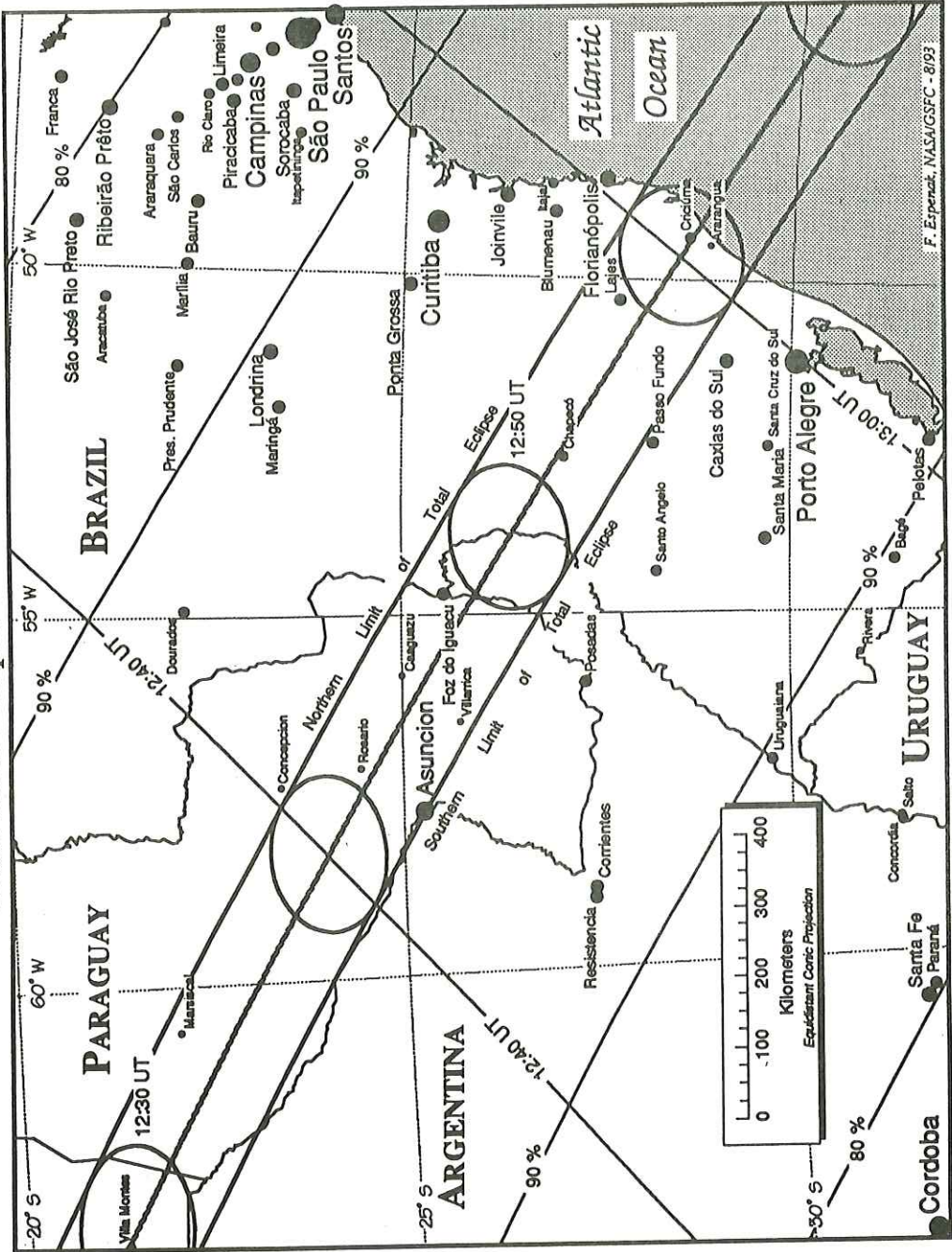


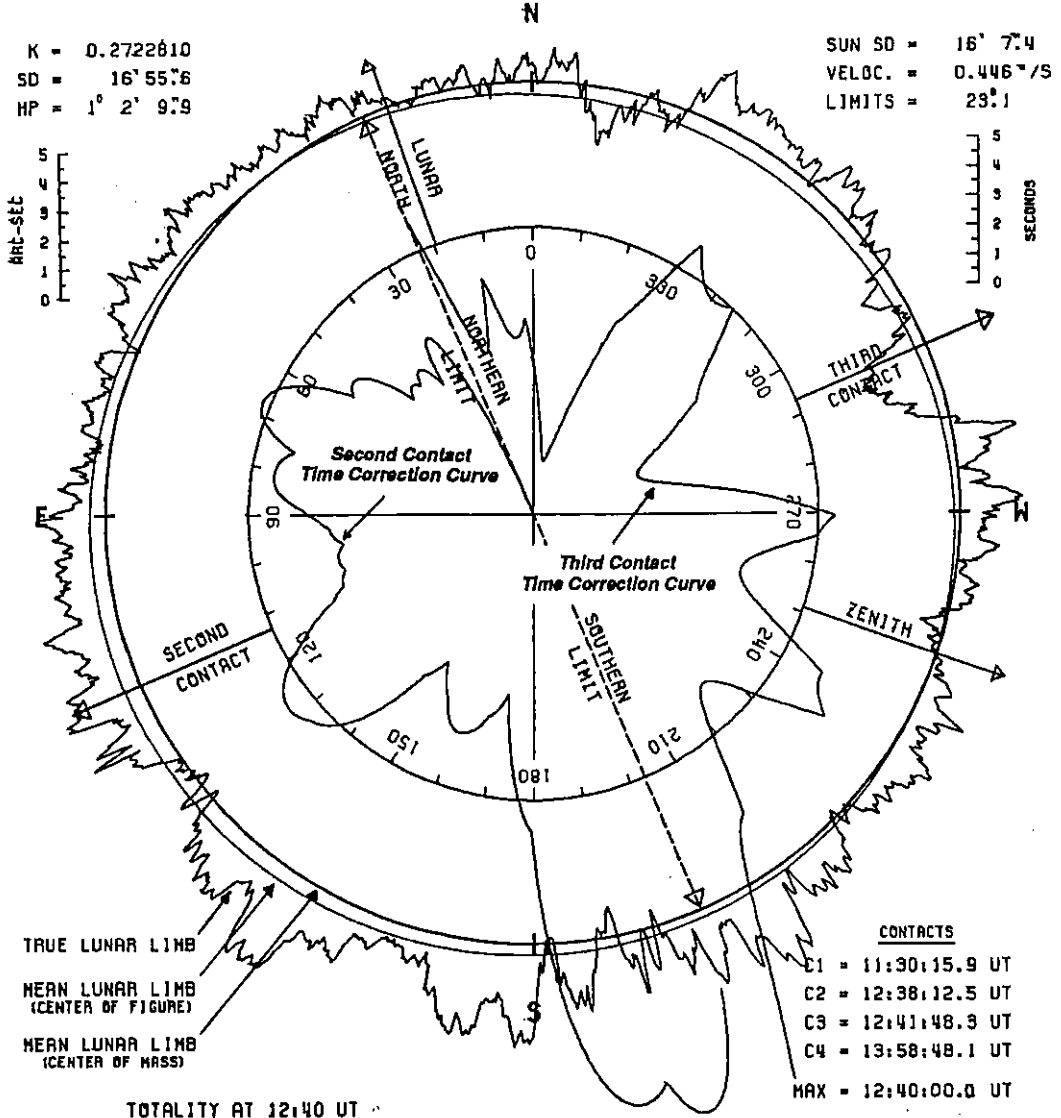
Figure 5: THE ECLIPSE PATH IN EASTERN SOUTH AMERICA
 Total Solar Eclipse of 3 Nov 1994



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Figure 6: THE LUNAR LIMB PROFILE AT 12:40 UT
Total Solar Eclipse of 3 Nov 1994

L = -0.30 B = 0.10 C = 19.65



K = 0.2722810
SD = 16' 55".6
HP = 1° 2' 9.9

SUN SD = 16' 7.4
VELOC. = 0.446"/S
LIMITS = 23°.1

CONTACTS	
C1	= 11:30:15.9 UT
C2	= 12:38:12.5 UT
C3	= 12:41:48.3 UT
C4	= 13:58:48.1 UT
MAX	= 12:40:00.0 UT

TOTALITY AT 12:40 UT

LAT = 24° 0' 7S MAXIMUM ALT = 47.7 DURATION = 3:35.8
LONG = 58° 13' 4W ECLIPSE : AZ = 86.2 RATIO = 1.04974

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Figure 10: THE SKY DURING TOTALITY AS SEEN AT 12:20 UT

Total Solar Eclipse of 3 Nov 1994

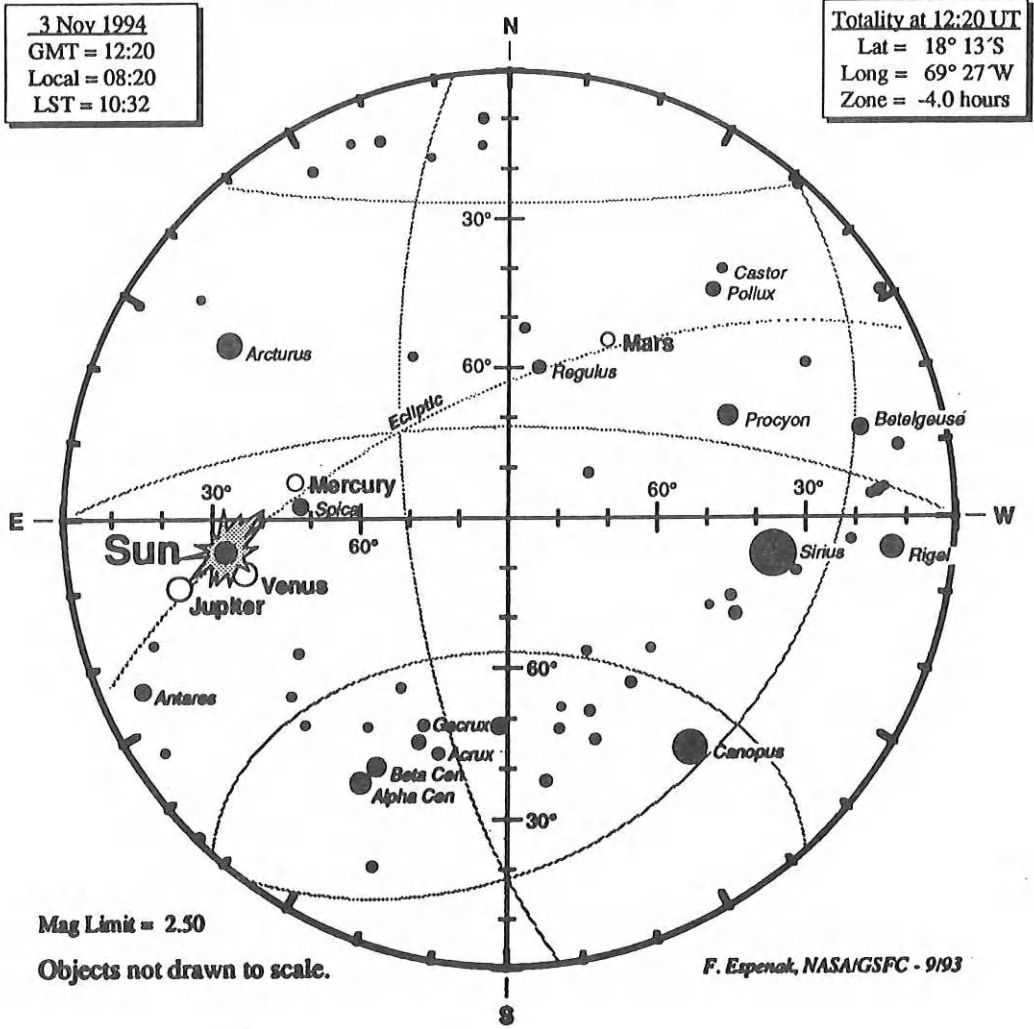


Figure 11: THE SKY DURING TOTALITY AS SEEN AT 13:00 UT

Total Solar Eclipse of 3 Nov 1994

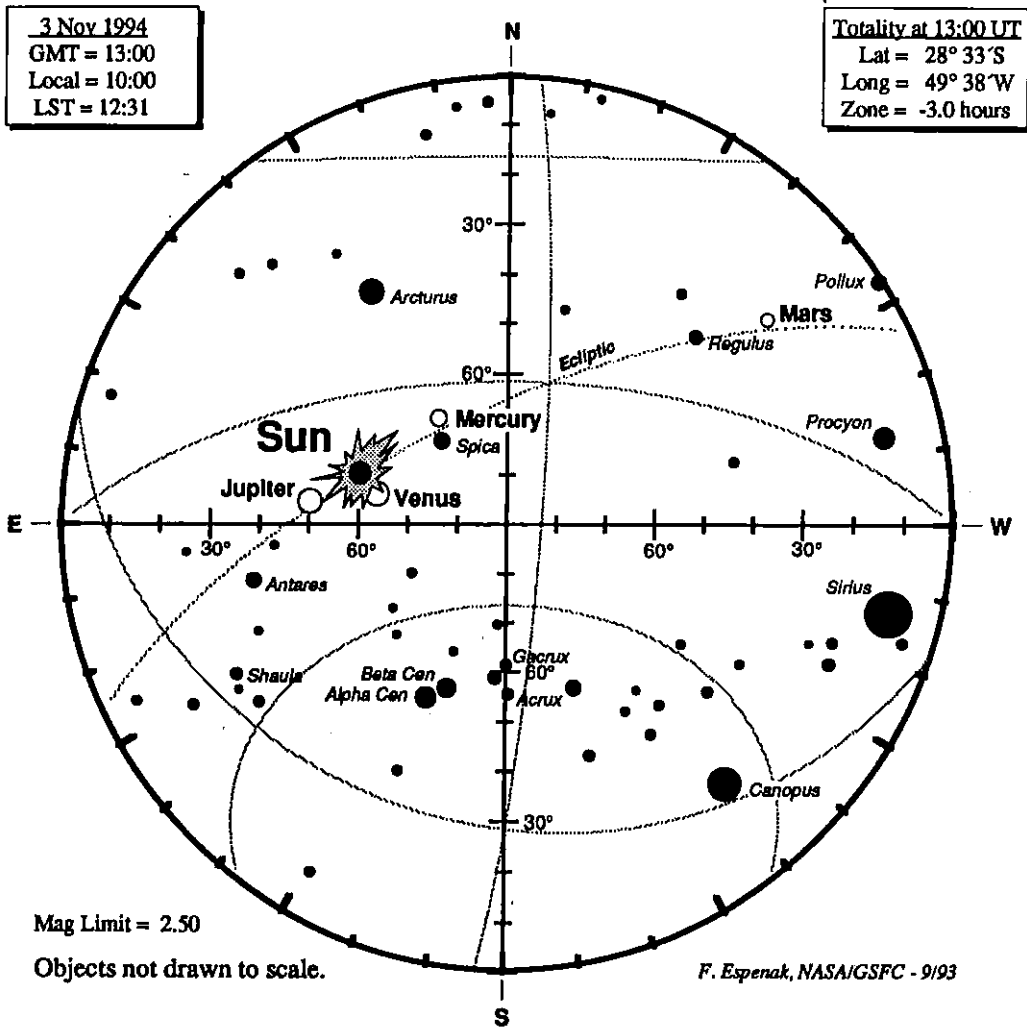


Table 1

ELEMENTS OF THE TOTAL SOLAR ECLIPSE OF 3 NOVEMBER 1994

Geocentric Conjunction 13:48:07.57 TDT J.D. = 2449660.075088
of Sun & Moon in R.A.: (=13:47:07.87 UT)

Instant of 13:40:06.02 TDT J.D. = 2449660.069514
Greatest Eclipse: (=13:39:06.32 UT)

Geocentric Coordinates of Sun & Moon at Greatest Eclipse (DE200/LE200):

Sun:	R.A. = 14h 33m 55.825s	Moon:	R.A. = 14h 33m 36.503s
	Dec. = -15°-05'-51.16"		Dec. = -15°-26'-53.71"
Semi-Diameter =	16' 07.43"	Semi-Diameter =	16' 43.07"
Eq.Hor.Par. =	8.87"	Eq.Hor.Par. =	1° 01' 21.06"
Δ R.A. =	9.863s/h	Δ R.A. =	154.292s/h
Δ Dec. =	-46.79"/h	Δ Dec. =	-509.87"/h

Lunar Radius k1 = 0.2725076 (Penumbra) Shift in Δb = 0.0"
Constants: k2 = 0.2722810 (Umbra) Lunar Position: Δl = 0.0"

Geocentric Libration: l = -0.8° Brown Lun. No. = 1173
(Optical + Physical) b = 0.5° Saros Series = 133 (44/72)
c = 19.7° Ephemeris = {DE200/LE200}

Eclipse Magnitude = 1.05351 Gamma = -0.35216 ΔT = 59.7 s

Polynomial Besselian Elements for: 3 Nov 1994 14:00:00.0 TDT (=t₀)

n	x	y	d	l ₁	l ₂	μ
0	0.1125604	-0.3855728	-15.1009045	0.5366173	-0.0094926	394.101532
1	0.5687835	-0.1257806	-0.0126857	-0.0000313	-0.0000312	15.001422
2	0.0000207	0.0001233	0.0000033	-0.0000130	-0.0000130	-0.000003
3	-0.0000097	0.0000020				

Tan f₁ = 0.0047133 Tan f₂ = 0.0046898

At time 't₁' (decimal hours), each besselian element is evaluated by:

$$x = x_0 + x_1*t + x_2*t^2 + x_3*t^3 \quad (\text{or } x = \sum [x_n*t^n]; n = 0 \text{ to } 3)$$

where: t = t₁ - t₀ (decimal hours) and t₀ = 17.000

Note that all times are expressed in Terrestrial Dynamical Time (TDT).

Saros Series 133: Member 44 of 72 eclipses in series.

Table 2

**SHADOW CONTACTS AND CIRCUMSTANCES
TOTAL SOLAR ECLIPSE OF 3 NOVEMBER 1994**

				$\Delta T = 59.7 \text{ s}$	
				$= 000^{\circ}15.0' \text{ E}$	
		Terrestrial Dynamical Time	Latitude	Ephemeris Longitude†	True Longitude*
		h m s			
External/Internal Contacts of Penumbra:	P1	11:06:00.2	00°43.1'S	080°47.5'W	080°32.6'W
	P2	13:09:15.5	35°49.7'S	122°38.4'W	122°23.4'W
	P3	14:10:44.1	58°51.5'S	079°44.6'E	079°59.5'E
	P4	16:14:07.0	24°53.0'S	029°34.2'E	029°49.2'E
Extreme North/South Limits of Penumbral Path:	N1	11:52:15.3	22°12.4'N	085°50.9'W	085°36.0'W
	S1	12:55:47.6	48°12.1'S	125°35.9'W	125°20.9'W
	N2	15:28:01.2	01°59.7'S	034°26.6'E	034°41.6'E
	S2	14:24:08.4	69°11.7'S	095°08.0'E	095°22.9'E
External/Internal Contacts of Umbra:	U1	12:02:38.6	07°41.6'S	096°50.7'W	096°35.7'W
	U2	12:04:43.9	08°05.5'S	097°28.6'W	097°13.6'W
	U3	15:15:21.6	32°10.2'S	046°50.4'E	047°05.3'E
	U4	15:17:28.0	31°46.5'S	046°09.8'E	046°24.8'E
Extreme North/South Limits of Umbral Path:	N1	12:03:13.5	07°19.8'S	096°53.5'W	096°38.5'W
	S1	12:04:09.8	08°27.1'S	097°26.0'W	097°11.0'W
	N2	15:16:53.0	31°24.9'S	046°10.4'E	046°25.3'E
	S2	15:15:55.9	32°31.7'S	046°50.0'E	047°05.0'E
Extreme Limits of Center Line:	C1	12:03:41.2	07°53.4'S	097°09.6'W	096°54.6'W
	C2	15:16:24.8	31°58.3'S	046°30.0'E	046°45.0'E
Instant of Greatest Eclipse:	G0	13:40:06.0	35°21.4'S	034°28.4'W	034°13.4'W
Circumstances at Greatest Eclipse:	Sun's Altitude = 69.1°		Path Width = 189.0 km		
	Sun's Azimuth = 15.3°		Central Duration = 04m21.9s		

† Ephemeris Longitude is the terrestrial dynamical longitude assuming a uniformly rotating Earth.

* True Longitude is calculated by correcting the Ephemeris Longitude for the non-uniform rotation of Earth.

(T.L. = E.L. - 1.002738* ΔT /240, where ΔT (in seconds) = TDT - UT)

Note: Longitude is measured positive to the East.

Since ΔT is not known in advance, the value used in the predictions is an extrapolation based on pre-1992 measurements. Nevertheless, the actual value is expected to fall within ± 0.3 seconds of the estimated ΔT used here.

Table 7
MAPPING COORDINATES FOR THE UMBRAL PATH

Longitude	Latitude of:			Universal Time at:			Circumstances on the Center Line							
	Northern	Southern	Center	Northern	Southern	Center	Sun	Sun	Path	Center				
	Limit	Limit	Line	Limit	Limit	Line	Alt	Az.	Width	Durat.				
			h	m	s	h	m	s	h	m	s	°	°	km
097°00.0'W	-	08°30.1'S	-	-	12:02:37	-								
096°00.0'W	07°14.8'S	08°48.0'S	08°08.4'S	12:02:10	12:03:16	12:02:42	1	105	137	01m54s				
095°00.0'W	07°48.6'S	09°05.0'S	08°25.3'S	12:02:17	12:03:16	12:02:45	2	105	138	01m55s				
094°00.0'W	08°03.4'S	09°22.1'S	08°42.6'S	12:02:20	12:03:22	12:02:51	3	105	139	01m57s				
093°00.0'W	08°20.6'S	09°40.4'S	09°00.3'S	12:02:27	12:03:31	12:02:58	4	105	141	01m59s				
092°00.0'W	08°38.3'S	09°59.1'S	09°18.5'S	12:02:36	12:03:42	12:03:08	5	104	142	02m01s				
091°00.0'W	08°56.5'S	10°18.2'S	09°37.1'S	12:02:47	12:03:56	12:03:21	6	104	144	02m03s				
090°00.0'W	09°15.0'S	10°37.8'S	09°56.2'S	12:03:01	12:04:12	12:03:36	7	104	145	02m05s				
089°00.0'W	09°34.0'S	10°57.8'S	10°15.7'S	12:03:17	12:04:31	12:03:53	8	104	146	02m07s				
088°00.0'W	09°53.5'S	11°18.3'S	10°35.6'S	12:03:36	12:04:52	12:04:13	10	104	148	02m10s				
087°00.0'W	10°13.4'S	11°39.3'S	10°56.1'S	12:03:57	12:05:17	12:04:36	11	103	149	02m12s				
086°00.0'W	10°33.8'S	12°00.7'S	11°17.0'S	12:04:22	12:05:44	12:05:02	12	103	151	02m14s				
085°00.0'W	10°54.6'S	12°22.6'S	11°38.4'S	12:04:49	12:06:14	12:05:30	13	103	152	02m16s				
084°00.0'W	11°16.0'S	12°45.1'S	12°00.2'S	12:05:19	12:06:47	12:06:02	14	103	154	02m19s				
083°00.0'W	11°37.8'S	13°08.0'S	12°22.6'S	12:05:52	12:07:23	12:06:36	15	102	155	02m21s				
082°00.0'W	12°00.1'S	13°31.4'S	12°45.4'S	12:06:28	12:08:02	12:07:14	16	102	157	02m24s				
081°00.0'W	12°22.8'S	13°55.3'S	13°08.8'S	12:07:07	12:08:44	12:07:55	18	102	158	02m26s				
080°00.0'W	12°46.1'S	14°19.7'S	13°32.6'S	12:07:49	12:09:30	12:08:39	19	102	160	02m29s				
079°00.0'W	13°09.8'S	14°44.6'S	13°56.9'S	12:08:35	12:10:19	12:09:26	20	101	161	02m31s				
078°00.0'W	13°34.0'S	15°10.0'S	14°21.7'S	12:09:24	12:11:12	12:10:17	21	101	162	02m34s				
077°00.0'W	13°58.7'S	15°35.8'S	14°47.0'S	12:10:17	12:12:08	12:11:11	23	100	164	02m37s				
076°00.0'W	14°24.0'S	16°02.2'S	15°12.8'S	12:11:13	12:13:08	12:12:09	24	100	165	02m40s				
075°00.0'W	14°49.6'S	16°29.1'S	15°39.0'S	12:12:12	12:14:11	12:13:11	25	100	167	02m42s				
074°00.0'W	15°15.8'S	16°56.4'S	16°05.8'S	12:13:16	12:15:18	12:14:16	26	99	168	02m45s				
073°00.0'W	15°42.5'S	17°24.2'S	16°33.0'S	12:14:23	12:16:29	12:15:25	28	99	169	02m48s				
072°00.0'W	16°09.6'S	17°52.5'S	17°00.7'S	12:15:34	12:17:44	12:16:38	29	98	171	02m51s				
071°00.0'W	16°37.2'S	18°21.3'S	17°28.9'S	12:16:48	12:19:03	12:17:54	30	98	172	02m54s				
070°00.0'W	17°05.2'S	18°50.4'S	17°57.5'S	12:18:07	12:20:25	12:19:15	32	97	173	02m58s				
069°00.0'W	17°33.7'S	19°20.0'S	18°26.5'S	12:19:30	12:21:52	12:20:40	33	96	175	03m01s				
068°00.0'W	18°02.6'S	19°50.0'S	18°56.0'S	12:20:56	12:23:22	12:22:08	34	96	176	03m04s				
067°00.0'W	18°31.9'S	20°20.4'S	19°25.8'S	12:22:27	12:24:57	12:23:41	36	95	177	03m07s				
066°00.0'W	19°01.6'S	20°51.2'S	19°56.1'S	12:24:01	12:26:35	12:25:17	37	94	178	03m10s				
065°00.0'W	19°31.7'S	21°22.3'S	20°26.6'S	12:25:40	12:28:18	12:26:58	38	93	179	03m14s				
064°00.0'W	20°02.1'S	21°53.6'S	20°57.5'S	12:27:22	12:30:04	12:28:42	40	93	180	03m17s				
063°00.0'W	20°32.8'S	22°25.3'S	21°28.7'S	12:29:09	12:31:54	12:30:30	41	92	181	03m20s				
062°00.0'W	21°03.8'S	22°57.2'S	22°00.2'S	12:31:00	12:33:48	12:32:23	42	91	182	03m23s				
061°00.0'W	21°35.1'S	23°29.3'S	22°31.9'S	12:32:54	12:35:45	12:34:19	44	90	183	03m27s				
060°00.0'W	22°06.5'S	24°01.5'S	23°03.7'S	12:34:52	12:37:47	12:36:18	45	88	184	03m30s				
059°00.0'W	22°38.2'S	24°33.9'S	23°35.7'S	12:36:54	12:39:51	12:38:22	47	87	185	03m33s				
058°00.0'W	23°10.0'S	25°06.3'S	24°07.8'S	12:39:00	12:41:59	12:40:29	48	86	185	03m37s				
057°00.0'W	23°41.8'S	25°38.7'S	24°40.0'S	12:41:09	12:44:10	12:42:39	49	85	186	03m40s				
056°00.0'W	24°13.8'S	26°11.1'S	25°12.2'S	12:43:22	12:46:24	12:44:52	51	83	187	03m43s				
055°00.0'W	24°45.7'S	26°43.4'S	25°44.3'S	12:45:37	12:48:41	12:47:08	52	82	187	03m46s				
054°00.0'W	25°17.5'S	27°15.6'S	26°16.4'S	12:47:56	12:51:00	12:49:27	53	80	188	03m49s				
053°00.0'W	25°49.3'S	27°47.6'S	26°48.2'S	12:50:17	12:53:22	12:51:49	55	78	188	03m52s				
052°00.0'W	26°20.9'S	28°19.4'S	27°19.9'S	12:52:41	12:55:46	12:54:13	56	76	188	03m55s				
051°00.0'W	26°52.3'S	28°50.9'S	27°51.4'S	12:55:07	12:58:12	12:56:39	57	74	189	03m58s				
050°00.0'W	27°23.4'S	29°22.0'S	28°22.5'S	12:57:36	13:00:39	12:59:07	58	72	189	04m00s				

Table 7
MAPPING COORDINATES FOR THE UMBRAL PATH

Longitude	Latitude of:			Universal Time at:			Circumstances on the Center Line					
	Northern	Southern	Center	Northern	Southern	Center	Sun	Sun	Path	Center		
	Limit	Limit	Line	Limit	Limit	Line	Alt	Az.	Width	Durat.		
							°	°	km			
				h	m	s	h	m	s	h	m	s
049°00.0'W	27°54.2'S	29°52.7'S	28°53.3'S	13:00:06	13:03:08	13:01:37	59	69	189	04m03s		
048°00.0'W	28°24.7'S	30°23.0'S	29°23.7'S	13:02:38	13:05:38	13:04:08	61	67	190	04m05s		
047°00.0'W	28°54.7'S	30°52.8'S	29°53.7'S	13:05:11	13:08:09	13:06:40	62	64	190	04m08s		
046°00.0'W	29°24.3'S	31°22.1'S	30°23.1'S	13:07:46	13:10:41	13:09:13	63	61	190	04m10s		
045°00.0'W	29°53.4'S	31°50.9'S	30°52.0'S	13:10:21	13:13:13	13:11:47	64	58	190	04m12s		
044°00.0'W	30°21.9'S	32°19.0'S	31°20.4'S	13:12:57	13:15:45	13:14:21	65	55	190	04m14s		
043°00.0'W	30°49.9'S	32°46.5'S	31°48.1'S	13:15:33	13:18:17	13:16:56	65	52	190	04m15s		
042°00.0'W	31°17.2'S	33°13.3'S	32°15.2'S	13:18:10	13:20:49	13:19:30	66	48	190	04m17s		
041°00.0'W	31°43.9'S	33°39.5'S	32°41.6'S	13:20:46	13:23:21	13:22:04	67	44	190	04m18s		
040°00.0'W	32°09.9'S	34°04.9'S	33°07.3'S	13:23:22	13:25:51	13:24:37	68	40	190	04m20s		
039°00.0'W	32°35.2'S	34°29.6'S	33°32.3'S	13:25:58	13:28:22	13:27:10	68	36	190	04m21s		
038°00.0'W	32°59.8'S	34°53.5'S	33°56.6'S	13:28:33	13:30:51	13:29:42	68	32	190	04m21s		
037°00.0'W	33°23.6'S	35°16.7'S	34°20.1'S	13:31:07	13:33:19	13:32:13	69	27	190	04m22s		
036°00.0'W	33°46.7'S	35°39.1'S	34°42.9'S	13:33:40	13:35:46	13:34:43	69	23	189	04m23s		
035°00.0'W	34°09.0'S	36°00.7'S	35°04.9'S	13:36:11	13:38:11	13:37:12	69	18	189	04m23s		
034°00.0'W	34°30.6'S	36°21.5'S	35°26.0'S	13:38:42	13:40:35	13:39:39	69	14	189	04m23s		
033°00.0'W	34°51.3'S	36°41.6'S	35°46.4'S	13:41:11	13:42:57	13:42:05	69	9	189	04m23s		
032°00.0'W	35°11.3'S	37°00.8'S	36°06.0'S	13:43:38	13:45:18	13:44:29	69	5	188	04m23s		
031°00.0'W	35°30.4'S	37°19.3'S	36°24.9'S	13:46:04	13:47:37	13:46:51	69	0	188	04m23s		
030°00.0'W	35°48.8'S	37°37.0'S	36°42.9'S	13:48:28	13:49:55	13:49:12	68	356	188	04m23s		
029°00.0'W	36°06.4'S	37°53.9'S	37°00.1'S	13:50:50	13:52:10	13:51:31	68	352	188	04m22s		
028°00.0'W	36°23.2'S	38°10.0'S	37°16.6'S	13:53:11	13:54:24	13:53:48	67	348	187	04m21s		
027°00.0'W	36°39.2'S	38°25.3'S	37°32.2'S	13:55:29	13:56:36	13:56:03	67	345	187	04m21s		
026°00.0'W	36°54.4'S	38°39.9'S	37°47.2'S	13:57:45	13:58:45	13:58:16	66	341	187	04m20s		
025°00.0'W	37°08.9'S	38°53.8'S	38°01.3'S	14:00:00	14:00:53	14:00:27	66	338	186	04m19s		
024°00.0'W	37°22.6'S	39°06.8'S	38°14.7'S	14:02:12	14:02:59	14:02:37	65	335	186	04m17s		
023°00.0'W	37°35.5'S	39°19.2'S	38°27.3'S	14:04:23	14:05:03	14:04:44	64	332	186	04m16s		
022°00.0'W	37°47.7'S	39°30.8'S	38°39.2'S	14:06:31	14:07:05	14:06:49	63	329	185	04m15s		
021°00.0'W	37°59.2'S	39°41.7'S	38°50.4'S	14:08:37	14:09:05	14:08:52	63	326	185	04m13s		
020°00.0'W	38°09.9'S	39°51.9'S	39°00.9'S	14:10:41	14:11:04	14:10:53	62	324	185	04m12s		
019°00.0'W	38°20.0'S	40°01.4'S	39°10.7'S	14:12:43	14:13:00	14:12:52	61	321	184	04m10s		
018°00.0'W	38°29.3'S	40°10.3'S	39°19.7'S	14:14:43	14:14:54	14:14:49	60	319	184	04m09s		
017°00.0'W	38°37.9'S	40°18.4'S	39°28.1'S	14:16:40	14:16:46	14:16:44	59	317	183	04m07s		
016°00.0'W	38°45.9'S	40°25.9'S	39°35.9'S	14:18:36	14:18:36	14:18:37	58	314	183	04m05s		
015°00.0'W	38°53.2'S	40°32.7'S	39°42.9'S	14:20:30	14:20:25	14:20:28	58	312	182	04m03s		
014°00.0'W	38°59.8'S	40°38.9'S	39°49.3'S	14:22:21	14:22:11	14:22:17	57	310	182	04m01s		
013°00.0'W	39°05.8'S	40°44.5'S	39°55.1'S	14:24:10	14:23:56	14:24:03	56	309	181	03m59s		
012°00.0'W	39°11.1'S	40°49.5'S	40°00.2'S	14:25:58	14:25:38	14:25:48	55	307	181	03m57s		
011°00.0'W	39°15.8'S	40°53.8'S	40°04.8'S	14:27:43	14:27:19	14:27:31	54	305	181	03m55s		
010°00.0'W	39°20.0'S	40°57.5'S	40°08.7'S	14:29:26	14:28:58	14:29:12	53	303	180	03m53s		
009°00.0'W	39°23.5'S	41°00.7'S	40°12.0'S	14:31:07	14:30:35	14:30:51	52	302	180	03m51s		
008°00.0'W	39°26.4'S	41°03.2'S	40°14.7'S	14:32:46	14:32:10	14:32:29	51	300	179	03m49s		
007°00.0'W	39°28.7'S	41°05.2'S	40°16.9'S	14:34:23	14:33:43	14:34:04	50	299	179	03m46s		
006°00.0'W	39°30.5'S	41°06.7'S	40°18.5'S	14:35:58	14:35:15	14:35:37	49	297	178	03m44s		
005°00.0'W	39°31.7'S	41°07.5'S	40°19.5'S	14:37:32	14:36:44	14:37:08	48	296	177	03m42s		
004°00.0'W	39°32.3'S	41°07.9'S	40°20.0'S	14:39:03	14:38:12	14:38:38	47	295	177	03m39s		
003°00.0'W	39°32.4'S	41°07.7'S	40°20.0'S	14:40:32	14:39:38	14:40:06	46	293	176	03m37s		
002°00.0'W	39°32.0'S	41°06.9'S	40°19.4'S	14:41:59	14:41:03	14:41:31	45	292	176	03m35s		
001°00.0'W	39°31.0'S	41°05.7'S	40°18.3'S	14:43:25	14:42:25	14:42:55	44	291	175	03m32s		
000°00.0'E	39°29.5'S	41°04.0'S	40°16.7'S	14:44:48	14:43:46	14:44:17	43	289	175	03m30s		

Table 7
MAPPING COORDINATES FOR THE UMBRAL PATH

Longitude	Latitude of:			Universal Time at:			Circumstances on the Center Line			
	Northern Limit	Southern Limit	Center Line	Northern Limit	Southern Limit	Center Line	Sun Alt	Sun Az.	Path Width	Center Durat.
				h m s	h m s	h m s	°	°	km	
001°00.0'E	39°27.6'S	41°01.7'S	40°14.5'S	14:46:09	14:45:05	14:45:38	42	288	174	03m28s
002°00.0'E	39°25.1'S	40°59.0'S	40°11.9'S	14:47:29	14:46:22	14:46:56	42	287	173	03m25s
003°00.0'E	39°22.1'S	40°55.7'S	40°08.8'S	14:48:47	14:47:38	14:48:13	41	286	173	03m23s
004°00.0'E	39°18.7'S	40°52.0'S	40°05.3'S	14:50:03	14:48:52	14:49:28	40	285	172	03m21s
005°00.0'E	39°14.8'S	40°47.9'S	40°01.2'S	14:51:17	14:50:04	14:50:41	39	284	172	03m18s
006°00.0'E	39°10.4'S	40°43.2'S	39°56.7'S	14:52:29	14:51:14	14:51:52	38	283	171	03m16s
007°00.0'E	39°05.6'S	40°38.1'S	39°51.8'S	14:53:39	14:52:23	14:53:01	37	282	170	03m14s
008°00.0'E	39°00.3'S	40°32.6'S	39°46.4'S	14:54:47	14:53:30	14:54:09	36	281	170	03m11s
009°00.0'E	38°54.6'S	40°26.6'S	39°40.5'S	14:55:54	14:54:35	14:55:15	35	280	169	03m09s
010°00.0'E	38°48.5'S	40°20.3'S	39°34.2'S	14:56:58	14:55:39	14:56:19	34	279	168	03m06s
011°00.0'E	38°41.9'S	40°13.4'S	39°27.6'S	14:58:01	14:56:41	14:57:22	33	278	168	03m04s
012°00.0'E	38°34.9'S	40°06.2'S	39°20.5'S	14:59:02	14:57:41	14:58:22	32	277	167	03m02s
013°00.0'E	38°27.6'S	39°58.6'S	39°12.9'S	15:00:01	14:58:39	14:59:21	31	276	166	02m59s
014°00.0'E	38°19.8'S	39°50.5'S	39°05.0'S	15:00:59	14:59:36	15:00:18	30	275	165	02m57s
015°00.0'E	38°11.7'S	39°42.1'S	38°56.8'S	15:01:54	15:00:31	15:01:13	29	274	165	02m55s
016°00.0'E	38°03.1'S	39°33.3'S	38°48.1'S	15:02:48	15:01:24	15:02:07	28	273	164	02m53s
017°00.0'E	37°54.2'S	39°24.1'S	38°39.0'S	15:03:40	15:02:16	15:02:59	27	272	163	02m50s
018°00.0'E	37°45.0'S	39°14.6'S	38°29.6'S	15:04:30	15:03:06	15:03:49	26	271	162	02m48s
019°00.0'E	37°35.4'S	39°04.6'S	38°19.9'S	15:05:18	15:03:54	15:04:37	25	270	162	02m46s
020°00.0'E	37°25.4'S	38°54.4'S	38°09.7'S	15:06:05	15:04:41	15:05:23	25	270	161	02m44s
021°00.0'E	37°15.1'S	38°43.8'S	37°59.3'S	15:06:49	15:05:26	15:06:08	24	269	160	02m41s
022°00.0'E	37°04.5'S	38°32.8'S	37°48.5'S	15:07:32	15:06:09	15:06:51	23	268	159	02m39s
023°00.0'E	36°53.5'S	38°21.5'S	37°37.4'S	15:08:13	15:06:50	15:07:32	22	267	158	02m37s
024°00.0'E	36°42.3'S	38°09.9'S	37°25.9'S	15:08:52	15:07:30	15:08:12	21	267	158	02m35s
025°00.0'E	36°30.7'S	37°58.0'S	37°14.2'S	15:09:30	15:08:08	15:08:50	20	266	157	02m33s
026°00.0'E	36°18.8'S	37°45.8'S	37°02.1'S	15:10:06	15:08:44	15:09:26	19	265	156	02m31s
027°00.0'E	36°06.7'S	37°33.3'S	36°49.8'S	15:10:40	15:09:19	15:10:60	18	264	155	02m29s
028°00.0'E	35°54.2'S	37°20.5'S	36°37.2'S	15:11:12	15:09:52	15:10:32	17	264	154	02m27s
029°00.0'E	35°41.5'S	37°07.4'S	36°24.3'S	15:11:42	15:10:23	15:11:03	16	263	153	02m25s
030°00.0'E	35°28.6'S	36°54.0'S	36°11.1'S	15:12:11	15:10:53	15:11:32	15	262	152	02m23s
031°00.0'E	35°15.3'S	36°40.4'S	35°57.7'S	15:12:37	15:11:20	15:12:60	14	262	151	02m21s
032°00.0'E	35°01.9'S	36°26.5'S	35°44.0'S	15:13:02	15:11:47	15:12:25	13	261	151	02m19s
033°00.0'E	34°48.2'S	36°12.4'S	35°30.1'S	15:13:26	15:12:11	15:12:49	12	260	150	02m17s
034°00.0'E	34°34.2'S	35°58.0'S	35°15.9'S	15:13:47	15:12:34	15:13:11	12	260	149	02m15s
035°00.0'E	34°20.1'S	35°43.4'S	35°01.6'S	15:14:07	15:12:55	15:13:32	11	259	148	02m13s
036°00.0'E	34°05.7'S	35°28.6'S	34°46.9'S	15:14:25	15:13:14	15:13:50	10	258	147	02m11s
037°00.0'E	33°50.6'S	35°13.5'S	34°32.1'S	15:14:42	15:13:32	15:14:07	9	258	146	02m09s
038°00.0'E	33°36.4'S	34°58.2'S	34°17.1'S	15:14:56	15:13:48	15:14:23	8	257	145	02m07s
039°00.0'E	33°21.4'S	34°42.8'S	34°01.9'S	15:15:09	15:14:02	15:14:36	7	256	144	02m06s
040°00.0'E	33°06.2'S	34°27.2'S	33°46.5'S	15:15:21	15:14:14	15:14:48	6	256	143	02m04s
041°00.0'E	32°50.8'S	34°11.4'S	33°30.9'S	15:15:30	15:14:25	15:14:58	5	255	142	02m02s
042°00.0'E	32°35.4'S	33°55.4'S	33°15.2'S	15:15:38	15:14:34	15:15:07	4	255	141	02m00s
043°00.0'E	32°19.7'S	33°39.2'S	32°59.3'S	15:15:44	15:14:42	15:15:14	3	254	140	01m59s
044°00.0'E	32°03.9'S	33°22.9'S	32°43.2'S	15:15:49	15:14:48	15:15:19	2	254	139	01m57s
045°00.0'E	31°47.9'S	33°06.4'S	32°27.0'S	15:15:52	15:14:53	15:15:23	2	253	138	01m56s
046°00.0'E	31°31.8'S	32°49.7'S	32°10.6'S	15:15:53	15:15:07	15:15:25	1	252	137	01m54s

Table 8a
CIRCUMSTANCES AT MAXIMUM ECLIPSE ON 3 NOVEMBER 1994
FOR ARGENTINA, BOLIVIA AND CHILE

Location Name	Latitude	Longitude	Elev. m	U.T. of Maximum Eclipse h m s	Umbral Duration	Path Width km	Sun Alt °	Sun Azim °	P °	V °	Eclipse Mag.	Eclipse Obs.
ARGENTINA												
Avellaneda	34°39.0'S	058°23.0'W	-	12:56:53.9			49	72	23	149	0.761	0.708
Bahía Blanca	38°43.0'S	062°17.0'W	31	12:58:45.6			45	71	22	152	0.622	0.538
Buenos Aires	34°36.0'S	058°27.0'W	29	12:56:43.9			49	72	23	149	0.761	0.709
Concordia	31°24.0'S	058°02.0'W	-	12:52:05.8			49	76	24	144	0.843	0.812
Córdoba	31°34.0'S	064°11.0'W	-	12:45:02.3			43	81	23	142	0.761	0.709
Corrientes	27°28.0'S	058°50.0'W	-	12:44:42.8			48	82	24	138	0.929	0.922
Godoy Cruz	32°55.0'S	068°50.0'W	-	12:42:36.9			38	83	22	142	0.675	0.602
La Plata	34°55.0'S	057°57.0'W	-	12:57:53.3			50	71	23	149	0.760	0.707
La Quiaca	22°06.0'S	065°37.0'W	-	12:28:48.0			38	92	23	130	0.973	0.975
Mar del Plata	38°00.0'S	057°33.0'W	-	13:03:20.2			50	66	23	154	0.692	0.624
Mendoza												
Mendoza	32°53.0'S	068°49.0'W	861	12:42:34.1			38	84	22	142	0.676	0.603
Paraná	31°44.0'S	060°32.0'W	-	12:49:28.9			47	78	23	144	0.803	0.762
Pocadas	27°23.0'S	055°53.0'W	-	12:48:31.6			51	80	24	139	0.971	0.973
Resistencia	27°27.0'S	058°59.0'W	-	12:44:29.7			48	82	24	138	0.928	0.920
Río Cuarto	33°08.0'S	064°21.0'W	-	12:47:24.0			43	80	23	144	0.723	0.661
Rosario	32°58.0'S	060°42.0'W	-	12:51:16.9			47	76	23	145	0.772	0.722
Salta	24°47.0'S	065°25.0'W	-	12:33:02.4			40	89	23	133	0.909	0.896
San Isidro	34°27.0'S	058°30.0'W	-	12:56:25.5			49	72	23	148	0.764	0.713
San Juan	31°32.0'S	068°31.0'W	-	12:40:40.9			38	85	22	141	0.710	0.645
San Miguel de Tuc.	26°49.0'S	065°13.0'W	-	12:36:23.4			40	87	23	136	0.862	0.836
San Salvador de Ju.												
San Salvador de Ju.	24°11.0'S	065°18.0'W	-	12:32:14.3			39	90	23	132	0.925	0.917
Santa Fe	31°38.0'S	060°42.0'W	-	12:49:07.1			46	78	23	143	0.803	0.762
Santiago del Estero	27°47.0'S	064°16.0'W	-	12:38:53.5			42	86	23	137	0.850	0.822
BOLIVIA												
Charaña	17°36.0'S	069°28.0'W	-	12:19:10.0	02m07.5s	172	32	97	203	304	1.046	1.000
Cochabamba	17°24.0'S	066°09.0'W	-	12:21:35.9			36	96	204	304	0.959	0.959
La Paz	16°30.0'S	068°09.0'W	3937	12:18:39.9			33	98	203	303	0.962	0.962
Oruro	17°59.0'S	067°09.0'W	-	12:21:32.1			35	96	203	305	0.988	0.991
Potosí	19°35.0'S	065°45.0'W	-	12:25:00.8	02m42.5s	177	37	94	204	307	1.047	1.000
Río Mulatos	19°42.0'S	066°47.0'W	-	12:24:14.8	03m04.9s	177	36	95	203	305	0.930	0.923
Santa Cruz	17°48.0'S	063°10.0'W	-	12:24:58.5			39	95	204	305	0.930	0.923
Sucre	19°06.0'S	065°16.0'W	3066	12:24:44.1			38	95	204	306	0.993	0.996
Tarija	21°31.0'S	064°45.0'W	-	12:28:46.6			39	92	24	129	1.000	1.000
Uyuni	20°28.0'S	066°50.0'W	-	12:25:17.8			36	94	23	128	0.999	1.000
Villa Montes	21°15.0'S	063°30.0'W	-	12:29:38.6	03m18.4s	180	40	92	24	129	1.048	1.000
Yacuiba	22°02.0'S	063°45.0'W	-	12:30:33.2			40	91	24	130	1.000	1.000
CHILE												
Antofagasta	23°39.0'S	070°24.0'W	101	12:26:55.9			34	93	23	131	0.874	0.851
Arica	18°29.0'S	070°20.0'W	31	12:19:42.6	01m50.7s	173	32	97	23	125	1.046	1.000
Calama	22°28.0'S	068°56.0'W	-	12:26:23.1			35	93	23	130	0.921	0.912
Chillán	36°36.0'S	072°07.0'W	-	12:45:46.2			36	82	22	146	0.559	0.463
Concepción	36°50.0'S	073°03.0'W	-	12:45:24.6			35	83	21	146	0.544	0.446
Copiapó	27°22.0'S	070°20.0'W	-	12:32:13.7			35	90	23	135	0.785	0.739
Coquimbo	29°58.0'S	071°21.0'W	-	12:35:46.0			35	88	22	138	0.713	0.648
Iquique	20°13.0'S	070°10.0'W	-	12:22:12.4			32	95	23	127	0.963	0.963
La Serena	29°54.0'S	071°16.0'W	-	12:35:43.8			35	88	22	138	0.715	0.651
Osnoro	40°34.0'S	073°09.0'W	-	12:51:27.2			35	79	21	150	0.467	0.360
Puerto Montt												
Puerto Montt	41°28.0'S	072°57.0'W	-	12:53:05.6			36	78	21	151	0.452	0.343
Punta Arenas	53°09.0'S	070°48.0'W	9	13:13:47.1			36	64	19	165	0.263	0.157
Putre	16°11.0'S	069°33.0'W	1312	12:19:52.1	02m58.9s	173	32	97	23	125	1.046	1.000
Rancagua	34°10.0'S	070°45.0'W	-	12:42:57.1			36	84	22	143	0.626	0.542
San Bernardo	33°36.0'S	070°43.0'W	-	12:42:03.9			36	84	22	143	0.638	0.557
Santiago	33°27.0'S	070°40.0'W	-	12:41:52.0			36	84	22	143	0.642	0.562
Talca	35°26.0'S	071°40.0'W	-	12:44:14.3			36	83	22	145	0.588	0.498
Talcahuano	36°43.0'S	073°07.0'W	-	12:45:10.1			35	83	21	146	0.546	0.448
Temuco	38°44.0'S	072°36.0'W	-	12:48:52.3			36	81	21	148	0.510	0.407
Valdivia	39°48.0'S	073°14.0'W	-	12:50:07.5			35	80	21	149	0.482	0.376
Valparaíso												
Valparaíso	33°02.0'S	071°38.0'W	44	12:40:23.7			35	85	22	142	0.641	0.560
Vina del Mar	33°02.0'S	071°34.0'W	-	12:40:27.0			35	85	22	142	0.641	0.561

Table 8b
LOCAL CIRCUMSTANCES DURING THE TOTAL SOLAR ECLIPSE OF 3 NOVEMBER 1994
FOR ARGENTINA, BOLIVIA AND CHILE

Location Name	First Contact				Second Contact				Third Contact				Fourth Contact			
	U.T.				U.T.				U.T.				U.T.			
	h	m	s	V	h	m	s	V	h	m	s	V	h	m	s	V
ARGENTINA																
Avellaneda	11:48:54.0	35	306	68									14:10:59.9	62	97	236
Bahía Blanca	11:55:40.8	33	314	80									14:06:25.1	57	88	228
Buenos Aires	11:48:45.6	35	306	68									14:10:49.0	62	97	236
Concordia	11:42:46.5	35	302	60									14:08:34.6	64	102	235
Córdoba	11:40:01.8	29	306	64									13:56:36.7	57	97	223
Corrientes	11:35:17.5	32	298	51									14:02:20.6	64	108	230
Godoy Cruz	11:41:21.8	25	311	70									13:49:32.5	52	92	216
La Plata	11:49:41.7	36	307	69									14:12:07.0	63	97	237
La Quiaca	11:23:32.4	23	295	42									13:42:28.7	55	110	217
Mar del Plata	11:56:23.3	37	310	76									14:15:17.9	61	92	239
Mendoza	11:41:17.7	25	311	70									13:49:31.8	52	92	216
Paraná	11:41:58.6	32	304	62									14:03:51.4	61	100	230
Poseadas	11:37:13.3	36	295	48									14:08:17.8	68	110	237
Resistencia	11:35:10.2	32	298	51									14:02:01.3	64	108	230
Río Cuarto	11:43:03.2	29	308	68									13:57:51.2	57	95	223
Rosario	11:44:17.2	33	306	65									14:04:45.8	61	98	230
Salta	11:27:38.2	25	298	49									13:46:26.7	56	107	218
San Isidro	11:48:25.7	35	306	68									14:10:35.0	62	97	235
San Juan	11:38:41.0	25	309	67									13:48:44.9	52	94	216
San Miguel de...	11:31:02.1	26	301	53									13:49:21.7	56	104	219
San Salvador ...	11:26:44.7	25	297	47									13:45:51.7	56	108	218
Santa Fe	11:41:42.0	32	304	62									14:03:25.3	61	100	229
Santiago del ...	11:33:03.2	27	301	55									13:52:15.2	58	103	221
BOLIVIA																
Charaña	11:16:30.2	17	290	34	12:18:07.3	32	68	169	12:20:14.8	32	337	78	13:30:06.3	49	114	213
Cochabamba	11:17:21.2	21	288	31									13:34:39.6	53	117	216
La Paz	11:15:35.7	18	288	31									13:30:17.2	50	117	214
Oruro	11:17:38.9	20	290	34									13:34:02.5	52	115	215
Potosí	11:20:06.7	22	291	36	12:23:40.6	37	81	184	12:26:23.1	37	324	67	13:38:37.1	54	114	217
Río Mulatos	11:19:52.6	21	292	37	12:22:42.5	36	123	226	12:25:47.3	36	282	26	13:37:09.0	53	113	216
Santa Cruz	11:19:10.6	24	287	30									13:40:01.1	57	119	218
Sucre	11:19:40.0	22	290	35									13:38:38.0	55	115	217
Tarija	11:23:04.3	24	293	40									13:43:06.8	56	112	218
Uyuni	11:20:51.4	21	293	39									13:38:10.6	53	112	216
Villa Montes	11:23:16.2	25	292	39	12:27:59.7	40	115	220	12:31:18.1	41	291	36	13:44:52.0	58	113	219
Yacuba	11:24:13.8	25	293	41									13:45:35.0	58	112	219
CHILE																
Antofagasta	11:24:29.4	19	299	50									13:36:49.0	50	104	213
Arica	11:17:21.1	17	292	37	12:18:46.6	31	164	266	12:20:37.3	32	241	344	13:30:08.4	48	112	213
Calama	11:23:01.9	20	297	46									13:37:35.5	51	107	214
Chillán	11:48:40.4	24	317	81									13:47:13.1	48	84	212
Concepción	11:49:07.4	24	318	82									13:45:53.6	47	83	211
Copiapó	11:30:36.8	21	304	58									13:41:17.4	50	99	213
Coquimbo	11:35:10.9	22	308	65									13:42:25.7	49	94	213
Iquique	11:19:36.2	18	295	41									13:32:44.8	49	110	213
La Serena	11:35:04.0	22	308	65									13:42:29.7	49	94	213
Ocoamo	11:57:40.4	25	323	91									13:48:27.8	46	78	211
Puerto Montt	11:59:49.6	26	324	93									13:49:22.5	46	77	211
Punta Arenas	12:30:11.3	30	336	120									13:57:49.2	42	61	211
Putre	11:17:09.2	18	291	36	12:18:23.0	32	113	215	12:21:21.9	33	291	33	13:30:48.5	49	113	213
Rancagua	11:43:36.5	24	313	74									13:47:25.5	49	89	214
San Bernardo	11:42:26.3	24	313	73									13:46:58.3	50	90	214
Santiago	11:42:08.2	24	312	73									13:46:55.2	50	90	214
Talca	11:46:10.8	24	315	78									13:46:60.0	48	86	213
Talcahuano	11:48:51.7	23	318	82									13:45:41.6	47	83	211
Temuco	11:53:25.8	25	320	86									13:48:03.9	47	81	212
Valdivia	11:55:52.0	25	322	89									13:47:48.3	46	79	211
Valparaíso	11:41:09.7	23	312	72									13:44:56.5	49	90	213
Vina del Mar	11:41:10.2	23	312	72									13:45:03.0	49	90	213

Table 9a
CIRCUMSTANCES AT MAXIMUM ECLIPSE ON 3 NOVEMBER 1994
FOR BRAZIL

Location Name	Latitude	Longitude	Elev. m	U.T. of Maximum Eclipse h m s	Umbral Duration	Path Width km	Sun Alt °	Sun Azim °	P °	V °	Eclipse Mag.	Eclipse Obs.
BRAZIL												
Alagoinhas	12°07.0'S	038°26.0'W	-	12:56:21.3			70	101	206	290	0.400	0.289
Americana	22°45.0'S	047°20.0'W	-	12:54:44.8			61	80	205	315	0.838	0.806
Anapolis	16°20.0'S	048°58.0'W	-	12:41:47.2			57	93	206	302	0.684	0.614
Aracaju	10°55.0'S	037°04.0'W	-	12:57:46.8			71	105	206	285	0.344	0.232
Aracatuba	21°12.0'S	050°25.0'W	-	12:46:57.7			57	85	205	311	0.840	0.809
Araguari	18°38.0'S	048°11.0'W	-	12:46:42.3			59	88	206	306	0.737	0.679
Arapiraca	09°45.0'S	036°39.0'W	-	12:57:01.9			71	108	206	281	0.303	0.193
Ararangua	28°56.0'S	049°29.0'W	-	13:00:52.4	03m60.8s	189	59	70	24	146	1.052	1.000
Araraquara	21°47.0'S	048°10.0'W	-	12:51:43.2			60	83	205	312	0.823	0.788
Bagé	31°20.0'S	054°06.0'W	-	12:57:27.3			54	72	24	146	0.895	0.880
Barra Mansa	22°32.0'S	044°11.0'W	-	13:00:20.6			65	77	205	316	0.786	0.741
Bauru	22°19.0'S	049°04.0'W	-	12:51:00.3			59	82	205	313	0.851	0.823
Belem	01°27.0'S	048°29.0'W	14	12:22:25.1			49	112	206	280	0.252	0.148
Belo Horizonte	19°55.0'S	043°56.0'W	-	12:56:41.1			65	83	205	310	0.709	0.645
Blumenau	26°56.0'S	049°03.0'W	-	12:58:25.1			59	73	205	322	0.975	0.978
Bragança Paulista	22°57.0'S	046°34.0'W	-	12:56:27.9			62	79	205	316	0.832	0.799
Brasília	15°47.0'S	047°55.0'W	1142	12:42:44.1			58	93	206	301	0.653	0.576
Cachoeiro de Ita.	20°51.0'S	041°06.0'W	-	13:04:01.4			69	77	205	314	0.694	0.626
Campina Grande	07°13.0'S	035°53.0'W	-	12:55:10.0			71	116	206	274	0.216	0.118
Campinas	22°54.0'S	047°05.0'W	-	12:55:26.4			61	79	205	315	0.838	0.807
Campo	21°45.0'S	041°18.0'W	-	13:05:00.7			69	75	205	316	0.723	0.662
Caruaru	08°17.0'S	035°58.0'W	-	12:56:32.0			71	113	206	277	0.249	0.145
Cascavel	04°07.0'S	038°14.0'W	-	12:45:07.5			65	118	207	273	0.162	0.078
Caxias	04°50.0'S	043°21.0'W	-	12:35:22.0			58	111	206	281	0.267	0.161
Caxias do Sul	29°10.0'S	051°11.0'W	-	12:58:27.5			57	72	24	145	0.989	0.993
Chapeco	27°06.0'S	052°36.0'W	-	12:52:54.6	03m52.4s	188	55	77	24	140	1.051	1.000
Colatina	19°32.0'S	040°37.0'W	-	13:02:59.8			70	81	205	311	0.649	0.571
Criciúma	28°40.0'S	049°23.0'W	-	13:00:37.0	04m01.9s	189	59	70	204	325	1.052	1.000
Cuiabá	15°35.0'S	056°05.0'W	-	12:30:00.2			47	96	205	302	0.771	0.721
Curitiba	25°25.0'S	049°15.0'W	-	12:55:39.0			59	77	205	319	0.937	0.922
Divinópolis	20°09.0'S	044°54.0'W	-	12:55:09.4			64	83	205	310	0.730	0.671
Dourados	22°13.0'S	054°48.0'W	-	12:41:49.7			51	87	205	311	0.930	0.924
Duque de Caxias	22°47.0'S	043°18.0'W	-	13:02:29.9			66	75	205	317	0.781	0.734
Feira de Santana	12°15.0'S	038°57.0'W	-	12:55:21.8			69	100	206	291	0.412	0.302
Florianópolis	27°35.0'S	048°34.0'W	31	13:00:17.1			60	71	204	324	0.986	0.989
Fortaleza	03°35.0'S	038°31.0'W	-	12:43:45.4			64	118	207	272	0.151	0.070
Foz do Iguaçu	25°33.0'S	054°35.0'W	-	12:47:26.4	03m26.4s	187	52	81	204	317	1.051	1.000
Franca	20°32.0'S	047°24.0'W	-	12:51:05.8			60	84	205	310	0.778	0.730
Goiânia	16°40.0'S	049°16.0'W	-	12:41:47.5			57	92	206	303	0.698	0.631
Gov. Valadares	18°51.0'S	041°56.0'W	-	12:59:05.6			68	84	206	308	0.649	0.571
Guarulhos	23°28.0'S	046°32.0'W	-	12:57:21.0			62	78	205	317	0.846	0.817
Ilhéus	14°49.0'S	039°02.0'W	-	12:59:08.6			71	93	206	297	0.489	0.384
Imperatriz	05°32.0'S	047°29.0'W	-	12:28:55.3			53	108	206	285	0.354	0.242
Ipatinga	19°30.0'S	042°32.0'W	-	12:58:52.1			67	83	206	310	0.676	0.605
Itabuna	14°48.0'S	039°16.0'W	-	12:58:35.0			70	93	206	297	0.492	0.388
Itajai	26°53.0'S	048°39.0'W	-	12:59:01.5			60	73	205	322	0.968	0.970
Itapetininga	23°36.0'S	048°03.0'W	-	12:54:49.5			60	79	205	316	0.871	0.849
Jacareí	23°19.0'S	045°58.0'W	-	12:58:09.9			63	77	205	317	0.834	0.801
Jequié	13°51.0'S	040°05.0'W	-	12:55:16.0			69	96	206	295	0.476	0.371
João Pessoa	07°07.0'S	034°52.0'W	-	12:57:36.8			72	118	206	271	0.197	0.103
Joinville	26°18.0'S	048°50.0'W	-	12:57:46.6			60	74	205	321	0.955	0.954
Juazeiro do Norte	07°12.0'S	039°20.0'W	-	12:46:57.8			66	111	206	280	0.270	0.164
Juiz de Fora	21°45.0'S	043°20.0'W	-	13:00:47.8			66	78	205	315	0.752	0.698
Jundiá	23°11.0'S	046°52.0'W	-	12:56:17.2			62	79	205	316	0.843	0.813
Lajes	27°48.0'S	050°19.0'W	-	12:57:40.8	03m07.9s	189	58	73	204	323	1.052	1.000
Limeira	22°34.0'S	047°24.0'W	-	12:54:20.1			61	80	205	314	0.834	0.801
Linhares	19°25.0'S	040°04.0'W	-	13:04:01.4			70	80	205	311	0.638	0.558
Londrina	23°18.0'S	051°09.0'W	-	12:49:06.4			56	82	205	314	0.907	0.895
Macapá	00°02.0'N	051°03.0'W	-	12:17:08.1			45	112	206	280	0.249	0.145

Table 9b
**LOCAL CIRCUMSTANCES DURING THE TOTAL SOLAR ECLIPSE OF 3 NOVEMBER 1994
 FOR BRAZIL**

Location Name	First Contact				Second Contact				Third Contact				Fourth Contact			
	U.T.	Alt	P	V	U.T.	Alt	P	V	U.T.	Alt	P	V	U.T.	Alt	P	V
	h	m	s	°	h	m	s	°	h	m	s	°	h	m	s	°
BRAZIL																
Alagoinhas	11:50:45.1	54	257	347									14:11:44.0	87	151	175
Americana	11:39:32.1	44	283	30									14:19:42.8	79	124	259
Anapolis	11:31:05.4	40	274	13									14:03:07.3	76	134	230
Aracaju	11:55:09.4	56	253	340									14:09:49.9	86	155	162
Aracatuba	11:33:49.1	40	283	28									14:10:12.3	76	124	241
Araguari	11:34:03.9	42	277	19									14:09:49.1	78	130	239
Arapiraca	11:57:21.4	57	250	335									14:05:53.6	85	159	169
Ararangua	11:45:39.5	43	293	49	12:58:56.4	59	130	251	13:02:47.2	59	276	37	14:24:11.2	74	112	261
Araraquara	11:37:18.1	43	282	28									14:16:07.5	78	125	251
Bagé	11:45:27.7	39	299	58									14:16:47.9	68	105	246
Barra Mansa	11:43:53.0	48	280	27									14:26:21.8	82	126	283
Bauru	11:36:46.3	42	284	30									14:15:08.1	77	123	249
Belem	11:34:01.7	38	246	325									13:18:15.6	62	164	227
Belo Horizonte	11:41:44.9	48	276	19									14:21:41.6	84	131	270
Blumenau	11:43:01.6	43	290	43									14:22:31.3	75	116	260
Bragança Paul..	11:40:49.4	45	283	30									14:21:46.4	80	124	264
Brasília	11:32:14.0	41	273	11									14:03:54.1	78	135	230
Cachoeiro de ...	11:47:33.7	52	275	19									14:29:59.6	84	132	316
Campina Grande	12:03:18.0	59	243	322									13:55:30.7	82	166	186
Campinas	11:40:03.1	44	283	30									14:20:32.1	79	124	261
Campos	11:47:58.6	51	277	22									14:31:23.0	83	130	315
Caruaru	12:01:19.5	58	246	327									14:00:31.0	83	163	177
Cascavel	12:00:48.8	55	238	313									13:37:04.6	75	172	214
Caxias	11:42:49.9	46	247	328									13:36:25.1	72	163	220
Caxias do Sul	11:44:17.3	41	295	50									14:20:41.7	72	110	254
Chapeco	11:39:34.9	39	293	46	12:50:58.5	55	118	234	12:54:50.9	56	288	44	14:14:55.4	72	113	246
Colatina	11:47:29.3	52	272	15									14:28:11.6	86	134	321
Criciúma	11:45:20.2	43	293	48	12:58:36.4	59	111	232	13:02:38.4	59	294	55	14:24:04.7	74	112	261
Cuiabá	11:22:08.4	31	279	18									13:48:05.6	66	129	223
Curitiba	11:40:35.7	42	288	39									14:19:51.5	76	118	256
Divinópolis	11:40:22.3	46	277	20									14:20:03.8	83	130	263
Dourados	11:30:30.4	35	288	34									14:02:51.8	70	119	232
Duque de Caxl..	11:45:33.7	49	280	27									14:28:49.6	82	127	293
Feira de Sant...	11:49:21.7	53	258	348									14:11:13.7	87	150	185
Florianópolis	11:44:33.7	44	291	44									14:24:29.9	75	115	264
Fortaleza	12:01:01.8	54	237	311									13:33:54.9	74	173	217
Foz do Iguaçu	11:35:23.9	36	292	43	12:45:44.6	52	88	201	12:49:11.0	53	318	70	14:08:30.0	70	114	238
Franca	11:36:59.6	43	280	24									14:15:23.7	79	128	249
Goiânia	11:30:55.1	40	275	14									14:03:17.2	76	133	231
Gov. Valadares	11:44:28.9	50	273	14									14:23:42.7	86	135	288
Guarulhos	11:41:29.2	45	283	31									14:22:45.2	79	123	266
Ilhéus	11:48:58.1	54	263	357									14:19:15.2	90	145	161
Imperatriz	11:32:16.8	40	254	338									13:34:35.4	68	156	222
Ipatinga	11:43:51.0	49	274	16									14:23:52.2	85	133	285
Itabuna	11:48:24.9	53	263	358									14:18:43.6	89	145	194
Itajaí	11:43:24.8	43	290	42									14:23:20.8	76	116	262
Itapetininga	11:39:38.0	43	285	33									14:19:36.1	78	122	258
Jacareí	11:42:06.1	46	283	31									14:23:45.8	80	124	270
Jequié	11:46:25.4	52	262	355									14:14:12.8	87	146	207
João Pessoa	12:07:20.4	61	241	318									13:56:11.0	82	167	179
Joinville	11:42:20.6	43	289	41									14:22:06.2	76	117	260
Juazeiro do N..	11:51:42.7	53	248	330									13:51:09.6	79	162	205
Juiz de Fora	11:44:26.8	49	278	24									14:26:47.1	83	128	288
Jundiaí	11:40:41.2	45	283	31									14:21:31.0	79	123	263
Lajes	11:42:57.8	42	292	46	12:55:53.3	58	88	207	12:59:31.2	58	318	76	14:20:52.8	74	113	256
Limeira	11:39:13.8	44	283	30									14:19:14.3	79	124	258
Linhares	11:48:30.2	53	272	14									14:29:09.1	86	135	332
Londrina	11:35:34.2	39	287	34									14:12:19.3	74	120	244
Macapá	11:30:15.5	34	245	324									13:10:56.6	57	164	229

Table 11a
CIRCUMSTANCES AT MAXIMUM ECLIPSE ON 3 NOVEMBER 1994
FOR PARAGUAY, PERU AND URUGUAY

Location Name	Latitude	Longitude	Elev. m	U.T. of Maximum Eclipse h m s	Unbral Duration	Path Width km	Sun Alt °	Sun Azim °	P °	V °	Eclipse Mag.	Eclipse Obs.
PARAGUAY												
Asuncion	25°16.0'S	057°40.0'W	150	12:42:42.6	00m40.7s	186	49	84	24	135	1.050	1.000
Caaguazu	25°00.0'S	055°45.0'W	-	12:44:53.6	03m29.9s	186	51	83	204	315	1.050	1.000
Concepcion	23°25.0'S	057°17.0'W	-	12:40:17.6			49	86	204	313	0.997	0.999
Encarnación	27°20.0'S	055°54.0'W	-	12:48:25.4			51	80	24	139	0.972	0.974
Fernando d.l. Mora	25°19.0'S	057°36.0'W	-	12:42:52.8	00m20.0s	186	49	84	24	135	1.050	1.000
Marsiscal	22°02.0'S	060°38.0'W	-	12:33:58.5	02m22.3s	182	44	90	204	310	1.049	1.000
Rosario	24°27.0'S	057°03.0'W	-	12:42:14.1	03m35.3s	186	49	85	204	314	1.050	1.000
Villarrica	25°45.0'S	056°26.0'W	-	12:45:08.6	02m14.4s	186	50	83	24	136	1.050	1.000
PERU												
Arequipa	16°24.0'S	071°33.0'W	2776	12:16:05.9	00m57.6s	169	29	98	203	303	1.045	1.000
Ayacucho	13°07.0'S	074°13.0'W	-	12:10:35.7			25	101	202	300	0.945	0.940
Callao	12°04.0'S	077°09.0'W	-	12:08:04.9			21	102	202	299	0.950	0.946
Chiclayo	06°46.0'S	079°51.0'W	-	12:02:00.9			16	104	201	294	0.831	0.796
Chimbote	09°05.0'S	078°36.0'W	-	12:04:30.5			18	103	201	296	0.883	0.862
Cuzco	13°31.0'S	071°59.0'W	3565	12:12:15.5			27	100	203	300	0.929	0.921
Guerreros Estn.	16°52.0'S	072°01.3'W	374	12:16:25.3	02m49.1s	169	29	98	203	304	1.045	1.000
Pachla	18°54.6'S	070°09.1'W	394	12:20:24.9			32	96	23	126	0.996	0.998
Huanayo	12°04.0'S	075°14.0'W	-	12:08:54.8			23	101	202	299	0.928	0.919
Ica	14°04.0'S	075°42.0'W	-	12:10:57.2			24	101	202	301	0.988	0.991
Iquitos	03°46.0'S	073°15.0'W	-	12:01:39.5			22	105	202	290	0.670	0.595
Juliaca	15°30.0'S	070°08.0'W	-	12:15:57.0			30	99	203	302	0.960	0.959
Lima	12°03.0'S	077°03.0'W	129	12:08:06.1			21	102	202	299	0.948	0.945
Mollendo	17°02.0'S	072°01.0'W	-	12:16:38.7	02m51.2s	170	29	98	23	124	1.045	1.000
Moquegua	17°12.0'S	070°56.0'W	-	12:17:35.0	02m42.6s	171	30	98	203	304	1.045	1.000
Nazca	14°50.0'S	074°57.0'W	-	12:12:13.4			25	100	202	302	1.000	1.000
Piura	05°12.0'S	080°38.0'W	-	12:00:30.4			15	104	201	293	0.794	0.749
Pucallpa	08°23.0'S	074°32.0'W	-	12:05:22.1			22	103	202	295	0.818	0.779
Sullana	04°53.0'S	080°41.0'W	-	12:00:14.3			14	104	201	292	0.786	0.738
Tacna	18°01.0'S	070°15.0'W	-	12:19:08.7	02m53.1s	172	31	97	23	125	1.046	1.000
Tarata	17°28.0'S	070°02.0'W	-	12:18:34.3	02m28.5s	172	31	97	203	304	1.046	1.000
Trujillo	08°07.0'S	079°02.0'W	-	12:03:27.5			17	103	201	295	0.861	0.833
Vitarte	12°02.0'S	076°56.0'W	-	12:08:08.0			21	102	202	299	0.946	0.942
URUGUAY												
Montevideo	34°53.0'S	056°11.0'W	24	13:00:11.4			51	69	23	151	0.782	0.735
Paysandí	32°19.0'S	058°05.0'W	-	12:53:30.9			49	75	23	146	0.820	0.783
Rivera	30°54.0'S	055°31.0'W	-	12:54:43.0			52	74	24	145	0.888	0.870
Salto	31°23.0'S	057°58.0'W	-	12:52:09.4			49	76	24	144	0.844	0.814
FRENCH GUIANA												
Cayenne	04°56.0'N	052°20.0'W	7	12:11:01.5			41	115	205	275	0.125	0.053
GUYANA												
Georgetown	06°48.0'N	058°10.0'W	2	12:03:34.1			33	113	204	276	0.157	0.074
SURINAME												
Paramaribo	05°50.0'N	055°10.0'W	4	12:07:08.6			37	114	205	275	0.142	0.064

Table 11b
LOCAL CIRCUMSTANCES DURING THE TOTAL SOLAR ECLIPSE OF 3 NOVEMBER 1994
FOR PARAGUAY, PERU AND URUGUAY

Location Name	First Contact				Second Contact				Third Contact				Fourth Contact			
	U.T. h m s	Alt °	P °	V °	U.T. h m s	Alt °	P °	V °	U.T. h m s	Alt °	P °	V °	U.T. h m s	Alt °	P °	V °
PARAGUAY																
Asunción	11:32:32.4	33	294	44	12:42:20.3	49	192	303	12:43:01.0	49	214	325	14:01:43.9	66	112	230
Caaguazú	11:33:35.7	35	292	42	12:43:09.8	51	93	204	12:46:39.7	51	313	64	14:05:15.8	69	114	234
Concepción	11:30:05.3	33	291	39									13:59:46.3	67	115	229
Encarnación	11:37:07.6	35	295	48									14:08:11.8	68	110	237
Fernando d.L....	11:32:39.9	33	294	44	12:42:40.8	49	198	309	12:43:00.8	49	208	320	14:01:56.3	66	112	231
Marsiscal	11:25:53.2	28	291	38	12:32:49.0	44	66	172	12:35:11.3	44	340	86	13:51:11.9	62	115	223
Rosario	11:31:45.7	33	292	42	12:40:27.2	49	102	212	12:44:02.6	50	304	54	14:01:47.8	67	114	231
Villarrica	11:34:11.9	34	294	45	12:43:59.8	50	166	278	12:46:14.2	51	240	353	14:04:55.8	68	112	233
PERU																
Arequipa	11:14:39.3	15	290	33	12:15:38.2	29	42	142	12:16:35.8	29	2	103	13:25:33.0	46	114	212
Ayacucho	11:11:02.6	11	286	27									13:17:48.1	41	117	211
Callao	11:09:57.8	7	286	27									13:13:24.5	37	116	210
Chiclayo	11:06:29.7	3	279	16									13:04:08.5	31	123	211
Chimbote	11:07:45.5	5	282	20									13:08:10.2	34	120	211
Cuzco	11:11:40.6	13	286	27									13:20:50.7	44	118	212
Quarrazcos Est..	11:15:07.5	15	291	35	12:15:01.2	29	103	204	12:17:50.3	29	301	42	13:25:37.5	45	113	212
Pachía	11:17:54.9	17	293	38									13:30:59.0	49	111	213
Huancayo	11:10:02.8	9	285	25									13:15:16.3	39	118	211
Ica	11:11:48.7	10	289	31									13:17:31.0	40	114	210
Iquitos	11:06:10.3	8	271	3									13:04:11.3	37	133	216
Juliaca	11:14:02.5	16	288	30									13:26:07.5	47	117	211
Lima	11:09:56.9	8	286	27									13:13:28.7	37	116	210
Mollendo	11:15:19.2	15	291	35	12:15:13.4	29	114	215	12:18:04.6	29	290	31	13:25:52.0	45	113	212
Moquegua	11:15:42.5	16	291	35	12:16:14.4	30	91	192	12:18:57.0	31	313	54	13:27:31.4	47	113	212
Nazca	11:12:36.9	11	289	32									13:19:21.2	41	114	210
Piura	11:05:51.8	2	277	12									13:01:31.6	29	125	212
Pucallpa	11:07:34.7	8	279	16									13:10:34.9	38	124	213
Sullana	11:05:45.1	1	277	11									13:01:04.0	29	125	212
Tacna	11:16:48.4	17	292	36	12:17:42.2	31	124	226	12:20:35.4	32	280	22	13:29:36.3	48	113	213
Tarata	11:16:12.6	17	291	35	12:17:20.9	31	79	181	12:19:49.4	32	325	67	13:29:07.5	48	114	213
Trujillo	11:07:10.9	4	281	18									13:06:32.3	33	121	211
Vitarte	11:09:56.3	8	286	27									13:13:34.1	37	117	210
URUGUAY																
Montevideo	11:50:44.3	38	305	60									14:15:45.1	64	98	242
Paysandí	11:44:28.8	35	303	62									14:09:25.2	64	101	235
Rivera	11:43:34.6	37	300	57									14:13:18.2	67	105	241
Salto	11:42:47.1	35	302	60									14:08:41.8	64	102	235
FRENCH GULANA																
Cayenne	11:37:18.5	33	233	307									12:49:18.9	49	176	240
GUYANA																
Georgetown	11:28:07.3	25	235	310									12:43:12.6	42	172	238
SURINAME																
Paramaribo	11:32:22.8	29	234	309									12:46:18.6	46	174	239