

1999年8月11日 皆既日食の概要

NASA Reference Publication 1398 より抄訳

(訳) 編集部

前号では、先に皆既帯の地図、気象に関する図と本文を掲載しましたので、今号では日食概要と局地予報等を掲載します。概要と局地予報（Table13）については、前号の地図と合わせてご覧下さい。その他の情報については、引き続き来年の1号からも掲載していきますのでお楽しみに。

なお、インターネットがお使いになれる方は下記のサイトでこれらの情報を入手できます。

<http://umbra.nascom.nasa.gov/eclipse/990811/rp.html>

概要

1999年8月11日水曜日に、東半球の端から端までを横断する狭い帯の中で皆既日食が起こる。月の本影の経路は大西洋に始まり、中央ヨーロッパ、中東、インドを通り（図3、4、5）、ベンガル湾で日の入とともに終わる。部分食は月の半影が通るずっと広い範囲で見られる。そこにはアジア（図1と2）の西半分、北アメリカの北東部、ヨーロッパのすべて、北アフリカが含まれる。

皆既帯とその見え方

20世紀最後の皆既日食は、月の本影が09：30：57UT、ノバスコシアのおよそ300キロ南の北大西洋で地球に接する所から始まる。日の出明暗境界線に沿った幅49キロの狭い皆既帯の中心からは、最大継続時間わずか47秒の皆既食が見られる。本影が北大西洋を飛び過ぎる最初の40分間、主な陸地に接近することはない。最終的に本影は10：10UT、イギリス南西海岸の沖にある Scilly 諸島に達する（図6）。この場所ではすでに午前半ば、太陽は東の地平線上、高度45度にある。中心線での皆既継続時間は2分。皆既帯の幅は103 kmに広がり、本影は0.91 km/sの対地速度で東に向かって走る。

1分後（10：11UT）、本影はコーンウォール半島の海岸に到着する。さらに4分後、つかの間の皆既を見ようと観測者が待ちうける南の海岸を、本影がすっぽりと包み込む。プリマス（イギリスを通る皆既帯の中で最も大きい都市）は中心線の北にあり、皆既が1分39秒続く。10：16UTまでに本影はイギリスを去り、あっという間にイギリス海峡を横断する。チャンネル諸島のガーンジーとジャージーはちょうど皆既帯の南にあり、ここでは食分 >0.995 の部分食が見られる。北にある Alderney は皆既帯に含まれ、1分半を越える皆既が見られる。

1961年以来、月は中央ヨーロッパにその暗い影を投げかけたことはなかった。本影の北端がイギリスを離れる時（10：16UT）、その南端はちょうどノルマンディーの海岸に達する。しかし、本影の中心が北フランスに上陸するまでに、さらに4分かかる（図7）。本影がフランスの田舎に達する時、その南端はパリの北30 kmを通り過ぎる。ライトでは10：23UTに食分0.992の部分食が見られる。

続いて本影は東向きに進み、皆既帯の北限界線は南ベルギー、ルクセンブルグ、そしてドイツを横切る。一方、中心線はシャンパニュ地方を進み、メッツの市民は2分13秒の皆既食を見ることができる（10：29UT）。4分後、本影は南ドイツ（図8）の絵のように美しいライン渓谷を通り過ぎる。皆既帯の北に位置するフランクフルトでは、食分0.979の部分食が見られる。他方、皆既中心線の近くに位置するシュツットガルトでは2分17秒の皆既が見られる。10時35分UT、太陽高度は55度になり、皆既帯の幅は109km、対地速度は0.74km/sになる。ミュンヘンは中心線から20km南にあるが、二百万人の市民は（幸運の風が日食当日、晴れわたった空をもたらすなら）2分以上の皆既を目撃できるだろう。

10：41UT、本影はドイツを去ってオーストリアに入り、そこでアルプス東部に達する。ウィーンは皆既帯の北ほぼ40kmにあり、ここでは食分0.990の部分食が見られる。皆既帯の南端はスロベニア北東部をかすめ、本影は10：47UT、ハンガリーに入る（図9）。バラトン湖は皆既中心線上にあり、ここでの皆既継続時間は2分22秒である（10：50UT）。ウィーンと同様、ブダペストは皆既帯のおよそ40km北にあって、食分0.991の部分食が見られる。本影がハンガリーを去ってルーマニアに入る前に、その南端はユーゴスラビア北部をかすめる。

食最大の瞬間^(*)は11：03：04UTに起こる。その時、月の本影の軸は地球の中心に最も近づく（ $\gamma^{(*)} = 0.506$ ）。その時、本影の中心はルーマニア中南部のうねる丘陵の間、ルムニク・ヴルチエの近くに位置する（図10）。皆既の最大継続時間は2分23秒に達し、太陽高度は59度、皆既帯の幅は112km、本影の速度は0.680km/sである。4分後（11：07UT）、ルーマニアの首都ブカレストは本影によってすっぽり包まれる。ブカレストは食最大の場所近くで、しかも中心線上にあるため、そこと同じくらいの2分22秒という長い皆既が楽しめる。本影は南～南東に進み、陸地を離れて黒海の対岸に出る前に、ルーマニア～ブルガリアの国境にかかる。

黒海を渡った本影が上陸するのは11：21：21UT、トルコ北部の海岸である（図11）。アンカラは皆既帯の150km南にあり、ここでは食分0.969の部分食が見られる。皆既帯は、継続時間をゆるやかであるが、着実に減少させながら内陸部に進み、斜めにトルコを二分する。11：29UT、トゥルハルでは2分15秒間の皆既になる。本影は11：45UTにトルコの南東国境に達し、それがイラクに入る時に、ほんのわずかシリア北西部をかすめる（図12）。中心線での継続時間は2分5秒、太陽高度は50度である。バグダッドは皆既帯の220km南にあり、食分0.940の部分食を見ることができる（図13）。11：52UT、イランの西の国境に達した本影は、続く30分間、人口のまばらな山脈や砂漠を渡る（図13、14、15）。テヘランは皆既帯の北にあり、その8百万人の住民は食分0.943の部分食を目にすることになる。12：22UTに本影はパキスタンに入り、アラビア海の沿岸にさしかかる（図16）。カラチ中心線の近くにあり、西の水平線上、太陽高度22度の所に1分13秒の皆既食が見られる。皆既帯の幅は85kmに縮み、本影のスピードは2km/sに増加している。

12：28UT、本影はその経路での最後の国インドに到着する（図17）。本影がインド亜大陸を通過する時、その速度は急速に増加し、中心線上での継続時間は1分以下に減少する。また太陽高度は7度になっている（図18と19）。カルカッタの1千百万人の住民は西の水平線上、高度わずか2度に食分0.879の部分食を目撃するであろう。12：36UT、Visakhapatnamのちょうど北で本影はインドを

去り、ベンガル湾の中へ入って行く。そこで本影は地球を離れて宇宙空間へ帰って行き（12：36：23 UTC）、次の千年期まで戻って来ることはない。3時間7分にわたって、月の本影はおよそ14000 km の長いコースをたどり、地球表面積の0.2%をカバーする。

*1 食最大の瞬間は、月の本影の軸線と地球の中心の間の距離が最小になる時に起こる。食最大の時と継続時間最大の瞬間、そして最大食分の瞬間（皆既食の場合）はわずかに違うが、差は通常非常に小さい。

*2 月の本影の軸と地球の中心の最小距離は、地球の赤道半径を単位に表す。

サロスの沿革

1999年8月11日の皆既食は、*van den Bergh* [1955] によって定義されるように、サロスシリーズ 145（表37）の21番目の日食である。このシリーズの全ての日食は月の昇交点で起こる。そして *gamma* はこのサロス145では一率に減少する。このシリーズは、1639年1月4日に北半球の高緯度で非常に小さい部分食から始まった若いものである。その後に起こった14の部分食は次第に食分を増やしていく、最初の中心食は1891年6月6日に起こった。それは食帯が東シベリアと北極海を通る、6秒の金環食であった。この時、本影の頂点はちょうど地球の表面の少し上方に達していたが、このシリーズの以後の日食で、月までの距離は次第に減少していった。実際、次の日食は1909年6月17日に起きた金環／皆既食であった。食の最大は北極海で起こり、24秒続いた。

サロス145の3番目の中心食は1927年6月29日に起こった。それはこのシリーズで最初の皆既食であって、スカンジナビアとシベリアのほか偶然にもイギリスを通過した。1945年7月9日には、皆既帯がアイダホで始まり、北東に進んでモンタナ、サスカチewanとマニトバを通った。ハドソン湾、グリーンランドと北大西洋を渡った後で、本影はスカンジナビアとシベリアに達した。5番目の中心食は1963年7月20日に起こり、現在の多くの日食観測者によく知られている。その皆既帯はアラスカ中部から東部カナダとメイン州にかかった。この日食は多くのメディアの注意を引いた。そしてこの日食の美しい記事が数ヶ月後、「ナショナル・ジオグラフィックマガジン」 [1963年11月] に載った。実際、著者の1人（*Espenak*）は少年時代、ロングアイランドにある祖母の家からこの日食の部分食を見た楽しい思い出を持っている。

このシリーズの最も最近の日食は1981年7月31日に起きた。その皆既帯は中央シベリアからサハリン島を通り、太平洋を渡ってハワイ北部で終わった。1999年の後、次の日食は2017年8月21日に起こる。これは1979年2月26日以降では、陸続きになっている合衆国各州から見える最初の皆既日食である。皆既帯はオレゴンからアイダホ、ワイオミング、ネブラスカ、ミズーリ、イリノイ、ケンタッキー、テネシーと伸びていき、Carolinias では最大継続時間2分40秒の皆既になる。

21世紀から24世紀を通して、サロス145はずつと皆既日食であり、継続時間は次第に増加していく。

そして皆既帯は南方に移行していく。シリーズの真ん中に起る日食（2324年2月25日）では、皆既継続時間は4分を超える。継続時間はさらに25世紀から26世紀にかけて増加し続ける。皆既の最大の継続時間は2522年6月25日に7分12秒のピークに達する。残りの6つの本影食で、継続時間は急速に減少していく。しかし2648年9月9日の最後の皆既食までの間、ほとんど3分の皆既時間を保つ。

続く3世紀半の間、次第に食分を減少させながら20の部分食が起こる。このシリーズ最後の日食は、南極で3009年4月17日に起る。サロスシリーズ145に含まれる食の詳細なリストを表37に示す。

サロスシリーズ145には次のように77の食が含まれる。

サロス145	部分食	金環食	金環—皆既食	皆既食
非中心食	34	0	0	0
中心食	—	1	1	41

98年2月26日 アルバ島皆既日食報告書 完成

今年の2月26日の皆既日食を、カリブ海のアルバ島で観測した33名の仲間が作った報告書が完成しました。B5版176ページ、カラーグラビア4ページというボリュームたっぷりの報告書です。

日食概要や局地予報から始まり、観測報告が15編、旅行記や日食の感動をつづった文が20編。観測には写真からビデオ、気象観測、シャドーバンドと幅広い内容が盛り込まれています。あの日の感動を新たにしたい方にも、来年の日食観測を計画しようと考えている方にも、必ず参考になるお薦めの一冊です。

なお、題名の“Bon Bini”とは、アルバ島で使われているパピアメント語で「ようこそ」の意味です。太陽と月の劇的な出会い、そして日食のためにアルバ島に集まつた仲間たちの出会いにふさわしい言葉として、この報告書のメインタイトルに選びました。

TABLE 13

LOCAL CIRCUMSTANCES FOR EUROPE - ALBANIA, AUSTRIA, BELARUS & BELGIUM
TOTAL SOLAR ECLIPSE OF 1999 AUGUST 11

Location Name	Latitude	Longitude	Elev.	First Contact			Second Contact			Third Contact			Fourth Contact			Maximum Eclipse			
				U.T. h m s	P °	V Alt. °	U.T. h m s	P °	V Alt. °	U.T. h m s	P °	V Alt. °	U.T. h m s	P °	V Alt. °	U.T. h m s	P °	V Alt. °	
				m	h	s	m	h	s	m	h	s	m	h	s	m	h	s	
ALBANIA	41°20' N	019°50' E	7	09:30:59.6	295	324	59	-	-	-	-	-	12:23:23.9	103	68	57	10:58:21.0	19	14 64 187
Tirane																		0.852	
AUSTRIA	47°43' N	017°37' E	-	09:19:21.3	286	316	50	10:40:56.1	132	141	10:43:03.6	262	271	12:05:11.6	108	91	56		
Bad Ischl	47°25' N	015°16' E	-	09:21:54.3	286	314	52	10:43:55.5	125	132	10:46:10.0	270	275	12:08:14.0	108	89	55		
Bruck an der Mur	47°51' N	016°20' E	-	09:22:02.3	285	311	52	10:41:49.1	285	315	10:41:03.8	289	297	12:09:41.1	108	92	55		
Eisenstadt	47°55' N	013°48' E	-	09:19:41.9	285	315	50	10:41:49.1	285	315	10:44:56.9	167	173	12:08:55.7	108	88	55		
Gmunden	47°05' N	015°27' E	582	09:15:47.0	286	315	52	10:44:57.0	287	315	10:46:09.2	228	234	12:05:31.9	108	85	55		
Innsbruck	47°16' N	011°24' E	-	09:15:47.0	286	315	49	10:45:07.6	287	315	10:46:17.7	287	293	12:08:51.7	108	85	55		
Judenburg	47°02' N	014°40' E	582	09:20:53.4	287	316	51	10:43:57.6	122	129	10:46:14.0	272	278	12:07:33.6	108	89	56		
Kapfenberg	46°53' N	015°18' E	-	09:20:12.0	286	314	52	10:43:44.2	287	314	10:45:00.6	230	237	12:07:35.0	107	88	56		
Klagenfurt	47°14' N	014°50' E	-	09:21:10.3	286	313	51	10:43:44.2	287	313	10:45:00.6	230	237	12:07:45.2	108	89	56		
Knickelfeld																	0.1m16s		
Leoben	47°23' N	015°06' E	-	09:21:37.8	286	315	52	10:43:42.7	134	140	10:45:49.6	261	267	12:08:00.4	108	89	56		
Linz	48°18' N	014°18' E	-	09:20:35.5	285	313	50	10:42:40.9	29	37	10:43:10.6	5	12	12:05:39.2	109	92	55		
Marzuschlag	47°36' N	015°41' E	-	09:23:36.8	286	313	52	10:45:32.0	94	100	10:47:11.4	305	312	12:08:40.4	108	90	55		
Neunkirchen	47°43' N	016°05' E	-	09:23:17.0	285	314	52	10:45:23.9	69	74	10:47:11.4	326	330	12:09:09.4	108	90	55		
Ried im Innkreis	48°11' N	013°30' E	-	09:19:19.4	285	314	50	10:40:34.5	77	87	10:42:35.7	317	325	12:04:28.7	108	90	55		
Salzburg	48°48' N	013°20' E	-	09:18:28.2	286	316	50	10:39:55.4	136	147	10:41:57.5	557	557	12:04:27.9	108	90	55		
Sankt Pölten	48°51' N	015:33' E	-	09:22:38.3	285	312	51	10:42:04.2	285	312	10:42:16.0	74	82	12:07:49.8	109	91	55		
Seyr	48°03' N	014:25' E	-	09:20:42.1	285	312	51	10:42:16.0	74	82	10:44:13.4	320	327	12:08:07.4	109	91	55		
Voitsberg	48°10' N	015:10' E	-	09:21:40.7	287	315	52	10:42:16.0	74	82	10:44:13.4	320	327	12:08:07.4	108	88	56		
Weiß	48°02' N	014:02' E	-	09:20:58.1	285	313	50	10:41:36.5	69	78	10:43:26.9	325	333	12:05:23.2	109	92	55		
Wien (Vienna)	48°13' N	016°20' E	202	09:23:34.2	285	311	52	10:46:00.3	45	50	10:47:06.1	350	354	12:08:54.6	110	89	55		
Wiener Neustadt	47°49' N	016°15' E	-														0.1m50s		
BELARUS	53°08' N	026°02' E	-	09:40:18.1	275	295	51	-	-	-	-	-	-	12:13:44.5	120	96	46		
Bobrujsci	53°15' N	029°14' E	-	09:45:20.4	274	290	52	-	-	-	-	-	-	12:14:55.9	122	95	45		
Borisov	54°03' N	028'30' E	-	09:44:18.5	273	297	51	-	-	-	-	-	-	12:15:26.1	118	95	45		
Brest	52°06' N	022°42' E	-	09:44:18.5	273	297	52	-	-	-	-	-	-	12:14:41.0	123	94	45		
Comel'	52°25' N	03:10' E	-	09:48:10.5	275	293	52	-	-	-	-	-	-	12:12:57.1	122	94	45		
Grodno	53°04' N	03:00' E	-	09:48:10.5	275	293	52	-	-	-	-	-	-	12:12:00.2	122	94	45		
Minsk	53°55' N	03:27' E	225	09:42:49.0	273	297	51	-	-	-	-	-	-	12:10:26.2	120	94	47		
Mozir'	53°54' N	03:02' E	-	09:42:49.0	273	297	51	-	-	-	-	-	-	12:11:35.5	120	94	45		
Orsza	54°30' N	03:02' E	-	09:45:18.8	276	297	51	-	-	-	-	-	-	12:16:33.0	123	94	45		
Pinsk	52°07' N	026'04' E	-	09:47:15.4	272	276	51	-	-	-	-	-	-	12:15:26.5	124	94	45		
Vitebsk	55°12' N	026'04' E	-	09:40:11.8	276	287	52	-	-	-	-	-	-	12:15:34.7	119	94	47		
BELGIUM	Antwerpen (Anwe-	51°03' N	00:42' E	-	09:08:33.5	281	314	42	-	-	-	-	-	-	11:47:17.3	109	109	54	
Action	49°41' N	00:57' E	-	09:08:15.0	283	317	43	10:27:57.4	44	64	10:29:01.2	347	6	11:49:36.7	107	105	56		
Bouillon	49°48' N	00:50'4 E	-	09:08:15.0	283	314	41	10:26:53.7	37	58	10:27:43.1	353	14	11:45:26.0	108	104	55		
Brugge (Bruges)	50°13' N	03:31' E	-	09:07:48.4	281	314	41	-	-	-	-	-	-	11:47:25.0	108	104	54		
Charleroi	50°56' N	04:27' E	-	09:08:08.2	281	315	42	-	-	-	-	-	-	10:26:17.4	108	105	54		
Hasselt	50°25' N	04:26' E	-	09:07:55.3	282	316	43	-	-	-	-	-	-	11:46:18.0	108	105	54		
Gent (Gand)	50°03' N	03:43' E	-	09:07:34.2	281	314	42	-	-	-	-	-	-	11:48:18.0	108	105	54		
Kortrijk (Court-	50°56' N	00:52' E	-	09:09:27.2	281	314	43	-	-	-	-	-	-	10:25:23.7	109	105	54		
La Louviare	50°28' N	00:41' E	-	09:06:55.0	281	315	42	-	-	-	-	-	-	11:54:32.0	108	105	54		
Leuven (Louvain)	50°51' N	00:42' E	-	09:08:37.7	311	314	42	-	-	-	-	-	-	11:47:57.7	109	108	54		
Lilage (Luik)	50°38' N	00:42' E	-	09:08:37.7	311	314	43	-	-	-	-	-	-	11:49:30.8	109	107	55		
Mechelen (Malin-	51°02' N	00:42' E	-	09:08:27.9	281	314	42	-	-	-	-	-	-	11:47:29.5	109	109	54		
Mons (Bergen)	50°28' N	00:45' E	-	09:08:30.1	282	316	43	-	-	-	-	-	-	10:26:37.2	109	105	54		
Namur	50°58' N	00:45' E	-	09:06:46.0	281	314	41	-	-	-	-	-	-	11:48:30.9	108	107	55		
Oostende (Osten-)	51°13' N	00:45' E	-	09:08:12.7	281	315	42	-	-	-	-	-	-	11:47:45.6	108	105	54		
Schaarbeek	50°51' N	00:42' E	-	09:09:51.1	282	314	43	-	-	-	-	-	-	10:26:22.1	105	25	148		
Verviers	50°35' N	00:55' E	-	09:08:41.0	283	316	44	10:27:07.1	70	91	10:28:56.6	320	340	11:50:01.6	106	55	148		
Virtton	49°34' N	00:53' E	-	09:08:41.0	283	316	44	-	-	-	-	-	-	10:28:01.8	105	56	148		

TABLE 14

BOSNIA & HERZEGOWINA, BULGARIA, CROATIA, CZECH REPUBLIC, DENMARK, ESTONIA & FINLAND
LOCAL CIRCUMSTANCES FOR EUROPE -
TOTAL SOLAR ECLIPSE OF 1999 AUGUST 11

Location Name	Latitude	Longitude	Elev.	First Contact			Second Contact			Third Contact			Fourth Contact			Maximum Eclipse			Eclipt. Mag.	Eclipt. Obs.	Umbral Durat.
				U.T. h m s	p o	v Alt	U.T. h m s	p o	v Alt	U.T. h m s	p o	v Alt	U.T. h m s	p o	v Alt	U.T. h m s	p o	v Alt			
BOSNIA & HERZEGOWINA																					
Banja Luka	44°16' N	017°11' E	-	09:25:00.7	290	319 55	-	-	-	12:14:35.5	106	80 56	10:50:12.6	18	20 61 177	0.951	0.945				
Mostar	43°20' N	016°49' E	-	09:26:24.7	292	322 56	-	-	-	12:15:25.0	106	76 57	10:53:31.3	19	19 62 179	0.916	0.901				
Prijedor	44°39' N	016°43' E	-	09:24:10.8	290	319 54	-	-	-	12:15:32.5	106	81 56	10:49:10.4	18	18 61 176	0.953	0.948				
Sarajevo	43°32' N	018°25' E	-	09:27:21.7	291	320 56	-	-	-	12:15:47.4	105	77 56	10:53:14.9	18	18 61 181	0.935	0.925				
Tuzla	44°32' N	018°45' E	-	09:27:41.9	290	317 56	-	-	-	12:16:23.1	106	75 55	10:53:14.9	18	17 61 181	0.955	0.950				
Zenica	44°42' N	017°55' E	-	09:26:23.6	291	319 56	-	-	-	12:16:31.7	105	78 56	10:52:02.1	18	19 61 179	0.940	0.932				
BULGARIA																					
Balgic	43°25' N	028°10' E	-	09:45:55.2	289	300 61	11:10:51.2	141	120	12:33:10.5	110	70 49	11:11:52.1	20	359 59	209	1.029	1.000	02m02s		
Burgas	42°36' N	027°28' E	-	09:50:08.8	291	303 62	11:10:15.8	140	118	12:33:44.2	109	68 50	11:11:47.7	20	359 59	208	0.977	0.975			
Dobrich	43°34' N	027°50' E	-	09:51:11.1	289	302 61	11:09:31.3	169	151	12:30:53.5	110	72 49	11:11:05.5	20	359 59	208	1.029	1.000	02m05s		
Ispetrich	43°43' N	026°50' E	-	09:43:10.4	289	302 61	11:09:44.7	231	212	12:33:23.6	110	75 50	11:09:08.4	20	358 59	205	1.029	1.000	01h13s		
Kavarna	43°22' N	024°28' E	-	09:46:14.6	289	301 61	11:11:14.4	266	244	12:30:23.6	110	70 49	11:11:08.5	20	358 59	204	1.029	1.000	02m10s		
Pleven	43°22' N	024°37' E	-	09:39:04.8	291	308 60	-	-	-	12:29:13.0	108	71 52	11:05:27.7	20	61 193	0.974	0.974				
Plovdiv	42°09' N	024°45' E	-	09:40:02.9	293	311 61	-	-	-	12:30:21.0	107	68 52	11:05:10.3	20	62 201	0.943	0.935				
Ruse	43°06' N	025°57' E	-	09:41:25.2	289	304 60	-	-	-	12:30:29.1	109	72 49	11:07:24.8	20	3 203	0.997	0.998				
Silistra	44°07' N	027°16' E	-	09:43:47.4	289	301 60	11:08:14.4	103	84	12:30:49.1	111	72 49	11:08:20.9	20	181 59 206	0.929	1.000		02m21s		
Sliven	42°40' N	026°19' E	-	09:42:47.2	291	306 62	-	-	-	12:31:51.4	108	69 51	11:09:28.7	20	1 205	0.971	0.970				
Sofija (Sofia)	42°01' N	023°19' E	550	09:36:57.5	292	313 60	-	-	-	12:22:23.9	106	70 53	11:03:50.1	20	7 62 196	0.944	0.936				
Stara Zagora	42°55' N	025°38' E	-	09:41:36.5	292	308 62	-	-	-	12:31:15.6	107	68 51	11:03:31.0	20	2 61 203	0.958	0.954				
Sumen	43°16' N	026°55' E	-	09:43:35.3	290	303 61	-	-	-	12:18:10.7	109	70 50	11:03:49.9	20	1 60 176	0.991	0.993				
Turtsakan	44°03' N	026°37' E	-	09:42:35.0	289	302 60	11:07:15.7	134	116	11:09:26.0	266	248	12:33:10.5	110	70 49	11:11:40.8	20	359 59	208	1.000	
Varna	43°13' N	027°55' E	35	09:45:33.3	290	301 61	-	-	-	12:16:03.2	108	84 56	10:47:14.3	18	23 59 173	0.970	0.965				
CROATIA																					
Osijek	45°33' N	018°41' E	-	09:27:33.5	289	314 55	-	-	-	12:16:03.2	108	81 55	10:52:26.1	18	18 60 181	0.963	0.984				
Rijeka	45°22' N	014°22' E	-	09:20:19.0	290	321 53	-	-	-	12:08:15.4	105	85 57	10:44:40.5	18	25 60 169	0.948	0.948				
Slavonski Brod	45°50' N	014°28' E	-	09:26:53.6	289	321 55	-	-	-	12:15:28.6	107	81 55	10:44:42.3	18	19 60 179	0.967	0.966				
Split	43°31' N	016°27' E	-	09:23:54.8	289	324 55	-	-	-	12:14:47.7	104	77 58	10:44:41.3	18	22 62 175	0.911	0.895				
Zagreb	45°48' N	015°58' E	-	09:21:41.2	292	324 54	-	-	-	12:11:57.6	104	80 58	10:44:53.7	18	24 61 171	0.919	0.905				
CZECH REPUBLIC																					
Brno	48°32' N	016°37' E	-	09:24:29.3	283	308 51	-	-	-	12:08:03.6	111	92 53	10:44:24.6	175	1 175	0.962	0.959				
Ceské Budějovice	49°02' N	014°28' E	-	09:21:04.3	284	311 51	-	-	-	12:05:06.2	110	94 54	10:44:32.1	175	1 175	0.981	0.982				
Hradec Králové	50°12' N	015°50' E	-	09:23:36.8	282	306 50	-	-	-	12:03:37.0	112	95 53	10:44:36.2	173	1 173	0.941	0.939				
Liberec	50°16' N	015°50' E	-	09:22:40.6	281	306 49	-	-	-	12:03:36.6	113	97 53	10:44:06.3	173	1 173	0.940	0.919				
Most	50°32' N	013°39' E	-	09:19:30.0	281	308 48	-	-	-	12:03:01.6	112	98 53	10:40:57.6	174	1 174	0.944	0.936				
Olomouc	49°56' N	017°16' E	-	09:21:17.9	282	304 51	-	-	-	12:08:28.2	112	93 53	10:47:15.8	176	1 176	0.948	0.941				
Ostrava	49°55' N	015°51' E	-	09:19:44.3	282	310 49	-	-	-	12:02:32.9	111	96 54	10:40:44.1	177	1 177	0.935	0.926				
Praha (Prague)	50°05' N	014°26' E	202	09:21:27.0	282	308 49	-	-	-	12:03:44.1	111	96 53	10:42:23.5	176	1 176	0.966	0.966				
Usti nad Labem	50°10' N	014°07' E	-	09:21:07.6	281	307 49	-	-	-	12:03:43.4	111	98 53	10:42:23.5	175	1 175	0.952	0.946				
Zlin	49°13' N	017°41' E	-	09:26:11.1	283	306 52	-	-	-	12:03:25.6	112	91 53	10:41:31.5	177	1 177	0.938	0.929				
DENMARK																					
Aalborg	57°03' N	009°56' E	-	09:20:38.7	272	294 42	-	-	-	11:49:34.8	114	8 19	10:34:30.9	188	1 188	0.791	0.742				
København (Cope-	56°59' N	010°18' E	19	09:20:05.1	273	298 43	-	-	-	11:50:55.0	118	112 49	10:31:54.0	188	1 188	0.652	0.570				
Odense	55°24' N	010°23' E	-	09:22:32.8	273	295 44	-	-	-	11:54:23.4	118	109 49	10:31:04.8	188	1 188	0.651	0.573				
ESTONIA																					
Tallinn	59°25' N	024°45' E	-	09:40:52.1	266	274 45	-	-	-	12:01:25.3	127	111 43	10:51:39.8	189	1 189	0.669	0.591				
FINLAND																					
Espoo (Espoo)	60°03' N	024°01' E	-	09:41:13.4	265	273 44	-	-	-	11:59:57.3	128	112 42	10:51:03.9	188	1 188	0.652	0.570				
Helsingink	60°00' N	025°58' E	9	09:42:43.3	265	274 44	-	-	-	12:00:17.5	122	112 42	10:51:40.3	189	1 189	0.652	0.570				
Lähti	60°03' N	025°49' E	-	09:42:54.2	270	274 44	-	-	-	11:59:26.8	128	114 41	10:51:40.3	189	1 189	0.651	0.545				
Oulu	65°01' N	023°58' E	-	09:42:02.0	258	263 40	-	-	-	11:52:12.1	121	121 38	10:49:54.2	188	1 188	0.550	0.455				
Tampere	61°30' N	023°45' E	-	09:40:55.5	263	271 43	-	-	-	11:57:12.9	129	118 41	10:49:19.8	188	1 188	0.529	0.543				
Turku (Abo)	60°27' N	022°17' E	-	09:38:52.7	265	275 44	-	-	-	11:57:32.4	124	114 43	10:49:18.4	188	1 188	0.559	0.573				
Vantaa (Vanda)	60°16' N	025°03' E	-	09:41:44.0	265	272 44	-	-	-	12:00:11.1	128	112 42	10:51:27.2	189	1 189	0.578	0.578				

TABLE 15
LOCAL CIRCUMSTANCES FOR EUROPE - ENGLAND
TOTAL SOLAR ECLIPSE OF 1999 AUGUST 11

Location Name	Latitude	Longitude	Elev.	First Contact				Second Contact				Third Contact				Fourth Contact				Maximum Eclipse		Eclip.	Eclip.	Umbra		
				U.T.		P.	V	U.T.		P.	V	U.T.		P.	V	U.T.		P.	V	U.T.						
				h	m	s		h	m	s		h	m	s		h	m	s		h	m	s	Mag.	Obs.	Durat.	
ENGLAND																										
Birmingham	52°30' N	001°50' W	163	09:02:52.1	278	313	37	-	-	-	-	11: 7:00:1	109	118	52	10:17:59.1	194	219	46	138	0.943	0.935				
Blackburn	53°45' N	002°29' W	-	09:03:40.3	276	310	37	-	-	-	-	11: 5:55.5	111	120	51	10:17:45.6	194	218	45	138	0.910	0.892				
Blackpool	53°55' N	003°03' W	-	09:03:13.9	276	310	36	10:18:22.1	53	83	10:13:40.7	333	3	11: 2:59.9	105	113	51	10:13:01.4	193	233	46	131	1.027	1.000	01m19s	
Blackman	53°44' N	004°43' W	-	08:57:15.0	281	319	36	-	-	-	-	11: 4:33.5	110	121	51	10:17:44.1	194	218	45	138	0.914	0.898				
Boleyn	53°35' N	002:26' W	-	09:03:21.2	277	310	37	-	-	-	-	11: 7:29.0	106	116	54	10:17:04.1	194	221	48	136	0.993	0.995				
Bournemouth	50°43' N	001°54' W	-	09:00:55.9	282	318	38	-	-	-	-	11: 6:37.1	111	119	51	10:19:43.3	194	217	49	139	0.907	0.889				
Bradford	53°44' N	001°45' W	-	09:02:46.5	276	309	37	-	-	-	-	11: 1:52.0	105	119	54	10:19:39.1	194	219	49	139	0.986	0.988				
Brighton	50°08' N	000°08' W	-	09:02:56.7	281	317	39	-	-	-	-	11: 6:17.9	107	111	53	10:16:27.6	194	224	47	136	0.972	0.973				
Bristol	51°02' N	002°35' W	-	09:56:58.0	280	316	37	-	-	-	-	11: 2:03.4	105	119	53	10:12:02.2	193	224	46	130	1.000	02m01s				
Carborne	50°42' N	005°19' W	-	08:56:19.2	280	320	35	10:11:01.7	96	127	10:13:02.9	290	320	-	-	-	-	-	-	-	-	-	02m01s			
Chesterfield	53°15' N	001°92' W	-	09:04:07.9	277	311	37	-	-	-	-	11: 37:19.9	110	118	52	10:18:53.5	194	219	46	139	0.922	0.908				
Coventry	52°25' N	002:20' W	-	09:03:07.0	273	313	38	-	-	-	-	11: 37:22.2	109	117	52	10:18:23.8	194	219	47	139	0.945	0.917				
Derby	52°55' N	002:05' W	-	09:03:41.2	272	312	37	-	-	-	-	11: 37:24.1	110	118	52	10:18:24.9	194	218	45	139	0.931	0.919				
Dudley	52°50' N	002:37' W	-	09:02:37.1	278	313	37	-	-	-	-	11: 1:46.7	109	118	52	10:17:39.2	194	218	46	137	0.943	0.935				
Exeter	50°43' N	003:31' W	-	08:59:16.2	281	319	37	10:11:19.2	104	134	10:13:21.7	283	313	-	11: 1:45.3	106	118	52	10:22:41.3	194	219	45	133	0.995	0.997	02m02s
Falmouth	50°08' N	005:04' W	-	08:57:07.8	282	310	36	-	-	-	-	11: 1:46.2	108	119	54	10:17:20.4	194	217	46	130	1.000	02m02s				
Gloucester	50°53' N	002:14' W	-	08:56:15.3	282	321	36	10:11:01.6	111	142	10:13:02.9	276	306	-	11: 1:46.7	107	119	54	10:22:47.2	194	217	46	131	0.961	0.957	
Helston	50°08' N	005:16' W	-	08:56:16.2	282	321	36	-	-	-	-	11: 1:46.7	108	119	54	10:17:08.7	104	119	53	10:22:47.2	194	217	46	130	0.960	02m01s
Hugh Wycombe	51°38' N	004:06' W	-	09:04:06.2	280	313	38	-	-	-	-	11: 36:38.2	111	119	51	10:19:03.1	194	218	46	139	0.965	0.962				
Hudderfield	53°33' N	001:47' W	-	09:04:13.9	277	310	37	-	-	-	-	11: 36:38.2	111	119	51	10:19:36.4	194	218	46	139	0.911	0.894				
Hugh Town	49°55' N	006:17' W	-	08:55:45.2	282	321	35	10:09:42.5	137	169	10:11:23.5	249	281	-	11: 30:29.9	104	120	53	10:10:32.9	194	215	45	128	1.026	1.000	01m1s
Ipwwich	52°20' N	001:10' E	-	08:58:34.6	282	310	38	10:13:17.6	78	108	10:15:06.6	308	338	-	11: 41:44.9	109	114	53	10:14:33.8	194	219	45	141	0.942	0.942	
Kingsbridge	50°17' N	003:46' W	-	09:02:20' W	282	310	38	-	-	-	-	11: 36:07.0	111	118	51	10:15:22.1	194	217	46	141	0.906	0.888				
Kings upon H...	53°45' N	002:50' W	-	09:03:55.0	277	309	38	-	-	-	-	11: 36:50.9	111	119	51	10:16:58.7	194	217	46	141	0.905	0.888				
Leeds	53°50' N	002:57' W	-	09:04:38.7	282	310	38	-	-	-	-	11: 37:00.7	109	117	52	10:19:07.3	194	218	47	139	0.938	0.928				
Leicester	52°28' N	001:05' W	-	09:03:46.8	278	311	38	-	-	-	-	11: 41:30.5	110	120	51	10:17:12.1	194	218	47	139	0.919	0.917				
Liverpool	52°25' N	002:51' W	-	09:02:51.4	277	311	36	-	-	-	-	11: 41:35.0	110	120	51	10:17:01.3	194	219	47	139	0.949	0.942				
London	51°30' N	000:10' W	45	09:03:33.5	280	315	39	-	-	-	-	11: 33:57.2	108	115	53	10:19:15.1	194	219	48	140	0.968	0.966				
Lucan	51°15' N	002:15' W	-	09:03:40.7	279	311	39	-	-	-	-	11: 33:57.2	108	115	53	10:19:32.5	194	218	48	140	0.957	0.953				
Manchester	53°30' N	002:00' W	-	09:03:36.0	277	310	37	-	-	-	-	11: 37:01.3	101	116	51	10:17:55.6	194	218	48	138	0.916	0.901				
Mansfield	53°09' N	001:11' W	-	09:04:15.2	277	311	38	-	-	-	-	11: 37:42.9	110	118	52	10:19:09.7	194	218	46	139	0.924	0.911				
Middlesbrough	54°43' N	001:14' W	-	09:06:02.5	275	306	37	-	-	-	-	11: 36:20.8	113	120	50	10:19:55.3	194	216	45	141	0.875	0.849				
Newcastle Upon	54:55' N	001:37' W	-	09:05:07.5	281	310	37	10:11:40.1	67	97	10:13:18.1	320	350	-	10:32:29.1	105	119	53	10:22:59.0	194	216	45	140	1.026	1.000	01m38s
Newquay	50°25' N	003:36' W	-	08:58:59.9	281	319	37	-	-	-	-	11: 34:47.3	106	118	54	10:43:35.4	194	222	47	133	1.027	1.000	00m30s			
Newton Abbot	50°32' N	003:36' W	-	08:58:59.9	281	319	37	-	-	-	-	11: 36:31.1	109	116	53	10:19:07.1	194	219	47	139	0.949	0.942				
Northampton	52:14' N	003:05' W	-	09:03:32.2	279	313	38	-	-	-	-	11: 41:38.9	110	116	53	10:19:38.9	194	218	47	139	0.933	0.922				
Nottingham	52:33' N	001:18' E	-	09:06:18.1	277	311	39	-	-	-	-	11: 33:49.0	110	118	52	10:19:05.6	194	218	47	139	0.917	0.912				
Oxbury	52:30' N	002:00' W	-	09:04:03.8	278	311	39	-	-	-	-	11: 38:45.7	109	118	51	10:18:56.8	194	218	47	138	0.955	0.935				
Penzance	50:07' N	005:33' W	27	08:56:39.3	282	321	35	10:10:39.4	108	139	10:12:41.0	279	309	-	11: 31:41.0	104	120	53	10:11:43.1	194	216	45	140	1.026	1.000	02m02s
Plymouth	50:07' N	004:10' W	-	09:00:50.0	281	318	38	10:12:54.2	66	96	10:14:32.0	320	350	-	11: 37:22.0	106	116	54	10:13:53.9	194	221	48	136	0.993	0.955	
Poole	50:43' N	004:10' W	-	09:00:50.0	281	318	38	-	-	-	-	11: 38:46.1	105	115	54	10:18:57.1	194	221	48	136	0.989	0.991				
Portsmouth	53:46' N	004:05' W	-	09:01:52.2	281	317	38	-	-	-	-	11: 38:46.1	105	115	54	10:18:57.1	194	219	48	138	0.989	0.992				
Preston	53:46' N	004:12' W	-	09:01:52.2	281	317	38	-	-	-	-	11: 38:46.1	105	115	54	10:18:57.1	194	219	48	138	0.989	0.992				
Reading	51:28' N	005:14' W	-	08:57:03.8	282	320	36	10:11:09.4	94	125	10:13:10.0	292	323	-	11: 33:11.4	105	119	53	10:12:09.6	194	224	46	130	1.026	1.000	02m01s
Saint Austell	50:20' N	004:48' W	-	08:57:36.3	282	320	36	10:11:54.4	77	107	10:13:44.4	309	339	-	11: 33:52.8	105	118	53	10:12:49.3	194	223	46	131	1.027	1.000	01m50s
Saint Ives	50:24' N	004:42' W	-	08:58:15.8	282	320	36	10:12:53.5	64	94	10:14:28.9	322	352	-	11: 33:52.5	105	118	54	10:12:41.2	194	224	46	132	1.027	1.000	01m35s
Sheffield	53:23' N	001:20' W	-	09:04:12.1	277	310	37	-	-	-	-	11: 33:09.3	110	119	51	10:18:50.1	194	218	46	139	0.918	0.903				
Southampton	50:55' N	001:25' W	-	09:01:38.4	281	317	38	-	-	-	-	11: 38:11.8	102	115	54	10:17:50.6	194	220	48	137	0.986	0.988				
Southend-on-Sea...	51:33' N	002:10' W	-	09:03:45.4	280	315	39	-	-	-	-	11: 38:18.7	108	118	54	10:17:50.6	194	218	47	139	0.961	0.952				
Stoke-on-Trent	53:00' N	002:10' W	-	09:03:06.0	281	312	37	-	-	-	-	11: 36:19.5</														

TABLE I.6
LOCAL CIRCUMSTANCES FOR EUROPE - FRANCE I
TOTAL SOLAR ECLIPSE OF 1999 AUGUST 11

Location Name	Latitude	Longitude	Elev.	First Contact			Second Contact			Third Contact			Fourth Contact			Maximum Eclipse			Eclip. Mag.	Eclip. Alt.	Eclip. Azm.	Umbra- Durat.						
				U.T.	P	V	U.T.	P	V	U.T.	P	V	U.T.	P	V	U.T.	P	V										
FRANCE				m	h	m	s	m	h	m	s	m	h	m	s	m	h	m	s	U.T.	P	V						
Abbeville	50°06' N	001°50' E	-	09:04:31.3	282	318	41	10:21:45.2	47	72	10:22:55.4	342	6	11:43:48.1	106	110	55	10:22:20.3	194	219	50	142	1.027	1.000	01m10s			
Albert	50°00' N	002°29' E	-	09:05:24.6	283	318	11	10:22:55.2	52	75	10:23:13.3	337	0	11:45:11.8	107	109	55	10:23:33.6	195	218	51	144	1.027	1.000	01m15s			
Aix en Provence	43°32' N	004:49.5' E	-	09:05:49.9	293	335	16	-	-	-	10:23:04.4	73	97	10:23:55.8	316	339	11:44:03.3	98	94	62	10:27:53.6	116	48	38	144	0.848	0.815	01m51s
Ansens	49°54' N	004:54.5' E	-	09:05:49.5	283	318	41	10:22:04.4	73	97	-	-	-	11:44:03.3	102	110	55	10:23:19.1	195	218	51	144	0.847	1.000	01m51s			
Angers	47°28' N	003:33' W	-	08:59:39.6	287	327	40	-	-	-	10:22:41.1	-	-	11:42:19.8	99	107	55	10:18:57.1	194	218	51	136	0.944	0.937	-			
Angoulême	45°39' N	007:09' E	-	08:59:22.3	290	332	41	-	-	-	10:22:07.3	-	-	11:42:27.1	97	107	59	10:18:59.0	195	218	56	148	0.920	0.872	-			
Anneyron	45°57' N	006:07' E	-	08:07:29.4	289	328	46	-	-	-	10:22:03.7	-	-	11:42:20.1	98	96	61	10:16:56.0	195	217	52	143	0.858	0.827	-			
Avgignon	45°29' N	001:29' W	-	08:56:19.1	293	339	10	-	-	-	10:18:49.2	107	61	10:14:58.2	102	112	10:16:56.0	105	53	130	0.825	0.785	-	-				
Bayonne	43°26' N	002:05' E	-	09:04:16.4	283	320	41	10:21:36.2	134	158	10:22:30.6	255	280	11:44:32.5	106	109	56	10:22:33.4	115	39	51	142	1.027	1.000	01m54s			
Beauvais	49°26' N	002:50' E	-	09:07:02' E	287	324	45	-	-	-	10:22:38.2	104	100	58	10:28:48.9	15	37	55	149	0.958	0.954	-						
Beziers	40°15' N	006:20' E	-	09:05:50.1	282	317	41	-	-	-	11:44:24.2	107	110	55	10:23:39.4	195	217	50	144	0.988	0.950	-						
Béthune	50°32' N	002:38' E	-	09:05:20.0	290	330	42	10:19:12.2	135	161	10:21:03.4	234	280	11:41:47.6	105	111	55	10:16:59.8	195	217	50	144	0.988	0.950	01m51s			
Biobec	43°34' N	000:29' E	-	09:02:30.0	293	334	41	-	-	-	11:45:06.4	105	108	56	10:22:10.9	195	217	50	142	0.967	1.000	-						
Bordeaux	44°57' N	000:34' W	48	08:58:03.4	291	334	41	-	-	-	11:43:37.2	102	117	10:18:57.1	102	112	10:16:56.0	105	51	130	0.933	0.923	-	-				
Boulogne Billancourt	48°50' N	002:15' E	-	09:04:01.0	284	322	42	-	-	-	11:43:33.0	102	117	10:18:57.1	102	112	10:16:56.0	105	51	130	0.922	0.921	-	-				
Brest	48°24' N	004:29' W	-	09:06:16.4	285	325	36	-	-	-	11:40:31.2	104	112	10:18:57.1	104	116	10:16:56.0	105	51	130	0.924	0.922	-	-				
Caen	49°11' N	000:21' W	-	09:01:13.8	284	322	39	-	-	-	11:43:22.3	108	112	10:18:57.1	104	116	10:16:56.0	105	51	130	0.924	0.922	-	-				
Calais	50°10' N	003:14' E	-	09:06:15.0	282	317	42	-	-	-	11:43:24.0	107	109	55	10:14:19.6	195	218	50	143	0.978	0.978	-						
Cambrai	50°10' N	003:14' E	-	09:06:15.0	282	317	42	-	-	-	11:46:03.6	107	109	55	10:14:19.6	195	217	51	145	0.996	0.988	-						
Cannes	43°33' N	007:01' E	-	09:08:13.4	293	334	48	-	-	-	11:56:42.0	99	91	61	10:30:58.4	16	39	58	148	0.856	0.824	-						
Châlons sur Marne	48°57' N	004:22' E	-	09:07:06.3	284	320	43	10:25:49.6	181	203	10:26:22.4	209	231	11:48:40.1	106	105	56	10:26:06.0	15	37	52	146	1.028	1.000	00m33s			
Chambéry	45°34' N	005:56' E	-	09:07:06.3	290	329	46	-	-	-	11:52:28.1	101	97	60	10:28:11.6	107	110	56	148	1.028	1.000	-						
Charleville Mézières	49°46' N	004:43' E	-	09:15:16.8	283	317	43	10:26:03.1	54	75	10:27:26.7	335	357	11:48:45.4	107	106	56	10:26:16.4	105	216	51	148	1.028	1.000	01m24s			
Châlons	49°39' N	001:39' W	-	09:15:17.7	283	319	43	10:26:16.7	97	124	10:28:27.2	292	315	11:48:50.7	106	108	56	10:27:10.6	105	217	51	148	1.027	1.000	02h10s			
Cherbourg	49°27' N	000:50' E	-	09:00:11.2	283	321	38	10:16:10.5	145	134	10:15:45.3	242	210	11:47:55.7	104	105	56	10:16:51.8	14	42	49	136	1.027	1.000	01m35s			
Clémont Ferrand	45°47' N	000:50' E	-	09:05:14.2	284	320	42	10:12:42.3	126	150	10:14:44.8	263	287	11:45:48.7	106	108	56	10:13:33.5	14	42	54	141	1.035	0.887	-			
Compiègne	49°25' N	002:52' E	-	09:05:14.2	284	320	42	10:12:42.3	126	150	10:14:44.8	263	280	11:45:48.7	106	108	56	10:13:33.5	14	38	51	143	1.027	1.000	02m02s			
Cordes	49°16' N	002:25' E	-	09:05:06.8	284	320	41	10:12:32.0	151	151	10:12:33.2	151	156	10:14:46.6	107	108	56	10:13:33.8	14	39	50	141	1.027	1.000	02m01s			
Crépy en Valois	49°17' N	002:54' E	-	09:05:06.8	284	320	41	10:12:32.0	151	151	10:12:33.2	151	156	10:14:46.6	107	108	56	10:13:33.8	14	39	50	141	1.028	1.000	02m01s			
Grenoble	45°10' N	005:43' E	-	09:06:39.5	293	330	46	10:27:55.6	100	120	10:30:09.3	291	310	11:52:16.3	101	97	60	10:28:19.9	146	40	56	145	0.997	0.877	-			
Hagondange	48°49' N	007:47' E	-	09:11:13.2	284	318	46	10:30:38.2	124	142	10:32:47.6	267	285	11:54:31.6	107	101	56	10:23:02.4	145	41	55	150	1.028	1.000	02m14s			
Hainaut	50°19' N	003:04' E	-	09:06:22.5	281	315	41	-	-	-	11:44:40.4	104	102	58	10:27:03.7	15	38	51	147	0.956	0.952	-						
Hardingue	50°13' N	002:22' E	-	09:05:58.5	281	315	41	-	-	-	11:44:09.9	108	111	54	10:23:22.9	14	21	50	144	0.991	0.923	-						
Eubeau	49°17' N	001:00' E	-	09:02:32.1	283	320	40	10:18:57.1	113	139	10:21:04.5	276	302	11:41:31.6	105	101	56	10:20:00.7	14	40	50	151	1.027	1.000	02m07s			
Fécamp	49°45' N	001:22' E	-	09:04:01.4	284	318	40	10:18:07.0	77	96	10:21:04.5	295	313	11:42:46.0	106	107	53	10:20:00.7	14	40	50	151	1.027	1.000	02m13s			
Forbach	49°11' N	001:33' E	-	09:03:07.1	283	320	41	10:20:43.1	117	112	10:22:50.2	297	297	11:43:33.7	106	110	56	10:21:13.8	14	21	53	152	1.028	1.000	02m07s			
Forges les Eaux	49°37' N	001:33' E	-	09:06:39.5	283	326	40	-	-	-	11:41:15.9	108	110	55	10:22:56.2	145	41	55	137	0.961	0.958	-						
Grenelle	49°15' N	002:02' E	-	09:02:55.9	283	326	40	-	-	-	11:45:15.9	107	110	55	10:22:56.2	145	41	55	137	0.961	0.958	-						
Lille	50°38' N	003:04' E	-	09:06:26.1	282	316	41	-	-	-	11:44:31.1	108	110	55	10:22:20.0	145	41	55	137	0.961	0.958	-						
Limoges	45°50' N	001:16' E	-	09:06:00.3	283	329	42	-	-	-	11:45:15.9	107	105	59	10:22:20.6	145	41	55	137	0.961	0.958	-						
Lions	49°31' N	005:16' E	-	09:08:07.7	283	318	44	-	-	-	11:45:15.9	107	105	56	10:22:20.6	145	41	55	137	0.961	0.958	-						
Lons-le-Saunier	47°45' N	003:22' W	-	08:56:11.7	281	326	37	-	-	-	11:33:32.7	101	115	56	10:13:32.2	13	46	49	131	0.947	0.940	-						
Lyon	45°45' N	004°51' E	286	09:05:38.3	280	329	45	-	-	-	11:51:18.7	101	99	60	10:26:43.7	15	40	55	145	0.911	0.899	-						
Marseille	43°18' N	005°24' E	75	09:05:44.6	284	336	46	-	-	-	11:51:31.0	98	102	56	10:26:58.1	15	42	55	144	0.941	0.936	-						
Maubeuge	50°17' N	003°28' E	-	09:07:05.8	283	321	42	-	-	-	11:44:11.1	101	109	55	10:23:38.7	145	41	55	143	0.911	0.907	-						
Meaux	48°57' N	002°42' E	-	09:04:14.4	282	321	42	-	-	-	11:46:10.6	101	105	56	10:22:41.3	15	39	52	143	0.956	0.937	-						
Neuilly	48°52' N	002:02' E	-	09:04:18.9	285	322	42	-	-	-	11:45:15.8	101	107	57	10:22:17.3	15	39	52	143	0.956	0.937	-						
Neuilly	49°08' N	005:16' E	-	09:08:13.7	284	328	44	10:27:55.6	113	133	10:30:09.0	277	297	11:51:35.0	107	103	56	10:22:02.3	15	31	50	151	1.028	1.000	02m13s			
Montbéliard	49°11' N	006:48' E	-	09:03:35.0	283	336	45	-	-	-	11:52:49.2	101	105	56	10:30:07.9	16	36	55	151	1.028	1.000	-						
Montpellier	43°36' N	003°33' E	-	09:09																								

TABLE 16 - continued
LOCAL CIRCUMSTANCES FOR EUROPE - FRANCE II
TOTAL SOLAR ECLIPSE OF 1999 AUGUST 11

Location Name	Latitude	Longitude	Elev.	First Contact			Second Contact			Third Contact			Fourth Contact			Maximum Eclipse			Eclips.						
				U.T.	P	V	U.T.	P	V	U.T.	P	V	U.T.	P	V	Alt	h	m	s	h	m	s	Mag.	Obs.	Umbral Durat.
				h	m	s	h	m	s	h	m	s	h	m	s	°	°	°	o	o	o	o	o	o	
FRANCE																									
Nancy	48°41' N	006°21' E	-	09:08:59.1	285	320	45	-	-	11:51:57.6	106	103	57	10:29:05.3	15	35	54	150	1.000	1.000					
Nantes	47°13' N	001°33' W	-	08:58:19.0	288	323	39	-	-	11:51:52.7	106	103	57	10:29:05.3	15	45	50	142	0.935	0.935					
Nice	43°42' N	007°15' E	-	09:08:36.1	293	334	48	-	-	11:57:05.3	99	91	61	10:16:04.2	16	39	38	149	0.861	0.831					
Names	43°50' N	004°21' E	-	09:04:18.6	293	334	48	-	-	11:51:09.6	98	97	61	10:15:42.2	16	43	57	142	0.853	0.853					
Neon	49°35' N	003°70' E	-	09:05:30.2	283	319	42	10:22:55.5	104	128	-	11:16:00.2	106	108	56	10:24:01.2	195	218	51	144	1.027	1.000	0.2m1s		
Orléans	47°55' N	001°54' E	-	09:02:56.1	286	321	42	-	-	11:44:54.0	103	107	57	10:21:55.1	15	41	32	141	0.963	0.963					
Paris	48°52' N	002°20' E	50	09:04:08.6	284	321	42	-	-	11:45:14.3	105	108	56	10:22:49.3	15	39	51	142	0.952	0.952					
Pau	43°18' N	000°22' W	-	08:57:40.9	293	339	41	-	-	11:46:55.6	105	105	62	10:16:56.0	14	49	54	132	0.822	0.822					
Perpignan	42°41' N	002°53' E	-	09:01:57.9	293	339	44	-	-	11:48:55.9	98	63	63	10:21:55.7	15	46	56	138	0.813	0.813					
Poitiers	46°35' N	002°20' E	-	09:00:08.3	288	329	41	-	-	11:42:28.7	101	108	58	10:19:00.3	14	44	52	136	0.921	0.907					
Reims	49°15' N	004°02' E	-	09:06:32.4	284	319	43	10:24:36.3	131	154	10:26:35.7	259	281	11:47:55.5	106	106	56	10:25:36.0	15	37	52	146	1.028	1.000	0.1m59s
Reims	48°05' N	001°41' W	-	08:58:49.1	285	325	39	-	-	11:48:59.3	102	113	57	10:16:16.1	14	44	50	134	0.960	0.956					
Rethe	49°31' N	004°22' E	-	09:07:09.2	283	318	43	10:25:04.7	94	116	10:27:15.1	296	317	11:48:19.3	107	106	56	10:26:19.3	15	217	52	147	1.028	1.000	0.2m0.5s
Rouen	49°27' N	001°05' E	-	09:03:06.0	283	320	40	10:22:11.0	144	170	10:21:50.5	244	270	11:42:31.0	105	111	56	10:21:50.7	14	40	50	140	1.027	1.000	0.1m40s
Saint Avoind	49°06' N	006°42' E	-	09:09:54.8	284	318	45	10:28:47.3	109	128	10:31:02.1	292	301	11:32:29.9	107	103	56	10:29:54.6	15	35	53	152	1.028	1.000	0.2m1.5s
Saint Etienne	45°26' N	004°24' E	-	09:04:53.3	290	330	45	-	-	11:50:36.1	100	99	60	10:25:54.7	15	41	55	144	0.900	0.880					
Saint Etienne d.	49°23' N	001°06' E	-	09:03:03.9	284	321	40	10:20:20.3	155	181	10:21:42.0	233	259	11:42:34.4	105	110	56	10:21:20.1	14	45	50	140	1.027	1.000	0.1m22s
Saint Nazaire	47°17' N	002°17' W	-	08:57:37.4	287	328	39	-	-	11:37:41.2	101	112	57	10:15:08.2	14	45	50	140	1.027	1.000					
Saint Quentin	49°51' N	003°21' E	-	09:06:03.5	283	318	42	10:23:39.3	66	99	10:25:22.2	323	346	11:46:19.5	107	108	56	10:22:30.7	15	39	51	145	1.027	1.000	0.1m43s
Sarcelles	49°00' N	002°23' E	-	09:04:18.2	284	321	42	-	-	11:45:15.6	105	108	56	10:22:35.8	15	39	51	143	0.996	0.997					
Sarrebourg	48°44' N	007°03' E	-	09:10:09.9	285	319	45	10:29:41.1	150	169	10:31:18.8	242	260	11:53:21.7	106	101	56	10:30:29.9	16	34	54	152	1.028	1.000	0.1m4.8s
Saverne	48°44' N	007°22' E	-	09:10:59.2	285	319	45	10:30:07.3	143	151	10:31:55.9	249	267	11:53:53.7	107	101	56	10:31:01.6	16	35	54	153	1.028	1.000	0.1m49s
Sedan	49°42' N	004°57' E	-	09:08:01.7	283	318	43	10:26:19.0	61	82	10:27:54.3	329	350	11:49:10.2	107	106	56	10:27:06.6	16	216	52	148	1.028	1.000	0.1m3.5s
Senlis	49°12' N	002°35' E	-	09:04:42.0	284	320	42	10:22:44.0	164	159	10:23:50.6	225	249	11:45:30.1	105	108	56	10:23:17.3	15	39	51	143	1.027	1.000	0.1m0.7s
Soissons	49°22' N	003°20' E	-	09:05:44.9	284	319	42	10:23:28.7	126	119	10:23:31.9	264	287	11:46:10.8	106	107	56	10:24:30.3	15	38	52	145	1.028	1.000	0.2m0.3s
Strasbourg	48°35' N	007°45' E	142	09:11:02.5	285	319	46	10:30:58.5	158	176	10:33:22.7	234	252	11:44:39.5	106	100	56	10:31:10.6	16	34	54	153	1.028	1.000	0.1m2.5s
Thionville	49°22' N	006°10' E	-	09:09:22.5	284	318	44	10:27:59.3	86	106	10:30:05.8	305	324	11:51:24.8	107	104	56	10:32:02.6	16	195	215	151	1.028	1.000	0.2m0.5s
Toulon	43°07' N	005°56' E	-	09:06:31.2	294	336	47	-	-	11:54:41.7	98	92	62	10:38:54.6	16	42	58	145	0.838	0.802					
Tours	47°23' N	000°41' E	164	09:00:10.9	293	337	43	-	-	11:45:13.9	96	102	62	10:30:38.2	15	47	55	146	0.836	0.836					
Troyes	48°18' N	004°05' E	-	09:05:57.3	285	322	43	-	-	11:48:33.6	105	105	57	10:25:33.9	15	38	53	145	0.981	0.982					
Valence	44°56' N	004°54' E	-	09:05:24.7	291	331	45	-	-	11:51:48.0	100	98	60	10:26:19.3	15	41	56	144	0.887	0.864					
Valenciennes	50°21' N	003°32' E	-	09:06:45.8	282	317	42	10:26:41.5	121	142	10:29:50.3	269	290	11:46:26.4	107	109	55	10:24:59.3	15	36	53	149	1.028	1.000	0.2m0.9s
Verdun	49°10' N	005°23' E	-	09:08:12.9	284	319	44	10:26:41.5	121	142	10:29:50.3	269	290	11:50:14.9	106	104	56	10:27:55.9	15	40	55	145	0.911	0.895	
Villeurbanne	45°46' N	004°53' E	-	09:05:41.7	290	329	45	-	-	11:51:22.0	101	99	60	10:26:17.4	15	40	55	145	0.911	0.895					

TABLE I⁷
LOCAL CIRCUMSTANCES FOR EUROPE - GERMANY I
TOTAL SOLAR ECLIPSE OF 1999 AUGUST 11

Location Name	Latitude	Longitude	Elev.	First Contact			Second Contact			Third Contact			Fourth Contact			Maximum Eclipse			Eclipt. Mag.	Eclipt. Obs. Durat.					
				U.T. h m s	P °	V °	U.T. h m s	P °	V °	U.T. h m s	P °	V °	U.T. h m s	P °	V °	U.T. h m s	P °	V °							
				m	h m s	o	m	s	o	m	s	o	m	s	o	m	s	o							
GERMANY																									
Aachen	50°47' N	006°05' E	-	09:14:16.9	281	314	43	10:34:32.7	79	94	10:36:35.3	313	327	11:50:13.0	109	54	10:28:58.0	195	214	0.970	0.969				
Aalen	48°50' N	010°05' E	-	09:14:12.8	284	316	47	10:33:53.3	116	116	10:38:10.1	277	290	11:50:03.5	108	56	10:35:34.0	196	210	1.028	1.000				
Augsburg	48°52' N	010°53' E	-	09:12:29.1	281	317	48	10:33:27.7	81	96	10:35:27.6	311	326	11:50:07.7	108	56	10:34:25.7	196	211	1.028	1.000				
Backnang	48°56' N	009°25' E	-	09:13:34.3	284	316	47	10:33:22.7	122	139	10:33:33.9	270	287	11:50:19.1	107	100	10:32:28.3	196	211	1.028	1.000				
Baden-Baden	48°46' N	008°14' E	-	09:11:14.9	281	318	46	10:32:40.6	117	134	10:34:55.0	275	290	11:50:22.2	112	106	10:32:41.1	196	210	1.028	1.000				
Berlin	52°01' N	013°22' E	-	09:21:12.6	278	303	47	-	-	-	11:59:27.5	114	120	10:32:27.6	199	53	10:29:53.9	196	204	1.028	0.972				
Bielefeld	52°01' N	008°31' E	-	09:14:21.4	279	308	44	10:32:40.6	117	134	10:34:55.0	275	290	11:50:22.2	116	107	10:32:47.6	197	157	0.922	0.915				
Bibliotheek	48°41' N	009°01' E	-	09:12:52.6	281	317	47	-	-	-	11:56:41.6	107	109	10:32:47.6	199	56	10:29:53.9	196	204	1.028	1.000				
Bochum	51°20' N	006°44' E	-	09:11:32.1	280	312	44	-	-	-	11:50:47.4	110	107	10:32:47.6	199	53	10:29:53.9	196	204	1.028	1.000				
Bonn	50°44' N	007°05' E	-	09:11:31.8	281	313	44	-	-	-	11:51:49.6	109	105	10:30:31.0	195	213	153	0.968	0.966						
Bottrop	51°31' N	006°55' E	-	09:11:45.8	280	311	44	-	-	-	11:50:55.1	110	107	10:30:16.4	195	214	153	0.947	0.940						
Brasenohl	52°16' N	010°31' E	-	09:17:10.4	279	306	45	-	-	-	11:55:31.7	113	104	10:35:10.4	196	208	52	161	0.912	0.896					
Braunschweig	53°04' N	008°49' E	-	09:15:35.1	278	305	44	-	-	-	11:52:17.6	113	108	10:32:43.0	195	209	51	158	0.895	0.878					
Bremen	53°33' N	008°34' E	-	09:15:41.0	277	304	44	10:33:03.2	74	91	10:33:58.8	318	334	11:51:08.2	114	109	10:32:43.0	195	209	51	158	0.886	0.863		
Bremerhaven	49°07' N	008°35' E	-	09:12:29.9	281	317	46	10:33:54.5	119	132	10:33:10.1	274	286	11:55:30.3	108	95	10:33:00.9	196	212	54	156	0.920	1.000	01m56s	
Bruchsal	48°15' N	011°27' E	-	09:16:13.2	281	316	47	-	-	-	11:55:03.6	109	102	10:33:04.2	196	212	54	156	0.993	0.977					
Darmstadt	49°53' N	008°40' E	-	09:13:04.1	281	314	46	-	-	-	11:52:27.6	113	104	10:32:47.6	199	56	10:29:53.9	196	204	1.028	1.000	02m15s			
Dessau	51°50' N	0121:45' E	-	09:19:12.8	279	301	44	-	-	-	11:53:45.2	112	106	10:31:46.5	196	53	10:29:53.9	196	204	1.028	1.000				
Dortmund	51°31' N	007:28' E	-	09:12:37.0	280	311	44	-	-	-	11:53:56.2	112	106	10:31:46.5	196	53	10:29:53.9	196	204	1.028	1.000				
Dresden	51°03' N	013:44' E	-	09:20:53.1	280	306	48	-	-	-	11:51:08.8	112	99	10:30:34.8	197	54	168	0.930	0.918						
Duisburg	51°25' N	006:46' E	-	09:11:38.6	280	311	44	-	-	-	11:50:46.3	110	107	10:30:16.4	195	212	51	153	0.950	0.944					
Düren	50°48' N	006:28' E	-	09:10:17.0	281	313	44	-	-	-	11:50:48.4	109	104	10:30:33.6	195	213	52	152	0.968	0.957					
Düsseldorf	51°12' N	006:47' E	-	09:11:29.7	281	312	44	-	-	-	11:50:58.6	110	106	10:32:43.0	195	212	52	153	0.956	0.951					
Erfurt	50°58' N	010:01' E	-	09:16:58.9	281	309	47	-	-	-	11:57:38.0	111	101	10:36:03.3	195	209	51	156	0.945	0.938					
Esslingen	49°36' N	007:57' E	-	09:16:11.2	281	313	47	-	-	-	11:51:23.4	112	106	10:36:05.2	195	210	51	156	0.982	0.983					
Essen	52°43' N	007:57' E	-	09:14:11.9	279	307	44	10:33:03.9	105	121	10:35:21.0	287	302	11:55:07.9	107	99	10:34:12.4	196	212	55	157	1.028	1.000	02m15s	
Esslingen	48°56' N	009:16' E	-	09:13:15.8	281	317	46	10:31:36.1	100	117	10:33:51.7	292	308	11:55:57.3	107	102	10:33:32.9	196	213	54	154	1.028	1.000	02m15s	
Ettlingen	48°36' N	008:24' E	-	09:12:08.4	281	317	46	-	-	-	11:55:51.0	109	102	10:33:32.9	196	213	54	156	0.979	0.979					
Frankfurt am Main	50°07' N	008:40' E	103	09:13:12.8	281	314	46	-	-	-	11:53:18.2	106	99	10:31:24.1	196	57	10:33:15.3	196	58	0.988					
Freiburg im Breisgau	47°59' N	007:51' E	-	09:10:52.1	281	320	46	-	-	-	11:55:24.7	111	104	10:31:31.3	196	57	10:33:15.3	196	58	0.988					
Freising	48°23' N	01:41:5' E	-	09:15:41.1	285	316	49	10:37:20.4	98	110	10:38:37.7	295	307	12:01:06.2	269	108	95	156	1.028	1.000	02m17s				
Fürstenfeldbruck	48°10' N	01:15:5' E	-	09:16:53.2	281	317	48	10:36:41.1	133	146	10:38:43.1	260	272	11:55:06.2	107	100	10:32:52.7	196	211	55	161	0.986	0.988		
Gaggenau	48°48' N	008:19' E	-	09:11:57.1	281	318	46	10:33:29.3	116	134	10:33:45.5	275	292	11:55:23.8	107	100	10:32:16.4	196	213	54	156	1.028	1.000	02m14s	
Geisenkirchen	51°31' N	009:50' E	-	09:14:00.1	281	317	47	10:34:02.9	112	127	10:36:20.0	281	295	11:58:07.3	107	98	10:31:51.3	196	214	55	158	1.028	1.000	02m17s	
Gera	50°52' N	012:04' E	-	09:12:10.1	280	311	44	-	-	-	11:51:13.3	110	107	10:35:14.0	195	214	54	154	0.946	0.939					
Gießen	50°35' N	008:40' E	-	09:18:23.7	281	308	47	-	-	-	11:55:18.4	111	100	10:35:30.4	196	211	53	156	0.943	0.935					
Göttingen	48°42' N	009:40' E	-	09:13:31.2	282	312	45	10:33:44.8	103	119	10:36:02.0	289	304	11:55:45.2	107	98	10:32:22.7	196	215	54	158	1.028	1.000	02m17s	
Göttingen	51°32' N	009:55' E	-	09:15:51.0	280	313	46	-	-	-	11:55:24.7	111	104	10:31:31.3	196	216	52	160	0.935	0.924					
Hagen	51°22' N	007:28' E	-	09:12:30.2	280	311	44	-	-	-	11:51:53.0	110	106	10:31:06.2	195	212	52	154	0.949	0.943					
Hamburg	53°33' N	009:59' E	20	09:17:28.2	278	303	44	-	-	-	11:53:02.5	114	107	10:34:45.5	196	215	51	161	0.986	0.986					
Hannover	52°24' N	009:44' E	-	09:16:14.2	279	304	44	-	-	-	11:54:09.1	110	106	10:34:05.1	196	213	52	150	0.939	0.930					
Heidelberg	49°25' N	008:43' E	-	09:12:51.4	283	316	47	10:34:33.0	98	113	10:35:33.3	294	308	11:56:33.2	108	101	10:33:12.1	196	214	55	156	0.998	0.999		
Heilbronn	48°40' N	010:08' E	-	09:14:12.7	284	316	47	10:33:19.5	57	72	10:33:48.3	335	351	11:56:33.2	108	106	10:33:12.1	196	214	55	159	1.028	1.000	02m16s	
Herford	52°06' N	008:40' E	-	09:14:33.7	279	308	44	-	-	-	11:55:33.3	110	106	10:34:35.4	196	214	55	157	1.028	1.000	02m25s				
Herne	51°32' N	007:13' E	-	09:12:18.5	280	311	44	-	-	-	11:55:33.0	110	106	10:34:34.9	196	214	55	157	1.028	1.000	02m16s				
Ingolstadt	48°46' N	011:27' E	-	09:16:46.2	284	315	48	10:37:11.2	54	67	10:38:35.6	339	351	12:00:35.8	108	106	10:34:33.7	196	209	56	162	1.028	1.000	01m24s	
Jena	50°56' N	01:13:5' E	-	09:17:45.2	281	309	47	10:31:11.1	40	57	10:33:06.2	352	9	11:58:30.9	111	101	10:37:33.4	196	207	53	163	0.943	0.935		
Kaiserslautern	49°26' N	007:46' E	-	09:11:33.7	283	316	45	-	-	-	11:53:59.7	108	102	10:31:38.7	196	213	54	164	1.028	1.000	00m55s				
Karlsruhe-Stadt	50°01' N	005:25' E	-	09:12:12.4	284	317	46	10:33:39.1	86	103	10:33:47.2	306	322	11:55:35.9	112	99	10:34:21.4	196	212	54	166	0.940	0.931		
Karlsruhe	51°19' N	009:24' E	-	09:12:12.4	281	310	45	-	-	-	11:55:35.7	110	102	10:34:23.1	196	212	52	159	1.028	1.000	02m08s				
Kassel	51°32' N	005:07' E	-	09:18:19.2	276	301	44	-	-	-															

TABLE 17 - continued
 LOCAL CIRCUMSTANCES FOR EUROPE - GERMANY II
 TOTAL SOLAR ECLIPSE OF 1999 AUGUST 11

Location Name	Latitude	Longitude	Elev.	First Contact						Second Contact						Third Contact						Fourth Contact						Maximum Eclipse						
				U.T. h m s	P °	V °	Alt °	U.T. h m s	P °	V °	Alt °	U.T. h m s	P °	V °	Alt °	U.T. h m s	P °	V °	Alt °	U.T. h m s	P °	V °	Alt °	U.T. h m s	P °	V °	Alt °	U.T. h m s	P °	V °	Alt °			
GERMANY																																		
Landau	49°12' N	008°07' E	—	09:11:54.0	284	317	46	10:31:17.6	72	90	10:33:10.8	319	336	11:54:45.8	108	101	56	10:33:14.2	196	213	54	155	1:028	1.000	0im53s									
Landschut	48°33' N	012°09' E	—	09:17:33.2	285	315	49	10:31:14.6	68	79	10:40:02.9	325	336	11:50:57.0	108	95	55	10:39:48.2	197	208	56	165	1:028	1.000	0im48s									
Leipzig	51°19' N	012°20' E	—	09:11:38.2	280	312	47	—	—	—	10:40:02.9	325	336	11:59:11.5	101	53	101	10:39:38.4	197	206	53	165	0:30	0.918										
Leverkusen	51°03' N	006°59' E	—	09:18:36.2	281	312	44	—	—	—	11:55:24.5	106	54	11:56:47.9	107	51	10:35:41.2	196	207	50	162	1:028	1.000	0im53s										
Lübeck	53°52' N	004°40' E	—	09:13:12.8	276	302	45	10:32:56.6	91	107	10:35:09.0	301	316	11:55:02.3	108	101	56	10:32:43.8	196	212	54	156	1:028	1.000	02m12s									
Ludwigsburg	48°53' N	009°51' E	—	09:12:30.3	281	317	47	—	—	—	11:55:02.3	108	101	56	10:32:47.7	196	207	52	164	1:028	1.000	0im53s												
Ludwigshafen	49°29' N	008°26' E	—	09:12:00.3	283	316	46	—	—	—	11:57:17.1	113	103	52	10:37:22.7	196	212	53	155	1:028	1.000	0im53s												
Magdeburg	52°07' N	011°28' E	—	09:18:54.4	283	314	45	—	—	—	11:54:18.3	109	102	55	10:32:44.8	196	212	53	155	1:028	1.000	0im53s												
Mainz	50°01' N	008°16' E	—	09:12:36.6	283	316	46	—	—	—	11:55:07.1	108	101	55	10:32:48.7	196	212	54	156	0:997	0.998	0im10s												
Mannheim	49°29' N	008°29' E	—	09:12:34.4	283	316	46	—	—	—	11:55:07.1	108	101	55	10:32:48.7	196	212	54	156	0:997	0.998													
Mönchengladbach	51°12' N	006°28' E	—	09:11:05.5	281	312	44	—	—	—	11:50:29.2	110	107	54	10:39:34.6	195	213	52	152	0:957	0.953													
Mülheim an der Ruhr	51°24' N	006°54' E	—	09:11:48.0	280	311	44	—	—	—	11:50:59.1	110	107	54	10:39:48.7	195	212	53	152	0:950	0.944	02m08s												
München	48°08' N	013°34' E	—	09:16:06.2	285	317	49	10:37:12.3	130	143	10:39:20.1	263	275	12:01:25.8	101	95	56	10:39:16.2	197	219	56	162	1:028	1.000										
Münster	51°57' N	007°37' E	—	09:13:08.9	279	309	44	10:29:43.5	73	91	10:31:36.9	318	336	11:53:05.5	101	102	56	10:31:40.2	196	211	53	155	1:028	1.000	0im53s									
Neunkirchen/Saar	49°20' N	011°10' E	—	09:10:41.2	284	312	45	10:32:50.2	94	108	10:34:24.2	344	371	11:54:39.8	108	101	54	10:34:49.5	195	213	54	155	1:027	0.952										
Neustadt an der Aisch	51°12' N	006°41' E	—	09:11:20.0	281	312	44	10:31:39.9	47	64	10:32:50.2	344	371	11:54:37.5	107	97	56	10:33:32.8	196	212	53	155	1:028	1.000	0im10s									
Neu-Ulm	48°23' N	007°27' E	—	09:14:09.8	285	316	46	10:34:31.5	134	149	10:36:34.2	259	273	11:52:40.0	107	104	55	10:31:05.7	195	213	53	155	1:028	1.000	02m03s									
Nürnberg	49°27' N	011°04' E	320	09:16:11.8	283	313	48	—	—	—	11:59:17.2	109	98	55	10:37:04.1	196	209	55	161	0:975	0.975													
Oberhausen	51°28' N	006°50' E	—	09:11:46.1	280	319	44	10:31:42.5	180	198	10:32:20.5	212	230	11:50:49.9	110	107	54	10:30:08.8	195	212	51	153	0:949	0.942	0im38s									
Offenburg	48°28' N	007°50' E	—	09:14:53.2	280	316	44	10:33:02.7	179	209	10:34:05.4	210	230	11:51:36.4	110	101	57	10:33:01.6	195	215	51	154	1:028	1.000										
Osnabrück	52°16' N	008°13' E	—	09:13:56.0	279	306	44	—	—	—	11:51:22.8	113	108	52	10:32:11.1	196	212	50	157	0:978	0.978													
Passau	48°18' N	008°12' E	—	09:19:30.7	284	317	50	10:32:06.5	98	115	10:34:21.8	294	310	12:00:07.7	109	94	55	10:41:22.9	195	206	51	156	1:028	1.000										
Pforzheim	48°55' N	0084°28' E	—	09:12:52.5	284	317	50	10:32:06.5	98	115	10:34:21.8	294	310	11:55:44.6	116	107	51	10:33:42.7	195	206	51	156	1:028	1.000	02m15s									
Pirmasens	49°12' N	007°36' E	—	09:11:20.6	284	317	50	10:30:21.1	82	100	10:32:25.2	309	327	11:53:54.7	107	102	52	10:33:24.1	195	212	51	156	1:028	1.000	02m04s									
Rastatt	48°51' N	008°22' E	—	09:11:49.9	284	318	46	10:31:16.7	113	130	10:33:32.1	279	296	11:55:16.1	114	102	56	10:33:28.6	195	212	44	16	1:028	0.877										
Reichlinghausen	51°36' N	007°13' E	—	09:12:21.1	280	311	44	—	—	—	11:55:18.1	111	107	54	10:30:43.8	195	212	51	154	0:944	0.936													
Regensburg	49°01' N	012°06' E	—	09:17:30.4	279	314	48	—	—	—	12:01:22.4	109	96	55	10:38:54.8	195	208	51	154	0:993	0.995													
Remscheid	51°11' N	007°11' E	—	09:11:59.7	281	312	44	10:33:08.6	139	155	10:35:04.5	253	269	11:57:08.8	107	98	56	10:34:04.5	195	212	51	154	1:028	1.000	0im56s									
Reutlingen	48°51' N	012°07' E	—	09:17:04.7	286	317	49	10:38:32.9	155	167	10:40:05.6	238	249	12:02:37.1	107	93	56	10:34:00.6	195	215	51	157	1:028	1.000	0im33s									
Ros托ck	47°55' N	012°07' E	—	09:12:39.2	276	300	45	—	—	—	11:55:44.6	116	107	51	10:37:42.7	195	206	51	156	1:028	1.000													
Rottweil am Neckar	48°28' N	0085°56' E	—	09:12:38.7	285	318	47	10:32:49.2	147	163	10:34:33.4	245	261	11:56:44.4	107	99	56	10:33:43.1	195	212	51	156	1:028	1.000	0im53s									
Saarbrücken	49°14' N	0065°45' E	—	09:12:22.7	284	317	45	10:29:17.8	89	108	10:31:21.7	303	321	11:52:52.0	110	103	56	10:32:23.5	195	214	52	152	1:028	1.000	02m09s									
Salzgitter	52°10' N	00925' E	—	09:10:34.0	284	317	45	10:29:32.6	81	99	10:31:34.9	310	329	11:53:01.2	107	102	56	10:30:33.7	195	214	52	152	1:028	1.000	02m02s									
Sankt Ingbert	49°27' N	007°06' E	—	09:14:16.1	284	316	47	10:30:00.2	52	70	10:31:19.6	319	337	11:53:59.2	109	103	56	10:30:33.7	195	214	52	152	1:028	1.000	0im19s									
Schwabische Gmünd	48°48' N	0094°57' E	—	09:14:04.7	284	316	47	10:32:38.4	116	132	10:34:53.5	276	292	11:56:39.1	107	99	56	10:33:46.0	195	215	52	156	1:028	1.000	02m15s									
Siegen	50°47' N	008712' E	—	09:12:30.2	282	312	45	—	—	—	11:55:16.1	106	51	106	10:34:47.3	195	206	51	156	1:028	1.000	0im53s												
Sindelfingen	48°42' N	009002' E	—	09:12:23.2	281	312	45	—	—	—	11:55:16.1	106	51	106	10:34:48.1	195	206	51	156	1:028	1.000	0im57s												
Sinsheim	49°15' N	008532' E	—	09:12:21.5	285	312	45	—	—	—	11:55:16.1	107	99	56	10:34:50.9	195	207	51	156	1:028	1.000	02m05s												
Sollingen	51°10' N	007055' E	—	09:11:51.2	281	312	44	—	—	—	11:55:16.1	108	100	55	10:33:29.8	195	212	54	154	1:028	1.000	01m03s												
Spayr	49°19' N	008926' E	—	09:12:24.3	284	316	46	10:32:12.5	44	61	10:33:17.2	347	34	11:55:10.2	108	101	56	10:32:44.8	195	212	54	155	1:028	1.000	0im05s									
Stuttgart	48°56' N	00911' E	—	09:11:39.2	284	317	47	10:32:55.4	105	121	10:35:12.4	287	303	11:56:53.8	107	99	56	10:34:03.9	195	212	55	154	1:028	1.000	02m17s									
Trier	49°45																																	

TABLE 18
LOCAL CIRCUMSTANCES FOR EUROPE - GREECE, GUERNSEY, HUNGARY, IRELAND & N. IRELAND
TOTAL SOLAR ECLIPSE OF 1999 AUGUST 11

Location Name	Latitude	Longitude	Elev.	First Contact			Second Contact			Third Contact			Fourth Contact			Maximum Eclipse			Eclip.	Eclip.	Umbra	
				U.T.	P.	V Alt.	U.T.	P.	V	U.T.	P.	V	U.T.	P.	V	U.T.	P.	V	Alt Azm.	Mag.	Obs.	
GREECE				m	h	m	s	m	s	h	m	s	h	m	s	h	m	s	h m s			
Athinai (Athens)	37°58' N	023°43' E	107	09:41:25.6	300	324	65	—	—	10:48:07.8	98	101	297	299	12:34:29.7	100	56	54	11:10:14.1	21	66	204
Irkallion	35°20' N	025°09' E	—	09:47:39.2	304	325	68	—	—	10:50:27.7	98	47	54	11:16:00.5	21	353	67	214	0.766	0.822	0.781	
Kallithéa	37°57' N	023°42' E	—	09:41:17.7	300	324	65	—	—	10:52:24.1	100	56	55	11:16:13.3	21	66	204	0.764	0.821	0.780		
Lárisa	39°38' N	022°59' E	—	09:37:13.7	298	323	53	—	—	10:50:44.9	102	61	55	11:15:29.4	20	65	197	0.854	0.922	0.786		
Pátrais	38°15' N	024°14' E	—	09:47:04.2	300	320	63	—	—	10:52:34.8	100	56	55	11:16:10.0	20	7	167	0.710	0.786	0.786		
Peristérion	38°01' N	023°42' E	—	09:41:20.5	300	323	65	—	—	10:52:34.8	101	56	55	11:16:08.2	21	66	204	0.723	0.820	0.783		
Piraias (Piraeus)	37°57' N	023°38' E	24	09:41:16.4	300	324	65	—	—	10:52:42.1	100	56	55	11:16:04.9	21	66	204	0.820	0.780	0.783		
Thessaloníki (S. Volos)	40°38' N	022°56' E	—	09:38:29.4	296	319	62	—	—	10:52:38.0	104	64	55	11:16:03.2	20	6	198	0.886	0.853	0.853		
GUERNSEY				m	h	m	s	m	s	h	m	s	h	m	s	h	m	s	h m s			
Saint Peter Port	49°27' N	002°32' W	—	08:59:03.3	283	322	38	10:15:20.6	140	169	10:17:01.8	247	275	11:36:45.3	104	115	55	10:15:34.6	14	43	134	
Alderney Island	49°43' N	002°21' W	—	08:59:39.3	283	321	38	10:15:20.6	140	169	10:17:01.8	247	275	11:37:15.3	105	115	55	10:16:11.2	14	42	135	
HUNGARY				m	h	m	s	m	s	h	m	s	h	m	s	h	m	s	h m s			
Baja	46°11' N	018°57' E	—	09:25:38.5	286	312	53	10:48:07.8	98	101	10:50:27.7	297	299	12:12:13.9	109	86	54	10:49:17.8	198	200	58	
Békéscsaba	46°41' N	021°06' E	—	09:37:58.7	287	312	55	10:51:55.7	173	172	10:52:56.6	223	222	12:13:37.5	108	82	54	10:52:26.1	18	19	177	
Budapest	47°30' N	019°05' E	120	09:31:11.4	286	307	56	—	—	10:53:21.0	110	82	53	10:55:12.0	108	193	58	187	1.029	1.000	0.1m01s	
Debrecen	47°32' N	021°38' E	—	09:32:34.1	285	304	55	—	—	10:53:17.8	112	84	52	10:56:04.0	198	193	58	188	0.998	0.999	0.993	
Dombóvár	46°21' N	018°08' E	—	09:34:24.1	285	304	55	—	—	10:53:12.1	110	84	52	10:56:08.8	108	84	54	10:56:08.8	18	19	179	
Dunaújváros	46°58' N	018°57' E	—	09:37:58.1	286	310	54	10:50:23.8	178	178	10:52:56.2	320	320	12:14:33.2	110	85	54	10:51:11.1	198	197	181	
Győr	47°42' N	017°38' E	—	09:35:49.0	285	310	53	10:50:51.8	75	74	10:52:56.2	322	322	12:14:33.2	110	88	54	10:52:49.0	198	200	57	
Hódmezővásárhely	46°25' N	020°29' E	—	09:30:22.2	287	309	55	10:53:34.7	95	92	10:55:53.3	302	298	12:17:24.5	110	82	53	10:54:44.0	198	195	185	
Kalocsa	46°32' N	018°59' E	—	09:28:01.5	287	311	55	10:51:04.6	122	121	10:52:23.2	274	273	12:15:11.9	109	83	54	10:52:23.3	18	11	59	
Kaposvár	46°22' N	019°47' E	—	09:25:58.3	287	314	54	10:52:31.0	55	53	10:55:55.8	341	339	12:11:33.1	108	84	55	10:50:31.6	18	19	178	
Kecskemét	46°54' N	019°42' E	—	09:29:15.1	286	306	55	10:52:31.0	53	53	10:55:55.8	341	339	12:15:46.1	109	85	54	10:53:53.5	19	16	58	
Kesthely	46°46' N	017°15' E	—	09:25:05.1	287	312	53	10:48:03.0	148	150	10:49:52.4	248	250	12:12:15.5	108	85	55	10:48:57.1	17	16	58	
Kiskunfélegyháza	46°43' N	019°52' E	—	09:29:26.5	286	312	52	10:52:40.2	75	73	10:53:32.2	321	318	12:16:17.0	110	83	53	10:53:39.8	198	196	177	
Kiskunhalas	46°26' N	019°50' E	—	09:38:55.2	287	311	55	10:52:24.5	105	106	10:54:24.1	279	276	12:16:07.6	109	83	54	10:53:43.0	198	197	183	
Kőszeg	47°01' N	016°37' E	—	09:43:03.1	287	314	53	10:46:37.3	135	135	10:49:43.2	266	263	12:10:52.2	108	87	55	10:57:07.0	18	21	58	
Máks	46°13' N	020°29' E	—	09:33:59.3	286	313	52	10:46:10.6	96	100	10:49:28.2	299	293	12:10:18.3	109	88	55	10:57:19.9	198	201	175	
Miskolc	48°06' N	020°47' E	—	09:30:59.1	287	310	56	10:49:55.7	112	108	10:52:55.2	109	108	12:17:55.2	109	81	53	10:55:20.1	18	19	186	
Nyíregyháza	47°59' N	021:43' E	—	09:32:42.2	284	303	55	—	—	10:52:46.1	112	85	52	10:55:49.6	158	193	57	198	0.960	0.956	0.953	
Paks	46°39' N	018°53' E	—	09:25:51.1	287	311	54	10:50:46.8	112	112	10:53:08.0	284	283	12:14:53.2	109	84	54	10:51:57.9	18	17	59	
Pécs	47°05' N	017°28' E	—	09:26:59.2	286	312	53	10:47:57.8	81	81	10:53:08.3	317	319	12:14:49.3	109	87	54	10:58:53.7	18	20	58	
Sárvár	46°13' N	018°13' E	—	09:26:44.5	288	311	54	10:49:52.0	75	75	10:54:33.2	321	318	12:16:17.0	109	83	55	10:58:07.6	198	196	177	
Sátoralnádasd	46°15' N	016°57' E	—	09:34:44.7	288	312	53	10:46:56.9	100	104	10:49:17.4	295	298	12:14:36.5	108	83	55	10:58:07.6	198	197	183	
Sárokszentpéter	46°55' N	018°04' E	—	09:36:28.1	286	313	53	10:49:08.7	108	109	10:55:30.9	288	288	12:13:17.5	109	85	54	10:58:09.8	198	197	188	
Sopron	46°14' N	016:52' E	—	09:34:02.5	286	312	52	10:46:31.1	56	59	10:49:57.9	339	333	12:10:10.0	109	88	54	10:57:45.1	198	201	175	
Szeged	46°15' N	016:09' E	—	09:30:03.8	286	310	55	10:53:22.2	118	115	10:55:43.0	279	275	12:17:22.1	109	82	54	10:58:02.6	198	195	185	
Székesfehérvár	46°21' N	018°42' E	—	09:37:14.2	286	311	54	10:49:55.8	61	62	10:53:33.1	334	334	12:13:25.5	110	86	54	10:58:04.5	198	198	180	
Szentendre	46°39' N	020:16' E	—	09:30:14.4	286	309	55	10:53:30.2	69	66	10:55:20.7	327	324	12:16:58.5	110	83	53	10:54:25.5	198	195	185	
Szombathely	47°14' N	016:38' E	—	09:24:06.3	286	313	53	10:46:23.4	110	114	10:48:44.9	285	288	12:10:37.5	109	87	55	10:57:34.2	198	21	58	
Várpalota	47°12' N	018:09' E	—	09:26:17.6	286	311	54	10:49:19.5	71	72	10:51:13.0	325	325	12:14:10.1	109	86	54	10:58:16.3	198	199	186	
Veszprém	47°06' N	017:55' E	—	09:26:13.6	286	312	53	10:48:48.0	90	92	10:51:03.3	305	306	12:12:47.1	109	86	54	10:59:55.6	198	199	178	
Zalaegerszeg	46°51' N	016:51' E	—	09:24:25.4	287	314	53	10:47:18.7	150	153	10:49:04.3	246	248	12:11:27.2	108	86	55	10:48:11.8	198	21	58	
IRELAND	Cork	51°54' N	008°28' W	17	08:56:03.2	279	316	33	—	—	—	—	—	—	11:27:06.8	124	51	10:09:06.5	193	224	43	
Dublin (Baile Á.)		53°20' N	006°15' W	47	08:59:42.8	277	312	34	—	—	—	—	—	—	11:30:16.9	109	123	50	10:12:19.4	193	221	43
IRELAND, NORTH	Belfast, NI	54°35' N	005°55' W	17	09:01:37.0	275	309	34	—	—	—	—	—	—	11:30:31.8	111	124	49	10:14:03.7	193	219	43
																		133	131	0.925	0.912	
																		0.907	0.891	0.868		

TABLE 20
LOCAL CIRCUMSTANCES FOR EUROPE -
LATVIA, LIECHTENSTEIN, LITHUANIA, LUXEMBOURG, MACEDONIA, MOLDOVA, MONACO & NETHERLANDS
TOTAL SOLAR ECLIPSE OF 1999 AUGUST 11

Location Name	Latitude	Longitude	Elev.	First Contact			Second Contact			Third Contact			Fourth Contact			Maximum Eclipse			Eclipt. Mag.	Eclipt. Obs.	Umbral Durat.				
				U.T. h m s	P °	V °	U.T. h m s	P °	V °	U.T. h m s	P °	V °	U.T. h m s	P °	V °	U.T. h m s	P °	V °							
LATVIA	55°53' N	026°32' E	-	09:41:45.2	271	219	49	-	-	12:09:18.7	124	102	44	10:56:23.4	197	119	49	194	0.737	0.674					
	Daugavpils	56°21' N	024°01' E	-	09:33:57.1	272	216	48	-	-	12:04:08.7	121	104	47	10:49:27.8	197	115	50	183	0.772	0.719				
	Riga	56°57' N	024°06' E	-	09:38:45.4	271	225	47	-	-	12:05:06.8	124	106	45	10:53:41.8	197	112	49	190	0.753	0.696				
	Siauliai	55°55' N	023°19' E	-	09:37:09.3	271	283	48	-	-	12:06:04.7	122	104	46	10:52:12.3	197	113	49	187	0.755	0.677				
	Vaduz	54°41' N	025°19' E	-	09:39:35.3	273	283	50	-	-	12:10:15.8	122	100	46	10:55:46.3	197	110	50	192	0.772	0.662				
LIECHTENSTEIN	47°09' N	009°31' E	-	09:12:54.9	287	321	48	-	-	11:58:52.5	105	95	58	10:34:56.4	16	32	56	157	0.971	0.970					
	Kaunas	54°54' N	022°54' E	-	09:37:34.1	273	284	49	-	-	12:08:26.1	122	101	46	10:53:42.5	197	112	50	189	0.775	0.722				
	Klaipeda (Memel)	56°43' N	024°01' E	-	09:33:57.1	272	216	48	-	-	12:04:08.7	121	104	47	10:49:27.8	197	115	50	183	0.772	0.719				
	Panevėžys	55°44' N	024°21' E	-	09:38:45.4	271	225	47	-	-	12:05:06.8	124	106	45	10:52:12.3	197	112	49	190	0.753	0.695				
	Vilnius	54°41' N	025°19' E	-	09:39:35.3	273	283	50	-	-	12:10:15.8	122	100	46	10:55:46.3	197	110	50	192	0.772	0.662				
LITHUANIA	49°32' N	005°52' E	-	09:09:05.6	283	317	44	10:27:39.9	69	89	10:29:27.8	321	341	11:50:47.8	107	104	56	10:28:33.8	195	215	53	150	1.028	1.000	
	Diekirch	49°48' N	005°52' E	-	09:09:13.4	283	317	44	10:28:49.3	72	92	11:51:50.2	319	338	11:51:50.2	107	104	56	10:28:45.6	195	215	53	150	1.028	1.000
	Echternach	49°50' N	005°59' E	-	09:09:30.4	283	317	44	10:28:21.2	52	72	10:23:41.1	339	358	11:51:52.8	107	104	56	10:29:01.1	195	215	53	151	1.028	1.000
	Luxembourg	49°36' N	006°09' E	334	09:09:30.4	283	317	44	10:28:21.2	52	72	10:23:41.1	339	358	11:51:52.8	107	104	56	10:29:01.1	195	215	53	151	1.028	1.000
	Bitola	41°01' N	021°20' E	-	09:04:04.9	296	322	61	-	-	12:26:25.0	103	66	55	11:01:13.8	20	10	64	192	0.882	0.857				
Macedonia	Gostivar	41°41' N	020°54' E	-	09:32:7.8	294	321	60	-	-	12:22:40.6	104	69	55	11:00:13.7	19	12	63	190	0.899	0.879				
	Kumanovo	42°08' N	021°43' E	-	09:33:10.2	294	318	60	-	-	12:25:24.4	105	69	55	11:01:19.3	19	10	63	132	0.915	0.890				
	Skopje	41°59' N	021°26' E	240	09:33:42.7	294	319	60	-	-	12:25:18.6	104	69	55	11:00:55.1	19	11	63	191	0.909	0.882				
	Tetovo	42°01' N	020°58' E	-	09:32:48.1	294	320	60	-	-	12:24:25.0	104	69	55	10:59:57.5	19	12	63	190	0.905	0.888				
	Bely	47°46' N	029°56' E	-	09:43:37.4	283	322	57	-	-	12:25:23.6	115	92	48	11:06:15.8	199	183	56	203	0.916	0.901				
Moldova	Bender	46°48' N	029°29' E	-	09:16:44.0	284	290	58	-	-	12:28:55.4	115	79	47	11:09:22.3	199	180	56	208	0.927	0.914				
	Kishinov	47°00' N	028°50' E	-	09:16:44.0	284	291	58	-	-	12:27:48.6	115	80	47	11:08:53.3	199	181	56	206	0.924	0.911				
	Tiraspol	46°51' N	029°38' E	-	09:46:59.3	283	290	58	-	-	12:29:00.3	115	79	47	11:10:03.0	200	180	56	208	0.924	0.911				
	Monaco	43°42' N	007°23' E	55	09:08:48.3	293	333	48	-	-	11:57:21.4	99	91	61	10:31:39.8	16	39	59	149	0.862	0.832				
	Aalst	52°37' N	008°44' E	-	09:10:11.2	278	309	42	-	-	11:46:46.3	111	111	53	10:27:09.5	195	213	50	150	0.924	0.911				
Netherlands	Amerfoort	52°09' N	005°24' E	-	09:10:33.6	279	310	42	-	-	11:46:07.0	111	109	53	10:28:03.6	195	213	50	151	0.935	0.925				
	Amsterdam	52°22' N	005°54' E	2	09:10:09.2	279	310	43	-	-	11:47:12.3	111	110	53	10:27:21.1	195	213	50	150	0.931	0.919				
	Apeldoorn	52°13' N	005°55' E	-	09:11:18.1	279	310	43	-	-	11:48:54.7	111	109	53	10:28:54.0	195	213	50	152	0.931	0.920				
	Arnhem	51°59' N	005°55' E	-	09:11:02.8	279	310	43	-	-	11:49:05.4	111	109	53	10:28:48.2	195	213	51	152	0.938	0.928				
	Breda	51°35' N	004°46' E	-	09:09:17.9	280	312	42	-	-	11:47:30.5	110	109	54	10:27:03.0	195	214	50	149	0.952	0.947				
Dordrecht	Eindhoven	51°26' N	005°28' E	-	09:09:22.8	280	312	43	-	-	11:49:17.4	110	110	54	10:26:56.2	195	214	51	150	0.954	0.949				
	Enschede	52°12' N	006°53' E	-	09:12:25.7	279	309	43	-	-	11:50:25.7	111	108	53	10:30:05.1	195	214	51	154	0.959	0.941				
	Geleen	50°58' N	005°52' E	-	09:10:08.9	281	313	43	-	-	11:44:44.2	109	107	54	10:28:38.7	195	214	51	151	0.966	0.963				
	Groningen	53°13' N	006°33' E	-	09:12:54.7	278	307	43	-	-	11:48:56.0	113	110	52	10:29:49.9	195	211	50	154	0.902	0.883				
	Haarlem	52°23' N	004°38' E	-	09:09:51.1	279	310	42	-	-	11:46:47.6	111	111	53	10:28:58.6	195	214	50	149	0.931	0.920				
Haarlemmermeer	Heerlen	50°15' N	005°59' E	-	09:10:14.7	281	313	43	-	-	11:47:58.2	109	107	54	10:28:49.2	195	214	52	151	0.967	0.925				
	Leiden	52°09' N	005°30' E	-	09:09:28.8	279	311	43	-	-	11:46:45.8	110	110	53	10:28:44.7	195	214	50	149	0.937	0.928				
	Maastricht	50°52' N	005°43' E	-	09:09:52.9	281	314	43	-	-	11:49:34.6	109	107	54	10:28:24.5	195	214	51	151	0.969	0.968				
	Nijmegen	51°05' N	004°28' E	-	09:10:19.0	280	311	43	-	-	11:49:00.9	110	108	53	10:28:10.0	195	213	51	151	0.942	0.934				
	Rotterdam	51°55' N	004°18' E	-	09:09:13.8	280	312	42	-	-	11:46:52.7	110	110	53	10:26:56.7	195	214	50	149	0.944	0.936				
's-Gravenhage (The Hague)	's-Gravenhage	52°06' N	004°18' E	-	09:09:11.8	279	311	42	-	-	11:48:29.8	110	111	53	10:26:56.7	195	214	51	150	0.940	0.931				
	Hertogenbosch	51°41' N	005°19' E	-	09:10:03.2	280	312	43	-	-	11:48:20.7	110	109	54	10:27:52.9	195	214	51	150	0.948	0.941				
	Tilburg	51°34' N	005°05' E	-	09:09:40.1	280	312	42	-	-	11:48:04.4	110	109	54	10:27:31.2	195	214	51	150	0.952	0.946				
	Utrecht	52°05' N	005°08' E	-	09:10:17.2	279	311	42	-	-	11:47:46.0	110	110	53	10:27:31.9	195	214	51	150	0.953	0.945				
	Zaandam	52°26' N	004°49' E	-	09:10:06.9	279	310	42	-	-	11:47:46.0	111	111	53	10:27:31.6	195	214	51	150	0.953	0.945				
Zoetermeer	Zoetermeer	52°03' N	004°30' E	-	09:09:23.4	279	311	42	-	-	11:46:50.1	110	110	53	10:26:43.7	195	214	50	149	0.941	0.932				

TABLE 22
LOCAL CIRCUMSTANCES FOR EUROPE - ROMANIA
TOTAL SOLAR ECLIPSE OF 1999 AUGUST 11

Location Name	Latitude	Longitude	Elev.	First Contact			Second Contact			Third Contact			Fourth Contact			Maximum Eclipse			Eclipt. Obs.				
				U.T.			P. V			U.T.			P. V			U.T.			Alt Azm Mag.				
				h	m	s	h	m	s	h	m	s	h	m	s	h	m	s	h	m	s		
ROMANIA																							
Arad	46°11' N	021°20' E	-	09:32:09.3	287	308	56	10:55:35.5	89	84	10:57:49.9	308	302	12:19:13.9	110	81	53	10:56:42.8	199	103	59	188	
Bacau	46°34' N	026°55' E	-	09:42:07.4	285	256	58	-	-	-	12:26:45.1	113	79	49	11:05:57.3	199	104	57	202	0.954	1.000	0.949	0.2m14s
Bala-Mare	47°10' N	025°33' E	-	09:41:22.3	283	257	-	-	-	-	12:23:54.1	115	82	49	11:04:14.8	199	105	56	200	0.927	0.954	0.949	0.349
Botosani	47°16' N	026°45' E	-	09:44:33.3	287	307	59	-	-	-	12:29:47.2	111	77	50	11:04:45.9	199	106	56	200	0.977	0.978	0.915	0.349
Braislă	45°16' N	025°58' E	-	09:40:02.0	287	301	58	-	-	-	12:26:05.3	111	77	50	11:04:45.9	199	106	56	200	0.988	0.990	0.978	0.349
Brașov	45°33' N	025°37' E	-	09:42:13.0	280	303	60	11:05:47.7	113	97	11:08:10.0	287	270	12:28:13.6	111	74	50	11:07:24.2	200	103	58	203	
București (Buch.)	44°26' N	026°45' E	-	09:42:27.1	287	299	59	-	-	-	12:28:30.3	112	74	49	11:07:27.1	200	103	58	203	0.993	0.993	0.993	0.2m22s
Buzău	45°09' N	026°43' E	-	09:43:52.9	288	300	60	11:08:19.0	93	75	11:10:34.9	306	287	12:30:47.8	111	73	49	11:07:27.1	200	101	58	206	
Carâșsebeș	44°01' N	022°20' E	-	09:33:21.3	288	309	57	10:59:01.4	144	137	10:59:58.1	253	245	12:21:10.1	109	78	53	10:58:59.8	19	111	60	100	
Ciuciulea	45°25' N	022°13' E	-	09:33:21.7	288	309	60	-	-	-	12:21:32.0	112	81	51	11:00:07.1	199	103	58	193	0.976	0.976	0.976	0.3m16s
Cluj	46°07' N	023°36' E	392	09:36:05.3	285	303	57	-	-	-	12:22:30.3	111	72	48	11:11:44.1	200	109	58	203	0.998	0.998	0.998	0.2m14s
Constanta	44°11' N	028°32' E	4	09:46:24.0	288	297	61	-	-	-	12:25:59.3	109	74	52	11:03:03.1	196	106	59	198	1.029	1.000	0.993	0.349
Craiova	44°34' N	028°45' E	-	09:37:08.2	288	308	59	11:05:34.3	90	77	11:04:48.7	309	295	12:25:38.1	110	76	51	11:03:16.1	199	106	59	198	
Curtici-De-Argeș	45°08' N	024°41' E	-	09:38:29.0	288	304	59	-	-	-	12:21:58.1	110	79	52	11:05:32.7	199	106	59	192	1.029	1.000	0.993	0.349
Deva	45°55' N	022°55' E	-	09:35:02.4	287	306	59	10:54:53.3	68	59	11:00:14.1	240	227	12:25:47.5	109	78	52	11:07:23.1	199	107	59	192	
Dragasani	44°10' N	024°16' E	-	09:37:52.5	289	306	59	11:05:39.8	156	146	11:04:14.1	240	227	12:23:28.7	109	76	53	11:07:24.6	199	108	59	193	
Drobeta-Turnu-S.	44°38' N	022°39' E	-	09:42:55.2	289	310	58	-	-	-	12:28:04.9	111	77	49	11:07:24.6	199	108	59	204	0.983	0.983	0.983	0.349
Focșani	45°41' N	022°11' E	-	09:42:55.2	286	298	60	-	-	-	12:29:26.3	113	76	48	11:07:24.6	199	108	59	204	0.974	0.974	0.974	0.349
Galati	45°26' N	028°03' E	-	09:41:23.7	289	304	60	-	-	-	12:29:24.3	109	72	51	11:07:21.3	200	101	58	206	0.972	0.972	0.972	0.349
Giurgiu	43°53' N	025°57' E	-	09:35:09.7	287	307	57	10:58:57.0	98	99	11:01:17.1	300	291	12:22:26.1	110	78	52	11:00:07.1	199	109	59	193	
Hateg	45°33' N	022:55:1' E	-	09:35:02.3	287	306	57	10:58:48.6	85	76	11:00:55.0	313	304	12:22:09.6	110	79	52	10:59:54.0	199	109	59	192	
Hunedoara	45°45' N	029°54' E	-	09:36:19.3	288	294	58	-	-	-	12:26:01.7	111	77	48	11:03:19.7	199	108	59	203	0.934	0.934	0.934	0.2m20s
Iasi	45°10' N	020°33' E	-	09:31:07.0	288	310	56	10:55:08.3	155	151	10:56:46.4	242	237	12:18:53.5	109	80	53	10:55:57.4	199	149	59	192	
Jimbolia	45°47' N	020°43' E	-	09:31:01.3	284	312	57	10:56:16.3	83	83	10:57:30.9	308	303	12:19:52.1	110	81	53	10:57:52.1	199	149	59	192	
Lipova	45°05' N	021°40' E	-	09:33:15.0	288	309	57	10:57:01.7	125	118	10:57:19.5	273	265	12:20:48.3	109	79	53	10:58:10.6	199	122	59	190	
Lugoj	45°45' N	021°54' E	-	09:33:15.0	288	307	58	10:57:30.7	115	116	10:57:39.3	253	273	12:23:12.1	110	77	52	11:00:50.5	199	149	59	194	
Lupeni	43°50' N	028'35' E	-	09:46:28.5	289	298	61	11:11:02.2	81	60	11:13:03.4	319	297	12:33:09.9	111	73	49	11:12:03.9	200	107	59	209	
Mangalia	44°15' N	028'16' E	-	09:45:37.8	288	298	61	-	-	-	12:31:54.1	111	73	49	11:10:55.0	200	107	59	208	1.000	1.000	1.000	0.2m22s
Medgidia	45°00' N	025'29' E	-	09:40:19.8	288	302	59	11:04:40.3	67	52	11:05:24.8	332	317	12:31:52.1	111	73	49	11:10:55.0	200	107	59	208	
Oradea	47°03' N	025°57' E	-	09:33:08.8	285	305	56	-	-	-	12:18:49.5	111	83	52	10:57:01.8	199	192	58	189	0.982	0.982	0.982	0.349
Petriaș	45°22' N	023'25' E	-	09:36:03.2	288	306	58	10:59:56.3	100	90	11:02:17.3	288	288	12:23:21.7	110	78	52	11:06:59.1	199	189	59	194	
Piatra-Neamț	46°55' N	026'22' E	-	09:41:01.3	284	297	57	-	-	-	12:24:55.5	113	80	49	11:05:57.4	199	188	57	200	1.029	1.000	0.944	0.2m23s
Ploiești	44°45' N	024'52' E	-	09:41:04.4	288	302	59	11:03:07.0	111	98	11:05:29.7	287	273	12:26:19.5	110	75	51	11:04:58.1	199	188	57	200	
Rimnicu Vilcea	45°17' N	024'22' E	-	09:37:18.3	288	305	58	11:01:58.8	104	92	11:04:21.1	294	281	12:25:15.3	110	76	52	11:03:30.0	199	187	59	197	
Satu Mare	45°48' N	022'53' E	-	09:34:43.1	284	302	55	-	-	-	12:18:57.2	113	84	51	10:57:07.0	199	191	57	191	0.955	0.955	0.955	0.2m22s
Sibiu	45°17' N	024'09' E	-	09:37:17.8	287	304	58	-	-	-	12:23:50.8	111	78	51	11:02:03.2	199	188	59	196	0.997	0.998	0.998	0.349
Simionicolau Mare	46°05' N	020°38' E	-	09:30:55.8	287	310	56	10:54:23.2	121	117	10:56:42.6	276	271	12:18:20.1	109	81	53	10:55:32.9	199	14	59	186	
Slatina	44°26' N	024'22' E	-	09:38:09.1	289	307	59	-	-	-	12:26:17.8	109	74	52	11:03:22.9	199	16	60	198	0.998	0.998	0.998	0.2m19s
Slobozia	44°34' N	027'22' E	-	09:37:37.0	289	309	60	11:08:56.3	26	8	11:09:18.5	13	355	12:30:13.4	111	74	49	11:09:04.4	200	181	59	205	
Suceava	44°16' N	029'12' E	-	09:40:16.1	283	295	57	-	-	-	12:22:38.6	114	82	49	11:05:33.3	199	185	56	199	0.933	0.933	0.933	0.2m16s
Timișoara	47°39' N	026'19' E	-	09:32:10.7	288	310	56	10:55:52.1	140	135	10:57:54.3	251	251	12:17:41.5	109	80	53	10:56:33.3	199	187	59	200	
Tirgoviste	44°56' N	025'27' E	-	09:39:59.0	288	303	59	11:04:11.9	84	69	11:06:19.9	320	300	12:27:01.6	110	75	51	11:05:16.0	199	185	59	200	
Tîrgu-Jiu	45°02' N	023'17' E	-	09:35:55.8	288	307	58	11:00:24.5	151	141	11:02:11.0	247	236	12:23:48.5	109	77	52	11:01:17.8	199	186	59	200	
Tîrgu Mureș	46°33' N	024'33' E	-	09:37:50.3	286	301	57	-	-	-	12:23:11.6	112	80	51	11:01:08.7	199	188	59	196	0.974	0.974	0.974	0.2m08s
Uricani	44°43' N	026'38' E	-	09:42:17.7	288	301	50	11:06:51.3	58	41	11:08:19.4	341	324	12:28:55.4	109	74	50	11:07:15.4	200	183	59	203	
Vulcan	45°23' N	023'17' E	-	09:35:49.7	288	307	58	10:59:45.1	111	102	11:02:08.0	287	276	12:23:16.4	110	78	52	11:00:56.6	199	188	59	194	

TABLE 24
LOCAL CIRCUMSTANCES FOR EUROPE - SLOVAKIA, SLOVENIA, SWEDEN, SWITZERLAND, WALES & YUGOSLAVIA
TOTAL SOLAR ECLIPSE OF 1999 AUGUST 11

Location Name	Latitude	Longitude	Elev.	First Contact			Second Contact			Third Contact			Fourth Contact			Maximum Eclipse			Eclips.						
				U.T.	P	V	Alt	U.T.	P	V	Alt	U.T.	P	V	Alt	U.T.	P	V	Alt	U.T.	P	V			
SLOVAKIA	48°09' N	017°07' E	-	09:25:02.4	285	310	52	-	-	-	-	12:10:11.2	110	89	54	10:47:51.5	198	200	176	0.987	0.987	0.989			
Bratislava	48°13' N	021°15' E	-	09:31:56.5	283	302	54	-	-	-	-	12:15:19.0	113	88	51	10:54:26.8	198	194	166	0.944	0.944	0.937			
SLOVENIA	46°03' N	014°31' E	-	09:20:28.8	288	319	52	-	-	-	-	12:08:34.9	106	86	57	10:44:24.8	17	25	169	0.968	0.966	0.966			
Ljubljana	46°33' N	015°39' E	-	09:22:24.1	287	316	52	-	-	-	-	12:09:53.4	107	86	56	10:46:12.6	18	23	172	0.989	0.991	0.991			
Maribor	46°33' N	015°39' E	-	09:22:24.1	287	316	52	-	-	-	-	11:52:14.7	121	113	47	10:38:11.8	196	203	167	0.763	0.707	0.707			
SWEDEN	57°43' N	012°55' E	-	09:24:48.3	270	290	43	-	-	-	-	11:51:10.4	120	114	47	10:37:10.2	195	203	166	0.767	0.712	0.712			
Borås	57°53' N	012°58' E	17	09:23:40.9	270	291	43	-	-	-	-	11:54:03.7	118	110	49	10:38:10.3	196	203	167	0.805	0.760	0.760			
Göteborg (Gothe-	57°53' N	012°42' E	-	09:23:01.4	273	294	44	-	-	-	-	11:55:34.0	121	112	47	10:39:15.2	196	203	170	0.756	0.699	0.699			
Helsingborg	57°47' N	011°11' E	-	09:26:23.3	270	299	43	-	-	-	-	11:54:45.4	122	113	46	10:39:12.2	196	203	172	0.735	0.672	0.672			
Jönköping	57°53' N	015°37' E	-	09:23:41.4	266	286	44	-	-	-	-	11:54:58.9	118	109	49	10:38:59.0	196	203	167	0.815	0.773	0.773			
Ljungby	56°23' N	013°00' E	-	09:23:01.0	273	295	45	-	-	-	-	11:54:55.1	123	113	46	10:32:00.0	196	199	47	0.664	0.649	0.649			
Malmö	55°36' N	016°11' E	-	09:29:00.0	269	285	43	-	-	-	-	11:52:39.1	123	115	45	10:30:31.3	196	200	173	0.728	0.716	0.716			
Norrköping	56°36' N	015°11' E	-	09:29:00.0	268	284	43	-	-	-	-	11:52:39.1	124	113	45	10:33:38.9	196	198	46	0.703	0.633	0.633			
Orebro	59°31' N	018°03' E	45	09:32:25.3	267	281	44	-	-	-	-	11:54:12.8	125	114	44	10:43:19.6	196	198	45	0.693	0.620	0.620			
Stockholm	59°52' N	017°38' E	-	09:32:22.5	267	281	43	-	-	-	-	11:53:31.3	124	115	45	10:42:09.4	196	199	46	0.703	0.633	0.633			
Uppsala	59°37' N	016°33' E	-	09:30:52.4	267	282	43	-	-	-	-	11:53:31.3	124	115	45	10:42:09.4	196	199	46	0.703	0.633	0.633			
SWITZERLAND	47°33' N	007°35' E	-	09:10:16.8	287	322	46	-	-	-	-	11:55:10.4	105	98	58	10:31:29.2	16	35	55	0.973	0.973	0.973			
Basel (Bâle)	46°55' N	007'26' E	572	09:09:47.4	288	324	46	-	-	-	-	11:55:20.9	104	98	58	10:31:16.8	16	36	56	0.956	0.951	0.951			
Bern (Berne)	46°10' N	006°10' E	405	09:07:39.0	289	327	46	-	-	-	-	11:55:30.3	103	98	58	10:30:16.8	16	38	56	148	0.929	0.917			
Geneva (Genève)	46°21' N	006°38' E	-	09:08:28.3	288	326	46	-	-	-	-	11:54:11.8	103	98	59	10:39:54.2	16	37	56	150	0.940	0.931			
Lausanne	46°31' N	007'03' E	-	09:08:18.8	287	323	47	-	-	-	-	11:56:49.1	104	96	58	10:32:48.2	16	34	56	154	0.962	0.959			
Luzern	47°03' N	009'23' E	-	09:12:49.3	287	321	48	-	-	-	-	11:55:24.9	105	96	57	10:34:38.9	16	32	56	157	0.978	0.978			
Saint Gallen	47°25' N	008'43' E	-	09:11:33.9	287	321	47	-	-	-	-	11:57:11.4	105	97	57	10:33:27.9	16	33	56	155	0.977	0.977			
Winterthur	47°23' N	008'32' E	493	09:11:33.6	287	322	47	-	-	-	-	11:56:57.8	105	97	57	10:33:09.6	16	34	56	155	0.973	0.973			
Zürich	47°30' N	003'42' E	-	09:11:33.6	287	321	47	-	-	-	-	11:34:01.1	107	119	53	10:14:42.5	193	221	46	134	0.970	0.972			
WALES	51°29' N	003°13' W	62	09:00:22.5	280	316	37	-	-	-	-	11:35:11.5	107	118	53	10:15:36.9	193	221	46	135	0.973	0.972			
Cardiff	51°35' N	003°47' W	-	09:00:41.9	280	316	37	-	-	-	-	11:35:30.2	107	118	53	10:15:57.6	193	221	46	135	0.970	0.969			
Newport	51°36' N	003°47' W	-	09:09:56.6	280	316	36	-	-	-	-	11:34:10.0	107	119	53	10:14:54.8	193	221	46	134	0.971	0.969			
Port Talbot	51°38' N	003°47' W	-	08:59:49.1	280	316	36	-	-	-	-	11:34:01.1	107	119	53	10:14:42.5	193	221	46	134	0.970	0.968			
Swansea	51°38' N	003°57' W	-	08:59:49.1	280	316	36	-	-	-	-	11:34:01.1	107	119	53	10:14:42.5	193	221	46	134	0.970	0.968			
YUGOSLAVIA	44°50' N	020°30' E	138	09:30:54.1	289	313	57	10:54:42.0	159	155	-	12:19:54.0	108	78	54	10:56:23.5	19	14	60	186	0.977	0.977			
Bogograd (Balgra-	45°50' N	020°28' E	-	09:30:10.0	288	311	56	10:56:13.4	238	234	-	12:19:26.4	109	80	54	10:55:21.7	19	14	59	186	1.000	0.999			
Kitinda	44°01' N	020°55' E	-	09:31:33.0	291	315	58	-	-	-	-	12:22:41.5	107	75	54	10:51:55.0	19	13	61	188	0.959	0.955			
Kragujevac	43°19' N	021°54' E	-	09:33:58.2	292	314	59	-	-	-	-	12:24:13.9	106	72	54	11:00:21.9	19	10	62	192	0.948	0.942			
Nis	43°19' N	019'50' E	-	09:39:57.6	289	313	56	-	-	-	-	12:18:16.7	108	79	54	10:54:47.9	19	15	60	184	0.984	0.984			
Novi Sad	42°39' N	021°10' E	-	09:32:52.5	293	318	59	-	-	-	-	12:22:58.2	105	71	55	10:53:43.1	19	12	62	190	0.924	0.911			
Pristina	46°06' N	019'39' E	-	09:29:12.1	287	311	55	10:52:55.1	153	151	10:54:36.8	244	241	-	12:16:49.2	109	82	54	10:53:46.1	18	16	59	183	1.029	1.000
Subotica	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-					

TABLE 27
LOCAL CIRCUMSTANCES FOR TURKEY
TOTAL SOLAR ECLIPSE OF 1999 AUGUST 11

Location Name	Latitude	Longitude	Elev.	First Contact			Second Contact			Third Contact			Fourth Contact			Maximum Eclipse			Eclipt. Mag.			Eclipt. Obs. Durat.				
				U.T. m h m s	P o	V Alt h m s	U.T. P o	V Alt h m s																		
TURKEY																										
Adana	37°01' N	035°18'E	25	10:06:45.8	296	284	68	-	-	-	12:52:47.3	107	53	43	11:33:45.0	22	339	57	236	0.925	0.912					
Adiyaman	40°46' N	038°10'E	-	10:32:23.3	293	298	64	-	-	-	12:40:31.0	108	53	43	11:19:24.9	21	351	60	238	0.963	0.960					
Anamur	40°16' N	111°50'E	-	10:11:50.6	293	274	66	-	-	-	12:55:44.2	110	54	43	11:37:00.2	20	347	54	230	0.977	0.977	0.2m10s				
Antalya (Antioch)	39°56' N	035°51'E	861	10:03:28.6	290	291	65	11:27:43.5	95	58	11:29:53.4	307	269	12:47:10.2	107	63	43	11:28:48.6	201	164	56	230	1.028	1.000		
Antalya	36°14' N	036°07'E	-	10:09:33.3	297	281	68	-	-	-	12:45:04.4	109	61	55	11:24:58.4	21	346	54	238	0.969	0.967					
Aydin	36°53' N	029°42'E	-	09:50:09.5	299	311	67	-	-	-	12:53:00.5	106	52	42	11:26:52.0	22	336	57	238	0.915	0.900					
Bartin	39°39' N	027°51'E	-	09:48:19.1	296	307	65	-	-	-	12:41:47.4	104	52	48	11:25:40.6	22	345	62	236	0.868	0.840					
Bartın	41°38' N	032°22'E	-	09:55:31.0	291	291	64	11:20:42.8	155	124	11:22:23.0	247	215	12:38:48.9	105	55	50	11:16:20.7	21	354	62	234	0.909	0.892	0.2m40s	
Batman	37°52' N	041°07'E	-	10:17:21.5	292	265	64	11:40:21.4	119	71	11:42:28.4	285	237	12:57:11.5	111	58	37	11:41:25.0	22	334	52	244	1.027	1.000		
Bursa	40°11' N	029°04'E	-	10:16:29.0	266	266	65	11:39:52.9	144	97	11:41:42.1	260	213	12:53:59.7	111	57	37	11:47:49.3	22	335	52	243	1.027	1.000	0.1m49s	
Cerikayak	39°15' N	037°31'E	-	10:08:38.7	292	276	65	11:33:03.5	154	112	11:34:41.4	249	207	12:53:58.5	111	60	41	11:35:52.6	22	340	55	236	1.028	1.000		
Cizre	37°20' N	042°12'E	-	10:20:13.2	292	262	64	11:42:49.3	117	68	11:44:54.5	237	238	12:53:03.3	112	57	36	11:38:51.2	22	345	51	246	1.027	1.000	0.0m0s	
Denizli	40°33' N	034°55'E	-	10:01:48.9	291	284	65	11:26:36.7	147	110	11:28:00.8	256	219	12:45:22.0	111	63	43	11:27:32.4	21	345	56	239	1.038	1.000	0.1m51s	
Diyarbakır	37°55' N	038°07'E	-	10:09:27.0	294	274	65	11:33:18.1	115	73	11:35:30.2	288	246	12:51:52.8	111	60	41	11:34:24.3	22	339	54	236	1.027	1.000	0.2s	
Edirne	41°40' N	026°34'E	-	09:43:51.3	293	307	63	-	-	-	11:40:42.8	240	193	12:33:47.0	107	66	51	11:20:02.8	22	335	53	242	1.027	1.000	0.1m1s	
Elaçığ	38°41' N	038°14'E	-	10:12:32.9	292	271	65	11:36:18.8	131	86	11:38:17.6	237	228	12:54:04.2	111	59	39	11:37:15.9	22	337	53	239	1.027	1.000	0.2s	
Erzurum	39°46' N	041°17'E	1951	10:15:02.7	289	265	63	11:37:49.8	145	100	11:39:38.0	258	212	12:53:14.7	111	63	38	11:38:44.1	22	346	51	231	1.027	1.000	0.1m8s	
Eskişehir	39°46' N	030°32'E	-	09:53:37.2	294	299	67	-	-	-	12:42:11.9	107	60	48	11:21:06.0	21	350	56	230	0.966	0.964	m4				
Gaziantep	37°05' N	037°22'E	-	10:10:54.9	295	277	67	-	-	-	12:54:39.8	108	54	41	11:37:02.5	21	349	51	239	0.939	0.931					
Gümüşhacıköy	40°48' N	029°25'E	-	10:50:22.1	293	301	64	-	-	-	12:39:58.6	108	63	48	11:37:25.9	21	353	50	236	0.950	0.949					
Istanbul	36°53' N	035°44'E	-	10:02:00.1	290	283	64	11:26:20.4	100	64	11:28:33.8	307	266	12:49:03.7	111	64	32	11:27:55.7	22	337	57	238	0.925	0.912	0.2m13s	
Istanbul	40°45' N	036°29'E	-	10:09:03.3	297	281	66	11:25:31.1	94	113	11:27:20.6	253	218	12:45:28.7	111	60	45	11:26:12.4	21	345	57	237	0.927	0.922		
Izmir	38°25' N	027°09'E	28	09:48:04.0	298	271	66	-	-	-	12:39:32.7	103	56	51	11:16:38.0	21	354	54	234	1.027	1.000	0.1m49s				
Kastamonu	40°46' N	029°55'E	-	09:51:24.5	293	299	64	-	-	-	12:43:36.0	111	65	44	11:24:20.7	21	347	57	235	0.954	0.954					
Kayseri	39°43' N	035°37'E	-	09:58:37.5	250	287	64	11:23:12.0	116	83	11:25:29.1	286	252	12:50:09.4	109	58	43	11:19:19.3	22	341	57	233	0.968	0.966		
Kırıkkale	39°50' N	033°31'E	-	09:59:38.9	254	283	66	11:23:31.1	94	113	12:45:57.9	109	60	45	11:26:14.2	21	345	57	237	0.927	0.922					
Konya	37°52' N	041°21'E	-	10:18:23.4	291	263	64	11:41:12.3	80	33	11:43:00.2	323	276	12:47:39.9	110	55	43	11:27:32.2	22	344	50	238	1.014	0.989		
Kırşehir	37°57' N	041°47'E	-	10:18:47.9	292	270	65	11:37:12.4	140	95	11:39:22.4	264	218	12:54:58.5	111	58	39	11:38:25.0	22	346	51	241	1.027	1.000	0.1m48s	
Maden	38°21' N	038°19'E	-	10:11:08.6	293	274	65	11:37:16.3	94	93	11:39:19.8	309	264	12:53:04.9	110	59	40	11:36:25.4	22	346	53	241	1.099	0.993	0.2m04s	
Marmara	38°36' N	027°56'E	-	09:48:27.5	298	311	66	-	-	-	12:39:18.2	104	60	51	11:24:47.5	21	349	58	233	0.939	0.900					
Marsas	36°56' N	036°55'E	-	10:09:17.7	295	278	67	-	-	-	12:33:56.8	109	55	41	11:35:27.5	22	338	56	237	0.957	0.953					
Mersin	36°48' N	034°38'E	-	10:05:40.8	297	287	68	-	-	-	12:52:51.1	106	54	40	11:29:45.2	22	342	55	237	0.912	0.905					
Merzifon	40°53' N	035°59'E	-	10:02:30.1	290	282	68	11:24:48.7	89	52	11:28:53.8	314	277	12:49:10.8	232	52	37	11:27:51.4	20	345	54	239	1.028	1.000	0.2m05s	
Midiyat	37°25' N	040°23'E	-	10:18:30.2	292	264	65	11:41:45.8	103	103	11:45:22.4	251	203	12:53:43.4	111	57	33	11:28:47.7	22	344	53	237	1.027	1.000	0.1m37s	
Osmancık	40°59' N	034°59'E	-	10:01:04.0	290	264	64	11:23:52.1	109	73	11:27:55.5	294	258	12:45:52.9	110	54	42	11:26:37.4	20	346	52	238	1.017	1.000	0.2m16s	
Osmaniye	38°42' N	036°57'E	-	10:56:40.1	291	269	64	11:24:17.5	113	95	11:31:33.0	307	268	12:48:58.9	112	62	42	11:24:52.9	20	347	57	236	1.028	1.000	0.2m00s	
Safrahanlu	41°15' N	032°45'E	40	11:17:00.1	291	269	64	11:41:44.8	66	19	11:43:13.5	337	289	12:46:39.2	113	65	45	11:24:47.5	21	349	58	237	1.028	1.000	0.1m29s	
Samsun	37°56' N	041°57'E	-	10:18:54.0	291	263	64	11:39:47.0	97	51	11:41:50.9	306	259	12:56:37.6	112	58	38	11:40:49.1	20	345	55	236	1.027	1.000		
Sivas	39°45' N	037'02'E	-	10:03:02.3	290	281	64	11:21:27.0	139	89	52	11:33:10.8	272	232	12:49:58.5	111	61	33	11:32:07.4	21	341	55	234	1.028	1.000	0.2m07s
Silivova (Suluova)	36°55' N	034°53'E	-	10:06:02.3	297	286	68	-	-	-	12:45:22.1	106	55	40	11:28:21.6	20	341	54	233	1.028	1.000					
Tarsus	41°20' N	036°14'E	-	09:59:23.7	290	285	64	11:23:52.7	83	49	11:25:52.9	320	285	12:43:52.0	112	63	43	11:28:27.7	20	342	53	235	1.017	0.993		
Taskopru	40°19' N	036°34'E	-	10:05:16.4	291	269	64	11:29:23.8	95	57	11:31:33.0	307	268	12:48:58.9	112	62	42	11:28:27.7	20	343	54	236	1.028	1.000	0.2m09s	
Tosya	41°01' N	036°32'E	-	10:10:44.1	288	269	63	11:36:10.1	71	27	11:37:48.2	333	289	12:50:30.7	111	63	39	11:34:23.4	20	345	55	237	1.028	1.000	0.1m38s	
Trabzon	41°00' N	036°33'E	-	10:09:23.8	291	264	64	11:35:10.1	219	71	11:37:48.2	333	289	12:50:30.7	111	63	39	11:34:23.4	20	345	55	237	1.028	1.000	0.1m38s	
Tunceli	39°07' N	036°22'E	-	10:04:14.9	291	260	64	11:36:28.7	109	71	11:37:48.2	333	289	12:50:30.7	111	63	39	11:34:23.4	20	345	55	237	1.028	1.000	0.2m15s	
Ürtü	37°08' N	038°46'E	-	10:13:41.1	294	272	66	-	-	-	12:45:10.1	110	55	40	11:39:09.6	22	335	54	241	1.028	1.000					
Van	38°28' N	041°57'E	-	10:20:51.4	289	59	62	-	-	-	12:46:33.4	113	60	45	11:43:28.1	21	342	55	233	1.028	1.000					
Yıldızeli	39°52' N	036°38'E	-	10:05:54.																						

TABLE 29
LOCAL CIRCUMSTANCES FOR IRAN
TOTAL SOLAR ECLIPSE OF 1999 AUGUST 11

Location Name	Latitude	Longitude	Elev.	First Contact				Second Contact				Third Contact				Fourth Contact				Maximum Eclipse				Eclips.	Umbra							
				U.T.		P	V	U.T.		P	V	U.T.		P	V	U.T.		P	V	U.T.		Mag.	Obs.	Eclips.								
				m	h	m	s	m	h	m	s	m	h	m	s	m	h	m	s	m	h	s										
IRAN				-	10:42:02.4	296	243	60	11:59:11.7	117	58	12:01:02.7	288	229	13:13:47.3	108	46	28	12:01:39.2	22	321	43	261	0.953	0.947							
Abvaz	31°19' N	048°42' E	-	10:40:01.3	293	242	59	-	-	-	-	13:10:56.7	111	51	28	12:00:07.3	22	324	43	260	1.025	1.000	0.975	1.000	0.947	0.947						
Aligudarz	32°24' N	059°41' E	-	10:40:07.1	287	239	55	-	-	-	-	13:10:55.5	116	51	58	11:58:40.7	202	144	43	259	0.958	0.938	0.976	0.903	0.958	0.958						
Amol	36°23' N	052°20' E	-	10:39:01.4	292	243	58	-	-	-	-	13:09:47.0	112	53	28	11:58:55.7	202	144	43	259	0.958	0.938	0.976	0.903	0.958	0.958						
Arak	34°05' N	059°41' E	-	10:30:24.0	287	248	58	-	-	-	-	13:11:54.5	109	48	29	12:00:27.3	22	323	44	256	0.974	0.910	0.972	0.930	0.958	0.958						
Ardabil	38°15' N	048°18' E	-	10:35:12.2	292	246	60	11:55:28.1	51	354	11:56:22.6	354	298	13:07:44.2	114	54	30	11:55:55.5	202	145	46	256	1.025	1.000	0.975	0.945	0.958	0.958				
Asadabad	34°47' N	048°07' E	-	10:40:28.7	292	246	60	11:55:30.4	51	354	11:56:22.6	354	298	13:07:44.0	117	60	30	11:55:43.2	201	147	40	259	0.910	0.892	0.975	0.930	0.958	0.958				
Babol	36°24' N	052°42' E	-	10:40:02.6	293	248	61	11:55:03.8	175	119	11:55:57.0	229	173	13:07:53.1	111	52	31	11:55:30.5	22	326	46	256	1.025	1.000	0.975	0.958	0.958	0.958				
Bakhtaran (Kermanshah)	34°00' N	047°04' E	1320	11:01:03.0	292	229	49	12:14:36.4	89	24	12:16:02.0	314	249	13:07:58.5	111	47	18	12:15:19.3	202	137	33	270	1.022	1.000	0.975	0.958	0.958	0.958				
Bam	29°06' N	058°21' E	-	11:01:29.4	291	251	-	11:01:29.4	291	251	11:01:29.4	291	251	12:16:58.4	108	41	19	12:16:58.4	201	135	34	271	0.949	0.949	0.975	0.958	0.958	0.958				
Bandar 'Abbas	27°21' N	056°17' E	-	11:01:29.4	291	251	-	11:01:29.4	291	251	11:01:29.4	291	251	12:16:58.4	108	41	19	12:16:58.4	201	135	34	271	0.949	0.949	0.975	0.958	0.958	0.958				
Borujerd	33°04' N	048°56' E	-	10:37:16.9	292	244	59	11:57:16.6	115	58	11:59:09.8	289	231	13:09:35.9	111	52	29	11:58:11.4	22	324	44	258	1.025	1.000	0.975	0.958	0.958	0.958				
Boushehr	28°59' N	050°50' E	-	10:49:03.1	298	258	58	11:57:33.6	118	60	11:59:26.2	287	229	13:11:29.9	107	42	25	12:08:58.0	22	326	41	260	0.925	0.912	0.975	0.958	0.958	0.958				
Deh Kord	33°09' N	048°53' E	-	10:38:04.9	294	249	59	11:58:30.5	116	60	11:59:30.5	289	231	13:11:54.5	108	48	29	12:00:27.3	22	323	44	260	0.974	1.000	0.975	0.958	0.958	0.958				
Dez Ful	32°23' N	048°24' E	-	10:39:39.4	295	244	60	11:58:31.1	145	87	12:00:06.5	259	201	13:13:08.5	112	51	29	11:59:19.5	201	145	45	256	0.974	0.910	0.975	0.958	0.958	0.958				
Dow Ruds	33°28' N	049°04' E	1597	10:44:06.6	292	239	59	11:58:31.1	145	87	12:00:06.5	259	201	13:13:08.5	112	51	29	12:01:28.6	202	142	41	262	1.024	1.000	0.975	0.958	0.958	0.958				
Esfahan (Isfahan)	35°40' N	051°10' E	-	10:39:12.4	292	241	57	11:59:38.0	75	17	12:01:26.3	329	270	13:07:43.7	115	57	28	11:57:44.5	202	143	42	260	1.025	1.000	0.975	0.958	0.958	0.958				
Golpayegan	33°27' N	050°18' E	-	10:41:12.4	292	241	58	11:59:38.0	75	17	12:01:26.3	329	270	13:07:53.9	112	62	30	11:56:57.7	118	62	30	11:56:57.7	201	146	44	257	0.997	0.998	0.975	0.958	0.958	0.958
Gorgan	36°50' N	054°29' E	-	10:43:00.4	291	246	60	-	-	-	-	13:07:53.9	112	62	30	11:56:20.4	202	146	44	257	0.997	0.998	0.975	0.958	0.958	0.958						
Hamedan	34°48' N	048°30' E	-	10:35:32.0	291	246	60	-	-	-	-	13:07:53.9	112	62	30	11:56:57.7	118	62	30	11:56:57.7	201	146	44	257	0.997	0.998	0.975	0.958	0.958	0.958		
Harsin	34°06' N	047°35' E	-	10:35:03.6	293	247	61	11:55:22.6	143	87	11:57:01.6	261	204	13:08:16.7	111	52	30	11:56:12.2	22	325	45	257	1.026	1.000	0.975	0.958	0.958	0.958				
Hemayunshahr	32°11' N	051°21' E	-	10:44:32.6	292	239	57	12:02:29.2	89	29	12:04:08.1	315	255	13:13:03.7	112	51	26	12:03:16.8	202	142	41	262	1.025	1.000	0.975	0.958	0.958	0.958				
Iranshahr	27°13' N	060°01' E	-	10:37:07.9	292	246	58	11:55:20.9	84	98	11:57:10.4	306	250	13:08:06.5	112	53	30	11:56:14.8	202	145	45	257	1.025	1.000	0.975	0.958	0.958	0.958				
Rangavar	34°30' N	047°58' E	-	10:35:32.9	292	246	60	11:55:18.9	98	41	11:57:10.4	306	250	13:07:01.5	115	57	28	12:01:04.7	201	145	45	257	0.946	0.938	0.975	0.958	0.958	0.958				
Karaj	35°48' N	045°59' E	-	10:42:18.1	291	248	57	-	-	-	-	13:10:49.9	113	54	27	12:01:01.0	201	144	41	259	0.979	0.977	0.975	0.958	0.958	0.958						
Kashan	33°57' N	051°29' E	-	10:42:22.3	290	240	57	-	-	-	-	13:18:52.0	112	52	28	12:12:25.1	201	138	36	268	1.025	1.000	0.975	0.958	0.958	0.958						
30°17' N	057°05' E	-	10:57:16.6	291	230	50	11:59:28.4	68	9	12:00:47.3	337	278	13:10:44.9	112	52	28	12:00:08.0	202	144	42	260	1.025	1.000	0.975	0.958	0.958	0.958					
Kerman	33°38' N	049°04' E	-	10:40:30.0	292	242	58	11:59:28.4	68	9	12:00:47.3	337	278	13:10:44.9	112	52	28	12:00:11.5	201	145	45	257	1.025	1.000	0.975	0.958	0.958	0.958				
Nahavand	34°12' N	049°18' E	-	10:39:35.0	292	245	60	11:56:17.3	107	50	11:58:11.0	298	240	13:13:05.8	109	48	28	11:57:14.3	202	145	45	257	1.025	1.000	0.975	0.958	0.958	0.958				
Najafabad	32°37' N	051°21' E	-	10:41:22.4	292	239	57	12:02:21.7	106	46	12:04:08.9	298	238	13:13:09.8	110	51	28	11:57:14.3	201	144	41	262	1.025	1.000	0.975	0.958	0.958	0.958				
Neyshabur	36°12' N	056°50' E	-	10:50:32.0	292	239	56	-	-	-	-	13:13:09.8	110	51	28	11:57:14.3	201	144	41	262	1.025	1.000	0.975	0.958	0.958	0.958						
Orumiyeh (Reza')	37°33' N	046°58' E	-	10:23:50.9	288	255	61	-	-	-	-	12:02:45.5	113	58	34	11:47:20.3	202	151	48	249	0.976	0.975	0.975	0.958	0.958	0.958						
Oz 'enbehshahr	36°28' N	052°33' E	-	10:40:55.0	296	239	55	-	-	-	-	13:06:59.3	117	60	28	11:58:04.6	201	146	45	259	0.976	0.975	0.975	0.958	0.958	0.958						
Qazvin	36°16' N	056°00' E	-	10:22:48.1	292	249	59	-	-	-	-	13:06:59.3	115	58	29	11:55:56.0	201	146	45	259	0.976	0.975	0.975	0.958	0.958	0.958						
Qom	34°39' N	050°34' E	-	10:40:18.2	290	241	57	12:10:41.7	77	13	12:10:51.9	327	263	13:18:24.2	111	57	27	11:59:14.7	202	145	45	259	0.976	0.975	0.975	0.958	0.958	0.958				
Rafsanjan	30°24' N	056°16' E	-	10:39:24.0	292	242	52	12:10:41.7	77	13	12:10:51.9	327	263	13:18:24.2	111	57	27	11:59:14.7	202	145	45	259	0.976	0.975	0.975	0.958	0.958	0.958				
Rasht	38°05' N	046°18' E	-	10:26:58.6	288	242	50	-	-	-	-	13:00:39.4	115	60	33	11:47:57.5	202	147	45	256	1.025	1.000	0.975	0.958	0.958	0.958						
Sabzevar	36°13' N	049°36' E	-	10:34:06.6	287	243	50	-	-	-	-	13:00:39.4	116	60	33	11:48:26.8	202	149	43	255	0.976	0.975	0.975	0.958	0.958	0.958						
Sananda'j	35°19' N	047°00' E	-	10:48:55.7	283	233	50	-	-	-	-	13:08:53.1	119	62	22	12:01:47.9	201	145	35	263	0.882	0.832	0.975	0.958	0.958	0.958						
Sari	36°34' N	052°04' E	-	10:41:04.5	293	238	55	12:05:02.3	141	80	12:05:35.9	263	202	13:16:17.9	111	60	26	11:58:04.8	201	146	45	259	0.976	0.975	0.975	0.958	0.958	0.958				
Shahreza	32°01' N	051°52' E	-	10:45:14.5	293	238	55	-	-	-	-	13:00:49.5	113	58	34	12:04:49.2	22	321	40	263	1.024	1.000	0.975	0.958	0.958	0.958						
Shahr Kord																																

TABLE 30

**LOCAL CIRCUMSTANCES FOR IRAQ
TOTAL SOLAR ECLIPSE OF 1999 AUGUST 11**

Location Name	Latitude	Longitude	Elev.	First Contact			Second Contact			Third Contact			Fourth Contact			Maximum Eclipse									
				m	h	m	s	m	h	m	s	m	h	m	s	h	m	s							
IRAQ	31°50' N	047°09' E	-	10:38:22.2	297	246	62	-	-	-	-	13:12:00.7	108	46	30	11:59:56.7	22	322	45	259	0.946	0.938			
Al-Tammarah	30°50' N	047°09' E	-	10:41:53.5	298	241	61	-	-	-	-	13:14:29.4	107	43	29	12:00:09.9	23	320	44	262	0.923	0.909			
Al-Bassah (Basra)	32°23' N	044°55' E	-	10:32:29.0	298	233	54	11:46:-38.8	188	137	11:47:08.4	216	164	-	13:09:01.5	107	46	33	11:55:21.1	23	324	48	256	0.927	0.915
Al-Hillah	32°20' N	043°08' E	223	10:32:29.0	293	250	64	11:46:-38.8	188	137	11:47:08.4	216	164	-	13:01:34.7	111	55	35	11:46:53.7	22	31	50	149	1.027	1.000
Al-Nawsil (Nosu...)	31°59' N	044°16' E	-	10:38:11.7	298	247	63	-	-	-	-	13:12:39.5	107	44	31	12:00:15.7	23	321	46	260	0.915	0.899			
An-Najaf	31°02' N	046°16' E	-	10:28:24.0	297	236	65	-	-	-	-	13:06:37.4	108	48	34	11:52:11.5	22	326	50	253	0.917	0.901			
An-Nasiriyah	33°25' N	043°17' E	-	10:29:03.6	292	253	62	11:50:20.1	127	74	11:52:16.0	277	223	13:04:39.3	111	54	33	11:51:18.2	22	328	48	253	0.926	0.925	
As-Ramadi	35°33' N	045°26' E	-	10:30:41.0	296	253	64	-	-	-	-	13:07:08.3	109	49	33	11:53:25.3	22	326	48	255	0.947	0.940			
Baghdad	35°22' N	044°55' E	34	10:30:41.0	296	253	64	-	-	-	-	13:07:37.9	108	48	33	11:53:50.2	22	326	48	254	0.959	0.955			
Ba Quban	35°45' N	044°58' E	-	10:30:26.5	292	259	64	11:44:45.7	122	72	11:46:48.2	281	231	13:00:31.8	111	56	36	11:45:47.0	22	327	50	248	1.027	1.000	
Dahuk	36°52' N	043°00' E	-	10:22:26.6	292	259	64	11:51:46.2	137	83	11:53:34.0	267	212	13:05:02.0	111	53	32	11:52:40.3	22	327	47	254	1.026	1.000	
Halabjah	35°10' N	045°51' E	-	10:30:41.1	293	251	62	11:52:35.9	139	87	11:59:15.6	265	213	13:08:32.3	110	46	33	11:54:38.4	23	325	49	255	0.925	0.912	
Irbil	36°11' N	040°01' E	-	10:23:14.3	288	254	63	11:52:25.9	139	87	11:59:15.6	265	213	13:04:06.4	111	53	34	11:51:11.8	22	329	48	252	0.996	0.988	
Karbala'	32°36' N	044°02' E	-	10:27:01.2	293	255	63	11:58:19.4	116	63	11:50:20.7	288	235	13:03:09.1	112	56	34	11:49:24.0	22	329	48	251	1.026	1.000	
Kirkuk	35°28' N	044°28' E	-	10:26:44.1	292	255	63	11:58:19.4	116	63	11:45:55.7	292	242	12:59:48.2	112	56	36	11:44:53.3	22	332	50	247	1.027	1.000	
Kuysanjaq	36°05' N	044°38' E	-	10:21:26.7	292	260	64	11:43:30.5	112	63	11:45:55.7	292	242	-	-	-	-	-	-	-	-	-	-	-	-
Zakhu	37°08' N	042°41' E	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

**TABLE 31
LOCAL CIRCUMSTANCES FOR PAKISTAN
TOTAL SOLAR ECLIPSE OF 1999 AUGUST 11**

Location Name	Latitude	Longitude	Elev.	First Contact			Second Contact			Third Contact			Fourth Contact			Maximum Eclipse								
				m	h	m	s	m	h	m	s	m	h	m	s	h	m	s						
PAKISTAN																								
Chamburi Na'lat	26°09' N	064°43' E	-	11:13:43.3	292	223	41	12:23:14.3	65	357	12:24:09.8	337	269	13:25:49.2	110	45	11	12:23:42.2	201	133	25	276	1.020	1.000
Faisalabad (Iya...)	31°25' N	07°30' E	-	11:14:13.3	29	217	33	12:25:22.8	84	317	12:27:28.6	317	248	13:25:56.0	120	61	7	12:48:43.3	200	138	19	277	0.807	0.761
Gharo	24°44' N	06°35' E	-	11:14:08.5	277	216	32	12:25:32.7	84	317	12:27:55.1	122	64	12:48:55.8	120	61	7	12:47:31.0	200	139	18	278	1.019	0.986
Guarawala	32°26' N	07°33' E	-	11:14:22.9	1	233	242	12:25:41.6	88	19	12:26:52.8	313	244	13:25:46.6	110	44	12	12:23:15.1	201	132	22	277	1.074	0.718
Hab Nadi Chooki	25°01' N	066°53' E	-	11:12:22.1	291	221	38	12:22:55.8	173	105	12:23:34.2	229	161	13:25:57.5	110	44	12	12:23:15.1	21	131	26	275	1.005	0.938
Hirok Sami	26°07' N	063°29' E	-	11:12:29.1	293	224	42	12:22:55.8	173	105	12:23:34.2	229	161	13:25:57.5	110	44	12	12:23:15.1	21	131	26	275	1.021	1.000
Hochab	26°01' N	063°56' E	-	11:15:01.5	292	223	42	12:22:54.7	134	66	12:24:09.0	268	200	13:26:56.7	110	44	12	12:23:15.1	21	131	26	275	1.021	0.983
Hyderabad	25°22' N	068°22' E	-	11:18:35.2	290	220	36	-	-	-	-	-	-	13:26:38.4	111	48	12	12:26:17.7	201	132	21	218	0.983	0.983
Lahore	31°15' N	07:30' E	-	11:15:02.8	278	216	32	-	-	-	-	13:13:07.7	123	66	8	12:51:13.1	200	140	20	215	0.702	0.702		
Mirpur Batoor	24°44' N	068°17' E	-	11:19:27.8	291	220	36	12:27:35.4	96	27	12:28:17.0	305	235	13:27:57.6	110	43	7	12:27:42.0	201	131	21	278	1.019	1.000
Mirpur Sako	24°53' N	067°37' E	-	11:15:35.6	291	222	37	12:28:34.8	93	355	12:27:04.2	357	288	13:27:46.9	110	44	12	12:26:49.1	201	132	21	278	1.019	1.000
Karachi	24°52' N	067°03' E	4	11:18:07.3	292	221	38	12:25:56.4	99	30	12:27:39.3	303	234	13:27:51.5	110	40	12	12:26:49.1	201	132	22	277	1.020	1.000
Kori Bandar	24°08' N	067°21' E	-	11:19:37.7	292	221	37	12:26:52.9	116	46	12:28:05.6	286	216	13:27:44.2	110	48	8	12:26:32.9	201	132	21	278	1.099	1.000
Naka Kharati	24°24' N	067°50' E	-	11:19:34.9	292	221	37	12:26:52.9	116	46	12:28:05.6	286	216	13:27:44.2	110	48	8	12:26:32.9	201	132	21	278	1.019	1.000
Rawalpindi	33°36' N	07:00' E	-	11:15:43.6	291	221	38	12:25:28.5	60	352	12:26:16.5	341	273	13:26:56.7	110	44	9	12:25:52.6	201	132	23	277	1.020	1.000
Sargodha	32°05' N	07:24' E	-	11:12:57.2	278	217	34	12:27:20.7	146	76	12:28:19.9	255	186	13:26:56.7	112	62	8	12:26:15.3	200	20	276	0.763	0.706	
Shahbandar	24°10' N	067°54' E	-	11:20:00.3	292	221	36	12:27:20.7	146	76	12:28:19.9	255	186	13:26:56.7	112	62	8	12:27:50.4	201	21	218	0.748	0.748	
Shahbandar Ka...at	26°42' N	063°58' E	-	11:32:01.1	291	223	42	12:26:48.2	146	72	12:28:19.9	255	186	13:26:56.7	112	62	8	12:27:50.4	201	21	218	0.748	0.748	
Sialkot	32°30' N	07:43' E	-	11:14:01.6	277	216	32	-	-	-	-	13:16:49.1	122	64	7	12:17:25.0	200	139	19	277	0.117	0.117		
Somnani	25°26' N	066°36' E	-	11:16:47.9	291	221	38	12:26:49.7	70	1	12:27:44.7	331	262	13:26:56.7	110	44	9	12:26:49.5	201	23	277	0.999	1.000	
Sujawal	24°36' N	068°05' E	-	11:19:30.1	291	221	37	12:26:49.7	70	1	12:27:44.7	331	262	13:26:56.7	110	44	8	12:27:44.7	201	21	218	1.019	1.000	
Tatta	24°45' N	067'55' E	-	11:19:07.0	291	221	37	12:26:49.7	70	1	12:27:44.7	331	262	13:26:56.7	110	44	8	12:27:44.7	201	21	218	1.019	1.000	

TABLE 32
LOCAL CIRCUMSTANCES FOR INDIA - I
TOTAL SOLAR ECLIPSE OF 1999 AUGUST 11

Location Name	Latitude	Longitude	Elev.	First-Contact				Second-Contact				Third-Contact				Fourth-Contact				Maximum Eclipse						
				U.T.	P	V	Alt	U.T.	P	V	Alt	U.T.	P	V	Alt	U.T.	P	V	Alt	U.T.	P	V	Alt			
				m	h	m	s	m	h	m	s	m	h	m	s	m	h	m	s	m	h	m	s			
INDIA																										
Agra	27°01' N	78°01' E	-	11:23:28.5	281	214	27	-	-	-	-	13:21:50.2	117	55	1	12:25:37.0	199	134	13	281	0.854	0.819				
Ahmedabad	23°02' N	70°27' E	55	11:25:30.9	230	218	31	-	-	-	-	13:28:48.6	110	43	3	12:30:33.3	200	130	16	280	0.995	0.997				
Ajmer	26°27' N	74°38' E	-	11:22:10.9	281	216	16	12:33:23.4	122	51	0	13:35:55.6	115	51	3	12:33:51.1	19	108	11	282	0.899	0.877	0.0m55s			
Akola	20°44' N	77°00' E	-	11:31:23.5	291	217	25	12:34:18.7	277	205	-	13:38:03.8	149	13	1	12:33:34.8	199	112	11	282	0.999	0.999	0.0m55s			
Aligarh	27°53' N	78°05' E	-	11:30:49.1	230	216	25	-	-	-	-	13:20:49.6	118	57	2	12:24:39.8	199	135	13	281	0.838	0.799				
Allahabad	25°27' N	80°51' E	-	11:22:44.8	280	214	27	-	-	-	-	13:27:45.1	9	199	133	19	283	0.861	0.828							
Alleppey	09°29' N	76°19' E	-	11:47:18.8	308	222	20	-	-	-	-	12:41:36.4	20	298	6	12:41:36.4	199	129	6	285	0.711	0.640				
Amala	30°21' N	76°50' E	-	11:18:36.3	238	214	29	-	-	-	-	13:17:35.0	121	61	4	12:21:02.5	199	137	16	279	0.797	0.747				
Amavati	20°56' N	77°55' E	-	11:33:29.1	280	216	24	-	-	-	-	12:33:33.7	199	128	3	12:33:33.7	199	137	16	283	0.999	0.999				
Amritsar	31°35' N	70°53' E	-	11:15:31.9	238	215	31	12:30:48.3	71	0	12:31:37.6	329	259	6	12:18:53.1	199	138	18	277	0.788	0.736					
Anand	22°34' N	72°56' E	-	11:26:24.5	231	218	10	12:29:41.6	181	111	12:30:16.9	109	42	3	12:31:13.0	200	130	15	281	0.918	1.000	0.0m49s				
Anjar	23°08' N	70°00' E	-	11:31:35.5	281	211	16	12:29:20.1	220	21	12:30:03.8	149	13	5	12:29:24.6	198	132	4	285	0.963	0.829	0.0m25s				
Asansol	23°41' N	86°59' E	-	11:31:34.5	291	211	16	-	-	-	-	12:33:41.8	199	128	1	12:33:41.8	199	128	1	283	0.971	0.968				
Aurangabad	19°53' N	75°20' E	-	11:31:34.5	290	216	24	-	-	-	-	12:34:49.1	29	307	128	12:41:36.2	199	128	1	283	0.916	1.000				
Badrera	20°52' N	77°44' E	-	11:31:34.5	290	216	24	-	-	-	-	12:33:41.8	199	128	1	12:33:41.8	199	128	1	283	0.900	0.853				
Balabupur	20°40' N	76°46' E	-	11:33:39.9	291	216	22	12:34:16.9	80	80	12:34:16.9	248	176	-	12:34:55.7	199	130	11	281	0.916	0.899					
Ballalpur	19°50' N	70°22' E	895	11:42:24.8	301	220	21	12:35:14.6	66	66	12:35:14.6	260	189	-	12:42:45.5	199	135	12	281	0.815	0.771	0.0m46s				
Bareilly	28°21' N	79°25' E	-	11:22:52.6	291	223	21	-	-	-	-	13:19:39.9	119	58	1	12:24:05.9	199	135	12	281	0.817	0.773				
Baroda	22°16' N	70°02' E	-	11:26:58.4	291	218	30	12:31:05.1	98	28	12:32:07.0	301	231	2	12:31:36.2	200	129	15	281	0.917	1.000	0.1m02s				
Benala	22°31' N	80°19' E	-	11:31:10.1	292	211	15	-	-	-	-	12:30:26.7	198	131	2	12:30:26.7	198	131	2	286	0.880	0.851				
Belgaum	15°53' N	76°31' E	-	11:17:08.0	290	215	25	-	-	-	-	12:30:23.3	199	123	1	12:30:23.3	199	123	1	283	0.844	0.822				
Bhatpara	22°52' N	88°24' E	-	11:32:48.7	291	211	15	-	-	-	-	12:30:02.0	198	131	2	12:30:02.0	198	131	2	286	0.871	0.840				
Bhavnagar	21°46' N	70°03' E	-	11:27:02.0	292	219	31	-	-	-	-	12:30:24.4	108	40	3	12:33:06.0	199	129	7	284	0.988	0.989				
Bhilai	21°13' N	80°26' E	-	11:32:44.9	281	214	21	-	-	-	-	12:30:24.4	199	130	10	12:30:24.4	199	130	10	281	0.947	0.937	0.0m17s			
Bhopal	23°16' N	77°24' E	-	11:28:13.0	281	216	26	12:29:28.2	186	116	12:29:44.7	214	144	4	12:29:36.5	200	130	19	279	1.019	1.000	0.0m47s				
Bhuj	23°16' N	69°40' E	-	11:22:54.8	282	220	34	12:29:21.7	290	234	12:30:06.3	109	41	6	12:30:18.2	200	132	18	282	1.017	1.000	0.0m47s				
Bhusawal	21°03' N	75°46' E	-	11:19:18.4	291	217	27	12:31:01.6	146	75	12:33:09.9	191	253	182	12:33:04.6	116	54	5	12:33:48.3	200	135	18	278	0.877	0.849	
Bikaner	28°01' N	70°38' E	-	11:33:23.3	283	217	32	-	-	-	-	13:22:04.6	116	54	5	12:33:04.6	116	54	5	281	0.877	0.849				
Bobili	18°34' N	80°22' E	-	11:36:34.7	290	215	18	12:35:26.6	136	64	12:36:08.5	261	189	-	12:35:47.6	19	307	4	285	1.014	1.000	0.0m42s				
Bombay	18°58' N	02°55' E	8	11:31:37.1	296	219	23	12:30:53.1	99	28	12:31:55.6	301	231	34	12:35:43.0	200	136	14	282	0.937	0.912					
Borsad	22°25' N	70°54' E	-	11:30:13.1	290	217	26	12:32:45.7	71	0	12:33:31.2	328	257	42	12:33:08.5	200	129	12	282	1.018	1.000	0.0m42s				
Burhanpur	21°18' N	72°32' N	08°58' E	-	11:34:28.8	305	221	15	-	-	-	-	12:34:02.9	198	130	2	12:34:02.9	198	130	2	284	0.879	0.849			
Calcutta	11°15' N	70°23' E	-	11:26:34.6	291	218	30	12:31:01.6	134	64	12:32:00.0	266	195	41	12:32:09.9	197	131	16	281	1.018	1.000	0.0m55s				
Chandigarh	30°44' N	70°27' E	-	11:18:35.5	277	214	29	12:33:15.9	102	32	12:33:18.2	297	227	109	12:33:35.8	109	41	2	12:20:29.7	199	137	16	279	1.008	0.736	
Chandrapur	19°57' N	70%18' E	-	11:33:29.1	290	216	22	12:34:17.4	120	48	12:35:09.7	278	207	12	12:34:43.6	199	130	8	283	1.015	1.000	0.0m52s				
Chhota Udepur	22°19' N	07°40' E	-	11:27:29.2	290	218	29	-	-	-	-	12:31:41.2	200	129	14	12:33:36.9	199	128	11	281	1.095	1.000				
Chopda	21°15' N	07%18' E	-	11:29:46.0	291	217	27	12:32:43.4	140	69	12:33:34.6	259	188	41	12:33:09.1	200	138	18	282	1.017	1.000	0.0m51s				
Cochin	09°58' N	07°61' E	-	11:46:33.2	307	222	20	-	-	-	-	12:45:05.1	197	126	12	12:45:11.2	198	128	6	285	0.724	0.656				
Combatore	11°00' N	07%56' E	-	11:55:09.0	305	221	20	-	-	-	-	12:44:33.1	197	129	6	12:44:33.1	197	129	6	284	0.758	0.698				
Cuttack	20°30' N	08%50' E	-	11:34:54.5	286	213	16	-	-	-	-	12:33:11.4	198	129	6	12:33:11.4	198	129	6	284	0.745	0.684				
Dabholi	21°21' N	07°32' E	-	11:27:17.8	291	218	24	12:29:12.9	78	7	12:31:43.9	109	41	3	12:31:19.3	200	130	18	280	1.018	1.000	0.0m29s				
Dharangaon	20°56' N	07%44' E	-	11:32:19.6	291	216	25	12:30:00.3	131	80	12:31:41.6	247	176	12	12:30:22.4	200	130	12	282	0.945	0.939					
Dharwad	21°21' N	07%20' E	-	11:31:11.7	291	216	25	12:30:22.0	63	352	12:33:56.3	336	265	13	12:30:12.1	200	130	17	280	1.017	1.000	0.0m41s				
Dedipada	21°38' N	07%35' E	-	11:28:11.0	0	292	218	29	-	-	12:30:06.5	108	41	2	12:32:30.4	200	130	14	281	0.998	0.999					
Dehra Dun	30°19' N	07%02' E	-	11:19:31.7	0	292	214	28	-	-	12:31:17.4	121	62	3	12:21:14.0	199	137	14	280	0.787	0.735					
Delhi	28°40' N	07%13' E	-	11:21:04.1	280	214	28	-	-	-	-	13:19:59.6	119	58	3	12:23:29.7	199	135	14	280	0.829	0.787				
Dhanbad	23°48' N	08%22' E	-	11:31:19.1	281	212	17	-	-	-	-	12:45:22.6	198	122	6	12:45:22.6	198	122	6	285	0.825	0.811				
Dharmadka	22°22' N	07%15' E	-	11:36:02.1	292	219	31	12:31:04.7	114	103	12:31:33.6	226	156	-	12:31:26.1	198	124	6	285	0.826	0.810					
Dharwara	21°01' N	07%16' E	-	11:30:04.4	291	217	27	-	-	-	-	12:31:30.1	198	124	6	12:31:30.1	198	124	6	285	0.999	0.999				
Dhongadhra	22°43' N	07%22' E	-	11:25:52.0	291	218	31	-	-	-	-	12:30:36.8	199	128	3	12:30:36.8	199	128	3	285	0.998	0.999				
Dondicha	21°20' N	07%34' E	-	11:24:44.9	291	218	28	-	-	-	-	12:30:25.9	198	124	10	12:30:25.9	198	124	10	285	0.826	0.812				
Durgapur	23°29' N	08%20' E	-	11:44:48.1	304	221	20	-	-	-	-	12:29:34.2	198	131	3	12:29:34.2	198	131	3	285	0.865	0.				

TABLE 32 - continued
LOCAL CIRCUMSTANCES FOR INDIA - II
TOTAL SOLAR ECLIPSE OF 1999 AUGUST 11

Location Name	Latitude	Longitude	Elev.	First Contact				Second Contact				Third Contact				Fourth Contact				Maximum Eclipse											
				U.T.				P.				U.T.				P.				U.T.											
				h	m	s	h	m	s	h	m	s	h	m	s	h	m	s	h	m	s	h	m	s							
INDIA																															
Gorakhpur	26°45' N	83°22' E	-	11:26:50.8	279	212	21	-				-				-				12:26:09.4	199	134	8	283	0.821	0.777					
Guntur	16°18' N	80°27' E	-	11:36:39.1	295	217	19	-				-				-				12:36:36.9	199	130	6	284	0.925	0.909					
Guaior	26°13' N	88°10' E	-	11:24:49.2	282	214	26	-				-				-				12:25:55.8	199	133	12	281	0.874	0.844					
Hangarhat	20°34' N	88°50' E	-	11:32:38.9	290	216	23	-				-				-				12:32:01.8	199	129	9	283	0.998	0.999					
Howrah	22°35' N	88°20' E	-	11:35:06.5	282	211	15	-				-				-				12:35:22.6	199	131	2	286	0.875	0.849					
Hulli	15°21' N	87°50' E	-	11:39:08.6	259	220	24	-				-				-				12:35:53.3	203	10	283	10	0.857	0.822					
Ryderabad	17°23' N	87°29' E	531	11:36:34.6	294	217	22	-				-				-				12:36:39.7	199	130	13	284	0.936	0.924					
Indore	22°43' N	81°55' E	-	11:28:03.1	289	216	27	-				-				-				12:30:20.9	200	130	13	281	0.973	0.971					
Jabalpur	23°10' N	87°57' E	-	11:22:38.9	285	214	23	-				-				-				12:30:19.6	199	131	2	283	0.928	0.913					
Jadabpur	22°29' N	88°23' E	-	11:33:13.4	282	211	15	-				-				-				12:30:28.0	198	131	2	286	0.880	0.852					
Jagdalpur	19°04' N	80°92' E	-	11:35:35.4	290	215	19	12:35:03.1	118	46	46	12:35:51.7	279	208	-	12:35:27.5	19	307	5	284	1.015	1.000									
Jalajpur	26°55' N	87°59' E	-	11:22:56.3	283	215	29	-				-				-				12:24:46.5	201	134	20	280	0.878	0.850					
Jalaon	21°01' N	87°54' E	-	11:30:14.5	281	217	27	12:33:14.3	173	102	102	12:33:40.3	226	154	53	0	12:33:27.3	208	128	1	281	1.017	1.000								
Jalgaoon	21°03' N	87°32' E	-	11:30:43.3	280	217	26	12:32:59.3	197	26	26	12:33:55.6	302	131	40	0	12:33:27.5	208	128	1	281	1.016	1.000								
Jambusar	22°03' N	87°28' E	-	11:27:30.3	281	218	30	12:31:37.8	173	102	102	12:32:06.1	226	155	13	41	12:33:52.0	199	131	15	281	1.018	1.000								
Jamnagar	22°48' N	87°04' E	-	11:24:27.0	283	210	33	-				-				12:33:47.3	20	309	18	280	0.985	0.986									
Janshehpur	22°48' N	88°51' E	-	11:32:22.1	282	212	17	-				-				-				12:35:35.9	198	131	5	285	0.889	0.862					
Jeypore	18°53' N	88°35' E	-	11:36:01.3	280	215	19	12:35:13.9	127	55	55	12:35:59.9	270	199	19	-	12:35:36.9	199	130	5	285	1.014	1.000								
Jhansi	25°26' N	87°35' E	-	11:26:03.9	283	214	25	-				-				-				12:22:46.5	199	130	12	282	0.888	0.862					
Jodhpur	26°17' N	87°02' E	-	11:21:12.6	286	217	32	-				-				-				12:24:34.3	114	50	0	4	12:24:12.6	200	133	17	279	0.917	0.900
Jollundur	31°19' N	87°54' E	-	11:16:25.7	278	215	30	-				-				-				12:16:27.0	121	62	5	281	1.016	1.000					
Kanpur	26°28' N	88°21' E	-	11:22:44.0	281	213	24	12:33:44.4	137	65	65	12:34:34.0	262	190	-	-	12:34:08.3	199	134	11	282	0.850	0.814								
Karanja	20°29' N	87°29' E	-	11:31:58.1	281	216	24	12:33:38.0	165	94	94	12:34:10.5	234	162	-	-	12:34:54.2	199	130	12	281	0.852	0.828								
Khamgaon	20°41' N	87°34' E	-	11:31:14.3	281	217	26	12:33:50.5	198	95	95	12:34:28.0	250	223	54	54	12:34:49.4	199	131	19	279	1.019	1.000								
Kharda	25°51' N	86°53' E	-	11:22:04.0	281	217	26	12:32:38.0	201	98	98	12:32:58.0	223	222	114	114	12:33:04.6	199	131	19	281	1.019	1.000								
Khetia	21°00' N	87°15' E	-	11:28:45.6	281	217	28	12:32:04.0	114	43	43	12:33:04.6	285	214	110	110	12:32:34.4	20	309	13	281	1.017	1.000								
Kholapur	16°42' N	87°13' E	-	11:34:45.5	288	219	26	-				-				-				12:34:54.7	199	127	6	284	0.983	0.955					
Kondagaon	19°36' N	88°40' E	-	11:34:48.5	289	215	18	12:35:20.6	281	218	53	12:36:00.9	272	200	-	-	12:35:37.1	199	127	5	285	1.014	1.000								
Koraput	20°41' N	87°43' E	-	11:20:04.6	280	215	18	12:35:14.7	125	53	53	12:36:00.9	272	200	13	13:25:15.4	114	49	2	282	0.917	0.899									
Kota	25°11' N	87°50' E	-	11:24:43.0	285	216	20	-				-				-				12:42:31.4	20	301	9	284	0.789	0.738					
Lakhati	22°34' N	86°47' E	-	11:21:19.7	292	220	35	12:28:05.9	142	72	72	12:29:06.7	259	189	189	189	12:28:33.7	109	42	7	281	1.019	1.000								
Limedi	26°51' N	87°18' E	-	11:22:33.7	291	219	31	12:30:34.2	144	73	73	12:31:28.6	256	186	186	186	12:31:21.4	109	41	3	281	1.018	1.000								
Lucknow	26°54' N	87°50' E	122	11:23:33.7	280	213	24	-				-				-				12:24:05.8	194	134	10	282	0.837	0.798					
Ludhiana	13°05' N	87°51' E	-	11:17:11.5	278	215	30	-				-				-				12:24:20.5	191	130	11	278	0.794	0.743					
Madras	13°49' N	86°01' E	-	11:42:52.3	280	219	18	-				-				-				12:41:49.7	199	130	4	285	0.840	0.801					
Madurai	09°55' N	87°07' E	-	11:46:57.2	286	211	18	-				-				-				12:45:00.2	19	298	5	285	0.739	0.674					
Maliya	20°03' N	87°06' E	-	11:07:16.2	281	219	33	12:33:25.2	127	57	57	12:30:39.6	273	203	203	203	12:31:07.5	19	310	18	280	1.018	1.000								
Malkapur	20°33' N	87°48' E	-	11:30:46.3	281	217	26	12:33:16.2	148	77	77	12:34:11.6	251	180	-	-	12:33:39.0	20	308	11	282	1.016	1.000								
Hangalore	12°52' N	87°53' E	-	11:41:45.0	303	221	23	-				-				-				12:42:31.4	20	301	9	284	0.789	0.738					
Mangrol Pir	20°19' N	87°21' E	-	11:32:07.7	291	216	25	-				-				-				12:31:21.8	119	59	2	281	0.998	1.000					
Meerut	28°59' N	87°52' E	-	11:20:55.7	279	214	28	-				-				-				12:23:21.5	199	136	14	280	0.830	0.789					
Moradabad	28°50' N	87°57' E	-	11:24:26.3	279	219	24	12:30:15.9	176	105	105	12:30:43.6	224	154	-	-	12:31:23.8	199	136	13	280	0.812	0.766								
Morvi	20°04' N	87°50' E	-	11:33:29.0	280	216	22	12:34:12.5	74	3	3	12:34:55.9	324	253	-	-	12:43:34.2	199	128	8	283	1.018	1.000								
Murtajapur	28°44' N	87°23' E	-	11:43:08.5	281	216	25	12:33:23.6	99	28	28	12:34:19.7	300	229	-	-	12:44:15.1	199	128	10	284	1.016	1.000								
Mysore	12°18' N	87°59' E	-	11:26:10.5	303	220	21	12:30:19.2	43	33	33	12:31:14.6	357	286	286	286	12:32:14.3	199	130	6	284	0.738	0.655								
Nadiad	22°42' N	87°22' E	-	11:26:10.5	281	218	30	12:30:19.2	43	33	33	12:31:14.6	259	188	-	-	12:33:19.9	199	129	9	283	1.008	1.000								
Nagpur	21°09' N	87°06' E	-	11:31:15.0	284	219	23	12:33:18.2	140	69	69	12:34:07.9	259	188	-	-	12:33:43.1	20	308	11	282	1.016	1.000								
Nandura	20°50' N	87°27' E	-	11:30:53.4	281	217	26	-				-				-				12:35:49.6	19	307	13	284	1.014	1.000					
Narasannapeta	18°25' N	87°43' E	-	11:36:55.6	290	215	17	12:35:27.2	124	52	52	12:36:11.9	273	201	-	-	12:34:35.1	19	307	13	282	0.960	0.954								
Nasik	19°25' N	87°58' E	-	11:30:41.7	294	218	28	-				-				-				13:31:52.0	119	57	3	281	0.830	0.789					
New Delhi	28°36' N	87°12' E	212	11:21:33.8	281	214	28	-				-				-				12:30:05.9	119	57	3	281	0.830	0.789					
Newrangapur	19°14' N	87°33' E	-	11:26:32.4	281	218	19	12:31:08.7	116	45	45	12:32:11.7	284	213	-	-	12:33:21.2	199	130	5	285	1.014	1.000								
Padra	22°14' N	87°05' E	-	11:26:55.2	281	218	17	12:31:30.1	117	47	47	12:32:45.1	292	220	-	-	12:33:40.3	199													

TABLE 32 - continued
LOCAL CIRCUMSTANCES FOR INDIA - III
TOTAL SOLAR ECLIPSE OF 1999 AUGUST 11

Location Name	Latitude	Longitude	Elev.	First Contact			Second Contact			Third Contact			Fourth Contact			Maximum Eclipse			Eclip.	Eclip.	Umbra			
				U.T.	P	V	Alt	U.T.	P	V	Alt	U.T.	P	V	Alt	U.T.	P	V	Alt	Mag.	Obs.	Durat.		
INDIA				m	h	m	s	m	h	m	s	m	h	m	s	m	h	m	s	h	m	s		
Patur	20°27' N	076°56' E	-	11:31:44.6	291	217	25	12:30:48.4	97	26	12:31:50.7	303	233	13:29:25.7	109	42	3	12:31:11.5	19	308	11	283	0.999	1.000
Petlad	22°38' N	072°08' E	-	11:26:27.7	291	218	30	12:30:48.4	97	26	12:31:50.7	303	233	13:29:25.7	109	42	3	12:31:19.6	200	129	15	281	1.018	1.000
Pondicherry	19°56' N	079°53' E	-	11:44:30.0	302	219	18	-	-	-	13:33:15.2	104	-	-	-	-	-	-	-	0m02s	0.759			
Pune (Poona)	18°32' N	073°52' E	-	11:32:30.5	296	219	27	-	-	-	12:36:19.8	20	306	13	282	0.925	0.910							
Raipur	21°9' N	09°38' E	-	11:32:46.2	287	214	21	-	-	-	12:37:43.1	19	305	5	285	0.952	0.953							
Rajahmundry	16°59' N	081°47' E	-	11:38:08.1	293	216	18	-	-	-	12:37:10.4	20	309	14	281	0.988	0.944							
Rajkot	22°38' N	07047' E	-	11:25:15.1	292	219	32	-	-	-	13:30:02.9	108	40	4	12:32:10.4	20	309	14	281	0.989	0.989			
Rajpura	21°9' N	07334' E	-	11:27:37.4	291	218	29	12:12:01.1	165	94	12:32:36.5	234	163	13:30:00.8	109	41	2	12:32:18.9	20	309	14	281	1.017	1.000
Ranchi	23°21' N	08520' E	-	11:31:30.1	282	212	18	-	-	-	12:30:06.1	188	131	5	285	0.982	0.954							
Repar	23°34' N	07039' E	-	11:23:21.4	291	219	33	12:29:05.8	58	348	12:29:46.9	343	273	13:28:34.9	110	43	5	12:30:28.4	20	130	18	279	1.018	0.991
Raurkela	22°13' N	08493' E	-	11:32:40.2	284	213	18	-	-	-	12:31:29.4	198	130	5	285	0.912	0.892							
Raver	29°15' N	07602' E	-	11:30:10.7	290	217	19	12:32:43.4	94	23	12:33:39.7	305	234	-	12:33:11.6	200	129	12	282	1.017	0.999			
Saharanpur	29°56' N	07793' E	-	11:19:38.2	278	214	28	-	-	-	13:17:56.2	120	61	3	12:31:41.1	199	137	15	279	0.798	0.749			
Salem	11°39' N	07810' E	-	11:44:27.6	303	220	19	-	-	-	12:43:27.4	19	300	5	285	0.785	0.732							
Salur	18°32' N	08313' E	-	11:36:34.9	295	215	18	12:35:35.2	156	84	12:36:07.2	241	169	-	12:35:51.2	19	301	4	1.014	1.000	0m12s			
Sangli	22°10' N	07334' E	-	11:35:38.8	298	219	26	-	-	-	12:37:17.1	198	120	30	11	283	0.890	0.865						
Sankheda	21°41' N	07335' E	-	11:27:25.5	291	218	29	12:21:19.8	90	76	12:32:19.8	304	233	13:29:34.6	109	41	2	12:31:49.6	200	129	15	281	1.017	0.999
Sandhya	20°41' N	07506' E	-	11:29:02.8	290	217	19	12:21:09.9	79	76	12:33:01.6	321	250	13:29:41.8	109	41	1	12:32:35.8	200	129	13	282	1.017	0.999
Shenagon	20°41' N	07458' E	-	11:26:32.2	291	218	28	12:22:37.3	180	108	12:32:58.3	220	149	13:30:10.0	108	41	1	12:32:39.7	200	129	14	281	1.017	0.999
Shirpur	21°21' N	07453' E	-	11:29:23.1	291	217	28	12:22:37.1	151	80	12:33:22.3	248	177	13:30:07.6	108	40	1	12:32:59.8	200	129	13	282	1.017	0.999
Sholapur	17°41' N	07555' E	-	11:33:05.8	296	218	25	-	-	-	12:31:21.1	231	141	12:33:21.3	20	305	1	12:37:23.9	200	130	16	280	0.922	0.906
Sojitra	22°33' N	07233' E	-	11:26:17.0	291	218	30	12:30:46.1	63	18	12:31:21.1	231	141	12:33:21.3	20	305	1	12:37:23.9	200	130	16	280	0.922	0.906
Srikakulam	18°8' N	08344' E	-	11:37:01.9	290	215	17	-	-	-	12:35:58.7	19	306	4	285	1.014	1.000							
Srinagar	34°05' N	07459' E	-	11:12:36.6	275	215	32	-	-	-	13:12:04.3	124	67	7	12:35:58.7	19	306	4	285	1.014	0m55s			
Surat	26°0' N	07260' E	-	11:28:22.4	293	218	30	-	-	-	13:30:52.4	100	39	12:33:30.1	20	308	15	381	0.979	0.979				
Surendranagar	22°42' N	07151' E	-	11:25:19.6	291	219	22	12:30:18.5	129	59	12:31:20.6	271	200	12:30:19.6	106	41	1	12:30:17.8	200	129	16	280	1.018	0m02s
Tekdi	21°34' N	07491' E	-	11:29:40.6	291	218	28	12:32:19.3	158	87	12:33:00.1	241	170	12:32:39.8	108	41	1	12:30:14.8	200	129	17	281	1.017	1.000
Tekdi	18°37' N	08743' E	-	11:36:43.8	289	214	17	12:35:16.9	69	357	12:35:52.7	328	256	13:30:21.1	105	34	1	12:35:27.0	200	129	18	282	1.014	0m06s
Thana	19°12' N	07258' E	-	11:31:21.1	291	219	29	-	-	-	13:30:51.1	105	34	1	12:35:27.0	200	129	18	282	0.934	0.920			
Tiruchirappal...	10°49' N	07641' E	-	11:45:45.7	304	221	18	-	-	-	12:44:08.7	19	298	5	285	0.767	0.769							
Trivandrum	08°29' N	07895' E	-	11:48:57.5	309	223	19	-	-	-	12:46:23.9	19	297	4	285	0.689	0.613							
Turicorin	08°47' N	07898' E	-	11:49:39.9	308	222	18	-	-	-	12:45:58.9	19	297	4	285	0.707	0.636							
Ujjain	23°11' N	07296' E	-	11:31:22.8	288	216	27	-	-	-	12:30:44.3	100	130	13	281	0.943	0.938							
Ulhasnagar	19°11' N	07307' E	-	11:31:24.9	295	219	29	-	-	-	12:35:26.8	20	306	14	282	0.945	0.923							
Varanasi (Benar...	25°20' N	08300' E	-	11:29:21.2	274	212	21	-	-	-	12:31:15.6	198	133	8	283	0.835	0.820							
Vijayavada	16°31' N	08937' E	-	11:38:25.0	284	217	19	-	-	-	12:38:32.1	19	305	5	284	0.932	0.917							
Vishakhapatnam	17°42' N	08318' E	-	11:33:11.2	290	216	23	12:34:10.1	120	49	12:35:02.9	278	207	-	-	-	-	-						
Wani	18°00' N	07935' E	-	11:39:08.8	283	216	21	-	-	-	12:34:43.1	19	306	4	285	0.943	0.943							
Warangal	21°10' N	07932' E	-	11:30:06.5	291	217	27	12:34:48.8	129	57	12:33:45.4	271	199	13:30:04.7	108	41	0	12:34:33.6	200	129	16	282	1.017	1.000
Yavalal	20°24' N	07908' E	-	11:33:23.1	291	216	24	12:33:47.2	111	39	12:34:42.2	288	216	-	-	-	-	-						

TABLE 33
LOCAL CIRCUMSTANCES FOR SRI LANKA & MALDIVES

Location Name	Latitude	Longitude	Elev.	First Contact			Second Contact			Third Contact			Fourth Contact			Maximum Eclipse			Eclip.	Eclip.	Umbra	
				U.T.	P	V	Alt	U.T.	P	V	Alt	U.T.	P	V	Alt	U.T.	P	V	Alt	Mag.	Obs.	Durat.
SRI LANKA				m	h	m	s	m	h	m	s	m	h	m	s	m	h	m	s	h	m	s
Colombo	06°56' N	07951' E	7	11:51:33.5	310	223	15	-	-	-	-	-	-	-	-	12:47:09.0	19	296	2	285	0.670	0.590
Dehiwala-Mount	06°51' N	07952' E	-	11:51:41.0	310	223	15	-	-	-	-	-	-	-	-	12:47:12.6	19	296	2	285	0.668	0.587
Jaffna	09°40' N	08900' E	-	11:47:35.7	305	222	16	-	-	-	-	-	-	-	-	12:47:55.5	19	298	3	285	0.740	0.684
Kandy	07°18' N	08938' E	-	11:51:02.4	308	222	14	-	-	-	-	-	-	-	-	12:46:41.9	19	298	1	285	0.666	0.610
Kotte	06°54' N	07954' E	-	11:51:33.6	310	223	15	-	-	-	-	-	-	-	-	12:47:10.9	19	296	2	285	0.670	0.589
Moratuwa	06°46' N	07953' E	-	11:51:48.5	310	223	15	-	-	-	-	-	-	-	-	12:47:16.2	19	296	2	285	0.666	0.585
MALDIVES				Male	04°10' N	073°30' E	-	11:55:48.8	319	228	19	-	-	-	-	12:50:08.3	20	292	6	285	0.538	0.436

TABLE 37
SOLAR ECLIPSES OF SAROS SERIES 145

First Eclipse: 1639 Jan 04 Duration of Series: 1370.3 yrs.
Last Eclipse: 3009 Apr 17 Number of Eclipses: 77

Saros Summary: Partial: 34 Annular: 1 Total: 41 Hybrid: 1

Eclipse				Mag./	Center	Eclipse				Mag./	Center
Date	Type	Gamma	Width	Durat.		Date	Type	Gamma	Width	Durat.	
1639 Jan 04	Pb	1.565	0.001			2360 Mar 18	T	-0.017	181	04m33s	
1657 Jan 14	P	1.554	0.017			2378 Mar 29	T	-0.048	193	04m51s	
1675 Jan 25	P	1.543	0.034			2396 Apr 09	T	-0.085	206	05m12s	
1693 Feb 05	P	1.527	0.059			2414 Apr 20	T	-0.128	217	05m33s	
1711 Feb 17	P	1.507	0.091			2432 Apr 30	T	-0.178	229	05m56s	
1729 Feb 27	P	1.481	0.134			2450 May 12	T	-0.233	241	06m19s	
1747 Mar 11	P	1.450	0.186			2468 May 22	T	-0.293	252	06m41s	
1765 Mar 21	P	1.412	0.251			2486 Jun 02	T	-0.358	263	06m59s	
1783 Apr 01	P	1.367	0.329			2504 Jun 14	T	-0.427	275	07m10s	
1801 Apr 13	P	1.315	0.420			2522 Jun 25	T	-0.499	287	07m12s	
1819 Apr 24	P	1.258	0.522			2540 Jul 05	T	-0.572	300	07m04s	
1837 May 04	P	1.193	0.638			2558 Jul 16	T	-0.646	315	06m43s	
1855 May 16	P	1.125	0.762			2576 Jul 27	T	-0.720	334	06m12s	
1873 May 26	P	1.051	0.897			2594 Aug 07	T	-0.792	361	05m32s	
1891 Jun 06	A	0.975	33	00m06s		2612 Aug 18	T	-0.862	406	04m45s	
1909 Jun 17	H	0.896	51	00m24s		2630 Aug 30	T	-0.930	512	03m54s	
1927 Jun 29	T	0.816	77	00m50s		2648 Sep 09	Ts	-0.992	.	02m49s	
1945 Jul 09	T	0.736	92	01m15s		2666 Sep 20	P	-1.050	0.919		
1963 Jul 20	T	0.657	101	01m40s		2684 Oct 01	P	-1.103	0.817		
1981 Jul 31	T	0.579	108	02m02s		2702 Oct 13	P	-1.150	0.727		
1999 Aug 11	T	0.506	112	02m23s		2720 Oct 23	P	-1.191	0.648		
2017 Aug 21	T	0.437	115	02m40s		2738 Nov 04	P	-1.225	0.584		
2035 Sep 02	T	0.373	116	02m54s		2756 Nov 14	P	-1.255	0.528		
2053 Sep 12	T	0.314	116	03m04s		2774 Nov 25	P	-1.278	0.486		
2071 Sep 23	T	0.262	116	03m11s		2792 Dec 06	P	-1.297	0.451		
2089 Oct 04	T	0.217	115	03m14s		2810 Dec 17	P	-1.311	0.426		
2107 Oct 16	T	0.178	114	03m16s		2828 Dec 27	P	-1.322	0.405		
2125 Oct 26	T	0.146	112	03m15s		2847 Jan 08	P	-1.331	0.389		
2143 Nov 07	T	0.121	111	03m14s		2865 Jan 18	P	-1.339	0.374		
2161 Nov 17	T	0.101	110	03m13s		2883 Jan 30	P	-1.348	0.359		
2179 Nov 28	T	0.087	110	03m12s		2901 Feb 10	P	-1.359	0.339		
2197 Dec 09	T	0.077	111	03m13s		2919 Feb 21	P	-1.371	0.316		
2215 Dec 21	T	0.070	114	03m14s		2937 Mar 04	P	-1.389	0.285		
2233 Dec 31	T	0.065	117	03m18s		2955 Mar 15	P	-1.411	0.245		
2252 Jan 12	T	0.061	123	03m23s		2973 Mar 25	P	-1.439	0.194		
2270 Jan 22	T	0.056	129	03m29s		2991 Apr 06	P	-1.472	0.134		
2288 Feb 02	T	0.050	138	03m38s		3009 Apr 17	Pe	-1.514	0.059		
2306 Feb 14	T	0.040	147	03m49s							
2324 Feb 25	Tm	0.026	158	04m02s							
2342 Mar 08	T	0.008	169	04m16s							

Eclipse Type: P - Partial
A - Annular
T - Total
H - Hybrid

Pb - Partial Eclipse (Saros Series Begins)
Pe - Partial Eclipse (Saros Series Ends)
Ts - Total Eclipse (no southern limit)

Note: Mag./Width column gives either the eclipse magnitude (for partial eclipses) or the umbral path width in kilometers (for total and annular eclipses).