Five Millennium Catalog of Solar Eclipses

2001 to 2100 (2001 CE to 2100 CE)

Introduction

Eclipses of the Sun can only occur when the Moon is near one of its two orbital nodes [1] during the New Moon phase. It is then possible for the Moon's penumbral, umbral or antumbral shadows to sweep across Earth's surface thereby producing an eclipse. There are four types of solar eclipses:

1. **Partial** - Moon's penumbral shadow traverses Earth (umbral and antumbral shadows completely miss Earth)
2. **Annular** - Moon's antumbral shadow traverses Earth (Moon is too far from Earth to completely cover the Sun)
3. **Total** - Moon's umbral shadow traverses Earth (Moon is close enough to Earth to completely cover the Sun)
4. **Hybrid** - Moon's umbral and antumbral shadows traverse Earth (eclipse appears annular and total along different sections of its path). Hybrid eclipses are also known as annular-total eclipses. [2]

Total eclipses are visible from within the Moon's umbral shadow while annular eclipses are seen within the antumbral shadow . These eclipses can be classified as central [3] or non-central as:

1. **Central (two limits)** - The central axis of the Moon's shadow cone traverses Earth thereby producing a central line in the eclipse track. The umbra or antumbra falls entirely upon Earth so the ground track has both a northern and southern limit.
2. **Central (one limit)** - The central axis of the Moon's shadow cone traverses Earth. However, a portion of the umbra or antumbra misses Earth throughout the eclipse and the resulting ground track has just one limit.
3. **Non-Central (one limit)** - The central axis of the Moon's shadow cone misses Earth. However, one edge of the umbra or antumbra grazes Earth thereby producing a ground track with one limit and no central line.

The recurrence of solar eclipses is governed by the **Saros** cycle. For more information, see **Periodicity of Solar Eclipses**.

Statistics for Solar Eclipses: 2001 to 2100

During the 21st century CE[4], Earth will experience 224 solar eclipses. The following table shows the number of eclipses of each type over this period.

Solar Eclipses: 2001 - 2100			
Eclipse Type	**Symbol**	**Number**	**Percent**
All Eclipses	-	224	100.0%
Partial	P	77	34.4%
Annular	A	72	32.1%
Total	T	68	30.4%
Hybrid	H	7	3.1%

Annular and total eclipses can be classified as either central or non-central as follows: 1) Central (two limits), 2) Central (one limit) or 3) Non-Central (one limit). The statistical distribution of these classes during the 21st century CE appears in the following three tables (no Hybrids are included since all are central with two limits).

Annular and Total Eclipses		
Classification	**Number**	**Percent**
All	140	100.0%
Central (two limits)	135	96.4%
Central (one limit)	2	1.4%
Non-Central (one limit)	3	2.1%
Annular Eclipses		
Classification	**Number**	**Percent**
All Annular Eclipses	72	100.0%
Central (two limits)	68	94.4%
Central (one limit)	2	2.8%
Non-Central (one limit)	2	2.8%
Total Eclipses		
Classification	**Number**	**Percent**
All Total Eclipses	68	100.0%
Central (two limits)	67	98.5%
Central (one limit)	0	0.0%
Non-Central (one limit)	1	1.5%

There are a minimum of two and a maximum of five solar eclipses in every calendar year. Statistics for the number of eclipses each year during the century are listed below.

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Number of Years with 2 Eclipses: 82
Number of Years with 3 Eclipses: 12
Number of Years with 4 Eclipses:  6
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The longest and shortest central eclipses of the century as well as largest and smallest partial eclipses are listed in the below.

Extreme Durations and Magnitudes of Solar Eclipses: 2001 to 2100			
Extrema Type	**Date**	**Duration**	**Magnitude**
Longest Annular Solar Eclipse	**2010 Jan 15**	11m08s	-
Shortest Annular Solar Eclipse	**2085 Dec 16**	00m19s	-
Longest Total Solar Eclipse	**2009 Jul 22**	06m39s	-
Shortest Total Solar Eclipse	**2068 May 31**	01m06s	-
Longest Hybrid Solar Eclipse	**2013 Nov 03**	01m40s	-
Shortest Hybrid Solar Eclipse	**2067 Dec 06**	00m08s	-
Largest Partial Solar Eclipse	**2051 Apr 11**	-	0.98490
Smallest Partial Solar Eclipse	**2098 Oct 24**	-	0.00562

During the century, 4 Saros series begin and 2 Saros Series end. The list below gives the year and Saros number of each of these events.

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4 Saros Series begin [Year/Saros]:   2011/156  2058/157  2069/158  2098/164
2 Saros Series end   [Year/Saros]:   2054/117  2083/118
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Catalog of Solar Eclipses

The catalog below lists concise details and local circumstances at greatest eclipse[**5**] for every solar eclipse during the century. A description or explanation of each parameter listed in the catalog can be found in **Key to Catalog of Solar Eclipses**.

Several fields in the catalog link to web pages or files containing additional information for each eclipse. The following gives a brief explanation of each link.

- **Catalog Number** - link to a small **global map** showing geographic visibility of the eclipse
- **Calendar Date** - link to the path of central eclipse plotted on Google maps
- **TD of Greatest Eclipse** - link to a large **global map** showing geographic visibility of the eclipse
- **Saros Num** - link to a catalog of all eclipses in the **Saros** cycle
- **Gamma** - link to a table of **Besselian elements** for the eclipse
- **Central Dur.** - link to a table of coordinates of the central eclipse path

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Catalog of Solar Eclipses: 2001 to 2100

Catalog Number	Calendar Date	TD of Greatest Eclipse	ΔT s	Luna Num	Saros Num	Ecl. Type	QLE	Gamma	Ecl. Mag.	Sun Path Lat °	Long °	Alt °	Width km	Central Dur.
09511	2001 Jun 21	12:04:46	64	18	127	T	-p	-0.5701	1.0495	11S	3E	55	200	04m57s
09512	2001 Dec 14	20:53:01	64	24	132	A	-n	0.4089	0.9681	1N	131W	66	126	03m53s
09513	2002 Jun 10	23:45:22	64	30	137	A	nn	0.1993	0.9962	35N	179W	78	13	00m23s
09514	2002 Dec 04	07:32:16	64	36	142	T	n-	-0.3020	1.0244	39S	60E	72	87	02m04s
09515	2003 May 31	04:09:22	64	42	147	An	t-	0.9960	0.9384	67N	24W	3	-	03m37s
09516	2003 Nov 23	22:50:22	64	48	152	T	t-	-0.9638	1.0379	73S	88E	15	495	01m57s
09517	2004 Apr 19	13:35:05	65	53	119	P	-t	-1.1335	0.7367	62S	44E	0		
09518	2004 Oct 14	03:00:23	65	59	124	P	-t	1.0348	0.9282	61N	154W	0		
09519	2005 Apr 08	20:36:51	65	65	129	H	-n	-0.3473	1.0074	11S	119W	70	27	00m42s
09520	2005 Oct 03	10:32:47	65	71	134	A	-p	0.3306	0.9576	13N	29E	71	162	04m32s
09521	2006 Mar 29	10:12:23	65	77	139	T	n-	0.3843	1.0515	23N	17E	67	184	04m07s
09522	2006 Sep 22	11:41:16	65	83	144	A	p-	-0.4062	0.9352	21S	9W	66	261	07m09s
09523	2007 Mar 19	02:32:57	65	89	149	P	t-	1.0728	0.8756	61N	55E	0		
09524	2007 Sep 11	12:32:24	66	95	154	P	t-	-1.1255	0.7507	61S	90W	0		
09525	2008 Feb 07	03:56:10	66	100	121	A	-t	-0.9570	0.9650	68S	150W	16	444	02m12s
09526	2008 Aug 01	10:22:12	66	106	126	T	-p	0.8307	1.0394	66N	72E	34	237	02m27s
09527	2009 Jan 26	07:59:45	66	112	131	A	-n	-0.2820	0.9282	34S	70E	73	280	07m54s
09528	2009 Jul 22	02:36:25	66	118	136	T	nn	0.0698	1.0799	24N	144E	86	258	06m39s
09529	2010 Jan 15	07:07:39	67	124	141	A	p-	0.4002	0.9190	2N	69E	66	333	11m08s
09530	2010 Jul 11	19:34:38	67	130	146	T	p-	-0.6788	1.0580	20S	122W	47	259	05m20s
09531	2011 Jan 04	08:51:42	67	136	151	P	t-	1.0627	0.8576	65N	21E	0		
09532	2011 Jun 01	21:17:18	67	141	118	P	-t	1.2130	0.6010	68N	47E	0		
09533	2011 Jul 01	08:39:30	67	142	156	Pb	t-	-1.4917	0.0971	65S	29E	0		
09534	2011 Nov 25	06:21:24	68	147	123	P	-t	-1.0536	0.9047	69S	82W	0		
09535	2012 May 20	23:53:54	68	153	128	A	-p	0.4828	0.9439	49N	176E	61	237	05m46s
09536	2012 Nov 13	22:12:55	68	159	133	T	-n	-0.3719	1.0500	40S	161W	68	179	04m02s
09537	2013 May 10	00:26:20	68	165	138	A	pn	-0.2694	0.9544	2N	175E	74	173	06m03s
09538	2013 Nov 03	12:47:36	68	171	143	H3	n-	0.3272	1.0159	3N	12W	71	58	01m40s
09539	2014 Apr 29	06:04:33	69	177	148	A-	t-	-1.0000	0.9868	71S	131E	0		
09540	2014 Oct 23	21:45:39	69	183	153	P	t-	1.0908	0.8114	71N	97W	0		
09541	2015 Mar 20	09:46:47	69	188	120	T	-t	0.9454	1.0445	64N	7W	18	463	02m47s
09542	2015 Sep 13	06:55:19	69	194	125	P	-t	-1.1004	0.7875	72S	2W	0		
09543	2016 Mar 09	01:58:19	70	200	130	T	-n	0.2609	1.0450	10N	149E	75	155	04m09s
09544	2016 Sep 01	09:08:02	70	206	135	A	-n	-0.3330	0.9736	11S	38E	70	100	03m06s
09545	2017 Feb 26	14:54:33	70	212	140	A	n-	-0.4578	0.9922	35S	31W	63	31	00m44s
09546	2017 Aug 21	18:26:40	70	218	145	T	p-	0.4367	1.0306	37N	88W	64	115	02m40s
09547	2018 Feb 15	20:52:33	71	224	150	P	t-	-1.2116	0.5991	71S	1E	0		
09548	2018 Jul 13	03:02:16	71	229	117	P	-t	-1.3542	0.3365	68S	127E	0		
09549	2018 Aug 11	09:47:28	71	230	155	P	t-	1.1476	0.7368	70N	174E	0		
09550	2019 Jan 06	01:42:38	71	235	122	P	-t	1.1417	0.7145	67N	154E	0		

09551	2019 Jul 02	19:24:07	71	241	127	T	-p	-0.6466	1.0459	17S	109W	50	201	04m33s
09552	2019 Dec 26	05:18:53	72	247	132	A	-n	0.4135	0.9701	1N	102E	66	118	03m40s
09553	2020 Jun 21	06:41:15	72	253	137	Am	nn	0.1209	0.9940	31N	80E	83	21	00m38s
09554	2020 Dec 14	16:14:39	72	259	142	T	n-	-0.2939	1.0254	40S	68W	73	90	02m10s
09555	2021 Jun 10	10:43:07	72	265	147	A	t-	0.9152	0.9435	81N	67W	23	527	03m51s
09556	2021 Dec 04	07:34:38	73	271	152	T	p-	-0.9526	1.0367	77S	46W	17	419	01m54s
09557	2022 Apr 30	20:42:36	73	276	119	P	-t	-1.1901	0.6396	62S	71W	0		
09558	2022 Oct 25	11:01:20	73	282	124	P	-t	1.0701	0.8619	62N	77E	0		
09559	2023 Apr 20	04:17:56	73	288	129	H	-n	-0.3952	1.0132	10S	126E	67	49	01m16s
09560	2023 Oct 14	18:00:41	74	294	134	A	-p	0.3753	0.9520	11N	83W	68	187	05m17s

Catalog of Solar Eclipses: 2001 to 2100

Catalog Number	Calendar Date	TD of Greatest Eclipse	ΔT s	Luna Num	Saros Num	Ecl. Type	QLE	Gamma	Ecl. Mag.	Sun Path Lat °	Long °	Alt °	Central Width km	Dur.
09561	2024 Apr 08	18:18:29	74	300	139	T	n-	0.3431	1.0566	25N	104W	70	198	04m28s
09562	2024 Oct 02	18:46:13	74	306	144	A	p-	-0.3509	0.9326	22S	114W	69	266	07m25s
09563	2025 Mar 29	10:48:36	75	312	149	P	t-	1.0405	0.9376	61N	77W	0		
09564	2025 Sep 21	19:43:04	75	318	154	P	t-	-1.0651	0.8550	61S	154E	0		
09565	2026 Feb 17	12:13:06	75	323	121	A	-t	-0.9743	0.9630	65S	87E	12	616	02m20s
09566	2026 Aug 12	17:47:06	75	329	126	T	-p	0.8977	1.0386	65N	25W	26	294	02m18s
09567	2027 Feb 06	16:00:48	76	335	131	A	-n	-0.2952	0.9281	31S	48W	73	282	07m51s
09568	2027 Aug 02	10:07:50	76	341	136	T	nn	0.1421	1.0790	26N	33E	82	258	06m23s
09569	2028 Jan 26	15:08:59	76	347	141	A	p-	0.3901	0.9208	3N	52W	67	323	10m27s
09570	2028 Jul 22	02:56:40	77	353	146	T	p-	-0.6056	1.0560	16S	127E	53	230	05m10s
09571	2029 Jan 14	17:13:48	77	359	151	P	t-	1.0553	0.8714	64N	114W	0		
09572	2029 Jun 12	04:06:13	77	364	118	P	-t	1.2943	0.4576	67N	66W	0		
09573	2029 Jul 11	15:37:19	77	365	156	P	t-	-1.4191	0.2303	64S	86W	0		
09574	2029 Dec 05	15:03:58	77	370	123	P	-t	-1.0609	0.8911	68S	136E	0		
09575	2030 Jun 01	06:29:13	78	376	128	A	-p	0.5626	0.9443	57N	80E	55	250	05m21s
09576	2030 Nov 25	06:51:37	78	382	133	T	-n	-0.3867	1.0468	44S	71E	67	169	03m44s
09577	2031 May 21	07:16:04	78	388	138	A	nn	-0.1970	0.9589	9N	72E	79	152	05m26s
09578	2031 Nov 14	21:07:31	79	394	143	H	n-	0.3078	1.0106	1S	138W	72	38	01m08s
09579	2032 May 09	13:26:42	79	400	148	A	t-	-0.9375	0.9957	51S	7W	20	44	00m22s
09580	2032 Nov 03	05:34:13	79	406	153	P	t-	1.0643	0.8554	70N	133E	0		
09581	2033 Mar 30	18:02:36	80	411	120	T	-t	0.9778	1.0462	71N	156W	11	781	02m37s
09582	2033 Sep 23	13:54:31	80	417	125	P	-t	-1.1583	0.6890	72S	121W	0		
09583	2034 Mar 20	10:18:45	80	423	130	T	-n	0.2894	1.0458	16N	22E	73	159	04m09s
09584	2034 Sep 12	16:19:28	81	429	135	A	-p	-0.3936	0.9736	18S	73W	67	102	02m58s
09585	2035 Mar 09	23:05:54	81	435	140	A	n-	-0.4368	0.9919	29S	155W	64	31	00m48s
09586	2035 Sep 02	01:56:46	81	441	145	T	p-	0.3727	1.0320	29N	158E	68	116	02m54s
09587	2036 Feb 27	04:46:49	82	447	150	P	t-	-1.1942	0.6286	72S	131W	0		
09588	2036 Jul 23	10:32:06	82	452	117	P	-t	-1.4250	0.1991	69S	4E	0		
09589	2036 Aug 21	17:25:45	82	453	155	P	t-	1.0825	0.8622	71N	47E	0		
09590	2037 Jan 16	09:48:55	82	458	122	P	-t	1.1477	0.7049	69N	21E	0		
09591	2037 Jul 13	02:40:36	83	464	127	T	-p	-0.7246	1.0413	25S	139E	43	201	03m58s
09592	2038 Jan 05	13:47:11	83	470	132	A	-n	0.4169	0.9728	2N	25W	65	107	03m18s
09593	2038 Jul 02	13:32:55	84	476	137	A	nn	0.0398	0.9911	25N	22W	88	31	01m00s
09594	2038 Dec 26	01:00:10	84	482	142	T	n-	-0.2881	1.0268	40S	164E	73	95	02m18s
09595	2039 Jun 21	17:12:54	84	488	147	A	p-	0.8312	0.9454	79N	102W	33	365	04m05s
09596	2039 Dec 15	16:23:46	85	494	152	T	p-	-0.9458	1.0356	81S	173E	18	380	01m51s
09597	2040 May 11	03:43:02	85	499	119	P	-t	-1.2529	0.5306	63S	174E	0		
09598	2040 Nov 04	19:09:02	85	505	124	P	-t	1.0993	0.8074	62N	53W	0		
09599	2041 Apr 30	11:52:21	86	511	129	T	-p	-0.4492	1.0189	10S	12E	63	72	01m51s
09600	2041 Oct 25	01:36:22	86	517	134	A	-p	0.4133	0.9467	10N	163E	66	213	06m07s
09601	2042 Apr 20	02:17:30	86	523	139	T	n-	0.2956	1.0614	27N	137E	73	210	04m51s
09602	2042 Oct 14	02:00:42	87	529	144	A	n-	-0.3030	0.9300	24S	138E	72	273	07m44s
09603	2043 Apr 09	18:57:49	87	535	149	T+	t-	1.0031	1.0095	61N	152E	0		
09604	2043 Oct 03	03:01:49	88	541	154	A-	t-	-1.0102	0.9497	61S	35E	0		
09605	2044 Feb 28	20:24:39	88	546	121	As	-t	-0.9954	0.9600	62S	26W	4	-	02m27s
09606	2044 Aug 23	01:17:02	88	552	126	T	-t	0.9613	1.0364	64N	120W	15	453	02m04s
09607	2045 Feb 16	23:56:07	89	558	131	A	-n	-0.3125	0.9285	28S	166W	72	281	07m47s
09608	2045 Aug 12	17:42:39	89	564	136	T	-n	0.2116	1.0774	26N	79W	78	256	06m06s
09609	2046 Feb 05	23:06:26	90	570	141	A	p-	0.3765	0.9232	5N	171W	68	310	09m42s
09610	2046 Aug 02	10:21:13	90	576	146	T	p-	-0.5350	1.0531	13S	15E	58	206	04m51s

Catalog of Solar Eclipses: 2001 to 2100

Catalog Number	Calendar Date	TD of Greatest Eclipse	ΔT s	Luna Num	Saros Num	Ecl. Type	QLE	Gamma	Ecl. Mag.	Sun Path Lat °	Sun Path Long °	Sun Path Alt °	Central Width km	Central Dur.
09611	2047 Jan 26	01:33:18	90	582	151	P	t-	1.0450	0.8907	63N	112E	0		
09612	2047 Jun 23	10:52:31	91	587	118	P	-t	1.3766	0.3129	66N	178W	0		
09613	2047 Jul 22	22:36:17	91	588	156	P	t-	-1.3477	0.3604	63S	160E	0		
09614	2047 Dec 16	23:50:12	91	593	123	P	-t	-1.0661	0.8816	66S	7W	0		
09615	2048 Jun 11	12:58:53	92	599	128	A	-p	0.6468	0.9441	64N	12W	49	272	04m58s
09616	2048 Dec 05	15:35:27	92	605	133	T	-n	-0.3973	1.0440	46S	56W	66	160	03m28s
09617	2049 May 31	13:59:59	92	611	138	A	nn	-0.1187	0.9631	15N	30W	83	134	04m45s
09618	2049 Nov 25	05:33:48	93	617	143	H	n-	0.2943	1.0057	4S	95E	73	21	00m38s
09619	2050 May 20	20:42:50	94	623	148	H	t-	-0.8688	1.0038	40S	124W	29	27	00m21s
09620	2050 Nov 14	13:30:53	95	629	153	P	t-	1.0447	0.8874	70N	1E	0		
09621	2051 Apr 11	02:10:39	95	634	120	P	-t	1.0169	0.9849	72N	32E	0		
09622	2051 Oct 04	21:02:14	96	640	125	P	-t	-1.2094	0.6024	72S	118E	0		
09623	2052 Mar 30	18:31:53	97	646	130	T	-n	0.3238	1.0466	22N	103W	71	164	04m08s
09624	2052 Sep 22	23:39:10	98	652	135	A	-p	-0.4480	0.9734	26S	175E	63	106	02m51s
09625	2053 Mar 20	07:08:19	99	658	140	A	n-	-0.4089	0.9919	23S	83E	66	31	00m50s
09626	2053 Sep 12	09:34:09	100	664	145	T	n-	0.3140	1.0328	21N	42E	72	116	03m04s
09627	2054 Mar 09	12:33:40	101	670	150	P	t-	-1.1711	0.6678	72S	98E	0		
09628	2054 Aug 03	18:04:02	102	675	117	Pe	-t	-1.4941	0.0655	70S	121W	0		
09629	2054 Sep 02	01:09:34	102	676	155	P	t-	1.0215	0.9793	72N	82W	0		
09630	2055 Jan 27	17:54:05	103	681	122	P	-t	1.1550	0.6932	70N	112W	0		
09631	2055 Jul 24	09:57:50	104	687	127	T	-p	-0.8012	1.0359	33S	26E	37	202	03m17s
09632	2056 Jan 16	22:16:45	105	693	132	A	-n	0.4199	0.9759	4N	154W	65	95	02m52s
09633	2056 Jul 12	20:21:59	106	699	137	A	nn	-0.0426	0.9878	19N	124W	88	43	01m26s
09634	2057 Jan 05	09:47:52	107	705	142	T	n-	-0.2837	1.0287	39S	35E	73	102	02m29s
09635	2057 Jul 01	23:40:15	108	711	147	A	p-	0.7455	0.9464	71N	176W	41	298	04m22s
09636	2057 Dec 26	01:14:35	109	717	152	T	p-	-0.9405	1.0348	85S	22E	19	355	01m50s
09637	2058 May 22	10:39:25	110	722	119	P	-t	-1.3194	0.4141	64S	61E	0		
09638	2058 Jun 21	00:19:35	110	723	157	Pb	t-	1.4869	0.1260	66N	10E	0		
09639	2058 Nov 16	03:23:07	111	728	124	P	-t	1.1224	0.7644	63N	174E	0		
09640	2059 May 11	19:22:16	112	734	129	T	-p	-0.5080	1.0242	11S	100W	59	95	02m23s
09641	2059 Nov 05	09:18:15	113	740	134	A	-p	0.4454	0.9417	9N	47E	63	238	07m00s
09642	2060 Apr 30	10:10:00	114	746	139	T	n-	0.2422	1.0660	28N	21E	76	222	05m15s
09643	2060 Oct 24	09:24:10	115	752	144	A	nn	-0.2625	0.9277	26S	28E	75	281	08m06s
09644	2061 Apr 20	02:56:49	116	758	149	T	t-	0.9578	1.0475	65N	59E	16	559	02m37s
09645	2061 Oct 13	10:32:10	117	764	154	A	t-	-0.9639	0.9469	62S	54W	15	743	03m41s
09646	2062 Mar 11	04:26:16	118	769	121	P	-t	-1.0238	0.9331	61S	147W	0		
09647	2062 Sep 03	08:54:27	119	775	126	P	-t	1.0191	0.9749	61N	150E	0		
09648	2063 Feb 28	07:43:30	120	781	131	A	-p	-0.3360	0.9293	25S	78E	70	280	07m41s
09649	2063 Aug 24	01:22:11	121	787	136	T	-n	0.2771	1.0750	26N	168E	74	252	05m49s
09650	2064 Feb 17	07:00:23	122	793	141	A	p-	0.3597	0.9262	7N	70E	69	295	08m56s
09651	2064 Aug 12	17:46:06	123	799	146	T	p-	-0.4652	1.0495	11S	96W	62	184	04m28s
09652	2065 Feb 05	09:52:26	124	805	151	P	t-	1.0336	0.9123	62N	22W	0		
09653	2065 Jul 03	17:33:52	125	810	118	P	-t	1.4619	0.1638	65N	72E	0		
09654	2065 Aug 02	05:34:17	125	811	156	P	t-	-1.2759	0.4903	63S	47E	0		
09655	2065 Dec 27	08:39:56	126	816	123	P	-t	-1.0688	0.8769	65S	149W	0		
09656	2066 Jun 22	19:25:48	127	822	128	A	-p	0.7330	0.9435	70N	96W	43	309	04m40s
09657	2066 Dec 17	00:23:40	128	828	133	T	-n	-0.4043	1.0416	47S	176E	66	152	03m14s
09658	2067 Jun 11	20:42:26	129	834	138	A	nn	-0.0387	0.9670	21N	130W	88	119	04m05s
09659	2067 Dec 06	14:03:43	130	840	143	H	n-	0.2845	1.0011	6S	32W	74	4	00m08s
09660	2068 May 31	03:56:39	131	846	148	T	p-	-0.7970	1.0110	31S	123E	37	63	01m06s

Catalog of Solar Eclipses: 2001 to 2100

Catalog Number	Calendar Date	TD of Greatest Eclipse	ΔT s	Luna Num	Saros Num	Ecl. Type	QLE	Gamma	Ecl. Mag.	Sun Path Lat °	Sun Path Long °	Sun Path Alt °	Central Width km	Central Dur.
09661	2068 Nov 24	21:32:30	132	852	153	P	t-	1.0299	0.9109	69N	131W	0		

09662	2069 Apr 21	10:11:09	133	857	120	P	-t	1.0624	0.8992	71N	101W	0			
09663	2069 May 20	17:53:18	133	858	158	Pb	t-	-1.4852	0.0879	69S	70W	0			
09664	2069 Oct 15	04:19:56	134	863	125	P	-t	-1.2524	0.5298	72S	5W	0			
09665	2070 Apr 11	02:36:09	135	869	130	T	-n	0.3652	1.0472	29N	135E	68	168	04m04s	
09666	2070 Oct 04	07:08:57	136	875	135	A	-p	-0.4950	0.9731	33S	60E	60	110	02m44s	
09667	2071 Mar 31	15:01:06	138	881	140	A	n-	-0.3739	0.9919	17S	37W	68	31	00m52s	
09668	2071 Sep 23	17:20:28	139	887	145	T	n-	0.2620	1.0333	14N	77W	75	116	03m11s	
09669	2072 Mar 19	20:10:31	140	893	150	P	t-	-1.1405	0.7199	72S	30W	0			
09670	2072 Sep 12	08:59:20	141	899	155	T	t-	0.9655	1.0558	70N	102E	14	732	03m13s	
09671	2073 Feb 07	01:55:59	142	904	122	P	-t	1.1651	0.6768	70N	115E	0			
09672	2073 Aug 03	17:15:23	143	910	127	T	-t	-0.8763	1.0294	43S	89W	28	206	02m29s	
09673	2074 Jan 27	06:44:15	144	916	132	A	-n	0.4251	0.9798	7N	79E	65	79	02m21s	
09674	2074 Jul 24	03:10:32	145	922	137	A	nn	-0.1242	0.9838	13N	134E	83	58	01m57s	
09675	2075 Jan 16	18:36:04	146	928	142	T	n-	-0.2799	1.0311	37S	94W	74	110	02m42s	
09676	2075 Jul 13	06:05:44	147	934	147	A	p-	0.6583	0.9467	63N	95E	49	262	04m45s	
09677	2076 Jan 06	10:07:27	148	940	152	T	p-	-0.9373	1.0342	87S	174W	20	340	01m49s	
09678	2076 Jun 01	17:31:22	149	945	119	P	-t	-1.3897	0.2897	64S	51W	0			
09679	2076 Jul 01	06:50:43	149	946	157	P	t-	1.4005	0.2746	67N	98W	0			
09680	2076 Nov 26	11:43:01	150	951	124	P	-t	1.1401	0.7315	64N	40E	0			
09681	2077 May 22	02:46:05	151	957	129	T	-p	-0.5725	1.0290	13S	148E	55	119	02m54s	
09682	2077 Nov 15	17:07:56	152	963	134	A	-p	0.4705	0.9371	8N	71W	62	262	07m54s	
09683	2078 May 11	17:56:55	153	969	139	T	n-	0.1838	1.0701	28N	94W	79	232	05m40s	
09684	2078 Nov 04	16:55:44	154	975	144	A	nn	-0.2285	0.9255	28S	83W	77	287	08m29s	
09685	2079 May 01	10:50:13	155	981	149	T	p-	0.9081	1.0512	66N	46W	24	406	02m55s	
09686	2079 Oct 24	18:11:21	156	987	154	A	t-	-0.9243	0.9484	63S	161W	22	495	03m39s	
09687	2080 Mar 21	12:20:15	157	992	121	P	-t	-1.0578	0.8734	61S	86E	0			
09688	2080 Sep 13	16:38:09	158	998	126	P	-t	1.0723	0.8743	61N	26E	0			
09689	2081 Mar 10	15:23:31	159	1004	131	A	-p	-0.3653	0.9304	22S	37W	68	277	07m36s	
09690	2081 Sep 03	09:07:31	160	1010	136	T	-n	0.3378	1.0720	25N	54E	70	247	05m33s	
09691	2082 Feb 27	14:47:00	162	1016	141	A	p-	0.3361	0.9298	9N	47W	70	277	08m12s	
09692	2082 Aug 24	01:16:21	163	1022	146	T	n-	-0.4004	1.0452	10S	152E	66	163	04m01s	
09693	2083 Feb 16	18:06:36	164	1028	151	P	t-	1.0170	0.9433	62N	154W	0			
09694	2083 Jul 15	00:14:23	165	1033	118	Pe	-t	1.5465	0.0168	64N	38W	0			
09695	2083 Aug 13	12:34:41	165	1034	156	P	t-	-1.2064	0.6146	62S	67W	0			
09696	2084 Jan 07	17:30:24	166	1039	123	P	-t	-1.0715	0.8723	64S	69E	0			
09697	2084 Jul 03	01:50:26	167	1045	128	A	-p	0.8208	0.9421	75N	169W	35	377	04m25s	
09698	2084 Dec 27	09:13:48	168	1051	133	T	-n	-0.4094	1.0396	47S	48E	66	146	03m04s	
09699	2085 Jun 22	03:21:16	169	1057	138	A	nn	0.0452	0.9704	26N	131E	87	106	03m29s	
09700	2085 Dec 16	22:37:48	170	1063	143	A	n-	0.2786	0.9971	7S	161W	74	10	00m19s	
09701	2086 Jun 11	11:07:14	171	1069	148	T	p-	-0.7215	1.0174	23S	12E	44	86	01m48s	
09702	2086 Dec 06	05:38:55	172	1075	153	P	p-	1.0194	0.9271	67N	96E	0			
09703	2087 May 02	18:04:42	173	1080	120	P	-t	1.1139	0.8011	70N	128E	0			
09704	2087 Jun 01	01:27:14	173	1081	158	P	t-	-1.4186	0.2146	68S	165E	0			
09705	2087 Oct 26	11:46:57	174	1086	125	P	-t	-1.2882	0.4696	71S	131W	0			
09706	2088 Apr 21	10:31:49	175	1092	130	T	-p	0.4135	1.0474	36N	15E	65	173	03m58s	
09707	2088 Oct 14	14:48:05	177	1098	135	A	-p	-0.5349	0.9727	40S	56W	57	115	02m38s	
09708	2089 Apr 10	22:44:42	178	1104	140	A	n-	-0.3319	0.9919	10S	155W	71	30	00m53s	
09709	2089 Oct 04	01:15:23	179	1110	145	T	n-	0.2167	1.0333	7N	163E	77	115	03m14s	
09710	2090 Mar 31	03:38:08	180	1116	150	P	t-	-1.1028	0.7843	72S	156W	0			

Catalog of Solar Eclipses: 2001 to 2100

Catalog Number	Calendar Date	TD of Greatest Eclipse	ΔT s	Luna Num	Saros Num	Ecl. Type	QLE	Gamma	Ecl. Mag.	Sun Path Lat °	Long °	Alt °	Central Width km	Dur.
09711	2090 Sep 23	16:56:36	181	1122	155	T	t-	0.9157	1.0562	61N	40W	23	463	03m36s
09712	2091 Feb 18	09:54:40	182	1127	122	P	-t	1.1779	0.6558	71N	18W	0		
09713	2091 Aug 15	00:34:43	183	1133	127	T	-t	-0.9490	1.0216	56S	150E	18	236	01m38s
09714	2092 Feb 07	15:10:20	184	1139	132	A	-n	0.4322	0.9840	10N	49W	64	62	01m48s
09715	2092 Aug 03	09:59:33	185	1145	137	A	nn	-0.2044	0.9794	6N	30E	78	75	02m31s
09716	2093 Jan 27	03:22:16	186	1151	142	T	n-	-0.2737	1.0340	34S	136E	74	119	02m58s
09717	2093 Jul 23	12:32:04	187	1157	147	A	p-	0.5717	0.9463	55N	1E	55	241	05m11s
09718	2094 Jan 16	18:59:03	189	1163	152	T	p-	-0.9333	1.0342	85S	11W	21	329	01m51s
09719	2094 Jun 13	00:22:11	190	1168	119	P	-t	-1.4613	0.1618	65S	164W	0		
09720	2094 Jul 12	13:24:35	190	1169	157	P	t-	1.3150	0.4224	68N	153E	0		
09721	2094 Dec 07	20:05:56	191	1174	124	P	-t	1.1547	0.7046	65N	95W	0		

09722	2095 Jun 02	10:07:40	192	1180	129	T	-p	-0.6396	1.0332	17S	37E	50	145	03m18s
09723	2095 Nov 27	01:02:57	193	1186	134	A	-p	0.4903	0.9330	7N	170E	61	285	08m47s
09724	2096 May 22	01:37:14	194	1192	139	T	nn	0.1196	1.0737	27N	153E	83	241	06m06s
09725	2096 Nov 15	00:36:15	195	1198	144	A	nn	-0.2018	0.9237	30S	163E	78	294	08m53s
09726	2097 May 11	18:34:31	196	1204	149	T	p-	0.8516	1.0538	67N	150W	31	339	03m10s
09727	2097 Nov 04	02:01:25	197	1210	154	A	t-	-0.8926	0.9494	66S	87E	26	411	03m36s
09728	2098 Apr 01	20:02:31	198	1215	121	P	-t	-1.1005	0.7984	61S	38W	0		
09729	2098 Sep 25	00:31:16	199	1221	126	P	-t	1.1184	0.7871	61N	101W	0		
09730	2098 Oct 24	10:36:11	200	1222	164	Pb	t-	-1.5407	0.0056	62S	95W	0		
09731	2099 Mar 21	22:54:32	201	1227	131	A	-p	-0.4016	0.9318	20S	149W	66	275	07m32s
09732	2099 Sep 14	16:57:53	202	1233	136	T	-n	0.3942	1.0684	23N	63W	67	241	05m18s
09733	2100 Mar 10	22:28:11	203	1239	141	A	n-	0.3077	0.9338	12N	162W	72	257	07m29s
09734	2100 Sep 04	08:49:20	204	1245	146	T	n-	-0.3384	1.0402	10S	39E	70	142	03m32s

World Atlas of Solar Eclipse Paths

Detailed maps of all annular, total and hybrid eclipses during the 21st century CE can be found at the **World Atlas of Solar Eclipse Paths**. The maps are broken down into 20 year intervals and may be accessed through the links below. Each map is stored in GIF format with a typical file size of 130 kilobytes.

	World Atlas of Solar Eclipse Paths				
21st century CE	2001-2020	2021-2040	2041-2060	2061-2080	2081-2100

Index to Five Millennium Catolog of Solar Eclipses

Each link below displays a web page containing 100 years of solar eclipses. Every eclipse has links of global maps, central paths plotted on Google Maps, **Saros** series tables, and **Besselian elements**.

	Five Millennium Catalog of Solar Eclipses				
Centuries	-1999 - -1900	-1899 - -1800	-1799 - -1700	-1699 - -1600	-1599 - -1500
	-1499 - -1400	-1399 - -1300	-1299 - -1200	-1199 - -1100	-1099 - -1000
	-0999 - -0900	-0899 - -0800	-0799 - -0700	-0699 - -0600	-0599 - -0500
	-0499 - -0400	-0399 - -0300	-0299 - -0200	-0199 - -0100	-0099 - -0000
	0001 - 0100	0101 - 0200	0201 - 0300	0301 - 0400	0401 - 0500
	0501 - 0600	0601 - 0700	0701 - 0800	0801 - 0900	0901 - 1000
	1001-1100	1101-1200	1201-1300	1301-1400	1401-1500
	1501-1600	1601-1700	1701-1800	1801-1900	1901-2000
	2001-2100	2101-2200	2201-2300	2301-2400	2401-2500
	2501-2600	2601-2700	2701-2800	2801-2900	2901-3000

These web pages are part of the **Five Millennium Catalog of Solar Eclipses: -1999 to +3000**

Calendar

The Gregorian calendar is used for all dates from 1582 Oct 15 onwards. Before that date, the Julian calendar is used. For more information on this topic, see **Calendar Dates**. The Julian calendar does not include the year 0. Thus the year 1 BCE is followed by the year 1 CE (See: **BCE/CE Dating Conventions**). This is awkward for arithmetic calculations. Years in this catalog are numbered astronomically and include the year 0. Historians should note there is a difference of one year between astronomical dates and BCE dates. Thus, the astronomical year 0 corresponds to 1 BCE, and astronomical year -1 corresponds to 2 BCE, etc..

Predictions

The coordinates of the Sun used in these predictions are based on the VSOP87 theory [Bretagnon and Francou, 1988]. The Moon's coordinates are based on the ELP-2000/82 theory [Chapront-Touze and Chapront, 1983]. For more information, see: **Solar and Lunar Ephemerides**. The revised value used for the Moon's **secular acceleration** is n-dot = -25.858 arc-sec/cy*cy, as deduced from the Apollo lunar laser ranging experiment (Chapront, Chapront-Touze, and Francou, 2002).

The largest uncertainty in the eclipse predictions is caused by fluctuations in **Earth's rotation** due primarily to tidal friction of the Moon. The resultant drift in apparent clock time is expressed as **ΔT** and is determined as follows:

1. pre-1950's: ΔT calculated from empirical fits to historical records derived by Morrison and Stephenson (2004)
2. 1955-present: ΔT obtained from published observations
3. future: ΔT is extrapolated from current values weighted by the long term trend from tidal effects

A series of **polynomial expressions** have been derived to simplify the evaluation of ΔT for any time from -1999 to +3000. The **uncertainty in ΔT** over this period can be estimated from scatter in the measurements.

Footnotes

[**1**] The Moon's orbit is inclined about 5.1° to Earth's orbit around the Sun. The points where the lunar orbit intersects the plane of Earth's orbit are known as the nodes. The Moon moves from south to north of Earth's orbit at the ascending node, and from north to south at the descending node.

[**2**] Hybrid eclipses are also known as annular/total eclipses. Such an eclipse is both total and annular along different sections of its umbral path. (See: **Five Millennium Catalog of Hybrid Solar Eclipses**)

[**3**] Central solar eclipses are eclipses in which the central axis of the Moon's shadow strikes the Earth's surface. All partial (penumbral) eclipses are non-central eclipses since the shadow axis misses Earth. However, umbral eclipses (total, annular and hybrid) may be either central (usually) or non-central (rarely).

[**4**] The terms BCE and CE are abbreviations for "Before Common Era" and "Common Era," respectively. They are the secular equivalents to the BC and AD dating conventions. (See: **Year Dating Conventions**)

[**5**] Greatest eclipse is defined as the instant when the axis of the Moon's shadow passes closest to the Earth's center. For total eclipses, the instant of greatest eclipse is virtually identical to the instants of greatest magnitude and greatest duration. However, for annular eclipses, the instant of greatest duration may occur at either the time of greatest eclipse or near the sunrise and sunset points of the eclipse path.

Acknowledgments

The information presented on this web page is based on data published in ***Five Millennium Canon of Solar Eclipses: -1999 to +3000*** and ***Five Millennium Catalog of Solar Eclipses: -1999 to +3000***. The individual global maps appearing in links were extracted from full page plates appearing in ***Five Millennium Canon*** by *Dan McGlaun*. The Besselian elements were provided by *Jean Meeus*. *Fred Espenak* assumes full responsibility for the accuracy of all eclipse calculations.

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"Eclipse Predictions by Fred Espenak (NASA's GSFC)"

Eclipse Links

Five Millennium Catalog of Solar Eclipses

Ten Millennium Catalog of Long Solar Eclipses

Saros Series Catalog of Solar Eclipses

World Atlas of Solar Eclipse Paths

- **Home**
- **Solar Eclipses**
- **Lunar Eclipses**

- **Transits**
- **Resources**

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