

Some remarks concerning solar eclipse data predictions

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Computing solar eclipse predictions consists of two main "steps": 1.) Accurate computing of the positions of Sun, Earth and Moon and 2.) computing the geometry of the Moon's shadow on Earth.

The accurate positions of the solar system bodies can be computed with (two) different mathematical methods. Numerical integration and analytical approach (calculation of the perturbations caused by other planets to the orbits of Earth and Moon).

To compute the planetary positions for a desired time point with numerical integration the positions and velocities of the involved bodies must be known for a certain time point and from this time point Newton's gravitational law (and relativistic effects ...) is applied in small time steps until the desired time point is reached. The advantage of numerical integration is the "intrinsic" accuracy which is limited only by the computer's numerical representation of numbers (rounding errors). The chosen step size is a compromise between cumulative rounding errors and precision.

To compute the planetary positions for any desired time point with the analytical approach (ten)thousands of terms (perturbations) are summed. For practical reasons very small terms are ignored.

For the calculation of solar eclipses over long time periods both methods may be used. The "mathematical errors" of both methods are much smaller than our knowledge about the physical parameters (mass, velocity, figure ...) of the bodies.

The Moon's position is influenced not only by the well known gravitational law but also by a "secular acceleration" caused by tidal effects. This additional acceleration yields to a difference in the Moons position of $-26''/\text{century}^2$. Several eclipse prediction works use(d) different values between $-25.83''/\text{century}^2$ and $-26''/\text{century}^2$ ("Six Millennium Catalog of Solar Eclipses" by Fred Espenak). The most modern value is $-25.858''/\text{century}^2$ ("Five Millennium Catalog of Solar Eclipses" by Fred Espenak and Jean Meeus).

To compute a "true" planetary position to an accuracy of 100 meters over a time period of five thousand years the planets position must be known to an accuracy of 100 meters on a certain date (near the present), the EXACT masses of all involved bodies must be known, and NO ROUNDING ERRORS are allowed!

The calculation of the eclipse phenomena is also not possible in a mathematical exact manner: We do not know the flattening of the Earth to more than five to six significant digits! We do not know the exact offset of the Moon's center of figure from its center of mass. Furthermore, the surface of the Moon is not polished, but there are mountains and depressions, as on Earth. How should we define the size of the Moon? If an average lunar radius is used the changeover between annularity and totality will not be "true". This case happened on October 3, 1986. Some authors stated this eclipse as annular-total, even with a maximum totality duration of zero seconds, where it was in fact never total. There was always sunlight shining through some lunar depressions.

There are several assumptions, adoptions and definitions that can change the type of an eclipse or even an eclipse to become inexistent. In any carefully performed eclipse calculation these effects are always observed at the moment when the shadow axis is very tangent to the Earth's surface.

Example:

The annular-total eclipse of December 17, -1935 begins total, remains total until approx. five seconds! before sunset. This can be visualized with my solar eclipse program Flnspektor (http://robertnufer.ch/06_computing/flnspektor/Setup_Flnspektor.exe).

To get a "feeling" for the "impact" of different eclipse predictions I compared the "Five Millennium Catalog of Solar Eclipses" (5MCSE) from Fred Espenak and Jean Meeus and the "Six Millennium Catalog of Solar Eclipses" (6MCSE) from Fred Espenak with my own calculations, a numerical integration (using the program Solex91 from Aldo Vitagliano) over ten millennia from -5000 to +5000.

To make it not too complicated, I compare here the first century common to all catalogs, the 20th century BC from -1999 to -1900.

From my numerical integration I compiled a seven millennia catalog with Saros counting information, and complete sets of Besselian elements in polynomial form. These data are now used in my program Flnspektor.

The only different eclipse type between my compilation and the 5MCSE in this century is the eclipse of December 17, -1935. (Flnspektor "labels" this eclipse as total, but when inspecting the eclipse near sunset one can observe the annularity approx. five seconds before sunset!

The differences between the two catalogs 5MCSE and 6MCSE are significant greater than the differences between my calculations and the 5MCSE. The root mean squares (rms) are given at the end of the table.

The following table contains eclipse prediction data from three data sources:

- **Five Millennium Catalog of Solar Eclipses**
Fred Espenak and Jean Meeus (NASA's GSFC)
(<http://sunearth.gsfc.nasa.gov/eclipse/SEcat5/catalog.html>)
- **Six Millennium Catalog of Solar Eclipses**
Fred Espenak (NASA's GSFC)
(<http://sunearth.gsfc.nasa.gov/eclipse/SEcat/SEcatalog.html>)
- **My own 10'000 years integration: The data source for Flnspektor**
Robert Nufer

The columns contain from left to right:

Nr Number of eclipse in century
 Date and time (TD) at eclipse maximum

For all three data sources:

Tp Eclipse type according to "Key to Catalog of Solar Eclipses" (Fred Espenak and Jean Meeus). The letters "b", "m" and "e" for begin, middle and end of Saros are omitted.

γ Gamma. Minimal distance of the shadow axis from the Earth's center (Equatorial Earth radii)

mg Eclipse magnitude

W Path width at eclipse maximum (kilometers)

D Center line duration of total or annular phase at eclipse maximum (seconds)

For the "**Six Millennium...**" and "**my own...**" data four columns are given containing the differences to the "**Five Millennium...**" data: Unit is the last digit of the corresponding data column.

$\Delta\gamma$ Difference between γ s.
(1 = 0.0001 Equatorial Earth radii (~640 meters))

Δmg Difference between eclipse magnitudes
(1=0.0001 magnitude)

ΔW Difference between path widths (kilometers)

ΔD Difference between Center line durations at eclipse maximum (seconds)

Solar eclipses from -1999 to -1900

Source:
Five Millennium Catalog of Solar Eclipses

Acknowledgement: Eclipse Predictions by
Fred Espenak and Jean Meeus (NASA's GSFC)

Nr	Date and Terrestrial Time (TT) at eclipse maximum		Tp	γ R_{Earth}	mg	W km	D sec
1	-1999 Jun	12 03:14:51	T	-0.2701	1.0733	247	397
2	-1999 Dec	5 23:45:23	A	-0.2317	0.9382	236	404
3	-1998 Jun	1 18:09:16	T	0.4994	1.0284	111	135
4	-1998 Nov	25 05:57:03	A	-0.9045	0.9806	162	74
5	-1997 Apr	22 13:19:56	P	-1.4670	0.1611		
6	-1997 May	22 02:45:35	P	1.3253	0.4035		
7	-1997 Oct	16 08:01:52	P	1.1669	0.6954		
8	-1997 Nov	14 18:48:49	P	-1.5183	0.0377		
9	-1996 Apr	10 13:54:52	A	-0.7231	0.9464	277	311
10	-1996 Oct	4 23:23:37	T	0.5166	1.0257	101	124
11	-1995 Mar	30 17:24:52	A	0.0609	0.9873	45	77
12	-1995 Sep	24 10:31:54	A	-0.1863	0.9766	85	142
13	-1994 Mar	20 03:59:50	T	0.8091	1.0333	186	155
14	-1994 Sep	13 14:32:00	A	-0.9265	0.9249	733	418
15	-1993 Feb	8 11:41:40	P	-1.0699	0.8826		
16	-1993 Mar	9 19:48:09	P	1.4907	0.0754		
17	-1993 Aug	3 21:35:06	P	1.3116	0.4292		
18	-1992 Jan	29 02:34:14	T	-0.3875	1.0181	67	90
19	-1992 Jul	23 04:03:17	H	0.5182	1.0059	24	29
20	-1991 Jan	17 11:29:42	A	0.3460	0.9599	155	303
21	-1991 Jul	12 17:34:12	T	-0.2421	1.0606	205	350
22	-1990 Jan	6 13:10:01	P	1.0749	0.8256		
23	-1990 Jul	2 10:30:06	T	-0.9623	1.0609	756	270
24	-1990 Nov	26 19:21:37	P	-1.2517	0.5316		
25	-1989 May	23 16:56:38	H	0.8616	1.0067	46	27
26	-1989 Nov	16 03:39:33	H	-0.5096	1.0036	14	18
27	-1988 May	11 23:28:58	A	0.0987	0.9652	126	251
28	-1988 Nov	4 17:46:47	T	0.1768	1.0435	148	244
29	-1987 May	1 00:29:51	A	-0.6733	0.9464	264	370
30	-1987 Oct	25 09:21:08	T	0.8460	1.0260	165	118

Solar eclipses from -1999 to -1900

Source:
Six Millennium Catalog of Solar Eclipses

Acknowledgment: Eclipse Predictions by
Fred Espenak (NASA's GSFC)

Tp	γ R_{Earth}	mg	W km	D sec	$\Delta\gamma$	Δmg	ΔW	ΔD
T	-0.2780	1.0730	247	398	-79	-3	0	1
A	-0.2250	0.9380	236	406	67	-2	0	2
T	0.4910	1.0290	111	137	-84	6	0	2
A	-0.8980	0.9810	158	75	65	4	-4	1
P	-1.4750	0.1450			-80	-161		
P	1.3160	0.4180			-93	145		
P	1.1730	0.6820			61	-134		
P	-1.5120	0.0480			63	103		
A	-0.7320	0.9460	282	310	-89	-4	5	-1
T	0.5230	1.0260	101	124	64	3	0	0
A	0.0520	0.9870	45	78	-89	-3	0	1
A	-0.1790	0.9770	84	140	73	4	-1	-2
T	0.8010	1.0330	183	156	-81	-3	-3	1
A	-0.9190	0.9250	695	419	75	1	-38	1
P	-1.0770	0.8690			-71	-136		
P	1.4840	0.0880			-67	126		
P	1.3200	0.4150			84	-142		
T	-0.3940	1.0180	68	91	-65	-1	1	1
H	0.5260	1.0050	22	27	78	-9	-2	-2
A	0.3390	0.9600	153	300	-70	1	-2	-3
T	-0.2350	1.0600	204	349	71	-6	-1	-1
P	1.0680	0.8370			-69	114		
T	-0.9550	1.0610	693	275	73	1	-63	5
P	-1.2580	0.5200			-63	-116		
H	0.8690	1.0070	47	27	74	3	1	0
H	-0.5160	1.0030	13	17	-64	-6	-1	-1
A	0.1070	0.9650	126	249	83	-2	0	-2
T	0.1710	1.0430	147	243	-58	-5	-1	-1
A	-0.6650	0.9460	261	371	83	-4	-3	1
T	0.8400	1.0260	164	120	-60	0	-1	2

Solar eclipses from -1999 to -1900

Source:
My own 10'000 years integration: The data source for Flinspektor

Eclipse Predictions by Robert Nufer

Tp	γ R_{Earth}	mg	W km	D sec	$\Delta\gamma$	Δmg	ΔW	ΔD
T	-0.2699	1.0733	247	397	2	0	0	0
A	-0.2320	0.9382	236	404	-3	0	0	0
T	0.4996	1.0284	111	135	2	0	0	0
A	-0.9048	0.9807	162	74	-3	1	0	0
P	-1.4667	0.1623			3	12		
P	1.3256	0.4033			3	-2		
P	1.1667	0.6961			-2	7		
P	-1.5185	0.0378			-2	1		
A	-0.7228	0.9465	277	311	3	1	0	0
T	0.5163	1.0257	101	124	-3	0	0	0
A	0.0611	0.9873	45	77	2	0	0	0
A	-0.1866	0.9766	85	142	-3	0	0	0
T	0.8093	1.0334	187	154	2	1	1	-1
A	-0.9268	0.9250	736	417	-3	1	3	-1
P	-1.0697	0.8830			2	4		
P	1.4909	0.0758			2	4		
P	1.3114	0.4298			-2	6		
T	-0.3873	1.0181	67	90	2	0	0	0
H	0.5180	1.0059	24	29	-2	0	0	0
A	0.3461	0.9599	155	303	1	0	0	0
T	-0.2422	1.0606	205	350	-1	0	0	0
P	1.0750	0.8255			1	-1		
T	-0.9624	1.0611	763	269	-1	2	7	-1
P	-1.2517	0.5317			0	1		
H	0.8616	1.0068	46	27	0	1	0	0
H	-0.5095	1.0036	14	18	1	0	0	0
A	0.0987	0.9652	126	251	0	0	0	0
T	0.1769	1.0435	148	244	1	0	0	0
A	-0.6733	0.9464	264	370	0	0	0	0
T	0.8461	1.0262	165	118	1	2	0	0

Solar eclipses from -1999 to -1900

Source:
Five Millennium Catalog of Solar Eclipses

Acknowledgement: Eclipse Predictions by
Fred Espenak and Jean Meeus (NASA's GSFC)

Nr	Date and Terrestrial Time (TT) at eclipse maximum		Tp	γ R_{Earth}	mg	W km	D sec
31	-1986 Mar	21 15:06:51	P	1.3284	0.3949		
32	-1986 Apr	20 02:55:09	P	-1.4035	0.2645		
33	-1986 Sep	15 07:15:14	P	-1.2711	0.4983		
34	-1985 Mar	11 03:26:36	T	0.5312	1.0490	191	269
35	-1985 Sep	4 09:29:03	A	-0.5977	0.9272	338	562
36	-1984 Feb	28 19:51:38	T	-0.1975	1.0690	229	353
37	-1984 Aug	23 09:09:06	A	0.1151	0.9402	223	447
38	-1983 Feb	17 11:43:36	T	-0.9309	1.0259	246	90
39	-1983 Aug	12 13:43:07	A	0.8332	0.9820	116	75
40	-1982 Jan	8 07:26:45	P	1.1451	0.7132		
41	-1982 Jul	3 17:34:50	P	-1.0663	0.8933		
42	-1982 Aug	2 01:40:26	P	1.4996	0.0678		
43	-1982 Dec	28 07:38:06	A	0.4710	0.9191	346	698
44	-1981 Jun	23 10:42:06	T	-0.3407	1.0693	240	388
45	-1981 Dec	17 07:52:15	A	-0.2249	0.9420	220	381
46	-1980 Jun	12 01:14:01	T	0.4248	1.0242	91	120
47	-1980 Dec	5 14:32:25	A	-0.9018	0.9845	127	58
48	-1979 May	2 19:42:02	P	-1.5543	0.0110		
49	-1979 Jun	1 09:17:39	P	1.2453	0.5442		
50	-1979 Oct	26 16:52:42	P	1.1691	0.6910		
51	-1979 Nov	25 03:41:17	P	-1.5170	0.0392		
52	-1978 Apr	21 20:18:29	A	-0.8065	0.9476	315	300
53	-1978 Oct	16 08:02:30	T	0.5237	1.0214	84	107
54	-1977 Apr	11 00:17:50	A	-0.0139	0.9927	26	44
55	-1977 Oct	5 18:43:53	A	-0.1747	0.9713	104	173
56	-1976 Mar	30 11:26:06	T	0.7436	1.0404	197	185
57	-1976 Sep	23 22:12:57	A	-0.9053	0.9215	678	430
58	-1975 Feb	18 19:47:20	P	-1.1099	0.8070		
59	-1975 Mar	20 03:32:45	P	1.4354	0.1811		
60	-1975 Aug	14 04:48:27	P	1.3569	0.3516		

Solar eclipses from -1999 to -1900

Source:
Six Millennium Catalog of Solar Eclipses

Acknowledgment: Eclipse Predictions by
Fred Espenak (NASA's GSFC)

Tp	γ R_{Earth}	mg	W km	D sec	$\Delta\gamma$	Δmg	ΔW	ΔD
P	1.3360	0.3800			76	-149		
P	-1.3960	0.2780			75	135		
P	-1.2780	0.4870			-69	-113		
T	0.5390	1.0490	191	267	78	0	0	-2
A	-0.6050	0.9270	341	561	-73	-2	3	-1
T	-0.1900	1.0690	229	354	75	0	0	1
A	0.1080	0.9400	224	450	-71	-2	1	3
T	-0.9240	1.0270	240	93	69	11	-6	3
A	0.8260	0.9820	115	76	-72	0	-1	1
P	1.1520	0.7020			69	-112		
P	-1.0740	0.8780			-77	-153		
P	1.4930	0.0810			-66	132		
A	0.4780	0.9190	348	698	70	-1	2	0
T	-0.3490	1.0690	240	389	-83	-3	0	1
A	-0.2180	0.9420	221	383	69	0	1	2
T	0.4160	1.0250	92	122	-88	8	1	2
A	-0.8950	0.9850	124	58	68	5	-3	0
Missing								
P	1.2360	0.5590			-93	148		
P	1.1750	0.6780			59	-130		
P	-1.5110	0.0490			60	98		
A	-0.8150	0.9470	323	299	-85	-6	8	-1
T	0.5300	1.0210	85	107	63	-4	1	0
A	-0.0220	0.9930	26	45	-81	3	0	1
A	-0.1680	0.9720	103	172	67	7	-1	-1
T	0.7360	1.0400	195	186	-76	-4	-2	1
A	-0.8980	0.9220	651	431	73	5	-27	1
P	-1.1170	0.7930			-71	-140		
P	1.4280	0.1940			-74	129		
P	1.3650	0.3380			81	-136		

Solar eclipses from -1999 to -1900

Source:
My own 10'000 years integration: The data source for Flinspektor

Eclipse Predictions by Robert Nufer

Tp	γ R_{Earth}	mg	W km	D sec	$\Delta\gamma$	Δmg	ΔW	ΔD
P	1.3283	0.3952			-1	3		
P	-1.4035	0.2648			0	3		
P	-1.2710	0.4985			1	2		
T	0.5311	1.0490	191	268	-1	0	0	-1
A	-0.5976	0.9272	339	562	1	0	1	0
T	-0.1976	1.0690	229	353	-1	0	0	0
A	0.1152	0.9402	223	447	1	0	0	0
T	-0.9311	1.0262	245	90	-2	3	-1	0
A	0.8334	0.9822	116	75	2	2	0	0
P	1.1450	0.7134			-1	2		
P	-1.0662	0.8936			1	3		
P	1.4998	0.0675			2	-3		
A	0.4708	0.9191	347	698	-2	0	1	0
T	-0.3405	1.0693	240	388	2	0	0	0
A	-0.2251	0.9420	220	381	-2	0	0	0
T	0.4251	1.0242	91	120	3	0	0	0
A	-0.9020	0.9847	127	58	-2	2	0	0
P	-1.5540	0.0122			3	12		
P	1.2456	0.5439			3	-3		
P	1.1689	0.6917			-2	7		
P	-1.5172	0.0392			-2	0		
A	-0.8061	0.9477	315	300	4	1	0	0
T	0.5235	1.0214	84	107	-2	0	0	0
A	-0.0136	0.9927	26	44	3	0	0	0
A	-0.1751	0.9713	104	174	-4	0	0	1
T	0.7438	1.0404	198	185	2	0	1	0
A	-0.9057	0.9216	680	430	-4	1	2	0
P	-1.1097	0.8075			2	5		
P	1.4355	0.1815			1	4		
P	1.3566	0.3523			-3	7		

Solar eclipses from -1999 to -1900

Source:
Five Millennium Catalog of Solar Eclipses

Acknowledgement: Eclipse Predictions by
Fred Espenak and Jean Meeus (NASA's GSFC)

Nr	Date and Terrestrial Time (TT) at eclipse maximum		Tp	γ R_{Earth}	mg	W km	D sec
61	-1974 Feb	8 10:34:06	T	-0.4230	1.0179	68	88
62	-1974 Aug	3 11:35:27	H	0.5677	1.0057	24	27
63	-1973 Jan	28 19:13:23	A	0.3168	0.9602	152	294
64	-1973 Jul	24 01:18:22	T	-0.1865	1.0601	201	338
65	-1972 Jan	17 20:43:43	P	1.0502	0.8677		
66	-1972 Jul	12 18:09:32	T	-0.9033	1.0603	464	290
67	-1972 Dec	7 03:38:57	P	-1.2500	0.5347		
68	-1971 Jun	2 23:50:31	A	0.9435	0.9992	8	3
69	-1971 Nov	26 12:22:23	H	-0.5060	1.0069	28	34
70	-1970 May	23 05:53:04	A	0.1869	0.9625	138	263
71	-1970 Nov	16 02:41:09	T	0.1785	1.0442	150	250
72	-1969 May	12 06:45:38	A	-0.5839	0.9485	231	384
73	-1969 Nov	5 18:10:59	T	0.8487	1.0233	149	111
74	-1968 Mar	31 22:13:17	P	1.3890	0.2843		
75	-1968 Apr	30 09:34:02	P	-1.3203	0.4110		
76	-1968 Sep	25 15:13:22	P	-1.2916	0.4628		
77	-1967 Mar	21 11:03:12	T	0.5876	1.0537	218	278
78	-1967 Sep	14 16:59:19	A	-0.6263	0.9232	368	567
79	-1966 Mar	11 03:42:14	T	-0.1456	1.0719	236	374
80	-1966 Sep	3 16:35:18	A	0.0794	0.9390	227	461
81	-1965 Feb	28 19:33:01	T	-0.8890	1.0279	208	104
82	-1965 Aug	23 21:25:13	A	0.7919	0.9831	98	74
83	-1964 Jan	19 15:11:49	P	1.1713	0.6686		
84	-1964 Jul	14 01:14:53	P	-1.1238	0.7821		
85	-1964 Aug	12 09:35:44	P	1.4540	0.1540		
86	-1963 Jan	7 15:19:18	A	0.4901	0.9215	340	686
87	-1963 Jul	3 18:12:59	T	-0.4077	1.0646	231	372
88	-1963 Dec	27 15:54:04	A	-0.2134	0.9464	202	354
89	-1962 Jun	23 08:20:59	T	0.3533	1.0193	71	101
90	-1962 Dec	16 23:03:15	A	-0.8949	0.9893	85	39

Solar eclipses from -1999 to -1900

Source:
Six Millennium Catalog of Solar Eclipses

Acknowledgment: Eclipse Predictions by
Fred Espenak (NASA's GSFC)

Tp	γ R_{Earth}	mg	W km	D sec	$\Delta\gamma$	Δmg	ΔW	ΔD
T	-0.4300	1.0180	69	89	-70	1	1	1
H	0.5750	1.0050	23	25	73	-7	-1	-2
A	0.3100	0.9610	150	291	-68	8	-2	-3
T	-0.1790	1.0600	200	337	75	-1	-1	-1
P	1.0430	0.8790			-72	113		
T	-0.8960	1.0610	450	294	73	7	-14	4
P	-1.2560	0.5240			-60	-107		
A	0.9510	0.9990	11	3	75	-2	3	0
H	-0.5120	1.0070	27	33	-60	1	-1	-1
A	0.1950	0.9630	138	261	81	5	0	-2
T	0.1730	1.0440	149	249	-55	-2	-1	-1
A	-0.5760	0.9490	229	385	79	5	-2	1
T	0.8430	1.0240	148	112	-57	7	-1	1
P	1.3970	0.2700			80	-143		
P	-1.3130	0.4240			73	130		
P	-1.2980	0.4520			-64	-108		
T	0.5950	1.0540	219	276	74	3	1	-2
A	-0.6330	0.9230	371	566	-67	-2	3	-1
T	-0.1390	1.0720	236	375	66	1	0	1
A	0.0720	0.9390	228	464	-74	0	1	3
T	-0.8820	1.0280	206	107	70	1	-2	3
A	0.7850	0.9830	98	75	-69	-1	0	1
P	1.1780	0.6570			67	-116		
P	-1.1310	0.7680			-72	-141		
P	1.4470	0.1660			-70	120		
A	0.4970	0.9210	342	685	69	-5	2	-1
T	-0.4150	1.0650	232	372	-73	4	1	0
A	-0.2070	0.9460	202	356	64	-4	0	2
T	0.3450	1.0200	71	102	-83	7	0	1
A	-0.8890	0.9890	83	40	59	-3	-2	1

Solar eclipses from -1999 to -1900

Source:
My own 10'000 years integration: The data source for Flinspektor

Eclipse Predictions by Robert Nufer

Tp	γ R_{Earth}	mg	W km	D sec	$\Delta\gamma$	Δmg	ΔW	ΔD
T	-0.4228	1.0179	67	88	2	0	-1	0
H	0.5675	1.0058	24	27	-2	1	0	0
A	0.3170	0.9602	152	294	2	0	0	0
T	-0.1866	1.0601	201	338	-1	0	0	0
P	1.0504	0.8675			2	-2		
T	-0.9034	1.0604	466	290	-1	1	2	0
P	-1.2500	0.5348			0	1		
A	0.9435	0.9995	8	3	0	3	0	0
H	-0.5059	1.0069	28	34	1	0	0	0
A	0.1870	0.9625	138	263	1	0	0	0
T	0.1786	1.0442	150	250	1	0	0	0
A	-0.5839	0.9486	231	384	0	1	0	0
T	0.8487	1.0234	149	110	0	1	0	-1
P	1.3890	0.2846			0	3		
P	-1.3203	0.4113			0	3		
P	-1.2916	0.4630			0	2		
T	0.5876	1.0537	218	278	0	0	0	0
A	-0.6263	0.9232	368	567	0	0	0	0
T	-0.1457	1.0719	236	374	-1	0	0	0
A	0.0795	0.9390	227	462	1	0	0	1
T	-0.8891	1.0281	208	104	-1	2	0	0
A	0.7920	0.9832	98	74	1	1	0	0
P	1.1712	0.6688			-1	2		
P	-1.1236	0.7824			2	3		
P	1.4542	0.1537			2	-3		
A	0.4899	0.9215	340	685	-2	0	0	-1
T	-0.4075	1.0646	231	372	2	0	0	0
A	-0.2136	0.9465	202	354	-2	1	0	0
T	0.3536	1.0193	70	101	3	0	-1	0
A	-0.8951	0.9895	85	39	-2	2	0	0

Solar eclipses from -1999 to -1900

Source:
Five Millennium Catalog of Solar Eclipses

Acknowledgement: Eclipse Predictions by
Fred Espenak and Jean Meeus (NASA's GSFC)

Nr	Date and Terrestrial Time (TT) at eclipse maximum		Tp	γ R_{Earth}	mg	W km	D sec
91	-1961 Jun	12 15:51:46	P	1.1676	0.6797		
92	-1961 Nov	7 01:46:11	P	1.1690	0.6910		
93	-1961 Dec	6 12:31:33	P	-1.5144	0.0428		
94	-1960 May	2 02:39:40	A	-0.8919	0.9479	410	289
95	-1960 Oct	26 16:45:10	T	0.5271	1.0175	70	91
96	-1959 Apr	21 07:07:29	A	-0.0923	0.9977	8	14
97	-1959 Oct	16 03:01:44	A	-0.1688	0.9665	122	203
98	-1958 Apr	10 18:45:52	T	0.6719	1.0468	206	212
99	-1958 Oct	5 06:02:20	A	-0.8914	0.9183	664	436
100	-1957 Mar	2 03:43:57	P	-1.1573	0.7169		
101	-1957 Mar	31 11:10:33	P	1.3744	0.2986		
102	-1957 Aug	25 12:12:43	P	1.3938	0.2884		
103	-1957 Sep	24 05:12:58	P	-1.5660	0.0061		
104	-1956 Feb	19 18:25:24	T	-0.4649	1.0176	68	85
105	-1956 Aug	13 19:17:10	H	0.6100	1.0054	23	25
106	-1955 Feb	8 02:47:50	A	0.2811	0.9608	148	281
107	-1955 Aug	3 09:08:54	T	-0.1359	1.0589	196	322
108	-1954 Jan	28 04:09:29	A+	1.0192	0.9207		
109	-1954 Jul	24 01:54:42	T	-0.8494	1.0580	361	291
110	-1954 Dec	18 11:52:50	P	-1.2518	0.5318		
111	-1953 Jun	14 06:46:26	P	1.0223	0.9489		
112	-1953 Dec	7 21:03:10	H	-0.5050	1.0107	43	52
113	-1952 Jun	2 12:18:03	A	0.2734	0.9595	153	274
114	-1952 Nov	26 11:34:24	T	0.1792	1.0452	153	258
115	-1951 May	22 13:02:16	A	-0.4945	0.9502	209	394
116	-1951 Nov	16 03:00:41	T	0.8520	1.0211	137	104
117	-1950 Apr	12 05:14:40	P	1.4542	0.1642		
118	-1950 May	11 16:12:21	P	-1.2352	0.5621		
119	-1950 Oct	6 23:18:01	P	-1.3058	0.4387		
120	-1949 Apr	1 18:33:43	T	0.6496	1.0576	248	279

Solar eclipses from -1999 to -1900

Source:
Six Millennium Catalog of Solar Eclipses

Acknowledgment: Eclipse Predictions by
Fred Espenak (NASA's GSFC)

Tp	γ R_{Earth}	mg	W km	D sec	$\Delta\gamma$	Δmg	ΔW	ΔD
P	1.1590	0.6940			-86	143		
P	1.1750	0.6780			60	-130		
P	-1.5090	0.0530			54	102		
A	-0.9010	0.9480	430	289	-91	1	20	0
T	0.5340	1.0180	70	92	69	5	0	1
A	-0.1010	0.9970	9	15	-87	-7	1	1
A	-0.1620	0.9670	121	201	68	5	-1	-2
T	0.6640	1.0470	204	213	-79	2	-2	1
A	-0.8840	0.9190	641	437	74	7	-23	1
P	-1.1640	0.7020			-67	-149		
P	1.3670	0.3120			-74	134		
P	1.4010	0.2750			72	-134		
P	-1.5590	0.0160			70	99		
T	-0.4720	1.0180	69	86	-71	4	1	1
H	0.6180	1.0050	22	23	80	-4	-1	-2
A	0.2740	0.9610	146	278	-71	2	-2	-3
T	-0.1290	1.0590	195	321	69	1	-1	-1
A+	1.0120	0.9150			-72	-57		
T	-0.8420	1.0580	355	294	74	0	-6	3
P	-1.2580	0.5210			-62	-108		
P	1.0300	0.9350			77	-139		
H	-0.5110	1.0100	42	50	-60	-7	-1	-2
A	0.2820	0.9600	153	272	86	5	0	-2
T	0.1730	1.0450	153	258	-62	-2	0	0
A	-0.4860	0.9500	208	395	85	-2	-1	1
T	0.8460	1.0210	137	106	-60	-1	0	2
P	1.4620	0.1490			78	-152		
P	-1.2270	0.5760			82	139		
P	-1.3120	0.4280			-62	-107		
T	0.6570	1.0570	249	277	74	-6	1	-2

Solar eclipses from -1999 to -1900

Source:
My own 10'000 years integration: The data source for Flinspektor

Eclipse Predictions by Robert Nufer

Tp	γ R_{Earth}	mg	W km	D sec	$\Delta\gamma$	Δmg	ΔW	ΔD
P	1.1678	0.6793			2	-4		
P	1.1688	0.6917			-2	7		
P	-1.5146	0.0428			-2	0		
A	-0.8915	0.9481	410	289	4	2	0	0
T	0.5269	1.0175	70	91	-2	0	0	0
A	-0.0920	0.9977	8	14	3	0	0	0
A	-0.1691	0.9665	122	203	-3	0	0	0
T	0.6721	1.0468	206	212	2	0	0	0
A	-0.8918	0.9184	665	436	-4	1	1	0
P	-1.1571	0.7174			2	5		
P	1.3745	0.2989			1	3		
P	1.3935	0.2893			-3	9		
P	-1.5664	0.0063			-4	2		
T	-0.4647	1.0176	67	85	2	0	-1	0
H	0.6098	1.0054	23	25	-2	0	0	0
A	0.2813	0.9608	148	281	2	0	0	0
T	-0.1360	1.0589	196	322	-1	0	0	0
A+	1.0194	0.9147			2	-60		
T	-0.8495	1.0581	362	291	-1	1	1	0
P	-1.2518	0.5319			0	1		
P	1.0223	0.9490			0	1		
H	-0.5050	1.0107	43	52	0	0	0	0
A	0.2735	0.9595	153	274	1	0	0	0
T	0.1793	1.0452	153	258	1	0	0	0
A	-0.4945	0.9502	209	394	0	0	0	0
T	0.8521	1.0212	137	104	1	1	0	0
P	1.4542	0.1645			0	3		
P	-1.2352	0.5622			0	1		
P	-1.3058	0.4389			0	2		
T	0.6495	1.0577	248	279	-1	1	0	0

Solar eclipses from -1999 to -1900

Source:
Five Millennium Catalog of Solar Eclipses

Acknowledgement: Eclipse Predictions by
Fred Espenak and Jean Meeus (NASA's GSFC)

Nr	Date and Terrestrial Time (TT) at eclipse maximum		Tp	γ R_{Earth}	mg	W km	D sec
121	-1949 Sep	26 00:37:49	A	-0.6477	0.9197	394	565
122	-1948 Mar	21 11:25:32	T	-0.0878	1.0742	242	391
123	-1948 Sep	14 00:12:27	A	0.0521	0.9380	231	471
124	-1947 Mar	11 03:11:51	T	-0.8390	1.0294	183	119
125	-1947 Sep	3 05:17:59	A	0.7585	0.9839	88	75
126	-1946 Jan	29 22:46:25	P	1.2051	0.6110		
127	-1946 Jul	25 09:01:49	P	-1.1756	0.6819		
128	-1946 Aug	23 17:40:35	P	1.4157	0.2262		
129	-1945 Jan	18 22:51:51	A	0.5161	0.9243	333	658
130	-1945 Jul	15 01:49:25	T	-0.4692	1.0593	221	348
131	-1944 Jan	7 23:51:29	A	-0.1977	0.9514	182	324
132	-1944 Jul	3 15:30:05	H	0.2846	1.0139	50	76
133	-1944 Dec	27 07:31:39	A	-0.8854	0.9946	41	20
134	-1943 Jun	22 22:27:06	P	1.0914	0.8113		
135	-1943 Nov	17 10:40:46	P	1.1685	0.6919		
136	-1943 Dec	16 21:18:48	P	-1.5092	0.0512		
137	-1942 May	13 08:59:51	A	-0.9784	0.9462	978	274
138	-1942 Nov	7 01:29:55	H3	0.5284	1.0143	57	77
139	-1941 May	2 13:57:20	H	-0.1717	1.0021	7	12
140	-1941 Oct	27 11:21:18	A	-0.1649	0.9623	138	229
141	-1940 Apr	21 02:04:36	T	0.5983	1.0524	213	236
142	-1940 Oct	15 13:56:25	A	-0.8816	0.9156	662	437
143	-1939 Mar	12 11:31:58	P	-1.2114	0.6133		
144	-1939 Apr	10 18:42:36	P	1.3086	0.4259		
145	-1939 Sep	4 19:47:20	P	1.4230	0.2384		
146	-1939 Oct	4 13:00:58	P	-1.5481	0.0367		
147	-1938 Mar	2 02:05:12	T	-0.5156	1.0169	67	81
148	-1938 Aug	25 03:09:40	H	0.6444	1.0050	22	23
149	-1937 Feb	19 10:09:18	A	0.2352	0.9613	144	269
150	-1937 Aug	14 17:09:41	T	-0.0934	1.0574	190	305

Solar eclipses from -1999 to -1900

Source:
Six Millennium Catalog of Solar Eclipses

Acknowledgment: Eclipse Predictions by
Fred Espenak (NASA's GSFC)

Tp	γ R_{Earth}	mg	W km	D sec	$\Delta\gamma$	Δmg	ΔW	ΔD
A	-0.6540	0.9200	398	563	-63	3	4	-2
T	-0.0810	1.0740	242	392	68	-2	0	1
A	0.0450	0.9380	231	473	-71	0	0	2
T	-0.8310	1.0300	182	122	80	6	-1	3
A	0.7520	0.9840	88	76	-65	1	0	1
P	1.2120	0.5990			69	-120		
P	-1.1830	0.6680			-74	-139		
P	1.4090	0.2380			-67	118		
A	0.5230	0.9240	335	658	69	-3	2	0
T	-0.4770	1.0590	222	348	-78	-3	1	0
A	-0.1910	0.9510	182	326	67	-4	0	2
H	0.2760	1.0140	51	78	-86	1	1	2
A	-0.8790	0.9950	40	20	64	4	-1	0
P	1.0830	0.8260			-84	147		
P	1.1740	0.6800			55	-119		
P	-1.5030	0.0620			62	108		
As	-0.9870	0.9450		271	-86	-12		-3
H	0.5350	1.0140	58	78	66	-3	1	1
H	-0.1800	1.0020	7	11	-83	-1	0	-1
A	-0.1580	0.9630	137	228	69	7	-1	-1
T	0.5900	1.0520	212	237	-83	-4	-1	1
A	-0.8750	0.9160	643	439	66	4	-19	2
P	-1.2190	0.5980			-76	-153		
P	1.3010	0.4390			-76	131		
P	1.4300	0.2250			70	-134		
P	-1.5420	0.0460			61	93		
T	-0.5230	1.0170	68	82	-74	1	1	1
H	0.6520	1.0050	21	21	76	0	-1	-2
A	0.2280	0.9620	142	266	-72	7	-2	-3
T	-0.0860	1.0570	189	304	74	-4	-1	-1

Solar eclipses from -1999 to -1900

Source:
My own 10'000 years integration: The data source for Flinspektor

Eclipse Predictions by Robert Nufer

Tp	γ R_{Earth}	mg	W km	D sec	$\Delta\gamma$	Δmg	ΔW	ΔD
A	-0.6477	0.9197	395	565	0	0	1	0
T	-0.0879	1.0742	242	391	-1	0	0	0
A	0.0522	0.9380	231	471	1	0	0	0
T	-0.8391	1.0296	183	119	-1	2	0	0
A	0.7586	0.9840	87	75	1	1	-1	0
P	1.2050	0.6112			-1	2		
P	-1.1755	0.6821			1	2		
P	1.4159	0.2260			2	-2		
A	0.5160	0.9243	333	658	-1	0	0	0
T	-0.4691	1.0593	221	347	1	0	0	-1
A	-0.1979	0.9514	181	324	-2	0	-1	0
H	0.2848	1.0139	50	76	2	0	0	0
A	-0.8856	0.9948	41	20	-2	2	0	0
P	1.0916	0.8109			2	-4		
P	1.1682	0.6925			-3	6		
P	-1.5094	0.0511			-2	-1		
A	-0.9780	0.9465	975	274	4	3	-3	0
H3	0.5281	1.0143	57	77	-3	0	0	0
H	-0.1714	1.0021	7	12	3	0	0	0
A	-0.1653	0.9623	138	230	-4	0	0	1
T	0.5985	1.0525	213	236	2	1	0	0
A	-0.8820	0.9157	663	437	-4	1	1	0
P	-1.2112	0.6140			2	7		
P	1.3088	0.4261			2	2		
P	1.4227	0.2394			-3	10		
P	-1.5484	0.0369			-3	2		
T	-0.5153	1.0169	67	81	3	0	0	0
H	0.6442	1.0050	22	23	-2	0	0	0
A	0.2354	0.9613	144	269	2	0	0	0
T	-0.0936	1.0574	190	305	-2	0	0	0

Solar eclipses from -1999 to -1900

Source:
Five Millennium Catalog of Solar Eclipses

Acknowledgement: Eclipse Predictions by
Fred Espenak and Jean Meeus (NASA's GSFC)

Nr	Date and Terrestrial Time (TT) at eclipse maximum		Tp	γ R_{Earth}	mg	W km	D sec
151	-1936 Feb	8 11:24:38	An	0.9793	0.9202	-	458
152	-1936 Aug	3 09:46:19	T	-0.8011	1.0548	300	280
153	-1936 Dec	28 20:02:32	P	-1.2579	0.5216		
154	-1935 Jun	24 13:43:01	P	1.0997	0.8073		
155	-1935 Dec	18 05:41:01	H2	-0.5070	1.0150	60	71
156	-1934 Jun	13 18:42:52	A	0.3594	0.9558	173	284
157	-1934 Dec	7 20:26:30	T	0.1788	1.0468	158	268
158	-1933 Jun	2 19:20:26	A	-0.4060	0.9512	195	399
159	-1933 Nov	27 11:49:40	T	0.8553	1.0194	128	99
160	-1932 Apr	22 12:14:51	P	1.5210	0.0401		
161	-1932 May	21 22:52:55	P	-1.1505	0.7135		
162	-1932 Oct	17 07:27:29	P	-1.3152	0.4228		
163	-1931 Apr	12 01:59:44	T	0.7158	1.0608	284	273
164	-1931 Oct	6 08:23:27	A	-0.6630	0.9167	418	559
165	-1930 Apr	1 19:02:33	T	-0.0247	1.0760	246	403
166	-1930 Sep	25 07:58:25	A	0.0317	0.9374	233	475
167	-1929 Mar	22 10:43:01	T	-0.7834	1.0303	164	133
168	-1929 Sep	14 13:20:52	A	0.7326	0.9846	80	74
169	-1928 Feb	10 06:11:20	P	1.2457	0.5418		
170	-1928 Aug	4 16:56:04	P	-1.2216	0.5932		
171	-1928 Sep	3 01:53:33	P	1.3838	0.2863		
172	-1927 Jan	29 06:15:48	A	0.5491	0.9274	326	618
173	-1927 Jul	25 09:31:57	T	-0.5249	1.0535	208	316
174	-1926 Jan	18 07:40:04	A	-0.1741	0.9570	159	290
175	-1926 Jul	14 22:44:43	H	0.2216	1.0079	28	46
176	-1925 Jan	7 15:52:48	H	-0.8696	1.0006	4	2
177	-1925 Jul	4 05:07:17	P	1.0195	0.9342		
178	-1925 Nov	28 19:33:50	P	1.1693	0.6904		
179	-1925 Dec	28 06:00:28	P	-1.4998	0.0675		
180	-1924 May	23 15:21:27	P	-1.0637	0.8577		

Solar eclipses from -1999 to -1900

Source:
Six Millennium Catalog of Solar Eclipses

Acknowledgment: Eclipse Predictions by
Fred Espenak (NASA's GSFC)

Tp	γ R_{Earth}	mg	W km	D sec	$\Delta\gamma$	Δmg	ΔW	ΔD
A	0.9720	0.9210	1300	463	-73	8		5
T	-0.7940	1.0550	296	282	71	2	-4	2
P	-1.2650	0.5100			-71	-116		
P	1.1070	0.7940			73	-133		
H	-0.5130	1.0150	59	70	-60	0	-1	-1
A	0.3680	0.9560	173	282	86	2	0	-2
T	0.1730	1.0470	158	268	-58	2	0	0
A	-0.3980	0.9510	194	400	80	-2	-1	1
T	0.8490	1.0200	128	101	-63	6	0	2
P	1.5290	0.0250			80	-151		
P	-1.1430	0.7270			75	135		
P	-1.3210	0.4120			-58	-108		
T	0.7230	1.0610	286	271	72	2	2	-2
A	-0.6690	0.9170	422	557	-60	3	4	-2
T	-0.0170	1.0760	246	403	77	0	0	0
A	0.0250	0.9370	234	477	-67	-4	1	2
T	-0.7760	1.0310	164	136	74	7	0	3
A	0.7260	0.9840	80	76	-66	-6	0	2
P	1.2530	0.5300			73	-118		
P	-1.2280	0.5800			-64	-132		
P	1.3780	0.2980			-58	117		
A	0.5560	0.9270	328	618	69	-4	2	0
T	-0.5320	1.0540	209	315	-71	5	1	-1
A	-0.1670	0.9570	160	292	71	0	1	2
H	0.2140	1.0080	29	47	-76	1	1	1
H	-0.8630	1.0010	4	2	66	4	0	0
A+	1.0110	0.9450			-85	108		
P	1.1750	0.6780			57	-124		
P	-1.4940	0.0780			58	105		
P	-1.0720	0.8420			-83	-157		

Solar eclipses from -1999 to -1900

Source:
My own 10'000 years integration: The data source for Flinspektor

Eclipse Predictions by Robert Nufer

Tp	γ R_{Earth}	mg	W km	D sec	$\Delta\gamma$	Δmg	ΔW	ΔD
An	0.9795	0.9205	1000	457	2	3		-1
T	-0.8013	1.0549	301	280	-2	1	1	0
P	-1.2578	0.5217			1	1		
P	1.0996	0.8074			-1	1		
T	-0.5069	1.0151	60	72	1	1	0	1
A	0.3594	0.9558	173	284	0	0	0	0
T	0.1789	1.0468	158	268	1	0	0	0
A	-0.4060	0.9512	195	399	0	0	0	0
T	0.8554	1.0195	128	99	1	1	0	0
P	1.5210	0.0405			0	4		
P	-1.1505	0.7135			0	0		
P	-1.3152	0.4231			0	3		
T	0.7158	1.0609	284	273	0	1	0	0
A	-0.6629	0.9168	418	559	1	1	0	0
T	-0.0247	1.0759	246	403	0	-1	0	0
A	0.0317	0.9373	233	475	0	-1	0	0
T	-0.7835	1.0304	164	133	-1	1	0	0
A	0.7327	0.9847	80	74	1	1	0	0
P	1.2457	0.5420			0	2		
P	-1.2215	0.5935			1	3		
P	1.3840	0.2861			2	-2		
A	0.5490	0.9274	327	618	-1	0	1	0
T	-0.5247	1.0535	208	315	2	0	0	-1
A	-0.1742	0.9570	159	290	-1	0	0	0
H	0.2218	1.0079	28	46	2	0	0	0
H	-0.8697	1.0008	5	2	-1	2	1	0
P	1.0197	0.9338			2	-4		
P	1.1691	0.6909			-2	5		
P	-1.5000	0.0673			-2	-2		
P	-1.0634	0.8584			3	7		

Solar eclipses from -1999 to -1900

Source:
Five Millennium Catalog of Solar Eclipses

Acknowledgement: Eclipse Predictions by
Fred Espenak and Jean Meeus (NASA's GSFC)

Nr	Date and Terrestrial Time (TT) at eclipse maximum		Tp	γ R_{Earth}	mg	W km	D sec
181	-1924	Nov 17 10:15:36	H	0.5283	1.0116	47	66
182	-1923	May 12 20:45:04	H	-0.2538	1.0059	21	36
183	-1923	Nov 6 19:44:18	A	-0.1649	0.9588	152	254
184	-1922	May 2 09:19:50	T	0.5213	1.0573	219	258
185	-1922	Oct 26 21:55:31	A	-0.8763	0.9134	671	435
186	-1921	Mar 23 19:12:17	P	-1.2716	0.4978		
187	-1921	Apr 22 02:10:29	P	1.2395	0.5603		
188	-1921	Sep 16 03:32:55	P	1.4440	0.2026		
189	-1921	Oct 15 20:56:53	P	-1.5362	0.0567		
190	-1920	Mar 12 09:36:57	T	-0.5721	1.0158	65	76
191	-1920	Sep 4 11:10:54	H	0.6724	1.0046	21	21
192	-1919	Mar 1 17:22:05	A	0.1830	0.9619	140	257
193	-1919	Aug 25 01:18:07	T	-0.0570	1.0556	184	289
194	-1918	Feb 18 18:29:52	A	0.9312	0.9255	755	450
195	-1918	Aug 14 17:45:39	T	-0.7596	1.0510	256	261
196	-1917	Jan 9 04:06:28	P	-1.2694	0.5017		
197	-1917	Jul 5 20:44:02	P	1.1718	0.6764		
198	-1917	Aug 4 07:51:37	P	-1.5248	0.0346		
199	-1917	Dec 29 14:13:35	T	-0.5141	1.0197	79	91
200	-1916	Jun 24 01:12:09	A	0.4409	0.9519	197	293
201	-1916	Dec 18 05:14:10	T	0.1747	1.0488	165	279
202	-1915	Jun 13 01:41:44	A	-0.3194	0.9518	186	400
203	-1915	Dec 7 20:35:33	T	0.8567	1.0182	121	96
204	-1914	Jun 2 05:36:42	P	-1.0668	0.8639		
205	-1914	Oct 28 15:39:52	P	-1.3215	0.4125		
206	-1913	Apr 23 09:22:31	T	0.7853	1.0629	332	259
207	-1913	Oct 17 16:15:51	A	-0.6726	0.9145	436	549
208	-1912	Apr 12 02:33:41	T	0.0431	1.0769	249	408
209	-1912	Oct 5 15:53:35	A	0.0182	0.9371	234	475
210	-1911	Apr 1 18:05:15	T	-0.7212	1.0307	149	146

Solar eclipses from -1999 to -1900

Source:
Six Millennium Catalog of Solar Eclipses

Acknowledgment: Eclipse Predictions by
Fred Espenak (NASA's GSFC)

Tp	γ R_{Earth}	mg	W km	D sec	$\Delta\gamma$	Δmg	ΔW	ΔD
H	0.5350	1.0120	47	66	67	4	0	0
H	-0.2620	1.0060	20	34	-82	1	-1	-2
A	-0.1580	0.9590	151	253	69	2	-1	-1
T	0.5130	1.0570	218	259	-83	-3	-1	1
A	-0.8700	0.9140	653	436	63	6	-18	1
P	-1.2790	0.4830			-74	-148		
P	1.2320	0.5740			-75	137		
P	1.4510	0.1890			70	-136		
P	-1.5300	0.0660			62	93		
T	-0.5800	1.0160	66	77	-79	2	1	1
H	0.6800	1.0040	20	19	76	-6	-1	-2
A	0.1750	0.9620	139	255	-80	1	-1	-2
T	-0.0500	1.0550	183	287	70	-6	-1	-2
A	0.9240	0.9260	714	453	-72	5	-41	3
T	-0.7530	1.0510	254	263	66	0	-2	2
P	-1.2760	0.4900			-66	-117		
P	1.1790	0.6630			72	-134		
P	-1.5170	0.0480			78	134		
T	-0.5200	1.0190	78	90	-59	-7	-1	-1
A	0.4490	0.9520	197	291	81	1	0	-2
T	0.1690	1.0490	165	279	-57	2	0	0
A	-0.3110	0.9520	186	400	84	2	0	0
T	0.8510	1.0190	121	99	-57	8	0	3
P	-1.0590	0.8770			78	131		
P	-1.3270	0.4020			-55	-105		
T	0.7930	1.0630	336	257	77	1	4	-2
A	-0.6790	0.9140	440	547	-64	-5	4	-2
T	0.0500	1.0770	249	408	69	1	0	0
A	0.0120	0.9370	235	477	-62	-1	1	2
T	-0.7140	1.0310	149	149	72	3	0	3

Solar eclipses from -1999 to -1900

Source:
My own 10'000 years integration: The data source for Flinspektor

Eclipse Predictions by Robert Nufer

Tp	γ R_{Earth}	mg	W km	D sec	$\Delta\gamma$	Δmg	ΔW	ΔD
H	0.5280	1.0116	47	66	-3	0	0	0
H	-0.2535	1.0059	21	36	3	0	0	0
A	-0.1652	0.9588	152	254	-3	0	0	0
T	0.5216	1.0573	219	259	3	0	0	1
A	-0.8767	0.9135	671	435	-4	1	0	0
P	-1.2714	0.4986			2	8		
P	1.2397	0.5603			2	0		
P	1.4437	0.2037			-3	11		
P	-1.5366	0.0569			-4	2		
T	-0.5718	1.0158	65	76	3	0	0	0
H	0.6722	1.0046	21	21	-2	0	0	0
A	0.1832	0.9619	140	257	2	0	0	0
T	-0.0572	1.0556	184	289	-2	0	0	0
A	0.9314	0.9256	760	450	2	1	5	0
T	-0.7598	1.0510	257	261	-2	0	1	0
P	-1.2693	0.5018			1	1		
P	1.1717	0.6766			-1	2		
P	-1.5250	0.0345			-2	-1		
T	-0.5139	1.0197	79	92	2	0	0	1
A	0.4409	0.9519	196	293	0	0	-1	0
T	0.1748	1.0488	165	279	1	0	0	0
A	-0.3195	0.9518	186	400	-1	0	0	0
T	0.8568	1.0183	121	96	1	1	0	0
P	-1.0669	0.8638			-1	-1		
P	-1.3215	0.4127			0	2		
T	0.7852	1.0631	332	259	-1	2	0	0
A	-0.6726	0.9146	436	549	0	1	0	0
T	0.0431	1.0769	249	408	0	0	0	0
A	0.0182	0.9371	234	475	0	0	0	0
T	-0.7212	1.0307	148	146	0	0	-1	0

Solar eclipses from -1999 to -1900

Source:
Five Millennium Catalog of Solar Eclipses

Acknowledgement: Eclipse Predictions by
Fred Espenak and Jean Meeus (NASA's GSFC)

Nr	Date and Terrestrial Time (TT) at eclipse maximum		Tp	γ R_{Earth}	mg	W km	D sec
211	-1911 Sep	24 21:33:45	A	0.7144	0.9854	73	74
212	-1910 Feb	20 13:23:40	P	1.2954	0.4569		
213	-1910 Mar	22 03:40:50	P	-1.5388	0.0265		
214	-1910 Aug	16 00:59:14	P	-1.2603	0.5188		
215	-1910 Sep	14 10:16:33	P	1.3600	0.3312		
216	-1909 Feb	9 13:30:39	A	0.5892	0.9307	320	568
217	-1909 Aug	5 17:20:50	T	-0.5746	1.0475	193	278
218	-1908 Jan	29 15:22:41	A	-0.1448	0.9628	136	253
219	-1908 Jul	25 06:03:48	H	0.1634	1.0017	6	10
220	-1907 Jan	18 00:08:49	H	-0.8487	1.0071	47	27
221	-1907 Jul	14 11:50:45	A	0.9506	0.9452	673	210
222	-1907 Dec	9 04:25:19	P	1.1714	0.6864		
223	-1906 Jan	7 14:37:00	P	-1.4864	0.0912		
224	-1906 Jun	3 21:45:37	P	-1.1470	0.7138		
225	-1906 Nov	28 18:58:47	H	0.5296	1.0095	38	56
226	-1905 May	24 03:36:37	H	-0.3336	1.0090	33	56
227	-1905 Nov	18 04:06:24	A	-0.1653	0.9559	163	276
228	-1904 May	12 16:35:44	T	0.4441	1.0613	223	279
229	-1904 Nov	6 05:56:20	A	-0.8727	0.9118	680	430
230	-1903 Apr	3 02:45:51	P	-1.3369	0.3724		
231	-1903 May	2 09:35:23	P	1.1681	0.6993		
232	-1903 Sep	26 11:27:50	P	1.4585	0.1777		
233	-1903 Oct	26 04:57:57	P	-1.5275	0.0711		
234	-1902 Mar	23 16:57:33	T	-0.6371	1.0140	61	67
235	-1902 Sep	15 19:22:56	H	0.6925	1.0044	21	20
236	-1901 Mar	13 00:23:10	A	0.1217	0.9623	137	249
237	-1901 Sep	5 09:35:37	T	-0.0279	1.0537	178	273
238	-1900 Mar	1 01:25:12	A	0.8748	0.9302	523	429
239	-1900 Aug	25 01:52:52	T	-0.7250	1.0467	222	236

Solar eclipses from -1999 to -1900

Source:
Six Millennium Catalog of Solar Eclipses

Acknowledgment: Eclipse Predictions by
Fred Espenak (NASA's GSFC)

Tp	γ R_{Earth}	mg	W km	D sec	$\Delta\gamma$	Δmg	ΔW	ΔD	
A	0.7080	0.9850	74	75	-64	-4	1	1	
P	1.3020	0.4450			66	-119			
P	-1.5310	0.0390			78	125			
P	-1.2670	0.5060			-67	-128			
P	1.3540	0.3420			-60	108			
A	0.5960	0.9310	323	567	68	3	3	-1	
T	-0.5820	1.0470	194	277	-74	-5	1	-1	
A	-0.1380	0.9630	136	254	68	2	0	1	
H	0.1560	1.0020	7	12	-74	3	1	2	
H	-0.8420	1.0070	46	27	67	-1	-1	0	
A	0.9430	0.9460	617	210	-76	8	-56	0	
P	1.1770	0.6750			56	-114			
P	-1.4810	0.1020			54	108			
P	-1.1550	0.6990			-80	-148			
H	0.5360	1.0100	39	57	64	5	1	1	
H	-0.3420	1.0090	32	54	-84	0	-1	-2	
A	-0.1590	0.9560	162	274	63	1	-1	-2	
T	0.4360	1.0610	222	280	-81	-3	-1	1	
A	-0.8660	0.9120	662	431	67	2	-18	1	
P	-1.3440	0.3570			-71	-154			
P	1.1600	0.7130			-81	137			
P	1.4650	0.1650			65	-127			
P	-1.5210	0.0800			65	89			
T	-0.6450	1.0140	63	68	-79	0	2	1	
H	0.6990	1.0040	19	18	65	-4	-2	-2	
A	0.1140	0.9630	136	247	-77	7	-1	-2	
T	-0.0210	1.0540	177	272	69	3	-1	-1	
A	0.8670	0.9310	506	430	-78	8	-17	1	
T	-0.7180	1.0470	220	238	70	3	-2	2	
					rms	72	76	10	2

Solar eclipses from -1999 to -1900

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My own 10'000 years integration: The data source for Flinspektor

Eclipse Predictions by Robert Nufer

Tp	γ R_{Earth}	mg	W km	D sec	$\Delta\gamma$	Δmg	ΔW	ΔD	
A	0.7145	0.9855	73	74	1	1	0	0	
P	1.2954	0.4570			0	1			
P	-1.5389	0.0267			-1	2			
P	-1.2602	0.5190			1	2			
P	1.3602	0.3312			2	0			
A	0.5892	0.9307	321	568	0	0	1	0	
T	-0.5745	1.0475	193	277	1	0	0	-1	
A	-0.1449	0.9628	136	253	-1	0	0	0	
H	0.1636	1.0017	6	10	2	0	0	0	
H	-0.8489	1.0072	47	27	-2	1	0	0	
A	0.9509	0.9455	669	210	3	3	-4	0	
P	1.1712	0.6870			-2	6			
P	-1.4866	0.0909			-2	-3			
P	-1.1467	0.7145			3	7			
H	0.5293	1.0095	38	56	-3	0	0	0	
H	-0.3332	1.0090	33	56	4	0	0	0	
A	-0.1656	0.9559	163	276	-3	0	0	0	
T	0.4444	1.0613	223	279	3	0	0	0	
A	-0.8731	0.9119	679	430	-4	1	-1	0	
P	-1.3367	0.3734			2	10			
P	1.1683	0.6991			2	-2			
P	1.4582	0.1790			-3	13			
P	-1.5279	0.0712			-4	1			
T	-0.6368	1.0141	61	67	3	1	0	0	
H	0.6922	1.0045	21	20	-3	1	0	0	
A	0.1220	0.9623	137	249	3	0	0	0	
T	-0.0281	1.0537	178	273	-2	0	0	0	
A	0.8751	0.9303	525	429	3	1	2	0	
T	-0.7252	1.0467	222	236	-2	0	0	0	
					rms	2	5	1	0

