

Polynomial Coefficients for ΔT and length of day (lod)
for years -720 to 2016 : Version 2018

Row	Years		Polynomial Coefficients			
	K_i	K_{i+1}	a_0	a_1	a_2	a_3
1	-720.0	400.0	20483.158	-20530.285	10289.578	-3726.121
2	400.0	1000.0	6516.330	-5962.228	-255.072	1244.067
3	1000.0	1300.0	1543.097	-1370.086	869.282	-378.827
4	1300.0	1500.0	663.466	-512.002	-118.755	169.232
5	1500.0	1600.0	201.941	-120.908	97.235	-65.127
6	1600.0	1650.0	113.140	-60.910	-24.537	17.734
7	1650.0	1720.0	45.427	-79.494	56.185	-9.757
8	1720.0	1800.0	12.360	4.118	35.151	-33.363
9	1800.0	1810.0	18.267	-3.209	-1.015	1.752
10	1810.0	1820.0	15.795	0.017	4.240	-3.582
11	1820.0	1830.0	16.471	-2.247	-6.504	3.097
12	1830.0	1840.0	10.816	-5.965	2.787	-0.014
13	1840.0	1850.0	7.625	-0.432	2.745	-0.594
14	1850.0	1855.0	9.343	1.637	0.241	-0.870
15	1855.0	1860.0	10.352	-0.490	-2.368	1.547
16	1860.0	1865.0	9.040	-0.586	2.272	-2.472
17	1865.0	1870.0	8.254	-3.457	-5.143	2.717
18	1870.0	1875.0	2.371	-5.593	3.008	-0.913
19	1875.0	1880.0	-1.126	-2.315	0.270	-0.039
20	1880.0	1885.0	-3.210	-1.893	0.152	0.563
21	1885.0	1890.0	-4.388	0.101	1.842	-1.439
22	1890.0	1895.0	-3.884	-0.531	-2.474	1.871
23	1895.0	1900.0	-5.017	0.134	3.138	-0.232
24	1900.0	1905.0	-1.977	5.715	2.443	-1.257
25	1905.0	1910.0	4.923	6.828	-1.329	0.720
26	1910.0	1915.0	11.142	6.330	0.831	-0.825
27	1915.0	1920.0	17.479	5.518	-1.643	0.262
28	1920.0	1925.0	21.617	3.020	-0.856	0.008
29	1925.0	1930.0	23.789	1.333	-0.831	0.127
30	1930.0	1935.0	24.418	0.052	-0.449	0.142
31	1935.0	1940.0	24.164	-0.419	-0.022	0.702
32	1940.0	1945.0	24.426	1.645	2.086	-1.106
33	1945.0	1950.0	27.050	2.499	-1.232	0.614
34	1950.0	1953.0	28.932	1.127	0.220	-0.277
35	1953.0	1956.0	30.002	0.737	-0.610	0.631
36	1956.0	1959.0	30.760	1.409	1.282	-0.799
37	1959.0	1962.0	32.652	1.577	-1.115	0.507
38	1962.0	1965.0	33.621	0.868	0.406	0.199
39	1965.0	1968.0	35.093	2.275	1.002	-0.414
40	1968.0	1971.0	37.956	3.035	-0.242	0.202
41	1971.0	1974.0	40.951	3.157	0.364	-0.229
42	1974.0	1977.0	44.244	3.198	-0.323	0.172
43	1977.0	1980.0	47.291	3.069	0.193	-0.192
44	1980.0	1983.0	50.361	2.878	-0.384	0.081
45	1983.0	1986.0	52.936	2.354	-0.140	-0.166
46	1986.0	1989.0	54.984	1.577	-0.637	0.448
47	1989.0	1992.0	56.373	1.649	0.709	-0.277
48	1992.0	1995.0	58.453	2.235	-0.122	0.111
49	1995.0	1998.0	60.677	2.324	0.212	-0.315
50	1998.0	2001.0	62.899	1.804	-0.732	0.112
51	2001.0	2004.0	64.082	0.675	-0.396	0.193
52	2004.0	2007.0	64.555	0.463	0.184	-0.008
53	2007.0	2010.0	65.194	0.809	0.161	-0.101
54	2010.0	2013.0	66.063	0.828	-0.142	0.168
55	2013.0	2016.0	66.917	1.046	0.360	-0.282

The above table of polynomial coefficients enables evaluation of ΔT in seconds (s) and its derivative (the length of day lod) in milliseconds (ms) for any epoch between -720 and 2016 . It is not valid outside the specified range of years.

For the year and fraction Y , extract the coefficients a_0, a_1, a_2, a_3 from row i of the table, where $K_i \leq Y \leq K_{i+1}$, and then calculate

$$\Delta T = a_0 + a_1 t + a_2 t^2 + a_3 t^3 \quad \text{s}$$

$$\text{lod} = (a_1 + 2a_2 t + 3a_3 t^2)/(K_{i+1} - K_i)/0.36525 \quad \text{ms}$$

where

$$t = \frac{Y - K_i}{K_{i+1} - K_i} \quad \text{and thus} \quad 0 \leq t < 1$$

These coefficients reproduce the spline approximation discussed by L.V. Morrison, F.R. Stephenson and C.Y. Hohenkerk, in “Historical Changes in UT/lod from Eclipses”, Proceedings of the *Journées des Systèmes de Référence et de la Rotation Terrestre*, 2017, <https://web.ua.es/journees2017/> (in preparation). This is an update of our Royal Society paper (2016)(see below) for the inclusion of three hitherto excluded Chinese eclipses in 198 BC, AD 306 and AD 616, and two critical Spanish observations in AD 1239 and strengthened the case for the Chinese observation in AD 1361.

The details of the observations and their reduction are available in our Royal Society paper and in the supplementary material: “Measurement of the Earth’s Rotation: 720 BC to AD 2015”, Stephenson, F.R., Morrison, L.V., and Hohenkerk, C.Y., published by *Royal Society Proceedings A*, and available from their website at <http://rspa.royalsocietypublishing.org/lookup/doi/10.1098/rspa.2016.0404>

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