

and

Phase of lunation	(0)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	
Winter variation (maximum period) corrected for (E).....	12·14	12·35	12·51	12·31	12·44	12·22	12·04	12·15	
Deduct (F).....	12·83	12·79	12·86	12·88	12·91	12·77	12·71	12·78	
Supposed effect of solar maximum	—·69	—·44	—·35	—·57	—·47	—·55	—·67	—·63	(P)

13. For the sake of comparability with Dr. Stewart's results for Kew, which may possibly refer to winters a year later in every case than those named above, we have repeated these calculations on that supposition, and have obtained, in lieu of series (N) and (P) the following :—

Phase of lunation	(0)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	
Supposed effect of solar minimum	—·10	—·21	—·34	—·45	—·27	—·25	—·12	·00	(N')
Supposed effect of solar maximum	—·58	—·44½	—·41	—·63	—·53	—·38	—·52	—·51	(P')

The series (N), (N'), (P), (P') are curved in figs. 9 to 12. Contrary to the Kew series, they show that the temperature-range is somewhat less when sun-spots are excessive than when they are defective, the mean values of the several series being —·17, —·21, —·54 and —·50 respectively. Figs. 9 and 10 are much alike, and imply that the general winter lunar variation found in this way is subject to a pronounced change of character during the time of deficient sun-spots, having superimposed upon it a variation of single period and of greater range than its own. This affords a partial explanation of the great difference between the curves of winter lunar variations for the first sixteen and last seventeen years (figs. 5 and 6), the latter period being made up of years of deficient sun-spots in greater degree than the former period.

“Sun-spots and Terrestrial Phenomena. II. On the Variations of the Daily Range of the Magnetic Declination, as recorded at the Colaba Observatory, Bombay.” By CHARLES CHAMBERS, F.R.S., Superintendent. Received May 30. Read June 15, 1882.

The present, like the preceding, investigation is on the model of one by Dr. Balfour Stewart, dealing with similar records obtained at the
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Kew Observatory.* The records extend, in the present case, from June 1, 1847, to December 31, 1872, and consist of differences (always taken to be of positive sign) between the highest and the lowest values of easterly declination observed by Grubb's declination magnetometer† on every observation day of the period. Until the end of the year 1865 the observation day was the Göttingen astronomical day; after that time it was the Bombay civil day. The daily differences were obtained from hourly observations made on all days except Sundays and a few holidays in each year. Grubb's declination magnetometer is of the well known form described in the Report of the Committee of Physics of the Royal Society, 1840 (p. 13). Up to 1868·00 each individual entry in the register of the scale-reading of the instrument was at once converted into easterly declination in minutes, and the daily ranges are the differences of such converted readings, but after the date named the differences of the scale-readings were first taken, and then converted into minutes. The ranges *include* the effect of disturbance.

A. Annual Variation of Declination-Range.

2. The year being divided into forty-eight equal parts, commencing with the midnight between the 31st December and 1st January,‡ means were taken of the ranges for the fifteen days preceding and fifteen days following the nearest midnight to the commencement of each 48th part of the year. Attributing four of the 48ths of a year to each month, and designating as "monthly means" the thirty-day means thus obtained, the following table exhibits each of the forty-eight results for each year, and on the average of all the years:—(See pp. 250 and 251).

The numbers in the last column are taken to represent the annual variation—combined with the annual mean value—of declination-range.

B. Variation of Long Period.

3. Proceeding now on Dr. Stewart's hypothesis as to the relation between declination-range and solar activity, we divide the numbers in each line of Table I by the mean number (in the last column) of that line, and multiply the quotient by 1000, thus obtaining a table "exhibiting the monthly means of declination-range (forty-eight points to each year), the mean value of the range for the whole series

* "Proc. Roy. Soc.," vol. 26, p. 102.

† On the rare occasions when this instrument was under adjustment, the blanks in its register were filled up from the register of a small declination magnetometer which was used as a subsidiary instrument.

‡ Leap-years were taken to contain 366 days, and other years 365 days.

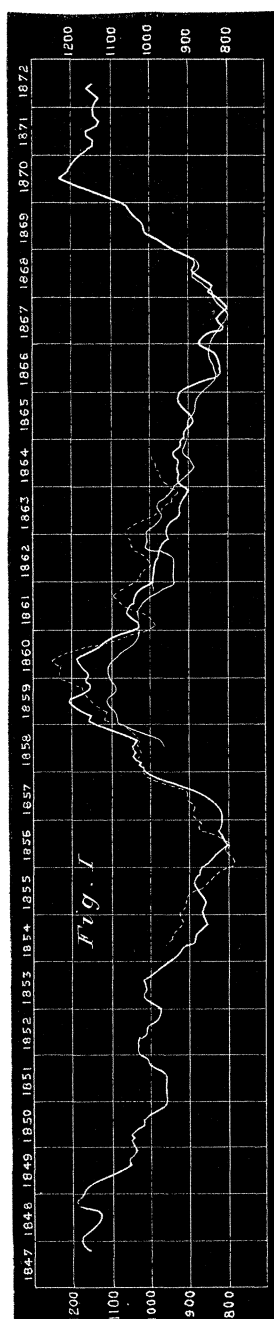


Table I.—Containing Monthly Means (48 to the year) of the Diurnal
which the Middle Date is the very commencement of the Year,

		1847.	1848.	1849.	1850.	1851.	1852.	1853.	1854.	1855.	1856.	1857.	1858.
January	(0).....	...	4.22	3.20	2.62	3.04	2.56	2.80	3.05	2.45	2.85	2.44	3.37
"	(1).....	...	3.50	3.54	2.93	3.30	3.15	2.87	3.22	2.51	2.99	2.58	3.28
"	(2).....	...	3.72	3.81	3.11	3.29	3.11	2.86	3.27	2.50	3.02	2.49	3.38
"	(3).....	...	3.65	3.85	3.91	3.34	3.19	2.79	2.96	2.53	2.80	2.43	3.01
February	(0).....	...	3.37	3.75	3.85	3.07	3.26	2.70	2.91	2.52	2.58	2.45	2.65
"	(1).....	...	3.45	3.65	3.56	2.81	3.45	2.65	2.70	2.47	2.30	2.43	2.74
"	(2).....	...	3.20	3.77	3.33	2.50	3.31	2.47	2.72	2.41	2.24	2.39	2.74
"	(3).....	...	3.25	3.76	2.55	2.47	3.51	2.47	2.67	2.47	2.17	2.22	2.99
March	(0).....	...	3.67	3.86	2.80	2.65	3.52	2.66	2.58	2.64	2.18	2.04	3.58
"	(1).....	...	3.96	3.98	3.11	2.86	3.31	2.95	2.68	2.61	2.36	2.19	3.85
"	(2).....	...	4.42	4.31	3.57	3.19	3.63	3.27	3.04	2.96	2.56	2.29	4.06
"	(3).....	...	4.69	5.10	4.01	3.55	4.06	3.87	3.44	3.45	3.35	2.56	4.53
April	(0).....	...	4.66	5.52	4.39	3.92	4.37	4.57	3.87	3.57	3.91	2.91	4.69
"	(1).....	...	4.66	5.70	4.65	3.99	4.80	4.71	4.39	4.27	4.21	3.26	4.78
"	(2).....	...	4.91	5.45	4.67	4.08	5.41	4.92	4.37	4.40	4.17	3.67	5.03
"	(3).....	...	5.28	5.15	5.11	4.34	5.43	4.86	4.61	4.60	3.91	4.10	4.97
May	(0).....	...	5.49	5.13	5.49	4.41	5.37	4.56	4.84	4.82	3.57	4.58	5.07
"	(1).....	...	5.45	5.57	5.56	4.42	5.57	4.93	4.86	4.69	3.60	5.02	5.36
"	(2).....	...	5.45	5.75	5.94	4.82	5.33	4.96	5.09	4.51	3.72	5.03	5.49
"	(3).....	...	5.45	6.11	5.79	5.00	5.35	5.13	5.11	4.58	3.80	4.88	5.42
June	(0).....	...	5.39	6.13	5.67	5.11	5.51	5.65	4.99	4.41	3.90	4.73	5.12
"	(1).....	...	5.52	5.84	5.75	5.45	5.48	5.57	4.90	4.39	3.98	4.18	4.85
"	(2).....	5.22	5.46	5.78	5.78	5.72	5.42	5.86	4.78	4.60	4.20	4.23	5.02
"	(3).....	5.46	5.55	5.53	5.81	5.75	5.39	5.94	4.89	4.65	4.04	4.34	5.16
July	(0).....	5.19	5.92	5.80	5.97	6.00	5.20	5.78	4.86	4.42	4.06	4.37	5.33
"	(1).....	5.34	6.24	5.78	5.81	5.85	5.40	5.89	4.62	4.42	4.26	4.52	5.42
"	(2).....	5.01	6.40	5.89	5.65	5.45	5.38	5.82	4.57	4.21	4.30	4.26	5.43
"	(3).....	4.85	6.68	6.10	5.52	5.10	5.37	5.95	4.44	4.12	4.53	4.30	5.44
August	(0).....	4.72	6.62	5.90	5.20	4.75	5.74	5.97	4.43	4.23	4.90	4.30	5.84
"	(1).....	4.97	6.71	6.11	5.37	4.81	5.86	6.24	4.74	4.31	4.97	4.58	6.16
"	(2).....	5.62	6.88	6.21	5.43	5.10	5.95	6.44	5.02	4.53	5.00	4.93	6.21
"	(3).....	6.07	7.01	6.26	5.91	5.60	6.18	6.91	5.18	4.88	5.47	5.32	6.32
September	(0).....	6.64	7.21	6.37	6.10	5.58	5.98	7.09	5.22	4.82	5.51	5.70	6.22
"	(1).....	6.55	6.86	6.16	6.40	5.88	5.14	6.88	5.15	5.91	5.49	6.06	6.06
"	(2).....	6.54	6.52	6.09	6.18	5.63	4.82	6.42	5.05	5.48	5.25	6.12	6.02
"	(3).....	6.19	6.00	5.47	5.74	5.42	4.19	5.38	4.61	5.13	4.40	5.67	5.59
October	(0).....	5.44	5.49	4.89	4.90	5.00	3.57	4.34	4.02	4.16	3.71	4.87	5.02
"	(1).....	5.07	4.98	4.13	4.05	4.61	3.55	3.41	3.74	3.59	3.09	3.95	4.34
"	(2).....	4.33	4.11	3.29	3.48	3.54	3.27	2.75	2.85	3.09	2.52	3.14	3.71
"	(3).....	3.71	3.34	2.66	2.78	2.87	2.96	2.64	2.41	2.74	2.36	2.28	3.26
November	(0).....	3.32	2.58	2.50	2.56	2.63	2.84	2.54	2.14	2.55	2.05	2.18	3.03
"	(1).....	3.04	2.76	2.37	2.37	2.52	2.54	2.48	2.04	2.38	1.89	2.30	2.98
"	(2).....	2.95	2.89	2.80	2.18	2.39	2.52	2.36	2.16	2.39	2.00	2.30	2.55
"	(3).....	2.88	3.11	2.93	2.24	2.50	2.74	2.44	2.34	2.33	2.23	2.50	2.48
December	(0).....	2.91	3.17	2.84	2.31	2.42	3.15	2.52	2.45	2.49	2.39	2.82	2.39
"	(1).....	3.77	2.83	2.79	2.38	2.27	3.10	2.55	2.40	2.40	2.40	2.76	2.32
"	(2).....	3.69	2.76	2.39	2.72	2.38	3.17	2.63	2.35	2.47	2.38	2.98	2.68
"	(3).....	3.85	2.93	2.49	2.76	2.41	3.09	2.80	2.26	2.81	2.50	3.24	2.93

Declination-Range, thus:—January (0) gives the Monthly Mean of January (1) that for one Week after the commencement, and so on.

1859.	1860.	1861.	1862.	1863.	1864.	1865.	1866.	1867.	1868.	1869.	1870.	1871.	1872.	Mean.
3.17	3.08	2.65	2.79	2.91	2.14	3.00	2.71	2.38	2.00	2.32	3.23	3.15	2.92	2.84
3.42	3.09	2.90	2.70	2.96	2.41	3.15	2.95	2.90	1.82	2.69	2.96	3.28	2.99	2.96
3.60	3.18	3.05	2.89	3.02	2.53	3.34	2.88	2.84	1.90	2.94	2.95	3.32	3.08	3.04
3.39	3.19	3.05	3.19	3.02	2.66	3.24	2.93	2.79	2.13	2.97	2.86	3.21	3.89	3.08
3.44	3.20	3.02	3.29	2.85	2.82	2.95	2.90	2.75	2.09	3.03	3.21	3.24	3.97	3.03
3.30	3.19	2.86	3.05	2.72	2.66	2.94	2.98	2.29	2.21	2.69	3.36	3.07	3.90	2.66
3.12	3.04	2.97	2.97	2.65	2.69	2.69	3.10	2.06	2.17	2.48	3.40	3.18	3.96	2.86
3.15	3.26	2.95	2.53	2.60	2.69	2.50	2.83	2.13	2.04	2.39	3.36	3.32	3.42	2.79
3.57	3.36	3.26	2.51	2.65	2.87	2.53	2.87	2.13	2.30	2.60	3.12	3.40	3.62	2.92
3.81	3.61	3.54	2.99	3.07	3.17	2.83	2.92	2.20	2.52	2.84	3.48	3.90	4.25	3.16
4.33	4.35	3.90	3.72	3.17	3.28	3.13	3.13	2.84	2.85	3.35	3.93	4.43	4.66	3.53
4.83	4.63	4.58	4.30	3.31	3.84	3.35	3.56	3.07	3.45	3.86	4.75	4.73	4.41	3.97
5.37	4.96	4.72	4.84	3.79	4.10	3.62	4.08	3.44	3.81	4.39	5.31	5.18	4.68	4.35
6.14	5.12	4.80	4.88	4.11	4.23	3.86	4.12	3.97	4.61	5.75	5.57	5.76	4.98	4.65
6.29	5.15	4.84	4.75	4.23	4.44	4.30	3.93	4.12	5.09	4.57	5.66	5.98	5.41	4.79
7.00	5.46	4.77	4.66	4.82	4.33	4.67	3.96	4.43	5.11	4.52	5.24	6.01	6.06	4.94
6.98	5.77	4.80	4.28	4.97	4.25	4.73	3.81	4.46	5.05	4.94	5.37	5.86	6.27	4.99
6.87	6.01	5.09	4.47	5.19	4.42	4.75	3.76	4.38	4.82	5.21	5.61	5.82	6.33	5.11
6.88	5.99	5.10	4.78	5.56	4.94	4.68	3.93	4.21	4.55	5.49	6.05	5.85	6.43	5.22
6.55	5.97	5.33	5.11	5.57	5.37	4.60	3.98	4.14	4.73	5.77	6.32	6.21	6.07	5.29
6.34	5.90	5.75	5.41	5.42	5.72	4.66	3.90	4.03	4.99	6.01	6.50	6.52	6.04	5.35
6.05	6.13	5.80	5.42	5.11	5.91	4.75	4.04	4.11	4.86	6.11	6.55	6.17	5.83	5.31
6.17	6.77	5.70	5.64	5.02	5.47	4.93	4.05	4.29	4.88	6.15	6.71	6.51	5.35	5.37
5.77	7.05	5.78	5.42	5.15	5.35	4.98	3.90	4.37	4.60	6.09	6.68	6.26	5.49	5.36
5.88	6.74	5.85	5.31	5.22	5.18	4.60	3.79	4.50	4.35	5.86	6.60	6.01	5.54	5.32
5.84	6.69	5.57	5.13	5.37	4.87	4.38	3.73	4.59	4.22	6.01	6.94	6.44	5.58	5.34
5.84	6.34	5.76	5.00	5.46	4.67	4.16	3.58	4.76	4.15	6.10	6.67	6.31	5.85	5.26
5.55	6.50	5.98	5.10	5.23	4.63	4.45	3.57	4.62	4.06	6.09	6.96	6.09	6.16	5.28
5.31	7.52	6.05	5.47	5.31	4.87	4.71	3.62	4.49	4.14	6.33	7.03	6.55	6.28	5.40
5.65	7.99	6.62	5.84	5.05	5.23	4.95	3.71	4.62	4.68	5.85	7.19	6.82	6.23	5.59
6.48	8.47	7.04	5.80	5.12	5.82	5.01	4.13	4.50	5.25	5.92	7.62	7.13	6.46	5.85
8.81	8.36	7.15	6.08	5.18	6.06	4.76	4.39	4.70	5.90	5.93	7.70	7.45	6.46	6.16
9.00	7.67	7.11	6.01	5.19	6.18	4.77	4.43	4.72	6.36	6.25	7.60	7.44	6.61	6.25
8.82	7.12	7.05	5.82	4.96	5.92	4.82	4.59	4.47	5.83	6.35	7.64	6.87	7.07	6.15
6.84	6.63	6.41	5.40	4.62	5.45	4.82	4.09	4.16	5.31	5.89	7.45	6.38	6.95	5.79
5.56	6.14	5.62	5.20	4.29	4.61	4.50	4.15	3.80	4.94	5.50	6.86	5.82	6.45	5.28
5.06	5.82	4.90	4.60	3.67	3.82	4.25	4.01	3.36	4.16	4.30	6.27	5.04	5.98	4.64
4.65	5.02	3.83	4.13	3.46	3.17	3.84	3.75	3.19	3.70	3.59	5.37	4.47	5.13	4.07
4.44	4.02	3.29	3.68	2.98	2.87	3.33	3.56	3.03	3.18	3.21	4.55	3.94	4.25	3.48
4.00	3.34	2.93	2.85	2.67	2.63	3.24	3.14	2.63	2.45	2.71	4.22	3.53	3.62	3.60
3.37	2.78	2.69	2.62	2.53	2.40	3.13	2.82	2.57	2.18	2.53	3.83	3.17	3.15	2.72
2.89	2.52	2.60	2.34	2.49	2.12	2.87	2.51	2.21	2.11	2.53	3.43	3.00	2.74	2.54
2.66	2.35	2.40	2.30	2.58	2.03	2.71	2.51	2.33	2.14	2.40	3.11	2.83	2.66	2.48
2.73	2.21	2.34	2.41	2.65	2.13	2.39	2.59	2.39	2.31	2.45	2.76	2.50	2.75	2.51
3.24	2.37	2.53	2.43	2.62	2.26	2.21	2.62	2.35	2.45	2.57	2.48	2.48	2.72	2.58
3.43	2.42	2.81	2.51	2.45	2.54	2.27	2.49	2.41	2.29	2.70	2.46	2.47	2.94	2.62
3.50	2.45	2.89	2.64	2.27	2.56	2.41	2.36	2.09	2.17	2.91	2.51	2.47	3.03	2.65
3.52	2.64	2.89	2.67	2.15	2.95	2.59	2.26	2.00	2.34	3.32	2.7	2.76	...	2.75

for each point being reckoned =1000," which table contains in all 1,225 numbers. A second table is formed from this by taking the mean of twelve successive numbers and moving onward a step (*i.e.*, by one number) after each operation: a third table is formed from the second by taking means of pairs of successive numbers: the third table contains 1,213 entries, or six less at the beginning and six less at the end than the first table: the numbers in the third table—called "three-monthly values"—will be made use of further on, in the inquiry into planetary variations. Next all the numbers in the third table, except those opposite to the divisions (0) of the several months, being rejected, the means are taken of sets of three of the 304 remaining numbers, selected in the following manner, viz.:—the means of the 1st, 4th, and 7th entries, of the 2nd, 5th, and 8th entries, and so on, the result being placed opposite the middle number of the three in each case. Finally, means are taken of pairs of the successive numbers thus found, the final means being called "nine-monthly values," and corresponding in time to the division (2) of the several months. These final means are shown in Table II, in which the entries are reduced to 297.

Table II.—Declination-Range, Nine-monthly Values.

Year.	January (2).	February (2).	March (2).	April (2).	May (2).	June (2).	July (2).	August (2).	September (2).	October (2).	November (2).	December (2).
1847 .....	...	...	...	...	...	...	...	...	...	...	1153	1168
1848	1176	1170	1166	1160	1144	1130	1123	1122	1134	1160	1182	1181
1849	1171	1165	1161	1155	1141	1118	1089	1061	1052	1053	1041	1035
1850	1036	1043	1050	1047	1048	1038	1018	1017	1017	1003	981	963
1851	956	957	959	958	958	957	957	963	978	1000	1006	1013
1852	1028	1031	1031	1034	1027	1015	1010	1010	1001	984	977	973
1853	974	995	1016	1020	1013	1008	1013	1019	1022	1015	997	976
1854	957	945	938	927	910	892	884	883	873	862	857	860
1855	865	863	859	855	857	866	876	887	891	882	878	878
1856	869	853	842	836	822	806	809	817	821	824	819	815
1857	815	815	819	823	833	844	863	905	935	953	983	1010
1858	1025	1025	1036	1047	1041	1044	1043	1033	1039	1056	1083	1114
1859	1141	1153	1151	1169	1193	1200	1207	1202	1179	1159	1159	1167
1860	1161	1157	1172	1181	1187	1189	1175	1152	1134	1122	1109	1079
1861	1047	1028	1027	1045	1062	1065	1060	1050	1048	1045	1039	1025
1862	1003	993	992	990	988	984	980	977	976	975	965	957
1863	959	961	960	953	937	926	928	927	918	911	906	900
1864	908	927	934	932	933	933	927	929	943	942	927	922
1865	918	914	916	910	896	892	898	905	914	922	929	926
1866	919	906	872	838	821	818	821	821	825	829	834	850
1867	864	867	856	833	812	807	819	822	806	797	801	813
1868	830	843	842	839	854	874	888	892	887	883	891	910
1869	929	949	977	998	1009	1014	1020	1033	1042	1047	1051	1054
1870	1065	1094	1130	1163	1189	1219	1230	1216	1207	1204	1200	1191
1871	1181	1169	1152	1151	1162	1170	1164	1140	1134	1145	1148	1147
1872	1146	1140	1135	1140	1160	1166	1148					

The numbers in the table are curved (in a strong line) in fig. 1, and the comparable numbers obtained by Dr. Stewart* for Kew and

* "Proc. Roy. Soc.," vol. 26, p. 109, and vol. 28, p. 84.

Trevandrum are curved on the same form—the former in a weaker and the latter in an interrupted line.

4. On these curves we may remark that they present such a general correspondence of movement, and approach to simultaneity, that any conclusions as to the relations of the declination-range to solar activity that may be drawn in respect of one of them will apply generally in respect of the others also. The sun-spot period is distinctly followed by them all—three showing the maximum of 1859–60, and two the minima about 1856 and 1866–67. The general correspondence of the curves will perhaps be most readily apprehended by noting the most marked cases of departure from it: these are—(1) that the elevation, in the middle of 1859, in the Kew and Bombay curves, has no counterpart in that of Trevandrum, but only a slight inflection of a continued rise; (2) that the depression, at the beginning of 1861, at Trevandrum and Bombay, is all but absent at Kew; and (3) that the elevation, near the end of 1862, at Kew and Trevandrum, has no counterpart at Bombay.

Features of the Trevandrum and Bombay curves that are perhaps worth noting are that the great rise from 1856 to 1860 begins earlier and ends later at Trevandrum than at Bombay, that it begins lower and ends higher, and that the turnings at beginning and end are sharper in the same case.

C. *Lunar Annual Variation.*

D. *Semi-annual Lunar Variation.*

5. The processes by which the lunar variations of declination-range have been brought out were the same as were applied to the temperature-ranges in paragraphs 7 to 13 of the preceding investigation; but the observations made use of in the case of the declination-ranges are those for the twenty-five winters and twenty-five summers embraced between 1847·75 and 1871·75. In this case a lunation was taken to be a winter one if the middle of it occurred between the 1st October and 1st April, and the remaining lunations were taken as summer ones; and—in correspondence with this—the elimination of the part of the winter or summer lunar variation due to the annual variation of the declination-range was effected by the same division of the year in respect of summer and winter. The following table shows the mean values of the declination-range for each of the eight phases of each of the 309 lunations of the period, and the summer lunations are distinguished in it by having their serial numbers enclosed by parentheses.

Table III.—Exhibiting the Declination-Ranges grouped according to Lunations.

Run- ning No.	Lunation commencing new moon.	(0)	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1	October 8, 1847.....	5'439	4'126	3'542	3'617	4'937	4'029	3'005	2'850
2	November 7, „.....	2'553	2'439	2'352	2'393	3'651	4'309	2'758	2'215
3	December 7, „.....	2'587	2'774	3'285	7'905	7'108	2'747	2'719	3'331
4	January 6, 1848.....	3'187	3'613	3'989	4'656	4'046	3'594	3'519	2'850
5	February 4, „.....	3'011	2'630	2'621	3'441	4'544	4'744	2'576	2'702
6	March 5, „.....	3'228	3'359	4'183	4'498	5'218	5'407	4'714	4'133
(7)	April 3, „.....	4'171	4'203	4'326	4'646	5'592	5'248	5'316	5'654
(8)	May 2, „.....	5'482	5'706	5'774	5'242	5'642	5'087	5'051	5'528
(9)	June 1, „.....	6'134	5'453	5'037	4'986	4'905	5'900	5'614	5'446
(10)	„ 30, „.....	6'009	5'866	6'004	6'118	6'542	7'096	6'616	6'296
(11)	July 29, „.....	6'519	7'376	6'195	5'941	7'342	8'571	6'822	6'840
(12)	August 28, „.....	7'440	6'908	7'171	6'772	7'079	7'307	5'758	5'454
13	September 26, „.....	6'022	5'687	5'242	4'409	4'957	4'945	3'989	3'257
14	October 26, „.....	3'211	2'398	1'940	1'827	1'907	2'343	4'029	3'639
15	November 25, „.....	3'457	3'102	2'589	2'867	2'787	2'294	2'575	3'022
16	December 25, „.....	2'521	2'913	3'348	3'490	3'194	2'940	4'298	4'413
17	January 23, 1849.....	4'304	4'052	3'732	3'619	3'422	3'104	2'953	3'890
18	February 22, „.....	4'628	4'512	3'966	3'639	3'570	3'245	3'663	4'578
(19)	March 24, „.....	4'985	5'488	6'296	6'908	6'370	5'402	5'053	5'150
(20)	April 22, „.....	5'322	4'951	4'635	5'034	5'569	5'957	5'116	5'096
(21)	May 21, „.....	7'034	6'833	5'417	5'372	7'148	6'908	5'093	5'417
(22)	June 20, „.....	6'042	5'775	5'186	5'262	6'136	5'797	6'135	6'099
(23)	July 19, „.....	6'249	5'562	5'276	5'563	6'319	6'496	5'574	5'671
(24)	August 17, „.....	5'986	6'827	6'078	6'127	6'484	6'854	6'061	5'701
(25)	September 16, „.....	5'564	6'256	6'307	5'329	5'150	4'368	3'411	3'474
26	October 15, „.....	3'153	3'090	2'964	2'605	2'468	1'871	1'752	2'678
27	November 14, „.....	2'816	2'486	2'483	4'161	4'268	2'567	2'236	2'420
28	December 14, „.....	2'328	2'357	2'419	2'823	2'706	2'454	2'534	2'483
29	January 13, 1850.....	3'284	3'598	3'559	3'757	3'519	3'282	5'699	4'921
30	February 11, „.....	2'758	2'288	2'437	3'179	2'506	2'182	2'494	3'066
31	March 13, „.....	3'439	4'127	4'006	3'941	4'326	3'639	4'442	5'151
(32)	April 12, „.....	5'265	4'635	4'407	4'865	4'578	4'710	5'413	6'066
(33)	May 11, „.....	6'994	6'547	5'013	5'162	5'746	5'851	5'894	5'449
(34)	June 9, „.....	5'472	6'071	5'803	5'665	5'757	5'975	5'826	5'576
(35)	July 9, „.....	6'558	6'261	6'124	5'442	4'887	5'563	5'608	4'725
(36)	August 7, „.....	4'888	5'501	5'442	4'715	5'574	5'940	6'089	6'427
(37)	September 5, „.....	6'839	6'964	6'249	6'593	6'249	6'302	5'230	4'732
38	October 5, „.....	4'892	3'948	3'410	2'964	2'952	3'117	2'906	2'663
39	November 3, „.....	2'413	1'944	2'018	2'328	2'221	1'648	2'059	2'458
40	December 3, „.....	2'437	2'025	2'174	2'857	2'770	2'643	3'392	3'605
41	January 1, 1851.....	2'691	2'842	3'536	3'694	3'336	3'462	3'783	3'530
42	„ 31, „.....	3'101	2'666	2'557	2'374	2'609	2'489	2'323	2'582
43	March 2, „.....	2'649	2'528	2'614	2'856	3'330	3'406	3'582	3'479
(44)	April 1, „.....	3'902	3'694	4'057	4'429	4'910	4'429	3'560	3'937
(45)	„ 30, „.....	4'143	4'543	5'242	4'910	4'898	4'120	3'754	5'207
(46)	May 30, „.....	6'146	6'085	5'528	5'273	5'287	5'356	4'887	5'322
(47)	June 28, „.....	7'348	7'406	5'860	5'493	5'298	5'986	4'395	5'082
(48)	July 28, „.....	5'654	5'173	4'234	3'765	4'875	5'310	4'475	5'122
(49)	August 26, „.....	6'376	6'676	5'482	5'825	5'883	5'597	5'608	5'974
50	September 24, „.....	5'860	5'675	5'530	4'658	4'040	3'674	3'159	2'980
51	October 24, „.....	2'928	3'185	2'759	1'751	2'226	2'661	2'255	2'530
52	November 22, „.....	2'907	2'571	2'209	2'306	2'775	2'402	1'808	1'895
53	December 22, „.....	2'224	3'158	2'849	2'470	2'676	2'384	3'009	4'024
54	January 20, 1852.....	4'223	3'239	2'884	2'610	2'702	2'495	2'953	5'150
55	February 19, „.....	4'887	2'679	2'439	3'434	3'674	3'077	3'400	3'903
(56)	March 20, „.....	3'788	3'571	3'823	4'037	5'379	5'013	4'772	5'026
(57)	April 19, „.....	5'373	6'242	6'243	5'788	5'561	5'533	4'383	4'664
(58)	May 18, „.....	5'837	6'215	5'601	5'379	5'299	5'459	4'818	5'631
(59)	June 17, „.....	6'415	5'700	5'139	5'288	5'357	5'343	4'876	4'452
(60)	July 16, „.....	5'339	6'270	6'123	5'054	4'854	4'904	5'711	6'375
(61)	August 15, „.....	6'479	6'810	6'672	5'503	5'402	6'123	5'551	5'494
(62)	September 13, „.....	5'444	5'063	3'731	3'777	4'017	3'828	3'576	3'955
63	October 12, „.....	2'666	2'993	3'799	3'319	2'998	2'460	2'300	2'211
64	November 11, „.....	2'335	2'280	2'380	2'678	2'678	3'387	3'124	3'525
65	December 10, „.....	3'994	2'994	2'162	2'513	3'722	3'599	2'815	3'035
66	January 9, 1853.....	2'723	2'431	2'656	2'816	3'360	3'249	2'633	2'761
67	February 7, „.....	2'278	2'164	2'610	2'484	2'188	2'383	2'657	2'789
68	March 9, „.....	3'365	2'815	2'907	3'873	4'137	3'262	3'445	4'884
(69)	April 8, „.....	5'872	5'590	5'109	4'715	4'263	4'147	4'726	5'424
(70)	May 7, „.....	4'727	3'857	4'441	4'699	5'928	5'310	4'840	5'184
(71)	June 6, „.....	5'299	6'037	6'357	6'191	5'917	5'755	5'894	5'895
(72)	July 5, „.....	5'580	5'688	5'688	5'919	6'363	5'315	5'184	6'237

Run- ning No.	Lunation commencing new moon.	(0)	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(73)	August 4, 1853.....	6·123	6·221	5·837	5·528	6·523	7·187	6·787	7·291
(74)	September 3, ".....	8·035	6·948	6·536	7·196	6·821	6·500	5·505	5·093
75	October 2, ".....	3·868	3·166	2·672	3·022	2·725	2·599	2·553	2·322
76	" 31, ".....	2·843	2·706	2·610	2·552	2·386	2·301	2·015	1·841
77	November 30, ".....	2·095	3·296	3·022	2·838	2·895	2·506	2·623	2·321
78	December 29, ".....	2·300	3·077	4·155	4·280	3·238	3·123	2·847	2·208
79	January 28, 1854.....	2·694	2·955	2·904	3·147	3·333	3·338	2·086	2·080
80	February 26, ".....	2·672	2·494	2·675	3·052	2·935	2·764	2·540	3·082
(81)	March 28, ".....	4·057	3·433	4·124	4·407	4·737	4·505	4·522	4·819
(82)	April 26, ".....	4·236	4·282	4·759	5·382	5·628	5·165	4·765	5·107
(83)	May 26, ".....	5·278	4·914	5·041	4·824	4·913	5·142	4·508	4·599
(84)	June 25, ".....	5·040	4·537	4·988	5·303	5·835	5·402	3·941	3·570
(85)	July 24, ".....	4·113	4·440	4·395	4·531	5·505	5·168	4·480	4·538
(86)	August 23, ".....	5·134	5·574	5·396	4·819	5·686	5·822	4·988	4·405
87	September 21, ".....	4·760	5·217	5·195	4·142	3·879	2·951	2·625	2·643
88	October 21, ".....	3·001	2·730	1·968	1·807	2·087	1·973	1·528	1·738
89	November 19, ".....	2·471	2·506	2·323	2·722	2·764	2·415	1·979	1·889
90	December 19, ".....	2·204	2·198	2·651	2·507	2·321	2·400	2·689	2·883
91	January 17, 1855.....	2·528	2·486	2·707	2·349	2·288	2·277	2·477	2·712
92	February 16, ".....	2·732	2·269	2·322	2·292	2·571	2·489	2·821	3·444
(93)	March 17, ".....	3·167	2·206	2·746	3·639	4·970	4·473	3·841	3·757
(94)	April 16, ".....	4·744	5·128	4·302	4·610	5·114	4·573	4·748	4·956
(95)	May 15, ".....	5·137	5·000	4·896	4·073	3·857	4·416	4·108	4·005
(96)	June 14, ".....	4·588	4·690	4·655	4·599	5·142	4·853	4·257	3·556
(97)	July 13, ".....	3·649	4·873	4·598	3·855	4·301	4·593	3·922	3·951
(98)	August 12, ".....	4·245	4·485	4·553	4·514	5·703	5·633	5·009	5·827
(99)	September 10, ".....	7·252	6·555	5·562	5·134	4·691	3·954	3·411	3·615
100	October 10, ".....	3·398	3·866	3·603	2·907	2·586	2·209	2·014	2·242
101	November 9, ".....	2·204	2·808	2·746	2·527	2·196	2·271	1·968	1·859
102	December 8, ".....	2·420	2·769	2·883	2·678	2·449	2·827	2·623	3·258
103	January 7, 1856.....	3·071	3·185	3·320	2·893	3·033	3·136	2·504	1·921
104	February 5, ".....	2·207	2·442	2·286	2·127	2·039	2·047	2·287	2·099
105	March 6, ".....	2·046	2·511	2·378	2·703	2·778	2·869	3·281	4·208
(106)	April 4, ".....	4·539	4·802	4·882	4·527	4·368	3·796	3·030	3·142
(107)	May 4, ".....	3·704	3·924	3·693	3·327	4·024	4·220	3·787	3·499
(108)	June 2, ".....	3·956	3·921	3·567	3·876	4·574	4·322	4·174	4·638
(109)	July 1, ".....	4·551	3·479	3·247	3·864	4·322	5·091	4·997	4·953
(110)	" 31, ".....	5·030	4·551	4·585	5·488	5·776	5·516	4·734	4·734
(111)	August 29, ".....	5·225	5·996	5·397	5·461	6·298	6·072	4·939	4·196
112	September 28, ".....	4·162	3·396	2·389	2·497	2·881	2·881	2·675	2·607
113	October 28, ".....	1·880	2·195	1·926	1·646	1·693	1·694	1·988	2·360
114	November 27, ".....	2·367	2·648	2·916	2·182	2·355	2·456	2·172	1·727
115	December 26, ".....	2·135	2·987	3·267	2·824	2·321	2·510	2·173	2·161
116	January 25, 1857.....	2·310	2·072	2·607	2·923	2·813	2·332	2·173	2·184
117	February 24, ".....	2·149	2·058	1·829	2·081	1·852	1·726	1·898	3·087
(118)	March 25, ".....	3·087	2·305	2·745	3·444	3·087	2·957	3·967	4·024
(119)	April 23, ".....	4·185	4·226	4·255	4·883	5·043	5·088	5·203	5·672
(120)	May 23, ".....	5·626	4·820	3·974	3·685	4·631	5·207	4·379	3·924
(121)	June 21, ".....	3·671	3·897	4·454	4·522	4·516	5·042	4·619	4·070
(122)	July 20, ".....	4·128	4·208	3·590	4·445	4·733	5·050	4·775	3·944
(123)	August 19, ".....	5·122	5·603	5·282	4·760	5·797	6·765	6·221	6·202
124	September 17, ".....	6·877	6·455	5·637	4·962	4·871	4·276	3·785	3·005
125	October 17, ".....	2·758	2·687	2·355	2·085	1·761	1·578	2·023	2·435
126	November 16, ".....	2·704	3·218	2·698	2·149	2·006	2·339	2·498	2·407
127	December 15, ".....	4·539	4·036	1·969	2·375	2·950	2·964	4·008	4·013
128	January 14, 1858.....	3·648	2·939	2·733	3·030	3·316	2·836	2·332	2·264
129	February 13, ".....	2·664	2·847	2·538	2·978	3·609	3·115	3·408	3·979
130	March 15, ".....	4·745	4·654	4·082	3·774	4·323	4·309	5·477	6·051
(131)	April 13, ".....	5·297	4·313	4·265	5·180	5·448	4·665	4·881	5·996
(132)	May 12, ".....	5·914	5·324	5·248	5·969	5·443	5·306	5·019	4·556
(133)	June 11, ".....	4·413	4·665	4·836	4·654	5·111	6·289	6·095	5·134
(134)	July 10, ".....	4·836	5·259	4·871	5·026	6·009	6·254	5·580	5·145
(135)	August 8, ".....	6·449	6·838	5·991	6·339	6·696	6·504	5·912	6·450
(136)	September 7, ".....	5·900	5·801	6·103	5·340	5·957	6·613	6·048	5·365
137	October 6, ".....	4·413	3·293	3·499	3·064	3·121	4·036	3·789	2·026
138	November 5, ".....	2·470	2·985	2·733	2·940	2·928	2·012	1·932	1·496
139	December 4, ".....	2·196	2·786	2·321	2·470	2·607	2·566	3·293	3·773
140	January 3, 1859.....	3·472	3·145	3·328	3·554	3·156	3·842	4·860	3·755
141	February 2, ".....	2·509	3·362	3·292	2·493	2·344	3·453	3·519	2·525
142	March 4, ".....	2·758	3·500	3·945	5·230	5·414	4·336	4·413	5·180
(143)	April 2, ".....	4·848	4·871	6·552	7·067	7·490	7·698	6·066	5·797
(144)	May 2, ".....	7·342	7·850	7·296	6·834	7·341	8·055	5·104	5·625
(145)	" 31, ".....	7·113	6·628	5·547	5·900	6·221	5·626	5·237	5·901
(146)	June 30, ".....	6·758	5·774	4·654	5·683	6·895	5·855	5·489	4·837
(147)	July 29, ".....	5·571	5·036	4·722	5·049	5·818	5·757	5·038	8·153
(148)	August 27, ".....	9·043	4·162	3·517	9·011	7·365	7·102	5·478	5·324
149	September 26, ".....	5·180	4·748	4·231	4·494	5·649	5·956	4·042	3·780

Run- ning No.	Lunation commencing new moon.		(0)	(1)	(2)	(3)	(4)	(5)	(6)	(7)
150	October 25,	1859.....	3·802	3·819	3·282	2·710	3·030	2·658	2·352	2·579
151	November 24,	„	2·653	2·573	2·298	3·361	3·853	5·284	4·289	3·046
152	December 23,	„	3·114	2·621	3·376	3·281	2·744	3·076	3·454	3·557
153	January 22,	1860.....	3·213	3·133	3·327	3·142	3·259	3·541	2·813	2·882
154	February 21,	„	3·143	2·470	2·209	3·310	4·693	4·700	3·476	3·458
(155)	March 22,	„	4·769	4·914	5·467	5·751	5·037	4·858	4·803	4·918
(156)	April 20,	„	5·032	5·216	5·799	5·947	6·199	6·261	6·124	6·450
(157)	May 20,	„	5·846	4·859	5·635	6·035	6·610	6·450	5·684	5·407
(158)	June 18,	„	6·370	7·274	7·525	8·289	8·657	7·045	5·167	4·802
(159)	July 18,	„	6·256	6·908	5·867	6·560	7·095	8·242	9·320	8·330
(160)	August 16,	„	8·440	8·166	8·097	7·918	9·057	8·462	7·399	5·696
(161)	September 14,	„	5·410	5·833	6·713	6·805	6·427	6·461	4·620	3·898
162	October 14,	„	4·278	4·008	3·170	2·610	3·306	3·418	2·425	2·299
163	November 12,	„	2·005	2·018	2·196	2·375	2·498	2·197	2·071	2·883
164	December 12,	„	2·710	2·306	2·539	2·553	2·649	2·832	2·855	2·924
165	January 10,	1861.....	2·723	2·923	3·191	3·786	3·374	3·054	2·776	2·445
166	February 9,	„	2·699	2·618	2·733	2·902	3·416	3·691	3·065	2·786
167	March 11,	„	3·651	3·923	3·705	4·186	5·404	5·404	5·730	5·512
(168)	April 9,	„	4·677	4·318	3·792	4·584	5·329	5·352	4·963	5·101
(169)	May 9,	„	4·483	4·426	4·643	5·078	6·299	6·385	5·665	5·490
(170)	June 8,	„	5·158	5·855	6·106	5·523	6·186	6·026	5·032	5·015
(171)	July 7,	„	6·719	7·554	5·653	4·312	4·904	5·600	5·851	7·096
(172)	August 6,	„	6·939	6·964	6·585	5·341	7·436	8·228	7·509	6·641
(173)	September 4,	„	7·520	6·683	5·895	6·690	7·041	6·539	5·580	4·971
174	October 3,	„	4·394	4·670	3·937	3·093	2·853	2·732	3·057	3·070
175	November 2,	„	2·758	3·030	2·825	2·276	2·481	2·154	2·161	2·140
176	December 1,	„	2·684	3·231	2·984	3·064	3·190	3·373	2·154	2·222
177	„ 31,	„	2·684	3·046	2·733	2·561	2·584	2·469	3·178	3·114
178	January 29,	1862.....	3·075	3·853	3·980	3·373	2·607	1·976	2·104	2·315
179	February 28,	„	2·909	2·662	2·264	2·374	3·361	3·727	4·093	4·642
(180)	March 29,	„	5·225	4·994	4·607	5·433	5·985	4·966	4·198	4·264
(181)	April 28,	„	4·665	4·814	4·151	4·007	4·038	4·887	4·981	5·365
(182)	May 28,	„	5·812	5·637	5·465	5·499	5·293	4·857	5·077	5·671
(183)	June 26,	„	6·254	6·329	4·985	4·857	4·709	4·786	4·447	4·825
(184)	July 26,	„	6·471	6·071	4·745	4·870	5·955	6·151	5·511	6·025
(185)	August 24,	„	6·574	5·891	5·594	5·584	6·661	6·089	5·396	5·271
186	September 23,	„	5·511	4·762	3·544	5·639	5·589	3·485	2·948	3·114
187	October 22,	„	3·814	2·710	2·492	2·206	2·378	2·206	2·332	2·675
188	November 21,	„	2·355	2·218	2·321	2·790	2·447	2·149	2·367	2·355
189	December 20,	„	2·732	2·893	3·241	2·621	2·543	2·806	3·190	3·266
190	January 19,	1863.....	2·916	2·868	3·022	3·110	2·584	2·579	2·481	2·538
191	February 17,	„	2·209	2·538	3·010	2·819	2·640	2·250	2·367	3·156
(192)	March 19,	„	4·013	4·253	3·704	3·430	2·936	3·032	3·853	4·998
(193)	April 17,	„	4·977	5·156	5·065	3·921	4·665	5·397	5·705	5·133
(194)	May 17,	„	6·167	6·082	5·774	5·118	5·374	5·737	4·643	4·473
(195)	June 15,	„	5·396	5·145	4·482	4·706	4·985	5·629	6·059	5·499
(196)	July 15,	„	5·282	5·877	4·882	4·692	5·510	5·133	4·836	5·706
(197)	August 14,	„	5·453	5·365	4·390	4·116	5·488	5·872	5·424	4·893
(198)	September 12,	„	5·511	5·044	3·727	3·853	4·413	4·150	3·796	3·937
199	October 12,	„	3·253	2·387	2·630	2·758	2·424	2·344	2·629	3·018
200	November 10,	„	2·223	2·277	2·481	2·648	2·790	2·895	2·973	2·593
201	December 10,	„	2·561	2·003	1·944	1·892	2·139	2·349	2·222	2·154
202	January 8,	1864.....	2·126	2·099	2·515	2·972	2·927	2·870	2·698	2·634
203	February 7,	„	3·098	2·950	2·150	2·447	2·538	3·086	2·480	2·368
204	March 7,	„	3·215	3·636	3·099	3·510	4·218	3·348	3·378	5·014
(205)	April 6,	„	4·871	4·747	4·310	3·830	4·551	4·486	4·103	4·307
(206)	May 5,	„	4·390	4·379	3·967	4·665	5·365	5·968	6·288	6·399
(207)	June 4,	„	6·004	5·488	5·431	5·735	5·762	6·256	5·170	4·473
(208)	July 3,	„	5·168	5·363	4·814	4·898	5·237	5·076	3·899	3·464
(209)	August 2,	„	4·333	5·545	5·648	6·191	6·778	6·448	5·111	5·351
(210)	„ 31,	„	6·833	6·334	6·265	6·476	6·036	5·427	4·797	3·956
211	September 30,	„	3·586	2·786	2·875	3·183	3·080	2·964	2·836	2·618
212	October 30,	„	2·470	2·031	1·635	2·072	2·538	2·100	1·669	1·864
213	November 28,	„	2·275	2·222	2·035	2·195	3·110	3·236	2·755	2·662
214	December 28,	„	2·182	2·864	3·759	3·471	3·178	3·807	3·461	2·864
215	January 26,	1865.....	2·866	3·312	3·358	2·915	2·058	2·832	3·392	2·785
216	February 25,	„	1·838	1·880	1·989	2·675	3·430	3·279	3·830	3·316
(217)	March 26,	„	2·858	2·881	2·893	3·647	4·196	4·418	4·413	4·692
(218)	April 25,	„	5·740	4·528	4·047	4·836	4·745	4·569	4·825	4·373
(219)	May 24,	„	4·913	4·885	4·061	4·253	4·893	4·950	4·665	4·973
(220)	June 22,	„	5·042	5·385	4·493	4·791	4·642	4·002	3·602	3·361
(221)	July 22,	„	4·002	4·253	5·419	5·968	5·442	5·351	4·447	4·157
(222)	August 20,	„	4·905	4·816	4·756	5·159	5·065	4·448	4·036	4·653
223	September 19,	„	5·019	5·453	5·019	4·157	3·716	3·501	3·443	3·544
224	October 19,	„	3·677	2·497	2·630	3·350	3·647	3·238	3·419	3·030
225	November 17,	„	2·389	1·841	2·332	2·332	2·355	2·207	2·287	2·515
226	December 17	„	1·944	1·962	2·586	2·950	3·224	2·835	2·710	3·247

Run- ning No.	Lunation commencing new moon.	(0)	(1)	(2)	(3)	(4)	(5)	(6)	(7)
227	January 17, 1866.....	2.777	2.976	3.464	2.552	2.104	3.156	3.167	2.456
228	February 15, „.....	2.772	3.847	3.856	3.163	2.738	2.027	2.043	2.824
229	March 17, „.....	3.488	3.557	3.682	4.013	3.910	3.819	3.567	4.665
(230)	April 15, „.....	5.282	4.250	3.654	3.223	3.258	3.819	3.647	4.242
(231)	May 14, „.....	4.573	4.510	3.276	2.381	4.150	4.573	3.601	3.636
(232)	June 13, „.....	4.288	4.473	3.840	3.546	4.183	4.020	3.442	3.429
(233)	July 12, „.....	4.161	3.510	3.187	3.556	3.469	3.515	3.281	3.673
(234)	August 10, „.....	3.948	3.990	4.196	3.639	4.380	5.609	5.164	4.071
(235)	September 9, „.....	4.135	4.249	4.346	4.501	3.934	3.988	3.990	4.418
236	October 8, „.....	3.951	3.752	3.441	3.224	2.961	2.881	3.327	3.087
237	November 7, „.....	2.031	2.301	2.095	2.127	2.435	2.991	2.812	2.652
238	December 7, „.....	2.921	2.499	2.149	1.825	1.564	2.264	2.333	2.771
239	January 6, 1867.....	2.150	2.561	3.430	3.830	3.315	2.652	2.161	2.309
240	February 4, „.....	2.275	2.264	2.618	2.140	1.989	1.976	1.452	1.413
241	March 6, „.....	2.689	3.018	2.584	2.212	2.264	2.618	3.487	3.944
(242)	April 5, „.....	3.762	3.293	3.476	4.722	5.063	4.560	4.379	3.567
(243)	May 4, „.....	4.459	4.884	4.310	4.184	4.214	3.965	3.353	3.549
(244)	June 2, „.....	4.061	4.665	4.550	3.784	4.390	4.253	3.967	4.267
(245)	July 2, „.....	5.316	5.168	4.185	4.184	4.904	4.570	4.653	4.747
(246)	„ 31, „.....	5.271	4.865	3.871	4.377	4.157	4.859	4.951	4.379
(247)	August 29, „.....	4.814	5.265	4.453	3.727	4.516	4.157	3.887	3.718
248	September 28, „.....	3.636	3.403	3.350	2.824	2.572	3.064	3.201	2.961
249	October 27, „.....	3.389	2.346	1.921	2.035	2.332	2.298	1.830	1.932
250	November 26, „.....	3.373	2.847	2.024	2.182	2.149	2.044	2.092	2.414
251	December 26, „.....	2.099	2.031	1.550	1.811	2.127	2.104	1.966	1.592
252	January 25, 1868.....	2.069	2.085	2.103	2.730	2.366	2.133	2.012	2.188
253	February 23, „.....	2.017	1.995	1.898	2.135	2.867	2.908	2.761	2.915
(254)	March 24, „.....	3.367	3.348	3.693	4.191	4.644	4.624	5.202	5.900
(255)	April 23, „.....	5.802	5.275	4.830	4.678	5.013	4.665	4.110	4.950
(256)	May 22, „.....	5.241	4.236	3.939	4.973	5.562	5.288	5.059	5.097
(257)	June 20, „.....	4.796	4.651	4.041	3.813	4.419	4.579	4.036	4.116
(258)	July 20, „.....	4.613	4.779	3.670	3.578	4.035	3.979	4.167	5.131
(259)	August 18, „.....	6.883	6.476	5.808	5.631	6.551	6.763	6.357	6.391
260	September 16, „.....	5.608	4.534	3.739	3.416	4.773	4.281	4.001	2.648
261	October 16, „.....	2.415	2.709	3.264	2.550	1.989	1.674	1.498	1.722
262	November 14, „.....	2.178	2.687	2.372	2.401	2.510	2.511	1.932	1.955
263	December 14, „.....	2.383	2.201	1.996	1.723	2.346	3.293	2.892	2.389
264	January 13, 1869.....	2.246	2.795	3.407	3.233	3.438	3.164	3.028	2.810
265	February 11, „.....	2.319	1.675	2.132	2.744	2.717	2.675	2.498	2.827
266	March 13, „.....	2.999	2.721	3.167	3.756	4.813	4.985	5.025	5.162
(267)	April 12, „.....	5.214	3.821	3.904	4.720	4.413	4.034	4.059	4.766
(268)	May 11, „.....	6.551	6.528	5.842	5.762	5.063	5.362	5.636	5.848
(269)	June 10, „.....	6.963	7.299	5.882	6.318	6.471	5.528	5.842	5.708
(270)	July 9, „.....	5.768	5.570	5.928	6.922	6.843	6.163	5.694	5.722
(271)	August 8, „.....	6.414	6.934	5.945	4.836	5.810	6.202	5.728	5.022
(272)	September 6, „.....	6.746	8.348	7.340	6.185	5.196	4.676	4.082	4.081
273	October 5, „.....	4.270	4.102	3.310	3.030	2.498	2.530	2.893	2.366
274	November 4, „.....	2.401	2.367	2.326	2.595	2.578	2.284	2.389	2.010
275	December 3, „.....	2.704	2.309	2.412	3.081	3.127	3.430	3.327	2.881
276	January 2, 1870.....	3.855	3.996	2.681	2.641	2.315	2.435	2.561	2.881
277	„ 31, „.....	3.739	3.458	3.773	3.950	3.293	2.778	2.807	3.138
278	March 2, „.....	3.265	3.304	3.161	3.395	3.958	4.315	4.293	4.562
(279)	April 1, „.....	5.465	6.323	5.236	6.431	5.907	5.019	5.145	5.111
(280)	„ 30, „.....	5.482	4.527	4.625	5.608	7.000	6.980	6.263	6.784
(281)	May 30, „.....	6.814	6.088	5.808	5.722	7.146	8.286	5.871	5.825
(282)	June 29, „.....	7.397	6.448	5.659	6.201	7.409	7.385	7.283	6.854
(283)	July 28, „.....	6.334	7.217	7.008	6.839	6.921	7.992	7.169	7.798
(284)	August 27, „.....	8.380	7.980	7.192	7.357	7.117	7.403	7.855	7.895
285	September 25, „.....	7.443	7.484	6.660	4.825	4.459	4.916	4.350	3.965
286	October 24, „.....	5.241	4.270	3.127	3.350	3.716	3.316	3.258	3.073
287	November 23, „.....	2.789	2.470	2.115	2.389	2.532	2.098	2.389	2.789
288	December 22, „.....	2.653	2.785	2.687	3.306	3.631	3.718	3.887	3.636
289	January 21, 1871.....	2.967	3.156	2.761	2.967	2.996	3.087	4.087	3.841
290	February 19, „.....	2.565	2.738	3.076	2.401	3.883	3.396	4.202	4.390
(291)	March 21, „.....	4.791	5.282	4.870	4.308	4.836	5.539	6.031	6.854
(292)	April 20, „.....	7.180	6.088	5.757	4.617	5.111	5.682	5.757	5.980
(293)	May 19, „.....	6.665	5.995	5.392	6.092	6.626	6.819	6.814	6.562
(294)	June 18, „.....	5.602	5.105	5.648	6.220	7.151	7.117	6.151	5.528
(295)	July 17, „.....	6.557	6.871	5.585	5.728	5.989	6.345	6.648	7.203
(296)	August 16, „.....	8.100	8.321	7.157	6.565	7.500	7.563	7.546	7.769
(297)	September 15, „.....	6.945	6.397	5.413	3.876	5.402	5.362	5.019	4.871
298	October 14, „.....	4.047	3.073	3.401	3.519	3.139	3.859	3.413	3.041
299	November 12, „.....	2.922	2.154	2.630	2.595	2.435	2.361	2.126	2.099
300	December 12, „.....	2.898	3.128	2.315	2.305	2.374	2.476	3.375	3.653
301	January 10, 1872.....	3.510	3.011	2.669	2.915	2.858	3.178	6.042	7.265
302	February 9, „.....	4.345	3.341	2.841	2.675	2.721	3.538	4.482	4.493
303	March 9, „.....	4.356	4.133	4.550	5.099	4.891	5.016	3.622	3.485

Run- ning No.	Lunation commencing new moon.		(0)	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(304)	April 8,	1872.....	5·036	5·185	5·534	6·325	6·562	6·922	5·745	5·762
(305)	May 7,	"	6·431	6·814	6·082	6·139	7·127	6·832	5·894	5·202
(306)	June 6,	"	5·168	6·157	5·837	5·824	5·734	4·651	4·368	5·145
(307)	July 5,	"	5·774	7·443	5·579	5·162	5·888	5·694	5·797	6·071
(308)	August 4,	"	6·957	7·374	6·545	5·687	5·825	5·763	5·985	6·717
(309)	September 3,	"	7·380	7·347	7·032	7·114	7·620	6·860	6·037	6·380

6. The whole series of 309 lunations of Table III gives the following results :—

Phase of lunation	(0)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(A)
Value of range	4·24	4·30	4·07	4·11	4·34	4·29	4·06	4·12	

a series which like that of Kew has a decided double period, having maxima about new and full moon and minima about first and last quarter. The sum of the four left-hand numbers (16·82) is the same (sensibly) as the sum of the four right-hand numbers (16·81).

The winter lunations by themselves, of which there are 153, give—

Phase of lunation	(0)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(B)
Value of range	3·14	3·05	2·95	3·01	3·09	3·00	2·97	3·03	
Correction applicable to winter months	—·08	—·04	—·01	+·01	+·03	+·03	+·02	·00	(C)
Corrected value of winter lunar range	3·06	3·01	2·94	3·02	3·12	3·03	2·99	3·03	

and the summer lunations by themselves, of which there are 156, give—

Phase of lunation	(0)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(D)
Value of range	5·52	5·52	5·18	5·18	5·56	5·56	5·13	5·19	
Correction applicable to summer months	+·07	+·03	—·01	—·02	—·03	—·03	—·03	·00	(E)
Corrected value of summer lunar range	5·59	5·55	5·17	5·16	5·53	5·53	5·10	5·19	

The series (A), (C), and (E) are curved in figs. 2, 3, and 4. The three curves are all double waves of regular and similar form and agreeing in phase, and the two waves have about the same amplitude; but the range of the winter curve is much less, and that of the summer curve much greater, than that of the annual curve. The summer variation is very similar to that of Kew, but the winter variations, though agreeing in being of less range than the respective summer variations, are quite unlike each other, that of Kew being mainly a single period variation.

D'. Possible Variations of the Lunar Effect with the Sun-spot Period.

7. The groups of years taken, in this case, as years about the times of maximum sun-spots, and as years about the times of minimum sun-spots, were the same as were used in the similar inquiry respecting temperature-ranges (paragraph 12), except that here the records under discussion stop at 1871·75 and both sets of winters include that of 1870·75 to 1871·75. The results given by the lunations of the first set of winter half-years are—for minimum and maximum sun-spot times respectively :—

Phase of lunation	(0)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	
Winter variation (minimum period)	2·83	2·89	2·84	2·77	2·74	2·66	2·63	2·76	(F)
Deduct (B).....	3·14	3·05	2·95	3·01	3·09	3·00	2·97	3·03	
Supposed effect of solar minimum	-0·31	-0·16	-0·11	-0·24	-0·35	-0·34	-0·34	-0·27	(G)

and

Phase of lunation	(0)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	
Winter variation (maximum period)	3·35	3·19	2·98	3·04	3·22	3·29	3·27	3·18	(H)
Deduct (B).....	3·14	3·05	2·95	3·01	3·09	3·00	2·97	3·03	
Supposed effect of solar maximum	+0·21	+0·14	+0·03	+0·03	+0·13	+0·29	+0·30	+0·15	(I)

and those given by the second set of winter half-years are :—

Phase of lunation	(0)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	
Winter variation (minimum period)	2·93	2·90	2·77	2·77	2·77	2·71	2·70	2·81	(F')
Deduct (B)	3·14	3·05	2·95	3·01	3·09	3·00	2·97	3·03	
Supposed effect of solar minimum	-0·21	-0·15	-0·18	-0·24	-0·32	-0·29	-0·27	-0·22	(G)

and

Phase of lunation	(0)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	
Winter variation (maximum period)	3·30	3·21	3·07	3·10	3·27	3·35	3·31	3·21	(H')
Deduct (B)	3·14	3·05	2·95	3·01	3·09	3·00	2·97	3·03	
Supposed effect of solar maximum	+0·16	+0·16	+0·12	+0·09	+0·18	+0·35	+0·34	+0·18	(I')

The selected lunations of the summer half-years give—for minimum and maximum sun-spot times respectively :—

Phase of lunation	(0)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	
Summer variation (minimum period)	4·83	4·77	4·39	4·46	4·83	4·85	4·50	4·47	(J)
Deduct (D)	5·52	5·52	5·18	5·18	5·56	5·56	5·13	5·19	
Supposed effect of solar minimum	-0·69	-0·75	-0·79	-0·72	-0·73	-0·71	-0·63	-0·72	(K)

and

Phase of lunation	(0)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	
Summer variation (maximum period)	6·11	6·17	5·79	5·79	6·23	6·21	5·77'	5·81	(L)
Deduct (D)	5·52	5·52	5·18	5·18	5·56	5·56	5·13	5·19	
Supposed effect of solar maximum	+0·59	+0·65	+0·61	+0·61	+0·67	+0·65	+0·64	+0·62	(M)

8. The series (G), (I), (G'), (I'), (K), and (M), are curved in figs. 5 to 10 in order, and their respective mean values are $-·26$, $+·16$, $-·24$, $+·20$, $-·72$ and $+·63$. These numbers imply that the result already found, that years about the time of maximum sun-spots have a larger declination-range than years about the time of minimum sun-spots, holds also for the winter and summer half-years separately.

The amplitude of the variation corresponding to the sun-spot variation is like the absolute declination-range, and even in greater proportion, much greater in summer than in winter. On the other hand, the supposed sun-spot effect on the lunar variation is greater in winter than in summer, the winter curves (figs. 5 to 8) being much bolder than the summer curves (figs. 9 and 10): the former are, indeed, of greater range and equally definite, though different, in character with the absolute winter variation shown in fig. 2.

E. Variations which seem to depend on Planetary Configurations.

9. The periods chosen for examination with respect to variation of declination-range are the same as were selected by Dr. Stewart in our model paper, viz: (α) the period of conjunction of Venus and Mercury, (β) the solar period of Mercury, and (γ) the period of conjunction of Mercury and Jupiter. Assuming with Dr. Stewart, that as the periods differ little from three months,* three-monthly values of the phenomenon will be nearly free from any inequality depending on the periods, and that differences between the monthly and the three-monthly values will exhibit any such inequality as may exist, we have subtracted the three-monthly values from the monthly values referred to

* The assumption, as regards the period of conjunction of Venus and Mercury, is not very exact, and this may be the reason why the variation found in this case is of less simple character than that of the other two periods.

in paragraph 3, thus obtaining a table of differences (48 to each year) to be re-arranged successively in three new tables, in lines corresponding to the respective periods—one line to each period.

The dates of conjunction and perihelion respectively having been taken from the "Nautical Almanac," the differences were divided into sets in such a manner that the mean dates of the first and last differences of each set never encroached on the preceding or following period. The number of differences in a set were, for the periods (β) and (γ), always either twelve or eleven, and when only eleven they were increased to twelve by repeating either the last difference of the preceding set or the first difference of the following set, whichever was the nearer in point of time to the intervening period. The period (α) is so variable that the number of differences in a set varied from seventeen to twenty-one; when seventeen they were increased to nineteen by repeating the preceding and following differences; when eighteen they were increased to nineteen in the same manner as eleven were increased to twelve in the case just described; when twenty the two first or two last numbers were replaced by the mean of them—whichever was furthest in point of time from the middle of the intervening period; and when twenty-one the two first and the two last differences were both replaced by their mean values.

The results (the algebraical sums of the columns) given by the several periods are as follows:—

Table IV.—Period of Conjunction of Venus and Mercury (0° denotes Conjunction).

			62 periods.	First 31 periods.	Last 31 periods.
Between	0°	and $(\frac{3.60}{1.9})^\circ$	+ 839	+ 637	+ 202
"	$(\frac{3.60}{1.9})^\circ$	" $2(\frac{3.60}{1.9})^\circ$	+ 741	+ 453	+ 288
"	$2(\frac{3.60}{1.9})^\circ$	" $3(\frac{3.60}{1.9})^\circ$	- 221	- 87	- 134
"	$3(\frac{3.60}{1.9})^\circ$	" $4(\frac{3.60}{1.9})^\circ$	- 545	- 331	- 214
"	$4(\frac{3.60}{1.9})^\circ$	" $5(\frac{3.60}{1.9})^\circ$	- 564	- 595	+ 31
"	$5(\frac{3.60}{1.9})^\circ$	" $6(\frac{3.60}{1.9})^\circ$	- 267	- 604	+ 337
"	$6(\frac{3.60}{1.9})^\circ$	" $7(\frac{3.60}{1.9})^\circ$	+ 448	- 261	+ 709
"	$7(\frac{3.60}{1.9})^\circ$	" $8(\frac{3.60}{1.9})^\circ$	+ 398	+ 46	+ 352
"	$8(\frac{3.60}{1.9})^\circ$	" $9(\frac{3.60}{1.9})^\circ$	+ 51	+ 130	- 79
"	$9(\frac{3.60}{1.9})^\circ$	" $10(\frac{3.60}{1.9})^\circ$	- 700	- 347	- 353
"	$10(\frac{3.60}{1.9})^\circ$	" $11(\frac{3.60}{1.9})^\circ$	- 311	+ 120	- 431
"	$11(\frac{3.60}{1.9})^\circ$	" $12(\frac{3.60}{1.9})^\circ$	+ 252	+ 388	- 136
"	$12(\frac{3.60}{1.9})^\circ$	" $13(\frac{3.60}{1.9})^\circ$	+ 637	+ 390	+ 247
"	$13(\frac{3.60}{1.9})^\circ$	" $14(\frac{3.60}{1.9})^\circ$	+ 855	+ 484	+ 371
"	$14(\frac{3.60}{1.9})^\circ$	" $15(\frac{3.60}{1.9})^\circ$	- 264	- 261	- 3
"	$15(\frac{3.60}{1.9})^\circ$	" $16(\frac{3.60}{1.9})^\circ$	- 976	- 516	- 460
"	$16(\frac{3.60}{1.9})^\circ$	" $17(\frac{3.60}{1.9})^\circ$	- 426	- 91	- 335
"	$17(\frac{3.60}{1.9})^\circ$	" $18(\frac{3.60}{1.9})^\circ$	+ 81	+ 282	- 201
"	$18(\frac{3.60}{1.9})^\circ$	" $(\frac{3.60}{1.9})^\circ$	+ 196	+ 234	- 38

Table V.—Period of Mercury about the Sun (0° denotes Perihelion).

			104 periods.	First 52 periods.	Last 52 periods.
Between	0° and	30°	- 1133	- 64	- 1069
"	30 "	60	- 538	+ 193	- 731
"	60 "	90	- 37	+ 155	- 192
"	90 "	120	+ 142	- 230	+ 372
"	120 "	150	+ 843	- 167	+ 1010
"	150 "	180	+ 953	- 117	+ 1070
"	180 "	210	+ 512	- 176	+ 688
"	210 "	240	+ 375	- 71	+ 446
"	240 "	270	- 22	+ 179	- 201
"	270 "	300	- 484	+ 175	- 659
"	300 "	330	- 389	+ 63	- 455
"	330 "	360	- 828	+ 138	- 966

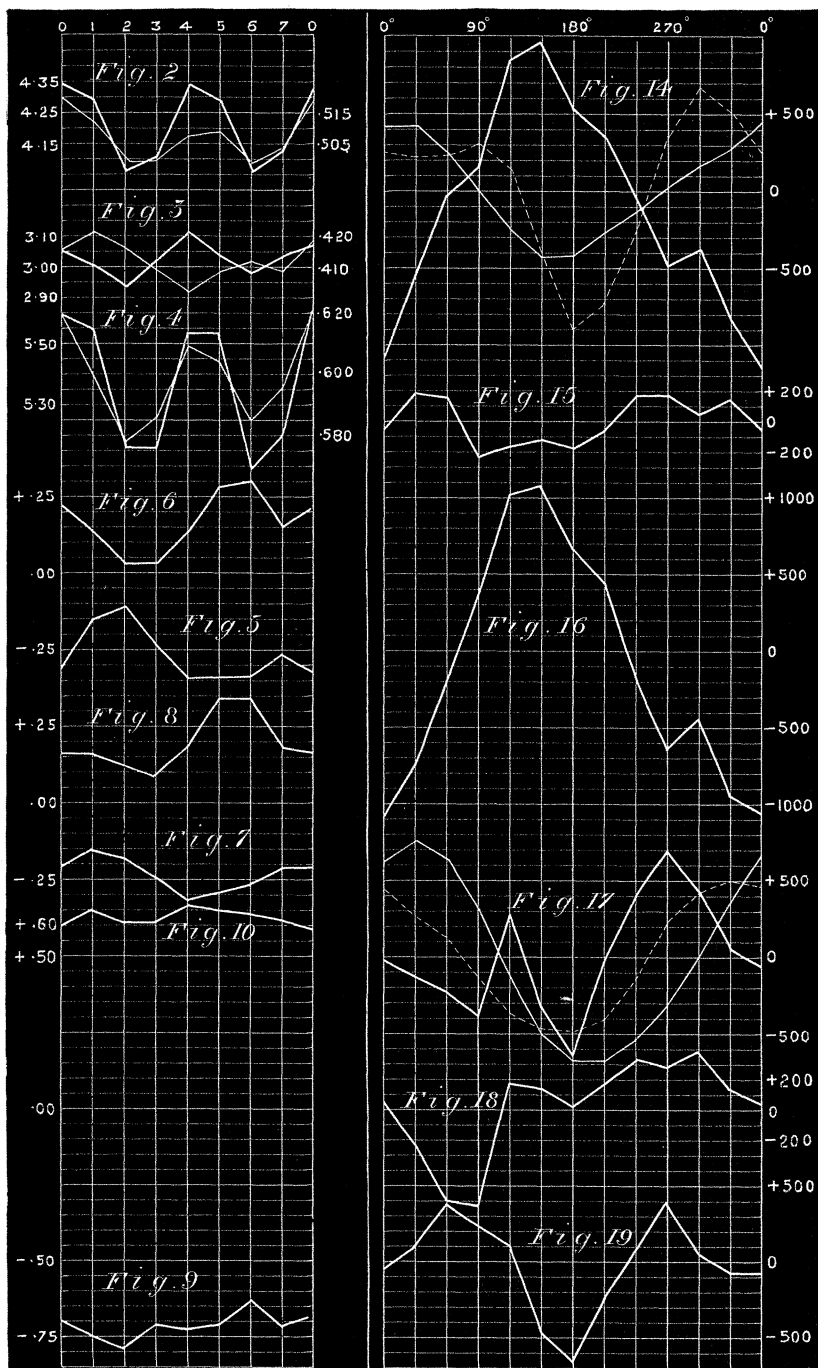
Table VI.—Period of Conjunction of Mercury and Jupiter (0° denotes Conjunction).

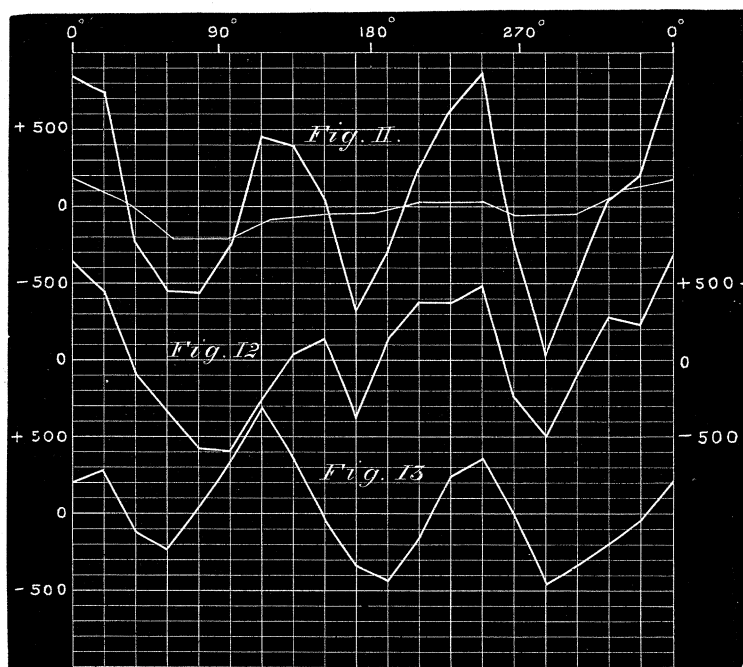
			102 periods.	First 51 periods.	Last 51 periods.
Between	0° and	30°	- 34	+ 50	- 84
"	30 "	60	- 130	- 223	+ 93
"	60 "	90	- 224	- 602	+ 378
"	90 "	120	- 395	- 628	+ 233
"	120 "	150	+ 285	+ 163	+ 122
"	150 "	180	- 350	+ 132	- 482
"	180 "	210	- 651	+ 10	- 661
"	210 "	240	- 73	+ 158	- 231
"	240 "	270	+ 401	+ 318	+ 83
"	270 "	300	+ 690	+ 291	+ 399
"	300 "	330	+ 415	+ 389	+ 26
"	330 "	360	+ 57	+ 136	- 79

The numbers in the several columns of Tables IV, V, and VI are graphically represented by figs. 11 to 19 in order.

10. The most marked feature in the Venus and Mercury period is a treble wave which repeats itself consistently in both halves of the series of observation, and has one of its maximum values at the time of conjunction. The variation given by the solar period of Mercury is nearly all due to the last 52 periods: it is represented by a single wave, which is similar to the corresponding Kew curve when inverted. The curves of the first 51 and last 51 periods of the conjunction of Mercury and Jupiter are very unlike each other, and they are also unlike the corresponding curves for Kew and Trevandrum.

The several curves in weak and interrupted lines for Kew and Trevandrum respectively are made for comparison with those for Bombay, which are drawn strong. In the planetary results it must





be observed that the variations are for different numbers of periods at the different stations as follows:—

	Bombay.	Kew.	Trevandrum.
Mercury and Venus	62	39	
Mercury	104	65	47
Mercury and Jupiter	102	63	43

11. It may be remarked that, as at Kew, there is some resemblance between the curves of lunar variation of temperature-range and declination-range, and that it exhibits itself both in summer and in winter separately. [Compare figs. 2, 3, and 4 of declination-ranges with figs. 2, 3, and 4 of temperature-ranges.] Comparing also fig. 1 of declination-ranges with fig. 1 of temperature-ranges, there is seen to be a remarkable inversion of movement between 1859 and 1872, but the same rule does not hold good for the earlier years.

1847 1848 1849 1850 1851 1852 1853 1854 1855 1856 1857 1858 1859 1860 1861 1862 1863 1864 1865 1866 1867 1868 1869 1870 1871 1872

1200
1100
1000
900
800

Fig. 1

