GOVERNMENT NOTIFICATION.—No. 281.

The following is published.

By Command,

J. H. STEWART LOCKHART,
Colonial Secretary.

Colonial Secretary's Office, Hongkong, 13th May, 1899.

Government of South Australia.

NOTICE TO MARINERS.

No. 2 of 1899.

ST. VINCENT GULF.

APPROACH TO PORT ADELAIDE.

Semaphore Anchorage.

Notice is hereby given that the Red Leading Light on the Flagstaff has been removed to the South side of the Water Tower, the line of bearing between the two lights being S.E. ¼ S., the same as before.

Note.—This affects Admiralty plan No. 1750.

THOS. N. STEPHENS,
President Marine Board.

Marine Board Offices, Port Adelaide, March 24th, 1899.

GOVERNMENT NOTIFICATION.—No. 282.

The following Report of the Director of the Observatory for 1898 is published.

By Command,

J. H. STEWART LOCKHART,
Colonial Secretary.

Colonial Secretary's Office, Hongkong, 13th May, 1899.

HONGKONG OBSERVATORY,
6th March, 1899.

SIR,—I have the honour to submit my annual report for 1898 to His Excellency the Governor. My fourteenth volume of "Observations and Researches" was published last autumn, and the fifteenth volume is now being printed. It contains synopses of fifteen years' meteorological and magnetic observations.

2. The typhoons in 1898 were above the average both with regard to number and intensity. The telegrams issued from here attained that year a maximum of efficiency. All necessary notices, and only necessary notices, were issued, so that the shipping was not needlessly disturbed. They were subsequently compared with entries in logbooks, and confirmed by such entries. In all 275 typhoons have now been investigated at this Observatory.

3. The comparison of weather-forecasts, issued daily about 11 a.m., with the weather subsequently experienced has been conducted on the same system as heretofore (Comp. Annual Report for 1896 § 5). We have :

Success 66 %, partial success 28 %, partial failure 6 %, total failure 0 %.

Following the method used in meteorological offices and taking the sum of total and partial success as a measure of success, and the sum of total and partial failure as a measure of failure, we find finally that :—

94 % of the weather forecasts were successful.

4. The China Coast Meteorological Register was printed every morning at the Observatory, and information regarding storms was telegraphed and exhibited on notice boards as often and as fully as such information could be justified by the weather telegrams received. This happened on 96 days in 1898. The Red Drum was hoisted 6 times, the Black Drum 1 time, the Red South Cone 2 times, the Black South Cone 5 times, the Red North Cone 0 times, the Black North Cone 0 times, the Red Ball 0 times, the Black Ball 5 times. The Gun was fired 3 times. Printed bulletins were circulated on 4 occasions.

5. Telegraphic connection with Victoria was interrupted on the 1st January, 1898, from 7.5 a. to 2.20 p.; on the 15th February from 10.8 a. to 10.24 a ; on the 12th March from 11.15 a. to 12.15 p.; on the 18th March from 10.7 a. to 10.20 a.; on the 28th March from 11.35 a. to 11.57 a.; on the 1st April from 12.37 p. to 1.48 p.; on the 2nd April from 12.30 p. to 2 p.; on the 29th April from 11.45 a. to Noon ; on the 5th July from 11.20 a. to 6.45 p.; from 2 p. on the 23rd to 10.10 a. on the 24th July ; on the 3rd October from 10.54 a. to 11.45 a. Interruptions occurred therefore on 12 days, and of course, also during thunderstorms. Telephone connection with the Peak was interrupted on the 6th February, 1898, from 2 p. to 8 p.; on the 28th April from 2 p. to 5 p., *i.e.* on 2 days as well as during thunderstorms.

6. During 1898 in addition to meteorological registers kept at 40 stations on shore, 3000 ship-logs have been copied on board or forwarded by the captains. The total number of vessels, whose log books have been made use of was 350. The total number of days' observations (counting separately those made on board different ships on the same day) was 24928.

7. The following is a list of ships from which logs have been obtained in 1898. The majority are steam ships, and the others are distinguished as follows :—bk., barque ; sh., ship ; bqt., barquentine ; sch., schooner :—Activ, Adolph Obrig (bk.), Adria, Airlie, Amara, Andalusia, Antenor, Argyll, Ariake Maru, Arizona, Armenia, Arratoon Apcar, Ask, Astral, Astrid, Asturia, Atlantic (sh.), Australian, Babelsberg, Balaarat, Baltimore (U.S.S.), Bankoku Maru, Bayern, Belgic, Benalder, Bengal, Benlarig, Benlomond, Benmohr, Benvenue, Bittern (bqt.), Blenheim (H.M.S.), Bombay, Bonaventure (H.M.S.), Bormida, Borneo, Boston (U.S.S.), Braemar, Brindisi, Broadmayne, Bullmouth, Bygdö, Candia, Canton (P. & O.), Canton (I.C.S.N.S.S.), Catherine Apcar, Celtic Bard (sh.), Centaur, Centurion (H.M.S.), Ceres, Ceylon, Changsha, Charleston (U.S.S.), Chelydra, Chihli, China (P.M.S.S.), China (German steamer), Chingkiang, Chingtu, Chingwo, Chiswick, Chiyoda Maru, Chi Yuen, Chowfa, Chowtai, Choysang, Chunsang, Chunshan, Chusan (P. & O.), Chusan (German steamer), City of Peking, City of Rio de Janeiro, Clam, Clara, Concord (U.S.S.), Concord (sch.), Coptic, Coromandel, Cosmopolit, Crown of Germany (bk.), Culgoa, Dagmar, Dardanus, Decima, Deike Rickmers, Deucalion, Deutschland (S.M.S.), Devawongse, Diomed, Doric, Drumeltan (bk.), Ebani, Edgar (H.M.S.), Elphinstone, Else, Empress of China, Empress of India, Empress of Japan, Esmeralda, Fooksang, Formosa, Framnes, Frejr, Fukui Maru, Fushun, Gaelic, Gefion (S.M.S.), Gerda, Germania, Ghazee, Gisela, Glenavon, Glenearn, Glenfalloch, Glenfarg, Glengarry, Glengyle, Glenogle, Glenturret, Grafton (H.M.S.), Guthrie, Hailan, Hailoong, Hainan, Haitan, Haimun, Hangchow, Hanoi, Hansa, Hektor, Hermes, Hertha, Hikosan Maru, Hinsang, Hiroshima Maru, Hohenzollern, Hoihao, Hongkong, Hongleong, Howard D. Troop (sh.), Hsiping, Humber (H.M.S.), Hunan, Hupeh, Hyson, Ichang, Idzumi Maru, Indrapura, Indravelli, Iolani (bk.), Iranian (bk.), Irene, Irene (S.M.S.), Jacob Christensen, Jacob Diederichsen, Japan, Jason, Java, Kachidate Maru, Kagoshima Maru, Kaiser (S.M.S.), Kaiserinn Augusta (S.M.S.), Kaisow, Kamakura Maru, Kanagawa Maru, Kansu, Kashing, Kawachi Maru, Kelat (bk.), Kensington (sh.), Keong Wai, Kiangnan, Kiev (R.V.F.), Kinai Maru, Kintuck, Kioto Maru, Kistna, Knight Templar, Knivsberg, Kongbeng, Konoura Maru, Kutsang, Kwanglee, Kweilin, Kweiyang, Königsberg, Leeyuen, Lennox, Letimbro, Likin (I.M.C.C.), Linnet (H.M.S.), Lion (French Man-of-War), Liv, Loksang, Loongmon, Loosok, Lothair (bk.), Loyal, Lyeemoon, Macduff, Machew, Malacca, Manila, Marie Jebsen, Maria Valeria, Marquis Bacquehem, Mary L. Cushing (sh.), Mathilde, Matsushima Maru (H.I.J.M.S.), Matsuyama Maru, Mazagon, Meefoo, Melbourne, Memnon, Menmuir, Merionethshire, Miike Maru, Mogul, Monadnock (U.S.S.), Mongkut, Monmouthshire, Monterey (U.S.S.), Moravia, Morven, Namyong, Nanchang, Nanyang, Naniwa (H.I.J.M.S.), Natuna, Nestor, Niobe, Oanfa, Ocampo, Oceana, Océanien, Olympia, Omi Maru, Onsang, Oopack, Oranje Prince, Orestes, Oslo, Oxus, Pakling, Paramita (sh.), Parramatta, Pathan, Patroclus, Pechili, Peiyang, Peru, Petrarch, Petrel (U.S.S.), Phra Chom Klao, Phra Chula Chom Klao, Phranang, Picciola, Pigmy (H.M.S.), Ping Suey, Plover (H.M.S.), Powerful (H.M.S.), Preussen, Prince Arthur (bk.), Priam, Prinz Heinrich, Progress, Pronto, Propontis, Quarta, Quickstep (bqt.), Ragnhild (sch.), Rattler (H.M.S.), Reuce (sh.), Richard Rickmers (bk.), Rickmer Rickmers (sh.), Rinsei Maru, Rio, Riojun Maru, Rohilla, Rosetta, Sabine Rickmers, Sachsen, Sagami Maru, Saghalien, Salazie, Sam Skolfield (sh.), Sanuki Maru, Sarnia, Sarpedon, Sendai Maru, Senta, Shanghai, Shantung, Siam (P. & O.), Siam (Danish S. S.), Siam (Shan S. S.), Singan, Singapore, Skitsushima, Socotra, Spinaway (bqt.), State of Maine (sh.), St. James (bk.), St. Mark (sh.), Stolberg, Suisang, Süllberg, Sultan, Sunda, Sungkiang, Sutlej, Swift (H.M.S.), Sydney, Szechuan, Tacoma, Taicheong, Taichiow, Taifu, Tailee, Taisang, Taiwan Maru, Taiyuan, Tamsui Maru, Tancarville, Tantalus, Teresa, Terrier, Tetartos, Thames, Tokio Maru, Toyo Maru, Tritos, Tsinan, Tyr, Venus, Verona, Victor (bk.), Victoria, Vindobona, Wakasa Maru, Waterwitch (H.M.S.), Westburg (bk.), Windsor Castle (bk.), Wosang, Wuotan, Yamashiro Maru, Yiksang, Yuensang, Zafiro, Zweena.

8. The entry of observations made at sea in degree squares for the area between 9° South and 45° North latitude, and between the longitude of Singapore and 180° East of Greenwich for the construction of trustworthy pilot charts has been continued, and 198785 observations in all have now been entered.

Table I.

Meteorological Observations entered in 10° Squares in 1893–1898 incl.

Square number.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	October.	Nov.	Dec.
19	1	0	0	0	0	0	5	1	0	0	0	0
20	28	11	7	41	23	10	6	8	7	40	23	22
21	22	22	51	39	41	1	10	2	7	28	19	36
22	8	3	12	28	35	25	29	10	0	11	0	1
23	223	260	82	48	14	1	105	78	34	48	68	172
24	366	270	335	318	245	258	493	419	325	456	476	356
25	181	116	120	106	137	115	147	136	124	311	299	189
26	2128	2006	2547	2494	3002	3055	3361	3556	3277	3247	2531	2347
27	0	0	0	2	1	1	0	2	3	1	0	0
55	20	29	26	16	18	46	30	29	16	10	12	12
56	19	51	30	12	24	40	49	50	12	32	19	10
57	29	57	38	55	42	34	57	32	12	54	22	26
58	41	43	91	51	71	55	39	53	19	33	52	40
59	118	126	114	36	69	90	101	68	20	95	130	84
60	236	230	216	154	142	219	338	254	165	196	160	164
61	2150	2040	2666	2484	3104	3483	3661	3736	3717	3623	3014	2437
62	1553	1701	1942	1876	2088	2152	2030	2054	2045	1999	1823	1723
63	7	10	11	14	16	17	14	9	13	13	1	3
91	36	50	40	54	11	24	21	30	35	39	58	74
92	51	55	45	52	12	13	12	19	35	24	60	68
93	41	49	37	22	0	11	1	26	28	29	30	50
94	28	39	6	29	1	12	4	16	38	15	22	19
95	61	101	53	73	70	61	32	31	54	87	48	98
96	1727	1503	1646	1686	2049	2044	2073	1955	1796	1972	1739	1591
97	793	726	910	803	928	1004	930	945	982	1008	986	871
98	251	221	248	260	325	377	350	345	385	343	319	295
127	127	58	82	86	65	48	94	85	86	103	104	68
128	133	69	97	105	72	76	107	112	84	145	139	95
129	151	82	138	163	90	117	104	134	92	170	186	145
130	357	259	366	285	442	445	509	497	385	459	425	366
131	416	325	442	441	457	550	561	637	450	520	457	326
132	1129	916	1333	1422	1945	2069	2542	2036	1867	2000	1823	1163
133	0	0	74	63	109	108	141	67	73	115	81	13
163	111	100	134	160	174	217	224	247	199	170	153	97
164	177	141	183	220	234	329	311	327	309	258	203	127
165	205	159	158	186	300	230	353	330	338	247	225	141
166	59	50	58	53	108	91	126	76	126	98	71	58
167	17	1	5	17	28	65	114	136	76	50	37	0
168	1	2	0	6	2	2	4	3	3	9	5	0
199	33	34	25	53	41	40	45	42	68	49	44	35
200	11	5	2	4	0	3	5	0	22	5	13	1
202	0	0	0	0	0	1	2	1	5	1	0	0
203	0	0	0	0	0	0	2	1	2	0	0	0
318	0	0	0	15	0	0	0	0	0	0	0	0
319	11	12	35	23	1	0	0	0	1	28	7	13
320	4	0	27	16	13	35	9	2	0	3	0	0
321	0	1	0	1	4	11	0	2	1	1	0	0
322	22	20	28	36	49	45	35	24	35	41	46	21
323	325	209	238	189	157	155	204	173	194	170	197	269
324	249	161	135	65	85	72	124	108	164	246	275	233
325	247	216	202	300	335	330	502	448	408	307	278	237
	13903	12539	15035	14662	17179	18287	20016	19352	18132	18909	16680	14091

9. As stated in the "Instructions for making Meteorological Observations, etc.," meteorological observations forwarded by observers who regularly send their registers to the Observatory are verified here free of cost. During the past year 5 barometers and one solar thermometer were verified. In addition, several hundred barometers and anëroids on board ship were compared with our standard, which has been occasionally checked by comparison with standard barometers verified at the Kew Observatory, and has at no time differed one thousandth of an inch from the British standard.

10. The mean values of the spectroscopic rainband (1-5) in 1898 were as follows:—January 1.35, February 2.07, March 1.81, April 2.23, May 2.10, June 2.67, July 2.19, August 2.35, September 2.33, October 1.74, November 1.40, December 1.00. Year 1.94.

11. In 1898 the number of transits observed was 2600. The axis of the transit instrument was levelled 215 times, and the azimuth and collimation were determined 67 times by aid of the meridian

mark erected in 1884. No measurable deviation of this mark from the true meridian has yet been detected. Mostly stars of southern declination, whose right-ascension is not very accurately known, have been observed, and it is intended when 20000 transits are available,—say in five years from now,—to form a catalogue of right-ascensions of about 2000 stars, so distributed that when the sky clears for only a couple of minutes a satisfactory determination of the time can be obtained. This is of great importance especially early in the year, when the sky is generally clouded here.

12. But with this view it is absolutely necessary that a fixed transit-circle be added to the equipment of this Observatory, the same as in other observatories. Such comparatively smaller centres of shipping as Madras and Perth (West Australia) have observatories supplied with fixed transit-circles, whereas the enormous shipping calling at Hongkong depends for its time and position and consequently safe navigation after leaving this port upon observations made with a small semi-portable instrument. I have already submitted to the Government that this defect ought to be remedied. A transit-circle is not only needed for determining time and longitude, but serves also to lay down geodetic bearings, latitude, right-ascension and declination. It can be used for observing earthquakes and would enable me to run a level right across the harbour, and otherwise contribute information required in survey work, which would be not only important at the present time but likely to be more and more useful in the future.

13. The sidereal standard clock was stopped on October the 7th in order to lessen the pressure of the electric contact springs on the teeth of the wheel attached to the arbor carrying the seconds' hand, the clock having previously tripped. The clock tripped again on the 30th October, the 18th November, and on the 1st December. After this the electric connections and the chronograph were overhauled. On November the 30th the rate was altered by adding to the pendulum a weight nearly equivalent to one second.—On the 19th August the cord of the standard meantime clock broke. Its driving weight is very heavy. On August the 22nd this clock was cleaned.

14. The errors of the time-ball are given in Table II. There were no failures in 1898. The ball is not dropped on Government holidays, and on March 6 it was not hoisted because a native computer did not attend to hoist it. On July 28th and August 17th it was not hoisted on account of strong E gales. It was dropped successfully 351 times in 1898. The probable error was in January ± 0ˢ.12, in February ± 0ˢ.31, in March ± 0ˢ.12, in April ± 0ˢ.12, in May ± 0ˢ.11, in June ± 0ˢ.10, in July ± 0ˢ.14, in August ± 0ˢ.12, in September ± 0ˢ.17, in October ± 0ˢ.16, in November ± 0ˢ.10, in December ± 0ˢ.13.

Table II.

Errors of Time-Ball in 1898.

− means too late. + means too early.

Date.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
1	...	0.1	0.1	0.1	+0.5	0.1	+0.2	...	0.1	0.1	0.1	0.1
2	0.1	0.1	−0.2	0.1	+0.3	0.1	+0.2	0.1	0.1	0.1	0.1	0.1
3	...	0.1	0.1	0.1	0.1	0.1	+0.2	0.1	0.1	0.1	0.1	0.1
4	−0.3	0.1	0.1	0.1	0.1	0.1	0.1	+0.2	−0.2	0.1	+0.2	0.1
5	−0.4	+0.3	0.1	0.1	0.1	0.1	0.1	+0.4	−0.2	−0.2	−0.3	0.1
6	−0.4	+0.2	...	0.1	0.1	0.1	0.1	+0.3	0.1	0.1	0.1	0.1
7	−0.2	+0.3	0.1	0.1	0.1	0.1	0.1	0.1	+0.2	0.1	0.1	0.1
8	0.1	+0.2	0.1	...	0.1	0.1	0.1	0.1	+0.2	+0.3	0.1	0.1
9	0.1	+0.4	+0.2	+0.2	0.1	0.1	0.1	0.1	0.1	+0.5	0.1	0.1
10	0.1	0.1	+0.2	...	0.1	0.1	0.1	0.1	0.1	+0.5	0 1	0.1
11	0.1	0.1	+0.2	...	0.1	0.1	0.1	0.1	0.1	+0.6	0.1	0.1
12	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	+0.3	+0.4	0.1	0.1
13	0.1	+0.3	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
14	0.1	+0.4	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
15	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
16	0.1	+0.3	+0.2	0.1	0.1	0.1	−0.3	0.1	0.1	0.1	0.1	0.1
17	0.1	+0.4	0.1	0.1	0.1	0.1	−0.3	...	0.1	+0.3	−0.2	0.1
18	0.1	+0.5	0.1	0.1	0.1	0.1	−0.2	0.1	−0.2	0.1	0.1	−0.2
19	0.1	+0.7	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
20	−0.2	+0.6	0.1	0.1	0.1	+0.2	−0.2	0.1	+0.4	0.1	0.1	0.1
21	0.1	+0.9	0.1	0.1	0.1	0.1	0.1	0.1	+0.3	0.1	0.1	−0.3
22	...	+1.0	+0.2	0.1	0.1	0.1	0.1	−0.2	+0.2	0.1	0.1	−0.4
23	0.1	+1.1	+0.4	0.1	0.1	+0.2	+0.2	−0.3	0.1	0.1	0.1	0.1
24	0.1	+1.2	0.1	0.1	...	+0.2	+0.2	0.1	0.1	0.1	0.1	0.1
25	0.1	0.1	0.1	0.1	0.1	0.1	+0.3	0.1	−0.2	0.1	−0.2	+0.4
26	0.1	0.1	0.1	0.1	0.1	0.1	+0.2	0.1	−0.3	+0.2	0.1	...
27	0.1	0.1	+0.2	+0.2	0.1	+0.2	0.1	0.1	−0.4	0.1	0.1	...
28	0.1	0.1	0.1	+0.3	0.1	0.1	...	0.1	−0.4	+0.2	0.1	+0.4
29	0.1	...	0.1	+0.3	−0.2	0.1	+0.3	0.1	−0.4	+0.4	0.1	+0.5
30	0.1	...	0.1	+0.4	...	0.1	+0.3	0.1	−0.4	+0.2	0.1	0.1
31	0.2	...	−0.2	...	0.1	...	+0.3	−0.2	...	0.1	...	0.1

15. Mr. J. I. PLUMMER determined the time, attended to clocks, chronometers, chronograph and time-ball and reduced transit observations. Mr. F. G. FIGG issued weather-forecasts and storm-warnings, drew storm-tracks, and made magnetic observations. Miss DOBERCK attended to marine meteorology, and the native assistant, under close supervision by Mr. FIGG and myself, attended to the meteorological instruments and the construction of meteorological tables, assisted by the native staff of computers and telegraphists.

16. The cisterns of the barograph and standard barometers are placed 109 feet above M.S.L. The bulbs of the thermometers are rotated 108 feet above M.S.L., and 4 feet above the grass. The solar radiation thermometer is placed at the same height. The rim of the rain-gauge is 105 feet above M.S.L., and 21 inches above the ground.

17. The monthly Weather Reports are arranged as follows :—

Table I. exhibits the hourly readings of the barometer reduced to freezing point of water, but not to sea level, as measured (at two minutes to the hour named) from the barograms.

Tables II. and III. exhibit the temperature of the air and of evaporation as determined by aid of rotating thermometers. Table II. exhibits also the extreme temperatures reduced to rotating thermometer by comparisons of thermometers hung beside them. Table III. exhibits also the solar radiation (black bulb in vacuo) maximum temperatures reduced to Kew arbitrary standard.

Table IV. exhibits the mean relative humidity in percentage of saturation and mean tension of water vapour present in the air in inches of mercury, for every hour of the day and for every day of the month, calculated by aid of Blanford's tables from the data in Tables II. and III.

Table V. exhibits the duration of sunshine expressed in hours, from half an hour before to half an hour after the hour (true time) named.

Table VI. exhibits the amount of rain (or dew) in inches registered from half an hour before to half an hour after the hour named. It exhibits also the estimated duration of rain.

Table VII. exhibits the velocity of the wind in miles and its direction in points (1—32). The velocity is measured from half an hour before to half an hour after the hour named, but the direction is read off at the hour.

Table VIII. exhibits the amount (0—10), name (Howard's classification) and direction whence coming of the clouds. Where the names of upper and lower clouds are given, but only one direction, this refers to the lower clouds. With regard to the names of clouds : nimbus (nim) is entered only when the rain is seen to fall ; when no rain is seen to fall cumulo-nimbus (cum-nim) is entered. This name indicates clouds intermediate between cum and nim. Cumulo-stratus (cum-str) is the well-known thunder cloud, while strato-cumulus (str-cum) signifies a cloud intermediate between stratus and cum. Sm-cum means alto-cumulus.

Table IX. exhibits for every hour in the day, the mean velocity of the wind reduced to 4 as well as 2 directions, according to strictly accurate formulæ, and also the mean direction of the wind.

Below this is printed a list of the phenomena observed.

18. The following annual Weather Report for 1898 is arranged as follows :—

Table III. exhibits the mean values for the year (or hourly excess above this) obtained from the monthly reports. The total duration of rain was 809 hours. There fell at least 0.01 inch of rain on 141 days.

Table IV. exhibits the number of hours during a portion of which at least 0.005 inch of rain (or dew) was registered.

Table V. exhibits the number of days with wind from eight different points of the compass. The figures are obtained from the mean daily directions in Table VII. of the monthly reports. Days with wind from a point equidistant from two directions given, are counted half to one of these and half to the other, *e g*, half of the days when the wind was NNE are counted as N, and the other half as NE.

Table VI. exhibits the number of days on which certain meteorological phenomena were registered, and also the total number of thunderstorms noted in the neighbourhood during the past year.

Table VII. shows the frequency of clouds of different classes.

Table VIII. is arranged as last year.

Table IX. exhibits the monthly and annual extremes.

Table X. contains five-day means.

I have the honour to be,
Sir,
Your most obedient Servant,

W. DOBERCK,
Director.

The Honourable
THE COLONIAL SECRETARY,
&c., &c., &c.

Table III.

Mean Values and Hourly Excess above the Mean of Meteorological Elements in 1898.

	1 a.	2 a.	3 a.	4 a.	5 a.	6 a.	7 a.	8 a.	9 a.	10 a.	11 a.	Noon.	1 p.	2 p.	3 p.	4 p.	5 p.	6 p.	7 p.	8 p.	9 p.	10 p.	11 p.	Midt.	Mean or Total.
Pressure.	+.005	—.005	—.014	—.016	—.011	+.002	+.017	+.031	+.043	+.044	+.033	+.016	—.008	—.028	—.042	—.046	—.042	—.033	—.019	—.001	+.012	+.021	+.021	+.015	29.812
Temperature,	— 1.6	— 1.8	— 2.0	— 2.2	— 2.3	— 2.3	— 1.9	— 0.7	+ 0.4	+ 1.4	+ 2.2	+ 2.7	+ 3.0	+ 3.1	+ 2.8	+ 2.3	+ 1.3	+ 0.3	— 0.1	— 0.4	— 0.6	— 0.9	— 1.2	— 1.4	72.2
Diurnal Range,	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	9.0
Humidity,	+ 6	+ 6	+ 6	+ 6	+ 5	+ 5	+ 3	0	— 3	— 5	— 7	— 8	— 8	— 8	— 7	— 6	— 3	0	+ 1	+ 2	+ 3	+ 4	+ 5	+ 5	75
Vapour Tension,	+.012	+.009	+.005	.000	—.003	—.006	—.008	—.010	—.012	—.011	—.012	—.011	—.010	—.011	—.006	—.004	+.001	+.004	+.007	+.010	+.011	+.013	+.015	+.014	0.628
Sunshine (Total),	...	...	...	...	...	10.8	90.6	170.4	190.4	208.3	221.3	225.9	225.5	224.0	219.4	199.0	116.9	23.7	...	...	...	...	...	...	2126.2
Rainfall (Total),	3.115	2.870	3.165	4.855	3.785	2.320	3.095	2.690	3.250	3.295	2.215	2.990	2.065	1.325	2.530	1.330	1.180	0.935	0.955	1.035	1.970	1.780	1.580	2.695	57.025
Hours of Rain (Total),	33	34	42	47	49	46	46	45	38	36	23	31	28	27	33	34	28	30	32	29	29	32	33	34	839
Intensity of Rain,	0.094	0.084	0.075	0.103	0.077	0.050	0.067	0.060	0.086	0.092	0.096	0.096	0.074	0.049	0.077	0.039	0.042	0.031	0.030	0.036	0.068	0.056	0.048	0.079	0.068
Wind-Velocity,	— 0.4	— 0.9	— 0.8	— 1.4	— 1.7	— 1.7	— 1.2	— 0.5	+ 0.4	+ 0.7	+ 2.2	+ 2.1	+ 2.0	+ 1.8	+ 1.5	+ 1.3	+ 0.8	— 0.3	— 0.6	— 1.0	— 0.7	— 0.6	— 0.5	— 0.3	12.4
Wind-Direction,	— 3°	— 2°	— 4°	— 6°	— 6°	— 5°	— 7°	— 8°	— 6°	— 5°	— 1°	+ 4°	+ 4°	+ 10°	+ 11°	+ 8°	+ 8°	+ 10°	+ 7°	+ 3°	— 1°	— 2°	— 3°	— 3°	E 11° N
Cloudiness,	+ 1	...	...	+ 1	...	...	+ 4	...	...	+ 2	...	...	0	...	...	+ 1	...	...	— 1	...	...	— 7	...	...	62
Solar Radiation,	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	128.2
Excess of do. do.,	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	51.0

Table IV.

Number of Hours during a portion of which it rained for each Month of the Year 1898.

Month.	1 a.	2 a.	3 a.	4 a.	5 a.	6 a.	7 a.	8 a.	9 a.	10 a.	11 a.	Noon.	1 p.	2 p.	3 p.	4 p.	5 p.	6 p.	7 p.	8 p.	9 p.	10 p.	11 p.	Midt	Total.
January,	...	5	3	7	2	4	3	3	3	3	2	3	2	2	3	3	3	3	4	4	5	4	3	4	78
February,	6	3	3	2	4	4	5	5	2	3	...	1	2	3	3	5	2	5	5	3	3	4	5	7	85
March,	...	...	1	1	3	1	1	2	1	1	...	...	...	...	1	1	1	...	1	1	1	1	1	1	20
April,	1	2	4	6	5	4	4	4	3	2	1	1	2	1	1	3	2	1	1	2	3	2	2	2	58
May,	3	4	4	5	5	5	5	5	6	3	2	2	1	1	3	3	1	3	4	1	...	4	2	1	73
June,	5	3	5	8	10	12	11	8	6	7	6	9	7	4	3	7	3	4	3	2	1	1	4	6	135
July,	6	6	6	8	7	4	6	8	3	7	5	5	6	5	6	4	3	6	4	4	4	2	3	3	121
August,	6	5	6	6	7	6	7	6	6	3	2	6	5	4	7	5	5	2	4	6	6	6	8	5	129
September,	3	3	4	2	1	2	2	1	2	3	1	...	1	2	1	2	2	...	...	1	1	2	2	1	39
October,	2	3	5	1	4	4	1	2	5	3	3	3	3	3	4	2	4	4	3	5	5	3	2	3	77
November,	1	...	1	1	1	...	1	1	1	1	1	...	1	1	1	1	1	1	3	...	...	1	1	1	21
December,	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	1	1	...	...	3
Total,	33	34	42	47	49	46	46	45	38	36	23	31	28	27	33	34	28	30	32	29	29	32	33	34	839

Table V.

Number of Days with Wind from eight different points of the Compass during each Month of the Year 1898.

Month.	N.	NE.	E.	SE.	S.	SW.	W.	NW.
January,	10	3	17	1	...	...	...	...
February,	5	3	17	1	1	1	...	...
March,	1	3	26	1	...	...	...	...
April,	1	7	19	1	...	...	2	...
May,	1	...	17	2	2	7	1	1
June,	...	1	9	2	7	9	2	...
July,	...	1	18	8	2	1	1	...
August,	1	4	8	5	2	5	6	...
September,	...	...	15	2	...	9	3	1
October,	16	4	6	1	...	...	2	2
November,	14	9	4	...	...	1	1	1
December,	8	3	16	1	...	...	1	2
Sums,	57	38	172	25	14	33	19	7

Table VI.

Total Number of Days on which different Meteorological Phenomena were noted and Total Number of Thunderstorms during each Month of the Year 1898.

Month.	Fog.	Electric Phenomena.	Lightning.	Thunder.	Thunderstorms.	Unusual Visibility.	Dew.	Rainbow.	Lunar Halo.	Lunar Corona.	Solar Halo.	Solar Corona.
January,	4	...	...	...	...	1	5	...	1	...	...	...
February,	11	...	...	...	...	...	4	...	...	1	1	1
March,	7	...	...	...	...	2	5	...	...	1	1	...
April,	6	5	5	3	2	2	6	...	...	...	...	...
May,	3	10	10	1	1	5	9	2	...	4	7	1
June,	...	25	23	17	7	1	...	6	5	4	7	1
July,	4	17	14	8	4	5	5	6	7	4	6	...
August,	5	20	20	7	4	2	10	6	5	6	10	1
September,	10	21	19	15	10	2	13	5	3	5	5	...
October,	4	1	1	1	1	1	3	1	2	1	3	...
November,	3	...	...	...	...	...	2	...	...	1	3	...
December,	4	...	...	...	...	...	1	...	...	...	...	...
Sums,	61	99	92	52	29	21	63	26	23	27	43	4

Table VII.

Total Number of Times that Clouds of different forms were observed in each Month of the Year 1898.

Month.	c.	c-str.	c-cum.	sm-cum.	cum.	cum-str.	str.	R-cum.	cum-nim.	nim.
January,	...	1	11	41	52	...	31	...	2	37
February,	...	1	12	41	74	...	27	2	8	47
March,	...	1	2	37	106	...	41	5	15	26
April,	...	2	18	57	99	...	25	7	11	44
May,	...	28	30	24	149	...	4	...	9	35
June,	...	29	58	26	162	1	5	3	14	55
July,	1	17	98	13	180	1	3	3	11	35
August,	...	34	73	47	168	1	8	5	7	35
September,	...	20	82	50	175	3	5	1	4	14
October,	...	11	41	53	90	...	28	1	3	29
November,	...	14	38	61	83	...	17	1	6	12
December,	...	1	13	27	41	...	5	...	3	2
Sums,	1	159	476	477	1379	6	199	28	93	371

Table VIII.

Month. 1898.	Barometric Tide.	Mean Diurnal Variability of Temperature.	Weight of Water Vapour in Troy Grains in each cubic foot of Air.	Rainfall. Mean.	Rainfall. 1898.	Hourly Intensity of Rain.	Mean Direction of Clouds whence coming. Lower.	Upper.	Cirrus.	Number of Days with Clouds below. 2000 ft.	1000 ft.
January, ...	0.108	2°.80	3.91	1.545	1.160	0.012	E 3° S	S 45° W	...	4	3
February, ...	0.097	2 .47	5.08	2.091	2.520	0.027	E 29° S	W 13° S	...	15	10
March, ...	0.110	2 .26	5.51	2.991	0.170	0.003	E 5° S	S 20° W	...	21	10
April,.....	0.096	2 .20	6.35	5.980	3.440	0.036	E 6° S	W 20° S	...	19	10
May, ...	0.090	1 .65	8.63	13.159	5.700	0.071	E 51° S	S 15° W	...	16	4
June, ...	0.079	1 .34	9.47	16.496	14.250	0.124	S 15° W	W 36° N	...	24	8
July, ...	0.068	0 .76	9.21	14.210	7.055	0.101	S 38° E	E 25° N	...	12	2
August, ...	0.075	1 .25	9.33	13.482	9.900	0.114	S 31° E	W 5° S	...	9	2
September, ...	0.088	0 .91	8.95	8.833	5.295	0.230	E 46° S	W 18° N	...	7	0
October,.....	0.093	2 .02	6.27	5.794	6.720	0.100	E 36° N	N 30° E	...	3	3
November,.....	0.105	2 .44	4.87	1.302	0.790	0.030	E 34° N	S 31° W	...	1	0
December, ...	0.111	1 .99	3.27	0.985	0.025	0.008	E 1° N	W 20° S	...	0	0
Mean,.....	0.093	1 .84	6.74	86.868	57.025	0.071	E 24° S	W 2° N	...	131	52

Table IX.

Monthly Extremes of the Principal Meteorological Elements registered during the Year 1898.

Month.	Barometer. Max.	Barometer. Min.	Temperature. Max.	Temperature. Min.	Humidity. Min.	Vapour Tension. Max.	Vapour Tension. Min.	Rain. Daily Max.	Rain. Hourly Max.	Wind Velocity. Max.	Radiation. Sun
January, ...	30.352	29.848	74.3	46.1	14	0.678	0.068	0.340	0.090	35	137.8
February, ...	.203	.421	77.2	46.6	13	.804	.070	1.190	0.400	36	127.6
March, ...	.084	.667	79.8	53.2	54	.772	.285	0.055	0.025	39	139.8
April,.....	.117	.653	86.3	57.9	42	.830	.307	1.645	0.500	46	141.7
May, ...	29.892	.495	91.5	64.9	44	.981	.390	2.350	0.635	37	148.2
June, ...	.725	.300	91.1	73.6	53	.992	.747	3.505	0.845	46	149.3
July, ...	.853	.344	88.7	76.3	49	.991	.611	1.270	0.340	50	149.8
August, ...	.784	.088	90.4	74.7	57	1.039	.701	2.585	0.780	62	153.6
September, ...	.890	.451	90.0	73.7	51	0.987	.606	0.990	0.545	26	150.4
October,.....	.954	.479	88.5	65.3	28	0.838	.308	2.320	1.070	30	154.4
November,.....	30.287	.606	82.8	50.6	11	0.679	.079	0.690	0.260	33	141.0
December, ...	.275	.875	79.7	50.0	7	0.527	.035	0.025	0.010	30	136.4
Year,.....	30.352	29.088	91.5	46.1	7	1.039	.035	3.505	1.070	62	154.4

Table X.

Five-Day Means of the Principal Meteorological Elements observed at Hongkong in 1898.

Five-Day Periods.	Barometer.	Temperature.	Humidity.	Vapour Tension.	Wind Velocity.	Nebulosity.	Sunshine.	Rain.
January 1– 5	29.965	63.6	85	0.502	11.5	8.2	3.1	0.074
„ 6–10	30.217	56.8	59	0.274	9.3	6.5	3.5	0.066
„ 11–15	29.987	64.3	78	0.480	9.1	6.8	4.0	0.061
„ 16–20	30.093	59.6	73	0.378	9.6	7.6	3.6	0.028
„ 21–25	.060	58.0	57	0.294	15.1	1.7	9.8	0.003
„ 26–30	.167	58.2	41	0.201	10.8	1.0	8.9	0.000
„ 31– 4	29.954	63.7	81	0.485	12.3	6.0	5.5	0.266
February 5– 9	.996	62.7	83	0.477	14.8	7.6	3.7	0.001
„ 10–14	.941	60.4	58	0.313	12.3	1.1	10.1	0.000
„ 15–19	.613	70.3	91	0.677	13.1	8.1	0.8	0.044
„ 20–24	.828	57.7	78	0.389	13.2	10.0	0.0	0.039
„ 25– 1	.987	61.9	76	0.440	12.5	6.3	4.1	0.104
March 2– 6	.873	60.7	88	0.472	22.3	9.7	1.2	0.012
„ 7–11	.966	61.7	79	0.437	16.8	9.2	1.1	0.004
„ 12–16	.918	61.9	76	0.422	10.5	3.5	7.6	0.000
„ 17–21	.830	64.9	84	0.516	14.9	8.7	1.5	0.004
„ 22–26	.938	66.0	80	0.520	15.0	6.7	4.6	0.011
„ 27–31	.822	70.2	87	0.644	13.5	5.8	5.1	0.003
April 1– 5	.878	67.8	83	0.571	14.8	9.4	1.9	0.001
„ 6–10	.901	64.2	85	0.511	16.4	9.7	0.0	0.218
„ 11–15	.997	67.8	66	0.456	11.8	3.9	7.0	0.000
„ 16–20	.782	75.1	84	0.736	5.5	5.8	7.2	0.000
„ 21–25	.797	69.6	87	0.626	22.5	9.4	1.1	0.465
„ 26–30	.838	70.4	83	0.618	21.3	9.3	2.5	0.004
May 1– 5	.770	71.5	77	0.597	13.3	6.0	6.9	0.352
„ 6–10	.682	79.6	82	0.834	8.0	5.6	10.1	0.003
„ 11–15	.700	76.3	90	0.816	20.5	8.7	3.5	0.704
„ 16–20	.671	79.2	89	0.892	10.7	5.7	7.6	0.039
„ 21–25	.818	80.4	84	0.870	11.3	4.3	9.1	0.042
„ 26–30	.750	82.6	76	0.845	5.7	2.3	11.6	0.000
„ 31– 4	.603	82.9	78	0.877	10.7	6.7	8.3	0.089
June 5– 9	.647	81.0	84	0.889	12.4	9.0	3.2	0.917
„ 10–14	.627	84.1	77	0.906	11.9	7.6	8.8	0.024
„ 15–19	.510	80.0	86	0.885	13.5	9.4	1.5	0.482
„ 20–24	.529	80.7	87	0.907	9.0	9.0	1.4	0.847
„ 25–29	.584	81.4	83	0.894	18.0	7.5	6.1	0.323
„ 30– 4	.583	80.8	84	0.876	22.0	8.5	5.6	0.443
July 5– 9	.699	81.6	81	0.872	14.0	6.4	8.9	0.190
„ 10–14	.742	82.1	76	0.832	8.2	4.3	9.9	0.012
„ 15–19	.694	82.5	78	0.866	8.3	5.7	7.7	0.197
„ 20–24	.675	81.9	83	0.902	8.0	6.0	7.1	0.110
„ 25–29	.549	81.6	79	0.857	21.8	7.3	4.6	0.363
„ 30– 3	.509	81.9	80	0.875	11.9	8.3	5.5	0.394
August 4– 8	.357	81.9	83	0.906	19.3	8.9	4.7	0.435
„ 9–13	.529	81.8	81	0.880	15.9	7.9	5.6	0.104
„ 14–18	.581	80.9	83	0.878	21.1	6.3	7.0	0.574
„ 19–23	.682	81.2	79	0.843	8.3	5.3	8.8	0.006
„ 24–28	.613	79.7	88	0.888	5.4	7.8	4.8	0.731
„ 29– 2	.630	83.0	80	0.910	7.5	5.9	8.8	0.198
September 3– 7	.759	81.3	82	0.874	5.7	5.8	7.5	0.124
„ 8–12	.752	79.8	81	0.829	7.8	6.4	6.7	0.276
„ 13–17	.718	79.9	83	0.850	9.7	6.3	6.3	0.146
„ 18–22	.782	81.1	75	0.795	10.4	3.4	9.9	0.000
„ 23–27	.828	80.9	81	0.854	6.0	8.0	4.7	0.280
„ 28– 2	.657	79.5	72	0.735	8.8	5.9	6.4	0.047
October..... 3– 7	.829	73.9	69	0.582	17.1	8.7	2.1	0.650
„ 8–12	.866	71.2	76	0.578	12.2	7.6	2.6	0.606
„ 13–17	.738	76.4	59	0.536	6.2	4.0	9.0	0.000
„ 18–22	.761	79.2	65	0.643	9.3	4.1	8.3	0.000
„ 23–27	.804	76.5	66	0.610	13.1	4.1	9.2	0.000
„ 28– 1	.867	71.5	72	0.561	12.6	9.2	2.1	0.076
November 2– 6	.888	70.7	81	0.608	15.3	8.9	2.7	0.150
„ 7–11	.893	71.1	57	0.438	14.8	6.9	4.9	0.008
„ 12–16	.701	73.8	62	0.518	6.2	6.2	4.3	0.000
„ 17–21	.830	71.5	64	0.498	8.8	4.5	7.6	0.000
„ 22–26	30.076	63.3	49	0.295	12.2	2.6	7.8	0.000
„ 27– 1	.118	65.6	47	0.301	12.3	2.9	8.5	0.000
December..... 2– 6	.021	62.1	42	0.238	8.7	0.2	9.4	0.000
„ 7–11	.047	63.4	57	0.340	14.4	1.4	8.3	0.000
„ 12–16	.097	59.8	27	0.144	12.2	0.2	9.2	0.000
„ 17–21	.048	63.7	63	0.369	13.4	4.4	6.1	0.005
„ 22–26	.105	60.3	55	0.292	8.4	2.4	8.0	0.000
„ 27–31	29.972	61.7	70	0.388	13.3	4.0	8.3	0.000

Appendix A.

Results of XV Years' meteorological observations made at the Hongkong Observatory.

In Appendix B to my annual report for the year 1893 (Observations and Researches in 1893 p. 20) are given ten years' means for the daily variation of the meteorological elements. The following table shows the fifteen years' means of the annual and monthly values of the meteorological elements. It also shows the probable upper and lower limits of certain of those values, so determined that in future years the actual values observed are as likely to fall outside as they are to fall within those limits. For instance, the mean temperature of January 1897 being 63°.1, by inspecting the following table, where the upper limit is given as 61°.1 for January, we learn that this month was unusually warm in 1897,—but the total rainfall for June 1896 being 18.630 inches while the upper probable limit for June is 22.792, we learn that this month was not unusually wet in 1896,—or the total rain-fall for May 1885 being 4.860, while the lower limit for the month is 5.178 shows that May was unusually dry in 1885. By applying the laws of chance a number of probabilities can be determined when such limits are known

Table XI.

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Mean pressure, ...	30.041	30.014	29.938	29.843	29.750	29.652	29.626	29.643	29.712	29.869	29.988	30.064	29.845
Upper limit, ...	30.070	30.052	29.956	29.859	29.765	29.682	29.652	29.668	29.745	29.893	30.020	30.092	29.854
Lower limit, ...	30.012	29.976	29.920	29.827	29.735	29.622	29.600	29.618	29.679	29.845	29.956	30.036	29.836
Mean pressure red. to M.S.L., ...	30.159	30.132	30.055	29.958	29.863	29.764	29.738	29.755	29.824	29.982	30.103	30.181	29.959
Mean pressure red. to M.S.L. and to 45°, lat.	30.103	30.076	29.999	29.902	29.807	29.708	29.682	29.699	29.768	29.926	30.047	30.125	29.903
Maximum.	30.367	30.390	30.308	30.158	30.045	29.880	29.882	29.851	29.984	30.157	30.311	30.444	30.444
Minimum, ...	29.686	29.421	29.552	29.576	29.447	29.284	28.762	29.088	28.876	29.089	29.575	29.757	28.762
Barometric tide,.....	0.107	0.106	0.103	0.093	0.085	0.071	0.068	0.073	0.080	0.091	0.102	0.109	0.091
Mean temperature,.....	59.7	57.7	62.2	69.9	76.6	80.7	81.6	81.0	80.4	76.2	69.2	62.4	71.5
Upper limit, ...	61.1	60.0	63.3	71.0	77.7	81.4	82.2	81.4	81.1	77.3	70.1	63.7	72.0
Lower limit, ...	58.3	55.4	61.1	68.8	75.5	80.0	81.0	80.6	79.7	75.1	68.3	61.1	71.0
Mean maximum,.....	64.1	61.7	66.4	74 5	81.2	85.2	86.2	86.0	85.3	80.7	74.3	67.5	76.1
Upper limit, ...	66.0	64.6	67.6	75.7	82.2	86.0	87.1	86.6	86.0	82.0	75.2	68.5	76.7
Lower limit, ...	62.2	58.8	65.2	73.3	80.2	84.4	85.3	85.4	84.6	79.4	73.4	66.5	75.5
Mean minimum,.....	56.0	54.5	58.9	66.7	73.5	77.4	78.0	77.3	76.6	72.5	65.3	58.3	67.9
Upper limit, ...	57.4	56.6	60.0	67.7	74.4	78.0	78.7	77.7	77.5	73.7	66.3	59.8	68.3
Lower limit, ...	54.6	52.4	57.8	65.7	72.6	76.8	77.3	76.9	75.7	71.3	64.3	56.8	67.5
Maximum,.....	79.2	79.0	82.1	88.6	91.5	93.6	94.0	92.9	94.0	93.8	85.6	81.9	94.0
Minimum, ...	32.0	40.3	45.9	55.6	64.1	69.2	72.1	71.6	65.6	60.8	50.6	40.7	32.0
Mean daily range, ...	8.1	7.2	7.4	7.7	7.7	7.8	8.2	8.7	8.7	8.3	9.0	9.2	8.2
Mean humidity, ...	74	79	84	85	83	83	83	83	77	71	65	64	78
Upper limit, ...	78	81	87	87	85	84	85	84	80	75	69	69	79
Lower limit, ...	70	77	81	83	81	82	81	82	74	67	61	59	77
Minimum, ...	5	11	24	20	35	34	47	46	25	22	10	7	5
Mean vapour tension, ...	0.391	0.390	0.480	0.633	0.772	0.873	0.892	0.880	0.800	0.648	0.477	0 372	0.634
Upper limit, ...	0.416	0.423	0.505	0.662	0.805	0.888	0 906	0.891	0.838	0.702	0.516	0.413	0.648
Lower limit, ...	0.366	0.357	0.455	0.604	0.739	0.858	0.878	0.869	0.762	0.594	0.438	0.331	0.620

TABLE XI.—*Continued.*

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Maximum,	0.748	0.804	0.825	0.900	1.011	1.053	1.118	1.060	1.057	0.953	0.870	0.741	1.118
Minimum,	0.035	0.036	0.129	0.174	0.314	0.372	0.548	0.562	0.257	0.177	0.067	0.035	0.035
Grains of water vapour,	4.31	4.32	5.27	6.85	8.25	9.26	9.44	9.32	8.49	6.92	5.16	4.09	6.81
Mean solar radiation,	113.3	104.2	112.6	123.5	133.5	137.5	139 8	140.2	140.0	135.4	128.9	120.0	127.4
Maximum solar radiation,	146.5	139.7	142.7	150.0	156.1	159.8	159.6	163.3	158.6	164.0	149.6	143.1	164.0
Mean excess over maximum,	49.2	42.5	46.2	49.1	52.2	52.3	53.6	54.2	54.8	54.6	54.6	52.5	51.3
Mean rain,	1.545	2.091	2.991	5.980	13.159	16.496	14.210	13.482	8.838	5.794	1.302	0.985	86.867
Upper limit,	2.607	3.269	4.478	8.808	21.140	22.792	19.224	17.851	12.201	9.395	2.366	1.664	104.439
Lower limit,	0.483	0.913	1.504	3.152	5.178	10.200	9.196	9.113	5.465	2.193	0.238	0.306	69.295
Maximum in 24 hours,	3.920	2.185	3.580	5.210	20.495	12.630	13.480	6.555	5.855	10.190	5.875	1.670	20.495
Mean maximum in 24 hours,	0.688	0.710	1.160	2.256	4.844	4.438	3.973	3.257	2.951	2.743	0.843	0.522	8.646
Upper limit,	1.175	1.092	1.717	3.209	7.704	6.923	5.775	4.304	4.389	4.471	1.527	0.906	11.700
Lower limit,	0.201	0.328	0.603	1.303	1.984	1.953	2.171	2.210	1.513	1.015	0.159	0.138	5.592
Maximum in 1 hour,	0.510	0.525	1.570	2.420	3.400	2.550	3.480	2.140	1.720	1.650	1.620	0.500	3.480
Mean maximum in 1 hour,	0.188	0.249	0.484	1.018	1.406	1.369	1.333	1.187	1.004	0.702	0.285	0.165	2.116
Upper limit,	0.304	0.385	0.770	1.505	2.030	1.962	1.837	1.546	1.298	1.027	0.502	0.287	2.588
Lower limit,	0.072	0.113	0.198	0.531	0.782	0.776	0.829	0.828	0.710	0.377	0.068	0.043	1.644
Hours of rain,	65	94	87	88	94	96	79	73	57	44	26	34	838
Upper limit,	91	127	109	110	116	122	98	91	72	67	42	52	934
Lower limit,	39	61	65	66	72	70	60	55	42	21	10	16	742
Wind direction,	E 15°N	E 14°N	E 8° N	E 2° N	E 11° S	S 39° E	S 43° E	S 33° E	E 15°N	E 21°N	E 29°N	E 27°N	E 3° S
Wind velocity mean,	14.4	15.0	16.5	14.9	13.5	12.5	11.5	9.6	12.2	14.7	13.8	12.7	13.4
Maximum,	46	53	49	46	42	48	108	66	89	85	49	63	108
Hours of sunshine,	136.7	77.7	79.5	110.7	152.1	155.4	197.6	197.2	200.1	214.5	196.2	189.7	1907.4
Cloudiness,	65	78	84	79	73	75	66	63	56	49	48	47	65
Upper limit,	74	88	92	84	79	80	71	68	61	57	57	58	68
Lower limit,	56	68	76	74	67	70	61	58	51	41	39	36	62
Direction of lower clouds,	E 2° S	E 8° S	E 25° S	E 44° S	S 22° E	S 2° W	S 9° E	S 2° E	E 3° S	E 11°N	E 15°N	E 4° N	E 32° S
Direction of upper clouds,	W16°S	W11°S	W18°S	W 9° S	W	N 30° W	N 40°E	N 32°E	N 33°E	N 20° W	W37°S	W25°S	W 23° N
Direction of cirrus clouds,	W	W	W	W 4° S	W 39° N	N 2° E	N 36°E	N 39°E	N 11°E	N 34° W	W34°S	W 7° S	W 42° N
Number of days with fog,	3	4	8	8	1	1	1	4	4	1	1	2	38
Number of days with electric phenomena,	0	0	4	9	12	17	18	20	13	3	0	0	96
Number of days with thunder,	0	0	3	6	6	9	9	10	6	1	0	0	50
Number of days with lightning,	0	0	3	7	11	16	17	18	12	3	0	0	89
Number of days with thunderstorms,	0	0	2	3	3	4	4	3	2	1	0	0	22
Number of days with rainbow,	0	0	0	0	1	3	5	4	2	1	0	0	17

TABLE XI.—*Continued.*

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Number of days with lunar corona, ...	2	1	1	2	4	6	6	5	5	3	3	2	39
Number of days with lunar halo, ...	0	0	1	0	2	4	6	6	4	1	1	0	26
Number of days with solar corona, ...	0	0	1	0	0	1	1	1	1	0	0	0	5
Number of days with solar halo, ...	0	0	1	2	2	5	7	7	4	1	1	0	30
Number of days with dew,	3	2	3	6	6	4	7	11	8	3	5	5	63
Number of days with unusual visibility, ...	1	2	2	2	3	4	4	4	3	3	3	2	33

Appendix B.

Magnetic Observations made during the year 1898, Comparison of Magnetometers and Means of 15 years' Magnetic Observations made in Hongkong.

The observations of declination and horizontal force published in Tables XII, XIII. and XIV. were made with magnet No. 55 on Kew pattern unifilar magnetometer Elliott Brothers No. 55 (unless otherwise stated) and with magnets No. 83 and 83A on magnetometer No. 83. The dip observations were made with dip-circle Dover No. 71, as usual.

The vibrations made with inertia bars published in Table XIV. furnish the moments of inertia by comparison with corresponding vibrations without the bars published in Table XIII.

The observations of horizontal force are expressed in C.G.S. units but the monthly synopsis in Table XV. exhibits also the vertical and total forces (computed by aid of the observed dips), and exhibits them also in British units and in Gauss's units. The value of log $\pi^2 K$ for 25° Cent. was for magnet No. 55 $3.44938 \pm .00007$ before cleaning, and 3.44901 ± 0.00009 after cleaning, for No. 83 3.44851 ± 0.00009, and for No. 83A. 3.46870 ± 0.00004. The induction coefficient used was, for No. 55, 5.189 ± 0.055, for No. 83, 5.151 ± 0.084, and for No. 83A, 6.160 ± 0.084. The temperature-reductions of m, the magnetic moments of the magnets, were as follows :—

No. 55 (Hongkong 1886) : $+ 0.000260t + 0.0000244t^2$

No. 83 (Kew 1897) : $+ 0.000283t + 0.0000102t^2$

No. 83A. (Kew 1897) : $+ 0.000384t + 0.00000166t^2$

The times of vibration exhibited in Tables XIII. and XIV. are each derived from 12 observations of the time occupied by the magnet in making 100 vibrations, corrections having been applied for rate of chronometer and arc of vibration. The vibrations made with the inertia bar are usually the mean of vibrations made before and after vibrations taken without the bar.

The mean value of the magnetic moment of magnet No. 55 was 0.44794 in British units and 584.82 in C.G.S. units.

Table XII.

Observations of Magnetic Declination and Dip.

1898.	H.K.M.T.	Declination East.	Magnet No.	Observer.	H.K.M.T.	Dip North.	Needle No.	Observer.
February, ...	12d. 3h. 4m. p.	0° 23′19″	83	F.G.F.	14d. 4h. 36m. p.	31° 35′.32	3	F.G.F.
	14 3 5 p.	24 43	55	„		34.92	4	„
	15 2 41 p.	24 42	55	„	15 3 57 p.	36.04	3	„
						34.45	4	„
	16 3 6 p.	24 55	55	„				
	3 45 p.	24 54	83	„				
April, ...	12 2 59 p.	22 35	83	„	12 4 21 p.	35.18	3	„
						35.84	4	„
	15 2 55 p.	22 47	83	„	15 4 28 p.	34.60	3	„
						33.77	4	„
	18 3 6 p.	23 15	83	„				
June, ...	13 2 57 p.	21 37	83	„	13 4 42 p.	36.85	3	„
	15 2 52 p.	21 48	83	„		32.75	4	„
	17 2 58 p.	21 53	83	„	17 4 22 p.	34.67	4	„
					21 4 22 p.	29.46	3	„
						31.03	4	„
					4 22 p.	* 32.25	3	„
August, ...	15 2 59 p.	21 23	83	„	12 3 44 p.	29.45	3	„
	16 2 50 p.	21 33	83	„		29.88	4	„
	19 3 15 p.	20 52	83	„	18 4 15 p.	31.03	3	„
						31.39	4	„
October, ...	12 3 5 p.	22 25	83	„	12 4 35 p.	33.76	7	„
	14 3 7 p.	22 22	55	„		34.06	8	„
	18 3 14 p.	22 15	83	„	17 4 2 p.	30.47	3	„
						32.82	4	„
December, ...	16 3 19 p.	22 35	83	„	19 4 30 p.	32.01	4	„
	19 3 15 p.	22 36	83	„		35.24	7	„

* Observed in 20° and 110° magnetic azimuth.

Table XIII.

Observations of Horizontal Magnetic Force made from the 1st January, 1898, till the 1st March, 1899.

Date.	H.K.M.T.	Time of one Vibration.	Temp. Cent.	Torsion.	Log m X.	Value of m.	Magnet. No.	H.K.M.T.	Dist. in cm.	Temp. Cent.	Deflection.	P.	Log $\frac{m}{X}$.	Value of X.	Observer.
1898—February 9, ...	3h 40m p.	3s.6272	18°.35	4'.74	2.33084	585.40	55	2h 41m p.	30	18°.15	6° 48' 0".0	5.899	...	0.36592	F.G.F.
									40		2 51 20 .0				
								4 44 p.	30		6 48 18 .7		3.20399		
									40		2 51 35 .0		3.20414		
„ 11, ...	4 42 p.	3.6295	21 .55	5 .50	2.33075	585.06	„	2 56 p.	30	20 .5	6 47 8 .7	...	...	0.36606	„
									40		2 51 0 .0				
								5 10 p.	30		6 47 27 .5		3.20349		
									40		2 51 20 .0		3.20382		
„ 12, ...	1 19 p.	3 .6276	19 .9	5 .58	2.33092	...	„	.....	...	...	.....	...	...	0.36603	„
„ 14, ...	12 55 p.	3 .6298	22 .8	4 .93	2.33093	...	„	.....	...	...	.....	...	...	0.36603	„
„ 15, ...	1 4 p.	3 .6307	22 .35	4 .34	2.33068	...	„	.....	...	...	.....	...	...	0.36593	„
„ 18, ...	3 39 p.	3 .6335	24 .35	2 .43	2.33059	585.10	„	3 4 p.	30	24 .5	6 47 12 .5	...	3.20413	0.36582	„
									40		2 50 52 .5		3.20381		
„ 21, ...	3 32 p.	3 .6302	19 .6	2 .53	2.33048	...	„	.....	...	...	.....	...	...	0.36585	„
„ 24, ...	3 27 p.	3 .6257	14 .85	3 .69	2.33071	...	„	.....	...	...	.....	...	...	0.36594	„
April 14, ...	3 36 p.	3 .6316	22 .5	3 .23	2.33059	585.20	„	2 56 p.	30	22 .35	6 47 37 .5	...	...	0.36584	„
									40		2 51 2 .5				
								4 17 p.	30		6 47 31 .2		3.20412		
									40		2 51 6 .2		3.20390		
May 11, ...	3 42 p.	3 .6355	29 .1	2 .51	2.33088	...	„	.....	...	...	.....	...	...	0.36612	„
„ „	4 58 p.	3 .6371	28 .65	2 .44	2.33041	...	„	.....	...	...	.....	...	...	0.36592	„
June 14, ...	3 34 p.	3 .6383	31 .7	2 .52	2.33071	584.79	„	2 59 p.	30	31 .3	6 45 5 .0	...	...	0.36618	„
									40		2 50 3 .7				
								4 11 p.	30		6 45 33 .7		3.20345		
									40		2 50 8 .7		3.20315		
„ 20, ...	3 57 p.	3 .6343	28 .0	2 .71	2.33095	584.82	„	3 19 p.	30	27 .65	6 45 41 .2	...	...	0.36638	„
									40		2 50 21 .2				
								4 37 p.	30		6 45 50 .0		3.20318		
									40		2 50 18 .7		3.20303		
July 19, ...	4 19 p.	3 .6379	31 .05	2 .46	2.33067	...	„	.....	...	...	.....	...	...	0.36627	„
„ „	5 44 p.	3 .6375	29 .75	2 .41	2.33054	...	„	.....	...	...	.....	...	...	0.36623	„
„ 20, ...	1 17 p.	3 .6417	32 .4	2 .49	2.33005	...	„	.....	...	...	.....	...	...	0.36602	„
October 14, ...	4 12 p.	3 .6384	28 .3	3 .74	2.32994	584.08	„	3 43 p.	30	27 .65	6 45 10 .0	...	...	0.36599	„
									40		2 50 21 .0				
								4 42 p.	30		6 45 26 .0		3.20270		
									40		2 50 31 .0		3.20328		
November 22, ...	1 22 p.	3 .6311	20 .4	5 .26	2.33017	...	„	.....	...	...	.....	...	...	0.36609	„
„ „ ...	3 53 p.	3 .6322	21 .45	5 .02	2.33011	...	„	.....	...	...	.....	...	...	0.36607	„
December 20, ...	3 49 p.	3 .6376	22 .25	5 .92	2.32851	...	„	.....	...	...	.....	...	...	...	„
„ 21, ...	1 3 p.	3 .6364	20 .8	6 .10	2.32853	...	„	.....	...	...	.....	...	...	...	„
„ „ ...	3 54 p.	3 .6360	21 .15	5 .70	2.32872	...	„	.....	...	...	.....	...	...	...	„
„ 22, ...	1 4 p.	3 .6361	21 .7	6 .14	2.32876	...	„	.....	...	...	.....	...	...	...	„
„ „ ...	3 50 p.	3 .6374	22 .3	5 .88	2.32855	...	„	.....	...	...	.....	...	...	...	„
„ 24, ...	.....	...	...	...	...	...	„	2 32 p.	24	21 .5	13 19 45.0	...	...	...	W.D.
									32		5 33 2.5				
„ 25, ...	.....	...	...	...	...	...	„	11 55 p.	24	20 .4	13 19 48.8	...	...	...	„
									32		5 33 20.0				
„ „ ...	.....	...	...	...	...	...	„	2 40 p.	24	20 .6	13 19 39.0	...	...	0.36659	„
									32		5 33 20.0				

TABLE XIII.,—*Continued.*

Date.	H.K.M.T.	Time of one Vibration.	Temp. Cent.	Torsion.	Log m X.	Value of m.	Magnet. No.	H.K.M.T.	Dist. in cm.	Temp. Cent.	Deflection.	P.	Log $\frac{m}{X}$.	Value of X.	Observer.
1898—December 26, ...	.....	...	...	...	...	...	55	12h 22m p.	24	20°.75	13° 20′ 3″.7	...	...	...	W.D.
									32		5 33 8.8				
„ 27, ...	.....	...	...	...	...	...	„	10 56 p.	24	18 .75	13 21 26.2	7.647	3.20030	...	„
									32		5 33 13.7		3.20030		
1899—January 3, ...	.....	...	...	...	...	...	„	3 53 p.	24	18 .8	13 20 40.0	...	...	...	F.G.F.
									30		6 45 40.6				
									40		2 50 20.0			0.36581	
„ 5, ...	.....	...	...	...	...	...	„	3 56 p.	24	19 .0	13 20 23.1	*2.464	3.20226	...	„
									30		6 45 30.6		3.20228		
									40		2 50 8.1		3.20228		
„ 4, ...	.....	...	...	...	...	...	„	3 57 p.	27	19 .3	9 17 50.0	8.163	...	...	„
									36		3 53 23.7				
									27		9 18 13.7		3.19988	0.36681	
									36		3 53 33.7		3.19989		
„ 13, ...	3h 48m p.	3s.6366	23°.5	6′.16	2.32896	581.80	„	3 21 p.	30	3 .05	6 44 53.7	7.615	3.20057	0.36661	„
									40		2 49 53.7		3.20058		
„ 17, ...	4 40 p.	3.6347	20 .5	6 .01	2.32891	581.62	„	2 51 p.	30	20 .5	6 45 6.2	...	3.20033	0.36667	„
									40		2 50 0.0		3.20039		
„ 18, ...	4 22 p.	3.6346	20 .0	6 .27	2.32882	581.80	„	2 50 p.	30	19 .4	6 45 36.2	...	3.20067	0.36648	„
									40		2 50 13.7		3.20077		
„ 19, ...	.....	...	...	...	...	...	„	3 45 p.	24	20 .1	13 20 1.2	...	...	...	„
									27		9 18 10.0				
									30		6 45 21.3				
									36		3 53 43.8				
									40		2 50 4.4				
1899—February 1, ...	.....	...	...	...	...	...	„	3 39 p.	24	19 .2	13 20 33.7	...	...	...	„
									27		9 18 17.5				
									30		6 45 30.0				
									36		3 53 40.0				
									40		2 50 8.7				
„ 2, ...	.....	...	...	...	...	...	„	3 47 p.	24	17 .0	13 21 1.3	...	...	...	„
									27		9 18 50.0				
									30		6 45 55.0				
									36		3 53 51.2				
									40		2 50 16.9				
„ 7, ...	.....	...	...	...	...	...	„	3 47 p.	24	19 .1	13 19 45.0	†9.010	3.20022	...	„
									27		9 17 46.2		3.20019		
									30		6 45 10.0		3.20022		
									36		3 53 27.5		3.20011		
									40		2 50 3.1		3.20019		
1898—February 8, ...	4 21 p.	3.0475	20 .85	0.48	2.48245	828.13	83	4 10 p.	30	20 .25	9 38 53.7	7.631	...	0.36673	„
									40		4 2 15.0				
								4 42 p.	30		9 39 7.5		3.35385		
									40		4 2 21.2		3.35366		
„ 9, ...	3 13 p.	3.0466	18 .3	0.54	2.48217	828.15	„	4 16 p.	30	18 .15	9 39 42.5	...	3.35402	0.36649	„
									40		4 2 43.7		3.35408		

* Q. = + 1473.

Q. = — 840.8

TABLE XIII.,—*Continued.*

Date.	H.K.M.T.	Time of one Vibration.	Temp. Cent.	Torsion.	Log m X.	Value of m.	Magnet. No.	H.K.M.T.	Dist. in cm.	Temp. Cent.	Deflection.	P.	Log $\frac{m}{X}$.	Value of X.	Observer.
1898—February 11, ...	4h 19m p.	3s·0474	20°.2	1'.47	2.48216	826.70	83	3h 44m p.	30	20°.05	9°36'30".0	...	3.35196	0.36712	F.G.F.
									40		4 2 1.0		3.35312		
„ 25, ...	12 59 p.	3.0485	16.7	1.36	2.48133	...	„	.....	...	...	.....	...	...	...	„
April 13, ...	3 29 p.	3.0606	23.4	1.27	2.47889	822.45	„	2 50 p.	30	23.4	9 35 1.2	...	...	0.36625	„
									40		4 0 36.2				
								4 43 p.	30	22.8	9 35 13.8		3.35142		
									40		4 0 47.5		3.35126		
May 9, ...	4 46 p.	3.0702	31.3	2.36	2.47733	...	„	.....	...	...	.....	...	...	...	„
June 16, ...	3 32 p.	3.0893	28.4	2.24	2.47147	807.68	„	2 57 p.	30	28.3	9 23 0.0	...	...	0.36663	„
									40		3 55 28.7				
								4 8 p.	30	28.75	9 23 7.5		3.34322		
									40		3 55 37.5		3.34280		
July 18, ...	4 17 p.	3.1031	28.65	2.43	2.46762	...	„	.....	...	...	.....	...	...	...	„
„ 19, ...	1 3 p.	3.1043	30.35	2.13	2.46759	...	„	.....	...	...	.....	...	...	...	„
August 15, ...	4 26 p.	3.1186	29.55	2.33	2.46345	792.34	„	3 49 p.	30	29.4	9 11 18.7	...	...	0.36689	„
									40		3 50 55.0				
								5 10 p.	30	28.9	9 11 53.7		3.33447		
									40		3 50 53.8		3.33427		
„ 16,.....	4 13 p.	3.1188	31.9	1.99	2.46379	792.56	„	3 42 p.	30	31.8	9 10 45.0	...	...	0.36707	„
									40		3 50 45.0				
								4 43 p.	30		9 10 47.5		3.33426		
									40		3 50 33.8		3.33426		
October 13, ...	3 50 p.	3.1389	28.35	2.45	2.45758	781.25	„	3 21 p.	30	27.45	9 3 40.0	...	...	0.36711	„
									40		3 47 39.0				
								4 27 p.	30		9 4 1.0		3.32807		
									40		3 47 45.0		3.32792		
November 23, ...	12 47 p.	3.1451	20.9	2.34	2.45474	...	„	.....	...	...	.....	...	...	...	„
December 16, ...	4 42 p.	3.1508	18.4	2.22	2.45279	773.50	„	4 12 p.	30	18.4	9 0 52.5	...	3.32422	0.36672	„
									40		3 46 27.5		3.32404		
„ 30, ...	1 8 p.	3.1493	20.9	4.71	2.45337	...	„	.....	...	...	.....	...	...	...	„
„ „ ...	3 37 p.	3.1501	21.2	4.60	2.45320	...	„	.....	...	...	.....	...	...	...	„
1899—January 9,.....	.....	...	...	...	...	...	„	3 52 p.	24	20.1	17 52 5.0	...	...	...	„
									27		12 24 46.2				
									30		8 59 45.0				
									36		5 10 40.0				
									40		3 46 1.9				
„ 10,.....	.....	...	...	...	...	...	„	3 47 p.	24	20.0	17 51 17.5	...	...	...	„
									27		12 24 12.5				
									30		8 59 32.5				
									36		5 10 27.5				
									40		3 45 51.3				
„ 11,.....	.....	...	...	...	...	...	„	4 2 p.	24	20.8	17 51 12.5	...	...	...	„
									27		12 24 1.2				
									30		8 59 11.3				
									36		5 10 20.0				
									40		3 45 43.1				

TABLE XIII.,—*Continued.*

Date.	H.K.M.T.	Time of one Vibration.	Temp. Cent.	Torsion.	Log m X.	Value of m.	Magnet. No.	H.K.M.T.	Dist. in cm.	Temp. Cent.	Deflection.	P.	Log $\frac{m}{X}$.	Value of X.	Observer.
1899—January 12, ...	.....	...	...	...	...	...	83	3h. 55m. p.	24	22°.3	17° 50′ 36″.3	*11.12	3.32247	...	F.G.F.
									27		12 23 56.2		3.32249		
									30		8 59 12.5		3.32247		
									36		5 10 17.5		3.32250		
									40		3 45 36.9		3.32247		
February 14, ...	3h. 2m. p.	3s.1538	20°.4	1′.63	2.45229	773.80	„	3 59 p.	27	19 .9	12 23 41.2	4.321	3.32503	†0.36616	„
									30		8 59 23.7		3.32491		
									36		5 10 43.8		3.32477		
									40		3 46 25.0		3.32512		
„ 15	4 18 p.	3.1564	23 .3	1 .34	2.45205	771.26	„	3 23 p.	27	23 .0	12 23 27.5	8.480	3.32283	0.36715	„
									30		8 58 8.8		3.32240		
									36		5 9 42.5		3.32245		
									40		3 45 16.3		3.32229		
1898—December 23, ...	3 41 p.	3.4199	20 .7	2 .26	2.40279	...	83A	.....	...	...	.....	...	...	...	„
„ 28, ...	1 17 p.	3.4192	22 .3	5 .43	2.40304	....	„	.....	...	...	.....	...	...	...	„
„ „ ...	3 49 p.	3.4214	23 .3	5 .00	2.40273	...	„	.....	...	...	.....	...	...	...	„
„ 29, ...	1 5 p	3.4201	22 .4	5 .34	2.40283	...	„	.....	...	...	.....	...	...	...	„
„ „ ...	3 41 p.	3.4199	22 .35	5 .20	2.40288	...	„	.....	...	...	.....	...	...	...	„
1899—January 13, ...	4 16 p.	3.4206	22 .7	5 .23	2.40280	689.10	„	2 43 p.	30	22 .7	7 57 43.8	5.353	3.27368	0.36687	„
									40		3 20 26.2		3.27356		
								4 47 p.	30	22 .3	7 58 1.3		3.27386		
									40		3 20 38.8		3.27394		
„ 17, ...	4 14 p.	3.4190	20 .65	5 .34	2.40277	688.57	„	3 42 p.	30	20 .7	7 57 38.7	...	3.27316	0.36712	„
									40		3 20 26.2		3.27312		
„ 18, ...	3 55 p.	3.4199	19 .7	5 .62	2.40231	688.38	„	3 28 p.	30	19 .5	7 58 3.7	...	3.27329	0.36684	„
									40		3 20 41.2		3.27340		
„ 20, ...	.....	...	...	...	...	...	„	3 49 p.	24	19 .75	15 43 51.2	...	...	...	„
									27		10 58 1.3				
									30		7 57 47.5				
									36		4 35 27.5				
									40		3 20 31.9				
„ 31, ...	.....	...	...	...	...	...	„	3 45 p.	24	19 .0	15 44 36.2	...	...	...	„
									27		10 58 0.0				
									30		7 57 53.8				
									36		4 35 30.0				
									40		3 20 33.1				
February 3, ...	.....	...	...	...	...	...	„	4 7 p.	24	19 .5	15 43 51.3	...	...	...	„
									27		10 57 38.7				
									30		7 57 25.0				
									36		4 35 10.0				
									40		3 20 21.3				
„ 6, ...	.....	...	...	...	...	...	„	3 50 p.	24	17 .8	15 43 43.8	4.843	3.27286	...	„
									27		10 57 28.7		3.27298		
									30		7 57 33.8		3.27308		
									36		4 35 22.5		3.27306		
									40		3 20 32.5		3.27303		

† Magnetic Disturbance.

* Q = —1294.

Table XIV.

Observations of Moments of Inertia of Magnets made from the 1st January, 1898, till the 1st March, 1899.

Date.	H. K. M. T.	Time of one vibration.	Temp. Cent.	Torsion.	Log T^2	Log $\pi^2 K$	Magnet No.	Bar No.	Magnetometer No.	Observer.
	h. m.									
1898 Feb. 12,.....	12 56 p.	5ˢ.8910	19°.45	7'.86	1.53982	3.44966	55	55	55	F. G. F.
„ „ 14,.....	1 18 p.	5 .8980	23 .25	6 .80	1.54015	3.44916	55	55	55	„
„ „ 15,.....	1 3 p.	5 .8991	22 .3	6 .49	1.54046	3.44907	55	55	55	„
„ „ 21,.....	3 31 p.	5 .9711	19 .6	4 .61	1.55125	3.44959	55	83	83	„
„ „ 24,.....	3 28 p.	5 .9640	14 .9	5 .81	1.55103	3.44943	55	83	83	„
„ May 11,.....	3 42 p.	5 .9058	29 .15	4 .41	1.54012	3.44948	55	55	83	„
„ „ „	4 59 p.	5 .9827	28 .7	4 .41	1.55144	3.44972	55	83	83	„
„ July 19,.....	4 19 p.	5 .9842	31 .05	4 .52	1.55125	3.44967	55	83	83	„
„ „ „	5 43 p.	5 .9822	29 .85	4 .46	1.55116	3.45002	55	83	55	„
„ „ 20,.....	1 15 p.	5 .9148	32 .2	4 .52	1.54090	3.44970	55	55	55	„
„ Nov. 22,.....	1 22 p.	5 .8991	20 .4	7 .30	1.54083	3.44922	55	55	55	„
„ „ „	3 30 p.	5 .9743	21 .3	7 .13	1.55167	3.44962	55	83	55	„
„ Dec. 20,.....	3 20 p.	5 .9114	22 .6	8 .30	1.54236	3.44887	*55	55	83	„
„ „ „	4 16 p.	5 .9530	21 .8	8 .28	1.54859	3.44862	55	83A	83	„
„ „ 21,.....	1 30 p.	5 .9098	21 .6	8 .27	1.54228	3.44895	55	55	83	„
„ „ „	12 38 p.	5 .9505	20 .3	8 .54	1.54847	3.44873	55	83A	83	„
„ „ „	3 23 p.	5 .9092	21 .2	8 .10	1.54225	3.44867	55	55	83	„
„ „ „	4 11 p.	5 .9505	21 .1	7 .80	1.54828	3.44875	55	83A	83	„
„ „ 22,.....	12 37 p.	5 .9064	20 .7	8 .69	1.54196	3.44907	55	55	83	„
„ „ „	1 34 p.	5 .9835	22 .3	8 .58	1.55296	3.44912	55	83	83	„
„ „ „	4 20 p.	5 .9089	22 .2	8 .23	1.54205	3.44931	55	55	83	„
„ „ „	3 24 p.	5 .9831	22 .5	8 .23	1.55285	3.44964	55	83	83	„
„ Feb. 25,.....	12 56 p.	5 .0185	16 .6	2 .00	1.40012	3.44859	83	83	83	„
„ May 9,.....	4 46 p.	5 .0527	31 .3	4 .38	1.40412	3.44907	83	83	83	„
„ July 18,.....	3 49 p.	5 .1090	28 .6	5 .14	1.41425	3.44830	83	83	83	„
„ „ 19,.....	1 5 p.	5 .1110	30 .5	4 .19	1.41422	3.44846	83	83	83	„
„ Nov. 23,.....	12 26 p.	5 .1755	20 .2	4 .60	1.42668	3.44876	83	83	83	„
„ Dec. 30,.....	1 12 p.	5 .1855	20 .9	6 .60	1.42840	3.44823	83	83	83	„
„ „ „	3 38 p.	5 .1872	21 .25	6 .45	1.42863	3.44812	83	83	83	„
„ Dec. 23,.....	3 43 p.	5 .5191	20 .7	3 .03	1.48165	3.46847	83A	83A	83	„
„ „ 28,.....	1 17 p.	5 .5161	22 .3	7 .12	1.48117	3.46886	83A	83A	83	„
„ „ „	3 50 p.	5 .5201	23 .3	7 .00	1.48160	3.46879	83A	83A	83	„
„ „ 29,.....	1 7 p.	5 .5179	22 .4	7 .33	1.48146	3.46875	83A	83A	83	„
„ „ „	3 44 p.	5 .5183	22 .4	7 .28	1.48152	3.46858	83A	83A	83	„

* Magnet No. 55 was cleaned and readjusted at the end of November, 1898.

In order to compare the results obtained with the different instruments it is necessary to know the probable errors so as to be able to judge how much of the difference is due to chance and how much to other causes. The probable errors may be estimated to be about the following: rate of chronometer 0ˢ.1, torsion (for 90°) 0'.1, temperature 0°.5, induction 2 %, observed period of vibration 0ˢ.0004, moment of inertia 0.00012, circle readings 10″, value of P 1.0. The following errors in the value of the horizontal force (expressed in units of the fifth decimal) are caused by these errors in the elements: by error of temperature 4, through vibration, and 4, through deflection, by induction-error 1, by vibration error 4, by moment of inertia 5, by defective circle readings 4, by wrong P 20. The probable error of a horizontal force is therefore about 0.00022. In England, where the horizontal force is only half of that in Hongkong, the probable error also ought to be about half of that in Hongkong.

From direct comparison of observations a smaller value of the error (say 0.00013) might be obtained as they are often reduced without changing K and P. The moment of inertia was determined at 25° Cent. for magnet 55 by using its own bar to be 3.44938 ± 0.00007 and by the bar supplied with No. 83 to be 3.44968 ± 0.00008. After cleaning it came out as 3.44901 ± 0.00009 by its own bar, as 3.44941 ± 0.00023 by the bar of 83, and as $3,44874 \pm 0.00005$ by the bar of 83A. These differences may be caused by minute internal cavities in the different bars. The moments of inertia adopted for each magnet have been observed with its own bar. A part of the differences of the results obtained with different magnetometers is due to this cause.

It has been suggested that the differences between magnetometers are due to traces of magnetic metals in the magnetometers. In Hongkong we have not found any perceptible difference between the old instrument made in 1883 and the new instrument made in 1897.

With reference to the induction coefficient, this has been obtained for both the horizontal and vertical position of the magnet by aid of the following formulæ:—

$$\mu_h = \frac{m \tan \frac{1}{2}(\phi - \phi')}{X \tan \frac{1}{2}(\phi + \phi')} \text{ and } \mu_v = \frac{m \tan \frac{1}{2}(\phi - \phi')}{\text{tani } X \tan \frac{1}{2}(\phi + \phi')}$$

The following refers to Magnet No. 55 :—

Year.	$\frac{1}{2}(\phi-\phi')$	μ_h	$\frac{1}{2}(\phi-\phi')$	μ_v	Year.	$\frac{1}{2}(\phi-\phi')$	μ_h	$\frac{1}{2}(\phi-\phi')$	μ_v
1886,.....	99″.99	5.286	60″.68	4.977	1892,.....	48″.20	4.722	35″.25	5.297
„	93 .28	5.463	60 .00	4.924	1898,.....	104 .37	5.411	69 .62	5 794
„	...	...	62 .20	5.113	„	104 .50	5.426	63 .75	5.299
1892,.....	97 .20	4.948	66 .90	5.498	„	97 .75	5.068	73 .87	6.112

We therefore have for magnet No. 55 $\mu_h = 5.189 \pm 0.055$ and $\mu_v = 5.377 \pm 0.093$ while the value obtained at Kew in 1883 was 4.9. Similarly we have for magnet No. 83 $\mu_h = 5.151 \pm 0.084$ and $\mu_v = 5.480 \pm 0.151$, while the value obtained at Kew was 4.962; and for No. 83A 6.160 ± 0.084 and 6.482 ± 0.151 while the value obtained at Kew was 6.047. The probable error of a single observed μ_h is 0.146, and of a single μ_v it is 0.262, so that the latter is about double the former because the vertical force is so small here. It will be seen from the table that a smaller value of the coefficient results from using smaller deflections, though the effect of this is so small that it may almost be attributed to chance. The induction coefficient of No. 55 shows no sign of change in course of sixteen years. No. 83 appears to have been made from the same steel tube, but No. 83A was made of another tube of different steel and shows larger temperature and induction coefficients. The values obtained at Kew, where the vertical force is large and where only vertical induction is observed, agree best with the values obtained at Hongkong, where the horizontal force is large, with the magnet horizontal. The differences between the values obtained in the two positions are larger than the probable errors of the differences and must be ascribed to the fact that the induced magnetism is not distributed over the magnet in the same manner as the permanent magnetism. Magnets destined for use near the magnetic poles ought therefore to be examined in the horizontal position at Kew.

The determination of P is very precarious and probably the difference between the results obtained with different magnetometers depends mainly upon errors made in the determinations of that constant which affects the third decimal of the horizontal force. Its determination is extremely liable to be vitiated by even small magnetic disturbances in horizontal force and still more by disturbances in declination. It does therefore not help matters much when P is separately determined each day, and the changes in P obtained in that way are evidently not to be trusted, even when the deflections have been observed with the greatest care, when the torsion has been reduced to a minimum, and precautions have been taken to protect the silk fibre from changes in humidity during the progress of the observations. According to Lamont's theory the lengths of the magnets are so selected as to make P very small, while no steps are taken to reduce Q, which being divided by the fourth power of the distance has an only minute effect on m : X. P and Q depend upon the "lengths of the magnets." If the magnet loses more magnetism near its middle than elsewhere, this "length" increases and *vice versa*, but when the progressive decrease of the magnetic moment has become so steady as in case of No. 55 it is not likely that changes in its P constant can amount to as much as the observations directly indicate. The effect of the P correction is very much decreased by observing at greater distances, for instance at 36 and 48, but at least in Hongkong even if m were kept as large as possible, the angles of deflection are then so much decreased that the observations must be indefinitely multiplied in order to attain to any accuracy especially on account of small magnetic disturbances. On the other hand it is scarcely legitimate to approach the magnets as close to each other as 24 centimeters.

From observations made with No. 55 at 5 different distances between January 19 and February 7, 1899, it follows that the correction to the horizontal force obtained with distances 30 and 40 only (P + 7.614) requires a correction of + .00011, while with 3 distances between January 3rd and 5th follows − .00018 (P 4.997). The correction to No. 83 from 5 distances, January 9 to 12, is + .00015 to the force obtained from 30 and 40 alone (P + 8.91). In case of 83A there seems to be no correction.

From 7 comparisons between 83 and 55, each used on its own magnetometer, it follows that the horizontal force obtained with the former exceeds that with the latter by $.00069 \pm .00008$, while from 3 comparisons between 83A and 55 the former exceeds the latter by $.00035 \pm .00004$. The former were compared throughout the year, the latter on only a few days, but the latter comparison was made

from simultaneous observations. As explained above the probable errors are not trustworthy. In course of time with changed P different results may be expected. These corrections are applied to all observations made with the new magnetometer.

Table XV.

Results of Magnetic Observations in 1898.

Month.	Declination East.	Dip North.	Magnetic Force.								
			English Units.			Metric Units.			C. G. S. Units.		
			X	Y	Total.	X	Y	Total.	X	Y	Total.
February, .	0° 24′ 31″	31° 35′ 11″	7.9389	4.8815	9.3197	3.6605	2.2508	4.2971	0.36605	0.22508	0.42971
April, ...	22 52	34 51	7.9312	4.8757	9.3100	3.6570	2.2480	4.2927	0.36570	0.22480	0.42927
June, ...	21 46	32 50	7.9415	4.8755	9.3186	3.6617	2.2480	4.2967	0.36617	0.22480	0.42967
August, ...	21 16	30 26	7.9442	4.8696	9.3180	3.6629	2.2453	4.2964	0.36629	0.22453	0.42964
October, ...	22 21	32 47	7.9424	4.8760	9.3197	3.6621	2.2482	4.2971	0.36621	0.22482	0.42971
December,.	22 36	33 37	7.9385	4.8763	9.3166	3.6603	2.2484	4.2958	0.36603	0.22484	0.42958
Mean, ...	0 22 34	31 33 17	7.9394	4.8758	9.3171	3.6607	2.2481	4.2960	0.36607	0.22481	0.42960

Table XVI. exhibits the means of 15 years' observations, but as no observations were made from May, 1890, till April, 1891, inclusive, less weight has been attributed to 1890 and 1891. The values for other months without observations were interpolated. All the results have been referred to the middle of the year by applying corrections for secular variation. The monthly means refer, as far as secular variation is concerned, to the middle of 1891. All the observations were made early in the afternoon, but as no correction for daily variation has been applied, the annual and semi-annual inequalities have not been determined.

Table XVI.

Means of Magnetic Observations made during 15 years in Hongkong.

Year.	Declination East.	Dip North.	Force.			Month.	Declination East.	Dip North.	Force.		
			X	Y	Total.				X	Y	Total.
1884...	0° 47′ 2″	32° 26′ 35″	0.36026	0.22902	0.42689	January, .	0° 35′ 46″	32° 4′ 9″	0.36289	0.22734	0.42824
1885...	45 10	26 22	.36021	.22894	.42681	February,.	35 29	3 22	.36297	.22730	.42827
1886...	42 57	25 32	.36063	.22909	.42725	March, ...	34 50	2 54	.36297	.22723	.42824
1887...	42 7	22 24	.36125	.22902	.42773	April, ...	34 4	3 5	.36297	.22726	.42825
1888...	40 59	20 58	.36131	.22884	.42769	May, ...	33 57	4 25	.36299	.22746	.42837
1889...	38 30	16 53	.36190	.22862	.42806	June, ...	34 0	4 6	.36309	.22748	.42847
1890...	37 20	8 38	.36233	.22767	.42792	July,.....	34 21	4 33	.36298	.22747	.42838
1891...	35 17	5 24	.36255	.22734	.42794	August, ...	34 0	4 25	.36284	.22736	.42821
1892...	33 33	3 31	.36352	.22767	.42893	September,	34 26	4 35	.36281	.22736	.42818
1893...	31 3	31 56 40	.36434	.22717	.42936	October,...	35 26	5 14	.36281	.22746	.42822
1894...	29 13	53 19	.36448	.22677	.42926	November,	35 53	6 2	.36290	.22763	.42841
1895...	27 47	46 54	.36479	.22595	.42913	December,	35 48	4 55	.36291	.22746	.42834
1896...	26 6	41 32	.36462	.22510	.42852						
1897...	23 25	37 03	.36546	.22498	.42916						
1898...	22 37	33 25	.36604	.22481	.42957						
Mean .	0 34 45	32 4 7	0.36295	0.22739	0.42831	Mean,.....	0 34 50	32 4 19	0.36293	0.22740	0.42830