

Appendix E.

REPORT OF THE DIRECTOR OF THE ROYAL OBSERVATORY, HONGKONG, FOR THE YEAR 1912.

I.—GROUNDS AND BUILDINGS.

The grounds were kept as tidy as the available coolie labour permitted. Provision for a gardener has been made in the Estimates for 1913.

The additions to the main building sanctioned in July were commenced on November 8.

Three rooms were colour-washed in the month of February, and electric light installed throughout the building.

II.—METEOROLOGICAL INSTRUMENTS.

Kew Barograph.—In the month of May this instrument was modified to give a scale of approximately 5 inches on the photographic paper for every inch rise or fall of the mercury in the barometer, and a scale was photographed on the register to facilitate measurement. In the month of December it was further modified to enable the photographic paper to run for 16 days without being changed.

Kew Thermograph.—Owing to the unsatisfactory exposure of the thermometers, registration with this instrument was discontinued on May 27, pending the construction of a suitable shelter.

Beckley Anemometer.—On February 7-8 this instrument was dismounted, cleaned, and oiled. A new gear wheel and endless screw were fitted in place of the old ones which were badly worn. In the month of December the instrument was modified to eliminate the errors of time scale and zero, inherent in its original form.

Dines-Buxendell Anemograph.—The method of determining the zero was altered at the end of July. Formerly the float was made to just touch the base of the water tank, without appreciable pressure, by placing a sufficient number of shot in the cup. But it was found that though this adjustment was made with the greatest care, after a few hours, if the taps were turned off, either the float did not fall sufficiently to touch the base of the tank, or, more frequently, it rested on it with quite appreciable pressure, as evidenced by the number of shot which had to be removed in order to re-adjust the float. It was therefore decided to adopt the method of adjustment given in the "Observers' Handbook", issued by the London Meteorological Office, namely, to add shot until

the float rests at a given level, as denoted by a mark on the stem. It has also been the practice, since March 1, to turn off the taps for 5 minutes at intervals of 6 hours, in order to check the time scale and to detect any change of zero. The exact times are written on the sheets and new base lines drawn through the recorded zeros. The hourly ordinates are measured from the new base lines.

As the instrument had to be tilted considerably to make the spindle float centrally, a light arm, 3 inches long, with an adjustable counterpoise at its extremity, was fitted to the penholder on November 17. This has corrected the defect.

In the month of December the instrument was modified to obtain both direction and velocity of the wind on the same sheet, and to allow the paper to run for an indefinite time. Arrangements were also made to time-scale the sheets electrically, by hourly impulses from a dial driven by the mean time clock; a cam on the minute arbor of the dial closing a circuit from the 60th to the 3rd minute of each hour. The current actuates the armature of an electro-magnet which lifts the pens from the paper.

The monthly results of comparisons with the records of the Beckley Anemograph, since the installation of the Dines instrument in April, 1910, are given in the following table:—

*Factor for Converting the Actual Run of the Beckley Anemograph
Cups to Velocities Recorded by the Dines Pressure
Tube Anemograph.*

Month.	Factor.		
	1910.	1911.	1912.
January, .....	.....	2'33	2'30
February, .....	.....	2'34	2'32
March, .....	.....	2'30	2'35
April,.....	.....	2'27	2'33
May,	2'23	2'25	2'34
June,.....	2'23	2'10	2'44
July,	2'14	2'21	2'57
August,	2'07	2'25	2'65
September,	2'18	2'31	2'49
October,	2'30	2'27	2'51
November,	2'28	2'27	2'47
December,.....	2'23	2'31	2'24
Year.	2'25	2'29	2'41

It will be seen that the factor was considerably greater from June to November, 1912, than in the two previous years, increasing steadily from May to August. It was also found that from the end of May to the middle of November the factor varied inversely with the velocity, whereas formerly it varied directly. Since the introduction of a counterpoise on the float spindle the factor has been nearly the same as in 1910-11, and no definite variation with velocity has been detected.

Halliwell Pluviograph.—After several unsuccessful attempts to make this instrument work satisfactorily, registration was discontinued on September 21.

III.—METEOROLOGICAL OBSERVATIONS AT THE OBSERVATORY.

Continuous photographic records showing the variations of barometric pressure are obtained with a Kew barograph, and automatic records of the direction and velocity of the wind with a Beckley and a Dines-Baxendell anemograph; the instruments having been modified as described in Section II. The amount of rain is recorded automatically by a Beckley pluviograph, the amount of sunshine by a Campbell-Stokes universal sunshine recorder and the relative humidity of the air by a small Richard hair hygograph.

Eye observations of barometric pressure, temperature of the air and of evaporation, and the amount of cloud were made at each hour of Hongkong local time. The character and direction of motion of the clouds were observed every three hours. Daily readings were taken of self-registering maximum and minimum and solar radiation thermometers.

Principal features of the Weather in 1912.—The year was characterized by a temperature $2^{\circ}8$ below normal in January and from 1° to 2° above from May to August. In the autumn the temperature was slightly below normal. The maximum, $91^{\circ}3$, occurred on September 10, and the minimum, $45^{\circ}3$, on December 28. The rainfall was above normal from January to March, and in August and December. In the remaining months it was below normal. A somewhat serious drought occurred from September 26 to November 27; only 0.02 inch of rain falling in this interval (0.10 inch on October 7, 0.005 inch on October 26, and 0.005 inch on November 15.) The total rainfall for the year was 63.935 inches against an average of 84.438 inches.

The Colony was not visited by a typhoon during the year, though five passed within 300 miles. The strongest typhoon wind, 43 m.p.h., occurred on September 5, with the centre of the typhoon 150 miles to south-westward. On March 13, the N.E. Monsoon attained a velocity of 46 m.p.h.

Fifteen typhoons and thirty-five less intense depressions occurred in the Far East in the year 1912. The tracks of the typhoons and the more important depressions will be published in the annual volume of Observations.

In the following table the rainfall at the Observatory is compared with the fall at the Police Station, Taipo, and the Botanical Gardens, Hongkong :—

Months.	Observatory (<i>Kowloon</i>).	Police Station (<i>Taipo</i>).	Botanical Gardens (<i>Hongkong</i>).
	<i>inches</i>	<i>inches.</i>	<i>inches.</i>
January,.....	2·710	3·370	3·280
February,	2·435	4·140	2·630
March,	4·345	3·350	4·360
April,	3·995	3·720	1·750
May,	3·940	5·180	5·810
June,	14·160	13·490	14·490
July,	7·555	9·760	7·000
August,	15·715	10·300	16·450
September,.....	3·880	3·740	4·850
October,	0·015	0·000	0·040
November,	0·285	0·230	0·440
December,	4·900	7·120	6·270
Year,	63·935	64·400	67·370

IV.—WEATHER FORECASTS AND STORM WARNINGS.

Daily Weather Report.—A weather map of the Far East, and the China Coast Meteorological Register, containing the Daily Weather Reports from about 40 stations in China, Indo-China, Japan, and the Philippines, and a daily weather forecast for Hongkong and District, the Formosa Channel, the south coast of China between Hongkong and Lamocks, and between Hongkong and Hainan, were issued daily as in former years. Copies of the map were exhibited on notice boards at the Hongkong Ferry Pier, the Blake Pier, and the Harbour Office. Since April 4 a copy has been sent daily to the Director of the Meteorological Observatory, Macao. Seventy copies of the Register were distributed to various offices, etc., in the Colony, and since November 18, a copy has been sent daily to the Director of the Meteorological Observatory, Macao. Copies are sent every week to the Hydrographic Office, Tokio, and to Lieut.-Commander Pradyat, Royal Siamese Navy; every 10 days to the

Director, Central Meteorological Observatory, Phulien, and every month to the Directors of the Weather Bureaus at Washington, Manila, and Melbourne. Additional Daily Bulletins are sent to the Local Press.

Daily Weather Telegrams.—In the month of February an attempt was made to establish uniform times of observation for the daily weather telegrams over the whole of China, and at my request the times were altered to 6 a.m. and 2 p.m. (120th meridian) at the following stations:—

Cape St. James.	Gap Rock.	Gutzlaff.
Tourane.	Waglan.	Zi Ka Wei.
Phulien.	Macao.	Wei Hai Wei.

At Sharp Peak, where the telegraph office does not open until 7 a.m., the hours of observation were altered to 7 a.m. and 2 p.m. As regards other stations under the control of the Chinese Maritime Customs, the Authorities, while appreciating the object of the scheme, thought it unadvisable to make the proposed change, as under existing conditions the improvement in synchronism would be at the expense of accuracy.

From March 15 the Manila weather telegrams for 6 a.m. and 2 p.m. were modified to show wind direction to 16 points instead of 8, and the reading of the wet bulb thermometer omitted.

By the courtesy of the Inspector General of the Chinese Maritime Customs, Changsha and Ichang were added to the list of telegraphic reporting stations in the month of June. Though the observations arrive too late to be included in the daily weather map, the previous afternoon's observations are of considerable value, except in cases of rapid weather changes.

Representations to the Chinese Telegraph Administration have led to an improvement in the transmission of weather telegrams from all reporting stations except Hoihow and Pakhoi, from which it appears to be impossible to obtain the observations with regularity or despatch. Apparently there are ten transmitting stations between Pakhoi and Hongkong, and eleven or twelve between Hoihow and Hongkong. It is not surprising therefore that delays occur.

For the prompt receipt of weather reports from these stations wireless telegraphy is necessary. It would also be of considerable benefit to install wireless stations at Yu-ling Kang on the south coast of Hainan, Swatow, Chelang Point, the Pratas Shoal, and the Paracels. Apart from the utility of the information thus obtained in connection with the ordinary daily weather forecasts, wireless messages from these stations would be a safeguard against the small but disastrous typhoons which occasionally strike the Colony without warning, and would ensure more accurate forecasts of the track and severity of practically every typhoon affecting Hongkong or the shipping leaving Hongkong.

Extra Weather Telegrams.—The service of extra telegrams during typhoon weather, hitherto confined to messages sent by the Director of the Manila Observatory at his discretion, and by the Director of the Taihoku Observatory on receipt of certain code words, was extended to Phulien, Macao, Amoy, and Sharp Peak, through the courtesy of the Authorities at these stations and of the Superintendent of the Eastern Extension Telegraph Company in Hongkong who made the necessary arrangements for the transmission of these telegrams at half rates over the lines of the Eastern Extension and the Great Northern Telegraph Companies. The French Telegraph Administration transmit the Phulien messages free over their lines.

From May to October the 9 p.m. observations at Swatow were forwarded to the Observatory by the Customs Authorities as in previous years, the Chinese Telegraph Administration making no charge for their transmission; but the messages were frequently delayed and sometimes not received.

By the courtesy of the Naval Authorities meteorological observations made on board His Majesty's ships were occasionally forwarded to the Observatory by wireless telegraphy.

Results of Weather Forecasts.—The results of comparison of the daily weather forecasts with the weather subsequently experienced are given below, together with the results for the previous five years :—

Year.	Complete Success.	Partial Success.	Partial Failure.	Total Failure.
	%	%	%	%
1907.....	57	32	10	1
1908.....	59	31	9	1
1909.....	58	32	8	2
1910.....	58	32	9	1
1911.....	55	32	11	2
1912.....	62	34	3	1

The forecasts comprise wind direction and force, and weather. Two elements correct constitute a partial success, and only one element correct constitutes a partial failure.

Storm Warnings.—Storm Warnings according to the "China Coast" code, and the local code, were displayed when necessary. Others according to the Hongkong telegraphic code were sent to the following Ports :—Amoy, Swatow, Macao, Canton, Phulien, Manila, Labuan, and Singapore. In addition to the above, special warnings were sent to Canton when typhoons approached within 300 miles of Hongkong.

In the month of May the "China Coast" code was modified so as to utilise 16 points of the compass in place of 8, when signalling the tracks of typhoons.

For the benefit of vessels taking shelter in Kowloon Bay and to the west of Stonecutters Island, arrangements were made early in the year with the Military Authorities and the Standard Oil Company, respectively, to repeat the local storm warnings at Lyemun and Lai-Chi-Kok.

V.—METEOROLOGICAL OBSERVATIONS FROM SHIPS, TREATY PORTS, &C.

Logs received.—In addition to meteorological registers kept at about 40 stations in China, meteorological logs were received from 334 ships operating in the Far East. These logs, representing 23,202 days' observations, have been utilised for determining typhoon tracks. The corresponding figures for the year 1911 were 348 and 24,653.

Comparison of Barometers.—During the year several hundred indirect comparisons of ships' barometers have been made, and direct comparison of barometers for various persons in the Colony.

Material for Pilot Chart.—The entry of sea observations into degree squares for the area 9° South to 45° North latitude and 100° to 180° East longitude has been discontinued except for squares containing less than 50 observations. For those containing more than 50 observations means are being formed and the observations collected into two-degree squares in place of one-degree squares. It is hoped that the material for a detailed pilot chart will be ready by the end of the year 1913.

VI.—MAGNETIC OBSERVATIONS.

Absolute determinations of magnetic horizontal force, dip, and declination were made near the middle of each month with instruments of the Kew pattern. Four dip needles were used in rotation, two on one day of each month.

A new mirror was fitted to the magnet of unifilar instrument No. 55 on January 5.

Beginning with the year 1912 the observations of horizontal force have been reduced by the aid of three tables; the first giving the correction to log. T. for varying chronometer rates and arcs of vibration (mean of the arcs at the beginning and end of the observations); the second giving the values of

$$\log. \pi^2 K - \log \left\{ 1 + \frac{H}{F} + \mu \frac{X_c}{m_c} - (qt + q't^2) \right\}$$

for varying values of t , when $(1 + \frac{H}{F} + \mu \frac{X_c}{m_c}) = 1.00354$, with a subsidiary table of corrections for any departure from this value, and the third giving the values of

$$\log. \left\{ 1 + \frac{2\mu}{r^3} + (qt + q't^2) + \log. \frac{r^3}{2} + \log. \left(1 - \frac{P}{r^2} \right) \right\}$$

for varying values of t , and two values of r , namely, 30 cms and

40 cms. The value of P used in this table was 7.05 (the mean of the past 3 years). The computations are considerably shortened by using these tables.

The mean values of the magnetic elements for the years 1911 and 1912 were as follows :—

	1911.	1912.
Declination (west)	0° 2' 26"	0° 4' 16"
Dip (north)	30 58 29	30 56 20
Horizontal Force (C. G. S. unit) ..	0.37145	0.37193
Vertical Force (C. G. S. unit) ..	0.22297	0.22294
Total Force (C. G. S. unit)	0.43324	0.43363

VII.—MISCELLANEOUS.

Time Service.—In February a proposal was submitted to Government for an improved Time Service, including an hourly signal to the Post Office for distribution to the various offices, etc., at a nominal charge.

Before any action was taken in the matter, however, the Manager of the China and Japan Telephone Company applied for a daily time signal to correct a recently imported electric transmitter with which he proposed to drive half-minute dials at various points in the Colony.

On the recommendation of the Director this application was approved, and in the month of December the Telephone Company laid an underground cable for this service from the Observatory to the telephone cable which connects Hongkong with Kowloon, and also re-modelled and re-wired the entire Time Service according to specification. The new system was brought into use on December 20.

Since the beginning of the year 1913 the Time Ball on Blackheads Hill has been dropped on Sundays and Government Holidays as well as on week days, at 13^h Hongkong Standard Time (5^h G.M.T.), arrangements having been made with the Harbour Master to have the ball hoisted by the Light Keeper stationed on the hill.

The Time Ball was dropped successfully 300 times in the year 1912. It failed on one occasion, December 16, owing to a break in the wire from the clock to the relay, which occurred after the noon test. The ball was not hoisted on March 13 and May 15 owing to gales. It fell with an error of 0s.3, or less, on 257 occasions, with an error of 0s.4 or 0s.5 on 30 occasions, with an error of 0s.6 or 0s.7 on 8 occasions. Errors of 0s.8, 0s.9, 1s.0, 1s.1 and 1s.2 occurred once. The probable error varied from $\pm 0s.33$ in January to $\pm 0s.11$ in May.

At the request of the Manager of the Kowloon-Canton Railway a time-signal has been sent to the Railway Station at 9.45 daily, since November 14. A time-signal is also telegraphed daily at 9^h

to the Office of the Eastern Extension Telegraph Company in Hongkong, and occasionally a special 9 a.m. signal is transmitted to Labuan.

Observations for Time.—Observations for time are made daily with the transit instrument, weather permitting. During the year 1912 the number of transits observed was 1,012. The errors of collimation, level, and azimuth were determined 52, 395, and 63 times, respectively. New spider threads were inserted on February 23 and October 15. On the second occasion they were fixed to the micrometer frame; formerly they were fixed to the wire plate. It is proposed to substitute a glass scale for the spider threads.

Clocks.—The Mean Time clock by Brock has proved useless as a Standard clock. After maintaining a fairly steady rate for one or two weeks its time-keeping becomes erratic, for no apparent reason. It is proposed to substitute an invar pendulum rod with a hardened lead bob in place of the present steel rod and heavy iron bob. In the month of November the clock was removed from the west Computing Room to the Clock Room. The performance of the Sidereal Standard clock (Dent No. 39741) was generally satisfactory except during disturbed and variable weather. The daily losing rate varied from $+0\cdot78$ on February 7 to $-0\cdot98$ on September 11, the temperature of the Clock Room on these days being $59\cdot3$ and $85\cdot8$, and the barometric pressure $30\text{ins } 19$ and $29\text{ins } 70$. The Time-Ball clock (Dent No. 39740) is corrected daily by the electric regulating apparatus, and its rate kept within $0\cdot5$ per day by the addition or removal of weights from the pendulum. A new Standard electric clock and three minute-dials have been ordered from Messrs. Gent and Co. of Leicester.

A discussion of the rates of the Standard Sidereal clock shewed that:—

- (a.) The adopted temperature co-efficient ($0\cdot063$ gain per day for an increase of 1° Fah.) was too large, and that the clock took an appreciable time to respond to the changes of temperature registered by thermometers placed on the side of the clock pillar opposite to the clock. There are at present no means of accurately determining the temperature of the pendulum.
- (b.) The barometric co-efficient, hitherto considered indeterminate, is at least $0\cdot5$ (gain per day for a decrease of 1 inch of barometric pressure).
- (c.) The effect of humidity is uncertain, owing partly to want of accurate determinations of the humidity within the clock case.

As temperature changes in Hongkong usually follow barometric pressure changes very closely, it is difficult to differentiate the effect of each on the clock rate. If the changes in these elements were perfectly correlated both as regards amplitude and phase, differentiation would be unnecessary; but in practice it is, on account of occasional imperfect correlation.

A new main spring was fitted to the mean time chronometer, Dent No. 40917, on August 18.

Special Work.—Special magnetic observations were made on May 12 at the request of the Superintendent of the Eastern Extension Telegraph Company in connection with a simultaneous series of observations of the strength, rate of change, direction, etc., of electrical earth currents in the cables between England and Hongkong.

At the request of the Naval Authorities two anemometers designed for use on board ship for calibrating guns, were tested at the Observatory in the months of June and July, and reported upon.

Special weather forecasts for Tongking Gulf were despatched to the Eastern Telegraph Company's repairing ship on August 31 and September 1.

Wind Force and Barometric Gradient.—A discussion of the wind force and barometric gradient at Gap Rock, taken from the Hongkong Weather Maps in 1910-12, gave the following results:—

Gradient.		Force (Beaufort scale).						Force (m.p.h.)	
·01 inch per 15 miles.	c.m.s. apart of 1 inch isobars on Hongkong weather Map.	Summer.			Winter.			Sum- mer.	Win- ter.
		1910.	1911.	Mean.	1910- 11.	1911- 12.	Mean.	Mean.	Mean.
		0·23	8·0	2·9	2·4	2·7	2·9	2·6	2·7	8·2	8·2
0·30	6·0	3·2	2·8	3·0	3·2	3·0	3·1	9·7	10·2
0·45	4·0	3·8	3·3	3·5	3·8	3·4	3·6	12·3	12·7
0·61	3·0	4·1	3·8	4·0	4·1	3·8	4·0	15·0	15·0
0·73	2·5	4·3	4·3	4·3	4·3	4·1	4·2	16·6	16·0
0·91	2·0	4·7	5·0	4·8	4·7	4·5	4·6	19·6	18·5
1·22	1·5	5·3	6·0	5·6	5·3	5·0	5·3	24·9	22·8
1·82	1·0	6·3	7·3	6·8	6·3	6·0	6·1	33·1	28·2
3·65	0·5	...	9·0	9·0	...	...	...	50·4	...

The Beaufort scale of force has been converted into miles per hour by means of the formula $v = 1·87 \sqrt{B^3}$, where v = the true velocity of the wind, *i.e.*, the velocity by the Beckley anemograph multiplied by 0·73.

Designation of Observatory.—In a despatch from the Secretary of State for the Colonies, No. 3309 of June 12, it was notified that His Majesty the King had been pleased to sanction that the Observatory should be styled the Royal Observatory, Hongkong.

Visitors.—On February 15 General de Negrier of the French Army visited the Observatory to discuss the question of atmospheric electricity in connection with its effect on aviation. Dr. C. K. Edmunds, the President of the Canton Christian College, visited the Observatory on his return from a magnetic surveying expedition in Indo-China and Siam in April. On September 9 Dr. Stanislaw Hanzlik, Professor of Meteorology and Climatology in the Imperial Bohemian University, Prague, visited the Observatory to discuss weather maps and forecasting. He proposed to visit the principal Observatories *en route* from Tokio to Prague. On July 17 His Excellency the Governor visited the Observatory to ascertain what additions to the buildings were necessary. Several Officers of the Navy and Army visited the Observatory in the course of the year, and many Commanders of vessels in Harbour called to make enquiries concerning the weather they were likely to encounter after leaving Hongkong. Similar enquiries were frequently made by telephone.

Commission for Maritime Weather Signals.—The Director was unable to accept an invitation to attend the Meeting of the Commission for Maritime Signals held in London in the month of September.

Staff.—Mr. F. G. Figg resigned the Office of Director on June 13, after 29 years' service. Mr T. F. Claxton was appointed Director on June 14. Mr. C. W. Jeffries was promoted to be Chief Assistant on the same date, and Mr. B. D. Evans, of the Royal Observatory, Greenwich, was appointed First Assistant on May 17. He arrived in the Colony on June 20.

Expenditure.—The annual expenditure on the Observatory for the past ten years is as follows :—

Year.	Total Expenditure.	Increase.	Decrease.
	\$ c.	\$ c.	\$ c.
1903	22,780.97	299.99	.....
1904	21,937.15	.....	843.82
1905	21,220.40	.....	716.75
1906	19,995.17	.....	1,225.23
1907	20,110.53	115.36	.....
1908	21,110.61	1,000.08	.....
1909	22,388.63	1,278.02	.....
1910	21,787.55	.....	601.08
1911	23,353.02	1,565.47	.....
1912	22,595.08	.....	757.94

Acknowledgments.—Acknowledgments are here made to the various persons and institutions who have contributed to the successful working of the Observatory during the past year. In particular to the Directors of the Weather Services in the Far East and

the Chinese Maritime Customs for daily observations and extra observations during typhoon weather, and for their kindly encouragement and help in my efforts to improve the Hongkong Weather Service; to the Telegraph Companies for transmitting the observations free of charge; to the Superintendents of the Eastern Extension Telegraph Company at Hongkong and Shanghai for their courteous co-operation; to the Officers of the Company at Cebu, Iloilo, Bacolod, and Malate, for making and transmitting observations twice daily; to the commanders of vessels who have furnished meteorological observations; and finally to the Observatory Staff for the manner in which they have carried out their respective duties.

T. F. CLAXTON,
Director.

1913, January 30.