No. 11.

Report for 1884 from the Government Astronomer.

Presented to the Legislative Council by Command of His Excellency the Governor.

HONGKONG OBSERVATORY,

1st *January*, 1885.

SIR,—For the information of His Excellency the Governor I have the honour to forward my annual report for 1884.

2. The necessity for an Observatory in Hongkong was recognised years ago. In 1879 the Royal Society suggested its establishment, and in 1881 a report was drawn up by Colonel PALMER, R.E., but his suggestions were not carried out, as the scheme submitted by him was considered to be too extensive for a beginning.

3. In May 1882 the Surveyor General submitted a report with reference to the Astronomical and Meteorological Observatory to the Secretary of State for the Colonies. The Astronomer Royal, to whom a copy of this report was forwarded, was of opinion, that the smaller and simpler scheme therein suggested, would suffice for present requirements, and that the most pressing needs of the Colony were a time-ball and a meteorological service. The Surveyor General's report received then His Lordship's approval, and early in 1883 I was appointed Director of the Observatory.—Meantime the Kew Committee, the Meteorological Council, the Meteorological Reporter to the Government of India and other authorities had opportunities of giving expression to their views on the subject.

4. I spent the following spring in inspecting the apparatus, that had been previously ordered or that I was instructed to order, and arranging details with the makers, as well as in studying the methods of observation adopted at the Royal Observatory, and the verification of meteorological and magnetic instruments at Kew.

5. The meteorological and magnetic instruments were ready before my departure from England. The Crown Agents for the Colonies arranged to have them carried without transhipment to Hongkong, and I started in June as passenger on the same steamer, accompanied by Mr. F. G. FIGG, who in the mean time had been appointed to be my first assistant.—The horological apparatus and the time-ball were not ready till long after my arrival in the Colony.

6. On my arrival here, I found the foundations of the Observatory already laid. In fact some progress had been made with the brickwork. The Surveyor General had selected the site some years ago, and it proved to be by far the best spot in the Colony for making scientific observations. The neighbourhood of the City of Victoria would not be suitable, as the mountains shut off from view a great portion of the southern sky, extending up to 25° of altitude, and for the same reason it is not possible to determine the true velocity and direction of the wind near the city. It is also likely, that the ferruginous rocks would deviate the plumb line, not to mention the magnetic needles.

7. I spent the following months partly in arranging details connected with the building and the foundations for the instruments, partly on a tour to the Treaty Ports of China, undertaken by order of His Excellency the Governor, to arrange to have meteorological observations made and regularly forwarded to the Observatory. The Inspector General of the Imperial Maritime Customs of China, who has contributed so much to forward the cause of science in that country, subsequently ordered a copy of all meteorological observations henceforth made in the harbours and lighthouses along the coast to be forwarded to me, and instruments of approved pattern are now being distributed among the stations.—It is certain, that not only the meteorology of China will benefit by Sir ROBERT HART's enlightened action, but the meteorology of the northern hemisphere will be forwarded, when reliable observations are made on a uniform plan in that extensive country.

8. The Observatory is built on the peninsula of Kaulung facing the harbour. It stands on the top of Mount Elgin, a small hill built up of decomposed granite, rising abruptly on all sides from the surrounding level ground and culminating in two prominences distant about 400 feet from each other. The top of the eastern prominence is flat, and forms, roughly speaking, a circle of about 200 feet diameter. Here the main building is situated. The magnetic hut is erected on the western prominence, the top of which was levelled and forms a rectangle 36 feet by 30 feet.

9. By the 1st January the main building was so far finished, that I could take up my residence there and start tri-diurnal meteorological observations. It is a rectangular block, 83 feet long and 45 feet wide (not including the transit room). The upper floor is devoted to my quarters. The ground floor comprises 4 rooms, each 20 feet long, 16 feet wide and 14 feet high, and 2 small rooms behind these. In the entrance hall are placed the telegraphic apparatus, through which the Observatory is connected with the Police Stations in Kaulung, and through them with the Central Police Station in Hongkong. To the right is my office, where the library is placed, contained in glazed teak-wood cases. The clock room, behind which is the galvanic battery room, is to the right of this. From the clock-room a door leads into the transit room. To the left of the entrance hall is the computing room, next to which is the instrument room, where the barometers, the barograph and the thermograph are placed, behind which is the photographic laboratory.—Every part of the two last rooms, including ceilings, floor and furniture, is painted dark red, and there are only a few panes of double red glass in the windows.

10. A one-storied block of outbuildings, containing servants' quarters, store-rooms, &c., communicates with the back-verandah by a covered passage.

11. The magnetic hut is 17 feet long, 13 feet broad, and the roof rises 11 feet high. It is made of wood, painted white outside and inside. Bamboo chips instead of nails were used in its construction as well as in the furniture. It has double doors, respectively louvered and glazed, to the north and south, and two windows on each side as well as two frosted glass windows in the roof, which throw light on the verniers. On top of massive teak-wood blocks sunk $3\frac{1}{2}$ feet in the ground and rising 4 feet above the floor are placed the unifilar magnetometer and the dip-circle. The former is placed north of the latter, and it is therefore convenient to observe the pole-star reflected from the speculum by opening the door. The sun and stars near the prime vertical can be observed through the windows on either side. The hut is very comfortable but is placed at an inconvenient distance from the main building. A broad road connects the two buildings and includes a bridge across the gap between the hills.—The magnetic observations are printed in my report of the 15th December (*Appendix* I to the forthcoming "*Observations and Researches in 1884*") and it is therefore unnecessary to make further reference to these observations.

12. As the time-service has not yet been started and as no astronomical observations have been published, it would appear most proper to defer the description of the astronomical instruments, some of which have not yet been erected.

13. The tri-diurnal meteorological observations, that were started at 10 a. on the 1st January, were continued up to the end of the year. In January and February observations were made at 10 a. 4 p. and 10 p. as printed in the *Weather Reports* for those months. In March and April they were made at 10 a. 1 p. 4 p. 7.45 p. and 10 p. From the 1st May till the end of the year they were made at 10 a. 1 p. 4 p. and 10 p. From the 1st April till the 1st October the standard barometer was generally read also at 1 a. Phenomena occurring at other hours including clouds of the *cirrus* type were also carefully noted.

14. The observations made at $7^h.\ 45^m.$ p. ($7^h.\ 0^m.$ a. Washington Mean Time) the epoch adopted for the International Simultaneous Meteorological Observations were transmitted to the Chief Signal Officer, U. S. A., Washington, D. C. They embrace the height of the barometer reduced to 32° Fahrenheit and to sea level, dry and damp bulb thermometers, relative humidity, direction and velocity of the wind, and also observations on rain, clouds and state of the weather. Since the 1st May only the latter observations were actually made at the time, it being preferred to read off the other elements from the curves described by the self recording instruments below described.

15. From the 1st January a new series of meteorological observations made according to my "Instructions for making Meteorological Observations" were commenced at different points in the Colony: At Victoria Peak observations of the barometer, dry and damp bulb thermometers, direction and force of the wind, clouds, sea and state of the weather are made at 7 a. 10 a. 1 p. 4 p. 7 p. and 10 p. The results for 10 a. 4 p. and 10 p. are published in the monthly reports. At the latter hour the self-registering thermometers including black bulb and grass minimum are read. The rainfall is collected in two gauges. One of them is an old roof-gauge. The other is placed one foot above the ground. Only the results from the latter are published.

16. Those observations being made at so high a level are of considerable importance, and it is to be regretted, that the authorities have not yet made arrangements for having observations made also at 4 a. In the absence of self-recording instruments the observations are not complete without the 4 a. observation. It would moreover be desirable at some future time to erect a self-recording anemometer on the look-out similar to the one on top of the Observatory. The comparison of the two records would clearly reveal certain most important features connected with the wind prevalent at different altitudes above sea level, which would deepen our insight into the law of storms in the China Sea.

17. At Cape d'Aguilar observations of thermometers, wind, clouds, sea-surface and weather are made at 4 a. 10 a. 4 p. and 10 p. as published in the monthly reports, but as these observations are wanting in accuracy, their publication with the exception of the state of the sea-surface, will be discontinued next year.

18. At Green Island the wind, clouds, sea-surface and weather are observed at 4 a. 10 a. 4 p. and 10 p. As the island is within 4 miles of the Observatory the station is not supplied with instruments, but the observer appears to be doing his best. At Stone Cutters' Island, which is within 2 miles of the Observatory but at a much lower level, the rain is measured at 10 a. as published.

19. All the observations made at these four stations are revised, corrected and reduced at the Observatory, and the instruments &c. are occasionally inspected.

20. The *barograph* was erected in March and worked without interruption since the 1st April. The slab is placed on a teak-wood table, which is firmly screwed to the floor.

21. The image of the flame of a Kerosine lamp, enlarged by a condenser, is thrown upon the void space, narrowed by a slit, above the mercury of a barometer of about three quarter inches internal diameter. By means of a photographic lens an image of this illuminated slit is thrown upon a cylinder covered with a sheet of sensitised paper, 23 inches long and $5\frac{3}{4}$ inches wide, which is revolved by a clock work, so that the portion covered by the image moves 0.364 inch an hour, the clock work moves also a shutter, that cuts off the light of the lamp from two minutes before, till two minutes after every even hour. The upper edge of the inverted image of the slit rises or falls as the mercury falls or rises in the barometer, but the lower edge is not permanently fixed, but rises or falls as the temperature of two zinc rods, fixed beside the barometer, falls or rises, and by aid of an adjustable glass lever the amount of displacement of the edge is made exactly equal to the temperature correction, that otherwise would have to be applied to the hourly readings.

22. The paper may be kept on the cylinder for two days, after which it has to be changed,—this being invariably effected between 10 a. and 11 a.,—developed, fixed, washed and dried. The photograph is ready to be measured three days after being removed from the cylinder. It is then placed between two glass plates in the *tabulator*, and the distances between the upper and lower edges of the blackened portion of the paper, which is interrupted by the two-hourly white lines, are read off at every hour or oftener, if required, by aid of a vernier capable of being read to 0.001 inch, two fine wires fixed in empty sight-tubes being made to cover the respective edges.

23. The standards of reference are obtained from 10 a. 1 p. 4 p. and 10 p. readings of the standard barometer, corrected and reduced to 32° Fahrenheit. From the 1st April till the 1st September the 1 a. readings were also made use of, but experience proved this to be superfluous. The nominal inches on the tabulator should be greater than true inches in the same proportion as the magnified image of the slit is greater than the true image, which is about $1\frac{1}{2}$. Experience shows, that this has not been strictly attained. The nominal inches are 1.594, whereas they should be 1.534 inches long. But as the pressure here nearly always changes very slowly and regularly within 24 hours, it is not necessary to know this proportion with great accuracy, and it is for the same reason difficult to determine it. The above number was derived from observations made during the Typhoon in September and agrees with other observations.

24. The room in which the barograph and the standard barometer are placed is carefully shut up, so that the daily range of temperature is reduced below half a degree. Three large Kerosine lamps, always burning in the room, raise its temperature in winter a couple of degrees above the temperature of the air outside, while in summer the room is colder than the air. The temperature is observed by reading a carefully verified thermometer immersed in mercury in a test-glass of the same diameter as the barograph barometer. The constancy of the temperature favours the accurate co-operation of the different parts of the apparatus, which are at a uniform temperature, just as a clock goes better in a room, where the temperature does not change much, because the different parts of the pendulum have the same temperature.

25. The barogram readings are entered in a journal kept in the computing room. The figures are corrected for the scale-error of the tabulator, and when reduced to standard by comparison with the readings of the standard barometer (corrected and reduced to 32° Fahrenheit), they are entered in the tables printed in the monthly reports.

26. The *thermograph* was erected in March and worked without interruption since the 1st April. The slab is placed on massive teak-wood blocks, firmly screwed to a slab of granite, which rests on solid masonry.

The bulbs of the recording thermometers (dry and damp bulb) are placed in a zinc screen outside the northern window of the instrument room, which is substantially boarded, and in which are also placed two thermometers with bulbs,—dry and damp,—of similar dimensions. These have been carefully verified at different temperatures by comparison with our standard thermometers. The tubes of the recording thermometers are bent and enter the instrument room through two slots (5.6 inches long, 1.2 inches broad and 9.2 inches asunder) bored in the boards. They then rise vertically and are held by pieces of brass, which may be raised or lowered to some extent. The slots are filled with non-conductive material, so that no air can pass out from the room. An airspeck is introduced into the mercury of each thermometer. These airspecks are photographed on the cylinder. A lamp is placed on each side of the thermograph, whose lights are condensed by lenses and reflected towards the cylinder from mirrors, placed on the slab behind the thermometer tubes. The light penetrating through

the airspecks is narrowed by slits, and the same arrangement is made to obtain the photographic record as in case of the barograph, but the photograph exhibits in this case two curves, which represent the heights of the dry and damp bulb thermometers interrupted by the two-hour lines. The record of the damp bulb is placed vertically under that of the dry, so that there is only one time-scale. One or two *zero lines*, from which to measure are obtained by allowing the light of either lamp to shine through a small hole in either of the frames, in which the slits are cut.

27. The photographic sheets obtained from the thermograph are treated exactly as those obtained from the barograph. When they are dry the distances of the points on the curves from the zero line are read off by aid of glass scales graduated to degrees. The temperature in either case corresponding to the zero line is obtained daily by comparison with the simultaneous readings of the thermometers in the screen, which are corrected before being entered in the thermograph journal. The degrees on the reading scales should be larger than the degrees on the thermometers in the proportion, in which the images are magnified by the photographic lens. This has been attained in case of the damp bulb, but the degrees on the dry bulb scale must be multiplied by 0.980 in order to represent the readings of the thermometer. A correction is applied for this before the readings are entered on the tables printed in the monthly reports.

28. In order to prevent by any possibility a mistake in the date of the photographic sheets, the weekday, month and date are written on the back of every sheet, as it is removed from the cylinder.—Before my appointment the Crown Agents for the Colonies had ordered the barograph and the thermograph as well as the anemograph through the Meteorological Office. The tabulator, reading scales &c., were subsequently ordered at my suggestion as well as the pluviograph. Unfortunately a large stock of waxed paper had also been supplied by the Secretary to the Meteorological Office, who was not aware, that argento-bromide paper had for years been successfully adopted in India. Now the necessity for iodising and sensitising every photographic sheet has caused a deal of trouble during the damp and hot season. The sensitised sheets were found not to keep for two days on the barrel. The sheets had then to be changed every day. Even the iodised sheets did not keep for any length of time. Only freshly iodised sheets could be sensitised with any certainty of success, and this added enormously to the labour a great part of the time of the second assistant being taken up by this work. Even when every precaution was taken, the result was not nearly as good as during the winter. Tannin, as recommended by Chambers, was tried, but made no improvement here. A supply of MORGAN & KIDD's argento-bromide paper has now been ordered, and thus the trouble of iodising and sensitising the sheets will be saved.—Another cause of occasional failure rests with the Kerosine lamps, but the new paper being so much more sensitive, the lamps are not likely to give any trouble, when the new process is introduced. It may also be found possible to secure Kerosine oil of superior quality. No great difficulty was encountered in keeping the damp bulbs constantly wetted, but occasionally the bulbs were found to be dry.

29. The clocks of the barograph and the thermograph were rated by shortening the pendulums, but it was found inconvenient to shorten them sufficiently. The outstanding error was corrected by laying suitable pieces of iron and a few small leaden weights on the flat upper surfaces of the bobs, the rates being subsequently kept constant by adding or removing one or more of the small weights. This arrangement proved so satisfactory, that the clocks when accurately started one morning were in by far the greatest number of cases found as accurate next morning, and the error seldom exceeded half a minute, and never 45 seconds.

30. The *anemograph* was erected in the course of January and worked without interruption since the 1st March. It is erected on a turret, built of strong teak-wood timber, fastened to the roof of the house by massive iron bolts. The turret rises 8 feet above the flat roof of the main building.

31. This instrument registers the number of miles traversed by the wind and also its direction. It consists of a ROBINSON's anemometer of large size, the cups of which are 45 feet above the ground and 155 feet above mean sea level. The shaft carrying the cups is supported by friction balls running in a groove on top of the direction shaft and terminates in an endless screw, which working through toothed gearing drives a cylinder in the turret, round which a thin strip of brass forming a screw is wrapped. Round another larger cylinder, which is driven by a clockwork, is wrapped the metallic paper, on which the space traversed by the wind is recorded by the screw-shaped pencil, which rests on it with part of the weight of the cylinder round which it is wrapped. The pencil has only one turn on this cylinder and its pitch is $2\frac{3}{4}$ inches long, equal to a scale of 50 miles printed on the paper. ROBINSON's original factor—3 is adopted in our anemometric records. Whenever from further investigation a new and reliable factor, dependent on the velocity of the wind shall have been determined for an instrument of exactly similar construction, it will be easy to alter the figures in our tables, but the action of the instrument is so perfect that no allowance need be made for friction.—In order to obtain a sufficiently distinct trace of the direction of the wind, the vane consists of two wind mill wheels, which keep their axis at right angles to the wind. With any change they move and carry with them a hollow brass tube, which contains, but is not connected with, the velocity shaft and acting through toothed gearing moves another thin screw-shaped pencil, which registers the direction on another part of the metallic paper. The pitch is equal to that of the velocity pencil and equal to a scale of the cardinal points of the compass printed on the paper. The clock moves the cylinder on which the paper is fastened 0.366 inch per hour.

32. The paper must be changed every morning about 10 a. The direction and velocity are then read off by aid of divided glass scales and immediately entered in the table printed in the monthly reports. The working of the instrument has been satisfactory. It is made extra strong and worked as well in the typhoon as in a gentle breeze.

33. The *pluviograph* was erected in the course of January and worked without interruption since the 1st March. It is made of cast iron and stands on masonry in the ground about 75 feet S.W. of the nearest part of the main building. The rain collected by the funnel passes through a tube into a copper cup floating in mercury protected from oxidation by glycerine. As the cup is filled it sinks in the mercury and registers the amount of descent by aid of a fine lead pencil on a ruled card fastened on a cylinder revolved by clockwork. When 0.2 inch have been collected, the cup is emptied spontaneously by a siphon arrangement, 0.1 inch of rain is represented by a length of 0.344 inch on the card, which was found correct. The hour lines are printed 0.365 inch apart, but it was not found practicable to lengthen the pendulum sufficiently for this and new hour times 0.372 inch apart have to be drawn on the cards. Care was taken by the maker to arrange, that the siphon should empty the cup as quickly as possible, and it was only during unusually heavy squalls, when the rain poured down in torrents, that it failed somewhat in its action, the amount entering the cup while it was emptying itself being lost. It was feared that the heavy rain might mechanically push down the cup, but this has scarcely been noticed in practice. For further security an ordinary rain-gauge, the rain collected in which is measured at 10 a., is kept beside the pluviograph, and it has occasionally been found advisable to correct the pluviograms by the readings of that gauge.

34. Early in the summer the place had not yet been turfed and the dust of decomposed granite raised by the wind was most destructive to the acting parts of the instruments and particularly so to the action of the rain-gauge. When the Governor last summer honoured the Observatory with his presence, His Excellency remarked this disadvantage, and the place was soon after turfed, since which time the rain-gauge has acted smoothly.

35. The pluviograms are read off by aid of a simple scale and immediately entered in the tables printed in the monthly reports.

36. The *sunshine-recorder* is placed in a groove in the coping stone on the parapet 34 feet above the ground. In construction and adjustment it is similar to an ordinary sun-dial, but the style throwing the shadow is replaced by a solid glass ball, which acts as a burning glass, and the hour circle consists of a blue card, on which the hours are printed, and which is changed every evening. Whenever the sun shines brightly, it burns a hole in the paper, and by comparing the burned trace with the half-hour lines it is easy to estimate, how many minutes the sun was shining every hour. The figures are immediately entered in the table printed in the monthly reports. Care is taken to keep the glass ball clean.

37. The barograph, the thermograph and the anemograph were made by Mr. MUNRO of King's Cross, London, and are as excellent specimens of workmanship as might be expected from this well-known maker. The principal part of Mr. FIGG's time has been occupied in attending to the selfrecording instruments and tabulating the records,—a task in which he has exhibited much patience and perseverance as well as that conscientious care, for which he was recommended to me by Mr. WHIPPLE, Superintendent of the Kew Observatory, and to which the great accuracy of our results is to a great extent due.

38. As stated in the "Instructions for making meteorological observations &c." meteorological instruments forwarded by observers, who regularly send their registers to the Observatory, are verified here free of cost. During the past year the following number of instruments has been verified and certificates issued:

Barometers: 13

Thermometers: 126

Anemometers: 1

39. The *monthly weather reports* up to July inclusive have been published. The tables are ready for the August and September reports. The typhoons in August are being investigated. The principal tables for the October and November reports are ready and some progress has been made in tabulating the records for December. I expect to be able to publish these reports in the course of next spring.

40. Some progress has also been made with the *annual weather report for 1884* and with the *five-day means of the principal meteorological elements*. The volume of "Observations and Researches made in 1884" will be published as soon as these reports are ready.

41. The *China Coast Meteorological Register* was issued daily from here. Through the courtesy of the Great Northern and of the Eastern Extension Australasia and China Telegraph Companies I received daily telegrams from Wladiwostock, Nagasaki, Shanghai and Amoy, and from Manila respectively. Subsequently the Superintendent of the latter Company was kind enough to supply telegrams

from Foochow and Haiphong in addition, but an even more important addition was made, when he in autumn arranged to have meteorological observations started at the telegraph station in Bolinao (Luzon). The telegraphic reports embrace generally readings of the barometer and the attached thermometer, dry and damp bulb thermometers, direction and force of the wind, state of the weather and amount of rain.

42. The Great Northern Telegraph Company receives the telegrams for 10 a. and 4 p. (previous day) during the forenoon. The E. E. A. & C. Telegraph Company receives the 10 a. and 4 p. observations separately. The Superintendent of the Station in Bolinao in the course of October commenced to forward observations also at other hours, whenever he apprehended atmospheric disturbance in the neighbourhood of Luzon. He then also observed the direction, whence the clouds were coming. The importance of similar telegraphic information from a gentleman of scientific training during the coming typhoon season cannot be overestimated.

43. As soon as possible after 10 a. and 4 p. observations made here similar to those received are forwarded to the two Companies.—The telegrams are exchanged between the Telegraph Offices in Victoria and the Observatory by means of either of our two chair-coolies. Of course it would be better to exchange the information through telegraph. There is a cable across the harbour through which the Police Stations are connected, but it has not been used for transmission of such messages. If it were possible to place the Observatory in direct communication with the Telegraph Companies Offices, the information would be supplied much sooner than is possible under existing circumstances.

44. As soon as the telegrams are received they are revised, corrected and reduced and the most prominent features and changes of the weather are pointed out, as well as the wind over the open sea between Shanghai, Hongkong and Luzon indicated by the gradients, the constants being statistically determined. Early information about typhoons is also issued, the existence of which is generally anticipated from observations here taken in connection with the general distribution of pressure &c., before it is indicated by observations contained in the telegraphic reports from any individual station, that may be situated nearer to the respective disturbance.

45. Every day the general whereabout of the centre and its progress since previous day are explained, and when, as frequently occurs during the progress of typhoons, the telegrams are not received, the information is based exclusively upon observations made here. In this part of my work I derived great help from Ferrel's theoretical papers and particularly from Meldrum's illustrious researches.

46. The Clerk of the Department has charge of the calculations connected with the register and as soon as copies of same are ready—generally about 1 h. 30 p.—they are forwarded by one of the chair-coolies to the following addresses:—

H. E. the Admiral of the Fleet.
The Harbour Office.
The Great Northern Telegraph Company.
The *Hongkong Telegraph.*
The *China Mail.*
The *Daily Press.*

47. Occasionally complaints have been received, that the register was not received at a sufficiently early hour.

48. A meteorological register containing the 4 p. observations made here, is sent in the evening to the *Daily Press*, which is a morning paper.

49. Whenever, as does not often occur, bad weather prevents the launch from running between Hongkong and Kaulung, or when information concerning typhoons, which should be published immediately, is at hand, a telegram is sent through the Police Stations to the Central Police Station in Hongkong, from which it is telegraphed to:

Government House,
The Government Offices,
Harbour Office,

and copies of the telegram are despatched by the Central Station to:

The Great Northern Telegraph Company.
The E. E. A. & C. Telegraph Company.
The *Daily Press.*
The *China Mail.*
The *Hongkong Telegraph.*
The Hongkong Club.
The Chamber of Commerce.
The Naval Yard.
The Commissariat.
The Surveyor General (when the Government Offices are closed).

50. It was in the course of the year arranged, that I am not to control the distribution of these telegrams, for which my responsibility ceases, as soon as they have been properly forwarded from the Observatory.

51. In fact now that meteorological signals can be exhibited from this side of the harbour, the distribution among so many addresses is perhaps unnecessary, and with reference to the Telegraph Companies I have formed the opinion, that telegrams concerning typhoons should be forwarded only to those Treaty Ports, to the ships in which their contents would be of importance in each individual case.

52. In the latter part of August a mast for hoisting police and storm-signals erected at Tsim-sha-tsui was furnished with the system of signals explained in my notice of the 11th August (Appendix F), and a gun was placed at the foot of the mast for giving warnings to the Colony.

53. The signals, although they were rather light,—being made of perforated canvas framed in leaden pipes,—blew down and were damaged, because the cord, that supported them, was far too weak. At the time the water-police had not yet taken possession of the new barracks and there were only a couple of English constables living in the old station, but it would be impossible to refer in too high terms to the conduct of the police, who are charged with hoisting the signals, both under those difficult circumstances and also afterwards.

54. A new set of signals made of rattan have since been made at the suggestion of the Surveyor General, but they are only 4, while the original signals were 6 feet in diameter. Whether they will be sufficient, remains to be seen. At any rate it is to be hoped, that arrangements will be made to have them hoisted to the top of the mast, which was reserved for these signals.

55. The notice referred to was extensively circulated and it was clearly stated, that the signals are hoisted solely with the object of informing masters of vessels leaving the port concerning the whereabout of the centre of typhoons, and that local storm-signals would be given by firing the gun,—so that it is surprising, that a portion of the public should be under the impression, that the signals indicate strong wind in the Colony, but no doubt more correct notions will get abroad next season.

56. Through these signals supplemented by the information given in the daily registers, masters of vessels are enabled to form an opinion of the winds and weather,—fine in some places foul in others,—likely to be encountered on the voyage, and to select the best time for starting all according to their destination. But after all I have learned, that cases still occur, where a captain, who is less familiar with typhoons, delays his ship in port, although the information issued to a practical meteorologist implies, that he is likely to encounter fine weather on a voyage to the port, for which he is about to start,—while another ship starting at the same time for some other port may run great risk.

57. To a port frequented by so vast a shipping as Hongkong it would be an advantage to have trustworthy information concerning bad weather likely to be encountered by each individual ship leaving the port placed within reach of every captain about to leave the port, and this can only be effected by allowing them to telegraph to me for information, adding the name and destination of the ship in question. Similar enquiries may in England, on payment of one shilling for the message be addressed to the meteorological office, but the answer contains only a guess at the weather expected next day, while in the China Sea it would be possible to give information concerning the weather likely to prevail on the voyage.

58. But in order to effect this it would be necessary to appoint a telegraph clerk in the Observatory. Occasionally during the past season masters of vessels have sent one of their mates over to make enquiries, and I have done my best to give them the required information, but at serious inconvenience owing to the smallness of the staff attached to this Department.

59. I devoted part of my time in the autumn of 1883 in studying past records of the weather kept by officers of the Harbour Department and Mr. FIGG assisted me in taking monthly means of observations. The results were published in the Gazette (Appendices A–C to "Observations and Researches in 1884"). He also took monthly means of the height of the barometer registered for over twenty years in the Harbour Office, but as some difficulty was encountered in ascertaining the corrections, which the barometers required, the results have not yet been published and will not be of much importance when published.

60. Beside the reports to appear in the "Observations and Researches in 1884," which will include a complete barometric determination of the height of Victoria Peak, I have published the following papers:

a. "On the Rainfall and Temperature of Markree, Sligo." (In "Quarterly Journal of the Royal Meteorological Society" April, 1884).

b. "Markree Observatory." (In "The Observatory. A monthly review of astronomy." October and November, 1884).

61. During the past year my time was to such an extent occupied in erecting and adjusting the instruments, in making the necessary arrangements of the methods of using them and in official correspondence, that I am not able to add a catalogue of the scientific instruments and books to this year's report. I also regret having been at times behind-hand in acknowledging the receipt of publications from other scientific centres and from individuals and having been forced by want of time to neglect my scientific correspondence in general, but although during the first portion of the new year several new instruments will have to be started, I expect to be able to attend more regularly to my duties in this respect.

62. Officers of the Royal Navy and Officers of the French squadron in China as well as numerous captains of merchant vessels have forwarded to me meteorological observations made during typhoons, by aid of which I have been enabled to investigate those atmospheric disturbances, from which investigations results useful to the navigation of the China Sea will follow.

I have the honour to be,

Sir,

Your most obedient Servant,

W. Doberck,
Government Astronomer.

The Honourable W. H. Marsh, C.M.G.,
Colonial Secretary,
&c., &c., &c.