

1881.  
VICTORIA.

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SIXTEENTH REPORT

OF THE

BOARD OF VISITORS

TO

THE OBSERVATORY;

TOGETHER WITH THE

*Annual Report of the Government Astronomer.*

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PRESENTED TO BOTH HOUSES OF PARLIAMENT BY HIS EXCELLENCY'S COMMAND.

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By Authority:

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## SIXTEENTH REPORT OF THE BOARD OF VISITORS TO THE OBSERVATORY.

TO HIS EXCELLENCY THE MOST HONORABLE THE MARQUIS OF NORMANBY,  
G.C.M.G., *Governor and Commander-in-Chief of the Colony of  
Victoria, &c., &c., &c.*

We beg leave to report to Your Excellency that we have completed our annual visitation of the Observatory, and have examined the instruments and records of the observations made in all the departments of the establishment since our last inspection.

The report of the Government Astronomer, which we have now the honor to submit, describes in detail the work accomplished during the year, and makes special reference to the assistance rendered by the staff of the Observatory to the Commissioners of the Melbourne International Exhibition, in testing the chronometers and watches which formed so important and interesting a part of the scientific exhibits.

We find that the reduction of some observations has fallen into arrear from the want of a very little occasional clerical assistance ; we recommend that a further sum not exceeding £100 a year be placed at Mr. Ellery's disposal for this purpose. No fixed appointment need be made, but a computer can be engaged by the day, whenever the observations accumulate. This is the practice at Greenwich and Kew, and at most other Observatories, and it has been found to work well.

The grounds about the Observatory are not well kept, and need attention. It is suggested that the director of the Botanic Gardens be requested to undertake this duty, which would not require much time or labor. To exclude the dust from the buildings and to prevent the injury it causes to the instruments, it is important that the grounds should be thickly planted with trees, and we beg to advise that this be done.

In view of the erection of a new transit circle, which we are glad to know is to be obtained immediately, we think that it would be well to prepare the piers for its reception as soon as possible, that the foundations may be thoroughly stable before the instrument is mounted.

It is due to the Astronomer and his assistants to add that we found everything in perfect order. A large amount of important work is constantly going on at the Observatory, and no opportunity is lost of extending its usefulness to scientific research, and to the practical needs of the community.

We desire to record our deep regret at the death of our colleague, the late Mr. Justice Stephen, who was a member of the Board for many years. Our number is now reduced to five, and it was eight when the Board of Visitors was first constituted. We think that it would be well if Your Excellency's Government should see fit to appoint three additional members.

GEORGE VERDON, F.R.S.,  
JAMES MOORE, M.A.,  
M. H. IRVING, M.A.,  
G. V. SMITH,  
J. E. BROMBY, D.D., Hon. Sec.



REPORT OF THE GOVERNMENT ASTRONOMER TO THE BOARD OF VISITORS  
TO THE OBSERVATORY, 9TH AUGUST 1881.

THE present report refers to the year commencing 1st July 1880 and ending 30th June 1881 (corresponding to the financial year now adopted by the Government of this colony), and it will convey to the Board an account of the chief work done at or in connection with this establishment during that period, and of its condition at the last-named date.

I.—PERSONAL ESTABLISHMENT.

This remains the same as at the date of my last report, and consists of—

Mr. ELLERY, Director, Government Astronomer,  
Mr. WHITE, Chief Assistant,  
Mr. MOERLIN, Assistant,  
Mr. TURNER,         ,,  
Mr. GILBERT,         ,,  
J. BURLEY, Messenger.

Messrs. Lilly and Kemp still continue to hold their positions on the temporary staff—the first as mathematical, and the second as clerical and photographic assistant; there are also a mechanic and a workman—the latter principally occupied in connection with the great telescope.

As regards the division of the duties of the establishment among the staff, no change of importance has been made. Mr. White, therefore, has retained charge of the meridional work, in which he is assisted by Mr. Gilbert. Mr. Moerlin has continued in charge of the meteorological and magnetic work, assisted by Mr. Kemp, and has also carried on the reductions of the polar distance observations made with the transit circle. On Mr. Turner has devolved all the observation, drawing, and photography in connection with the great telescope, as well as obtaining sun-pictures daily with the photo-heliograph. Mr. Gilbert has continued in charge of the time signals, distribution of time, ships' chronometers, and like matters; he assists Mr. White in meridional observations, and also acts as accountant and storekeeper. Mr. Lilly assists in special mathematical work and observation, and has also charge of the library of the establishment, and the acknowledgment of donations to it. Mr. Kemp, besides assisting Mr. Moerlin in the photographic and clerical part of the duties devolving on him, acts also as telegraph clerk, for the Observatory is connected by wire with the central telegraph office, and receives and sends all weather telegrams and other telegraphic communications, as in the case of a branch telegraph office.

II.—GROUNDS AND BUILDINGS.

The grounds remain in much the same condition as at the time of the last report; some little clearing and planting has, however, been done, and, in view of a probable future change in the character of the enclosing fence, a hedge of Cape thorn has been planted all round, by the curator of the Botanical Gardens. The fence itself is now greatly in need of general repairs.

The Observatory grounds form an irregular oval, containing  $5\frac{1}{2}$  acres; close along the west side runs one of the principal park footpaths, while the east side abuts on to the fence of the Government House grounds, which forms a tangent to it. It is proposed to remove the Observatory fencing on that side and join it to that of the Government House by lines nearly tangential to the north and south ends of the oval. This will lessen the amount of fencing, and do away with the objectionable *cul de sacs* now existing between the two fences.

The buildings generally are in good repair. The main structure, however, now requires painting and general renovation.

To provide for our largely increasing library, the room formerly used for a prime vertical instrument has been furnished with shelving, and is devoted to the storage of such books as are not in constant requisition.

The building used for the thermographic instruments prior to the erection of the new magnetic house has also been fitted up with shelving for the storage of spare volumes of Observatory publications, &c.

III.—ASTRONOMICAL INSTRUMENTS.

The principal fixed astronomical instruments, namely, the transit circle and collimators, the south equatorial, north equatorial, great telescope, photo-heliograph, and east transit are in excellent working order. The transit circle furnishes results as satisfactory as ever, but it is, nevertheless, apparent that its form of construction is not so fully adapted to the requirements of a transit circle as those of more modern ones, and serious doubt arises whether the light four-foot circle, partly protected by the piers, and partly exposed, is not subject to irregular changes in form, sufficient in degree to slightly affect the accuracy of the polar distance observations. Such a defect will not be due to any deterioration of the instrument, but is inherent in the form of construction.

In June a thorough examination of all the mechanical parts of the great telescope was made, and the working surfaces carefully cleaned; a marked improvement in its motion when driven by the clock resulted. The mirrors used are the same as at the last visitation, and they still retain a good working polish, although there is an appreciable diminution of reflective power from a faint and general tarnish on the large mirror. The various accessories of this instrument are in effective condition.

There has been no noteworthy change in the minor instruments, such as clocks, chronographs, and apparatus for time distribution, all of which continue to work well.

#### IV.—MAGNETICAL AND METEOROLOGICAL INSTRUMENTS.

The magnetical instruments and arrangements remain the same as at the time of my last report, and everything is working well and satisfactorily. The whole of the magnetographic apparatus was carefully cleaned and re-adjusted in May last.

There have been a few additions and alterations among the meteorological instruments; the anemograph, which I referred to in former reports as being nearly worn out, has now been replaced by an entirely new instrument of a somewhat different form, more especially as regards the registering portion. The parts exposed to the wind are almost identically the same as those hitherto in use, and known under the name of the Kew pattern of Robinson's anemometer, but the velocity shaft, instead of running upon six or seven gun-metal balls, now runs in a plain bearing, part of which is always immersed in oil, and the lower end of the shaft rests upon a hard steel bearing in an oil cup. The mechanism connected with the direction-vane is also improved, and the working parts very carefully protected from dust, which has been found to rapidly wear them out. The registering apparatus is now placed in the room immediately beneath the square tower, upon which the exposed part of the instrument stands, and the motions of both the direction and the velocity shafts, after the latter has been diminished 7,000 times by toothed wheels gearing into endless screws, are communicated to it by light brass tubes with universal joints. This part of the apparatus differs considerably from that of the old form, and may claim to be a great improvement, for the following reasons:—It records on a flat surface moving vertically in front of the registering pencils, so that the whole of the recorded sheet is in full view at all times; the scale is large and open; the clock moves the sheet vertically three-quarters of an inch in an hour; the velocity pencil moves over one inch for every ten miles of wind travelled; and the direction record occupies about an inch for every eight points of the compass. In the old form the record was obtained upon a sheet of paper rolled on a cylinder moving at the rate of half an inch per hour, with half an inch for every ten miles of wind movement, and three-quarters of an inch for eight points of the compass.

There is an electric arrangement also to cause the velocity pencil to fall back to zero every hour as well as at the completion of a record of fifty miles of wind movement, while in the old form the register only returned to zero after every fifty miles of wind. It is also arranged that the velocity pencil can be made to produce a small offset from its trace every minute—for obtaining velocities during short intervals with accuracy—a thing often required during strong winds. This apparatus works very satisfactorily indeed, but a further improvement is now being made by substituting mechanical for electric action in bringing the velocity pencil back to zero every hour and every fifty miles. When completed I intend to prepare drawings and full descriptions of the registering parts of the apparatus. Another and a very simple form of instrument for measuring the force of the wind has been made, and was set in action at the Observatory in April last; it is known as Hagemann's vacuum anemometer, and depends on the fact that air moving horizontally over the mouth of a vertical tube, closed at its lower end, causes a vacuum in the tube in exact proportion to the velocity or force of the wind. To utilize this action the lower end of the tube terminates in an apparatus like a small gasometer, which rises and falls with the varying vacuum in the tube; the movements of the gasometer are registered on smoked paper placed on a barrel revolving once in 24 hours. From present experience of this form of anemometer, I think it will be found the most useful of all existing forms for determining the actual pressures to which buildings and structures of every kind are subjected in strong winds. I have not yet made any systematic comparisons between its results and those of other forms, but I hope to do so shortly. I described the instrument in detail in a paper read before the Royal Society in June last.

The new barograph, which had just been erected at the date of my last report, has undergone some slight alterations in the mode of its registering, and acts much more accurately now than at first.

For the purpose of getting earth temperatures at a greater depth than that of our lowest earth thermometer, which is only 8 feet below the surface, a narrow well lined with earthenware pipe of 4 inches diameter was constructed in March. As soon as the disturbed soil has properly consolidated round the well it is intended to take regular readings of thermometers at 15 feet below the surface, as well as at depths corresponding to the old earth thermometers, for the sake of comparison, and to determine whether thermometers in a tubular well give the true temperatures pertaining to various depths. From some preliminary trials I am led to believe this method of obtaining earth temperatures will be found satisfactory.

With the above exceptions the meteorological arrangements remain the same as heretofore, and are quite satisfactory.

#### V.—THE LIBRARY.

This department of the establishment has been very largely increased during the past year, principally by donations from other observatories and scientific societies; and it has been found necessary to make the large addition of shelf-room already referred to. A list of donations received during the year is given in the Appendix.

## VI.—PUBLICATIONS.

No astronomical publication has been issued during the year. The separate results of R.A. and N.P.D. for the years 1876-77-78-79-80, and the annual catalogues of each of these years, except the last, are completed and ready for the printer.

The *Monthly Record of Meteorology and Terrestrial Magnetism* has been published up to the end of 1880, but the annual results have fallen into arrears for want of more clerical and computing assistance.

The *Daily Weather Bulletin* has been published about one o'clock every day throughout the year, Sundays and general holidays excepted.

The planisphere of the southern heavens referred to in my last report has been completed, and 500 copies of it are now printed. I have thought it desirable, however, to delay their issue until a handbook, explaining the method of using it, which is now in the press, is also ready to accompany it.

## VII.—THE WORK OF THE OBSERVATORY.

*Meridian Observations.*—The meridian work with the transit circle has consisted of observations of standard stars for determining the error of the clock and azimuth of the instrument, of stars which culminate near the zenith of the Observatory, stars observed with comets, and stars whose positions have been required for geodetic and other purposes. Since January last the meridian work has been confined almost exclusively to observations for clock corrections on account of the great amount of time taken up by the preparation of the second general catalogue, containing the results of the transit work for the last ten years.

The following are the numbers of observations made with the transit circle during the period under review :—

|                                    |     |     |     |      |
|------------------------------------|-----|-----|-----|------|
| Right Ascension Observations       | ... | ... | ... | 1655 |
| Polar Distance ditto               | ... | ... | ... | 398  |
| Observations for Collimation Error | ... | ... | ... | 138  |
| Ditto for Level                    | ... | ... | ... | 151  |
| Ditto for Nadir                    | ... | ... | ... | 149  |
| Ditto for Micrometer Runs          | ... | ... | ... | 24   |
| Ditto for Flexure of Telescope     | ... | ... | ... | 7    |

The whole of these are reduced up to 30th June 1881.

*Great Telescope Observations.*—During the year the actual work with the great telescope was done on 68 nights, 24 of which were devoted to lunar photography ; this appears to be a small proportion of the possible 313 nights, but unfavorable weather or bright moonlight has interfered on 125 nights, while 82 nights were occupied with visitors.

The great influx of visitors to Melbourne during the currency of the International Exhibition led to incessant requests for opportunities to see some of the heavenly bodies through our large reflector. These requests being as far as possible acceded to, a larger number of nights than usual had to be given up for this purpose.

The chief work done during the year is as follows :—Twenty-two nebulae of Sir John Herschel's catalogue, with a new one not previously recorded, were observed and sketched, the position of the new one being 4' 30" south of H. 3705, and preceding it by 67 seconds of time. The majority of the nebulae observed agree well with Herschel's description, with the exception of Nos. 4502, 4510, and 5012, which do not agree with Herschel's measures ; 3430 is much more suddenly condensed in the centre, while 3734 is much fainter than Herschel describes.

Sixty-four photographs of the moon in different phases were obtained. Drawings and observations of the physical appearance of Comet *b* 1881 were made on six occasions.

The nebula surrounding  $\eta$  Argus was on three occasions carefully compared with the drawings of 1875, but no decided change could be detected.

*Heliographic Work.*—The heliograph has been kept constantly at work and a sun picture obtained upon every fine day possible ; it has been the rule hitherto not to take these photographs on Sundays ; as, however, it appears that inconvenient breaks are likely to occur in the series by the continuance of this practice, I propose to make some arrangement that pictures may be obtained on every fine Sunday.

During the past year 175 photographs of the sun have been obtained, which indicate a marked increase of spots and disturbances of the solar surface in this period.

*Occasional Observations.*—On May 21st a large comet made its appearance in the southern heavens, the position of which was obtained on every fine night until it had gone so far north as to be beyond our reach. It was observed here on 19 occasions, on 17 of which satisfactory measures of its position were obtained. From a selection of these an orbit was computed by the Chief Assistant, Mr. White, and, as the elements obtained did not resemble those of any former comet closely enough to lead to any probable identity, I think it may be regarded as a new one. Spectroscopic examination of this body exhibited the usual cometic bands. News has been received already of the appearance of this comet in the northern skies.

Another comet (called Swift's Comet or Comet *a* 1881) was discovered by northern observers in May last, and, when intelligence of its movement towards our skies reached Melbourne, search was made for it but without success, the comet having probably become too faint for observation before the intelligence arrived.

*Magnetic and Meteorological Work.*—The monthly determination of the absolute force of the three elements of terrestrial magnetism has been continued. The self-registering magnetometers have been in operation continuously throughout the year, with a break of a few hours only during the cleaning and re-adjustment above referred to.

The electrograph, barograph, and thermograph have also been at work uninterruptedly, and the respective photographic curves show but few breaks throughout the twelve months.

The anemographic records were interrupted from 13th December to 23rd December 1880, during the erection of the new wind-gauge already described.

The self-registering rain gauge (ombrograph) is found to work most satisfactorily and has furnished a complete record of the rainfall for the year.

Some changes and additions have been made as regards the meteorological work in the country, and four new second class stations have been formed, viz., at Echuca, the Lakes' Entrance (Gippsland), Omeo, and Mount Macedon, the latter being at an elevation of 3,000 feet. Additional rain-gauge stations have also been established, and we now receive monthly returns of rainfall from 117 localities, many of which are furnished by private observers; from these returns a monthly table of rainfall is compiled, which is published in the principal daily and weekly journals.

Considerable interest is now taken in magnetic storms and disturbances of terrestrial magnetism, and this has increased since self-registering magnetic instruments like those at this Observatory, established at various places on the earth's surface, have shown that every large disturbance is common to the whole globe. I have, therefore, been frequently requested by directors of observatories in Europe to furnish duplicates of our magnetographic curves obtained during disturbed periods, and they, at the same time, have sent copies of their curves for the same periods. Of course such requests are at once complied with, and, in doing so, the question of the most effective, simple, and economical method of reproducing our curves arose; this was satisfied by the adoption of a modified form of Herschel's cyanotype process, which gives the curves, &c., in white on a ground of deep Prussian blue. This process is simple, rapid, and economical, and gives effective fac-similes of the curves. Duplicates for the disturbed periods in August 1880 and January and March 1881 have been supplied to Kew Observatory, in England, and Pulkowa Observatory in Russia.

The sunshine recorder described in the last report has been kept in constant operation, the daily results being tabulated from the cardboard registers, and the percentage of sunshine for each month deduced.

*Special Work for the Public.*—This now forms no inconsiderable item in the work of the Observatory, and comprises the testing, regulating, adjusting, and giving certificates of accuracy of quality to scientific instruments of all kinds, such as chronometers, barometers, and other meteorological instruments, surveying and nautical instruments, and lineal measuring apparatus.

Fifty-three marine chronometers have been received for rating, and thirty-nine aneroids have been tested under the air-pump in the past year.

During the time of the Exhibition, the assistance of this establishment was given to the jury on horology (of which I was chairman), by carrying out a series of trials of the time-keeping qualities of a large number of chronometers and pocket watches, submitted for competition by the exhibitors. In all, three marine chronometers and forty-six pocket chronometers and watches were received for this purpose. One of the basement rooms (the standard bar room) was prepared for their reception, a box for submitting the watches and chronometers to high and low temperatures was constructed, and racks by which the watches could be placed in the various necessary positions for properly testing their adjustments were fitted up. The trials extended over a period of twenty-seven days, and involved a considerable amount of labor in comparing computation of errors and rates. The trials were as exhaustive as was possible in the time allowed, and were satisfactory in every respect; the methods adopted in conducting these trials and the results are given in the Jurors' Report on Horology to the Exhibition Commissioners.

Short weekly paragraphs on the weather, or astronomical or physical subjects of interest, under the title of "Notes from the Observatory," have been contributed to the daily papers as heretofore.

*Time Signals and Distribution.*—The new time-ball on the old light-house tower at Williamstown, which was being constructed at the date of my last report, was completed in September, and used for the first time on the 11th of that month. The old ball was taken down on 19th August, and no time-signal was given at Williamstown from that date until 11th September. After a few failures at first, due to slight defects in the apparatus, which were easily remedied, the new time-ball has continued to act very satisfactorily. It differs from the old one in a few respects, principally in the ball itself being of copper, instead of wood and canvas, and the mast being an iron tube in place of a wooden one as formerly; the hoisting, discharging, and breaking arrangements differ from the old ones only in being more accurately constructed. The signal for dropping the ball is sent automatically from the Observatory clock to an indicator in the time-ball room of the tower, the ball trigger being discharged by the attendant; immediately it has dropped three feet, the ball itself closes a telegraphic key, which reports on the Observatory chronograph the exact instant of fall.

Besides this check, it has always been the custom to observe the drop from one of the windows of the Observatory with the aid of a telescope; a telegraphic key, close to the hand of the observer, enables him to record on a second chronograph the instant he observes the drop.



In the past year the signal has failed 15 times out of 260. Eight of these were due to defects in the new apparatus, six to interruptions on the telegraph line, and one to a fault in the Observatory transmitting relay.

It is probable that a distinct line will be granted to the Observatory for this time-signal, and, in this case, the number of failures will no doubt be greatly reduced.

The signal from which the Williamstown ball is dropped is automatically repeated for the Geelong time-ball, and for all telegraph stations from the Central Telegraph Office, and this distributes Melbourne time to all parts of the colony.

*The Clock Control System*, which is extended to various public offices, the Houses of Parliament, and the railway stations, as well as to several private establishments, has continued to work thoroughly well so long as the lines are not interrupted by breaks or crossing.

*The Post Office Clock*.—This clock, which automatically sends a signal to the Observatory every day, just after 1 p.m., has gone as well as usual during the year; its error ranging from ten seconds fast to twelve seconds slow, except in one instance when it was under repair, and the error amounted to as much as twenty-eight seconds slow.

*Tide Gauge of Hobson's Bay*.—During the past year it has been found necessary to deepen the well of the tide gauge, as it had silted up some two or three feet, and interfered with the descent of the float at very low tides.

The records have been continuous, and, after the times of high and low water have been entered in the tide ledger, they have been filed away for any subsequent reference.

#### INTERCOLONIAL METEOROLOGY.

A second conference of the meteorologists of Australasia was held in Melbourne in April last, and the meetings took place at the Observatory. Representatives of four colonies, namely, New South Wales (Mr. Russell), New Zealand (Dr. Hector), South Australia (Mr. Todd), and Victoria (myself), attended. Assurances of co-operation, however, from Tasmania and Western Australia were received.

The conference sat on five days, and agreed upon numerous matters relative to the adoption of uniform methods of observing, recording, and exchanging weather information by telegraph. An important decision was also arrived at relative to the adoption in Australia of the isobaric system of studying and forecasting the movements of storms, found so useful and successful in the northern hemisphere, and each representative agreed to adopt this system as the basis of investigation and exchange of warnings.

Western Australia has already practically joined in this work, and, as the Government of Tasmania has signified its readiness to co-operate, it only remains for a few matters of detail to be arranged, when that colony will be included in the general Australian scheme.

The report of the conference has been printed and presented to Parliament, and a copy of it is now upon the table.

The steps already taken by this Observatory to carry out the recommendations of the conference are the establishment of four fully-equipped 2nd class stations, as already mentioned, the preparation of a weather map of Australasia, for use by all the colonies, which has now, by the valuable aid of our Surveyor-General and his department, been published and distributed.

It has also been arranged among the representatives that a set of portable instruments shall be prepared and sent from one central colonial observatory to another, with the view of determining from time to time the differences, if any, between the standards or constants of barometers, thermometers, wind-gauges, &c., used in each colony.

As regards the daily publication of weather information by this Observatory, I propose to shortly discontinue the *Weather Bulletin* and issue a *Weather Chart* in its place; on this will be graphically represented, by curves, symbols, and words, the areas of high and low barometric pressure, direction and force of winds, state of weather and sea, with forecast of coming barometric depressions and storms. To this end experiments are now being made for the purpose of determining the best method of publishing daily information on the weather map, and, by the ready and valuable co-operation of the Manager of the Central Telegraph Office, the system of intercolonial weather telegraphy is being gradually modified and improved. It is intended to issue the charts to certain central public offices, and it may also be arranged that copies of this can be obtained by private individuals, by some small payment to cover actual cost of map, &c. I have, however, not obtained the views of the Government on this matter, and at present, therefore, it is merely my own suggestion.

I regret I am unable to report any further progress in the matter of a new Transit Circle. The Government has approved of our obtaining one more adequate to modern requirements, and the necessary estimate was made in 1879; it was, however, accidentally omitted from the official Estimates of that year, and placed upon those of 1880, but, by request of the Government, was withdrawn for a year. The amount has again been placed on the Estimates of the current financial year, and I trust that the necessary vote will now be soon passed.

With reference generally to the present position of the Observatory and its future work, I believe that, so far as instrumental means are concerned, with the exception of the great want of a more powerful meridian instrument above referred to, it is quite capable of dealing with most of the requirements of a national observatory; it must, however, be remembered that astronomical and physical science is making rapid strides, and that new and more perfect methods of practically attacking the numerous questions that arise are being devised from time to time; it therefore

becomes necessary, in order that we may not fall behind or neglect our share of the work, and perhaps lose the honorable position our colony now holds in this direction, to replace the old and more imperfect appliances and methods by the improved ones. It will thus be seen that new requirements of a national observatory are constantly arising.

The Government and Parliament have always readily acceded to our wants as they have arisen, and I do not think our Observatory need ever fall behind for want of instrumental means. The chief want, however, and one that will arise periodically, is that of more clerical and computing assistance. The ordinary daily routine work now almost entirely occupies the whole time of the staff, more especially since it has been largely increased by the intercolonial meteorological system. When it becomes necessary, therefore, to undertake any special work, such as preparing star catalogues, or the astronomical, meteorological, and physical results for publication, a great difficulty is experienced and the publication is much delayed. It would be well to adopt the custom of the older observatories and obtain temporary clerical and computing assistance, for short periods from time to time, as required. The work is such as could be performed by any one expert in arithmetical operations and writing, and no difficulty would therefore be likely to occur in securing the necessary aid ; this want has been felt so much during the past year that, unless we are to let these matters fall into arrears, I am afraid I shall have to ask the Government for an increased vote for this purpose.

9th August 1881.

ROBT. L. J. ELLERY,  
Government Astronomer.

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APPENDIX.

BOOKS, ETC., PRESENTED TO THE OBSERVATORY.

| Title and Author of Book.  | By whom Presented.                                |     |                    |
|--|---|-----|--------------------|
| Greenwich Observations, Astronomical, Magnetical, and Meteorological, for the Year 1878  | Greenwich Observatory                             | ... | England.           |
| Greenwich Astronomical Results for the Year 1878   | Ditto   | ... | "                  |
| Greenwich Meteorological and Magnetical Observations for the Year 1878   | Ditto   | ... | "                  |
| Greenwich Spectroscopic Observations for the Years 1878, 1879  | Ditto   | ... | "                  |
| Extracts from the Introductions to the Greenwich Astronomical Observations; 1878 and 1879  | Ditto   | ... | "                  |
| Note upon the Systematic Errors of the Greenwich North Polar Distances. By W. H. M. Christie   | Ditto   | ... | "                  |
| The Greenwich Sunshine Records; 1876—1880  | Ditto   | ... | "                  |
| Assumed Mean Right Ascensions of Clock and Circumpolar Stars, with Corrections to the Right Ascensions of the Nautical Almanac for 1881        | Ditto   | ... | "                  |
| Report of the Astronomer Royal to the Board of Visitors to the Greenwich Observatory, June 5, 1880   | Ditto   | ... | "                  |
| Hourly Readings from the Self-Recording Instruments at the Seven Observatories in connection with the Meteorological Office, for the Year 1879 | Meteorological Office, London                     | ... | "                  |
| Meteorological Observations at Stations of the Second Order for the Year 1878  | Ditto   | ... | "                  |
| Contributions to the Knowledge of the Meteorology of the Arctic Regions; Part II.  | Ditto   | ... | "                  |
| Daily Weather Reports of the Meteorological Office; June 1879 to June 1880   | Ditto   | ... | "                  |
| Report of the Meteorological Council to the Royal Society for the Year 1879-80   | Ditto   | ... | "                  |
| Memoirs of the Royal Astronomical Society; Vols. XLI. and XLV., 1879-80  | Royal Astronomical Society                        | ... | "                  |
| Monthly Notices of the Royal Astronomical Society, April 1880 to 1881  | Ditto   | ... | "                  |
| Sessional Proceedings of the National Association for the Promotion of Social Science; Vol. XIII., No. 2                                       | National Association for Promoting Social Science | ... | "                  |
| Nautical Almanac for 1884  | Nautical Almanac Office                           | ... | "                  |
| Radcliffe Observations, 1876; Vol. XXXVI.  | Radcliffe Observatory, Oxford                     | ... | "                  |
| Results of the Meteorological Observations at the Radcliffe Observatory; 1876 to 1879  | Ditto   | ... | "                  |
| Quarterly Journal of the Meteorological Society; Nos. 33, 34, 35, 36, 37   | Meteorological Society                            | ... | "                  |
| List of Fellows of the Meteorological Society; January 1881  | Ditto   | ... | "                  |
| Series of Observed Lunar Distances, with Explanations and Analysis. By Rev. J. B. Pearson, D.D.  | Dr. Pearson, Cambridge                            | ... | "                  |
| Stonyhurst Observatory Results of Meteorological and Magnetical Observations; 1879   | Stonyhurst Observatory                            | ... | "                  |
| The Selenographical Journal for 1880   | Selenographical Society                           | ... | "                  |
| Journal of the Scottish Meteorological Society; Nos. 60, 61, 62, 63  | Scottish Meteorological Society                   | ... | Scotland.          |
| Proceedings of the Philosophical Society of Glasgow; 1879-80   | Philosophical Society of Glasgow                  | ... | "                  |
| On some Recent Improvements made in the Mountings of the Telescopes at Birr Castle   | The Earl of Rosse                                 | ... | Ireland.           |
| The Scientific Transactions of the Royal Society of Dublin; Vol. II., Series II.   | Royal Society of Dublin                           | ... | "                  |
| The Great Trigonometrical Survey of India; Vol. V. (The Pendulum Observations and their Reduction)   | India Office...                                   | ... | India.             |
| Indian Daily Meteorological Observations, April 1880 to April 1881   | Indian Meteorological Department                  | ... | "                  |
| Indian Meteorological Memoirs; Vol. I., Parts IV. and V. By H. F. Blandford  | Ditto   | ... | "                  |
| Report on the Administration of the Meteorological Department of the Government of India, 1879-80  | Ditto   | ... | "                  |
| Report on the Meteorology of India in 1878   | Ditto   | ... | "                  |
| Meteorological Observations recorded at Six Stations in India in the Year 1879; corrected and reduced  | Ditto   | ... | "                  |
| Meteorological Observations of Western India; January to June 1879   | Bombay Meteorological Department                  | ... | "                  |
| Brief Sketch of the Meteorology of the Bombay Presidency in 1879. By F. Chambers   | Ditto   | ... | "                  |
| Abnormal Variations of Barometric Pressure in the Tropics, and their Relation to Sunspots, Rainfall, and Famines                               | Ditto   | ... | "                  |
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| Meteorology of the Himalayan Districts. By S. A. Hill  | Meteorological Department of Northern India       | ... | "                  |
| Results of the Meteorological Observations for 1879 at the Vizagapatam Observatory   | Vizagapatam Observatory                           | ... | "                  |
| Transactions of the Royal Society of Victoria. Vols. V. and X.   | Royal Society of Victoria                         | ... | Victoria.          |
| Journal and Proceedings of the Royal Society of New South Wales, 1879. Vol. XIII.  | Royal Society of New South Wales                  | ... | New South Wales.   |
| Sydney Observatory Weather Maps; January 1877 to July 1880   | Sydney Observatory                                | ... | "                  |
| Results of Meteorological Observations made in New South Wales during 1876, 1877, 1878, 1879   | Ditto   | ... | "                  |
| Results of Rain and River Observations made in New South Wales during 1880   | Ditto   | ... | "                  |
| Results of Astronomical Observations made at the Sydney Observatory in the Years 1877-78   | Ditto   | ... | "                  |
| Astronomical and Meteorological Papers. By H. C. Russell. Read before the Royal Society of New South Wales                                     | H. C. Russell, B.A., F.R.A.S.                     | ... | "                  |
| Meteorological Report for Western Australia for the Year 1879....  | Surveyor-General                                  | ... | Western Australia. |
| Twelfth Annual Report of the New Zealand Institute, 1879-80  | Dr. Hector  | ... | New Zealand.       |

## APPENDIX—continued.

| Title and Author of Book.   | By whom Presented.                                    |     |     |                |
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| Meteorological Reports for New Zealand, for the Years 1870, 1873, 1875, 1877, 1880                              | Dr. Hector  | ... | ... | New Zealand.   |
| New Zealand Meteorological Observations for the Year 1880   | Ditto   | ... | ... | "              |
| Daily Bulletin of International Meteorological Observations; August 1879 to August 1880, Washington, U.S.       | Chief Signal Officer U.S. Army Department, Washington | ... | ... | United States. |
| Monthly Weather Review; March 1880 to March 1881. Washington, U.S.  | Ditto   | ... | ... | "              |
| Tables to Facilitate the Reduction of the Places of the Fixed Stars   | Washington Naval Observatory                          | ... | ... | "              |
| Telegraphic Measurement of Differences of Longitude by Officers of the U.S. Navy in 1878-79                     | Ditto   | ... | ... | "              |
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| Bulletins of the American Geographical Society; No. 3, 1880, and No. 1, 1881                                    | American Geographical Society                         | ... | ... | "              |
| Annals of the Astronomical Observatory of Harvard College, Cambridge, U.S.; Vol. XII.                           | Harvard College Observatory                           | ... | ... | "              |
| Dimensions of the Fixed Stars. By Professor Pickering, Cambridge Observatory, U.S.                              | Ditto   | ... | ... | "              |
| Boletín del Ministerio de Fomento, Mexico; April 1880 to April 1881   | Central Meteorological Observatory                    | ... | ... | Mexico.        |
| Revista Científica Mexicana; April to December 1880   | Ditto   | ... | ... | "              |
| Informe que el Director del Observatorio Meteorológico Central, Mexico  | Ditto   | ... | ... | "              |
| Auales del Ministerio de Fomento de la República Mexicana; Vol. III., 1880                                      | Ditto   | ... | ... | "              |
| Anuario del Astronómico de Chapultepec para el Año de 1881  | Chapultepec Observatory                               | ... | ... | "              |
| Primera Memoria del Observatorio Astronómico Nacional de Chapultepec  | Ditto   | ... | ... | "              |
| Guatemala Meteorological Observations for the Year 1880   | Guatemala Meteorological Observatory                  | ... | ... | Guatemala.     |
| Earthquake and Volcanic Phenomena in the Republic of Salvador; 1879-80  | Salvador Geological Department                        | ... | ... | Salvador.      |
| Annales de l'Observatoire de Paris; Memoires. Vols. I. to XIV. 1837 to 1867, 1874 and 1879; 25 volumes          | Paris Observatory                                     | ... | ... | France.        |
| Atlas des Orages de l'Année 1865  | Ditto   | ... | ... | "              |
| Atlas des Mouvements Généraux de l'Atmosphère; 1864   | Ditto   | ... | ... | "              |
| Annales du Bureau Central Météorologique de France; Vols. I., II., IV.  | Bureau Central Météorologique de France               | ... | ... | "              |
| Annuaire de l'Observatoire de Montsouris; 1877, 1878, 1879, 1880. (Météorologie)                                | Montsouris Meteorological Observatory                 | ... | ... | "              |
| Procès-Verbaux des Séances de 1880 de Comité International des Poids et Mesures                                 | Comité International                                  | ... | ... | "              |
| Souvenir de L'Amphiorama; ou, la Vue du Monde. By F. W. C. Trafford   | F. W. C. Trafford, Zurich                             | ... | ... | Switzerland.   |
| Note sur l'Emploi du Microphone dans le Service de l'Heure Astronomique   | W. Meyer, Geneva                                      | ... | ... | "              |
| Almanaque Náutico para 1880, 1881, 1882; Madrid   | San Fernando Observatory, Madrid                      | ... | ... | Spain.         |
| Bulletin de la Société de Géographie d'Anvers; Vol. V., 4 Nos.  | Société de Géographie d'Anvers                        | ... | ... | Belgium.       |
| Annuaire de l'Académie Royale de Belgique, 1881   | Académie Royale de Belgique                           | ... | ... | "              |
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| Aspect de la Planète Mars pendant l'Opposition de 1879...   | Ditto   | ... | ... | "              |
| Mémoire à l'appui des Remarquables Observations de M. Schiaparelli sur la Planète Mars                          | Ditto   | ... | ... | "              |
| Nederlandsch Meteorologisch Jaarboek voor 1879  | Netherlands Meteorological Institute                  | ... | ... | Holland.       |
| Regenwaarnemingen in Nederlandsch-Indië, Eerste Jaargang, 1879  | Dr. P. A. Bergsma                                     | ... | ... | "              |
| Bullettino Meteorologico dell' Osservatorio del R. Collegio Carlo Alberto in Moncalieri; Vol. XV., 1880         | Moncalieri Observatory, Turin                         | ... | ... | Italy.         |
| Versuch einer Mathematischen theorie zur Erklärung des Lichtwechsels der Veränderlichen Sterne. By H. Gylden    | Stockholm Observatory                                 | ... | ... | Sweden.        |
| Den Norske Nordhavs-Expedition 1876-78. (Zoology and Chemistry)   | H. Tornbe   | ... | ... | "              |
| Observatoire de Zi-ka-Wei, Chine; Perturbation Magnétique des 11, 12, 13, and 14 Août, 1880                     | Zi-ka-Wei Observatory                                 | ... | ... | China.         |
| Memoirs of the Science Department; University of Tokio, Japan. Vol. III., Part I                                | Tokio University                                      | ... | ... | Japan.         |
| Note upon a new Seismometer. By Dr. G. Wagener. Tokio University  | Ditto   | ... | ... | "              |
| Meteorologische Beobachtungen angestellt in Tifiser Observatorium, 1879   | Tiflis Observatory                                    | ... | ... | Caucasus.      |
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| Annalen des Physikalischen Central-Observatoriums. Jahrgang 1879. By Dr. H. Wild                                | St. Petersburg Observatory                            | ... | ... | "              |
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| Über die Spectra der Cometen. By Dr. Hasselberg   | Ditto   | ... | ... | "              |
| Über des Leuchten der Gase. By Dr. Hasselberg   | Ditto   | ... | ... | "              |
| Observations de Poulkova; Vol. XI. By Dr. Otto Struve   | Pulkowa Observatory                                   | ... | ... | "              |
| Études sur le Mouvement Relatif des Deux Étoiles du Systeme de 61 Cygni. By Dr. Otto Struve                     | Ditto   | ... | ... | "              |
| Recherches sur la Réfraction Astronomique. With Tables. By M. Kowalski  | M. Kowalski, Kasan                                    | ... | ... | "              |
| Circular zum Berliner Astronomischen Jahrbuch. Nos. 136 to 160  | Berlin Observatory                                    | ... | ... | Germany.       |
| Preussische Statistik von Königlichen Statistischen Bureau in Berlin  | Prussian Statistical Bureau                           | ... | ... | "              |
| Publicationen des Astrophysikalischen Observatoriums zu Potsdam   | Potsdam Observatory                                   | ... | ... | "              |
| Vierteljahrsschrift der Astronomischen Gesellschaft. 1880. 15 Jahrgang  | Astronomische Gesellschaft                            | ... | ... | "              |
| Resultate der Meteorologischen Beobachtungen in Leipzig im Jahre 1879. By Dr. Bruhns                            | Leipzig Observatory                                   | ... | ... | "              |

APPENDIX—*continued.*

| Title and Author of Book.  | By whom Presented.                   |        |          |
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| Monatliche Berichte über die Resultate aus den Meteorologischen Beobachtungen; 1879                        | Leipzig Observatory                  | ... .. | Germany. |
| Welterberichte der Seewarte, 1876-79. By Dr. Neumayer  | Deutsche Seewarte, Hamburg           | ... .. | "        |
| Meteorologische Beobachtungen in Deutschland; 1876-77. By Dr. Neumayer                                     | Ditto                                | ... .. | "        |
| Archiv der Deutschen Seewarte; 1878. By Dr. Neumayer   | Ditto                                | ... .. | "        |
| Monatliche Uebersicht der Witterung, 1876, 1877, 1878. By Dr. Neumayer                                     | Ditto                                | ... .. | "        |
| Instruction für die Signalstellen der Deutschen Seewarte. By Dr. Neumayer                                  | Ditto                                | ... .. | "        |
| Bericht über eine Konferenz in Hamburg. December 1875  | Ditto                                | ... .. | "        |
| Anleitung zu Wissenschaftlichen Beobachtungen auf Reisen. By Dr. Neumayer                                  | Ditto                                | ... .. | "        |
| Jahrbücher der K.K. Central Anstalt für Meteorologie und Erdmagnetismus; 1878 and 1879                     | Vienna Meteorological Observatory... | ...    | Austria. |
| Zeitschrift der Österreichischen Gesellschaft für Meteorologie. XV. and XVI. Band. By Dr. J. Hann          | Ditto                                | ... .. | "        |
| Über die Bestimmung grosser wahrer Anomalien in parabolischen Bahnen. By Dr. Th. Von Oppolzer              | Vienna Observatory                   | ... .. | "        |
| Astronomische, Magnetische, und Meteorologische Beobachtungen an der K.K. Sternwarte zu Prag im Jahre 1879 | Prague Observatory                   | ... .. | "        |
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