

1871.
VICTORIA.

SEVENTH REPORT

OF THE

BOARD OF VISITORS

TO THE

OBSERVATORY;

WITH THE

ANNUAL REPORT OF THE GOVERNMENT ASTRONOMER.

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

By Authority:
JOHN FERRES, GOVERNMENT PRINTER, MELBOURNE.

APPROXIMATE COST OF REPORT.

	£	s.	d.
Preparation—Not given.			
Printing (850 copies)	8	7	0

SEVENTH REPORT OF THE BOARD OF VISITORS TO THE OBSERVATORY.

To His Excellency the VISCOUNT CANTERBURY, K.C.B., Captain-General and Governor-in-Chief of the Colony of Victoria, and Vice-Admiral of the same, &c., &c., &c.

MAY IT PLEASE YOUR EXCELLENCY—

The Board of Visitors to the Observatory, having made its customary annual inspection, find that the buildings continue substantially in good condition; the slight repairs mentioned by the Government Astronomer, it recommends should be attended to.

The instruments are all in good working order.

With the transit circle 2063 observations for right ascension, and 1588 for polar distance, have been made. All the work with this instrument for 1870 is reduced and catalogued, and, together with that for 1869, is ready for printing.

The zone observations specially allotted to this colony are still being prosecuted with the east transit instrument. The total number of stars observed to this period is 48,260, of which number 32,031 are finally reduced, leaving 11,343 unreduced.

Besides this staple work of the Observatory, which the Board is happy to testify is always progressing with regularity and precision, the Government Astronomer has given considerable attention to further perfecting the system of time signals, for the benefit of the maritime community and for the establishment and dissemination of true time for public convenience. For this purpose he has had constructed at the Observatory a new clock, whose special office is to transmit the various time signals and control other clocks in Melbourne which are connected with it by telegraphic wire, so that they are kept in unison with it. After prosecuting some experiments to ascertain the best form of pendulums and magnets for clocks to be controlled, he has adopted a style which he reports works very satisfactorily.

With the proposal of the Government Astronomer, to publish monthly the facts and results of the meteorological and magnetical observations, the Board wholly accords. To render these subjects useful to the public, it seems necessary that they should be printed within limited periods of time, and due circulation given to them.

The work with the Great Telescope has been carried on diligently during the past year, and a great number of most important drawings of nebulae have been made; a series of experiments has been instituted for the purpose of ascertaining the best mode of reproducing these drawings, and a satisfactory result having been arrived at, they will be engraved and printed without delay.

With respect to the Great Telescope, the A speculum, which was re-polished by Mr. Le Sueur, appears to give satisfaction. The B speculum, which formed the subject of our last year's Report, has not been in use since A was ready; the cause, however, of the cruciform appearance given to the stars, seems to be now ascertained, and it is anticipated that in the re-polishing of it the defect will be removed.

By some misapprehension on the part of the Board of Crown Lands and Survey, the tenure of the land on which the Observatory is placed was supposed to be resumable; this has led to some correspondence, and finally to a deputation from this Board to the Honorable Commissioner of Lands and Survey, by which means the facts of the case have been satisfactorily explained. To prevent any future error, and to preserve inviolate the site on which buildings and instruments have been erected at so great a cost, some of great public utility and others representing the scientific research and knowledge of the Southern Hemisphere, the Board has requested that the Crown grant of the land, consisting of 5 acres 2 roods, on which are the Observatory and instruments, together with that on which the officers of the Observatory have their residences, being 1 acre 2 roods 25 perches, should receive the signature of Your Excellency as a grant in the name of the trustees.

The Board calls attention to the fact that a total eclipse will be visible this year in the north of this continent, and that the best place for observing it will be near Cape York. The Board trusts that the Government of this colony will not allow the occasion to pass without some effort being made to turn it to account in the cause of astronomical science.

W. P. WILSON, M.A.,
JOSEPH H. KAY, Captain R.N., F.R.S.,
H. AMSINCK, Com. R.N.,
J. WILBERFORCE STEPHEN, M.A.,
JAMES MOORE, M.A.,
A. J. SMITH, Commander R.N.,
J. E. BROMBY, D.D., Secretary.

REPORT OF THE GOVERNMENT ASTRONOMER TO THE BOARD OF VISITORS TO THE OBSERVATORY.

Read at the Annual Visitation, 18th April 1871.)

I HAVE the honor to lay before the Board of Visitors my Annual Report upon the present state of the Observatory and upon the work done there since the visitation on the 31st March 1870.

There has been a change in the personal establishment in consequence of the resignation of Mr. Le Sueur, as observer with the Great Equatorial, in July last. To fill the vacancy Mr. E. F. MacGeorge was temporarily appointed in August. I was satisfied of the fitness of this gentleman in many respects for the office, yet the work is of so special a nature that I recommended the appointment to be made subject to the result of a period of trial. My recommendation was, as you are aware, submitted for the opinion of the Board of Visitors, which agreed that a probational appointment as recommended was highly desirable. So far as I am at present able to judge I believe Mr. MacGeorge will fill the office most creditably.

The staff of the Observatory consists therefore at the present time of the following:—

- Mr. ROBT. J. ELLERY (Director), Government Astronomer.
- Mr. E. J. WHITE, Assistant Astronomer.
- Mr. C. MOERLIN, Assistant.
- Mr. E. F. MACGEORGE, Assistant.
- Mr. J. E. GILBERT, Assistant.

There are also a messenger and a workman.

Soon after the resignation of Mr. Le Sueur I recommended the promotion of Mr. C. Moerlin to the vacancy caused thereby in the 3rd class of the civil service. This recommendation was also submitted to the Board, which approved of it, but I have not yet been informed whether the Government has made the appointment.

BUILDINGS.

The buildings are in good repair. No additions have been made since the date of my last report.

The flat roof of the south half of the Telescope House has leaked considerably in heavy drifting rain. The necessity of running the movable roof over the south portion of the building, in uncovering the telescope, rendered it necessary to construct the fixed roof as flat as possible, which is covered with zinc, and is so flat that there appears to be considerable difficulty in making it weather-proof. Some repairs have lately been made which so far appear to have remedied the defects.

The outer roof and walls of the Magnetograph House will require some attention in consequence of the continual settling of the bank upon which the wooden sides are built. I think this can be remedied at a trifling cost.

I propose to plant a few more trees and shrubs on that portion of the Observatory grounds occupied by the Great Telescope which has been enclosed since the first planting was done.

INSTRUMENTS.

All the instruments are in good working order. The transit circle, which is in continual use, maintains its character as a first-class instrument. The 5-feet equatorial and the east transit are also in an efficient state. The 45-inch transit instrument is still in the hands of Mr. Todd, at Adelaide, having been lent some years ago to the South Australian Government for the use of the Adelaide Observatory.

The transit clock (Frodsham 998) maintains its reputation for its accuracy of performance. Its rates during the last few years have been even better than those which drew such an eulogium from the jurors on horology in the Paris Exhibition of 1867. As it had not been cleaned since its first erection in 1860 it was taken down in September last for this purpose, on which occasion Mr. White made a discussion of the rates from 1st February to 19th August (which would include changes due to the extremes of our seasonal temperature), from which it appeared that the pendulum was under-compensated and would require an addition of 1.1 inches to the column of mercury; as the jar would only contain an additional $\frac{3}{4}$ of an inch it was filled. A cursory examination of its rate since, however, shows it to be so nearly compensated that no further alteration appears necessary. From Mr. White's investigations the effect on the clock due to the barometer, appears to be 0.51 sec. per inch change of pressure. As this is nearly double the theoretical effect, it has been considered desirable to hold over the application of this correction to the rates till a more extended series of observations shall have ratified these results. At Pulkowa, where the barometric changes are much greater than here, affording a better means of calculating the effect, it has also been found larger than that given by theory.

The zone clock (Frodsham 106) also continues performing most satisfactorily. The other clocks—namely, the old sidereal and the mean-time clocks—are in good order; the former is still, however, subject to sudden and unaccountable changes of rate. Mr. Frodsham, the maker, wished me to send the works home to him, as he thought he knew the cause and could remedy it. This I was about to do some weeks ago, when the news of his death reached me.

An additional clock has been constructed in the Observatory workshop since the last visitation of the Board; it has been devised to do the *telegraphic time work*, and is provided with five contact wheels and five pairs of springs. The escapement is of the form known as "Denison's four-legged gravity;" the pendulum (one second) is Graham's mercurial compensation, and made unusually heavy: the cylinder contains nearly 40 lbs. of mercury. Provision is made for correcting the daily accumulation of rate by adding to or subtracting small weights from the pendulum, which can be easily done from the outside of the clock-case, and without any disturbance to the pendulum. The contact springs are arranged, two pairs for controlling by Jones's method, one pair for time-ball signals, and two pairs for single-seconds signals for controlling half-seconds pendulums or other purposes within the Observatory. This (which we have styled the *normal clock*) has not yet been used for the transmission of signals, pending the determination, by experiment, of the weight necessary to do all the work arranged for safely, without injuriously affecting the rate. The late results are very satisfactory, and I intend shortly to work the clock-controlling line with it. At present the controlling is done by the mean-time clock, and the time signals are given by the controlled lobby clock, as described in my last report.

The transit-circle chronograph (by Siemens), as well as the two *conical-pendulum barrel chronographs*, used in the zone observations, are in good order and work satisfactorily.

TIME SIGNALS.

The time signals have been continued without any change. The arrangements, referred to in my last report, for ensuring greater accuracy and regularity with the time-ball at Williamstown have proved most satisfactory; the automatic return signal gives certain information of the instant of the drop of the ball, rendering observation of it by telescope, as heretofore, unnecessary.

The "time line," for clock-controlling, which had been erected a little before the date of my last report, was put in circuit with our mean-time clock some time after; and Mr. Gaunt's clock, at the corner of the Royal Arcade, in Bourke street, has been accurately controlled to true time ever since. The clocks at the Hobson's Bay Railway Station have also lately been added to the circuit; but whether they have been thoroughly controlled I am as yet unable to say, because the clocks are not provided with seconds hands; but as both the pendulums and magnets have been made well and of the proper form, I have no doubt, if properly adjusted, they will be thoroughly controlled. I believe it is the intention of the Victorian Railway Department to extend the line to Spencer street, in order to control the clocks there.

Some months ago I instituted a series of experiments for ascertaining the best form and position of magnets; form of pendulum coil, kind and strength of battery for controlling, as well as the maximum amount of daily rate that could be safely controlled. The result showed that, with single magnets and two-cells of Meidinger's battery, with a fine resistance of 200 B.A. units, seventy seconds was the maximum; with double horse-shoe magnets (on Sir W. Thompson's plan) and two cells, a rate of three minutes could be controlled. With additional battery power, I believe as much as six or seven minutes a day could be controlled; but, as it is not likely that a clock so bad as to vary its rate that amount will be placed in circuit, I have hitherto contented myself with two cells, arranging that every clock is rated as close as possible before attachment. The condition, that every controlled clock exposed for public use should have a galvanometer showing, by the omitted vibration at each 60th second, whether the clock is under control or not, has not yet been insisted upon. It will be necessary to do so before more clocks are connected.

The magnetic, meteorological, and other instruments for physical investigation are, with two exceptions, in excellent condition, and the barograph, thermograph, and magnetographs work most satisfactorily. The electrographic apparatus, however, has not worked well since its removal to the Meteorological Room, owing to the difficulty of maintaining good insulation; the registration with this instrument has therefore been stopped until more perfect insulation can be maintained in all weathers. The anemograph has also been somewhat out of order; there has frequently been some difficulty with the direction fans—they sometimes worked very stiffly from defects in the friction rollers, caused by dust-mixing with the oil necessary for lubrication. The arrangement was altered about six months since, so that the fan shaft works in centres instead of on friction rollers; but the centres wear down so quickly that I believe it will be necessary to revert to the friction rollers, on a different plan to that first adopted. The registration of the direction and force of the wind has not, however, been interrupted, except for a few hours.

The difficulty experienced in encompassing the extreme range of temperature with the thermograph, referred to in my last report, has not been felt so much during the last summer, as no very high temperatures occurred. It will, however, be necessary to provide thermometers with a less open scale for summer use.

The various other instruments for physical investigation will be found in good order. An improvement has been made in the large spectroscope which greatly facilitates its use; it consists of an automatic adjustment of the whole train of prisms to the angle of minimum deviation by simply pointing the telescope; the same adjustment by a somewhat different method seems to have been adopted in England about the same time. I shall be glad to explain this orally to the Board.

I have made and measured with great care a series of resistance-coils in terms of the B.A. unit belonging to the Observatory, varying from one up to five thousand units; these are combined in a very convenient apparatus on the Wheatstone bridge principle for measuring electric resistance. One of Sir William Thompson's reflecting differential galvanometers, of great sensibility, has also been obtained from Messrs. Elliott and Co., London. A pair of excellent micrometers, for comparisons of standards of length, has been lately obtained from Messrs. Troughton and Simms, of London; and I propose to arrange our standard bar apparatus, and other means of obtaining and testing linear measures, in the west basement room, in a more permanent manner than hitherto, and only wait for the return of the standard bars, camels (which have been lent to the New South Wales Government for the measurement of a standard base line in that colony) before doing so. When this is complete the Observatory will possess the means of measuring or testing standards of English measure, standards of English and French weights, standards of electric resistance, and to determine many questions in physical science referable thereto.

The workshop attached to the Observatory has continued in active operation with the exception of about two months at the end of last year, when, owing to reductions in the votes, the services of the instrument maker had to be dispensed with. Since the commencement of the current year, however, I have been able to retain him in constant employment.

THE GREAT TELESCOPE.

At the date of my last report (31st March 1870) Mr. Le Sueur was busily engaged in observing and drawing some of the nebulae, as well as in some investigations concerning the light of Jupiter. Mirror B was in the telescope, and mirror A in the polishing machine ready for re-polishing, it having become so tarnished as to seriously interfere with its use. In July Mr. Le Sueur commenced preparations for polishing, and completed the operation on the 14th. On replacing the mirror A in the telescope, and after proper adjustment, the performance was found to be very satisfactory: the polish was good and the definition far superior to that given by B, and it was considered by both Mr. Le Sueur and myself to give sharper images than when first used. This mirror has remained in the telescope ever since, and maintains its polish moderately well.

The resignation by Mr. Le Sueur in July last of course upset the order of things in this branch of the Observatory, for although a successor (Mr. E. F. MacGeorge), as already mentioned, was almost immediately probationally engaged, some time elapsed before he obtained sufficient experience to take up the work where Mr. Le Sueur left off; he, however, commenced working on η Argus and Doradus in a few months after his appointment, and the results so far show that he is quite capable of grappling with this, the most important part of the work. He has also practised diligently with the spectroscope, and has now become moderately expert in its use.

The photographic apparatus arrived from Dublin a few weeks since, but it has not yet been fitted up, as a movable stage outside the building, to afford convenient access to the mouth of the telescope, will have to be arranged before it can be used. This apparatus consists of two separate complete arrangements, one of which will carry a plate of 5 inches and the other 5 x 8 inches square; both are similar, and agree with the description given in Dr. Robinson's monograph of the Great Melbourne Telescope. A prism of high dispersive power has been sent out for the spectroscope by Mr. Grubb, but has not been used. The 12-inch mirror and mounting for practice in polishing and grinding, Mr. Grubb informs me, is in a forward state and will soon be sent out.

I have had the whole of the telescope works painted during the last fortnight, for it had not been painted since its arrival and first erection, and was rather pasty-colored and unsightly; the appearance is now greatly improved. There are one or two very convenient arrangements which have been added to the mechanism at Mr. MacGeorge's suggestion, by which the observer has convenient and perfect control over the R.A. slow motion, by means of an endless cord and pulley, in any position of the telescope while observing. Pointers and graduated arcs have also been fixed so as to show conspicuously the amount of motion made in sweeping in both declination and R.A. The guide rollers, over which the focusing cord passes at the eye end, have been placed on an arm which can be tilted so as to keep the cord sufficiently tight in all weathers. With these exceptions the whole mechanism remains the same as at the date of my last report.

As regards the performance of the telescope, in my last report I stated that mirror A with either combination did not satisfy Mr. Le Sueur or myself, but that mirror B performed much better. Shortly afterwards, however, it was observed that there was a tendency to a triplication of images of stars, very slight, but quite apparent, indicating some flexure in the mirror; this triplication of image was observed by the Committee of the Board. After A was repolished, B was removed. The performance of the telescope with A has been found far better than at any time since its erection, and observing has proceeded satisfactorily with it up to the present time. On examining B, when on the polishing machine, it was found that three lugs placed to prevent the mirror from falling forwards when its surface was nearly vertical, had been rubbing on the edge of the speculum—not from the speculum being forced up by the collimating screws (which might easily be done if they were used carelessly), but by the play in the internal ring allowing the edge of the mirror to come into contact with the lugs when the telescope was far from vertical, and that too when the mirror was well down in its cell. This would amply account for the multiplication of images. The lugs have been reduced so as to clear properly, but whether the flexure has become permanent or not has yet to be ascertained. Mr. Grubb has informed me that careful polishing with very little pressure on the polisher will probably remedy the defect; this operation will be tried as soon as a little more experience in polishing has been obtained with the experimental mirror when it arrives. Further experience with the Great Telescope, and of the conditions which affect its performance, have very much enhanced our opinion of it, and the drawings and other results obtained unmistakably show that excellent work can be done with it. On really favorable occasions the performance, even with very high powers, is exceedingly good. It is evident, however, that a telescope of such large dimensions, requires a very long practice before it can be fairly or successfully used. The mechanical arrangements are all in perfect order, and the moving and setting the telescope from one object to another is performed almost as quickly and as easily as with a five-foot equatorial. The clock has worked well and with great regularity from the first.

Arrangements were made about ten months ago that visitors could be admitted to view the moon and planets through the Great Telescope on certain nights in each month; from the 4th to the 10th night of new moon were selected, and visitors are now admitted at certain hours on these evenings, on condition they make appointment beforehand; no more than twelve to be admitted on each evening. A book is kept in which the names are entered as the appointments are made. This privilege has been fully used, and too frequently the numbers have been exceeded. The number of visitors since this arrangement was first made has been 590. It will be necessary before long to modify the plan, as the admission of the public on so many nights each month is a serious hindrance to the work.

Some little time since I received a letter from Dr. Robinson respecting a statement in my last report concerning the alteration of the stops of the eye-piece by Mr. Le Sueur. Quoting Mr. Le Sueur's own words in my report, I wrote (page 13, line 43), "This disc at first met with much opposition on the part of Dr. Robinson and Mr. Grubb, but the former (who has had more experience with Cassegrains than any one) now agrees that the disc is necessary, if the eye-stops are retained in the places originally assigned to them by Mr. Grubb." Dr. Robinson in his letter to me says, "I never made any such statement. I said the disc was necessary if the stop were placed as Mr. Le Sueur placed it; but I distinctly told him that he did not place it as Mr. Grubb placed it, or as it was placed by any other optician. I also told him the proper place for it was at or near the image of the small box formed by the eye-piece. I also told him that the extra field which he gained would be nearly useless from its want of light; and also, that if any false light

was seen when the eye-stop was in its normal position, it could only proceed from the aperture in that stop being too large, and it could be remedied by substituting a smaller one. Under these circumstances I must beg you to contradict that statement as of my opinion, either in the Melbourne papers or your next report."

The eye-stops are still in their places, as altered by Mr. Le Sueur. I am under the impression, but not certain, that he increased the aperture in all the stops soon after the erection of the telescope. I propose to go through the adjustment of the stops afresh, commencing with smaller apertures than those now used.

I am much indebted to Mr. Grubb for advice and suggestions for overcoming difficulties that have from time to time arisen, and for the readiness he evinces in aiding us in all matters pertaining to the Great Telescope. This gentleman has forwarded me some copies of a pamphlet, being an examination and reply to the official reports from Melbourne respecting the Great Melbourne Telescope, a copy of which is now on the table.

LIBRARY.

The library of the Observatory has been increased during the last year by the following donations:—

Journal of the Scottish Meteorological Society. Nos. 1 to 21—January 1864 to January 1869. Nos. 22 and 23—April to July 1869.	Scottish Meteorological Society.
Nouvelles Météorologiques. No. 2—February 1870. With table ...	Société Météorologique de France.
Mémoire sur l'Etat Actuel de l'Observatoire Impérial ...	Imperial Observatory, Paris.
Erdbeben in Kaukasien im Jahre 1868. (Von H. Kiefer, Ingenieur, Assistent am Physikalischen Observatorium in Tiflis)	Imprimerie de l'Administration Centrale du Caucase.
Exercices Hypsométriques par A. Moritz. 1869 ...	Ditto.
Rectification d'une Erreur découverte dans la table de M. Regnault, relative à la Force Expansive de la Vapeur d'Eau	M. A. Moritz.
Mélanges Physiques et Chimiques tirés du Bulletin de l'Académie Impériale des Sciences de St. Pétersbourg. Tome viii. 1869	Imperial Academy of Sciences, St. Petersburg.
Ueber die Anwendung des Pistorschen Reflections-Kreises zum Messen von Angular-Distanzen zwischen terrestrischen Objecten	Von Herrn Dr. A. Moritz, Director des Observatoriums in Tiflis.
Der Bewegungs-Mechanismus am Drchthurme des Observatoriums zu Tiflis	Ditto.
Mélanges Physiques et Chimiques. Tome vii. ...	Ditto.
Die Sonnenfinsterniss vom 6 März (22 Februar) 1867. Von A. Moritz in Tiflis	Ditto.
Bemerkungen über die Meereshöhe von Tiflis ...	Ditto.
Russian Calendar for 1868-9 and 1870, with three Russian Pamphlets, 1869 (one 1865 to 1869)	Ditto.
Meteorologiske Jagttagelser del Sydliqe Norge, 1863-4-5 and 1866 ...	L'Institut Météorologique de Norwége (H. Mohn, Director).
Meteorologiske Jagttagelser paa Fem Telegrafstationer ved Norges Kyst, 1866	C. Fearnley, Christiania Observatorium.
Norsk Meteorologisk Aarvog for 1867 and 1868 ...	Norske Meteorologiske Institut.
Astronomische Beobachtungen auf der Sternwarte zu Bonn. 7th vol. 1869	Von Dr. W. A. Argelander.
Verzeichniss der von Bradley, Piazzi, Lalande and Bessel beobachteten Sterne, von Prof. Harding, Göttingen. 1830 (2 Nos.), 1831 (2 Nos.), 1333 (1 No.), 1834 (2 Nos.), 1835 (2 Nos.), 1840 (2 Nos.), 1843 (2 Nos.), 1845 (1 No.), 1848 (1 No.), 1849 (1 No.), 1852 (2 Nos.), 1853 (1 No.), 1854 (2 Nos.); 1856 (1 No), 1858 (2 Nos.), mit Catalog zu den 24 Stunden der akademischen Sternkarten für 15° südlicher bis 15° nördlicher Abweichung, 1859	Von der Königlichen Akademie der Wissenschaften zu Berlin.
Charts showing the surface temperature of the South Atlantic Ocean in each month of the year	Issued under authority of Committee of Meteorological Office, London
Meteorological Phenomena, 1867. Athens (printed in Greek) ...	From Observatory, Athens.
Meteorological Phenomena, 1861. Athens (printed in Greek) ...	Ditto.
Report of the National Academy of Sciences for 1866 ...	Committee of National Academy of Sciences.
Report of the National Academy of Sciences for 1867 ...	Ditto.
Annual Report of the Board of Regents of the Smithsonian Institution, 1866	Washington. Jos. Henry, Secretary S. Institution.
Annual Report of the Board of Regents of the Smithsonian Institution, 1867	Ditto.
Astronomical and Meteorological Observations made at the United States Naval Observatory during the year 1866	Rear-Admiral Chs. H. Davis, U.S.U. Superintendent.
Physical Observations in the Arctic Seas, 1860 and 1861. (From the Smithsonian Institute, Washington)	By Isaac J. Hayes, M.D., Commanding Expedition, Revd. Chas. A. Schott.
Results of Meteorological Observations made at Marietta, Ohio, between 1826 and 1859 inclusive	S. P. Hildreth, M.D., Revd. Chas. Schott.
Supplement to Abstracts of English and Colonial Patent Specifications relating to the Preservation of Food, 1870	By Wm. Hy. Archer, Registrar-General, Victoria.
Comptes Rendus des Séances de la Commission Permanente de l'Association Géodésique Internationale pour la mesure des degrés en Europe, 1869	Florence.
Jahresbericht am 24 Mai 1868, dem Comité der Nicolai Hauptsternwarte, St. Petersburg abgestattet 1867, ditto 1868	
Mémoires de l'Académie Impériale des Sciences de St. Pétersbourg: viie serie, tome xi., No. 7, 1867	
Tabulæ Auxiliares ad Transitus per planum primum verticale. Reducendos inservientes, 1868	Otto Struve, Speculæ Pulcovenis Director, 1868.
Greenwich Observations, 1867 ...	G. B. Airy, Esq.
Greenwich Astronomical Results, 1867 ...	Ditto.
Greenwich Magnetical and Meteorological Observations, 1867 ...	Ditto.
Meteorologische Beobachtungen, Switzerland, December 1863, January, February, March, April, and May 1864	
Transactions of the Connecticut Academy of Arts and Sciences, vol. 1, part 1 (1866)	
November Meteors of 1866; as observed at the U. S. Naval Observatory, Washington	
Annals of the Astronomical Observatory of Harvard College, vol 5 (Observations upon the Great Nebulæ of Orion), 1867	Geo. Phillips Bond, A.M.

Nederlandsch Meteorologisch Jaarboek voor 1863 (1st part)	G. B. Airy.
Report of the Astronomer Royal to the Board of Visitors of the Royal Observatory, Greenwich, 4th June 1870	
Planet Och Komel. Observationer Auställda ar 1868 pa Lunds Observatorium	Axel Möller.
Ascensions Droites Moyennes des Etoiles principales pour l'Epoque 1845 : dans les années 1842-1853	O. Struve, l'Observatoire Central Nicolas.
The Mare Serenitatis, its Craterology and principal features, by Wm. Radcliff Birt, F.R.A.S.	
Annalen der Physik und Chemie. 1869, No. 12, and No. 1 and No. 2, 1870	J. C. Poggenorff
Tabulæ Quantitatum Besselianarum pro Annis 1750 ad 1840	Otto Struve, St. Petersburg.
On Secular Variation of Lunar Tints and Spots and Shadows on Plato ...	W. R. Birt, F.R.A.S.
Mémoires de l'Académie Impériale des Sciences de St. Petersburg : viiè série, tome xii, No. 4	Dr. H. Gyldén.
Constitution der Atmosphäre	Ditto.
Constitution der Atmosphäre, tome xii., No. 5, Des Grossen Kometen von 1861	O. Struve.
Constitution der Atmosphäre, tome xiii., No. 1, Periodischen Lebenserscheinungen der Pflanzen	Carl Linsser.
Observations de Poulkowa. Vol. 1 and vol. 2	O. Struve.
Siderum Nebulosorum Observationes Havnienses, 1861-1867	Dr. H. L. d'Arrest.
Proceedings of the Royal Society, London. Vol. xvii., No. 109, 110, 111, 112, and 113 ; vol. xviii., No. 114	
Mémoire sur la Température de l'Air à Bruxelles	Ern. Quételet.
Météorologie de la Belgique comparée à celle du Globe	Ad. Quételet.
Annales Météorologiques de l'Observatoire Royal de Bruxelles, 1867 ...	Ditto.
Annales de l'Observatoire Royal de Bruxelles, vol. 17, 1866 (2 copies) ...	Ditto.
Annales de l'Observatoire Royal de Bruxelles, vol. 18, 1868	Ditto.
Observations des Phénomènes Périodiques pendant l'Année 1864	Ditto.
Sur les Etoiles filantes périodiques du mois d'Aôut 1867	Ditto.
Des Lois Mathématiques concernant les Etoiles filantes (2 copies) ...	Ditto.
Observations des Etoiles filantes périodiques de Novembre 1866	Ditto.
Etoiles filantes sur l'Héliographie et la Sélénographie, &c. (2 copies) ...	Ditto.
Etoiles filantes du milieu de Novembre 1867	Ditto.
Sur l'Heure des Chutes d'Acrolithes (2 copies)	Ditto.
Communications sur le 17 ^{me} tome des Annales de l'Observatoire Royal de Bruxelles (2 copies)	Ditto.
Bolide observé le 11 Juin 1867	Ditto.
Cinquantième Anniversaire du rétablissement de l'Académie Royal des Sciences, &c., de Belgique	Ditto.
Nouvelles Météorologiques. No. 7, July 1870	Ditto.
Collection de Tables à l'Usage des Stations Météorologiques du Caucase. Calculées par A. Moritz, 1868	A. Moritz.
Vol. xxvii. Radcliffe Observations, 1867	Revd. Robt. Main, M.A.
Second Radcliffe Catalogue of Stars for 1860	Ditto.
Nouvelles Météorologiques, 1870, 1st August, No. 8	Meteorological Society of France
Results of Meteorological Observations made at the Radcliffe Observatory	Revd. Robt. Main, M.A.
Annales de l'Observatoire Physique Central de Russie, for 1865	H. Wild.
Annual Report of the Director of the Cincinnati Observatory, June 1870	

ASTRONOMICAL WORK.

Foremost among this are the transit circle observations, which have been assiduously carried on by Mr. White. The principal subjects of observation have been, as heretofore, N.A. fundamental stars for clock errors; standard circumpolar stars for instrumental errors; stars required for reducing the zone observations; and the principal stars of the St. Helena catalogue, which culminate to the south of our zenith. The numbers of observations made during the year are as follows:—

Right ascension	...	...	...	...	...	2,063
Polar distance	...	...	...	...	...	1,588

All the observations for 1870 are fully reduced and catalogued; those for 1871 have their instrumental corrections applied; the clock corrections, however, have been held over till the effect of the barometer on the rate has been finally adopted. The last astronomical observations printed (3rd vol.) contained the results for 1866, 1867, and 1868. The results of the years 1869 and 1870 are now ready for the press, and will, I hope, shortly be printed. A commencement has been made with the preparation of a general catalogue for the epoch 1870, containing the results of all the transit-circle work at the Melbourne Observatory since its completion in 1863 to the end of 1870.

The zone observations have been continued by Messrs. Moerlin and Gilbert. The catalogue number of the Melbourne zones have now reached 48,260. The work already done, both in observation and reduction, is as follows:—

Total number observed	...	...	...	...	48,260
Observed since last report	...	...	...	...	9,955
Number finally reduced	...	...	...	...	32,031
Reduced to apparent places	...	...	...	...	4,886
Unreduced	...	...	...	...	11,343

The extra meridional work has been almost entirely done with the Great Telescope. The small refractor has been used principally for sun-spot observations, and for places of comet 1, 1870, during the brighter part of its apparition. It will shortly be used for sun photography, as a camera has been constructed for this purpose.

The observations with the large telescope include, among others, observations of comet 2, 1870—of the nebulae η Argus, 30 Doradus, θ Orionis, of the moon for comparison of the new B.A. maps, besides observations on several multiple stars; on the physical appearances of Saturn and Jupiter; spectroscopic examination of stars, and micrometric measures of Saturn's rings.

The observations in meteorology and terrestrial magnetism have been carried on with the usual regularity. The monthly determinations of the absolute force of terrestrial magnetism in its three elements have been carried out with regularity. The effect of the presence of the mass of iron in the Great Telescope in the neighborhood, referred to in my last report, still appears from the observations to be insensible. The reductions of meteorological observations, made four times in twenty-four hours, are computed and tabulated up to date, as well as those made at the different country stations, with the exception of those made at Gabo Island and Portland, which have only recently come to hand.

The following are the gentlemen who send meteorological reports:—

<i>Sandhurst</i>	...	John Hamlet Taylor, Esq., District Surveyor.
<i>Ballarat</i>	...	Henry Morres, Esq., District Surveyor.
<i>Cape Otway</i>	...	J. H. Kelsall, Esq.
<i>Port Albert</i>	...	Jacob Ferris, Esq., Telegraph Station Master.
<i>Ararat</i>	...	Ph. Chauncey, Esq., District Surveyor.
<i>Portland</i>	...	E. Braim, Esq., Postmaster.
<i>Gabo Island</i>	...	Geo. Tapp, Esq., Lighthouse Keeper.
<i>Wahgunyah</i>	...	R. Kilburn, Esq., Telegraph Station Master.
<i>Stawell</i>	...	Bernhard Smith, Esq., Warden and Police Magistrate.

Besides these—

G. W. Robinson, Esq.	...	...	...	<i>Berwick,</i>
Mr. Hill	...	...	...	<i>Mornington,</i>
William Nicholson, Esq., Harbor Master	...	...	...	<i>Geelong,</i>
D. Harbord, Esq., Shire Engineer	...	...	...	<i>Camperdown,</i>
Hector MacLean, Esq.	...	...	...	<i>Hamilton,</i>
Thomas Hale, Esq., Mining Registrar	...	...	...	<i>Daylesford,</i>
Edward C. Dunn, Esq.	...	...	...	<i>Katandra,</i>

regularly communicate registrations of rainfall and other meteorological data.

The question how to deal with the meteorological and magnetical observations has become a very weighty one. Sheet after sheet of the readings of the various meteorological instruments accumulate into piles; certain portions are reduced to means or corrected readings for immediate use; but I have hesitated to print, at a great expense, columns upon columns of mere instrumental readings on the remote prospect of their being useful in such a form. I am of opinion that most good will be done by adopting some method for deducing daily, monthly, and annual results, preserving the original observations for any after reference that may be required; and I think this plan would be best carried out by issuing a monthly or a quarterly pamphlet, containing the results of our work in meteorology and magnetism in a form which, while giving all information of use to the public, will form a full and scientific record of the meteorological and magnetical conditions and changes for the period represented by each pamphlet. The difficulty still remains of deciding upon the best form, with the view of affording most readily the information likely to be required in any future investigations into these branches of physical science which may be instituted.

For the reason given above, no volume of meteorological or magnetical observations have been published since the retirement of Professor Neumayer from the Observatory. Monthly results obtained from the Melbourne observations are published in the *Argus* and *Australasian*, and the editor of the latter kindly furnishes us with slips, which are distributed among the neighboring colonies.

The photographic records from the barograph, thermograph, magnetographs, &c., are filed away in order. The tabulation of the magnetograph curves is completed in—

Declination—Up to the end of April 1870.

Horizontal force—To the middle of November 1869.

Vertical force—To the end of September 1869.

The absolute determinations of the magnetic elements, which have been made every month, are reduced up to date. The anemograph curves are tabulated up to date. No systematic tabulation of the barograph and thermograph curves has yet been made, pending the adoption of some definite plan.

With respect to the magnetograph curves, I have endeavored to ascertain the mode of tabulation likely to be ultimately adopted in England; but no definite scheme appears yet to have been decided upon. The selection and tabulation of disturbed periods for comparison among the various magnetic stations is, however, considered desirable.

The tabulation of all these photographic curves can be obtained at any time; it is only a matter of so much plain clerical assistance, as the process can be learnt in a few minutes by any ordinary intelligent person.

In the quarterly publication of the German Astronomical Association appeared a lengthy notice and criticism of our volume of observations for the years 1863 to 1865 by Mr. Gylden, of the Pulkowa Observatory. As it gives us a notion of the opinion held abroad of the character and value of our work, I beg to quote a paragraph from Mr. Gylden's pamphlet:—

"The observation series at the observatories of the Southern Hemisphere are hitherto available not only in smaller numbers, and to a small extent, but they are also mostly executed with far less perfect instruments than those which have been made at the observatories in the Northern Hemisphere. It follows, therefore, immediately that our knowledge of the positions and motions of (celestial bodies) stars of the Southern Hemisphere rank behind those which we have obtained with regard to stars situated more northerly, and accessible to European observers. The necessity is all the more felt, therefore, to examine the already published star catalogues of the Southern Heavens, with reference to their reliability, in order thereby to prepare their greatest possible resulting value for astronomy. For this reason I beg to draw the attention of the readers of this periodical to an observation series, which, as it appears, may be numbered among the most excellent which have reference to Southern stars, and which, if an opinion may be formed of their accuracy by the consistency of the observations, may be ranked by the side of the better of the European observation series. It is the series of observations which has been executed under the direction of Robt. J. Ellery at the new Melbourne Observatory, during the years 1863-1865."

A total eclipse of the sun will occur on December 11th this year. The path of totality passes over Australia a little south of Cape York. As the result of the eclipse expedition to the Mediterranean last December was not so successful as was hoped, owing chiefly to cloudy weather, leaves many points connected with eclipses of the highest scientific interest and value still undecided, it will be of great importance to astronomy if the eclipse of December can be properly observed. A suggestion was made at the last meeting of our Royal Society by Professor Wilson, that the opportunity of seeing so grand a sight as a total eclipse, coupled with a summer trip to North Queensland, would be a sufficient inducement to many besides scientific men to join in chartering a steamer for the expedition. I hope that this suggestion may be carried into effect, as this is the only total eclipse that will come within our reach for many years; if it should, I shall of course seek the consent of the Government to allow our observers to join in the work.

No preparations have yet been made for observing the transit of Venus in 1874, nor do I think any special ones will be necessary, beyond practising beforehand the methods of observation which will be adopted.

ROBT. J. ELLERY,
Government Astronomer.

Melbourne Observatory,
18th April 1871.