1886.

VICTORIA.

TWENTY-FIRST REPORT

OF THE

BOARD OF VISITORS

TO

THE OBSERVATORY;

TOGETHER WITH THE

Annual Report of the Government Astronomer.

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

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TWENTY-FIRST REPORT

OF THE

BOARD OF VISITORS TO THE OBSERVATORY.

To His Excellency Sir Henry Brougham Loch, *Knight Commander of the Most Honorable Order of the Bath, Governor and Commander-in-Chief in and over the Colony of Victoria and its Dependencies, &c., &c., &c.*

We have the honour to inform your Excellency that we have completed our annual inspection of the Observatory. The buildings and instruments are in good order, and the work in all its departments is proceeding satisfactorily.

The report of the Government Astronomer, attached, gives a full and interesting account of the operations of the year, and it contains some important representations, to which we beg leave to invite the special attention of your Excellency's Government.

The condition of the mirrors of the Great Melbourne Telescope is such that, in Mr. Ellery's opinion, arrangements for having them repolished cannot be much longer delayed. As soon as he has obtained the information he is seeking from Mr. Grubb, of Dublin, and other authorities on the subject, he will make definite proposals to the Minister of his Department. There can be no question as to the necessity for repolishing the mirrors, in order that their full gathering power may be made fully available for the important and delicate work upon which the telescope is employed. We do not doubt that, as soon as Mr. Ellery is in a position to indicate the best means for repolishing the specula, and estimate the cost, the Government will authorize it to be done.

The increase of dust in the neighbourhood of the Observatory requires that every means shall be adopted to protect the instruments from its effects. Belts and masses of trees between the roads and the Observatory buildings form the most effectual screens ; and we are glad to see that the attention of the Government Astronomer is continually directed to the necessity for meeting a difficulty which has always been serious, and is increasing every year. We recommend that the Curator of the Domain, Mr. Guilfoyle, be requested to bear this important object in mind when he lays out the planting of the Park between the St. Kilda road and the Observatory.

GEO. VERDON, Chairman,
F. STANLEY DOBSON,
W. F. STAWELL,
W. C. KERNOT, M.A.,
M. H. IRVING, M.A.,
G. V. SMITH,
J. E. BROMBY, Hon. Sec.

Melbourne, 16th September, 1886.

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

August, 1886.

THE last visitation of the Board took place on the 6th October, 1885, and the Report I then submitted dealt with the condition and work of the Observatory from 30th June, 1884, to 30th June, 1885. The present Report, which I now beg to submit, refers to the year ending the 30th of June of the present year.

I.—PERSONAL ESTABLISHMENT.

There has been no change in the staff of the Observatory during the past year. It is as follows:—

Mr. ELLERY, Director, Government Astronomer;
Mr. WHITE, Chief Assistant;
Mr. MOERLIN, Assistant;
Mr. GILBERT, ,,
Mr. BARACCHI, ,,
Mr. PRINGLE, ,,
Mr. KEMP, ,,
Mr. INGAMELLS, ,,
G. SWANSON, Mechanic;
J. BURLEY, Senior Messenger;
G. POWER, Messenger.

Mr. Baracchi, whose chief duties are in connexion with the great telescope, unfortunately contracted typhoid fever in March last, and had a long and severe illness, from which he has scarcely yet quite recovered. He resumed his duties on the 27th July, but is not yet permitted to do night work.

The distribution of the duties of the establishment is much the same as at the date of the last visitation.

II.—GROUNDS AND BUILDINGS.

Improvements to the grounds have been continued by planting, clearing, and attention to the shrubberies, &c., and they are now altogether in a much more satisfactory condition than formerly, when the means at my command for this purpose were barely sufficient to keep them from becoming a wilderness. The increasing dustiness of the neigbouring roads and parts of the city renders it of the utmost importance to keep as dense a screen of foliage around the building as possible, especially to the north and west. The plantations are now rapidly increasing within the grounds, and the director of the Botanic Gardens, Mr. Guilfoyle, has promised to keep our necessities in this direction in view in dealing with the plantations in the domain outside our grounds; it is hoped that much of the dust which now invades the Observatory with strong north-west and westerly winds will be thereby considerably diminished. The buildings, with the exception of the great telescope and absolute magnetic houses, are now in excellent condition; the great telescope building simply requires re-painting and some repairs to the flat roof, which have already been taken in hand by the Public Works Department; the requisite repairs to the magnetic house I expect to get effected before the summer. In order to keep control of some slight and apparently-periodic movements in azimuth of the transit circle, I have had erected on the south boundary of our grounds a large brick pier, protected by a small house, to carry a collimating mark three hundred feet south of the instrument. This arrangement, with a long focus lens in place of the south collimator, furnishes the means of determining the extent and periods of these minute movements with much greater precision and certainty than is otherwise possible.

III.—INSTRUMENTS.

The new transit circle has been in constant use during the year, and is in excellent order. The mounting exhibits very satisfactory stability. There appears, however, to be a very gradual but persistent lowering of the west pier, for since its final erection, in August, 1884, the west pivot has very slowly lowered to the extent of 16 of arc, while other errors, with the exception of the small periodic oscillations of the azimuth error, have remained practically the same as from the first; and the azimuth error itself, though sometimes exhibiting the minute oscillations referred to, has remained generally constant. There also appears a decided diurnal change in the level, for the east pivot is always slightly higher in the morning and lower in the evening; this I believe is simply due to the heating effects of the sun on the earth's crust, or on the building; probably both.

The difficulties which sometimes occur in observing the images of the wires reflected from a mercury bath placed vertically beneath the instrument, for determining the nadir, have been much increased with the new transit, and on some occasions it has been almost impossible to get the mercury-surface sufficiently quiescent to permit of any observation at all. This does not appear to be due to ordinary disturbances about the building, or tremor from distant traffic, but rather to some other cause which sets up a minute tremor of the mercury, the effects of which are not discernible by the naked eye; this is more especially the case on cold, clear, and frosty nights. To get over these difficulties, various plans have been tried without marked success. The mercury bath has always been suspended on a system of india-rubber slings, so that no tremor could reach the mercury from the earth except through eight india-rubber bands stretched moderately by the weight of the mercury and containing vessel. This method was always perfectly satisfactory with the old transit circle, which, however, was a smaller instrument of lower power. Some months ago, Admiral Mouchez, Director of the Paris Observatory, published the details of a method he had found to be quite effective in securing a quiet mercury-surface, even amidst the constant traffic tremors of that great city, almost in the midst of which the Observatory stands. I at once got a bath made after the manner described, where one mercury bath is made to float, but in a partially restrained way, within another; this turned out so very successful that it has been used ever since, and although there are a few occasions on which it is difficult to get good images, it is immensely superior to any other methods we have tried, and a welcome acquisition to the observers.

Another accessory has been added to the transit-room in the shape of two sympathetic dials, placed on the inner faces of the collimating piers. These are kept going synchronously with the sidereal clock, and one or the other is always visible to the observer at the instrument in almost any position he may be in.

The great telescope continues in good working order, but the mirrors are gradually absorbing more light, which, although not much felt in most of our work, will, I fear, shortly begin to tell prejudicially on the more delicate observations, and render repolishing absolutely necessary. In view of this, it is, I think, desirable to decide before long how the repolishing of the mirrors should be accomplished. Although we possess the grinding and polishing machine sent out with the instrument, the operation is one which should certainly not be undertaken except by some one thoroughly skilled in such work. It appears, therefore, that one or two courses are open: either to send one pair of mirrors to Mr. Howard Grubb, of Dublin, to be repolished and returned, and on their arrival to send him the other pair also; or to obtain the services of some one skilled in mirror polishing, and get the necessary renovation of the surfaces carried out on the spot. To enable me to make some recommendation on this point, I have written to Mr. Howard Grubb, and also communicated with a gentleman, now residing in Sydney, who has had large and extended experience in such operations. The whole instrument is now undergoing thorough repair and recleaning, and will be ready for work again about the middle of next month.

A valuable accessory to the great telescope was constructed in the observatory workshop early in this year, namely, a *Sketching Micrometer*, which is fitted to the eye-piece (power 238). The former sketching eye-piece had a reticle dividing the practical field into rectangular spaces by three wires 90″ apart in R.A., and four wires 1′ apart in declination, all the wires being fixed and of sufficient thickness to be visible against a moderately dark sky. In the new arrangement, the wires are very fine (silver), and are rendered bright in a dark field by means of two small electric glow lamps, fixed and carefully screened within the eye-piece tube (which is 8 inches diameter) by means of small mirrors. The light from these lamps is reflected across the wires in such a manner that they appear bright on a perfectly dark field, and by means of a rheostat the amount of light can be so regulated that the wires can be illuminated to any degree, from bare visibility to exceeding brightness. The whole eye-piece is mounted on a position circle. In the focus of the eye-lens (the eye-piece being a negative one) are six fixed wires, the four central ones being 1′ apart, and two others 3′ distant from the outer ones of the central system. Parallel to these are also two wires 3′ apart, movable by a micrometer screw, whose revolution value is 10″ of arc.

Another system of fixed wires, 90″ apart, is arranged at right angles to the others, and together the fixed wires form a square occupying the centre of the field. This sketching micrometer is found to be a great acquisition, and Mr. Baracchi speaks in the highest terms of its performance and the facility and expedition it affords in observing.

The North and South Equatorials are in good condition and satisfactory working order.

The Photoheliograph has been under alteration for some time. The change of size of picture from four to eight inches gave rise to a great deal of trouble and delay with regard to focus exposure, &c., and for a considerable period no work was done with it; it is now, however, in use again, and working satisfactorily.

The Meteorological and Magnetic self-recording instruments are all in good order, and have been so throughout the year. No alterations and additions worthy of note in this direction have been made, and everything has gone smoothly and satisfactorily during the period under consideration.

The Clocks and Chronographs are all in good order. A new kind of pen has been tried with the transit barrel-chronograph. The fine glass ruling pens hitherto used are found to rapidly wear away at the points, which gradually get quite flat from the friction on the paper. The new one has a *ruby point* (drilled with a fine capillary hole), which is fused into a piece of glass-thermometer tube; this forms the style or nib of the syphon pen; it has only been in use about a month, but it rules a very fine clear line, and it may be reasonably expected, from the much greater hardness of ruby as compared with glass, that it will maintain its point for a much longer period.

IV.—The Library.

During the past year, 241 books and pamphlets have been received, as donations from kindred institutions in all parts of the world, a catalogue of which is given in the Appendix. Considerable additions have also been made to the library by purchase. The re-arrangement referred to in my last report has not yet been carried out. The new catalogue completed last year is found of very great service.

V.—The Work of the Observatory.

In the astronomical work of the Observatory, meridian observation is always regarded of paramount importance, and next in order the revision of the southern nebulæ with the great telescope, while, of course, every astronomical occurrence of scientific interest claims and receives attention. Of this class of work, observations of small and telescopic comets have constituted the most important item for the last few years, and in the months of May and June last we had as many as three under review at the same time.

Through the arrangements for astronomical telegrams made by European and American astronomers with the several Telegraph Cable Companies, we get the earliest information from Kiel (the Central Bureau for astronomical telegrams), in cypher, of every discovery of comets, &c., made in the Western world. We are thus supplied with particulars of newly-found celestial objects, often within twenty-four hours of the time they were first discovered.

Transit Circle Observations.—All the meridian work of the year was done with the new transit circle. It comprises, besides the usual observations of fundamental clock stars, standard circumpolar stars for determination of the azimuth error, faint stars selected from the Melbourne zones, stars observed differentially with comets, stars culminating near the north and south horizons for determining the refraction, and a list of stars observed at the request of the Bureau des Longitudes for insertion in the Connaissance des Temps.

The number of observations with the transit circle were as follows:—

Right Ascension Observations	3,189
Polar Distance Observations	1,520
Observations for Instrumental Errors, viz.:—	
Collimation	156
Level	282
Nadir	261
Runs of Miscroscopes	51
Flexure of Telescope	13

All the individual observations are completely reduced to mean places.

The Great Telescope.—This instrument was almost exclusively devoted to its special province, the revision of the Southern nebulæ. Exceptions to this rule, however, occurred on the apparition of Barnard's comet, in July, 1885, and in December also, as well as on the occasion of the discovery of Fabry's comet in December.

During the year, 214 of Sir J. Herschel's nebulæ were finally revised—7 were searched for and not found; 30 nebulæ were found, but not identified in the catalogues, and may therefore be regarded as new. There now remains only 95 nebulæ, which were observed by former observers, that require final revision before publication.

The long illness of Mr. Baracchi in the autumn prevented the carrying out of the programme of the year, and the amount of work in this direction is therefore considerably less than it was hoped would be accomplished. Material nearly sufficient for a second number of "Observations of the Southern Nebulæ" is, however, now available, and it is hoped will soon be in the printer's hands.

Extra meridional observations were made with the smaller Equatorials (8 inch and 4½ inch), during the year, of the various comets which appeared, viz.:—

	Nights.
Comet, Fabry	30
„ Barnard III., 1885	14
„ „ II., „	5
„ Brooks I.	1
„ „ III.	4

Measures of α Centauri were obtained every month; and a series of experiments and measures with Pritchard's wedge photometer, and spectroscopic observations of Lal. 10,063, were also carried out.

Photoheliography.—As already stated, the photoheliograph was not in working order for several months during the year, owing to difficulties which beset the change of the sun picture from 4 to 8 inches. This necessitated the use of a much longer camera, for which it was found there was not sufficient space in the room, and alterations had to be made to provide for this; then it was found that the camera sent out by the makers was too short for the new secondary magnifier; and considerable time was occupied in making all these matters right.

The instrument did very little actual work between the months of April and July. The number of sun pictures obtained during the year was, therefore, only 92.

Meteorology and Terrestrial Magnetism.—This part of the Observatory work expands a little every year, and the demands upon it are also increasing considerably.

The great importance attaching to rainfall and water supply renders it necessary to spread gauges wherever the services of trustworthy observers can be secured, while the collection and tabulation of the results involves no inconsiderable labour.

The due issue of weather maps and forecasts for Southern and Northern Victoria has been continued without intermission.

The ordinary routine eye-observations have been carried on as usual, while the self-recording instruments have furnished an uninterrupted record of the direction and force of the winds, hours of sunshine, pressure and temperature of air, rainfall, humidity, &c.

Monthly determinations of the absolute force of terrestrial magnetism have been carefully carried on, and the photographic magnetographs have supplied their continuous curves of the changes of terrestrial magnetism in its three elements. There are no changes in this branch to record.

During the past year, we sent out fourteen rain-gauges, and we now obtain monthly returns from 272 observers, nearly all of whom give their voluntary services; and many who possess gauges of their own kindly furnish copies of their observations to the Observatory.

The branch meteorological stations at Ballarat, Sandhurst, Echuca, Portland, Cape Otway, Wilson's Promontory, and Gabo Island, have continued in operation, and supply regular and satisfactory returns, while less complete returns are furnished by 20 other stations.

There has been prepared a complete register of Victorian rainfall. It is arranged with the localities in alphabetical order, and shows at a glance the annual and monthly rainfall, as well as averages for years and months.

Time-balls, Time Service, &c.—The telegraph time service is working satisfactorily, and remains as described in former reports.

The Williamstown time-ball signal, which is the one used by mariners in the port, has been given every day, Sundays or public holidays excepted; it failed 14 times out of 298, chiefly in consequence of interruptions on the telegraph lines.

The Post Office clock has not gone so satisfactorily during the past year as formerly, but in August, 1885, it was stopped and thoroughly cleaned and repaired, since which, with an accidental exception, it has maintained its old and excellent character as a timekeeper.

Tidal Observation.—The tide-gauge at Williamstown has been kept at work during the year, and has furnished an uninterrupted record.

Chronometers.—Twenty-three chronometers and seven watches have been tested or rated.

Aneroid Barometers.—Forty-nine of these instruments were tested *in vacuo* for the public.

VI.—Publications.

No astronomical publications, except the joint report of the Government Astronomers of New South Wales, Adelaide, and Victoria, on the Telegraphic Determination of Australian Longitudes, were issued during the year. The results of the transit-circle observations up to the end of 1883 are, however, ready for the press, and considerable progress has also been made in preparing for the printer the Melbourne zone observations.

The Monthly Record of Meteorology and Terrestrial Magnetism has been issued to the end of March, and the number for April is in the press.

The monthly returns of rainfall have been issued up to the 1st of June.

The rainfall map of Southern Australia and Tasmania for 1885 has also been issued.

VII.—Intercolonial Weather Telegraphy.

Our system of weather telegraphy improves a little every year, and the only drawbacks are the inevitable ones of telegraphic communication. When the lines are in good order, the system works admirably.

New reporting stations were added to our list last year, namely, Cossack and Ashburton on the western and north-western coast of Western Australia. This now only leaves gaps between Cossack and Port Darwin, a coast-line of approximately 1,000 miles, and between Port Darwin and Cooktown, a coast-line of about 1,200 miles, to complete a perfect chain of reporting stations all round Australia.

Tasmania, also, only needs one or two stations to be established on the west coast (on which, however, there is as yet but little settlement) to complete a practical meteorological blockade.

The issue of forecasts, weather bulletins, &c., to the press and public, and throughout the country generally, by telegraph, has been carried on as usual, and appears to be fully appreciated.

General.

A problem that still remains to us is, how best to satisfactorily reproduce the drawings made with the great telescope. The lithographic method which we have adopted heretofore, although in some measure satisfactory and economical, does not appear capable of doing justice to the drawings of the observers. I referred in my last report to a method of obtaining a photographic negative from large drawings done on black paper, and then printing copies by the platinum process. We have made some experiments in this direction, which promise exceedingly well, but the cost at present appears to be almost prohibitive. Some future inquiry and experiment is necessary before this point can be settled.

I do not propose to make any great change in the routine work, and, generally speaking, the duties for the current year are laid out.

There are no astronomical events of more than ordinary interest expected; and, with the exception of the discovery of a few new comets, there will probably be very little to withdraw the attention of the staff from the regular work already arranged for.

ROB. L. J. ELLERY,
Government Astronomer.

16th September, 1886.

APPENDIX.

BOOKS, ETC., PRESENTED TO THE OBSERVATORY.

Title and Author.	By whom Presented.	
Report of the Astronomer Royal to the Board of Visitors to the Royal Observatory, 6th June, 1886	Greenwich Observatory ...	England.
Greenwich Observations, 1883	Ditto	"
Greenwich Spectroscopic and Photographic Observations, 1883 ...	Ditto	"
Greenwich Astronomical Observations, 1883	Ditto	"
Greenwich Magnetical and Meteorological Observations, 1883 ...	Ditto	"
Diagrams representing the Diurnal Change in Magnitude and Direction of the Magnetic Forces in the Horizontal Plane at the Royal Observatory Greenwich, 1841-76	Ditto	"
International Inventions Exhibition, 1885: Climatological Observations and their relation to Health	Royal Meteorological Society ...	"
Quarterly Journal of the Royal Meteorological Society: April, 1885, to April, 1886	Ditto	"
Quarterly Journal of the Royal Meteorological Society. Nos. 12-20, 25-32.	Ditto	"
Contributions to our Knowledge of the Meteorology of the Arctic Regions. Vol I., Part 4	Ditto	"
Daily Weather Reports: January to December, 1885	Ditto	"
Reports of the Meteorological Council of the Royal Society, for the Year ending 31st March, 1885. (2 copies)	Ditto	"
Meteorological Observations at Stations of the 2nd Order for the Year 1881	Ditto	"
Quarterly Weather Reports: July, 1877, to December, 1877 ...	Ditto	"
Hourly Readings, January, 1883, to September, 1883	Ditto	"
Weekly Weather Reports. Vol. I. and title page and Appendixes I. and II.; Vol. II., Nos. 10 to 52; and Appendix I., Vol. III., Nos. 1 to 15.	Ditto	"
Monthly Weather Reports: March, 1885, to January 1886	Ditto	"
Meteorological Record. Nos. 17 to 20	Ditto	"
Proceedings of the Royal Society. Vol. XXXVII., Nos. 232 to 237	Royal Society	"
Memoirs of the Royal Astronomical Society. Vol. XLVIII., Part II., 1884	Royal Astronomical Society ...	"
Monthly Notices of the Royal Astronomical Society. Vol. XLV., Nos. 7 to 9; Vol. XLVI., Nos. 1 to 7	Ditto	"
Report of the British Association for the Advancement of Science, 1884	British Association	"
Nautical Almanac for 1889	The Lords Commissioners of the Admiralty	"
Results of Astronomical and Meteorological Observations at the Radcliffe Observatory in 1882. Vol. XL.	Radcliffe Observer, Oxford ...	"
Report of the Kew Committee for the year ending October 31, 1885...	Kew Observatory	"
The History of the Kew Observatory, Richmond, Surrey, by R. H. Scott	Ditto	"
Astronomical Observations, 1882-5, Rousden Observatory. (3 copies)	C. E. Peak, Esq.	"
Meteorological Observations, 1885	Ditto	"
Results of Meteorological and Magnetical Observations, 1884 ...	Stonyhurst Observatory ...	"
Transactions of the Philosophical Society of South Africa. Vol. III., Part 2, 1883-5	Philosophical Society of South Africa	Cape Colony.
Annual Report of the Director of the Royal Alfred Observatory, 1883	Royal Alfred Observatory ...	Mauritius.
Mauritius Meteorological Results from the Blue Book for 1883 ...	Ditto	"
On the Changes of the Radiation of Heat from the Moon during the Total Eclipse of October 4, 1884. Dr. Boeddicker	The Earl of Rosse	Ireland.
Notes on the Aspect of the Planet Mars in 1884	Ditto	"
Scientific Transactions of the Royal Dublin Society. Vol. III., Series II. Nos. 7, 8, 9, 10	Royal Dublin Society	"
Proceedings of the Royal Dublin Society. Vol. IV. (N. S.), Nos. 7, 8, 9. Vol. V., Parts 1 and 2.	Ditto	"
Journal of the Scottish Meteorological Society, 1884	Scottish Meteorological Society ...	Scotland.
Dun Echt Observatory Publications. Vol. III., Mauritius Expedition, 1874, Division II.	The Earl of Crawford and Balcarres	"
Proceedings of the Philosophical Society of Glasgow, 1884-5. Vol. XVI.	Philosophical Society of Glasgow	"
Report on the Meteorology of India in 1883. 9th year. H. F. Blandford	Indian Meteorological Department	India
Report on the Meteorology of India in 1884. 10th year	Ditto	"
Indian Meteorological Memoirs. Vol. II., Parts IV., No. 6 and 5. Vol. III., Part I. Vol. IV. Part I.	Ditto	"
Report of the Administration of the Meteorological Department of the Government of India, 1884-5	Ditto	"
Rainfall in Bengal: June, 1885, to March, 1886	Ditto	"
Abstract of the Thermometrical Observations at Chowringee and Alipore: June, 1885, to March 1886	Ditto	"
Results of Meteorological Observations in Bengal: June 21, 1885, to April 24, 1886	Indian Meteorological Office ...	"
Results of Meteorological Observations at six stations in India: December, 1884, to November, 1885	Ditto	"
Brief Sketch of the Meteorology of the Bombay Presidency, 1883-4, 1884-5	Meteorological Reporter, Bombay	"
Meteorological and Magnetical Observations, 1884	Colaba Observatory, Bombay ...	"
Magnetical Observations at Madras, 1851-5	Madras Observatory	"
Telegraphic Determinations of the Difference of Longitude between Madras and other places. N. R. Pogson	Ditto	"
Magnetical Observations at Singapore, 1841-5. Captain Elliot ...	Ditto	"
Administration Report of the Meteorological Reporter to the Government of Madras, 1884-5	Meteorological Reporter, Madras	"

APPENDIX—*continued.*

Title and Author.	By whom Presented.	
Meteorological Observations, 1884...	J. V. Juggarow Observatory, Vizagapatam	India
The Hindu Zodiac	Colonel Fraser...	"
Reports of the Mining Registrars, for the Quarter ending June 30, 1885	Mining Department	Victoria
Victorian Year-Book, 1884–5	Government Statist	"
A Descriptive Atlas of the Eucalypts of Australia and adjoining Islands. Baron von Mueller	The Government	"
Journal and Proceedings of the Royal Society of New South Wales, 1884. Vol. XVIII.	Royal Society of New South Wales	New South Wales
Results of Meteorological Observations, 1882-5	John Tebbutt, Esq.	"
Weather Charts : July, 1885, to June, 1886	Government Astronomer ...	"
Adelaide University Calender, for the Academic Year 1886... ...	Adelaide University	South Australia
Statistics of the Colony of Tasmania in 1884	Government Statist	Tasmania
Meteorological Observations made at Hobart Town, 1876–79 ...	The Government	"
Meteorological Report for 1884	Meteorological Recorder ...	West Australia
Report of Progress : 1882, 1883, 1884, and maps	Geological and Natural History Survey	Canada
Geological Maps	Ditto	"
Report of the Meteorological Service of the Dominion of Canada, 1883	Meteorological Office, Toronto ...	"
Monthly Weather Review : June, 1885, to April, 1886, except July and November, 1885	Ditto	"
The Orbits of Oberon and Titania, the outer Satellites of Uranus ...	United States Naval Observatory	United States
Orbit of the Satellite of Neptune	Ditto	"
Astronomical and Meteorological Observations, 1880. Vol. ...	Ditto	"
Report of the Superintendent of the United States Naval Observatory, for the Year ending October, 1885. (2 copies)	Ditto	"
Nautical Almanac for 1885	United States Nautical Almanac Office	"
Annual Report of the Chief Signal Officer, for the Year ending June 30, 1882 (2 copies), and 1883 (2 copies)	Chief Signal Officer, United States	"
Bulletin of International Observations : September 1, 1882, to December 31, 1884	Ditto	"
Monthly Weather Review : November, 1883, to December, 1884 ...	Ditto	"
Researches on Solar Heat. Langley (Professional Papers, No. 15) ...	Ditto	"
Temperature of the Earth's Surface and Atmosphere. Ferrel (Professional Papers, No. 13)	Ditto	"
Report for the Year 1884–5	Yale College Observatory ...	"
Report for 1885. Dr. Draper	New York Meteorological Observatory	"
Results of Meteorological Observations : June, 1885, to March, 1886 (except July and November, 1885)	Ditto	"
Memoirs of the National Academy of Sciences. Vol. II.	National Academy of Sciences ...	"
Bulletin of the American Geographical Society, 1885. Nos. 1, 2 ...	American Geographical Society...	"
Methods and Results of the Determination of g with Kater's Pendulums	United States Coast Survey ...	"
Telegraphic Determination of Longitude in Mexico, Central America, and the West Coast of South America	Bureau of Navigation, Washington	"
Pilot Charts of the North Atlantic Ocean : July and October, 1885 ...	Ditto	"
Annual Report of the Board of Regents of the Smithsonian Institution, for the Year 1882	Smithsonian Institution ...	"
Catalogue of 1213 Stars observed at Harvard College Observatory ...	Harvard College Observatory ...	"
Observations of Variable Stars in 1885	E. C. Pickering, Esq.	"
First, Second, and Third Reports of the Committee on Standards of Stellar Magnitude	Ditto	"
Third Report of the Committee on Standards of Stellar Magnitude ...	Ditto	"
A Photographic Study of the Great Nebula of Orion	Ditto	"
An attempt to Photograph the Solar Corona without an Eclipse. (From *Science.*)	W. H. Pickering, Esq.	"
Apparent Position of the Zodiacal Light. A. Searle	A. Searle, Esq.	"
Science Observer. Vol. IV., Nos. 12	Boston Scientific Society ...	"
Publications of the Washburn Observatory. Vol. II.	Washburn Observatory... ...	"
Catalogue of 1001 Southern Stars, and a List of 437 Southern Stars, for 1850. O. E. S. Holden and the Rev. Father Hagen	Ditto	"
One of the 75 Photos. of the Solar Eclipse : March 6, 1885	Lick Observatory	"
Annual Report, 1885	Dearborne Observatory... ...	"
Estudios de Meteorologia comparada. Tome I. Par Mariano Barcena y Miguel Perez. (3 copies)	Mexican Meteorological Office ...	Mexico
Annuario del Observatorio Astronomico Nacional di Tacubaya, 1885...	Tacubaya Observatory	"
Annuario del Observatorio Astronomico Nacional di Tacubaya, 1886...	Ditto	"
Boletin del Ministerio de Fomento. Vol. X., Nos. 7 to 133... ...	Ministerio de Fomento... ...	"
Revista do Observatorio. Jan.–May, 1886	Imperial Observatory of Rio de Janeiro	Brazil
Observaciones Magneticas y Meteorologicas. Jan. to June, 1876 ...	Meteorological Observatory, Havanna	Cuba
Observaciones Magneticas y Meteorologicas. Jan. to Sept., 1885 ...	Ditto	"
Introduccion al Tome V. Resultados del Observatorio Nacional Argentino	National Cordoba Observatory ...	Argentine Confederation
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