1888.

VICTORIA.

TWENTY-THIRD 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-THIRD REPORT

OF THE

BOARD OF VISITORS TO THE OBSERVATORY.

To His Excellency Sir Henry Brougham Loch, *Knight Grand Cross of the Most Distinguished Order of Saint Michael and Saint George, 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 report that we made our annual visitation to the Observatory on the 4th of October, when we received the Report of the Government Astronomer, appended hereto, and examined the instruments and records of the Observatory.

We found the establishment in its usual state of efficiency. The instruments were in good order and the reductions of the observations and the computing well advanced.

In our last report we mentioned the necessity for repolishing the mirrors of the Great Melbourne Telescope. It will be seen from Mr. Ellery's Report that this has been undertaken at the Observatory under his direction, the risk and cost of sending the specula to England having been found prohibitory. This work is from its nature difficult and hazardous, but we are glad to have the assurance that after many months of experiment with smaller specula it is now being satisfactorily carried out, and we have reason to hope that the mirrors will be restored to their original condition and that the observations with the telescope will soon be resumed.

We are glad to learn that our recommendation in favour of building quarters for the Government Astronomer within the grounds of the Observatory has been accepted by the Government, and that provision has been made for enabling this Observatory to take part in the great international work of making a photographic chart of the stellar heavens.

Since the date of Mr. Ellery's Report a Conference of Australian Meteorologists has been held in Melbourne, under his presidency, at which resolutions were adopted which will tend to improve the system of intercolonial meteorology and overcome many of the difficulties which have hitherto prevented the full advantage of the work done in the various observatories from being made available for public purposes.

The approaches to the Observatory by road are still most unsatisfactory, and we are glad to see from the Astronomer's Report that it is probable a convenient entry from the St. Kilda-road will soon be constructed.

GEORGE VERDON, F.R.S.,
M. H. IRVING, M.A.,
W. C. KERNOT, M.A., C.E.,
G. V. SMITH,
F. STANLEY DOBSON, LL.D., Q.C., F.L.S.,
WILLIAM F. STAWELL.

J. E. BROMBY, Hon. Sec.

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

September, 1888.

The last visitation of the Board of Visitors to the Observatory was made on the 16th August, 1887, when I furnished my Report of the state of the establishment, and the work done during the year ending the 30th June, 1887. The period to which my present report refers commences on July 1st, 1887, and terminates on the 30th June, 1888.

I. Personal Establishment.

As regards the staff, the only change I have to record is the appointment of Mr. Swan to a position in the Professional division. Mr. Swan fills a vacancy caused by the transfer of Mr. Gilbert to the General Post Office, and was himself transferred from the Lands Department, where he held the position of computer and draughtsman. The personal establishment on the 30th June last was as follows:—

Mr. Ellery, Director, Government Astronomer;
Mr. White, Chief Assistant;
Mr. Moerlin, Assistant;
Mr. Baracchi, ,,
Mr. Swan, ,,
Mr. Pringle, ,,
Mr. Kemp, ,,
Mr. Ingamells, ,,
G. Swanson, Mechanic;
J. Burley, Mechanical Attendant;
A. E. Hale, Messenger and Attendant.

There has been some change in the distribution of duties, in consequence of the removal of Mr. Gilbert and the appointment of Mr. Swan. Mr. Ingamells undertakes the accountant's and general clerical duties (as was done by Mr. Gilbert), assists in the issue of weather charts, and is also in training as a transit observer. Mr. Swan is wholly occupied in observing and computing observations made with the Transit Circle, under the direction of Mr. White. Messenger Power resigned his post in June last year, and was replaced by J. Burley, who was re-appointed to the Observatory in August following.

With these exceptions, the duties of the several officers remain as heretofore. Mr. White, the Chief Assistant, having charge of all meridian work, Mr. Baracchi remains in charge of Great Telescope and extra meridian work; Mr. Pringle assists in Transit Circle observations, has charge of the Library, and assists in the correspondence, &c.

II. Grounds and Buildings.

The grounds are in a satisfactory condition, and, being now able to obtain the services of a gardener for a large part of the year, I expect they will be kept in good order, and still further improved. The growth of the trees and shrubberies around the grounds is now giving us great shelter both from strong winds and from dust storms in summer.

As regards the approaches to the Observatory, I am sorry to say we are as badly off as ever, and, although some preliminary work has been done for opening up an entrance from the St. Kilda-road near the Government House gate, all vehicular traffic to the Observatory has to go nearly half-a-mile around by the Domain road, and back into the Domain, to reach the Observatory gates. I am informed, however, that the new entrance and road will probably be proceeded with shortly.

The buildings generally are in good order; the Magnet House, for absolute determinations, has been lined inside with varnished pine instead of enamelled cloth as before. The main building will require external painting in the course of a year or so, but is otherwise in a satisfactory condition.

Alterations in the disposal of some of the rooms were referred to in my last Report as being in progress—these are now completed, and are as follows:—A new workshop has been erected on the east side of the Great Telescope room, and a small gas-engine fitted up for driving the lathes, &c. The old workshop has been converted into a laboratory and experiment room, while the two small rooms hitherto used for this purpose are used as messengers' quarters.

It will be soon necessary to consider the question of a new telescope house for the protection of the telescope now being made for the photographic charting of the Heavens. I have not definitely fixed upon the site, but believe the best position will be near the south-east angle of the main building, adjoining the present laboratory. It is not intended to erect a very costly building—the dome itself, which will be at least 18 feet in diameter, will, however, be the most expensive part.

The Board, in its last report to the Governor, recommended that my residence should be built within the Observatory grounds. I am glad to report that the Government have so far acceded to this as to place the sum of £2,300 on this year's Estimates for the purpose.

III.—Instruments.

In April last the polish of the mirrors of the great telescope had become so dull that Mr. Baracchi reported he could no longer rely on any comparisons of the fainter nebulæ with the observations previously made. Early in May, therefore, the telescope was dismantled, with the view of repolishing the mirrors. Such an operation I knew from experience to be extremely difficult and tedious, requiring great skill and proficiency in its performance. I therefore arranged that some small mirrors (12-inch) should be figured, polished, and tested for practice before attempting the larger surfaces. No polishing having been done for nearly twenty years, the polishing machines and steam engine had to be got in order; the old boiler was found to be scarcely safe, and a new one was obtained. The experimental work was commenced in May, and at the end of June a very considerable experience had been attained by Mr Baracchi, as well as by the mechanical assistants, and my own previous knowledge of the subject very much refreshed. It is probable some months will elapse before our two 4-feet mirrors will be ready for use in the telescope. At present they are lying ready for placing on the polishing machine.

The New Transit Circle has been in constant use, and continues to be satisfactory in its performance and in the stability of its mounting. The error of collimation is very steady. The level error is the most variable, both in its seasonal changes and those of short period. At the beginning of June, 1887, the correction for level was 0·56; at the middle of February the western pier had sunk so much as to make the correction 1·31; after this the quantity diminished so that by the beginning of June, 1888, it had become 1·06. The azimuth correction varies within very small limits, the greatest amount being 0·33 and 0·09 during the year.

Both the North and South Equatorials are in constant use and in good working order. No changes or additions to these instruments have been made during the year.

The Photoheliograph has been slightly altered in its optical arrangement, with the view of getting rid of the magnified images of particles of dust, from which it is impossible to keep the outer surface of the secondary magnifier quite free, and which greatly disfigure the pictures. The two lenses of the secondary magnifier have been placed closer together, which has the effect of bringing the front lens farther from the principal focus, and so getting rid of the dust images. This change shortens the camera considerably for the same sized picture of the sun as previously used (eight inches), but no loss of definition is sensible; indeed the shortening has greatly improved the pictures.

Some small additions have been made in the shape of minor instruments and apparatus. The vacuum chamber for testing barometers referred to in my last report has been completed, and proves very satisfactory, both for testing aneroids and mercurial barometers. It consists of a rectangular cast-iron chamber, with thick plate-glass windows at the top, back, and front. This chamber is open at the top, and has a closely fitting cast-iron cover with indiarubber joint, which can be screwed down and made air-tight. A barometer tube with a calibrated bore and cistern (which is air-tight), is connected with the chamber by a small brass tube with stop-cock. A steel bar, with a fiducial point at bottom, passes through a stuffing-box in the cistern, and can be screwed up or down for contact with the mercury in the cistern; a platinum disc is let in near the top of this bar, with a line engraved at very approximately 30 inches from the fiducial point. The differences between the 30-inch line and the top of the column is read by means of a very fine table cathetometer by Troughton and Simms. The air-pump is single-barrel, double-acting, and is very quick in working.

A Gray-Milne seismograph was received from Mr. White, of Glasgow, in September last year, and was erected beneath and on the foundation of the north collimator pier in the transit room. It was in operation for a short time, but, the mode of registration being found unsatisfactory from constant breaking of the capillary glass syphon pens, it was put out of work until some stronger pens could be obtained from the maker. Professor Milne, of Tokio, sent us a pendulum seismoscope of his own design, which arrived last April.

Clocks and Chronographs.—Both the transit clocks (Frodsham No. 991 and No. 1062) continue most satisfactory in their performance, and the other clocks, such as the mean time, normal, sidereal control, are in good working order. Two additions have been made to this class of instruments during the year: first, a controlled mean time clock, purposely for sending time-ball signals over the telegraph lines at one o'clock; and, second, a Seth Thomas precision clock. As regards the first, it had been a complaint of the Telegraph Department for many years that the automatic clock contacts sent upon the lines for time signals were too sharp and short for the proper adjustment of the line relays. Several experiments were made to obtain prolonged contacts, with more or less success, but none were quite satisfactory. I therefore designed a controlled pendulum clock, in which the pendulum drives the seconds wheel and hand, and thence the minute and hour hands. The seconds wheel closes contact springs in the usual way as each tooth passes, but, as the motion of the wheel is as slow as that of the pendulum, the contact is sufficiently prolonged to obviate all difficulty complained of as regards adjustment of line relays. This clock has been in operation since 23rd January, and works very well indeed. The Seth Thomas clock arrived in June last, and was erected on the base of the old prime vertical instrument. It is beautifully constructed, and has apparently less friction in its motion than any other clock we possess, and therefore exhibits the barometric error in the highest degree. Its performance so far has quite come up to our expectations.

The four chronographs of the parabolic pendulum form and the Siemens chronograph (double Morse register) are all in constant use and in good repair. The parabolic pendulum chronograph sent to the Indian and Colonial Exhibition has not yet been returned. I believe it is still in the hands of Messrs. Dent and Co., Strand, London. The autographic meteorological and magnetical instruments have continued in uninterrupted operation throughout the year.

IV.—The Library.

During the year 234 volumes have been added to the library by donations and purchase, exclusive of periodicals. Extra room for our rapidly increasing library will soon become a pressing necessity, for, with the present accommodation a satisfactory arrangement of books is almost impossible.

V.—The Work of the Observatory.

The meridian work with the *Transit Circle* has been carried on steadily. The work done includes the observation of the fundamental clock stars, the close circumpolar stars, the stars of the Berliner Jahrbuch, which culminate sufficiently high to be well seen in our latitude, and stars to which the places of comets and the small planets have been referred, the last included a list of stars selected by Dr. Gill, the Astronomer Royal at the Cape of Good Hope, for the reduction of his heliometer observations. The observations made with the Transit Circle are as follows :—

Right Ascension Observations	2,962
Polar Distance Observations	1,434
Observations for Instrumental Errors, viz. :—	
Collimation	151
Level	264
Nadir	253
Runs	50
Flexure	13

Comparatively little work has been done with the *Great Telescope*, except in the first months of the period under consideration, owing to the great loss of light brought about by the increased tarnish of the mirrors already referred to. The observations made may be summarized as follows :—

Number of Herschel's nebulæ observed and sketched—

Number observed three times	39
„ „ twice	11
„ „ once	12
„ „ probably new	16
„ searched for and not found	3
Total	81

About 36 nights were allotted to visitors during the bright moonlight, and about 470 persons attended.

The extra meridianal observations made with the *North and South Equatorials* include—

Observations of Sawerthal's comet, *a* 1888	24
Observations of Sappho in April	17
Search for Eucrate in July and August	247

Photoheliography.—Photographs of the sun were obtained on 129 days only, as a considerable time was lost in August 1887, and March and April last, experimenting upon the alterations of the secondary magnifier already referred to, and the consequent readjustment of the camera and other parts.

Terrestrial Magnetism.—The usual work of this branch of the Observatory has been carried on as usual, consisting of monthly determinations of the absolute force of terrestrial magnetism, and the record by photography of variations in the three elements. The argentic bromide paper which we have now used for several years has greatly lessened the work in this direction.

Meteorology.—Our work in this department becomes greater every year, principally by the increase of reporting stations over the Australian continent, increase in the number of rainfall stations within our own colony, and the growing requirements of the public.

The country *meteorological* stations have furnished regular records as usual ; reports of rainfall were received from 369 localities, and 34 new rain gauges were distributed during the year.

The daily weather chart, with morning and afternoon forecasts, was issued regularly throughout the year on the same plan as formerly.

I propose to ask the Government to invite the attendance of the Meteorological Directors of the several Australian colonies to a conference in Melbourne during the currency of the Centennial Exhibition to discuss several important matters in connexion with the intercolonial weather telegram system, and more especially the propriety of more closely assimilating our methods of reporting and construction of weather charts, and, generally, with the view of further improving meteorological work in Australia.

The Intercolonial Weather Service.—This service is improving every year, and is now carried on very satisfactorily. So far as this Observatory is concerned but little change has been made, but the increase in the number of reporting stations, of course, proportionately increases the work.

The Telegraph Time and Clock Control Service has remained in satisfactory operation. The General Post Office clock was taken down in February last, and will probably not be replaced for several months.

Testing Instruments.—The following is a statement of chronometers rated and tested, and instruments tested for the public during the year :—

Chronometers rated	36
Thermometers tested	30
Aneroid barometers tested	32
Surveyors' chains and other linear measures tested	12

VI.—Publications.

No astronomical publications have been issued during the year. The Second General Catalogue and the Yearly Catalogue and Separate Results for 1880–5, to form volume VII., are in the printer's hands.

As regards meteorological publications, the Monthly Record of Meteorology and Terrestrial Magnetism have been issued to the end of March last, the Monthly Rainfall Register up to the end of April, and the Monthly Rainfall Map till the end of May.

VII.—General.

It is not intended to make any important change in the routine work of the Observatory during the current year, except so far as is necessary in consequence of the Great Telescope being dismantled. Besides the ordinary work with the Transit Circle, it is proposed to observe a list of stars to aid Dr. Gill in his observations for the parallax of Sappho as well as of Iris.

Preparations for the stellar photography campaign will demand attention in a few months at latest, and it is not improbable that the work itself may be entered upon before the date of the next visitation of the Board. The telescope and mounting is in progress, and some parts are well forward, but I have no definite information yet as to the date at which it may be expected to arrive in Melbourne, neither have I yet been informed of the stellar region which will fall to the share of this Observatory. I believe we shall be ready to commence as early, if not earlier, than most of the others taking part; if so, it will enable us to devote some time to preliminary practice, which is very necessary in so novel an undertaking.

I propose to make some modification in our weather chart. At present we issue a chart about one o'clock daily, giving the meteorological information for all stations in Australia at 9 a.m., as well as a synopsis of existing weather at that time in each colony, with a morning forecast. After the 3 p.m. telegrams are in, the isobars for Australia are drawn, and the forecast for the ensuing 24 hours made; a skeleton weather map is also filled up for the *Argus*. The change I propose is to issue no map till after two o'clock; this map will have the isobaric curves drawn in, and give the meteorological information from principal stations only which will add much to its clearness and will facilitate interpretation. At present the maps are issued on two different scales, which by the new plan will be avoided, resulting I hope in a saving of work as well as an improved weather map.

ROBT. L. J. ELLERY,
Government Astronomer.

APPENDIX.

BOOKS, ETC., PRESENTED TO THE OBSERVATORY.

Title and Author.	By whom Presented.	
Report of the Astronomer Royal to the Board of Visitors of the Royal Observatory, Greenwich, June 4, 1887	Greenwich Observatory ...	England.
Greenwich Astronomical Results, 1885	Ditto	,,
Greenwich Spectroscopic and Photographic Results, 1885	Ditto	,,
Greenwich Magnetical and Meteorological Results, 1885	Ditto	,,
Greenwich Observations, 1885	Ditto	,,
Numerical Lunar Theory, by Sir G. B. Airey, K.C.B.	Ditto	,,
Corrections to the Right Ascensions of the Nautical Almanac for January 1st, 1888	Ditto	,,
Report of the Meteorological Council of the Royal Society for the year ending 31st March, 1887	Meteorological Office ...	,,
Daily Weather Reports, 1887	Ditto	
Meteorological Observations at Stations of the Second Order, 1883 ...	Ditto	,,
Quarterly Weather Report, October, 1878, to September, 1879 ...	Ditto	,,
Hourly Readings, October, 1884, to September, 1885	Ditto	,,
Weekly Weather Report. Vol. IV., No. 34, to Vol. V., No. 18 ..	Ditto	,,
Monthly Weather Report, June to April, 1888	Ditto	,,
The Meteorological Record. No. 24 to 27	The Royal Meteorological Society	,,
Hints to Meteorological Observers, with instructions for taking observations, and tables for their reduction	Ditto	,,
List of Fellows	Ditto	,,
Quarterly Journal, April, 1887 to April, 1888	Ditto	,,
Proceedings of the Royal Society. Nos. 245 to 255	The Royal Society	,,
Monthly Notices. Vol. XLVII., No. 7 to XLVIII., No. 7	The Royal Astronomical Society	,,
H. M. Colonial Possessions. No. 3. Gambia	The Colonial Office	,,
Transit of Venus, 1882. Report of the British Commission	The Transit of Venus Commission	,,
Results of Astronomical and Meteorological Observations, 1884 ...	The Radcliffe Observer, Oxford	,,
Notes on taking Meteorological Observations on board ship	Captain D. W. Barker ...	,,
Rousden Observatory, Devon. Vol. IV. Meteorological Observations, 1887	C. E. Peek, Esq., M.A., &c....	,,
The Scieutific Proceedings of the Royal Dublin Society. Vol. V. (N. S.), Parts 3, 4, 5, 6	The Royal Dublin Society ...	Ireland.
The Scientific Transactions of the Royal Dublin Society. Vol. III. (series II.), Nos. 11, 12, 13	Ditto	,,
Astronomical Observations and Researches made at Dunsink, part 6 ...	Dunsink Observatory ...	,,
Journal of the Scottish Meteorological Society, 1886...	Scottish Meteorological Society	Scotland.
Proceedings of the Philosophical Society of Glasgow, 1886-87. Vol. XVIII.	The Philosophical Society of Glasgow	,,
Results of Meteorological Observations, 1886, at the G. V. Juggarow Observatory, Vizapatam	A. V. Nursingrow, Esq., J. V. Juggarow Observatory	India.
Charts of the Bay of Bengal	Meteorological Department of the Government of India	,,
Report on the Meteorology of India in 1885; 11th year	Ditto	,,
Indian Meteorological Memoirs. Vol. IV., Parts II., III., IV.; Vol. III., Part II.	Ditto	,,
Report on the Administration of the Meteorological Department of the Government of India in 1866-7	Ditto	,,
Memoir on the Winds and Monsoons of the Arabian Sea and North Indian Ocean. W. L. Dallas	Ditto	,,
Report on the Meteorology of India in 1886. 12th year	Ditto	,,
Cyclone Memoirs. Part I.	Ditto	,,
Results of Meteorological Observations in Bengal, 8th May, 1887 to 26th May, 1888	Ditto	,,
Abstract of Thermometrical Observations at Chowringhee and Alipore, May, 1887 to April, 1888	Ditto	,,
Rainfall in Bengal, May, 1887 to April, 1888	Ditto	,,
Results of Meteorological Observations at Six Stations in India, April, 1887 to April, 1888, and title page, &c.	Ditto	,,
Brief sketch of the Meteorology of the Bombay Presidency in 1886-7 ...	The Meteorological Reporter for Western India	,,
Mauritius Meteorological Results for 1886. Two copies	Royal Alfred Observatory ...	Mauritius.
Annual Report for 1886. Two copies	Ditto	,,
Goldfields of Victoria. Reports of the Mining Registrars for quarters ending June 30 and December 31st, 1887	Mining Department ...	Victoria.
Annual Report of the Secretary for Mines and Water Supply for 1886	Ditto	,,
Mineral Statistics of Victoria for the year 1886	Ditto	,,
Fourth Progress Report	Royal Commission on Water Supply	,,
Transactions of the Royal Society of Victoria. Vol. XXIV., Part I. ...	Royal Society of Victoria ...	,,
Results of Rain and River Observations made in New South Wales and part of Queensland during 1886	The Observatory, Sydney ...	New South Wales
Notes upon the History of Floods in the River Darling, by H. C. Russell, B.A., F.R.S.	H. C. Russell, Esq.	,,

APPENDIX—*continued.*

Title and Author.	By whom Presented.	
Notes upon Flood in Lake George, by H. C. Russell, B.A., F.R.S. ...	H. C. Russell, Esq.	New South Wales
Results of Meteorological Observations made in New South Wales in 1885	The Observatory, Sydney ...	,,
Weather Charts, June, 1886 to February, 1888	Ditto	,,
Daily Weather Charts to June 30 (complete)	Ditto	,,
Journal and Proceedings of the Royal Society of New South Wales. August, 1887. Vol. XXI, parts 1–3, 1886, Vol XX.	The Royal Society of New South Wales	,,
The Australian Hand-book for 1888	The Publishers, Sydney ...	,,
Meteorological Observations made at Hobart, and other places in Tasmania, during the year 1886 (2 copies)	The Meteorological Reporter...	Tasmania.
Statistics of the Colony of Tasmania for the year 1886	The Government Statist ...	,,
The Comets of February, 1880, and January, 1887	A. B. Biggs, Esq.	,,
Report of the Board of Governors of the Library and Museum, and Art Gallery of South Australia, 1886–7	Public Library, Museum, and Art Gallery	South Australia.
Daily Weather Charts, May 1 to June 30, 1888	Adelaide Observatory ...	,,
The Daily Weather Charts to June 30, 1888	Government Meteorological Reporter	Queensland.
Meteorological Reports for the years 1885–6	The Meteorological Reporter	Western Australia.
Report of the Superintendent of the Natal Observatory, 1886 ...	Government Astronomer ...	Natal.
Elements of Comet 1886 *e* (Finlay), and Comet 1887 *a*	W. H. Finlay, Esq. ...	Cape Colony.
Magnitude of η Argns in March, 1886	Ditto	,,
Report of the Meteorological Commission, 1886	Meteorological Commission ...	,,
Report of the Meteorological Service of the Dominion of Canada, 1884...	Meteorological Office, Toronto	Canada.
Monthly Weather Review, April, 1887 to March, 1888	Ditto	,,
Report of the Superintendent of the United States Naval Observatory for the year ending June 30, 1887 (2 copies)	United States Naval Observatory	United States.
Observations made during the year 1883	Ditto	,,
Report of the Superintendent for the year ending June 30, 1887 ...	American Nautical Almanac Office	,,
The American Nautical Almanac and Ephemeris for 1890	Ditto	,,
Report of the Chief Signal Officer, 1885, parts 1 and 2	The Chief Signal Officer ...	,,
Report of the Chief Signal Officer, 1885, part 2. Meteorology, by W. Ferrel, M.A., Ph.D.	Ditto	,,
Report of the Chief Signal Officer, 1887 (without appendices)... ...	Ditto	,,
Tri-daily Meteorological Record, January and February 1878 (2 copies), March and April, 1878	Ditto	,,
Monthly Weather Review. March, 1887 to April, 1888	Ditto	,,
Summary and Review of International Meteorological Observations. February, 1886 to April, 1887	Ditto	,,
Daily Weather Charts to the end of March, 1888	Ditto	,,
Report of the Secretary of War, 1886. Vol. IV.	Ditto	,,
Annual Report. July, 1885, part I.	Smithsonian Institute ...	,,
Pilot Chart of the North Atlantic. March, 1888	Hydrographic Office, U.S. Navy	,,
Memoirs of the National Academy of Sciences. Vol. III., part II. ...	National Academy of Sciences, Washington	,,
Proceedings of the American Academy of Arts and Sciences (N.S.) Vol. XIV., parts I. and II.	American Academy of Arts and Sciences, Boston.	,,
Proceedings of the American Association for the Advancement of Science. 33rd meeting, August, 1886; 34th meeting, 1887	The American Association for the Advancement of Science	,,
Annals of the Astronomical Observatory of Harvard College. Vol. XVII., Vol. XVIII., Nos. 1 and 2	Harvard College Observatory	,,
Meteorological Observations. Boyden Fund Circular, No. 2	Ditto	,,
Pritchard's Wedge Photometer	Ditto	,,
Observations of Variable Stars in 1886. E. C. Pickering	Ditto	,,
42nd Annual Report of the Director	Ditto	,,
Annals of the New York Academy of Sciences. Vol. II., III. ...	The New York Academy of Sciences	,,
Transactions of the Astronomical Observatory of the Yale University. Vol. I., part I.	Yale College Observatory ...	,,
Meteorological Observations. Monthly results, April, 1887 to May, 1888	Meteorological Observatory of the Department of Public Parks	,, ,,
Bulletin of the American Geographical Society. 1886, No. 4 to 1888, No. 2	American Geographical Society	,,
Results of Meteorological Observations made at the Blue Hill Meteorological Observatory, Mass., U.S.A., 1887	A. Lawrence Rotch, Esq., S.B.	,,
Effects of Solar Radiation upon Thermometer Bulbs having different Metallic Coverings. H. A. Hazen.	H. A. Hazen, Esq., A.M. ...	,,
On Vertical Currents in Cyclones (translation)	Ditto	,,
Thermometer Exposure	Ditto	,,
Reduction of Air-pressure to Sea-level	Ditto	,,
On the Determination of True Air Temperatures	Ditto	,,
Publications of the Morrison Observatory, Glasgow, Missouri. No. 1...	Morrison Observatory ...	,,
Publications of the Washburn Observatory. Vol. V., 1886.	Washburn Observatory ...	,,
Contributions to Meteorology. Revised edition, chapter I.	Professor E. Loomis ...	,,
Corrigenda in various star catalogues	Professor C. H. F. Peters ...	,,
Flamsteed's stars "observed but not existing"	Ditto	,,
Observaciones magnêticas y meteorologicas del real Collegio de Belen de la Compañia de Jesus en la Habana, 4° Trimestre, 1885. 1° and 2° Trimestre, 1886	Havanna Observatory ...	Cuba.
Memorias de la sociedad Cientifica "Antonio Alzate," Tomo I., cuadermo num. I. to II.	Sociedad Cientifica "Antonio Alzate"	Mexico.
Longitud del Observatorio astronómico Nacional Mexicano	National Observatory ...	,,
Résumen general de las observaciones meteorologicas 1887, 1877–87 ...	Mariano Leal, Leon	,,
Boletin de Estadistica. Tomo I. Nos. 1–41	Meteorological Office ...	,,
Annuario de la oficina central, meteorologica de Chili. Tomo XVIII., correspondiente a 1886; 2° cuadermo	Meteorological Commission, Santiago de Chili	Chili
Annuario publicado pela imperial observatorio, 1885, 1886, 1887 ...	Imperial Observatory, Rio de Janeiro	Brazil.
Revista do Observatorio. Anno II. May, 1887 to April, 1888 ...	Ditto	,,

APPENDIX—*continued.*

Title and Author.	By whom Presented.	
Anales de la officina Meteorologica Argentina. Tomo V.	National Observatory, Cordoba	Argentine Republic
Observatorio Nacional Argentina. Vol. VI.	Ditto	,,
Annuario del Observatorio de la Plata, para el ano 1887, 1888 ...	Observatorio de la Plata, Buenos Ayres	,,
Boletin Mensuel del Observatorio Meteorologico del Colegio Pio de villa Colon. Ano I., No. 1, 2, 3	Observatorio Meteorologico del Colegio Pio de villa Colon	,,
Procès-verbaux des Seances de 1886	Comité international poids et mesures	France
Anales du Bureau Central Météorologique de France. Année 1884, II.; 1885, I., II., IV.	Bureau Central Meteorologique de France	,,
Bulletin du Comité international permanent pour l'execution photographique de la carte du ciel	Comité international permanent pour l'execution de la carte du ciel	,,
Rapport du directeur de l'observatoire cantonal de Neuchatel, 1886 ...	Neuchatel Observatory ...	Switzerland
Almanaque Nautico para 1888-1889	San Fernando Observatory ...	Spain
Anales. Seccion 2, Ano 1886	Ditto	,,
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