

1879.

VICTORIA.

FOURTEENTH 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.

By Authority:

JOHN FERRES, GOVERNMENT PRINTER, MELBOURNE.

APPROXIMATE COST OF REPORT.

	£	s.	d.
Preparation—Not given.			
Printing (825 copies)	8 5 0

FOURTEENTH REPORT OF THE BOARD OF VISITORS TO THE OBSERVATORY.

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

We have the honor to report that on 2nd August we made the annual visitation to the Observatory, and, after receiving the Government Astronomer's report, proceeded to inspect the various buildings and instruments.

The general condition of the establishment, which is dealt with fully under different heads in the Astronomer's report, we found to be good and satisfactory. The valuable instruments we also found to be well cared for, and generally in excellent order; in some instances, however, the wear and tear consequent upon over twenty years' service renders it desirable they should soon be replaced by new ones. The Government Astronomer informs the Board that some of these he will be able to replace from the ordinary annual votes of the department.

The necessity for providing a more powerful transit circle than the Observatory now possesses is becoming greater every year, and we are glad to see by the Astronomer's report that the Government has promised a vote for the purpose; we trust, therefore, the establishment will soon be furnished with an instrument of the kind adequate to the present requirements of science.

The Board thinks it very desirable that the work done with the Melbourne reflector should be published without further delay, and although the Astronomer reports that considerable difficulties have arisen in the endeavour to reproduce the drawings for publication, it hopes that these will be overcome, and that the important work done with this splendid instrument will be given to the world at the earliest possible date.

The Board is gratified to find that an attempt is being made by the Astronomer to place the work of the Observatory before the public in a popular form by weekly notes in the Melbourne daily papers; it highly commends this excellent plan for keeping the public informed of what is being done in the department, for by this means information interesting to very many is published at short intervals, and becomes valuable as an instrument of education to all.

The Board desires to express its satisfaction at the careful and methodical manner in which the ordinary work of this establishment has been carried on. The Government Astronomer seems to have taken especial pains so to conduct the department under his charge that it should fulfil the more immediate objects which the public welfare demands from such an institution, and also that it should diffuse in an intelligent form larger knowledge in those branches of science which come within its scope.

We cannot close our Report without expressing the high satisfaction we feel at finding that the Melbourne Observatory continues to maintain the distinguished reputation it has achieved for itself. No important phenomenon in the heavens presents itself to any of the astronomical observers throughout the world but the co-operation of the Melbourne Observatory is at once solicited; and this high position we feel assured it will retain so long as the real objects of such a national establishment are steadily kept in view as hitherto.

J. W. STEPHEN, M.A.,
M. H. IRVING, M.A.,
JAMES MOORE, M.A.,
G. V. SMITH,
J. E. BROMBY, M.A., Hon. Sec.



REPORT OF THE GOVERNMENT ASTRONOMER TO THE BOARD OF VISITORS
TO THE OBSERVATORY, JULY 1879.

GENTLEMEN,

The last visitation of the Board was made on 29th August 1878, and the Report which I have now the honor to submit has reference to the history of the Observatory from the 30th June 1878 to the 30th June of the present year, and to the state of the establishment at this latter date.

PERSONAL ESTABLISHMENT.

No change has taken place in the staff since my last Report; it consists of the following:—

Mr. ELLERY (Director), Government Astronomer,
Mr. WHITE, Chief Assistant,
Mr. MOERLIN, Assistant,
Mr. TURNER, "
Mr. GILBERT, "
J. ROUGH, Messenger.

Messrs. Lilly and Kemp have been, as heretofore, employed—the former as mathematical, the latter as clerical assistant, on the temporary staff. There are also a mechanic, and a workman who is principally occupied with the great telescope.

The distribution of the duties of the Observatory is unchanged. The general direction and supervision, correspondence, and special observational work devolve upon me. Mr. White takes charge of all work in connection with the transit circle, meridional observations, and computations connected therewith, in which he is assisted by Mr. Moerlin and Mr. Gilbert. The meteorological and magnetic work is in charge of Mr. Moerlin, in which he is assisted by Mr. Kemp. Mr. Lilly assists in mathematical work requiring special knowledge. The observations with the great telescope, as well as the photoheliography, still devolve upon Mr. Turner. The accounts, store-keeping, &c., are in charge of Mr. Gilbert.

BUILDINGS AND GROUNDS.

The principal buildings are in moderately good condition. The great telescope house has been thoroughly repaired throughout, and now appears to be weatherproof. The machinery for moving the roof off and on acts very satisfactorily, and without any strain upon the roof itself; the difficulty which existed so long has therefore been entirely removed.

The main building will soon require painting, both inside and outside; and various minor repairs to prevent dilapidation are also necessary.

The ventilation of the new magnet house has been much improved by the introduction of a large central air shaft opening into a cowl on the roof. Into this shaft the heated air and products of combustion from the registering gas burners are led by branch tubes, and by this means not only is the temperature of the different rooms modified, but the air is maintained in a moderately pure condition.

An addition has been made to the meteorological apparatus by the erection of a new thermometer shed which is intended to supersede the various smaller stands and cages hitherto in use. From experiments made during last summer to ascertain the best method of exposing thermometers so as to obtain the true temperature of the air, unaffected by solar or terrestrial radiation, I found that double thin metallic screens, with an intervening free air space of at least ten inches, give the best result, and that thermometers exposed to the free circulation of air, screened from any direct rays of the sun or driving rain, under such a covering, followed the temperature variations of the air quickly and accurately. A shed constructed on this plan was erected in May last, and since then the thermometric readings have been regularly recorded from the instruments in this, as well as from those in the stands hitherto used, in order to arrive at any difference of mean temperature due to the difference of exposure. The shed is constructed of a strong wooden frame work, quite open, covered with a double roof of corrugated galvanized iron, having about twelve inches open air space between each roof. Experience up to the present time proves this kind of exposure to be good and convenient, but how far the temperature means will differ from those obtained under the former modes of exposure cannot be ascertained until it has been in operation for at least a year. There is no doubt, however, that the new method furnishes the truest results.

There has not been much done to the grounds since the last visitation, except some little planting. The fencing which surrounds the grounds is getting into bad repair, and will soon require attention.

INSTRUMENTS.

Some additions, in the shape of minor instruments, have been made during the year. A new solar spectroscope by Browning, for use with the south equatorial, and a large *direct-view half-prism spectroscope*, designed by Mr. Christie, of Greenwich, and made by Mr. Hilger, of London, for the great telescope, have been obtained. The former is found to be admirably adapted for spectroscopic examination of the sun, and also (by reducing the number of prisms)

for the brighter stars also. The large direct spectroscope was damaged in transmission from London, and although I do not think it has been seriously injured, I have not yet been able to thoroughly examine and readjust it.

As questions frequently arise, sometimes in the courts of law, where evidence is required of the wind's force in the violent though brief gusts which often occur during storms, I arranged, and have had constructed on the premises, an apparatus for showing the pressure in pounds per square foot by automatic registration. This was erected in January last, and has worked satisfactorily ever since. [*A specimen record sheet is on the table.*] Besides this apparatus, an electric rain gauge and indicator has been constructed. The indicator is fixed in the hall, and shows by means of three dials the amount of rain fallen since the 1st of January, and registers every half-hundredth of an inch which falls. This is found very convenient, and enables us to answer frequent enquiries as to rainfall without referring to or disturbing the standard gauges in the grounds.

The standard instruments of the Observatory are in good order. The transit circle continues to furnish excellent results, and as far as its optical capabilities extend is still a first-class instrument. But, for reasons stated in my last Report, it has become very desirable, and indeed a matter of great importance, that the Observatory should now be furnished with a transit circle of considerably larger dimensions, to enable us to keep pace with other national Observatories, and to undertake important observations in conjunction with those of Europe and America—a co-operation frequently required, and in many cases of great importance on account of our geographical position.

The great telescope is now in capital working order, at least as far as the mechanism and polish of the mirrors is concerned, and it is somewhat remarkable how well the polish has kept, for although the specula are not so brilliant as when fresh from the polisher, the diminution of light from tarnish is almost imperceptible. Great care has, of course, been taken to preserve the polish by a proper use of drying material in winter, and exclusion of dust in summer. The flexure of the large mirror, which varies slightly with different positions of the telescope, is one of the principal difficulties in its use, but this is for the most part readily overcome by collimating the mirror for every largely differing position of the telescope.

Both the north and south equatorials are in good condition; they always perform satisfactorily, and have proved first-class instruments of their size. The photoheliograph has, of late, I fear, got somewhat out of adjustment, for the sun pictures recently obtained do not come up to the excellence of earlier ones. A thorough investigation as to the cause of this is now being made.

The clocks, chronographs, and minor appliances are doing good service, and are all in excellent working order. The electric connections within the buildings having increased year by year as requirements arose, have now become so numerous as to necessitate a re-arrangement for convenience and to avoid confusion. This has already been commenced, and will probably be completed in about a month.

The meteorological as well as the electrical and magnetical apparatus are all working satisfactorily, with the one exception of the anemograph. This, as I stated in my last Report, is fast wearing out; by frequent repairing, it has been made to do duty up to the present time, but it must soon be replaced by a new one.

The electrograph, which had been out of operation since the new magnet house was built, was set up again about two months ago, and is now registering satisfactorily the electric state of the atmosphere and its changes.

THE LIBRARY.

Considerable additions have been made to this branch of the Observatory, principally by donations and exchanges, a list of which appears in the Appendix. The shelf room in the Observatory has now become insufficient, and it is intended to increase it by extending the book-cases along the east side of this room (the Library).

PUBLICATIONS.

I regret very much that I am not able to place before the Board at this meeting the results of the work with the great telescope, for we have met with unexpected difficulties in obtaining perfect impressions of the drawings on stone made by Mr. Morris more than a year ago, owing to the extremely fine stippling by which the fainter portions of the nebulae are represented.

Further trials are being made by the experienced lithographers of the Mining Department, and although I am able to show you a few copies to-day, it is still a matter of doubt whether a sufficient number of good copies can be printed in this style (white on black) to enable us to publish them. In case this method is found impracticable for such work, I have already arranged for some experiments for the reproduction of the drawings by a certain photographic process, in which intense black grounds are obtained by the use of platinum and known as Willis's process. Of course we can still resort to the various methods of reproducing them black on a white ground, but the reverse is so much more effective, that I hesitate to revert to the old plan, until all reasonable and practicable means of depicting the objects on a black ground are exhausted. Until these drawings can be reproduced it will be useless to publish any of the work done with our large reflector. The results of observations made with the transit circle have been published up to 1870 only, and Vol. V., which will contain the results of 1871-72-73-74-75, is now in the press and nearly completed. In November last the observations of Mars and companion stars, obtained at

the opposition of that planet in August, September, and October 1877, were published in a pamphlet form, and issued to the various observatories as well as to the astronomical societies and other scientific bodies in the Colonies, India, Europe, and America. The Monthly Record of Meteorology and Terrestrial Magnetism has been issued to the end of March last. The number for April is in the printer's hands, and its issue is daily expected. The publication of the yearly results in meteorology, &c., has been delayed for a considerable time for the completion of a new map of the colony divided into climatic regions, which will for the future form part of the volume. In consequence of this delay, the number for 1876 has only just been issued; it will shortly be followed by the 1877 volume.

The publication of the daily weather bulletin has been continued throughout the year. Seventeen copies of it are printed at the Observatory every day, Sundays excepted, and distributed in Melbourne.

THE WORK OF THE OBSERVATORY.

The most important astronomical work done at the Observatory is that with the transit circle, and the results obtained are not only of the highest permanent value, but nearly all other astronomical work done here depends more or less upon it. This part of the work has therefore, as usual, been carried on unremittingly under the charge of Mr. White, assisted by Mr. Gilbert. For the first part of the period under review, as mentioned in my last Report, to allow time for reducing the zone observations, this work was restricted to the necessary observations for finding the clock and instrumental errors; somewhat later, a list of stars was observed, which had been prepared by Mr. Gill, the present Astronomer-Royal at the Cape of Good Hope, for the purpose of testing the personal equations of the observers at the principal observatories, as dependent on the magnitudes of the stars. Since April it has been employed on our fundamental azimuth catalogue, the stars of which, owing to the want of trustworthy data for the determination of their proper motions, require incessant attention.

The following are the numbers of recorded observations for the last twelve months:—

R. A. observations	...	...	...	...	1,706
P. D. observations	...	...	...	...	693
Observations for error of collimation	...	...	...	...	133
"	"	level	...	...	146
"	"	nadir	...	...	144
"	"	runs of micrometer	...	...	44
"	"	flexure of telescope	...	...	11

Of these, the R. A. observations are reduced up to date, 324 of the P. D. observations are completely reduced, 167 are reduced to apparent places, and the remainder are in progress of reduction. The annual catalogues for 1877 and 1878 have been completed for some time past.

Some further progress has been made in the reduction of the zone observations, and I am glad to report that of the forty-eight thousand six hundred and seventy-two observations recorded all are reduced in right ascension, and over 36,000 in both R. A. and polar distance.

The work with the great telescope has, as usual, been principally confined to the revision of Sir John Herschel's Southern Nebulae; in a few instances, however, it has been used for other observations. During the period under consideration successful observations were made on sixty-one nights, fifty nights were given up to visitors, and the rest were either cloudy, full moonlight, or rendered unavailable through repairs to the building in November and December last.

The work done is as follows:—Fifty-four of the smaller nebulae and clusters contained in Sir John Herschel's catalogue have been observed and compared, the great majority of which were found to still agree with that astronomer's descriptions. Some, however, have considerably changed, whilst others are completely altered in appearance. Drawings and descriptions of all these have been made and preserved. Five nebulae and one small cluster described by Herschel could not be found after careful search, viz.:—Nos. 376, 1153, 1373, 2106, and 2113. Observations of the Trifid nebula (Herschel, No. 4355) were made on ten nights, so as to compare it with drawings and observations by Messrs. Holden and Trouvelot with the great refractor at Washington; these observations are not yet completed. The great nebula around γ Argus was on two occasions again compared with the drawing made in March 1875, which is still found to represent its appearance very accurately. Among other observations with the great telescope are some of Encke's comet (of which drawings were also secured), observations of the satellites of Uranus, measurement of spectrum of γ Argus, &c.

Early in February a telegram was received from Dr. Oppolzer, of Vienna, requesting a watch on the sun's disc on the 16th of the same month for possible appearance of the supposed intra-mercurial planet Vulcan. A watch was kept for nearly three days, but nothing was seen of the planet.

The measurement of double stars between declination 52° S. and the south pole has been continued with the south equatorial.

In August last Encke's comet was observed with both the north and south equatorial as well as the great telescope, and a series of measures obtained with the two former instruments.

The conjunction of Mars and Saturn, which took place in the end of June Greenwich time, though actually on the early morning of the 1st of July Melbourne time, was observed here under exceptionally favorable circumstances. The occurrence afforded an opportunity of testing the accuracy of the tables of these two planets, as well as of comparing the physical appearances of the two bodies in one telescopic field, a condition under which they can seldom be seen. The necessary observations were satisfactorily obtained and duly recorded.

With the photoheliograph 169 sun pictures have been obtained, and the almost complete absence of spots has been the most remarkable feature in them.

The meteorological and magnetic observations have been continued as in former years. Determinations of the absolute force of terrestrial magnetism are made regularly every month, when the indications of the self-registering magnets are compared, and the correction for zero in each element secured. Continuous records are obtained by photography as heretofore from the barometer, wet and dry bulb thermometers, the Thomson electrometer, the magnetometers (in declination, vertical and horizontal force), and automatically in ink or pencil, from the Robinson's anemometer (which furnishes the velocity and direction of the wind), the wind pressure gauge, and the registering rain gauge. The records furnished by these instruments are filed away in order for reference. Those given by the Robinson's anemometer are tabulated up to date, and the results are published in the monthly pamphlet.

There are now eighty-nine country meteorological stations in connection with the Observatory, seven of which furnish complete returns, seventeen send daily weather telegrams, while sixty-five are simply rain-gauge stations furnishing rainfall returns monthly, or in a few cases the rainfall, coupled with maximum and minimum temperature and other meteorological notes.

The monthly returns of rainfall in various parts of the country are collected about the 12th of each month, and supplied to the daily papers, which publish them; and information which I believe is both interesting and useful to a large portion of the public is thus made available. The late dry seasons have no doubt added to the interest felt in these statistics; they are, nevertheless, of general importance and value, and I am desirous of making them even more so by an extended distribution of rain gauges into most of the outlying districts. I am encouraged in such a course by the numerous offers to take charge of these instruments from residents in all parts of the colony; indeed it is due to those who already so kindly assist in this direction to say that the published monthly returns would be only very partially representative of the colony were it not for their gratuitous and assiduous help.

Amongst the other routine work of the Observatory, the rating of ships' chronometers, testing and adjusting aneroid barometers, and other meteorological and nautical instruments for the public, forms a considerable item, and during the year under review forty-one marine chronometers and twenty-nine aneroid barometers, besides numerous other instruments, were received for the above purposes. The appliances of the Observatory enable us to perform these services—for which no charge is made—easily and accurately, and the facilities thus afforded appear to be of general utility, for resort is constantly made to them by the public.

For a considerable time past I had been made aware of the existence of a desire in many quarters that the public might be brought a little more *en rapport* with the doings of the Observatory by means of short occasional paragraphs in the principal daily newspapers, either on the actual proceedings at the Observatory, or on kindred subjects. Already a weekly meteorological synopsis was furnished to the press, and early in April last I added to this by brief weekly articles on astronomical or physical matters connected with the Observatory work, in which I thought many readers of the papers might be interested. The daily press in Melbourne have kindly given me their countenance and assistance, and I have reason to believe this proceeding has so far been favorably received by the public.

TIME SIGNAL AND DISTRIBUTION OF OBSERVATORY TIME.

No change has been made in this branch of the Observatory work. Upon the time signal given with the Williamstown time ball depends in a very great measure, if not entirely, the errors and rates of the chronometers carried by ships leaving our waters on long voyages, and upon these again depend in no small degree the safety of the ships themselves; every care, therefore, is taken, and no effort spared to maintain the accuracy and regularity of this signal. Having an exceedingly trustworthy attendant at Williamstown, and the cordial assistance of the Telegraph Department, it is seldom the signal fails or is incorrect. Occasionally, however, through accidents on the telegraph line, or other unforeseen causes, failures occur. During the last year, out of 300 times, the signal was given accurately 289 times, or eleven failures in three hundred. Five of these failures were due to interruptions on the lines, one to a defect in the signalling clock, one to a mistake in changing current at the Observatory, and four to the ball being dropped one second wrong owing to defective electric signals. Any error in the signal, however, is automatically shown on the Observatory instruments, and notified in the papers the following day, so that a defective signal of the latter kind can be utilized by observers on board ships by simply applying the errors published.

The Post Office clock, the error of which is ascertained each day at noon and published in the papers, maintains its high character. An opportunity occurred lately, while it was stopped for cleaning, for altering the compensation of the pendulum by withdrawing about 15 lbs. of mercury—for it had been found to be slightly over-compensated—its rate, therefore, will no doubt now be found to be even smaller than hitherto.

The system of controlling clocks in Melbourne by an electric current from the Observatory has been extended; but from the too frequent interruptions in the current which occur, it is evident some modification in the mode of distributing the current is necessary, and after conferring with S. W. McGowan, Esq., Inspector of Telegraphs, and K. L. Murray, Esq., Superintendent of Railway Telegraphs, it has been decided to alter the existing arrangement, and divide the clock circuit into two, by which means it is thought the present difficulties will be obviated.

The other methods of distributing Observatory time to various parts of the colony through the central telegraph office, and described in former Reports, are in force, and appear to work satisfactorily.

I would again call attention to the increasing requirement of a larger transit circle than that now possessed by the Observatory, for reasons already given. Some time after the last visitation of the Board I brought the matter under the notice of the head of my department, the Honourable the Chief Secretary, who entertained it favourably, and it is to be hoped that part at least of the necessary funds may be ere long voted for such a purpose.

A little time subsequent to the presentation of the last Report of the Board to Parliament some correspondence took place relative to the promptitude in the despatch of weather telegrams between the various colonies; and I am glad to say that there has been a considerable improvement in this matter during the past year.

ROB. L. J. ELLERY,
Government Astronomer.

Observatory, Melbourne, 24th July 1879.

APPENDIX.

BOOKS, ETC., PRESENTED TO THE OBSERVATORY.

Name of Book.	By whom Presented.
Greenwich Observations, 1876	Greenwich Observatory
Greenwich Astronomical Results, 1876	Ditto
Greenwich Meteorological and Magnetic Results, 1876	Ditto
Greenwich Star Catalogue of 1872	Ditto
Reduction of Twenty Years' Meteorological Observations taken at Greenwich	Ditto
Cape of Good Hope Observations, 1859 and 1875	Ditto
Greenwich Nautical Almanac Corrections for 1879	Ditto
Greenwich Nautical Almanac for 1882	Ditto
Hourly Readings from the Self-recording Instruments at the Seven Observatories in connection with the Meteorological Office, June 1877 to December 1878	Meteorological Office, London
Quarterly Weather Reports, from June to December 1875	Ditto
Meteorological Observations at Stations of the Second Order, from June 1876 to December 1877	Ditto
Meteorology of the North Atlantic during August 1873	Ditto
Synchronous Charts of the North Atlantic during August 1873	Ditto
Daily Weather Reports of the Meteorological Office, January to June 1878... ..	Ditto
Report of the Meteorological Council of the Royal Society (December 1878)... ..	Ditto
Reports of the Permanent Committee of the First International Meteorological Congress at Vienna (Nos. 12 and 13)	Ditto
Memoirs of the Royal Astronomical Society, Vol. XXXIX., Part II.	Royal Astronomical Society
Monthly Notices of the Royal Astronomical Society, April 1878 to March 1879	Ditto
Tables for the Reduction of Solar Observations, Vol. II. By Warren de la Rue	Warren de la Rue, Esq.
Astronomical Observations made at the Oxford University Observatory (No. 1)	Professor Pritchard
Astronomical Observations at Leyton Observatory, 1877	J. G. Barclay, Esq.
Catalogue of Scientific Papers, by Professor Rankine	J. R. Napier, Esq.
Discussion of the Melbourne Meteorological and Magnetic Observations (1858-1863)	Professor Neumayer
Paper on the Relative Duration of Sunshine at Kew and Greenwich	G. M. Whipple, Esq.
Quarterly Journal of the Meteorological Society for 1878	Meteorological Society
The Selenographical Journal for 1878	Herbert Sadler, Esq.
Indian Daily Meteorological Observations from April 1878 to April 1879	Indian Meteorological Department, Calcutta
Réport on the Meteorology of India for 1876, by H. F. Blanford	Ditto
Indian Meteorological Memoirs, by H. F. Blanford. Vol. I., Part II.	Ditto
Report on the Administration of the Indian Meteorological Department for 1876-77	Ditto
Colába Meteorological Charts, with descriptive letterpress by C. Chambers	Colába Observatory
Results of Meteorological Observations at Vizagapatam Observatory, 1877	A. V. Nursingrow, Esq.
The Transactions of the Royal Irish Academy of Science, Vol. XXVI.	Royal Irish Academy of Science
Paper on Binary Stars, by W. Doberck	W. Doberck, Esq.
The Inventor of the Telescope, by W. Doberck	Ditto
Journal of the Scotch Meteorological Society for 1877	Scotch Meteorological Society
Victorian Year Book, 1877-78	Government Statist, Victoria
Geological Survey of Victoria; Progress Report, No. 5	Mining Department, Victoria
Victorian Reports on Mines for the Years 1874-75-76-77	Ditto
Report of the Melbourne Harbour Trust Commissioners for 1878	Melbourne Harbour Trust
Results of Rain Observations for New South Wales during 1878	H. C. Russell, Esq., Government Astronomer
Sydney Meteorological Observations, in monthly parts, for 1878	Ditto
Adelaide Meteorological Observations, in monthly parts, for 1878	C. Todd, Esq., Government Astronomer
Adelaide Meteorological Observations for 1876-77.	Ditto
Meteorological Report of Western Australia for 1877, by M. Fraser	M. Fraser, Esq., Surveyor-General

APPENDIX—continued.

Name of Book.	By whom Presented.
Pamphlet on "Modern Astronomy," by F. Abbott	F. Abbott, Esq.
Wellington Meteorological Observations, March 1878 to March 1879	Dr. Hector
Pamphlet on the "New Solar Elements," by G. T. Carruthers	Rev. G. T. Carruthers
Daily Bulletin of International Meteorological Observations, August 1877 to August 1878; Washington, U.S.	General A. J. Myer, Chief Signal Officer, U.S. Army Department
Monthly Weather Review, March 1878 to March 1879, Washington, U.S.	Ditto
Annual Report of the Chief Signal Officer to the Secretary of War (U.S.) for the Year 1877	Ditto
Daily Bulletin of the U.S. Army Signal Service, April to October 1874	Ditto
American Ephemeris and Nautical Almanac for 1880	Washington Naval Observatory
U. S. Instructions for observing the Total Solar Eclipse of 29th July 1878	Ditto
Observations and Orbits of the Satellites of Mars, with Data for Ephemerides in 1879, by Professor Asaph Hall	Ditto
Observations of Double Stars, Mean Results, 1877	Cincinnati Observatory
Report of the New York Meteorological Observatory for 1877, by Dr. Draper	New York Meteorological Observatory
Smithsonian Report for 1876	Smithsonian Institution, Washington
Annals of the Astronomical Observatory of Harvard College, Vol. IV., Part II.	Harvard College Observatory
Bibliographical Contributions to the Library of Harvard College, No. 1	Ditto
Bulletins of the American Geographical Society, Nos. 1, 2, 3, and 4, Session of 1878	American Geographical Society
Report on the Solar Eclipse of 29th July 1878	Chicago Astronomical Society
Report on the Total Solar Eclipse of 29th July 1878	Rev. J. M. Degni, S.J.
Report on the Total Solar Eclipse of 29th July 1878	L. Waldo, Esq.
Boletín del Ministerio de Fomento, Mexico, March 1878 to March 1879. M. Bárcena	Mexico Central Observatory
Revista Meteorológica Mensual, Mexico, January to June 1878. M. Bárcena	Ditto
Datos Altimétricos: Memoria por V. Reyes	Ditto
La Ley de Periodicidad de las Lluvias en el Valle de Mexico. V. Reyes	Ditto
Annales de la Oficina Meteorológica Argentina, Buenos Ayres	Dr. B. A. Gould
Apuntes relativos a los Huracanes de las Antillas. Rev. R. F. B. Viñes, S.J.	Colegio de Belen, Habana
Connaissance des Temps pour l'an 1880	Bureau des Longitudes, Paris
Procès-Verbaux des Séances de Comité des Poids et Mesures, 1877	Ditto
Brussels Meteorological Observations, in monthly parts, for 1878	Brussels Observatory
Observations Météorologiques à Bruxelles; Résumé pour 1877	Ditto
Société Belge de Géographie; Bulletins Nos. 1, 2, 3, 4. 1878.	Société Belge de Géographie
Observations Météorologiques des Stations du Second Ordre dans les Pays-Bas, 1876	Netherlands Institute, Utrecht
Nederlandsh Meteorologisch Jaarboek voor 1872, 1873, 1876, 1877	Ditto
Die Triangulation von Java, Vols. I. and II.	Professor Oudemans
Bijdrage tot de Kennis der Weersgesteldheid ter Kuste van Atjeh	Dr. Bergsma
Elementer och Efemerid för Fayeska kometen återkomst, 1880	Professor Axel Moller, Christiania
Almanaque Nautico, 1879. Madrid	San Fernando Observatory, Madrid
Anales del Instituto y Observatorio de Marina de San Fernando, 1875, 1876	Ditto
Vierteljahrsschrift der Astronomischen Gesellschaft, 1878. 13. Jahrgang	Astronomische Gesellschaft
Astronomische, Magnetische, und Meteorologische Beobachtungen, 1877	Dr. Carl Hornstein, Prague
Zeitschrift der Österreichischen Gesellschaft für Meteorologie. XIII. Band. Vienna	Dr. J. Hann, Meteorological Observatory of Vienna
Bericht zweiten internationalen Meteorologen-Congress	Ditto
Jahrbücher der K. K. Central-Anstalt für Meteorologie und Erdmagnetismus. Jahrgang 1875, 1876. Vienna	Ditto
Schriften der Universität zu Kiel, 1876	Kiel University
Des Neuen Universitäts; Gebandes zu Kiel. (Dr. F. Polbehr)	Ditto
Meteorologische Bureau im Königreich Sachsen	Professor Carl Bruhns
Charte der Gebirge des Mondes (25 Blätter), Dr. J. Schmidt	Berlin Observatory
Charte der Gebirge des Mondes (Erläuterungsband), Dr. J. Schmidt	Ditto
Kurze Erläuterung zu Mondcharte	Ditto
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