

REPORT

UPON THE

LONGITUDE OF WELLINGTON,

AND OF OTHER PARTS OF THE COLONY IN RELATION TO
THE INITIAL LONGITUDE OF WELLINGTON.

PRESENTED TO BOTH HOUSES OF THE GENERAL ASSEMBLY, BY COMMAND
OF HIS EXCELLENCY.

WELLINGTON.

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1870.

1910. 11. 11

NOTES ON THE DISTURBANCE

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REPORT UPON THE LONGITUDE OF WELLINGTON, AND OF OTHER PARTS OF THE COLONY IN RELATION TO THE INITIAL LONGITUDE OF WELLINGTON.

THE Board appointed on the 8th July, 1869, "to report upon the Longitude of Wellington, and of other parts of the Colony in relation to the Initial Longitude of Wellington," have the honor to communicate the result of their inquiries, for the information of His Excellency the Governor.

The longitude of Pipitea Point, in the Harbour of Wellington, was originally fixed at the separate visits of Her Majesty's survey ships "Pandora" and "Acheron," in 1852 and 1854 (by the chronometric measurement of the meridian distance from Sydney), every precaution being taken to secure a correct initial meridian as the basis of the elaborate coast survey of these Islands, which has since been so admirably executed under the direction of the Admiralty. The longitude thus determined for Pipitea Point was 11h. 39m. 11.53sec. E., or $174^{\circ} 47' 53''$ E.

At an early date after their appointment, the Board communicated with Mr. Ellery, the Government Astronomer in charge of the Melbourne Observatory, and received from him the valuable memorandum appended to this Report. Mr. Ellery recommended that until the Board had command of sufficiently accurate appliances, it would be better to rely on chronometric measurement of the meridian distance from the Melbourne Observatory, the longitude of which has been now established, and to confine the astronomical observations to the accurate determination of local time. The Board, desiring to act in accordance with this advice, obtained the assistance of the navigating officers of H.M.S. "Challenger," who compared, with chronometers on which they placed full reliance, the Time-ball time of Sydney with that of Wellington. The results thus obtained agreed within .27 of a second with those of H.M.S. "Acheron" and "Pandora."

The Board recommend, therefore, that the official longitude of the chart shall be, for the present, presumed to be correct, and adopted as the initial longitude of New Zealand, from which all other longitudes shall be determined.

By this course all ground for questioning the longitude will be removed, and the Board feel assured that the limit of error would be less than a mariner is capable of determining with the instruments at his command on shipboard.

The Board do not wish to convey the impression that the official longitude thus created should not be subject to further verification and amendment, but they are clearly of opinion that it is not desirable to keep it an open question for the sake of any small possible error, nor to delay longer the far more important work of ascertaining the differences of longitude between different parts of the coast line of these Islands.

These differences can be accurately determined by telegraph, and laid down in their correct relation to the meridian of Wellington; and if any further change requires to be made in that longitude, only the meridian lines on the charts will require alteration.

The extension of the telegraph to most parts of the Colony makes the determination of the meridian difference between its different parts easy of attainment.

The usual course is to observe the local time by transits at the two stations, and to compare the time at each place. The objection to this course is the irregularity of instruments and of the personal error of observers; and the Board therefore recommend a modification of this plan to be adopted, as more likely to give reliable results. This is, that by telegraphic communication with the Observatory the difference in time of the actual transits of the same stars over the meridian of the two stations should be observed on the same clock.

By a few preliminary observations of high and low stars, the two instruments can be readily adjusted in the meridian, and very few observations will suffice to establish the meridian difference required.

With the view of carrying out this determination, which, as the foundation of all accurate surveys, is one of the most important works that can be undertaken in the Colony, the Board strongly urge that one of the "Sectors" recommended by Mr. Ellery for this purpose, and also for the determination of latitudes, should be obtained, and placed in the hands of a competent observer.

JAMES HECTOR,
Chairman.

Colonial Museum, 10th August, 1870.

GENTLEMEN,—

Melbourne Observatory, 15th September, 1869.

I have been instructed by the head of my Department, to furnish whatever information in my power to give, that may be required by the Board of Longitude of Wellington, and I have now the honour to assure you of the gratification it will afford me to be of any service to the Board in obtaining the objects they have in view. I had several conferences with Mr. G. A. Woods, during his late visit to Victoria, relative to the determination of the geographical position of Wellington, and I believe I am fully informed of the requirements of the Board, and of the appliances they have at command. I was requested by Mr. Woods to place in writing the various suggestions I made to him concerning the several points on which he questioned me, and I do so with much pleasure.

1st. With regard to the determination of the longitude of Wellington, I suggested the method I

should adopt in obtaining the longitude of a place situated as Wellington is, with reference to Greenwich and to our own observatory—namely, that transits of the moon's bright limb and the moon-culminating stars should be observed regularly, taking care to have the transits of the first and second limbs nearly equal each lunation; that copies of these should be sent to Greenwich Observatory every mail, requesting in return that such corresponding transits as were obtained there might be forwarded to Wellington; and that in the mean time a very close approximation indeed to the true longitude could be obtained by calculating the moon's R.A. from the data given in the *Nautical Almanac* under "Moon's Culminations;" for since the adoption, within the last few years, of Hansen's *Lunar Tables* in the computation of these data, the tabular errors of the moon's place are exceedingly small, and not above one-tenth of what they were eight or nine years ago, when Burchard's *Elements* were used. I do not think that comparing moon culminations with Melbourne would give a better result than taking the *Nautical Almanac* data.

I am of opinion that a far closer determination of the difference of longitude between Melbourne and Wellington could be obtained by transmission, several times, of at least three chronometers between the two places, always provided the local time at Wellington can be obtained with precision; the comparisons of these chronometers should be made without removing them from on board the ship they may be sent in, which can be accomplished by means of a journeyman chronometer or a time-ball. Three or four comparisons each way will, I believe, give the difference of longitude more exactly than a long series of moon culminations.

I pointed out the importance of determining the latitude as well as the longitude, and would suggest the method of transits in the prime vertical with a good transit instrument, as the best where a transit circle is not available. For this purpose it becomes necessary to know with great precision the Polar distance of the stars observed; and as the N.A. list contains so few that will be available, our Observatory would be able to render direct assistance with its transit circle in determining the positions of the stars not in the N.A. list which may be observed.

In this method it will be absolutely necessary that a very delicate level, the value of whose divisions is accurately known, should be used, as the correctness of the latitude will depend directly on the precision of the level.

A very useful instrument for determining latitude, and especially differences of latitude, is the "Zenith Telescope," which is now being extensively used in India for this purpose. Enclosed is a photograph of one for India made by Messrs. Troughton and Simms: it is portable, and is very useful in determining latitudes in surveys; this instrument is described in Loomis' *Astronomy*. It appears that the transit instrument already at the disposal of the Board has no collimation micrometer. I think it would be advisable to have one added to the instrument, and a collimation telescope procured, which should be mounted on a brick or stone pier a few feet to the North or South; the collimation error could thus be obtained with precision at any moment with facility. If it be possible to get a meridian mark at a distance not less than a mile and a half on the opposite side to the collimating telescope, it will be found very useful. In observing R. Ascensions, it is very necessary to determine the errors of collimation level and azimuth with each set of observations, and most especially with small instruments; the collimation error may be eliminated by obtaining an equal number of observations with the pivots in reversed positions; but in moon culminations this cannot well be done, and the collimation error should be determined frequently with great precision.

Mr. Woods submitted some questions relative to instituting observations of terrestrial magnetism in Wellington. I am of opinion that it would be highly desirable to establish a system of magnetic observations at Wellington: the result from such a locality would be highly interesting, and of great scientific value. At the Melbourne Observatory, monthly determinations of the declination, dip, and horizontal force are made; and we have also a set of the Kew magnetographs (self-registering by photography), which gives a continuous record of the variations of these three forces. This, of course, involves a considerable amount of work. The monthly absolute determinations, however, with the new Kew pattern instruments, only occupy about eight hours every month, and these are the only magnetic observations taken at most Observatories where the subject of terrestrial magnetism is entertained at all. For these observations, a magnetic theodolite and dip circle are required—the new Kew pattern is best by far. They cost about £90 together. A small wooden building, free from iron, having two small stone piers free from the floor, is all the accommodation required for them. The self-registering magnetometers cost about £350.

If magnetic observations were instituted in Wellington, it would be advisable that the observer should take a few weeks' drilling at the Melbourne Observatory. There is a set of instruments at this Observatory, of the German pattern, which is not in use now, and, if desirable, could be lent to the New Zealand Government; these instruments are much more troublesome and tedious to use than those of the Kew pattern, but quite reliable nevertheless.

I believe I have now referred to all the points spoken of by Mr. Woods, and I need only add that it will afford me great pleasure to answer any further questions, and to do anything I can in assisting the Board in the objects they have in view.

To the Board of Longitude,
Wellington.

I have, &c.,
ROBT. L. J. ELLERY,
Government Astronomer, &c.