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BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

RECORD No. 1966/175

MELBOURNE OBSERVATORY GROUP ANNUAL REPORT, 1964

by

C.A. van der Waal

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SUMMARY

Few changes occurred during 1964, and the instruments operated with very few interruptions.

Electric power was connected to the Toolangi magnetic observatory, thus creating the opportunity for proper lighting and for the installation of heating in the absolute building.

1. INTRODUCTION

A brief description of the Melbourne Observatory Group, as well as the relation between the group and the Mundaring and Port Moresby Observatories is given in the annual report for 1962 (van der Waal, 1966).

Few changes occurred during 1964, and the instruments have been operating with very few interruptions.

Electricity was connected to the magnetic observatory creating the opportunity for proper lighting and for the installation of heating in the absolute building.

Towards the end of the year it was decided that the author will remain in charge of Toolangi and the Antarctic observatories when the Geophysical Branch moves to Canberra in 1965. He will be assisted by C.H. van Erkelens, R.G. Toy, and a computing assistant.

Delays in typing have caused long delays in publishing magnetic and seismic data from Antarctic stations and an effort is being made to bring this up to date. The fact that it will not be necessary to publish annual seismic bulletins from the Antarctic stations in future will assist in catching up on the back-log.

2. TOOLANGI MAGNETIC OBSERVATORY

Observatory buildings

All observatory buildings were kept in good order. They were painted inside and out in March.

The electric wiring of the buildings and the installation of thermostatically controlled floor-heat in the absolute house was commenced in February. Some difficulty was encountered in finding non-magnetic fittings but the problem was solved and the lighting was connected in July and the power in August. However, the lighting in the absolute hut for illuminating the instrument scales and circles is unsatisfactory. The light is not sufficiently diffused, and the installation of some kind of diffusing material under the light will be tried.

Instruments

Recording of the D, H, and Z components of the geomagnetic field with the La Cour variometers was continued throughout the year. Control observations were made every week with the Ruska magnetometer No. 4813 for D, three QHMs (Nos. 288, 289, and 290) for H, and BMZ No. 119 for Z.

Orientation tests on the variograph were carried out in May. It was not necessary to change the magnet position, but the H-trace spot was repositioned so that it will not overlap the baseline trace.

Two proton precession magnetometers were sent to the Antarctic stations at the beginning of the year and good results were obtained. However, on return, both instruments required attention in the workshop, and they

were not ready for use again until the end of the year when they had to go back to the Antarctic stations.

A d.c. power supply for the proton precession magnetometer was constructed and tested. It gave some inconsistent results at first, but appeared to be working all right later. It was not considered reliable enough to send to the Antarctic stations.

One proton precession magnetometer coil for backing-off Z was re-designed and re-constructed.

The Askania declinometer that was intended to go to Macquarie Island in March gave inconsistent comparison results and was not sent. A new T-piece for hanging the magnet on the suspension was ordered but results were still not satisfactory. Another new declinometer was sent in December.

The circuits for obtaining scale values of the variometer have been unsatisfactory for some time. These circuits are now being re-designed. The control panel, ammeter, batteries, and charger will be installed in the store hut and a more accurate meter can then be used without interfering with the magnetic instruments.

The Port Moresby declinometer was received for repairs.

Instrument comparisons

Instruments used for the standardisation of Antarctic instruments were compared with Toolangi instruments before they were sent down, and again after their return in April. Consistent results were also obtained with the proton precession magnetometer.

The Port Moresby declinometer, which was received for repairs, was compared with the Toolangi declinometer but the results were not satisfactory and the comparisons will have to be repeated.

A set of three QHMs was sent to Port Moresby in October to standardise the Port Moresby QHMs. They were compared with the Toolangi instruments before and after this.

Large scatter in the D pier differences occurred when doing simultaneous observations. This scatter is as yet unexplained.

Analysis of results

Normal computations of control observations, scaling of K-indices, and extraction of phenomena were carried out.

The preliminary scale values used during the year were: for D, 1.17 minutes per millimetre to June and 1.16 minutes per millimetre from July; for H, 4.57 gammas per millimetre to April and 4.54 gammas per millimetre from May; and for Z, 4.41 gammas per millimetre to February and 4.39 gammas per millimetre from March.

During 1964, eight observatory years of mean hourly values were scaled. This is two more than the data produced by all BMR observatories in 1964. Therefore unless the scaling is speeded up it will be many years before it is up to date. The main causes of the low output were scaler breakdowns and staff shortage. Breakdowns occurred throughout the year, although to a somewhat lesser extent towards the end of the year, and a considerable amount of time was lost through this. Constant shortage of staff prevented the full use of the scaler when it was in operating condition. When used full time one observatory year can be scaled in ten working days.

The following observatory years were scaled: Macquarie Island 1957, Mawson 1957 and 1958, Gnangara 1958, Toolangi 1959 and 1960, and Port Moresby 1959 and 1960.

Punching of hourly mean values from Toolangi 1934 to 1937 was completed in March and the automatic typing of this data was completed in May.

During the year the Silliac Computing Centre changed to 'open shop' and it became necessary for observatory staff to go to Sydney to complete the outstanding computing. This was done by B.G. Cook and J.C. Branson in September, and most of the outstanding work was done during this time. Because of this, the reduction and automatic typing of the Watheroo 1948 to 1958 mean hourly values was virtually completed. The reduction and automatic typing of Macquarie Island 1955 and 1956 was also completed. A carbon ribbon put on the typewriter in place of the normal inked ribbon improved the typing considerably.

Several years of previous baseline adoptions for Antarctic stations were revised to remove discontinuities between years.

During the year a large computing system was installed for the CSIRO in Canberra and other capital cities. In Canberra a CDC 3600 was installed and in each of the capital cities a CDC 3200 has been or will be installed. These computers will be available to the BMR. As the Geophysical Branch is moving to Canberra in 1965 the CDC 3600 will be used. To do this, writing of Fortran programmes suitable for this equipment was commenced and certain sub-routines had been successfully tested by the end of the year. The present 5-hole tape used can be read by the new equipment but the output will be in 8-hole tape. Therefore some equipment will have to be modified and some new equipment has been ordered to enable automatic typing of the output. Programmes will generally be on cards and card punches will also be purchased.

It is proposed to punch all control observations on cards, compute them on electronic computers, and store the results on magnetic tape. Recomputation, because of changes in parameters such as instrument corrections, temperature co-efficients, etc., which is very time consuming, can then be done on the computer.

A manual card punch will be purchased for each observatory, so that punching of absolute observations can be kept up to date. In the meantime tables were prepared to simplify the QHM computations.

Miscellaneous projects

Dr J. Mainstone, from the University of Queensland, came to Toolangi in June to repair the magnetic tape pulsation recorder that is installed at the seismic observatory. Calibration with a rotating magnet was attempted but was unsuccessful because of a fault in the time marking.

The USCGS, co-operating with N.A.S.A., commenced scaling of magnetograms at 2.5-minute intervals for selected periods and observatories. The Toolangi and Antarctic observatories are among the ones asked to co-operate. Microfilm copies of Toolangi magnetograms are being sent to the USCGS, Washington (World Data Centre A) every month, and those of the Antarctic stations as soon as they are returned and preliminary parameters have been determined.

Some tabulations of hourly mean values based on these scalings, in the form of computer print-outs, have been received. The 2.5-minute scalings can also be obtained on magnetic tape; at first it was thought that by using these, hourly scalings of the magnetograms could be eliminated, but on closer examination of the problems involved it was decided that applying corrections to the tape data, such as changes in baseline values, instrument corrections, etc., would be more work than hourly scalings and computing with the correct parameters.

Requests

Requests for copies of magnetograms, hourly, monthly, and other magnetic data were received from a number of local and overseas sources. At the request of the Department of Civil Aviation one of their compass theodolites was calibrated at Toolangi.

3. TOOLANGI SEISMIC OBSERVATORY

Observatory buildings

The seismic observatory buildings were maintained in good order.

Early in the year evidence of vandalism was found around the observatory and it was necessary to surround the site with a security fence. A chain wire fence was constructed and completed late in the year.

The access road to the seismic site was graded and some gravel put on in a few places. As expected, this proved insufficient; the gravel was washed out again soon afterwards.

No information was received from the Department of Works about the test hut which was to be constructed during this year.

When the seismic vault was designed it was expected that the exposed concrete south wall would be sufficient insulation to prevent daily changes in temperature inside the vault. However, although the wall is not exposed to the sun, daily changes in outside

temperature are conveyed by the concrete, setting up convection currents inside the vault. These currents cause the long-period seismograph to drift to and fro making analysis of earthquakes difficult. To solve this problem it was proposed to build another wall around the exposed side, leaving a cavity between the walls, thus insulating the vault properly. Funds for this purpose were put on the 1964-65 estimates and it is expected that the wall will be constructed in 1965.

Instruments

The following seismographs were operated at Toolangi Observatory during the year:

Benioff short-period, N-S, E-W, Z components, T_s = 1s, T_g = 0.25s.

Sprengnether long-period, N-S, E-W components, T_s =15s, T_g = 90s.

Columbia long-period, Z component, T_s =15s, T_g = 90s.

Milne-Shaw long-period, E-W component, T =12s.

When inspecting the long-period galvanometer suspensions it was found that they were in very bad condition and new suspensions were obtained from the makers in the USA. The bottom suspensions were all right but two of the three top suspensions were unusable and more had to be ordered. The seismograph was calibrated with the old suspensions and it will be re-calibrated when the new ones are fitted.

The present emergency power supply is insuffi-cient to keep the seismographs operating during power failures. Additional units capable of operating the equipment fully for 11 hours were being planned and should be installed during 1965.

The voltage regulating section of the crystal clock failed in December and for a few days the timing was uncontrolled. During the repair the timing was obtained from the Synchronome pendulum clock, which gave excellent results.

A d.c. power supply to operate the Synchronome clock and the time mark relays was designed.

The proposed vertical seismograph with a visual recorder (helicorder) was set up in the Melbourne Observ-atory for testing. It was intended that the seismograph would remain at the Melbourne Observatory, while the helicorder would be installed in the Observatory office, the two being connected by a telephone line (fire alarm line). In order to comply with P.M.G. regulations it was necessary to prevent any possibility of high voltage getting onto the telephone line, and therefore a modulator and demodulator were constructed in the workshop so that a carrier could be used to transmit seismic signals. This equipment was tested and the drawings submitted to the P.M.G. for approval. The tests were satisfactory and oral approval was obtained from the P.M.G. by the end of

the year. However, because of the projected move of the Geophysical Branch to Canberra and the uncertainty of the future location of the Toolangi Observatory office, it was decided not to continue with the project at present.

When Mr Michel of Lamont Geological Observatory visited the Toolangi Observatory in April he suggested the installation of the recording micro-barograph which was received with the seismograph. However, there is no place available for the photographic recorder.

Analysis of records

Analysis of all earthquakes for distribution was continued throughout the year.

The trial period for the automatic handling of seismic data by the International Seismological Summary using mark sense cards from a limited number of stations was completed. A new organisation, the International Seismological Research Centre, which replaces the I.S.S., has commenced the project on a permanent basis. All Bureau stations have now been asked to co-operate. Mark sense cards can still be used, but the data which can be entered has been extended. However, punch cards can also be used and a hand punch has been ordered.

It was noticed during the year that several times seismic data from Toolangi and Antarctic stations were missing from the USCGS earthquake data reports, apparently because the data were not received in time to be included. Because of this, much more time than necessary was required to check earthquake data before sending them to I.S.R.C. It was therefore decided to send earthquake data to the USCGS four times per week instead of twice, as was done before. Since this was done no data have been missing from the data reports.

The Lamont Observatory has requested the original seismograms from the long-period instrument and these will be sent after analysis and copying on 16-mm film.

Miscellaneous projects

The United Kingdom Atomic Energy Authority is planning to set up a seismic array in northern Australia. It will consist of two lines of short- period seismometers (Willmore type). The lines are at right angles and cross near the ends of each. About ten seismometers will be installed in each line, extending over about 25 km.

It was suggested that after about two years the establishment might be handed over to the BMR.

In the meantime a U.K.A.E.A. party was in Australia to do a noise survey of the proposed sites in the Northern Territory and Queensland, and the author joined this party for about three weeks in March. The sites tested were at Tennant Creek, N.T., and near Duchess and Mary Kathleen, Queensland. The site at Tennant Creek appeared to be the most suitable. However, it is understood that the authorities may reconsider the siting of this installation.

4. ANTARCTIC OBSERVATORIES

Separate reports are written about the operation of the Antarctic observatories.

At head office, P.J. Gregson, who was observer at Macquarie Island, and I.E. Black, who was observer at Mawson, analysed the observations made at these stations during 1963. The seismograms were checked and re-analysed when necessary and the results listed for publication.

As the data will be processed by I.S.R.C. one year after the event, most of the data from the Antarctic stations can be punched every year at head office, but a few months will have to be done from telegraphed data after these are checked with the USCGS data reports.

It is proposed that I.S.R.C. bulletins will be published soon after the data are processed and it will therefore not be necessary to publish annual Antarctic bulletins.

Magnetic phenomena were abstracted and distributed.

High latitude stations have been asked to scale hourly ranges of H and D (R-index). An accuracy of ten gammas is suggested. It was first intended that the millimetre values should be scaled by hand and punched on cards to be converted on the computer. However, it was decided that this scaling could be done at the same time as the scaling of hourly mean values and, with a suitable programme, the data can then be extracted from the tape and converted on the computer.

The usual ordering and preparation of stores and equipment for the Antarctic observatories was done. Stores for Wilkes 1964 left from Melbourne in January and stores for Mawson 1964 were sent to Fremantle early in February. Stores for Macquarie Island 1965 and Mawson 1965 left Melbourne in December.

5. DARWIN SEISMOLOGICAL OBSERVATORY

Recording at the temporary seismic station in Darwin with the three-component Willmore seismograph was continued throughout the year.

The two recorders that were in Melbourne for repairs were returned at the beginning of the year and have been operating satisfactorily since then.

Large numbers of earthquakes from a distance of about 5° have again been recorded.

Some drilling for a suitable foundation for the seismic piers at the Manton Dam site was done early in the year but this was stopped when funds were exhausted. Later, additional funds were made available and in December a site was prepared for further drilling by bulldozing. Drilling was expected to commence again in January 1965.

6. REFERENCE

van der WAAL, C.A. 1966 Melbourne Observatory Group annual report, 1962. Bur. Min. Resour. Aust. Rec. 1966/173.

APPENDIX 1

Staff movements and visitors

Staff for the whole year

C.A. van der Waal

B.G. Cook

C.H. van Erkelens

J.C. Branson

R.G. Toy

I. Bodo (Mrs.)

L. Stewart (Miss)

V. O'Donnell (Miss)

Commenced duty during the year on dates shown

I.D. Ripper, Geophysicist Class 1, 5th February

R.G. Sutton, Geophysicist Class 1, 26th October

J. Haigh, Geophysicist Class 1, 26th October

Miscellaneous

C.H. van Erkelens was on relieving duty in Port Moresby until 27th March.

C.A. van der Waal was with the United Kingdom Atomic Energy Authority party and visited Darwin from 4th to 26th March. He attended a regional management conference from 19th April to 2nd May.

I.D. Ripper transferred to Port Moresby Observatory on 6th April.

B.G. Cook attended a course in Fortran 32 at the CSIRO from 25th to 28th May.

J.R. Wilkie transferred to Port Moresby Observatory on 18th May.

I.E. Black attended a computing course on 1st and 2nd June.

J.C. Branson attended a Fortran course from 31st August to 4th September.

P.J. Gregson transferred to Mundaring on 1st October.

G. Smith joined the group on 9th November.

Antarctic staff

G. Small left for Wilkes on 3rd January.

R.J.S. Cooke left for Mundaring on 15th January and left for Mawson from Fremantle on 6th February.

I.E. Black returned from Mawson on 20th March.

P.J. Browne-Cooper transferred from Mundaring on 19th October and attended the ANARE indoctrination course from 26th to 30th October.

J. Haigh transferred from Mundaring on 26th October and attended the ANARE indoctrination course from 26th to 30th October. He left for Mawson on 22nd December.

R.G. Sutton joined the Observatory Group on 26th October and attended the ANARE indoctrination course from this date to 30th October. He left for Macquarie Island on 2nd December.

P.M. McGregor left for Macquarie Island on 2nd December for about four months.

G.D. Lodwick returned from Macquarie Island on 17th December.

Vacation students

D. Ng commenced on 8th January and resigned on 20th March.

D. Mines resigned on 23rd January.

J. Fok resigned on 14th February.

J. Fitzgerald commenced on 1st December.

P. Lung commenced on 29th December.

Visitors

J.A. Brooks from Port Moresby visited head office on 12th and 13th February, 21st August, and 31st August to 3rd September.

Mr. Michel of Lamont Geological Observatory visited the Seismic Observatory on 6th April.

I.B. Everingham of Mundaring Observatory visited the office on 21st August, and from 31st August to 3rd September.

R.F. Thyer and D. Vertigan visited the Toolangi Observatories on 19th August.

P.M. McGregor of Mundaring Observatory visited head office from 30th November to 2nd December prior to departing for Macquarie Island. Dr J. Mainstone of the University of Queensland visited Toolangi in June to repair the magnetic tape pulsation recorder.

Messrs. H.A. Doyle and R. Underwood of the Australian National University, Dr. R. Green of the University of Tasmania, and Mr. G.A. Eiby of the New Zealand Department of Scientific and Industrial Research visited the office after the Hobart Symposium.