RESULTS

OF THE

MAGNETICAL AND METEOROLOGICAL OBSERVATIONS

MADE AT

THE ROYAL ALFRED OBSERVATORY, MAURITIUS

IN THE YEAR

1900

UNDER THE DIRECTION OF

T. F. CLAXTON, F.R.A.S.

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RESULTS OF MAGNETICAL AND METEOROLOGICAL OBSERVATIONS—*concluded.*

MAURITIUS MAGNETICAL AND METEOROLOGICAL OBSERVATIONS, 1900.

Introduction.

§ I.—*Position of the Observatory Buildings and Instruments.*

The Observatory, in Latitude 20° 5′ 39″ S. and Longitude 3^{h}. 50^{m}. 12^{s}·6. E., is situated on a plain about three miles from the West Coast and stands in eleven acres of Crown Land. The reference mark at the entrance of the Main Building is 178·1 feet above sea level.

From west-south-west through west to north there is an uninterrupted view of the sea, and from north through east to south-east the ground generally rises to Mount Piton, the summit of which bears about four miles east-south-east and is 917 feet above mean sea level. Between south-east and south-west there is a chain of mountains the highest peak of which, the Pieterboth, bears nearly six miles due south, and has an altitude of 2,874 feet. The nearest extremities of two spurs which run north and north-west from the Pieterboth are at distances of three to four miles, and have an elevation of about 560 feet.

The Island is of volcanic origin, and the rocks are more or less magnetic. Around the Observatory the soil has a depth of 3 to 14 feet, below which is solid basalt.

The Main Building, the foundation stone of which was laid on May 30th, 1870, by his Royal Highness the Duke of Edinburgh, was completed in the year 1875. It is a stone structure of rectangular base, 56 feet long by 38 feet wide, and faces north-by-west. It is sheltered on all sides by a verandah and balcony, added in the years 1878, 1881, and 1882. On the ground floor are three rooms, the Director's official room and the South-West Computing Room on the western side of the entrance hall, and on the eastern side the Principal Computing Room, in which are placed the Standard barometer, and self-registering maximum and minimum thermometers. A mean solar clock by Dent is fixed to the northern wall and there are two mean solar chronometers, Kullberg No. 3,400 and Webster No. 925, for magnetic and

actinometric observations and for use with the photoheliograph; and one sidereal chronometer, Muirhead No. 450, for use with the 12-inch theodolite.

At the south end of the entrance hall is the transit pillar, which rises to a height of 36 feet above the ground floor. On the first floor are four rooms, two on either side of the staircase, the east rooms serving as a library and the west as sleeping apartments. On the second floor is an attic, in which are three doors opening into domes and a staircase leading to the roof, upon which is mounted the Campbell-Stokes sunshine recorder. In the North-East Dome is a 6-inch equatorial by Cooke, and in the South Dome the old transit instrument by Troughton and Simms and a sidereal clock by Parkinson and Frodsham. The North-West Dome contains the registering parts of the Beckley Anemometer, the cups of which are 5 feet above the dome and 51 feet above the ground.

The Magnetic Observatory, which was completed in the year 1874, is situated 60 yards to the north of the main building. It consists of a rectangular stone chamber 40 feet long and 34 feet wide, with its floor 12 feet below the surface of the ground. The building is primarily divided into east and west rooms, the former being used for photographic operations. The West Room contains the magnetograph and barograph, and in its construction great care was taken to exclude iron and other magnetic substances; precautions are also taken to keep the daily range of temperature small. The walls are double, with an air space of 30 inches between them, and there is a wooden ceiling in addition to the exterior roof; the latter is thickly thatched with straw, and slopes from an altitude of 12 feet to the north and south walls, which rise to a height of 2 feet above the ground. At a distance of 35 yards to the east of the Magnetic Observatory is a stone-capped ventilator communicating with the Magnetograph Room by means of a 12-inch pipe, laid underground at a depth of 11 inches below the surface.

In the year 1875 a small wooden building for absolute magnetic observations was erected 80 yards to the north-west of the Main Building, and 60 yards to the west of the Magnetic Observatory. Similar precautions were observed respecting the introduction of iron as in the case of the Magnetic Observatory, the nails, locks, &c., being either of copper or brass. A verandah was added in the year 1880, and in November 1896 an opening was made in its south side to admit of observation of circumpolar stars, up to an altitude of 10°, for determining the azimuth of what is known as the Magnetic Mark. But as only a few stars could be conveniently observed through the original opening, in May 1900 it was extended, and the doorway heightened to admit of observations of stars up to an altitude of 25°. The pillars on which the instruments are placed are built of non-magnetic bricks and rise from

substantial foundations below the floor; they are at equal distances apart, and lie in a direction nearly at right angles to the Astronomical Meridian. The Unifilar instrument is placed on the central pillar, and the Dip Circle on the western; the eastern pillar is not at present in use.

In the year 1878 a stone building was erected 240 feet to the north-east of the main building for the reception of the photoheliograph and thermograph. The Photoheliograph Room is 16 feet in diameter, and is surmounted by a wooden dome running on iron wheels and rotated by means of three handwheels. Adjoining it on the southern side are two small rooms, one of which is used for photographic operations. The second, or east room, contains the registering parts of the Kew thermograph, and is known as the Thermograph Room. The stems of the photographic thermometers project outwards into the Thermograph Screen, and are held in position by a metal frame to which are also attached the standard dry bulb and wet bulb thermometers. The screen is 6 feet square by 6 to 7 feet high, the roof sloping towards the South away from the building; the sides are of double louvre boarding, and the planks of the floor are double, with an air space between each to ensure sufficient ventilation, and to afford protection against radiation from the ground. The bulbs of the thermometers are 2 feet above the floor and 6 feet above the ground.

About midway between the Photoheliograph Dome and the Magnetic Observatory is the Seismograph Room, a wooden building 12 feet square and 18 feet high, erected originally for the reception of an Electrometer in 1894. A circulation of air is maintained by three 9-inch ventilating tubes, so arranged that no direct rays of light can penetrate into the room; two project outwards through the north and west walls respectively, at a distance of 9 inches from the ground, and the third passes through the roof. The instrument was first mounted on a small brick pillar built up from the floor, which is of concrete; but it was found that a more substantial foundation was necessary, and in the month of November 1899 the floor was broken and a hole dug 6 feet deep by 4 feet square; this was filled up with 4 feet of concrete, and the instrument now rests on a tapering column rising from the concrete base to a height of 4 feet above the ground, without touching the earth on any side. In the month of March 1900 the room was completely enclosed by a straw thatching, allowing an air space of 3 feet on every side; by this means the daily range of temperature to which the instrument is subjected has been considerably reduced.

At a distance of 16 yards to the south of the Seismograph Room is a small wooden hut erected in the year 1885 for the Balfour Stewart Actinometer. The instrument is mounted on a stone pier of 18 inches diameter at base tapering to

12 inches at the top, and exposure to the sun's rays is effected by means of a divided roof, one half of which opens towards the north and the other towards the south.

About 40 yards to the east of the Main Building is a circular enclosure 11 yards in diameter. In it are placed (1) a Stevenson screen containing self-registering maximum and minimum thermometers; (2) a similar screen containing a Mason hygrometer; (3) a wooden stand 4 feet high, carrying two solar radiation thermometers; (4) a terrestrial radiation thermometer; (5) an evaporometer, consisting of a shallow cylindrical brass vessel 8 inches in diameter, surrounded by a wire cage; (6) a Symons earth thermometer for registering the temperature of the soil at a depth of 62 inches below the surface; (7) a similar thermometer for registering the temperature of the soil at a depth of 120 inches below the surface.

The Beckley self-registering raingauge is placed 10 yards to the south-south-west of the above enclosure, and the Glaisher raingauge 32 yards to the north of the north-west corner of the Main Building.

§ II.—*Routine Work of the Observatory and Staff.*

Continuous photographic records showing the variations of magnetic declination, horizontal force and vertical force, barometric pressure, temperature of the air, and of evaporation; also automatic records of the direction and velocity of the wind, and of the amount of rain, are obtained with instruments of the Kew pattern. The duration of bright sunshine is registered by a Campbell-Stokes universal instrument. Photographic records of earth movements are obtained with a Milne Seismograph.

Absolute values of magnetic declination and horizontal force are determined, as a rule, four times a month, and of dip, eight times a month. Eye observations of the principal meteorological elements are made daily at 6^h, 9^h, 13^h, and 15^h Mauritius Civil Time; the day commencing at midnight and counting from 0^h to 23^h. Daily readings are taken of solar and terrestrial radiation thermometers and of earth thermometers. Actinometric observations are taken on those days on which the sky in the neighbourhood of the sun is free from cloud at or near apparent noon.

The magnetical and meteorological records are measured at each hour of Mauritius Civil Time, and the records of the seismograph at each hour of Greenwich Civil Time.

Photographs of the sun are taken daily, weather permitting, and the negatives and one print of each forwarded to the Secretary of the Solar Physics Committee, London; one print is retained. Observations for Time are made daily with few exceptions. The Time-Ball on the Signal Mountain at Port Louis was dropped by hand three times a week until 1900 September 30, and subsequently on every week

APPENDIX.

RESULTS

OF

SEISMOLOGICAL OBSERVATIONS,

1900.

Continuous registration of unfelt earth movements has been obtained with a Milne seismograph of the pattern recommended by the Seismological Committee of the British Association for the Advancement of Science, and described in the Annual Report of the Committee for 1896.

Particulars of 82 earthquakes registered at Mauritius during the year 1900 are given in Table I.

In order to utilise the seismograms for measurement of gradual changes of level, on 1898, September 15th, a silk thread was stretched across the brass slit at $18^{div} \cdot 7$, in order to furnish a base line. It was found, however, that on account of the large diurnal movement of the boom the thread was frequently eclipsed and no base line obtained; on September 23rd, therefore, a second thread was inserted at $11^{div} \cdot 0$, so that one or other of the threads is always photographed, and a base line available for determining the position of the boom, the scale reading of which is measured at every hour of Greenwich Civil Time.

The factor for converting scale readings into seconds of arc is determined, usually once a week, by turning the arm of the level screw through a known arc and noting the displacement of the boom. In spite of the precautions taken to ensure accuracy in the scale value determinations, it was found that the separate observations of a series were very discordant, frequently varying 100 per cent. from the mean. Lost time in the thread of the level screw was suspected, and the following observations were made on 1900, December 1st, special care being taken to complete each series without changing the motion of the screw from direct to retrograde or *vice versâ*.

DETERMINATION OF SEISMOGRAPH SCALE VALUE, DECEMBER 1ST, 1900.

Reading of Level Arm.	Scale Reading of Boom.	Effect of 1 div. Change of Level.	Reading of Level Arm.	Scale Reading of Boom.	Effect of 1 div. Change of Level.	Reading of Level Arm.	Scale Reading of Boom.	Effect of 1 div. Change of Level.
Div.	mm	mm.	Div.	mm.	mm.	Div.	mm.	mm.
17·2	28·0		20·0	−1·0		14·0	63·2	
18·0	22·5	6·9	19·0	6·7	7·7	15·0	57·0	6·2
19·0	9·0	13·5	18·0	15·5	8·8	16·0	45·0	12·0
20·0	−1·0	10·0	17·0	25·6	10·1	17·0	31·5	13·5
			16·0	35·5	9·9	18·0	23·0	8·5
			15·0	49·3	13·8	19·0	10·0	13·0
			14·0	63·2	13·9	20·0	−0·5	10·5
						19·0	5·0	5·5

It will be seen that a relatively small effect is produced by the first deflection in each series, which points to the existence of lost time, the extent of which may be computed as follows:—

From the initial deflection in each series, the mean displacement of the boom produced by a movement of 1^{div} of the level arm is $6^{mm}\cdot6$, while from the remaining observations it is $11^{mm}\cdot5$, indicating lost time corresponding to a boom displacement of $4^{mm}\cdot9$, or ·00115 of a revolution of the screw.

Seeing, however, that the whole weight of the instrument is supported by the level screws, and that no looseness can be detected in the attachment of the arm to the finely threaded screw with which the observations are made, it is more probable that the defect is due to the method of mounting. In place of nuts embedded in the pillar the level screws work on brass runners, and this is certainly the cause of many observed irregularities too large to be attributable to errors in the screw.

The distance between each thread of the screw is $0^{mm}\cdot508$; a rotation of 1°, or $\frac{1}{360}$ of a revolution, therefore raises or lowers the corner of the bed plate $0^{mm}\cdot00141$, and this, in the example given, produces a displacement of the end of the boom varying from $5^{mm}\cdot5$ to $13^{mm}\cdot9$. The range is $8^{mm}\cdot4$, or 73 % of the mean value, indicating an irregularity in the screw to the extent of $0^{mm}\cdot00103$ between the readings 14° and 20° on the level arm.

value varies considerably from time to time, and it is imperative that frequent determinations should be made.

Daily values have been obtained by smoothing, and means formed for periods during which the scale value is sensibly constant, for converting the hourly measures into seconds of arc.

In forming the diurnal variation of level for each month, Table III., all available days have been used, and the non-periodic variations eliminated by the method described in the Introduction under the heading *Magnetic Reductions.*

The periodic variations, which are given in Table III. for every hour of Greenwich Civil Time, have been subjected to harmonic analysis, and the results given in Tables IV. and V. The constant angles have been referred to Mauritius apparent midnight by the application of the necessary corrections for Longitude and Equation of Time.

The progressive change of level given in Table II. is the excess of the ordinate at Mauritius mean midnight on a given day over the corresponding ordinate on the following day (+) indicating a tilt to westward and (−) a tilt to eastward. The wanderings of the boom are respresented graphically on Plate III.

In Table VI. are given particulars of the changes of level produced by heavy falls of rain during the year 1900.

The figures show what exceedingly small changes of level are recorded by this type of instrument, and suggest the desirability of a micrometer screw of exceptional quality and finish with which to accurately determine the scale value, or a suitable apparatus for observing the time of vibration of the boom; with the unaided eye this cannot be accurately observed when the arc of vibration is sufficiently small.

During the year fifty-two determinations of scale value were made, the results of which are given below:—

DETERMINATIONS of SEISMOGRAPH SCALE VALUES, 1900.

Day.	Value of 1mm on Seismogram.	Day.	Value of 1mm on Seismogram.	Day.	Value of 1mm on Seismogram.
	"		"		"
January 6	0·281	May 12	0·398	September 8	0·337
13	0·281	19	0·358	15	0·409
20	0·281	26	0·382	22	0·358
27	0·265	June 2	0·318	29	0·347
February 3	0·241	9	0·280	October 6	0·715
10	0·230	16	0·261	13	0·499
17	0·240	23	0·328	16	0·176
24	0·248	30	0·358	20	0·153
March 3	0·269	July 7	0·395	27	0·109
10	0·298	12	0·261	November 3	0·155
16	0·251	21	0·441	10	0·155
24	0·290	28	0·239	18	0·220
31	0·329	August 4	0·310	20	0·130
April 7	0·222	11	0·328	24	0·130
14	0·233	18	0·337	December 1	0·170
21	0·253	25	0·294	15	0·190
28	0·258	September 1	0·318	29	0·200
May 7	0·300				

The above values are derived from the second deflection of the level arm in a given direction. It will be seen that although lost time is thus eliminated the scale

TABLE I.—LIST of EARTHQUAKES recorded at the ROYAL ALFRED OBSERVATORY, MAURITIUS, during the YEAR 1900.

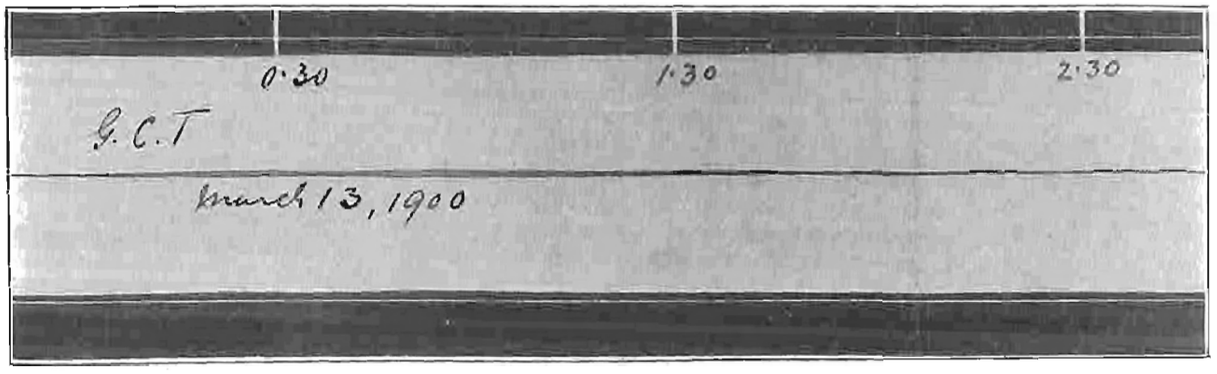
Shide Register Number.	Mauritius Register Number.	Date.	Commencement of Disturbance (G.C.T.).	Commencement of Large Waves (G.C.T.).	Time of Maximum (G.C.T.).	½ Amplitude.	End of Disturbance (G.C.T.).	Remarks.
		1900.	h m	h m	h m	″	h m	
376	*61	January 5	..	19.13·7	19.28·9	0·96	..	
377	*62	,, 11	9.20·5	9.32·6	10. 5·5	0·73	..	
378	63	,, 13	..	..	10.44·3	0·12	..	Several thickenings during the day.
379	*64	,, 15	20.23·0	..	..	..	20.41·0	
380	65	,, 17	.	..	6.48·0	..	..	
381	66	,, 20	6.57·7	S. 5·8	8.20·7 8.26·0	0·45 0·45	8.49·3	Small tremors for some hours afterwards.
382	67	,, 24	7.33·1	..	8. 8·6	0·13	9. 9·6	
	68	,, 30	22.47·6	..	22.53·7	0·11	23.32·1	
384	*69	,, 31	14.30 ±	..	..	..	16.11 ±	Several small tremors.
385	70	,, 31	19.40·0	..	..	..	20.30·0	Numerous slight thickenings.
	71	Feb. 3	4.26·9	4.34·1	4.37·3	0·42	4.44·5	Small tremors till 5h. 45m.
	72	,, 5	10.28·5	10.52·6	10.58·7	0·20	11.13·1	
	73	,, 7	22. 7·2	..	22. 8·6	0·06	22.10·4	Thickening of trace.
388	74	,, 13	6.56·0	..	..	..	7.34·0	Several thickenings.
	75	,, 20	21.44·4	21.47·3	21.49·0	0·40	22.27·3	
390	76	,, 22	12.46·0	..	..	..	12.52·0	Slight thickenings.
392	77	March 6	18.27·0	..	..	..	18.37·0	Several thickenings.
393	78	,, 7	7.30·0	..	..	..	8.30·0	Very slight thickenings.
394	79	,, 9	..	..	3.15·0	..	..	Numerous irregular movements from 1h.30m to 4h.30m. Boom touching eclipse hand of watch.
396	80	,, 9	13. 1·0	..	..	..	13.27·0	Several thickenings.
	81	,,12–13	23.58·2	..	0.56·1	0·24	2.48·9	A long series of regular oscillations. No shocks are shown. *See* Plate II.
	82	,, 17	21. 6·5	..	21.19·1	0·10	21.35·8	Similar to above, but not so marked.
	*83	,, 21	0.39·4	..	0.53·4 2.58·4	0·04 0·14	3. 9·6	
399	84	April 1	7.42·1	7.50·2	7.53·7	0·12	..	
	85	,, 13	6.42·2	..	6.49·9	..	6.54·0	
402	86	,, 17	..	..	1.13·0	..	..	Several thickenings about this time.
404	87	,, 24	23.24·9	23.33·5	23.34·0	0·40	24.30·0	
	88	,, 30	20. 3·6	..	20.25·0	0·11	20.35·2	
405	89	May 11	..	..	17.49·0	..	..	Thickening of trace.
407	90	,, 16	20.30·0	..	..	..	21. 0 ±	Several slight thickenings.
	91	,, 20	6.46·0	6.48·3	6.50·3	0·09	..	
	92	,, 21	14.31·9	..	14.36·0	1·71	..	
408	93	,, 26	16.22·8	..	16.34·1	0·14	17.39·1	
	94	,, 27	0. 5·3	..	0.36·1	0·06	1. 8·6	
410	95	June 2	13h	..	..	..	15h	Numerous irregular tremors.
411	96	,, 9	13. 1·7	..	13. 5·6	0·08	..	
412	97	,, 9	..	.	16. 0·6 16.25·2	.. ..	..	Isolated thickenings.
413	98	,, 10	11.10·8	..	11.36·1	0·06	11.53·6	
414	99	,, 12	21.11·6	..	21.35·3	0·10	21.45·3	
415	100	,, 16	..	..	16.22·5	..	.	Isolated thickening.
416	101	,, 19	23.52·0	..	..	..	24. 4·0	Several thickenings.
417	102	,, 21	21.10·6	22.12·1 22.47·9	22.15·0 22.50·0	0·91 0·76	..	

* The beginning and ending of these earthquakes were masked by air tremors.

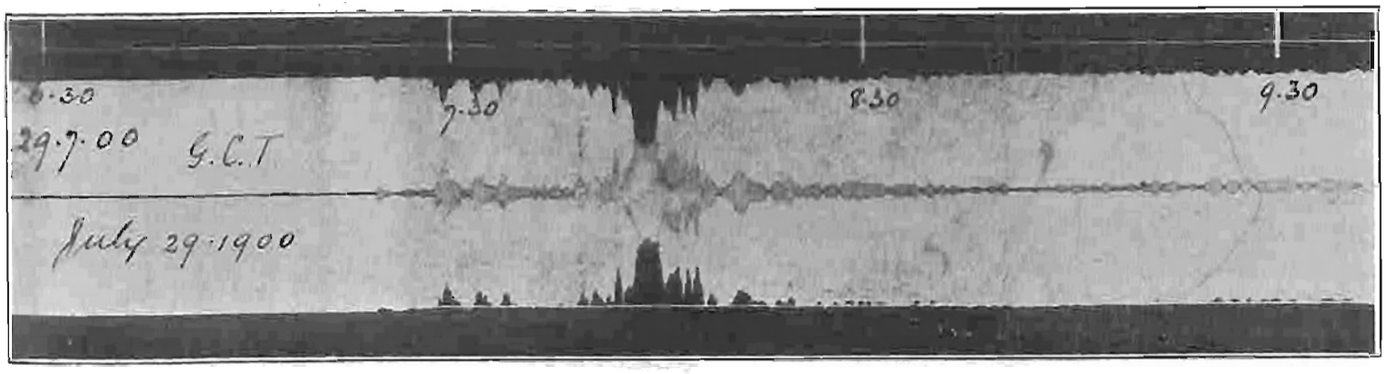
TABLE I.—LIST of EARTHQUAKES recorded at the ROYAL ALFRED OBSERVATORY, MAURITIUS, during the YEAR 1900—*continued.*

Shide Register Number.	Mauritius Register Number.	Date.	Commencement of Disturbance (G.C.T.).	Commencement of Large Waves (G.C.T.).	Time of Maximum (G.C.T.).	Amplitude.	End of Disturbance (G.C.T.).	Remarks.
		1900.	h m	h m	h m	"	h m	
419	103	June 28	..	..	..	..	..	
420	104	,, 28	..	..	..	..	..	Air tremors very active. Several movements are regular and look seismic.
	105	July 7	..	..	11.11·0	..	..	Very slight thickening of trace.
422	106	,, 15	20. 2·6	..	20. 9·7	..	20.16·7	Slight thickening.
	107	,, 21	7. 7·5	7.37·5	7.43·0	0·20	..	Occasional thickenings until 11h.
424	108	,, 29	7.15·2	7.27·8	7.58·4	2·86	10.45·2	*See* Plate II.
	109	Aug. 1	8.26·5	..	8.31·8	0·09	8.38·0	
	110	,, 1	8.48·0	9. 0·0	9. 3·7	0·13	9.28·5	
425	*111	,, 5	4.55·0	..	..	..	5.40·0	Several thickenings, apparently seismic.
427	112	,, 13	20.35·0	..	21. 0·5	..	21.39·0	Several thickenings.
428	113	,, 20	18.35·1	..	19.23·3	..	19.28·6	
	114	,, 23	3. 3·5	..	3. 5·5	..	3. 7·5	Slight thickening.
	115	,, 28	0.31·0	..	1. 1·3	..	1.29·1	
430	116	,, 28	10.10·0	..	..	..	12.10·0	Frequent tremors ; apparently seismic.
431	117	,, 29	2.55·9	..	3.27·9	..	4. 6·5	
432	118	Sept. 1	8.13·0	..	..	..	8.53·0	Frequent tremors throughout; also very slight tremors occasionally during the day.
	119	,, 4	9.37·1	..	9.39·5 9.49·2	..	9.53·2	Thickening of trace.
	120	,, 6	0.43·2	..	0.46·3	0·13	0.47·7	Frequent tremors during the night.
	121	,, 6	2.27·4	..	2.30·0	0·11	2.33·1	
433	122	,, 8	3.52·3	..	4. 1·8	..	4.20·0	Thickening of trace.
	123	,, 9	23. 4·5	..	23.10·4	0·13	23.43·0	
	124	,, 13–14	22.40·0	..	0.41·5	0·24	3.5 ·0	Frequent tremors, with occasional movements which appear to be seismic.
435	125	,, 17	22. 9·7	22.19·3	22.51·0 22.53·0	0·41	24.40±	Register faint. Time of Max. doubtful.
436	126	,, 19	10. 6·5	10.26·2	10.32·2	0·20	11.26±	Register at end very faint.
437	127	,, 20	..	..	9.19·7	..	..	Very slight thickening.
438	128	,, 20	19.20·7	..	19.52·2	..	20. 0·3	
	129	Oct. 19	0.48·7	..	0.51·5 0.55·7	0·05 0·05	1. 3·6	
	130	,, 20	18.48·1	19. 8·5	19.10·0	0·10	19.34·1	
	131	,, 26	..	8.10·3	8.12·7	0·28	..	A seismic movement among frequent tremors.
445	132	,, 29	9.33·8	10.12·6	10.21·2	2·40	14.44·0	*See* Plate II.
446	133	Nov. 5	8. 9·0	..	..	..	9. 3·0	Several very slight thickenings.
447	134	,, 9	16.47·3	17.43·2	17.48·4	0·15	19. 3·1	
	135	,, 12	..	1.31·0	2. 0·3	0·42	..	Preceded and followed by occasional tremors.
	136	,, 16	21.34±	..	21.43·2	0·10	22. 4±	
450	137	,, 24	..	8.52·7	8.57·4 9. 1·5	0·15 0·14	..	Tremors all day.
	138	,, 30	..	13.23·3	13.25·9	0·15	..	Tremors all day. Instrument very sensitive.
	139	Dec. 9	..	10.41·2	10.43·3	0·07	..	Ditto.
	140	,, 13	..	17.41·1	17.44·1	0·09	..	Ditto.
452	141	,, 18	22.41·5	22.59·4	23. 0·8	0·09	23.52·6	
454	142	,, 25	..	..	6. 6·7	0·33	7.16±	Sheet changed at 5h 40m. Tremors all day.

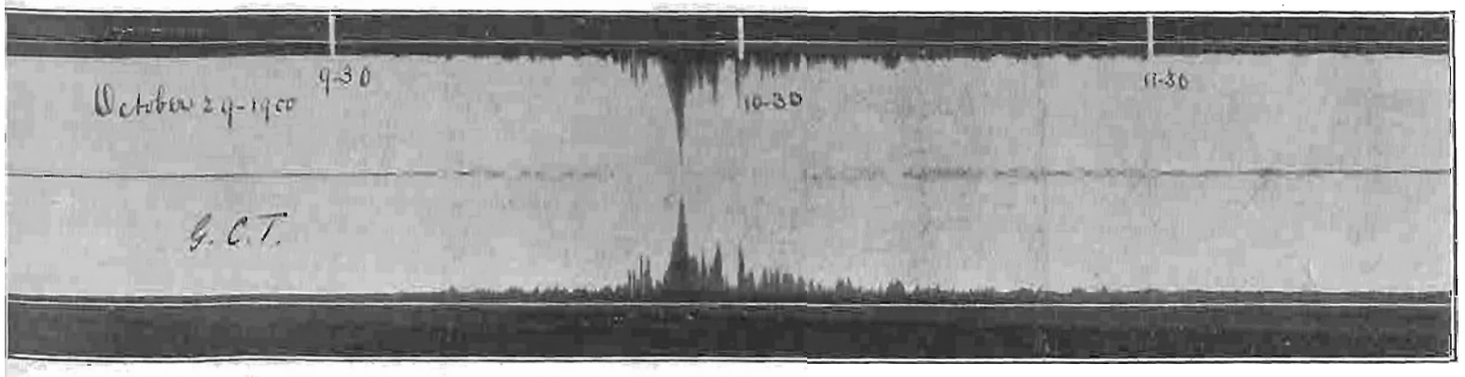
EARTHQUAKES RECORDED AT THE ROYAL ALFRED OBSERVATORY, MAURITIUS, DURING THE YEAR 1900.



1 millimetre of ordinate = 0·29″.



1 millimetre of ordinate = 0·26″.



1 millimetre of ordinate = 0·15″.

AN UPWARD MOVEMENT INDICATES A TILT TO EASTWARD.

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T. F. CLAXTON, F.R.A.S.

LONDON:
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1904

RESULTS OF MAGNETICAL AND METEOROLOGICAL OBSERVATIONS—*concluded.*

APPENDIX.

RESULTS

OF

SEISMOLOGICAL OBSERVATIONS,

1901.

Continuous registration of unfelt earth movements has been obtained with a Milne seismograph of the pattern recommended by the Seismological Committee of the British Association for the Advancement of Science, and described in the Annual Report of the Committee for 1896. Details of installation are given in the Introduction.

Particulars of 108 earthquakes registered at Mauritius during the year 1901 are given in Table I., the principal of which are reproduced in Plate II.

In order to utilise the seismograms for measurement of gradual changes of level, on 1898, September 15th, a silk thread was stretched across the brass slit at $48^{div}\cdot7$, in order to furnish a base line. It was found, however, that on account of the large diurnal movement of the boom the thread was frequently eclipsed and no base line obtained; on September 23rd, therefore, a second thread was inserted at $11^{div}\cdot0$, which cannot be eclipsed simultaneously with the thread at $48^{div}\cdot7$.

The factor for converting scale readings into angular measure is determined from time to time by noting the displacement of the boom produced by turning the arm of the level screw through a known arc. The boom is first brought to a convenient position near one end of the scale; the level screw arm is then moved in steps, usually of 3°, and the scale reading of the boom noted at each successive step, care being taken to avoid any retrograde motion of the screw during a series of observations in one direction. When the separate observations are unusually discordant the operation is repeated. The first observation of a series is rejected in order to eliminate lost time.

During the year 1901 twenty-seven determinations of scale value were made, the results of which are as follows :—

Day, 1901.	Value of $1^{m.m.}$ on Seismogram.	No. of Observations.	Day, 1901.	Value of $1^{m.m.}$ on Seismogram.	No. of Observations.
	"			"	
January 8 -	0·203 ± ·022	5	June 22 - -	0·192 ± ·027	4
15 -	0·052 ± ·033	3	July 13 - -	0·147 ± ·036	5
18 -	0·080 ± ·017	4	August 13 -	0·168 ± ·011	2
19 -	0·239 ± .015	6	17 -	0·588 ± ·036	4
25 -	0·242 ± ·003	2	30 -	0·578 ± ·021	5
28 -	1·182 ± ·026	4	September 19 -	0·531 ± ·017	5
30 -	0·273 ± ·002	4	28 -	0·543 ± ·027	5
February 11 -	0·304 ± ·021	5	October 15 -	0·520 ± ·026	5
26 -	0·298 ± ·017	5	November 5 -	0·517 ± ·019	4
March 30 -	0·289 ± ·017	5	26 -	0·485 ± ·029	3
April 23 - -	0·311 ± ·004	4	December 4 -	0·302 ± ·018	6
May 16 - -	0·324 ± ·032	5	11 -	1·155 ± ·017	4
June 2 - -	0·379 ± ·007	2	16 -	0·403 ± ·008	4
14 - -	0·111 ± ·014	4			

During the cyclone of January 9–12 the sensibility increased considerably, indicating a tilt of the boom pillar towards the south. The instrument was adjusted to a normal sensibility on January 19, and upon the development of a second cyclone, on January 25, the sensibility was further decreased in order to prevent the boom

from wandering off the sheet, as usually happens during a cyclone, with normal sensibility. Similar precautions were taken on December 11.

The seismogram ordinates are measured at every hour of the day (commencing at Greenwich mean midnight as the time-breaks are made at every hour of Greenwich Civil Time) with a millimetre scale on which are etched also horizontal lines corresponding to the base-lines previously mentioned. Scale values for each day are obtained by smoothing the separate determinations made during periods for which no adjustment has been necessary.

The daily range of level given in Table II. refers to the civil day, and the progressive change of level is the excess of the ordinate at 0^h over the ordinate at 24^h on each day, the sign (+) indicating a tilt to westward, and (−) a tilt to eastward. The wanderings of the boom are represented graphically on Plate III., together with the daily level readings of the Transit Instrument.

In forming the mean diurnal inequality of level for each month all available days have been used, and the non-periodic inequality eliminated by the method described in the introduction under the heading "Magnetic Reductions." For converting the hourly ordinates into angular measure a mean scale value is used for periods during which it is sensibly constant. The use of a mean scale value for each month would shorten the computations, but would, in some months, introduce considerable error.

The true solar diurnal inequality of level for each month, and for the year, given in Table III. has been subjected to harmonic analysis and the results given in Tables IV. and V. The constant angles contained in Table V. have been referred to Mauritius apparent midnight by the application of the necessary corrections for Longitude and Equation of time.

In each month the first term c_1, of the Fourier series is by far the most important, and it is doubtful whether the third and fourth terms have any real significance. Their relatively large value in certain months is probably due to petty irregularities in the curves not eliminated in the monthly mean.

The ratios c_2/c_1, c_3/c_1, and c_4/c_1 are given in Table VI.

In Table VII. are given particulars of the changes of level produced by heavy rain during the year 1901. The movements of the boom during the passage of a cyclone to the West of Mauritius from January 9–16th are shown graphically in Plate II. on which the register of the Pluviograph from January $11^d\ 19^h$ to $12^d\ 16^h$ is also reproduced.

TABLE I.—LIST of EARTHQUAKES recorded at the ROYAL ALFRED OBSERVATORY, MAURITIUS, during the YEAR 1901.

Shide Register Number.	Mauritius Register Number.	Date.	Commencement of Disturbance (G.C.T.).	Commencement of Large Waves (G.C.T.).	Time of Maximum (G.C.T.).	½ Amplitude.	End of Disturbance (G.C.T.).	Remarks.
			h m	h m	h m	″	h m	
455	143	January 7	0.52·2	1.40·0	1.46·6	1·28	3.18·8	
	144	„ 8	0.32·9	..	1.35·4 2.10·5	..	2.43·0	A long series of sensibly regular oscillations. No shocks are shown.
456	145	„ 8	20. 1·9	..	20. 7·9	0·07	20.18·4	
	146	„ 18	15.53·8	15.59·6	16. 0·5	0·02	16. 6·5	
	147	„ 20	0.13·1	..	0.39·9	0·10	0.43·3	
	148	„ 21	7.13·4	7.15·9	7.18·5	0·07	7.23·1	
	149	„ 31	12.26·1	..	12.27·7	..	12.31·1	Slight tremors occasionally throughout the day
	150	Feb. 2	17.45·9	..	17.49·7	..	17.58·3	Thickening of trace.
	151	„ 3	22.29·2	..	..	..	22.32·0	Dislocation.
	152	„ 9	13.30·4	..	13.34·1	0·07	13.37·6	
	153	„ 11	21.19·6	..	..	..	21.28·3	Two slight thickenings of the trace.
	154	„ 14	5.24·9	5.28·2	5.32·5	0·15	?	Sheet changed at $5^h.50^m$.
468	155	„ 15	8.31·1	..	8.35·2	0·07	8.38·1	
	156	„ 16	2. 9·2	..	2.12·9	..	2.19·2	Thickening of trace.
	157	„ 16	6.58·9	7. 2·5	7. 4·8	0·09	7. 8·6	
	158	„ 20	10. 4·1	10.29·9	10.33·4 10.37·1	0·27 0·18	10.52·4	Tremors for several hours afterwards.
	159	„ 20	11.36·1 11.58·5	..	11.37·0	..	11.41·7 12. 8·7	Isolated thickenings of the trace.
469	160	„ 27	0.57·4	..	1. 0·4	..	1. 5·5	
	161	March 3	15.40·0	..	..	..	16.18·8	Air tremors active all night. Several movements appear to be seismic.
471	162	„ 4	16.40·2	16.45·3	16.49·2	0·18	17.15·0	
472	163	„ 5	11. 5·4	12.37·9	12.47·1	0·21	13.30·8	
474	164	„ 16	12. 0·1	12. 3·6	12. 8·8	2·75	14. 5·5	Interval of preliminary tremors unusually short.
	165	„ 18	8	..	..	..	12	Frequent tremors, with occasional movements which appear to be seismic.
	166	„ 18	17.18·9	..	..	..	17.43·9	Several slight thickenings of the trace.
475	167	„ 19	0.10·2	..	0.20·6	..	1. 8·5	Thickening of the trace.
	168	„ 19	20.59·7	..	..	..	21.21·1	Several slight thickenings of the trace.
	169	„ 19	23.46·2	..	23.47·5	..	23.54·6	Slight thickening.
	170	„ 20	3.12·2	..	..	..	3.17·3	A few small, irregular movements.
	171	April 1	12.32·3	..	12.32·8	..	12.37·0	Slight movement, probably insect effect.
	172	„ 3	12.24·9 12.37·1	..	12.26·1 12.37·5	..	12.28·2 12.40·2	Very slight thickenings of the trace.
481	173	„ 3	16.11·6	..	16.14·7	..	16.22·2	Thickening of the trace.
483	174	„ 5	22.14·0	22.28·6	22.31·8	0·26	22.51·2	
485	175	„ 6	.. 13.12·7	..	12.44·1 13.15·7	..	.. 13.19·6	Isolated small thickenings of the trace.
486	176	„ 6	21.19·0	21.53·4	22.57·9	0·38	23.35·1	
	177	„ 6	23.28·3	..	..	..	..	
		„ 7	..	0.26·2	0.33·2	3·10	3.23·0	*See* Plate II.

TABLE I.—LIST of EARTHQUAKES recorded at the ROYAL ALFRED OBSERVATORY, MAURITIUS, during the YEAR 1901—*continued.*

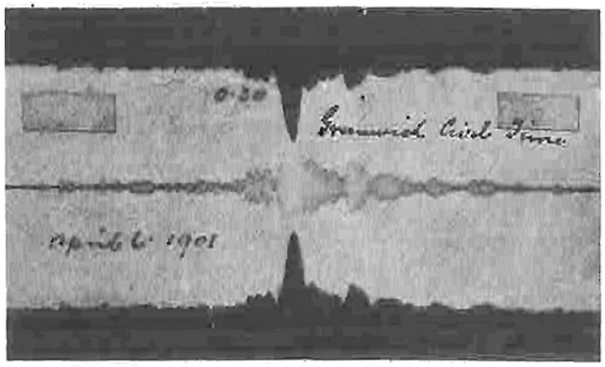
Shide Register Number.	Mauritius Register Number.	Date.	Commencement of Disturbance (G.C.T.).	Commencement of Large Waves (G.C.T.).	Time of Maximum (G.C.T.).	½ Amplitude.	End of Disturbance (G.C.T.).	Remarks.
		d	h m	h m	h m	″	h m	
	178	April 8	..	..	13.29·6	..	..	Slight thickening of the trace.
489	179	„ 9	22.24·0	..	22.26·9	..	22.31·9	„ „ „
	180	„ 12	12.49·2	..	12.51·0	..	12.54·3	„ „ „
	181	„ 14	..	..	11.12·8	..	..	„ „ „
	182	„ 18	3.13·7	3.33·1	3.35·2	..	3.51·5	„ „ „
	183	„ 23	19.59·6	..	..	..	20. 1·4	Probably insect effect.
	184	„ 27	4.21·6	4.27·4	4.28·3	..	4.45·1	
	185	„ 27	..	..	9.28.4	..	..	Probably insect effect.
	186	May 7	10.18·0 10.21·2 ..	..	..	..	10.18·9	Isolated thickening of the trace. Slight tremors lasted till $10^h.59·3^m$.
				..	10.22·9	..	10.40·1	
				..	10.23·5	..	..	
	187	„ 12	8.15·6	..	8.19·7	..	8.21·8	Slight thickening of the trace.
493	188	„ 14	7.15·6	7.49·2	7.52·4	..	9.17·8	
	189	„ 18	14. 5±	..	14. 7·3	..	14.13±	
	190	„ 19	15.40·0	..	15.43·1	..	15.50±	
	191	„ 21	1.38·0	..	1.43·1	0·17	1.50·3	
	192	June 2	1.26·7	1.39·0	1.42·0 1.45·4	..	1.49·2	Tremors continued for several hours afterwards.
	193	„ 9	19.54·1	..	..	..	20.12·5	Several vibrations.
502	194	„ 13	4.17·2	..	4.25·0	..	4.39·1	Thickening of the trace.
	195	„ 14	23.34·0	23.40·1	23.43·1	..	23.45·2	„ „
	196	„ 16	20. 8·1	..	20. 8·8	..	20. 9·6	„ „
	197	„ 19	9.48·2	..	..	..	9.50·3	„ „
	198	„ 23	21.20·8	..	21.28·5	0·09	21.30·2	Slight tremors until $21^h.35·1^m$.
505	199	„ 24	7.27·4	..	7.48·8	..	..	Preceded and followed by tremors.
	200	July 29	4.54·3	..	4.57·3	..	4.58·4	Tremors from $4\frac{1}{2}^h$ to $5\frac{1}{2}^h$.
513	201	Aug. 6	18.17·7	19. 4·5	19. 6·1	0·10	19.40±	
514	202	„ 9	9½	..	..	..	11¾	Maximum phase doubtful; instrument disturbed by insects.
515	203	„ 9	13.16·8	13.29·0	14. 1·6	1·48	..	*See* Plate II.
516	204	„ 9	19.±	19.26·4	19.30·5	0·86	..	
	205	„ 15	10	..	10.46·2 10.52·6 11. 3·1	..	12	Several thickenings of the trace.
	206	„ 16	9½	..	10. 8·9 10.10·9	..	10½	„ „ „
521	207	„ 18	20	..	20.34·0	..	21	„ „ „
523	208	„ 21	10.23·7	..	10.25·0 10.31·8 10.36·9	..	10.47·1	„ „ „
	209	„ 29	3.53·7	4. 0·2	4. 1·8	0·35	..	Tremors for several hours afterwards.
					4. 3·1	0·26	..	
	210	„ 30	22. 8·6	22.26·8	22.34·0	0·26	22.53·3	
	211	Sept. 1	13. 1·5	..	..	..	13.11·7	Slight thickening of the trace.
	212	„ 3	..	..	4.12·0	..	..	Possibly due to air tremors.
	213	„ 7	1.26·7	..	..	..	1·33·0	Slight thickening of the trace.

TABLE I.—LIST of EARTHQUAKES recorded at the ROYAL ALFRED OBSERVATORY, MAURITIUS, during the Year 1901—*concluded.*

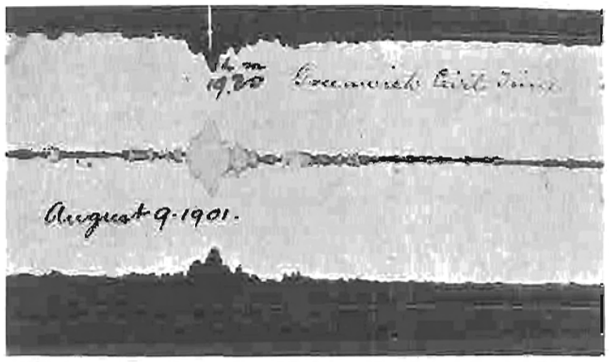
Shide Register Number.	Mauritius Register Number.	Date.	Commencement of Disturbance (G.C.T.).	Commencement of Large Waves (G.C.T.).	Time of Maximum (G.C.T.).	½ Amplitude.	End of Disturbance (G.C.T.)	Remarks.
		d	h m	h m	h m	″	h m	
529	214	Sept. 7	22½	..	..	..	..	Active tremors; several movements between 7h. 23m. and 7h. 23½m. look seismic.
		,, 8	..	..	..	..	3½	
530	215	,, 8	18. 0·4	18.39·5	18.45·4	1·12	..	Tremors for several hours afterwards.
	216	,, 10	4.42·0	..	..	..	5½±	Sheet changed at 5h. 40m.
	217	,, 10	6.56·0	..	..	..	7.15·3	Several thickenings of the trace.
	218	,, 15	21.17·0	..	21.21·6	0·19	21.39·5	
	219	,, 16	15.15·2	..	..	..	15.42·0	Several thickenings of the trace.
	220	,, 22	21.36·1	..	..	..	21.41·0	Thickening of the trace.
	221	,, 24	8.12·6	..	8.24·7	0·30	..	
	222	,, 28	16. 5·7	..	16. 8·0	0·27	16.12·8	Several isolated thickenings occurred between 16h. 5·7m. and 17h. 0·5m. Largest only are given.
					16. 9·0	0·27	..	
			16.36·1	..	16.39·0	..	16.40·8	
			16·40·8	..	16.41·9	..	16.45·2	
534	223	,, 30	10·44·4	11.23·9	11.27·0	..	12.50·2	
	224	Oct. 3	..	..	4.55·2	..	..	Slight thickening of the trace.
					4.55·8	..	..	
536	225	,, 8	3.34·0	..	3.59·6	0·33	5. 7·6	Seismic movements among frequent air tremors.
	226	,, 8	23.51·3	..	23.55·7	0·33	23.59·4	
537	227	,, 11	4.25·6	..	4.33·9	..	4.46·2	Several thickenings of the trace.
	228	,, 17	0.25·8	..	0.30·8	..	0.36·7	Thickening of the trace.
541	229	,, 17	1.44·1	..	2.14·0	..	2.25·8	
542	230	,, 17	..	6.20·8	6.24·1	0·33	6.48·3	
543	231	,, 19	9.14·7	10.48·2	10.49·8	0·36	12.22·9	
	232	,, 20	3.17·8	..	3.18·9	..	3.24·0	Thickening of the trace.
548	233	,, 29	7.52±	8.31·5	8.39·1	0·26	8.41·1	Tremors for several hours afterwards.
	234	,, 31	6. 9.6	6.39·2	6.46·3	..	7. 5·6	,, ,, ,, ,,
	235	,, 31	9¼	..	9.27·2	..	9¾	Several tremors.
	236	Nov. 3	12.50·4	..	12.51·9	..	12.57·5	Thickening of the trace.
552	237	,, 8	11. 7·9	..	11.21·6	..	11.31·0	,, ,,
	238	,, 9	9.23·9	..	9.29·0	..	9.33·1	,, ,,
	239	Dec. 2	14.48·8	..	14.51·4	..	14.53·4	,, ,,
	240	,, 5	17.43·3	18.10·1	18.14·2	0·15	18.30·0	
563	241	,, 6	14. 8·6	14.27·9	14.44·5	0·55	15.57·4	
564	242	,, 9	2.54·6	..	2.58·4	..	3.26·9	Thickening of the trace.
	243	,, 13	22.23·5	..	22.27.7	..	22.29·6	,, ,,
565	244	,, 14–15	23. 9·2	23.18·4	23.40·9	0·44	1.57·0	
	245	,, 16	16.51·6	..	16.55·2	..	17. 0·2	Thickening of the trace.
566	246	,, 18	0·52·0	..	1. 1·7	..	1. 8·8	,, ,,
568	247	,, 24	..	..	21. 2·5	..	..	,, ,,
	248	,, 26	10.22·0	10.35·1	10.41·6	0·39	11.53·5	
570	249	,, 31	6½±	..	..	..	8½±	Several thickenings; possibly air tremors.
571	250	,, 31	9.21·0	9.32·0	10.44·3	..	12.21·9	

PLATE II.

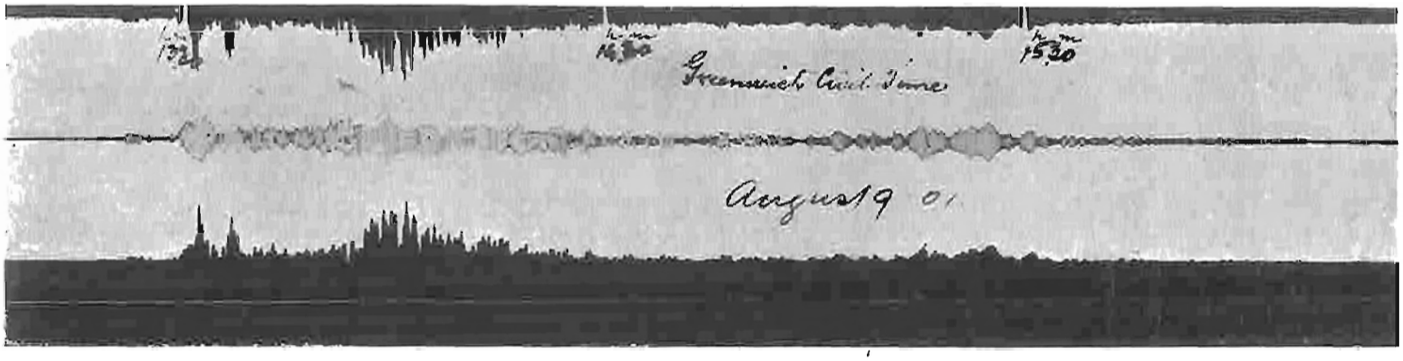
REGISTERS OF EARTHQUAKES, AND OF EARTH TILTS DURING HEAVY RAIN IN THE YEAR 1901, AT THE ROYAL ALFRED OBSERVATORY, MAURITIUS.



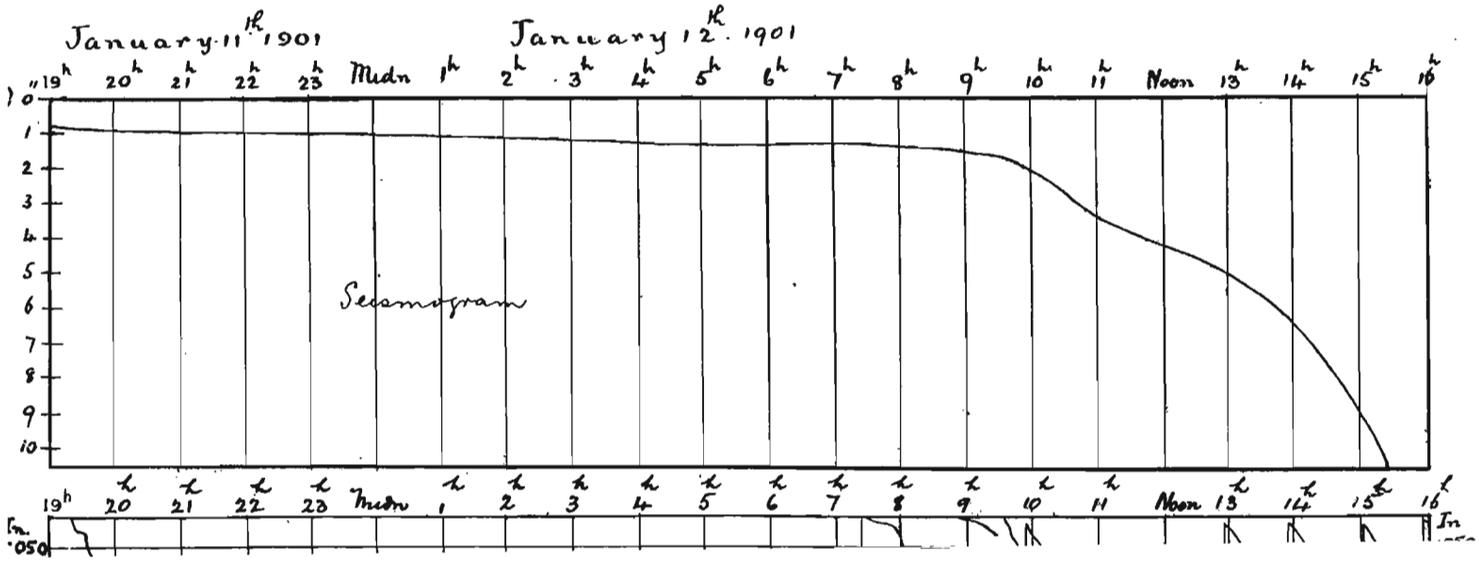
1 millimetre of ordinate = 0″·29.



1 millimetre of ordinate = 0″·14.



1 millimetre of ordinate = 0″·14.



RESULTS

OF THE

MAGNETICAL AND METEOROLOGICAL OBSERVATIONS

MADE AT

THE ROYAL ALFRED OBSERVATORY, MAURITIUS,

IN THE YEAR

1902.

UNDER THE DIRECTION OF

T. F. CLAXTON, F.R.A.S.

MAURITIUS :

PRINTED BY THE GOVERNMENT PRINTING ESTABLISHMENT.

1911.

PAGE.

RESULTS OF MAGNETICAL AND METEOROLOGICAL OBSERVATIONS.—*continued.*

APPENDIX.

RESULTS

OF

SEISMOLOGICAL OBSERVATIONS,

1902.

The instrument used for the registration of unfelt earth movements is of the Milne pattern recommended by the Seismological Committee of the British Association for the Advancement of Science, and described in the Annual Report of the Committee for the year 1896. Details of installation are given in the Introduction (page *v*).

Particulars of 98 Earthquakes recorded in the year 1902 are given in Table I, and the principal registers reproduced in Plate II.

On 1902 February 7 a second pendulum was added to the pillar, for the registration of earth movements in a North-South direction, and arranged to record on the same strip of paper as the original pendulum which registers the East-West component. The new pendulum is mounted on the eastern side of the pillar ; it is 125 m.m. long and at its outer end carries a solid cylinder of brass weighing about 5 ozs. The other end is fitted with an agate cup which pivots upon a steel point, projecting nearly horizontally from an iron block clamped to the base of the pillar. The pendulum is supported by a thin silver wire terminating in a silk thread which passes over an endless screw to a small windlass, both attached to the head of the pillar ; the former serves for adjustment in azimuth and the latter for adjustment in altitude.

With only one pendulum, adjustment in azimuth is readily made by the finely threaded foot screw ; but with two pendulums the adjustment should be made without altering the level of the bed plate. In the second (North-South) pendulum the maker made provision for this by leading the suspension thread over a grooved bar movable laterally by pulling screws ;

but as this method was not sufficiently delicate an endless screw was substituted for the bar and pulling screws. (On 1902 February 22 a similar device was fitted for the East-West pendulum).

The recording index is a tapering aluminium boom, 1·068 m. long, securely fixed at right angles to the pendulum proper at a point 20 m.m. from the pivot end of the latter, and 115 m.m. from the south end of the former ; it thus lies parallel with the East-West boom. At its northern end it carries a black horizontal disc of aluminium, 20 m.m. long and 15 m.m. wide*, pierced with a fine slit in a North-South direction. The boom is counterpoised by a small weight at its southern extremity and stayed by a silk thread running North and South from a slender mast fixed to the cross joint. This mast, which can be clamped at any azimuth, furnishes an additional adjustment in altitude ; the end of the boom rising or falling as the silk is twisted or untwisted round the mast.

The centre of gravity is 80 m.m., the centre of the brass weight 107 m.m., the point of suspension 74 m.m., and the point of registration 953 m.m. from the agate cup. (The corresponding distances in the East-West pendulum are 110, 100, 127 and 957 m.m., respectively).

In addition to earthquake movements the instrument records gradual changes of level, for the study of which the seismogram ordinates are measured at every hour of the day (commencing with Greenwich mean midnight as the time-breaks show Greenwich time, for convenience in the earthquake measures). Until 1902 February 20 the ordinates were measured from one or other of two base-lines produced by the shadow of threads stretched across the registering slit at $11{\cdot}0^{\text{div.}}$ and $48{\cdot}7^{\text{div.}}$. On that date the threads were removed and others inserted at every second millimetre, those at 10, 30 and 50 millimetres being duplicated, and at 0, 20, 40 and 60 millimetres, triplicated. With the scale thus photographed the seismograms are more readily and accurately measured.

For converting the scale readings into angular measure it was formerly the practice to tilt the bed plate through a small angle, by means of the finely threaded foot screw, and note the corresponding displacement on the photograph ; but with two booms this method is objectionable for various reasons. Even with one boom it was not altogether satisfactory ; in spite of the precautions taken to ensure accuracy the probable error of observation was frequently 10 % of the observed quantity, and occasionally much greater than this. Moreover, on account of the spontaneous variations in the sensibility which occur from time to time, it is necessary to determine the scale value at short intervals, thus causing frequent dislocations which tend to vitiate the registers. Throughout the year 1902, therefore, the scale value has been determined by noting the time of vibration of the boom, either from direct observation or by measuring on the seismograms the time interval between a given number of vibrations, as the boom comes to rest after disturbance produced by the daily trimming of the lamp &c.

On 1902 May 20 the following observations were made to establish the relation between the scale value and time of vibration of the North-South boom, under actual working conditions. The amount of tilt was determined from readings of an astronomical level fixed in a North-South direction on the bed plate (1 div. of level = 1″·42).

* The disc of the East-West boom has been reduced to nearly the same size

Time of Vibration (τ).
m.
0·198
0·192
...
0·268
0·250
0·663
0·492
0·368
0·467
0·379
0·383
0·337
...
0·320
0·416
0·383
0·383
0·295
0·288

Similar
meter foot sc

Time of Vibration (τ).
m.
0·227
0·237
...
0·240
0·300
0·295
0·292
0·340
0·367
0·308
0·375
0·312
0·427
...
0·417
...

Though the position of the pivot remained unaltered during each set of experiments the individual determinations of scale value and time of vibration are discordant. In the North-South boom the latter appears to increase with increasing scale readings, while in the East-West boom it increases with decreasing scale readings, indicating that direct motion of the northern foot screw tilts the pillar not only to South but slightly to East also; similarly direct motion of the western (micrometer) foot screw tilts the pillar not only to East but slightly to South also. But this effect must be due to irregularities in the form of the agate cups and of the pivots on which they rest, as, from the relative positions of the three foot screws and the pillar, direct motion of the northern and western screws should give small westerly and northerly components of tilt, respectively; hence in determining the scale value by the method of tilting the sensibility is altered during the operation, and the result applies only to the mean position of the pillar before and after tilting.

The results in the above Tables show that, within the limits of the probable error of observation, the scale value varies inversely with the square of the time of vibration of the boom, and may be written

$$\delta = x + y/\tau^2$$

where δ is the angular value of 1 division of the scale, τ the time of vibration of the boom, and x, y, constants.

Grouping the observations containing greatest, mean, and least values of δ we have the following equations

North–South Boom	East–West Boom
$1{\cdot}406 = x + 35{\cdot}08\,y$	$1{\cdot}620 = x + 46{\cdot}91\,y$
$0{\cdot}608 = x + 15{\cdot}35\,y$	$0{\cdot}749 = x + 22{\cdot}44\,y$
$0{\cdot}178 = x + 5{\cdot}05\,y$	$0{\cdot}182 = x + 8{\cdot}25\,y$

from which are obtained the following values of x and y.

From Equation	North–South Boom		East–West Boom	
	x	y	x	y
I and II	−·013	+·0405	−·051	+·0356
II and III	−·033	+·0417	−·147	+·0399
I and III	−·028	+·0407	−·125	+·0372

The most probable values of x and y are those derived from I and III, which have accordingly been adopted, and the formula for deriving the angular value (in seconds of arc) of 1 division of the scale from the time vibration of the boom is

for the North–South boom $\delta = {\cdot}0407/\tau^2 - {\cdot}028$
and for the East–West boom $\delta = {\cdot}0372/\tau^2 - {\cdot}125$.

In both pendulums the values of x and y derived from Equations I and II are less than those derived from II and III; but in view of the large probable error of observation it is doubtful whether this has any real significance. It is, however, a coincidence which calls for remark.

In the North-South boom, at normal sensibility (1 m.m. = about 0″·4) an error of 0·01 m. in the observed time of vibration produces an error of 0″·026 in the scale value, and in the East-West boom an error of 0″·037. From the above observations, however, it appears that the natural period of the booms cannot be determined with certainty to within about 0·02 m., owing probably to imperfect pivoting and the consequent irregularity of movement when the arc of vibration is sufficiently large for observation with the unaided eye. To correctly interpret the records of this instrument, therefore, a telescope is necessary for determining the natural period of the booms when the arc of vibration is exceedingly small.

The results of the determinations of scale value, from the time of vibration of the boom, in the year 1902, are given below. The letters M. and E. indicate measures of the photographs, and eye observations, respectively

Month and Day, 1902.	Value of 1 m.m. of ordinate. N.-S. Boom.	Value of 1 m.m. of ordinate. E.-W. Boom.	M. or E.	Month and Day, 1902.	Value of 1 m.m. of ordinate. N.-S. Boom.	Value of 1 m.m. of ordinate. E.-W. Boom.	M. or E.
January 7	...	0″·22	M.	October 18	0″·43	0″·23	E.
9	...	0·32	M.	18	0·28	0·21	E.
21	..	0·32	M.	20	0·52	0·22	M.
February 11	0·50	0·31	M.	21	0·52	0·34	M.
23	...	0·27	M.	22	0·57	0·22	M.
25	0·29	0·30	M.	23	0·64	0·23	M.
28	..	0·33	M.	24	0·64	0·28	M.
March 13	0·28	0·76	M.	25	0·64	0·22	M.
17	0·32	....	M.	27	0·45	0·31	M.
23	0·22	...	M.	28	0·43	0·27	M.
25	0·28	...	M.	30	...	0·28	M.
26	...	0·26	M.	November 1	...	0·24	M.
27	0·42	0·23	M.	2	0·64	0·23	M.
April 3	0·42	...	M.	5	0·64	0·24	M.
5	0·27	0·38	E.	13	...	0·24	M.
16	...	0·37	M.	16	...	0·24	M.
17	0·27	...	M.	18	...	0·22	M.
May 3	0·26	...	M.	20	...	0·24	M.
9	0·35	...	M.	21	0·64	0·23	M.
15	0·30	...	M.	23	0·42	0·21	M.
26	0·41	...	M.	24	...	0·24	M.
June 14	0·82	0·33	E.	29	0·35	0·21	M.
26	...	0·26	M.	December 1	0·22	0·46	M.
July 14	0·88	0·35	E.	2	0·24	0·46	M.
30	1·20	0·28	E.	5	0·31	0·46	M.
August 7	0·38	0·21	E.	13	0·25	...	M.
September 12	0·57	0·26	E.	16	0·27	...	M.
				18	0·24	0·46	M.
				22	0·27	...	M.
				23	...	0·62	M.
				26	0·27	...	M.
				27	0·27	0·42	M.

A bar indicates that adjustments have been made before the next determination of scale value.

The scale values used for converting the diurnal range and progressive change of ordinate into angular measure are obtained by smoothing the separate determinations for periods in which no adjustments have been necessary. The diurnal range of level given in Table II refers to the Mauritius Civil Day, and the progressive change of level (Table III), is the excess of the ordinate at 0^h over the ordinate at 24^h on each day, the sign (+) indicating a tilt to Eastward and Northward, and the sign (−) a tilt to Westward and Southward.

In forming the mean diurnal inequality of level for each month, only those days have been included for which complete and undisturbed registers of both North-South and East-West movements are available. For converting the hourly ordinates into angular measure a mean scale value is used for periods during which it is sensibly constant.

The non-periodic variations are eliminated by applying to each mean hourly value the correction

$$(x - 12)\ \frac{h_0 - h_{24}}{24}$$

where x is the hour, counted from midnight, and h_0, h_{24}, the mean monthly value of the converted ordinate at 0^h, and 24^h, respectively.

In order to refer the Diurnal Inequality of Level to Mauritius Time the mean monthly ordinates at every hour of Greenwich civil time were plotted on a curve and fresh ordinates measured at every hour of Mauritius Civil Time (Table IV).

The curves of North-South movement (Plate III) show a double oscillation; the normal northerly tilting which sets in at about 15^h is checked at about $17\frac{1}{2}^h$ and reversed at about 18^h, for a period varying from 1 to 2 hours in different months. This effect is probably due to the lamp used to prevent tremors during the night. The lamp is lighted between 17^h and 18^h, and is placed on the floor about 4 feet to the North-East of the pillar, its position varying slightly from day to day. In the curves of East-West movement (Plate IV) the effect of the lamp is not so apparent, as the turning point on the curve occurs at about the time of lighting the lamp. Without the lamp the turning point would probably occur somewhat later, and the subsequent westerly tilt be less steep. The effect of removing the lamp is not apparent, in both sets of curves the morning turning point occurring at about the time of extinguishing the lamp.

To illustrate more fully the nature of the diurnal tilting of the pillar vector diagrams for each month, showing the amount and direction of tilt from hour to hour, have been constructed by plotting the values given in Tables IV and V as rectangular co-ordinates from a fixed point (Plate V).

The diagrams are widely different in different months. In March there is a steady tilt to the North-West until about $7^h.15^m$, when a movement in the opposite direction sets in, becoming relatively rapid until Noon and then decreasing, until shortly before 15^h when the pillar begins to tilt towards the north; after 16^h the movement gradually changes to North-West and West, changing again to the North-West between 20^h and 21^h. The curve between 13^h and 20^h forms a closed loop, and the effect of the lamp is to decrease the area of this loop by check-

ing the northly, and accentuating the westerly tilting after 18h. The maximum north-westerly disturbing force occurs between 7h and 8h, and the maximum south-easterly disturbing force between 15h and 16h.

The curve for November encloses a larger area than for any other month and, with those for August and September, offers a striking contrast to the curves for the other months. From midnight to $5\frac{1}{2}$h the tilt is to the North, turning then sharply to East and South-South-East, and gradually becoming south-easterly after 9h; after 14h it becomes southerly, by 17h westerly, and by $17\frac{1}{2}$h west-north-westerly; but the latter movement is checked by the lamp before 18h and becomes west-south-westerly until 19h, then westerly; the final northerly tilt setting in between 21h and 22h, the movement is relatively slow near the turning points at 0h and 15h.

The amount and direction of tilt from day to day (from 0h to 24h) is shown graphically on Plate VI. The diagram has been constructed in a similar manner to those on Plate V, by plotting the accumulated values of Table III as rectangular co-ordinates from a fixed point. It will be seen that the pillar tilted generally to the North-West by irregular movements until the end of November, when a rapid tilt to North set in and lasted until December 8; the pillar then tilted to the South-East until the end of the year, its position on December 31 indicating a tilt of 52″·7 to the North-North-West of its position on March 10, after allowing for dislocations.

In Table V are given particulars of the changes of level produced by heavy rain during the year 1902. A portion of the seismogram during the cyclone of February 5 is reproduced on Plate II together with the corresponding portion of the pluviogram drawn to the same time scale. On the same plate is given a diagram showing the amount and direction of tilt of the seismograph pillar from hour to hour during the passage of a cyclone over Mauritius on February 9. The effect, if any, of the steep pressure gradient is masked by the rainfall effect, the pillar tilting towards the area of low pressure as it approached from the North and again, approximately, as it receded to the South-South-East; whereas the pillar should tilt away from an area of low, towards an area of high pressure, if the earth's crust responds to changes of pressure.

TABLE I.—LIST OF EARTHQUAKES recorded at the ROYAL ALFRED OBSERVATORY, MAURITIUS, in the YEAR 1902.

Shide Register Number	Mauritius Register Number.	Date, 1902.	Commencement of Preliminary Tremors (G.C.T.)	Commencement of 2nd Phase (G.C.T.)	Commencement of Large Waves (G.C.T.)	Time of Maximum (G.C.T.)	End of Disturbance (G.C.T.)	Amplitude.		Remarks.
		d	h. m.	h. m.	h. m.	h. m.	h. m.	m.m.	"	
572	251	Jan. 1	...	...	6.40·0	6.42·1	8.30	0·60	0·23	
	252	,, 6	...	...	...	7.51·1	...	...	...	Thickening of trace.
573	253	,, 9	0.14·1	...	0.57·8	0.58·9	1.30	0·40	0·15	
	254	,, 11	19.32·4	...	19.38·5	19.42·0	19.50·7	0·47	0·18	
575	255	,, 13–14	22.40·4	22·51·2	22.57·0	23. 0·8	0. 4·5	1·00	0·38	
578	256	,, 18–19	23.54	...	...	0. 2·5	1.11	...	...	Thickening of trace.
	257	,, 21	10.29	...	...	11. 7	11.17	...	...	Several slight thickenings of trace.
	258*	,, 22–23	22. 0	...	...	...	2.30	...	...	Several slight thickenings of trace: possibly air-tremors.
	259	,, 24	4.15	...	...	5.11·9	5.45	...	...	Very slight thickenings of trace.
581	260	,, 24–25	23.41·6	23.53·3	0·14·0	0.26·0	...	2·60	0·99	Movements decreased until 25d. 1h. 38m. and then recommenced.
	261	,, 25	...	1·38·0	1.54·4	2. 2·7	6. 0	1·50	0·57	
	262	,, 27	...	...	...	0.13·2	...	...	...	
582	263	,, 28	19·35	...	...	20. 9	20.41	...	...	Very slight movement.
583	264	,, 29	2. 8	2·17·5	...	2.20·5	...	...	...	Very slight tremors till 6h.
584	265	,, 30	13·46·4	...	14.57·0	15. 4·9	17.30	1·10	0·42	Commenced abruptly: end faint.
	266	Feb. 3-4	23.40·6	...	0. 2·4	0.10·4	0.49	0·52	0·20	
			February 8–26 Instrument dismounted for alterations							
	267	March 3	11.34·8	...	...	11.37·8	11.42·0	...	...	Thickening of trace.
	268	,, 10	4.32·4	...	4.34·4	4.35·4	5.18·6	1·05	0·40	
596	269	,, 12	15.28	...	...	...	16.19	...	...	Frequent slight thickenings of trace.
599	270	,, 22–23	23.56	...	...	...	0.36	...	...	,, ,, ,,
601	271	,, 28	14.55·1	...	15. 3·6	15. 4·2	17.42	1·0	0·64	
	272	April 17	...	...	...	2.54	...	...	...	Active air tremors from 2¼h. to 5h.
			...	...	...	3.25	...	...	...	Seismic origin doubtful.
606	273	,, 19	2.43·6	...	2·53·2	3. 0·0	...	1·8	0·68	*See* Plate II. h. m. Max in N.–S. register at 3. 6·2 (4·0 mills)
	274	,, 19	...	...	3.37·6	3.43·4	5·30	1·1	0·42	,, ,, 3.49·2 (4·0 mills)
	275	,, 19	10.50·3	...	...	10.51·4	11.13·8	0·25	0·09	,, ,, 10.52 (0·4 mills)
				...	...	10.54·7	...	0·25	0·09	
	276	,, 21	17.37	...	...	17.39	...	...	...	Probably due to insect.
	277	,, 25–26	23.53	...	...	...	0.39	...	...	Frequent slight thickenings of trace.
	278	,, 26	2.30	...	...	3.56·1	5·15	...	...	Numerous thickenings of trace.
	279	May 12	2.30	...	...	3. 6·0	...	0·65	0·25	Probably air tremors.
			...	...	...	3.16·6	...	1·00	0·38	
	280*	,, 19	...	...	...	0.20·6	...	...	...	Seismic origin doubtful.
			...	...	...	2.41·0	...	...	...	
			...	...	...	3.52·8	...	...	...	
	281	,, 24	6.44·6	...	...	6.46·7	6.48·5	...	...	Isolated thickening:
			6.52·4	...	...	6.54·6	6.55·6	...	...	Times uncertain.

TABLE I.—LIST OF EARTHQUAKES recorded at the ROYAL ALFRED OBSERVATORY, MAURITIUS, in the YEAR 1902.—*continued.*

Shide Register Number.	Mauritius Register Number.	Date, 1902.	Commencement of Preliminary Tremors (G.C.T.)	Commencement of 2nd Phase (G.C.T.)	Commencement of Large Waves (G.C.T.)	Time of Maximum (G.C.T.)	End of Disturbance (G.C.T.)	Amplitude.		Remarks.
		d	h. m.	h. m.	h. m.	h. m.	h. m.	m.m.	"	
	282	June 2	0.30	...	...	1.51	3.30	...	...	Frequent slight thickenings of trace.
	283*	,, 2	13.58·7	...	...	13.59·5	...	...	...	Slight movements (probably air tremors) from $2^d.\ 6\frac{1}{2}^h$ to $19\frac{1}{4}^h$ and from $2^d.\ 21^h$ to $3^d.\ 5\frac{1}{2}^h$.
	284	,, 3	17. 4·0	...	...	17.15·5	17.16·2	...	...	Frequent slight thickenings (probably air tremors) from $3^d.\ 16^h$ to $4^d.\ 5\frac{1}{2}^h$.
	285	,, 4	20.49	...	...	...	21.52	...	...	Some movements between these times appear to be seismic.
	286	,, 19	...	...	...	4. 7·3	...	...	...	Seismic origin doubtful.
	287	,, 20	...	...	...	3.37·9	...	...	...	,, ,,
	288	,, 21	1.49	...	...	2.25·7	7.44	...	...	Frequent slight thickenings of trace.
	289	,, 22	6. 0	...	...	...	13.30	...	...	,, ,,
	290	,, 26	3.30	...	...	4.20·6	5.30	...	...	Thickenings of trace.
	291	July 3	6· 0	...	...	7. 9·7	11. 0	...	...	Seismic origin doubtful.
617	292*	,, 6	13.30	...	...	7.30·8 14. 7·8 14.15·6 14.25·1 14.43·7	14.45	...	...	Frequent slight thickenings of trace.
618	293	,, 9	3.58·7	...	...	4. 3·1	4.13·2	...	...	Thickenings of trace.
	294	,, 19	17.30	...	...	17.32·6	17.36·5	...	...	,, ,,
619	295	,, 20	9.43	...	...	9.50	9.56	...	...	,, ,,
	296	,, 26	0. 0	...	...	...	3.30	...	...	A series of regular pulsations vide B. A. Report 1896 p. 21 fig. 6.
	297	,, 26	19.29·2	...	...	20. 2·6	...	...	...	A seismic movement among a series of pulsations as above, lasting from $17\frac{3}{4}^d$ to $23\frac{3}{4}^h$ with gradually increasing period.
	298	August 2	10.15·2	...	...	10.20·6	...	...	...	Isolated thickening of trace.
	299	,, 2	11.26·6	...	...	11.39·4	...	...	...	Frequent slight thickenings of trace.
	300	,, 2	14.45·1	15. 5·1	15. 9·8	15.12·4	15.34·3	0·09	0·25	
			...	...	...	15.16·1	...	...	...	
	301	,, 2	23. 9·9	...	...	...	23.12·9	...	...	
	302	,, 2	23.23·7	23.34·5	23.37·8	23.39·3	23.53·7	0·55	0·15	
	303	,, 3	2.39	...	...	...	3.47	...	...	A series of regular pulsations with tremors superposed occasionally.
	304	,, 7	12. 4·2	12.11·6	12. 7	12.15·0	12.26·0	0·45	0·12	
622	305	,, 8	21. 0	...	...	...	21.45	...	...	A series of regular pulsations.
	306	,, 8	23.46·5	...	...	23.48·5	23.56·8	...	...	Irregular tremors from $8^d.\ 22^h$ to $9^d.\ 3\frac{3}{4}^h$.
			...	...	...	23.52·6	...	...	...	
	307	,, 9	15. 2·5	...	...	...	15.12·6	...	...	Frequent slight thickenings of trace.
	308*	,, 11–12	18. 0	...	...	...	6. 0	...	...	Unusually active tremors: some may be seismic.
	309*	,, 16	8.28·4	...	8.30·6	8.31·8	8.37·9	...	...	Small tremors.
	310	,, 16	...	8.52·6	8.54·5	8.57·0	9.39·8	...	...	Three distinct periods of activity.
			...	...	8.58·7	8.59·7	...	...	...	
			...	...	...	9. 1·4	...	...	...	
			...	...	9. 3·2	9. 5·2	...	...	...	
			...	...	...	9. 8·3	...	...	...	
625	311*	,, 21	10.21·0	...	...	11.49·9	12.41	...	...	Frequent small tremors from $21^d.\ 6^h$ till $13\frac{3}{4}^h$ when stove was lighted.
625	312*	,, 22	...	...	3.18·9	3.33·6	...	...	...	*See* Plate II.
			...			3.37·7	...	...	...	

TABLE I.—LIST of EARTHQUAKES recorded at the ROYAL ALFRED OBSERVATORY, MAURITIUS, in the YEAR 1902.—*continued.*

Slide Register Number.	Mauritius Register Number.	Date. 1902.	Commencement of Preliminary Tremors (G.C.T.)	Commencement of 2nd Phase (G.C.T.)	Commencement of Large Waves (G.C.T.)	Time of Maximum (G.C.T.)	End of Disturbance (G.C.T.)	Amplitude.		Remarks.
		d	h. m.	h. m.	h. m.	h. m.	h. m.	m.m.	"	
	282	June 2	0.30	...	...	1.51	3.30	...	...	Frequent slight thickenings of trace.
	283*	,, 2	13.58·7	...	...	13.59·5	...	...	...	Slight movements (probably air tremors) from $2^d.\ 6\frac{1}{2}^h$ to $19\frac{1}{4}^h$ and from $3^d.\ 2^h$ to $3^d.\ 5\frac{1}{2}^h$.
	284	,, 3	17. 4·6	...	...	17.15·5	17.16·2	...	...	Frequent slight thickenings (probably air tremors) from $3^d.\ 16^h$ to $4^d.\ 5\frac{1}{2}^h$.
	285	,, 4	20.49	...	...	...	21.52	...	...	Some movements between these times appear to be seismic.
	286	,, 19	...	...	...	4. 7·3	...	...	...	Seismic origin doubtful.
	287	,, 20	...	...	...	3.37·9	...	...	...	,, ,,
	288	,, 21	1.49	...	...	2.25·7	7.44	...	...	Frequent slight thickenings of trace.
	289	,, 22	6. 0	...	...	...	13.30	...	...	,, ,,
	290	,, 26	3.30	...	...	4.20·6	5.30	...	...	Thickenings of trace.
	291	July 3	6· 0	...	...	7. 9·7	11. 0	...	...	Seismic origin doubtful.
			...	...	...	7.30·8				
617	292*	,, 6	13.30	...	...	14. 7·8	14.45	...	...	Frequent slight thickenings of trace.
			...	...	...	14.15·6				
			...	...	...	14.25·1				
			...	...	...	14.43·7				
618	293	,, 9	3.58·7	...	...	4. 3·1	4.13·2	...	...	Thickenings of trace.
	294	,, 19	17.30	...	...	17.32·6	17.36·5	...	...	,, ,,
619	295	,, 20	9.43	...	...	9.50	9.56	...	...	,, ,,
	296	,, 26	0. 0	...	...	...	3.30	...	...	A series of regular pulsations vide B. A. Report 1896 p. 21 fig. 6.
	297	,, 26	19.29·2	...	...	20. 2·6	...	...	...	A seismic movement among a series of pulsations as above, lasting from $17\frac{3}{4}^d$ to $23\frac{3}{4}^h$ with gradually increasing period.
	298	August 2	10.15·2	...	...	10.20·6	...	...	...	Isolated thickening of trace.
	299	,, 2	11.26·6	...	...	11.39·4	...	...	...	Frequent slight thickenings of trace.
	300	,, 2	14.45·1	15. 5·1	15. 9·8	15.12·4	15.34·3	0·09	0·25	
			...	...	...	15.16·1	...	...	...	
	301	,, 2	23. 9·9	...	...	...	23.12·9	...	...	
	302	,, 2	23.23·7	23.34·5	23.37·8	23.39·3	23.53·7	0·55	0·15	
	303	,, 3	2.29	...	...	...	3.47	...	...	A series of regular pulsations with tremors superposed occasionally.
	304	,, 7	12. 4·2	12.11·6	12. 7	12.15·0	12.26·0	0·45	0·12	
622	305	,, 8	21. 0	...	...	...	21.45	...	...	A series of regular pulsations.
	306	,, 8	23.46·5	...	...	23.48·5	23.56·8	...	...	Irregular tremors from $8^d.\ 22^h$ to $9^d.\ 3\frac{3}{4}^h$.
			...	...	...	23.52·6	...	...	...	
	307	,, 9	15. 2·5	...	...	...	15.12·6	...	...	Frequent slight thickenings of trace.
	308*	,, 11–12	18. 0	...	...	...	6. 0	...	...	Unusually active tremors: some may be seismic.
	309*	,, 16	8.28·4	...	8.30·6	8.31·8	8.37·9	...	...	Small tremors.
	310	,, 16	...	8.52·6	8.54·5	8.57·0	9.39·8	...	...	Three distinct periods of activity.
			...	...	8.58·7	8.59·7	...	...	...	
			...	...	...	9. 1·4	...	...	...	
			...	...	9. 3·2	9. 5·2	...	...	...	
			...	...	...	9. 8·3	...	...	...	
625	311*	,, 21	10.21·0	...	...	11.49·9	12.41	...	...	Frequent small tremors from $21^d.\ 6^h$ till $13\frac{3}{4}^h$ when stove was lighted.
625	312*	,, 22	...	...	3.18·9	3.33·6	...	...	...	*See* Plate II.
			...			3.37·7	...	...	...	

TABLE I.—LIST OF EARTHQUAKES recorded at the ROYAL ALFRED OBSERVATORY, MAURITIUS, in the YEAR 1902.—*concluded.*

Slide Register Number.	Mauritius Register Number.	Date, 1902.	Commencement of Preliminary Tremors (G.C.T.)	Commencement of Principal Phase (G.C.T.)	Commencement of Large Waves (G.C.T.)	Time of Maximum (G.C.T.)	End of Disturbance (G.C.T.)	Amplitude.		Remarks.
		d	h. m.	h. m.	h. m.	h. m.	h. m.	m.m.	"	
637	313	August 22	6. 0	...	...	...	10. 0	...	...	Frequent abrupt dislocations : Vide B.A. Report 1896, p. 10, fig. 2.
639	314	" 24	2.21·5	...	...	2.24·2	2.28·1	...	...	Slight thickening of trace.
	315	" 26	2.51	...	...	...	3.29	...	...	Several very slight thickenings of trace.
636	316	" 30	22. 7·1	...	22.21·0	22.54·0	22.55·7	0·70	0·19	
			...	...	...	22.55·4	...	...	...	
	317	Sept. 19	22.11·6	...	22.14·1	22.14·8	22.18·1	0·50	0·12	
641	318	" 22	2. 0·0	...	2.11·9	2.12·8	...	3·20	0·80	Followed by tremors for several hours.
642	319	" 23	20.39·1	...	...	20.54·3	...	2·00	0·50	
	320*	" 23	...	...	21.37·4	21.38·4	23.15	2·10	0·52	" " "
			...	...	...	21.45·4	...	1·65	0·41	
			...	...	...	21.54·4	...	2·60	0·65	
			...	...	...	22.10·8	...	2·45	0·61	
			...	...	...	22.14·7	...	1·55	0·39	
	321*	October 5	1·30	...	...	...	3.30	...	...	Frequent very slight tremors ; possibly air tremors.
644	322	" 6	9.46·4	...	9.55·2	9.57·0	10.18	...	...	Thickening of trace ; watch error uncertain.
	323*	" 9	4. 0	...	...	...	5.30	...	...	Frequent tremors (possibly air tremors) until changing sheet at $5\frac{1}{2}^{h}$.
	324*	" 10	...	...	11.51·0	11.54·6	12. 1·8	0·55	0·14	
	325*	" 13	0. 0	...	...	1.44·7	4. 0	0·50	0·13	Frequent tremors : possibly air tremors.
646	326	" 13	12.41·5	...	...	...	12.58·2	...	...	Several slight thickenings of trace.
	327	" 13	14.32·6	...	14.40·7	14.54·0	14.57·2	...	...	Thickening of trace.
	328	" 17	11.30	...	...	...	12.30	...	...	Frequent slight thickenings of trace.
	329	" 20	4.50	...	...	...	5.20	...	...	Occasional slight thickenings of trace.
651	330*	" 28	...	...	...	11. 3	...	...	...	Frequent tremors on 28th : possibly air tremors : time of max approximate.
	331	" 28	...	...	17. 7	17. 9	17.13	...	...	Isolated : Times approximate.
	332	" 28	...	...	21.22·8	21.23·3	21.26·0	...	...	" " "
	333	" 29	...	...	15. 2	15. 2·8	15. 7	...	...	" " "
	334	" 29	...	...	19.36·3	19.36·9	19.39	...	...	" " "
	335	" 30	...	...	23.33·0	23.34·4	23.37·0	...	...	Apparently seismic movements among frequent air tremors.
			...	...	23.42·9	23.47·7	23.53·7	...	...	
	336	Nov. 2	...	...	19.45·0	19.45·7	19.48·7	0·35	0·09	
	337	" 3	13.51·6	...	...	13.52·5	13.56·0	...	...	Irregular thickening of trace.
653	338	" 4	11.55·8	12. 1·8	12. 3·6	12. 4·1	12.41·8	0·60	0·16	
	339	" 15	9.39·5	...	10. 7·8	10.10·8	10.51·2	0·50	0·13	
658	340	" 20	20.51·3	...	21.21·7	21.23·3	23. 7·3	1·50	0·39	Max in N.-S. register at $22^{h}.\ 57^{m}.$ (0·6 m.m.).
			...	...	...	21.29·6	...	1·00	0·26	
659	341	" 21	7.12·7	7.25·6	7.42·4	7.48·1	10.30	1·90	0·49	
	342	" 29	...	...	...	6.45·8	...	...	...	An apparently seismic movement among frequent air tremors.
	343*	" 30	...	...	3. 3	...	3. 7	...	....	Very slight thickening of trace : isolated.
	344	Dec. 4	0. 0	...	...	...	0. 6	...	...	Very slight thickening of trace.
	345	" 6	13.35·9	...		13.39·8	13.42·5	...	...	Irregular thickening of trace.
	346	" 13	0.37·6	...	0.44·7	0.50·3	1. 1·8	0·40	0·10	
662	347	" 13	17.25·1	...	17.29·3	17.41·0	17.53·6	0·50	0·13	
663	348	" 16	5.32·6	...	...	5.36·8	...	...	...	

PLATE 2.

REGISTERS OF EARTHQUAKES AND OF EARTH-TILTS IN THE YEAR 1902 AT THE ROYAL ALFRED OBSERVATORY.

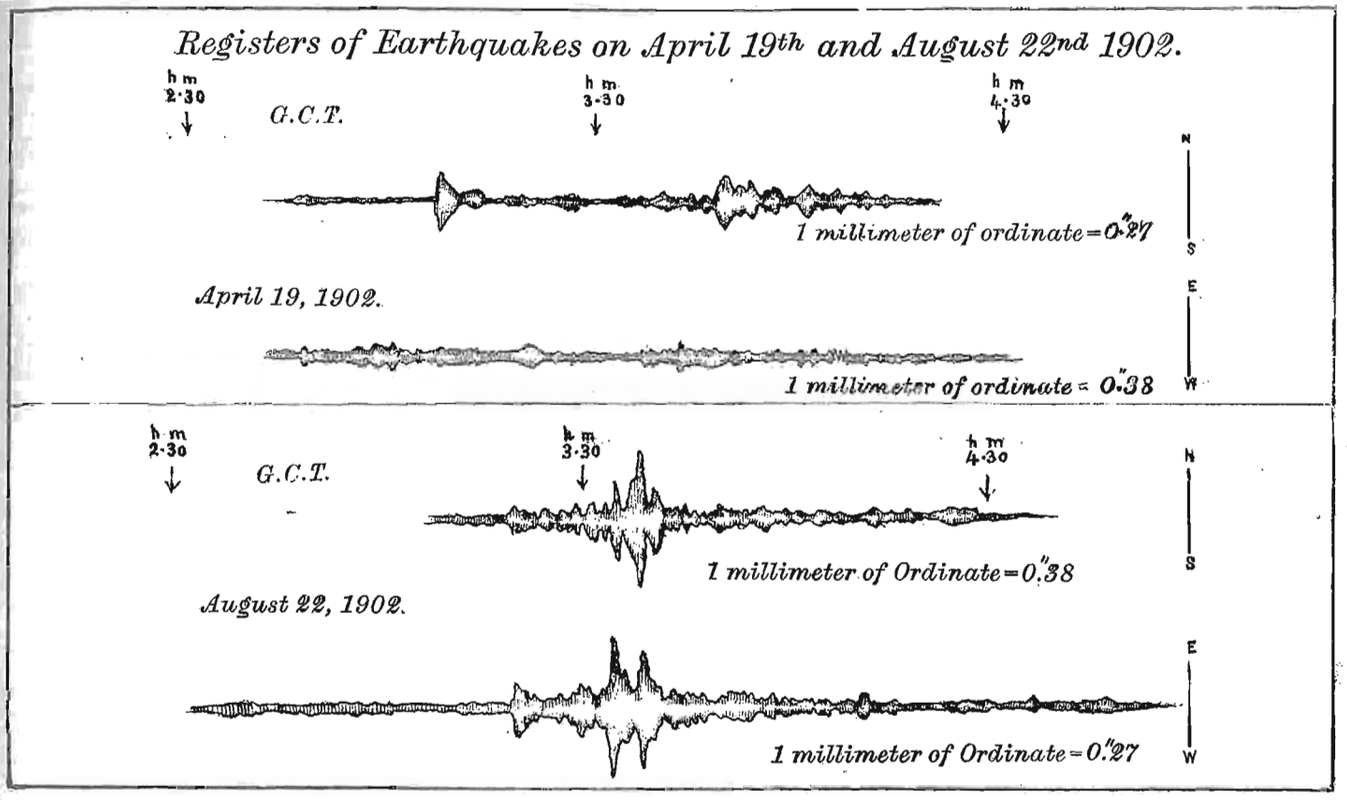


DIAGRAM SHOWING TREMORS AND EARTH TILTING PRODUCED BY THE PASSAGE OF A CYCLONE TO THE NORTH OF MAURITIUS ON 1902 FEBRUARY 5.

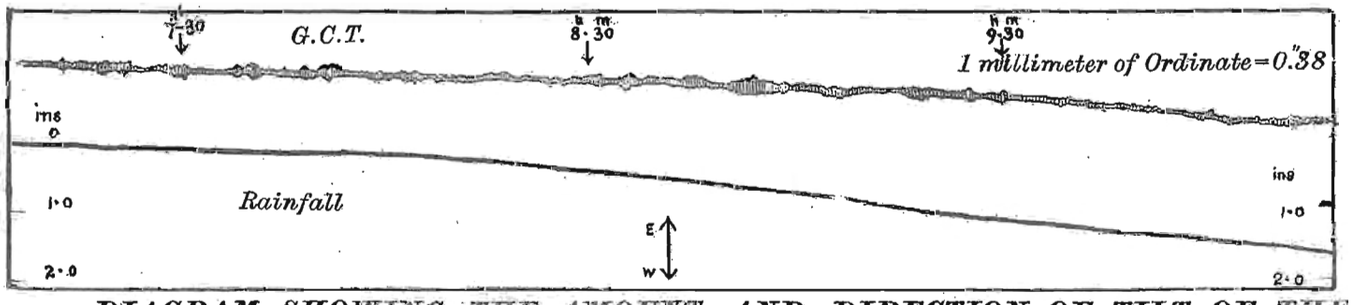
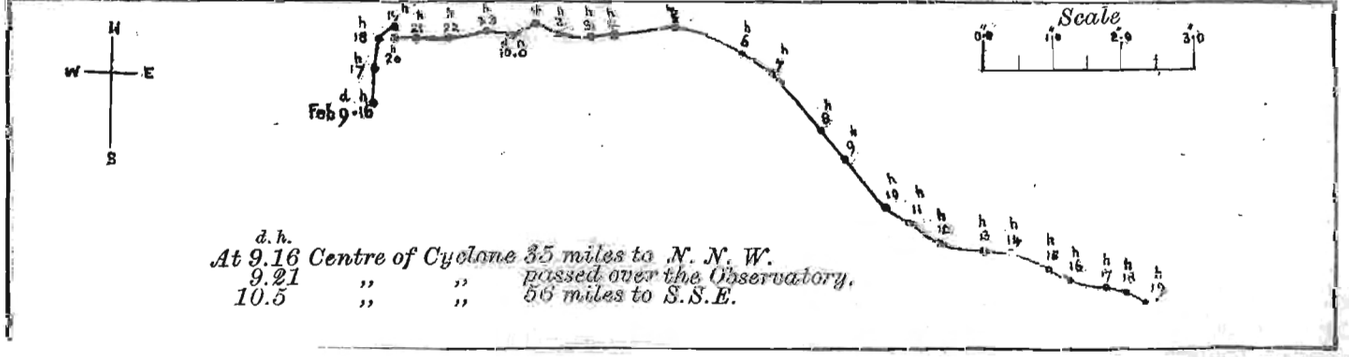


DIAGRAM SHOWING THE AMOUNT AND DIRECTION OF TILT OF THE SEISMOGRAPH PILLAR DURING THE PASSAGE OF A CYCLONE OVER MAURITIUS ON 1902 FEBRUARY 9.



RESULTS

OF THE

MAGNETICAL AND METEOROLOGICAL OBSERVATIONS

MADE AT

THE ROYAL ALFRED OBSERVATORY, MAURITIUS,

IN THE YEAR

1903.

UNDER THE DIRECTION OF

T. F. CLAXTON, F.R.A.S.

AND EDITED BY

A. WALTER, F. R. A. S.—Director.

MAURITIUS :

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1911.

APPENDIX.

RESULTS

OF

SEISMOLOGICAL OBSERVATIONS.

1903.

APPENDIX.

RESULTS

OF

SEISMOLOGICAL OBSERVATIONS,

1903.

The instrument used for the registration of unfelt earth movements is of the Milne pattern, recommended by the "Seismological Committee of the British Association for the Advancement of Science", and described in the "Annual Report of the Committee" for the year 1896. Details of installation are given in the Introduction to this volume.

Particulars of 80 Earthquakes recorded in the year 1903 are given on pages (lxviii) to (lxix).

On 1902 February 7, a second pendulum was added to the pillar, for the registration of earth movements in a North-South direction, and arranged to record on the same strip of paper as the original pendulum which registers the East-West component. The new pendulum is mounted on the eastern side of the pillar; it is 125 m.m. long and at its outer end carries a solid cylinder of brass weighing about five ounces. The other end is fitted with an agate cup, which pivots upon a steel point, the latter projecting nearly horizontally from an iron block clamped to the base of the pillar. The pendulum is supported by a thin silver wire terminating in a silk thread which passes over an endless screw to a small windlass, both attached to the head of the pillar; the former serves for adjustment in azimuth and the latter for adjustment in altitude.

With only one pendulum, adjustment in azimuth is readily made by a finely threaded foot screw; but with two pendulums the adjustment should be made without altering the level of the bed plate. In the second (North-South) pendulum, the maker made provision for this by leading the suspension thread over a grooved bar, movable laterally by pulling screws;

but as this method was not sufficiently delicate, an endless screw was substituted for the bar and pulling screws. (On 1902 February 22, a similar device was fitted for the East-West pendulum).

The recording index is a tapering aluminium boom, 1·068 metres long, securely fixed at right angles to the pendulum proper at a point 20 m.m. from the pivot end of the latter, and 115 m.m. from the south end of the former ; it thus lies parallel with the East-West boom. At its northern end it carries a black horizontal disc of aluminium, 20 m.m. long and 15 m.m. wide,* pierced with a fine slit in a North-South direction. The boom is counterpoised by a small weight at its southern extremity and stayed by a silk thread running North and South from a slender mast fixed to the cross joint. This mast, which can be clamped at any azimuth, furnishes an additional adjustment in altitude ; the end of the boom rising or falling as the silk is twisted or untwisted round the mast.

The centre of gravity is 80 m.m., the centre of the brass weight 107 m.m., the point of suspension 74 m.m., and the point of registration 953 m.m., from the agate cup. (The corresponding distances in the East-West pendulum are 110, 100, 127, and 957 m.m., respectively).

In addition to earthquake movements the instrument records gradual changes of level, for the study of which the seismogram ordinates are measured at every hour of the day (commencing with Greenwich Mean Midnight until May 30 and subsequently Mauritius Mean Midnight). To facilitate measurement, and to insure accuracy, a scale is photographed on the register by means of fine threads inserted at every second millimetre, those at 10, 30 and 50 millimetres being duplicated and at 0, 20, 40 and 60 millimetres triplicated.

For converting the scale readings into angular measure it was formerly the practice to tilt the bed plate through a small angle, by means of the finely threaded foot screw, and note the corresponding displacement on the photograph ; but with two booms this method is objectionable for various reasons. Even with one boom it was not altogether satisfactory ; in spite of the precautions taken to ensure accuracy the probable error of observation was frequently 10% of the observed quantity, and occasionally much greater than this. Moreover, on account of the spontaneous variations in the sensibility which occur from time to time, it is necessary to determine the scale value at short intervals, thus causing frequent dislocations which tend to vitiate the registers. Throughout the year 1903, therefore, the scale value has been determined by noting the time of vibration of the boom either from direct observation or by measuring, on the seismograms, the time interval between a given number of vibrations, as the booms come to rest after disturbance produced by the daily trimming of the lamps &c.

The results of the observations made to establish the relation between the scale value and the time of vibration of the booms, are given in the Volume of Observations for 1902 :

The formulæ used throughout the year 1903 were :—

$$\delta = \cdot0407/\tau^2 - \cdot028 \quad \text{for the North–South boom}$$
$$\delta = \cdot0372/\tau^2 - \cdot125 \quad \text{for the East–West boom}$$

where δ is the angular value (in seconds of arc) of 1 mill of ordinate and τ the time of vibration (in minutes).

The Scale values thus found were as follows :—

Month and Day, 1903.		Value of 1 m.m. of ordinate. N.-S. Boom.	Value of 1 m.m. of ordinate. E.-W. Boom.	Month and Day, 1903.		Value of 1 m.m. of ordinate. N.-S. Boom.	Value of 1 m.m. of ordinate. E.-W. Boom.	Month and Day, 1903.		Value of 1 m.m. of ordinate. N.-S. Boom.	Value of 1 m.m. of ordinate. E.-W. Boom.
	d	"	"		d	"	"		d	"	"
January ...	7	1·02	0·64	May ...	11	0·19	0·30	August ...	26	0·31	0·57
	8	0·97	0·42		12	0·29	0·31		28	0·39	...
	10	1·02	0·43		13	0·15	0·16		29	0·37	...
	11	1·02	0·38		14	1·15	...				
	13	1·02	0·43		15	0·90	0·22				
	17	0·62	0·58		18	...	0·22	September ...	1	0·34	0·28
	18	...	0·74		20	...	0·43		4	0·33	0·36
	20	0·40	...		21	...	0·32		5	0·33	0·30
	21	0·57	...		22	...	0·32		6	0·34	0·30
	22	0·71	...		26	...	0·32		12	0·35	0·31
	24	...	0·66		27	...	0·35		13	0·33	0·26
	30	...	0·66		30	...	0·28		14	0·36	0·40
									19	0·36	0·35
February ...	3	0·80	0·66	June ...	5	...	0·61		23	...	0·44
	18	0·92	0·79		7	0·16	0·38		24	0·33	...
	19	0·52	...		8	0·15	...		25	0·33	0·44
	20	0·81	...		9	...	0·41		26	0·33	0·40
	22	...	0·98		11	0·30	0·31		28	0·33	0·33
	25	...	1·00		12	...	0·31				
					16	0·69	...	October ...	4	0·35	0·39
March ...	1	0·86	0·60		17	...	0·29		5	0·29	0·32
	15	...	0·50		20	...	0·29		9	0·32	0·30
	17	...	0·27		25	0·40	...		12	0·49	0·46
	20	...	0·27		26	...	0·30		14	0·46	0·61
	27	...	0·31		27	0·40	...		17	0·42	0·48
	28	...	0·27		28	0·40	0·29		21	0·71	0·38
	29	...	0·27		29	0·15	0·29		24	0·56	0·30
					30	0·27	...		27	0·52	0·38
									29	...	0·30
April ...	2	0·83	...	July ...	1	0·72	0·28				
	3	...	0·36		2	...	0·29				
	4	0·74	0·27		3	...	0·26	November ...	1	0·42	0·29
	6	0·74	0·27		4	0·90	0·35		2	...	0·29
	8	0·85	...		6	...	0·35		3	...	0·31
	9	1·15	0·30		10	0·72	0·30		5	0·77	0·29
	15	0·74	...		11	0·40	0·25		7	...	0·29
	17	0·85	0·31		14	0·55	0·39		13	0·66	0·31
	18	...	0·27		20	0·39	0·25		16	0·61	0·38
	21	0·74	0·27		30	0·56	0·29		18	...	0·28
	23	0·74	0·24		31	0·56	0·48		30	0·52	0·30
	25	0·74	0·27						21	0·52	0·28
	30	0·66	0·49						23	0·52	0·21
				August ...	4	0·41	0·45		24	...	0·30
					7	0·41	..		29	0·45	0·28
May ...	4	...	0·25		8	0·72	0·57				
	5	0·26	0·46		10	0·31	...				
	6	0·48	0·36		11	0·36	...				
	7	0·26	...		12	0·39	...	December ...	2	0·66	0·31
	8	0·40	0·25		13	0·30	0·57		7	0·71	0·38
	9	0·56	...		16	0·39	...		11	...	0·31
	10	0·44	0·36		25	0·44	0·57		14	...	0·31

The scale values used for converting the diurnal range and progressive change of ordinate into angular measure are obtained by smoothing the separate determinations for periods in which no adjustments have been made, and for the hourly ordinates a mean scale value is used for periods during which no large change of scale value has occurred.

The diurnal range of level given on pages lxx to lxxii refers to the Mauritius Civil Day, and the progressive change of level (Table III) is the excess of the ordinate at 0^h over the ordinate at 24^h on each day, the sign (+) indicating a tilt to Eastward and Northward, and the sign (−) a tilt to Westward and Southward.

The amount and direction of tilt from day to day (from 0^h to 24^h) is shown graphically on (Plate III). The diagram has been constructed in a similar manner to those on (Plate VI) by plotting the accumulated values on pages (lxx) to (lxxii) as rectangular co-ordinates from a fixed point. From January 6^d to 12^d the pillar tilted 5″ to Southward ; from January 23^d to February 10^d tilted 8″ to East-North-East, from February 10^d to March 13^d tilted 8″ to South by West, after a tilt of 7″ to South-West and return. From March 13^d to 20^d it tilted 7″ to West-South-West. Thence to the middle of November the tilting was 46″ to North-Westward, by very irregular movements. From November 15^d to December 1^d the pillar tilted irregularly $3\frac{1}{2}$″ to South-ward and thence to December 15^d tilted 6″ to East-North-East Ward, after which the movement was generally Westward. On pages (lxxiv) are given particulars of changes of level produced by heavy rain during the year 1903.

In forming the mean diurnal inequality of level for each month only those days have been included for which complete and undisturbed registers of both north and east components are available. The non-periodic variations are eliminated by applying to each mean hourly value the correction :—

$$(h - 12)\ \frac{x_0 - x_{24}}{24}$$

where h is the hour, counted from midnight, and x_0, x_{24}, the mean monthly value of the converted ordinate at 0^h, and 24^h respectively.

In order to refer the Diurnal Inequality of Level to Mauritius Civil Time, the mean monthly ordinates from January to May (when they were measured at each hour of Greenwich Civil Time) were plotted on a curve and fresh ordinates measured at each hour of Mauritius Civil Time (pages lxxiii).

The North component (Plate IV) shows a double oscillation ; the tilt to north which sets in at about 15^h is reversed at about 18^h for a period which varies considerably in different months. This effect is probably due to the lamp used to prevent tremors during the night. The lamp is lighted between 17^h and 18^h and is placed on the floor about 4 feet to the North-East of the pillar, its position varying slightly from day to day. As, in the position, this lamp clearly produces a tilt to South it may be assumed that it also produces a tilt to west. Such an effect is, however, masked in the East component, as the turning point in this element occurs approximately at the times of lighting the lamp. For a similar reason, the effect of extinguishing the lamp in the morning is not apparent in either component.

To illustrate more fully the nature of the diurnal tilting of the pillar, vector diagrams for each month and for the year, showing the amount and direction of tilt from hour to hour, have been constructed by plotting the values given on pages (lxxiii) as rectangular co-ordinates from a fixed point (Plate VI).

The diagrams are widely different in different months. In January there is a steady tilt to the North-North-West until shortly before 6^h, when a rapid reversal takes place the tilt becoming relatively rapid (towards South-East) until Noon and then decreasing. After 13^h the movement becomes more easterly, gradually changing to northerly, westerly and southerly, thus forming a closed loop between 14^h and $18\frac{3}{4}^h$. By 20^h the movement is again westerly, gradually becoming north-north-westerly. In the winter months the curves are irregular, showing on the whole a north-westerly tilt until about 6^h with return until the afternoon. The form of the closed loop in the evening is determined principally by the lamp which produces a considerable tilt to Southward. The November and December curves are similar in character with very small evening loops and enclose larger areas than any other except the February

TABLE I.—LIST of EARTHQUAKES recorded at the ROYAL ALFRED OBSERVATORY, MAURITIUS, in the YEAR 1903.

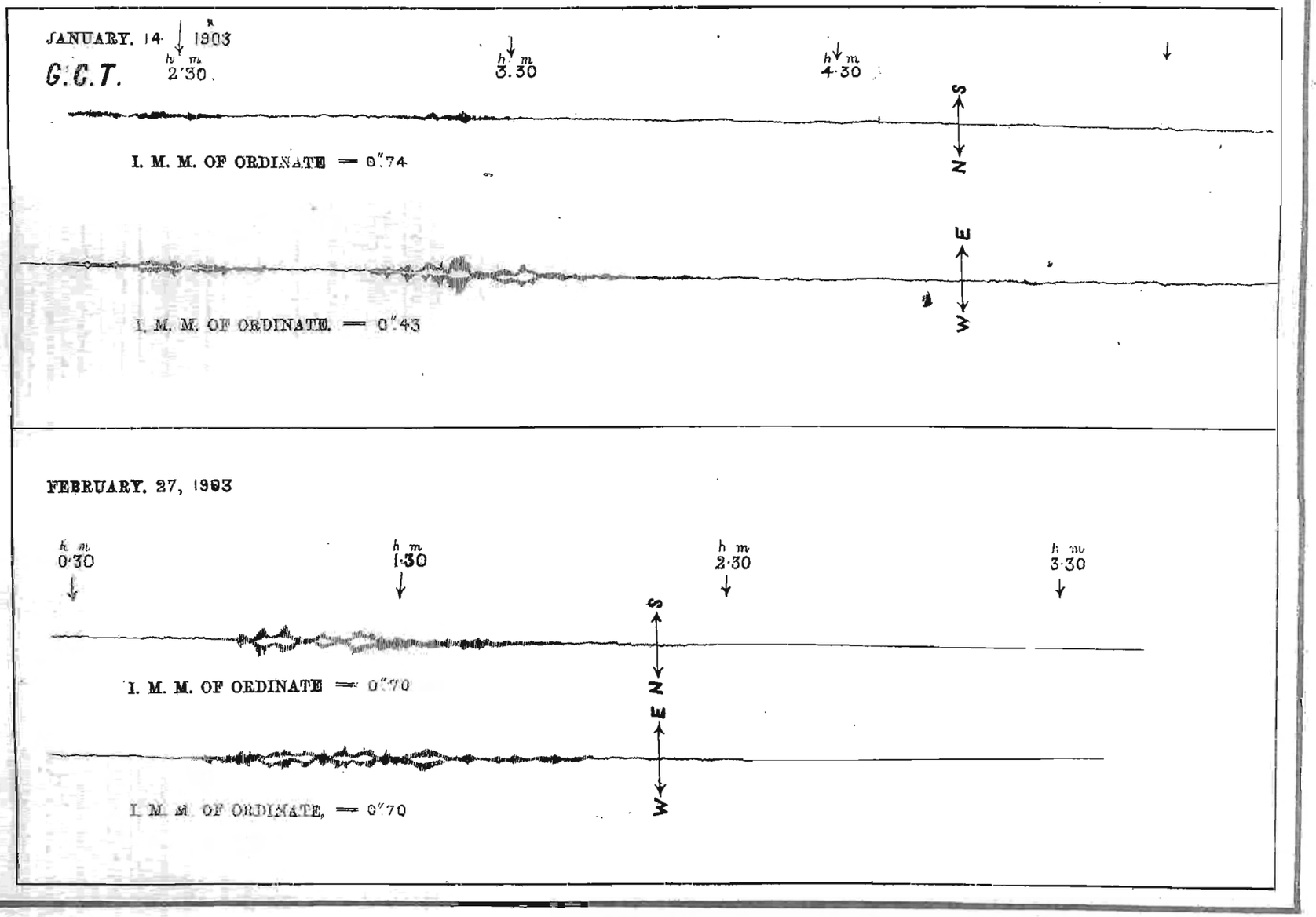
Shide Register Number.	Mauritius Register Number.	Date. 1903.		Commencement of Preliminary Tremors (G.C.T.)	Commencement of 2nd Phase (G.C.T.)	Commencement of Large Waves (G.C.T.)	Time of Maximum (G.C.T.)	End of Disturbance (G.C.T.)	Amplitude.		Remarks.
			d	h. m.	h. m.	h. m.	h. m.	h. m.	m.m.	"	
	349	Jan.	2	...	...	12.58·9	13. 0·8	13. 1·8	0.55	0·20	Loss of register after 13h. 4m.
	350	,,	3	...	...	23.19·0	23.23·2	23.25·2	...	...	Isolated thickenings of the trace.
	351	,,	3	...	...	23.36·9	23.39·3	23.40·5	...	...	
668	352	,,	4	5.26·6	5.34·6	...	6.11·9	7.	1·00	0·36	Sheet changed at 5h. 50m.
	353	,,	5	...	...	...	12.43·8	...	...	...	Slight thickening of trace.
	354*	,,	6	1.30·2	...	...	2.13·0	3. 5	...	...	Frequent thickenings of trace.
	355	,,	9	2.24·3	...	...	2.31·5	2.45·7	...	...	Several thickenings of trace.
				...	...	...	2.37·5	...	...	...	
671	356	,,	14	2.18·8	...	2.22·4	2.24·7	2.47·8	1·5	0·49	*See* Plate. Continuous small movements (till No. 357).
	357	,,	14	...	3. 5·1	3.19·0	3.21·4	4. 7·2	...	...	Small tremors for several hours afterwards.
676	358	Feb.	1	10. 1·3	10. 8·0	10.11·8	10.16·7	10.59·1	0·55	0·27	A few slight movements for several hours afterwards.
				...	...	...	10.26·6	...	0·65	0·32	
	359	,,	1	...	...	15.18·5	15.19·1	15.21·5	0·35	0·17	Isolated thickening of trace.
	360	,,	2	10.14·5	10.16·6	10.21·7	10.22·5	10.28·8	0·25	0·12	
682	361	,,	11	16.16·1	...	16.25·0	16.25·0	17.13·7	0·85	0·46	A few faint tremors afterwards.
686	362	,,	27	0.53·6	1. 1·0	1.30·9	1.35·8	3. 0·4	2·25	1·57	*See* Plate.
	363	March	2	...	...	0. 3·1	0. 3·9	0. 6·5	0·25	0·16	Isolated.
	364	,,	11	7.58·0	...	...	8. 4·3	8.12·3	...	...	Several very slight thickenings.
690	365	,,	15	15.35·3	...	15.53·6	15.56·4	16. 8·0	...	...	Thickening of trace.
692	366	,,	22	15. 0·1	...	15. 7·9	15. 9·9	15.20·8	...	...	,, ,,
698	367	,,	29	16.42·4	...	...	17.26·2	18.24·6	...	...	,, ,,
				...	...	...	17.48·8	...	...	...	
699	368	,,	30	3.42·5	3.47·2	3.58·5	4. 3·4	4.15·4	0·60	0·13	Small movements until 4h. 34m.
	369	April	1	7.20·5	...	...	7.25·0	7.26·9	0·15	0·03	Isolated.
	370	,,	3	8. 5·8	...	...	...	8. 8·3	...	...	Several slight thickenings of trace.
	371	,,	4	7.24	...	...	...	7.27	...	...	Slight thickening of trace.
	372	,,	10	19.16	...	...	...	19.22·6	...	...	,, ,,
703	373	,,	12	3.46·2	...	3.54·0	3.54·7	5.10·2	0·20	0·05	,, ,,
	374	,,	12	23. 2·7	...	...	23. 4·2	23. 8·6	0·20	0·05	Isolated.
	375	,,	27	...	...	...	8.12·9	...	...	...	Isolated : very slight thickenings of trace.
704	376	,,	29	0. 5	0.12·5	0.15·0	0.17·5	0.52·9	1·50	0·34	
705	377	,,	29	4.10·7	5. 1·2	5.12·0	5.14·8	7.16·2	1·45	0·33	Sheet changed between 5h. 36m. to 46m.
	378	May	9	13.54·4	...	...	...	14. 0·6	...	...	Isolated thickening of trace.
707	379	,,	13	6.47·5	...	6.58·0	7. 1·3	13.	2·0	0·46	Faint movements commenced at 6h. 14m. 5.
	380	,,	13	...	7.17·2	7.23·3	7.25·5	7.40	...	...	Faint movements for several hours afterwards.
	381	,,	13	15.23·6	...	...	...	15.27·6	...	...	Isolated : very slight.
708	382	,,	15	12½	...	...	...	13. 5	...	...	Several thickenings of trace.
	383	,,	16	3. 4·6	...	3.10·0	3.13·1	3.22·3	...	...	Slight thickening of trace.
	384	,,	17	0.30	0.58·9	1. 5.2	1. 7·2	3.48	0·85	0·20	
	385	,,	23	20.31·1	...	...	...	20.32·1	...	...	Thickening of trace.
710	386	,,	23	22.30	22.46·0	22.49·0	22.50·9	23.11	0·50	0·12	
	387	,,	28	4.36·7	...	...	...	5.16·0	...	...	Several slight thickenings of trace.
	388	June	2	1.30	...	...	...	3	...	...	
718	389	,,	4	15.11·8	...	15.17·2	15.18·9	15.46·5	0·40	0·10	
720	390	,,	7	9.28·0	9.43·7	9.49·7	9.53·9	10. 2·1	0·35	0·09	Isolated : slight.
	391	,,	8	5.45·9	...	5.55·2	5.56·4	6.32·7	0·60	0·15	
722	392	,,	9	11.51·6	12. 5·0	12. 7·8	12. 9·1	12.26·0	0·40	0·10	

TABLE I.—*concluded*.—LIST of EARTHQUAKES recorded at the ROYAL ALFRED OBSERVATORY, MAURITIUS, in the YEAR 1903.

Shide Register Number	Mauritius Register Number.	Date, 1902.		Commencement of			Time of Maximum (G.C.T.)	End of Disturbance (G.C.T.)	Amplitude.		Remarks.
				Preliminary Tremors (G.C.T.)	2nd Phase (G.C.T.)	Long Waves (G.C.T.)					
			d	h. m.	h. m.	h. m.	h. m.	h. m.	m.m.	"	
	393	June	10	16.58·5	...	17. 2·5	17. 3·5	17.35	...	...	Faint movements for several hours afterwards.
724	394	,,	10	17.18·2	17.26·0	17.30·6	17.32·2	17.41·5	0·45	0·11	
	395	,,	15	23. 2·5	...	...	...	23.22·3	...	...	Several very slight thickenings of trace.
727	396	,,	17	20.28·4	...	...	...	20.37·7	...	...	Several slight tremors.
732	397	,,	24	19.25·6	...	...	14.14·3	14.16·4	0·25	0·06	
	398	,,	25	13.49·3	...	...	...	19.29·8	...	...	Very slight thickenings of trace.
738	399	July	2	21.37·1	...	22.14·8	22.16·1	22.31·8	0·35	0·11	
740	400	,,	4	5.17·0	...	5.21·1	5.25·2	5.36·0	0·35	0·11	
746	401	,,	12	6. 2·1	6.10·0	6.13·0	6.15·9	6.44·7	0·20	0·06	Very faint movements commenced at $5^h.\ 40^m.\ 6.$
	402	,,	14	...	...	...	8.34·3	...	...	...	Slight thickenings of trace.
				...	...	...	8.57·1	...	...	...	
759	403	August	11	...	...	4.53·2	4.54·3	...	0·50	0·27	Tremors lasted till 14^h.
				...	...	...	5.17·4	...	0·45	0·26	
	404	Sept.	3	3.51·8	...	...	4. 2·7	4.45·7	...	...	
	405	,,	3	6.41·5	...	...	6.44·6	7. 2·1	...	...	
				...	...	...	6.50·8	...	...	...	
	406	,,	6	13.25·8	...	...	14. 3·4	14.15·5	...	...	
	407	,,	7	7.37·7	...	...	...	7.54·9	...	...	Several isolated thickenings of trace.
764	408	,,	7	7.58·5	8. 4·4	8. 6.9	8.13·7	8.41·3	1·0	0·30	
765	409	,,	8	5.20·8	...	...	5.27·0	6. 3.1	...	...	
	410	October	1	22.56	...	...	...	23. 2	...	...	
	411	,,	4	17.19·8	...	...	...	17.27	...	...	
	412	,,	14	6.58·1	7. 3·6	7. 5·1	7. 7·4	...	0·5	...	
	413	,,	19	...	...	3.31·5	3.35·8	...	0·5	...	
	414	,,	20	3.32·5	3.43·0	3.47·2	3.48·0	...	0·25	...	
	415	,,	21	0.24	...	..	...	0.28	...	...	
777	416	,,	21	...	...	10. 2·2	...	11.10	...	...	E.-W. boom disturbed by insects. Max in N.-S. $10^h.\ 6^m.$ amplitude 6·5 mils.
	417	,,	21	17.36	...	...	...	17.41	...	...	
	418	,,	24	...	...	1.24·7	1.25·0	1.40	1·5	0·45	
	419*	,,	25	...	...	...	1.41·0	...	0·6	0·18	An apparent seismic movement among frequent A T_s.
	420*	,,	29	14.44·2	...	15.12·4	15.20·0	15.40	1·7	0·51	
	421	,,	30	3.50·4	...	4.50·4	4.55·9	...	2·0	0·60	
	422	Nov.	10	17.42·4	...	...	...	17.56·7	...	...	Frequent thickenings of trace.
	423	,,	10	18. 1·9	18. 8·4	18. 9·7	18.16·9	18.37.7	0·6	0·18	
	424	,,	10	...	21.44·2	21.50·0	21.51·5	...	0·5	0·15	
	425	Dec.	9	...	...	6. 9	6.11	6.16	1·0	0·30	Seismic origin doubtful.
	426	,,	10	...	...	17.16	17.24·6	..	..	...	Register faint.
				...	...	..	17.25·6	...	...	.	
	427	,,	13	19.44·4	...	...	20.47·3	20.59·1	..	...	Slight thickening of trace.
	428	,,	18	14. 1·4	14. 4·4	14. 6·8	14. 9·9	14.15	0·5	0·15	Seismic origin doubtful.

PLATE 7.

COPIES OF EARTHQUAKES RECORDED AT THE ROYAL ALFRED OBSERVATORY DURING THE YEAR 1903.



RESULTS

OF THE

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IN THE YEAR

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1906.

RESULTS OF MAGNETICAL AND METEOROLOGICAL OBSERVATIONS—*concluded.*

APPENDIX.

LIST OF EARTHQUAKES RECORDED BY THE MILNE SEISMOGRAPH DURING THE YEAR 1904.

(The Results of Observations of Earth Tilts given in previous Volumes are not published in the present Volume, as it has been found that the Records are affected by a Lamp used at Night to check Tremors.)

ST of EARTHQUAKES recorded by the MILNE SEISMOGRAPH at the ROYAL ALFRED OBSERVATORY, MAURITIUS, during the YEAR 1904.

Mauritius Register Number.	1904. Date.	Time of Commencement of Preliminary Tremors (G.C.T.)	Time of Commencement of 2nd Phase (G.C.T.)	Time of Commencement of Large Waves (G.C.T.)	Time of Maximum (G.C.T.)	Time of End of Disturbance (G.C.T.)	Amplitude. Mills.	Amplitude. In Arc.	Remarks.
	d	h m	h m	h m	h m			″	
429	Jan. 10	3.13·0	3.39·6	3.47·1	3.48·6 3.53·6	3.56·6	..	..	Thickening of trace.
430	„ 20	15.15·4	15.55·4	16. 9·4	16.16·4	17.20	..	..	
431	„ 29	0.32·8	..	..	0.33·3	1. 5	0·85	0·34	
432	„ 29	3¾	..	..	5.49	6¼	0·25	0·10	Frequent irregular thickenings of trace.
433	Feb. 4	21.10	..	..	21.11·7	21.13·7	..	..	Isolated; followed by occasional thickenings of trace.
	„ 4		21.57·7	22. 3·7	22.14·7	23. 4·7	0·4	0·13	
434	„ 9	8.47	..	..	..	8.55	..	..	
435	March 31	2.38·7	2.40·7	2.45·7	2.48·2	3.31·7	0·5	0·27	
436	„ 31	6. 9·7	..	6.16·7	6.18·7	6.31·7	0·4	0·33	
437	April 4	10.24·3	10.36·3	10.58·8	11.12·3	..	1·0	0·30	Register faint.
438	„ 5	10.36·9	10.53·4	11. 0·9	11. 3·4	11.27	0·3	0·09	
439	„ 11	14.42·8	..	14.50·8	14.55·3	15.15·8	0·3	0·09	
440	„ 24	7.12·3	..	7.22·8	7.26·8	..	0·4	0·12	
441	„ 26	10.11·9	..	..	..	10.22·9	..	..	Frequent irregular thickenings of trace.
442	May 1	7.21·4	..	7.28·4	7.29·4	8. 3·4	..	..	
443	„ 1	15.50·4	..	16. 5·4	16.16·9	16.51·4	1·0	0·30	
444	„ 2	0. 8·8	..	..	..	0.15·8	..	..	Several slight thickenings of trace.
445	„ 2	10.58·8	..	11. 1·8	11. 3·8	11.15·3	0·6	0·18	
446	„ 15	22.15·0	..	..	22.16·5	22.20·0	..	..	Isolated thickening of trace.
447	„ 19	16.27·9	..	..	16.30·9	16.35·9	..	..	„ „ „
448	„ 21	11.13·1	..	..	..	11.17·4	..	..	Very slight thickening of trace.
449	„ 26	4. 2·1	..	..	4. 7·1	4.19·1	0·3	0·09	Possibly air tremors.
450	„ 29	0. 8·7	..	0.14·7	0.19·7	0.30·2	0·8	0·24	Tremors for several hours afterwards.
451	„ 31	3.41·2	..	..	3.47·7	4. 0·2	0·3	0·09	Isolated thickening of trace.
452	June 25	15.12·5	..	..	15.16·0	15.20·5	..	..	Isolated; followed by occasional thickenings of trace.
	„ 25	..	15.35·5	15.46·0	15.54·5	17.35·5	2·0	0·60	
453	„ 25	21.21·1	..	22. 0·1	22. 9·6	23.41·1	..	..	
454	„ 26	2¼	..	..	..	3¼	..	..	Occasional thickenings of trace.
455	„ 27	0.28·2	..	1.11·7	1.38·2	4. 5·2	0·7	0·21	
456	July 23	0.56·1	..	1.16·1	1.19·6	1.39·6	..	..	
457	„ 23	..	..	..	16. 9·1	..	..	..	Register faint.
458	„ 25	1.58·6	..	..	2. 1·1	2. 5·1	0·5	0·15	Active air tremors commenced at 2½h.
459	„ 27	5.57·6	..	..	..	6. 3·6	..	..	Very slight thickening of trace.
460	„ 27	16.44·6	..	..	16.49·6	17. 7·6			

List of Earthquakes recorded by the Milne Seismograph at the Royal Alfred Observatory, Mauritius, during the Year 1904—*continued*.

Slide Register Number.	Mauritius Register Number.	1904. Date.	Time of Commencement of Preliminary Tremors (G.C.T.).	Time of Commencement of 2nd Phase (G.C.T.).	Time of Commencement of Large Waves (G.C.T.).	Time of Maximum (G.C.T.).	Time of End of Disturbance (G.C.T.).	Amplitude. Mills.	Amplitude. In Arc.	Remarks.
		d	h m	h m	h m	h m	h m		″	
..	461	Aug. 3	11.12	..	..	13 13·3	11.29·8	..	..	Irregular tremors. Clock error uncertain.
..	462	„ 3	12.37	..	..	12.45·3	13. 3·8	..	..	
877	463	„ 8–9	23.22·4	..	..	23.52·9	0. 4·9	..	..	Frequent thickenings of trace.
878	464	„ 11	6.43·3	..	..	..	7.26·3	..	..	„ „ „
..	465	„ 14	0.25·9	..	..	3.21·9	5.15·9	..	..	Active air tremors; some movements look seismic.
..	466	„ 18	2½	..	..	..	5½	..	..	„ „ „ „
..	467	„ 18–19	22.20	..	..	..	5.10	..	..	„ „ „ „
..	468	„ 23	13.20·5	..	..	..	13.25·5	..	..	Irregular thickenings of trace.
884	469	„ 24	20.36·3	21.23·8	21.45·3	23.0 ·8	23.25·3	0·9	0·27	
..	470	„ 25	0.0	..	..	..	6. 0	..	..	Active air tremors.
..	471	„ 27–28	22.0	..	..	..	5. 0	..	..	„ „ „ .
886	472	„ 30	12.2 ·5	12.13·5	12.16·5	12.23·5	12.51·5	0.8	0·24	
889	473	Sept. 11	4. 7·8	..	..	5.13·8	5.27·8	0·4	0·09	
		„ 11	6.15·8	6.18·8	6.21·8	6.24·8	6.53·8	0·4	0·09	
890	474	„ 13	18. 3·1	..	..	18.12·1	18.16·1	..	..	Isolated thickening of trace.
..	475	„ 16	13.39·8	..	..	13.44·8	13.46·8	..	..	„ „ „
892	476	„ 19	5.50·1	..	..	6. 1·0	6.31·6	..	..	Frequent thickenings of trace.
		„ 19	6.54·1	..	..	7.18·6	7.37·6	..	..	„ „ „
..	477	„ 25	15.30	..	..	..	16. 0	..	..	Frequent slight thickenings of trace.
..	478	„ 27	1. 0	..	..	..	4. 0	..	..	„ „ „ „
..	479	Oct. 2	2.52	..	..	..	3.42	..	..	
900	480	„ 3	..	3.15·2	3.16·7	3.19·7	5. 1·7	2·0	0·46	Register faint.
901	481	„ 4	2.43·8	2.51·3	3.15·8	3.17·8	4.19·8	..	..	
903	482	„ 8	17.1 ·1	..	..	17. 4·1	17. 7·1	..	..	
906	483	„ 11	6.23·9	..	..	..	7. 4·9	..	..	Frequent slight thickenings of trace.
..	484	„ 16	1.15·5	..	..	..	1.23·5	..	..	„ „ „ „
..	485	„ 25	10.42·3	..	..	..	11. 1·3	..	..	„ „ „ „
911	486	„ 28	14.7 ·8	..	14.16·8	14.19·3	14.48·3	2·2	0·51	Beginning of disturbance abrupt.
..	487	„ 31	21.0 ·8	..	..	..	21. 6·3	..	..	Frequent slight thickenings of trace.
..	488	Nov. 3	8¼	..	..	10. 1·8	12¼	..	..	Frequent air tremors; movement at time of max. looks seismic.
..	489	„ 5	7.57	..	..		8. 7	..	..	Frequent very slight thickenings of trace.
919	490	„ 6	0.10	..	..		2.10	..	..	Moderate air tremors } Possibly masked seismic movement.
		„ 6	2¾	..	..	..	8½	..	..	Active air tremors - }
..	491	„ 8	6¼	..	..	7.33·2	9¼	..	..	Frequent thickenings of trace.
..	492	„ 20	20¼	..	..	..	3¾	..	..	Active air tremors.
		„ 21	4. 0·8	..	4. 3·8	4.10·3	4.36·3	1·0	0·26	
..	493	„ 23	16.49·8	..	16.51·8	16.54·8	17. 6·8	1·0	0·26	
924	494	Dec. 1	20¼	..	..	..	3¾	..	..	Active air tremors.
		„ 2	3.35·5	..	3.44·0	3.46·5	3.58·5	0·7	0 22	
925	495	„ 4	3.51·6	..	..	3.54·1	3.59·1	0·4	0·13	In North-South only: barely perceptible in East-West.
		„ 4	4.40	..	..	4.44·1	4.48·1	0·6	0·19	
		„ 4	10.36·6	..	10.39·1	10.40·6	10.44·6	0·5	0·16	
937	496	„ 19	..	..	..	17.25·8	..	0·7	0·22	Masked by air tremors.
938	497	„ 20	5.43·8	..	..	5.46·8	5.48·8	..	..	Isolated thickening of trace.
		„ 20	6.3 ·8	6.18·3	6.22·8	6.24·8	..	0.5	0·16	
..	..	„ 20	..	6.48·8	6.56·8	7. 0·8	..	2·5	0 80	
939	498	„ 23	15.40·8	..	..	16.12·3	16.20·8	..	..	Frequent thickenings of trace.
940	499	„ 25	18¼	..	..	..	19¾	..	..	„ „ „
941	500	„ 28	17¼							

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1907.

INTRODUCTION—*concluded.*

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(The Results of Observations of Earth Tilts given in previous Volumes are not published in the present Volume, as it was found that until August 17, when the Seismograph was removed to the Magnet Basement, the Records were affected by a Lamp used at night to check Tremors.)

List of Earthquakes recorded by the Milne Seismograph at the Royal Alfred Observatory, Mauritius, in the Year 1905.

Slide Register Number.	Mauritius Register Number.	Date. 1905.	Time of Commencement of Preliminary Tremors (G.C.T.)	Time of Commencement of 2nd Phase (G.C.T.).	Time of Commencement of Large Waves (G.C.T.).	Time of Maximum (G.C.T.).	Time of End of Disturbance (G.C.T.).	Amplitude. Mills.	Amplitude. In Arc.	Remarks.
		d	h m	h m	h m	h m	h m		″	
..	501	Jan. 8	..	..	19.59	20. 2·5	20. 9	..	..	Mere thickening of the trace.
948	502	,, 9	..	..	6.43·5	6.47·5	6.49	..	..	,, ,, ,,
..	503	,, 10	..	..	23 2	23. 3·5	23. 6	..	..	,, ,, ,,
..	504	,, 13	13. 2.5	13.44	13.46·5	13.47·5	13.52·5	1·0	0·28	
949	505	,, 13	13.58·5	14. 5	14. 9·5	14.12·5	14.39·5	1·2	0·34	
..	506	,, 13	15.38·5	15.43·5	15.46·5	15.49	15.56	0·8	0·22	
..	507	,, 20	..	..	22.56	22.58·5	23. 0·5	0·5	0·14	
955	508	,, 22	..	3. 3·5	3.17·5	3.20	4. 4·5	2·5	0·70	
960	509	Feb. 13	5.48·5	..	6.15·5	6.21	..	..	..	Register faint.
..	510	,, 13	7.36·5	..	..	..	7.55	..	..	Several thickenings of the trace.
..	511	,, 13	18.18·5	..	..	..	18.55·5	..	..	In E.–W.; slight thickenings. Larger in N.–S. with max. $18^h\cdot37^m$.
961	512	,, 14	..	..	..	10. 2·5	..	3·0	0·84	Two minutes earlier in N.–S.
962	513	,, 15	6. 0·5	..	..	..	7·55·5	..	..	Thickenings of trace.
963	514	,, 17	12. 1	12. 8	12.15·5	12.18	12.43	..	..	Thickening of trace.
964	515	,, 19	5. 3	5.11·5	5.25	5.33	5.45	1·0	0·27	Registered in N.–S.; lost in E.–W.
966	516	,, 27	18.50	..	19.16	19.18·5	19.30·5	0·7	0·19	In N.–S.
			18.51	..	19.20	19.32·5	19.47·5	1·5	0·42	In E.–W.
967	517	March 4	16.23	..	16.56·5	17. 1	17.25	..	..	Thickening of the trace.
969	518	,, 5	..	..	0.19·5	0.19·5	..	..	..	Registered in N.–S.; lost in E.–W.
976	519	,, 18	13.10·5	..	..	13.16	13.28	..	..	Thickening of the trace.
977	520	,, 19*	..	0.23.5	0.51	0.57·5	..	11·5	3·22	
						1. 1·5		6·0	1·68	
						1. 7		4·0	1·12	
..	521	,, 22	3.49·5	..	4. 0·5	4. 1·5	4.20·5			Thickening of the trace.
		,, 22	..	4.35	4.38	4.45·5	6. 0·5	1·0	0·28	Max. in N.–S. occurred 2½ mins. earlier.
982	522	April 4	1. 0	1. 8	1.16	1.22·5	..	..	..	Rooms crossed; amplitude uncertain.
..	523	,, 10	17.19	..	17.27	17.34	17.46	..	..	Thickening of the trace.
..	524	,, 12	8.14	..	..	..	9. 4	..	..	Several thickenings of the trace.
..	525	,, 20	..	..	..	18.28·5	..	..	..	Register faint.
..	526	,, 29	9.42	..	9.46·5	9.48	9.57	0·8	0·16	

LIST of EARTHQUAKES recorded by the MILNE SEISMOGRAPH at the ROYAL ALFRED OBSERVATORY, MAURITIUS, in the YEAR 1905—*continued.*

Slide Register Number.	Mauritius Register Number.	Date. 1905.	Time of Commencement of Preliminary Tremors (G.C.T.).	Time of Commencement of 2nd Phase (G.C.T.).	Time of Commencement of Large Waves (G.C.T.).	Time of Maximum (G.C.T.).	Time of End of Disturbance (G.C.T.).	Amplitude. Mills.	Amplitude. In Arc.	Remarks.
		d	h m	h m	h m	h m	h m.		″	
..	527	May 8–9	20.20	..	..	..	0.20	..	..	Successive series of active irregular movements, which do not appear to be of seismic origin.
..	..	,, 9	0.42	..	..	..	1. 5	..	..	
..	..	,, 9	1.16	..	..	..	1.23	..	..	
..	..	,, 9	2.13	..	..	..	2.33	..	..	
..	528	,, 17	10.52	..	..	10.55·5	11. 6	..	..	Irregular thickening of the trace.
1000	529	,, 18	13.59	14.10·5	14.33	14.38	15.22·5	1·2	0·24	
..	530	,, 27	0.54·5	..	..	..	2.35·5	..	..	
1010	531	June 2	..	..	6. 3·5	6. 7·5	6.11	..	..	Thickening of the trace.
..	532	,, 2	..	..	7.48·5	7.51·5	7.56	..	..	,, ,, ,,
..	533	,, 5	..	..	..	14.36		0·4	0·11	,, ,, ,,
1018	534	,, 9	12.47·5	12.54	12.56	12.57·5	13.16	1·1	0·31	
					13.25	13.26·5	13.47	0·5	0·14	
						13.30		0·6	0·17	
1020	535	,, 12	6.12	..	..	..	6.35	..	..	Thickening of the trace.
1021	536	,, 14	12.22	..	12.38	12.40·5	13. 3	1·0	0·28	
1025	537	,, 30	16.52·5	..	17.36	17.37·5	..	0·5	0·14	
						17.42		1·2	0·34	
					18. 0	18. 3·5		2·5	0·70	
1038	538	July 11	9.45·5	..	9·54·5	9.56	9.58·5	..	..	Thickening of the trace.
..	539	,, 17	6.29·5	..	..	..	6.35	..	..	,, ,, ,,
..	540	,, 18	10.12	..	..	10.13·5	10.15	..	..	,, ,, ,,
1052	541	,, 23	..	3. 9·5	3.24	3.34·5	..	14·0	3·92	*See* Plate I.
..	542	Aug. 3	..	..	..	9.19·5	..	..	..	Register faint.
1059	543	,, 8†	..	..	14. 3	14. 5·5	..	..	..	Register faint; thickening of the trace.
1064	544	Sept. 8	..	..	2. 3·5	2.4	2.18	..	..	Thickening of the trace.
..	545	,, 14	..	..	..	21.6	..	..	..	Registered in N.–S. only.
1065	546	,, 15	..	7.4	7.11	7.15	9.12	3·5	1·43	
..	547	,, 17	0.25	..	..	..	0.32			Thickening of the trace.
1070	548	,, 26	1.55	..	..	1.59	2.12·5	..	..	In E.–W.; thickening of the trace.
		,, 26	1.43	..	1.53	1.56	2.7	0·5	0·18	In N.–S.; thickening of the trace.
..	..	,, 29	..	..	12.12·5	12.14	12.48	0·5	0·20	
..	549	Oct. 19	..	..	..	16.32	..	0·8	0·39	Felt at Six Islands; register faint.
1087	550	Nov. 8	22.35	..	22.46	22.54	23.23	0·5	0·26	
1096	551	Dec. 4	7.36·5	..	7.39	7.40·5	8. 4·5	0·65	0·26	
1101	552	,, 17	7. 3·5	..	..	7.18·5	7.37	0· 5	0·20	
..	553	,, 19	..	..	..	13.28·5	..	..	..	Thickening of the trace.

RESULTS

OF THE

MAGNETICAL AND METEOROLOGICAL OBSERVATIONS

MADE AT

THE ROYAL ALFRED OBSERVATORY, MAURITIUS,

IN THE YEAR

1906.

UNDER THE DIRECTION OF

T. F. CLAXTON, F.R.A.S.

LONDON:
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PAGE

APPENDIX—*continued.*

APPENDIX.

RESULTS

OF

SEISMOLOGICAL OBSERVATIONS.

1906.

APPENDIX.

RESULTS

OF

SEISMOLOGICAL OBSERVATIONS,

1906.

Introduction.

The Seismograph used for the registration of unfelt earth movements is of the Milne pattern, recommended by the Seismological Committee of the British Association for the Advancement of Science, and described in the Annual Report of the Committee for the year 1896.

The instrument is mounted in the north-east corner of the Magnet Basement, on a concrete pillar which rises from a foundation of the same material, $8\frac{1}{2}$ feet deep and 4 feet square. The pillar, which projects 4 feet above the floor, is 6 feet high and tapers from 4 feet square at the base to $1\frac{1}{2}$ feet at the top. It is not in contact with the earth on any side, so that the instrument records the movements of the concrete foundation, the base of which is $10\frac{1}{2}$ feet below the level of the floor and $22\frac{1}{2}$ feet below the level of the ground.

On 1902, February 7, a second pendulum was added to the instrument for the registration of earth movements in a north-south direction, and arranged to record on the same strip of paper as the original pendulum.

When removed to the Magnet Basement on 1905, August 17, the instrument was orientated with its booms in an east-west direction, so that this component is now registered by the new and the north-south component by the original pendulum.

For further particulars concerning the working of the instrument, reference may be made to the volumes for 1902 and 1903 (Appendix).

Particulars of 64 earthquakes registered during the year 1906 are given on pp. (lxviii) and (lxix).

It will be seen that the time of vibration of both booms varies considerably. It is the practice, therefore, to determine it at short intervals, and use mean values for periods during which the variations are relatively small. It should be mentioned that the probable error of observation amounts to $0^m \cdot 02$ when the time of vibration is small, or when the pendulum comes to rest too quickly, also the experiments indicate that the relation between α and τ depends to a small extent on the position of the pivot in the agate cup, owing to imperfections in the form of one or other, or both. For these reasons the adopted scale values may occasionally differ by 10 per cent. from the true value. This will affect all absolute values; but in the case of mean monthly diurnal inequalities the form of the curve, if not the amplitude, may be considered correct. For various reasons, in some months only a few days' registers were available; the monthly means are therefore not strictly comparable, apart from errors in the adopted scale values.

The diurnal range of level given on pp. (lxx) to (lxxii) refers to the civil day, and the progressive change of level is the excess of the ordinate at 24^h over the ordinate at 0^h on each day, the sign (+) indicating a tilt to north or east, and the sign (—) a tilt to south or west. The gradual tilting of the pillar is shown graphically on Plate III. The diagram has been constructed by plotting the accumulated changes of level as rectangular co-ordinates from a fixed point.

After irregular wanderings with very little resultant movement during the first three months of the year, the pillar tilted more or less steadily to north-north-east until May 14, to the extent of 14″, and from thence tilted 24″ to east-north-east by a series of irregular movements The resultant tilt from January 1 to December 31 was $40'' \cdot 4$ in a direction N. 44° E.

In determining the mean diurnal inequality of level for each month (p. (lxxiii)), only those days have been included for which complete and undisturbed registers of both north and east components are available. The non-periodic variations have been eliminated by applying to each mean hourly value the correction—

$$\gamma = (h - 12)\ (x_0 - x_{24})/24,$$

where γ is the correction to be applied to the mean monthly value at the hour h, and x_0, x_{24}, the mean monthly values at the hours 0^h and 24^h respectively.

The monthly mean north and east components of tilt are shown graphically on Plates 4 and 5, and to illustrate more clearly the nature of the diurnal tilting of the pillar, vector diagrams for each month, showing the amount and direction of tilt from hour to hour, have been constructed by plotting the north and east components as rectangular co-ordinates from a fixed point (Plate VI).

The vector diagrams are widely different in different months; though a tilt to north or north-east from about 7^h to 17^h, and thence back to south or south-east,

is shown in each month. In January, February, and December, the second branch of the curve (from north to south) lies to the east of the first branch, and in March, April, May, August, September, October, and November, to the west, while in June and July the two branches are nearly coincident. In each month the movement was most rapid during the hottest hours of the day. The greatest amplitude of motion occurred in April and the least in July. The October curve enclosed the greatest area and the July curve the least.

Comparing the diagrams with those for the years 1902 and 1903, when the instrument was in the electrometer hut, and subjected to the influence of a lamp used at night to check air tremors, we find that the phase has been altered by approximately 12 hours, though the direction of tilt has not been greatly altered. The amplitude of motion has been reduced in the proportion of about 4 to 1.

The north and east components of the true solar diurnal inequality of level for each month have been subjected to harmonic analysis and the results given on pp. (lxxiv) and (lxxv).

LIST of EARTHQUAKES recorded at the ROYAL ALFRED OBSERVATORY, MAURITIUS, in the YEAR 1906.

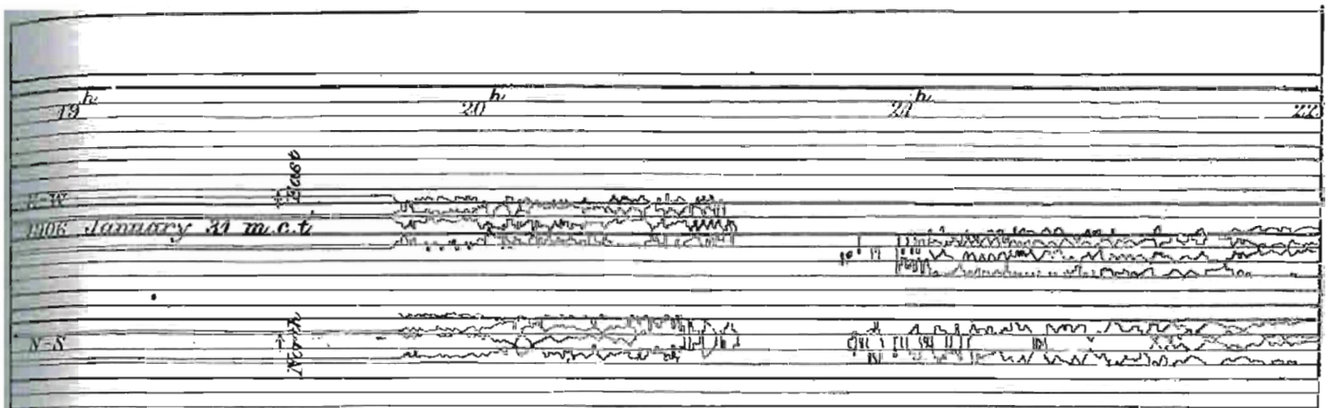
Shide Register Number.	Mauritius Register Number.	Date, 1906.	Time of Commencement of Preliminary Tremors (G.C.T.).	Time of Commencement of 2nd Phase (G.C.T.).	Time of Commencement of Large Waves (G.C.T.).	Time of Maximum (G.C.T.).	Time of End of Disturbance (G.C.T.).	Amplitude. Mills.	Amplitude. Arc.	Remarks.
		d	h m	h m	h m	h m	h m		"	
..	554	Jan. 2	2.14·5	..	..	2.17	2.19	..	..	Thickening of trace.
..	555	„ 19	9¼	..	..	..	9¾	..	..	Several slight irregular movements.
..	556	„ 22	4.56	..	5. 3	5. 6·5	5.14	..	..	Thickening of trace.
..	557	„ 31	15.24	..	..	..	15.38·5	..	..	First preliminary tremor.
				15.58	..	16.56	19.15	20·0	8·8	*See* Plate II.
..	558	Feb. 2	0.39	..	..	0.45	0.54·5	..	..	Thickening of trace.
..	559	„ 2	18. 0	..	18. 7·5	18.13	18.29	1·0	0·3	
..	560	„ 3	22. 2·5	..	..	22. 7·5	22.10	..	..	Thickening of trace.
..	561	„ 5	5.11	..	..	5.14·5	5.29	0·5	0·1	
..	562	„ 10	9.20	..	..	9.28	9.36	..	..	Thickening of trace.
..	563	„ 19	2.25	2.49	2.55·5	3. 1	5	2·5	0·7	
..	564	„ 27	19.58·5	20.11·5	..	20.18	..	0·5	0·1	
..	565	March 9	20.11	..	..	20.21·5	20.39	..	..	Thickening of trace.
..	566	„ 21–22	23.57·5	..	0. 4·5	0. 6·8	0½	1·5	0·6	
..	567	„ 22	6.20	..	..	6.22	6.24	..	..	Thickening of trace.
..	568	„ 25	22.15	..	..	..	22.46	..	..	Frequent thickenings.
..	569	„ 26	6.59	..	..	..	7. 0	..	..	Very slight movement.
..	570	„ 27	5.14	5.21	..	5.34	5.52	1·0	0·4	Sheet changed at 5ʰ.25ᵐ.
..	571	„ 28	18.53	..	..	19. 2	19.16	..	..	Thickening of trace.
..	572	April 2	11.56·5	..	..	11.57·5	12. 0	..	..	Thickening of trace.
..	573	„ 14	4.20·5	..	..	..	5. 7	..	..	In E.–W. Several thickenings of
		„ 14	4.21	4.28	4.51·5	4.53·5	5.33	0·5	0·1	In N.–S. [trace.
..	574	„ 18	13.41	13.58	..	14.50	17	5·0	2·0	*See* Plate II.
..	575	„ 19	7.17	..	..	7.49·5	8.37	..	..	Thickening of trace.
..	576	„ 20	5.50	..	..	..	9.35	..	..	Frequent small tremors.
..	577	„ 23	4.39	..	..	..	6.17	..	..	Thickening of trace.
..	578	„ 25	8.55	..	..	9. 9	9.24	..	..	„ „
..	579	„ 25	1.57	..	..	2.16·5	2.23	..	..	„ „
..	580	May 4	6.10·5	..	..	..	6.14·5	..	..	Isolated thickening of trace.
..	581	„ 5	0.49·5	..	..	0.50·5	1.37	..	..	Several slight thickenings of trace.
..	582	„ 14	4.57·5	..	..	5.23·5	5.28·5	..	..	Slight thickenings of trace.
..	583	„ 21	13.30	..	..	13.36·5	13.49·5	..	..	Thickening of trace.

LIST of EARTHQUAKES recorded at the ROYAL ALFRED OBSERVATORY, MAURITIUS, in the YEAR 1906—*continued.*

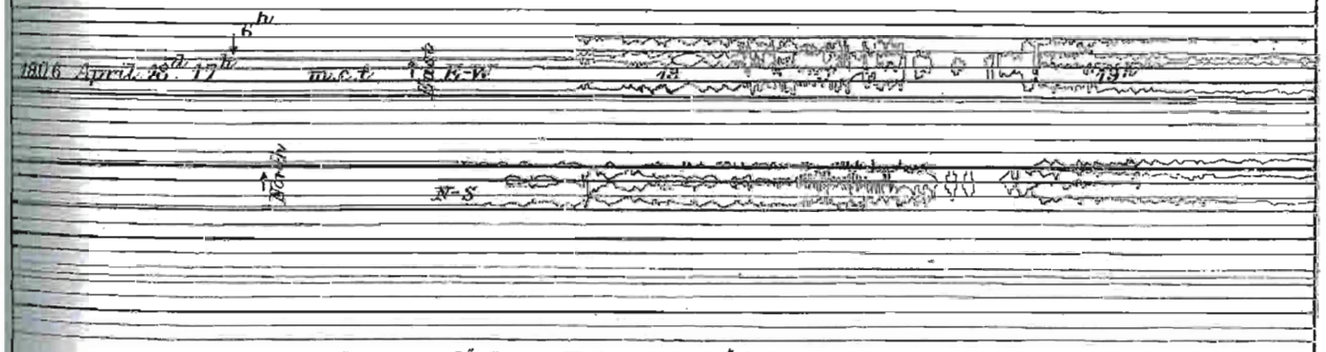
Shide Register Number.	Mauritius Register Number.	Date. 1906.	Time of Commencement of Preliminary Tremors (G.C.T.).	Time of Commencement of 2nd Phase (G.C.T.).	Time of Commencement of Large Waves (G.C.T.).	Time of Maximum (G.C.T.).	Time of End of Disturbance (G.C.T.).	Amplitude. Mills.	Amplitude. Arc.	Remarks.
		d	h m	h m	h m	h m	h m		″	
..	584	June 1	5.42	..	..	..	6.35·5	..	..	Thickening of trace.
..	585	„ 2	14.45	..	..	15.17·5	15.35	..	..	„ „
..	586	„ 3	4·53	..	..	4.53·5	4.57	..	..	„ „
..	587	„ 8	4.17·5	..	..	4.18·5	5.11	..	..	„ „
..	588	„ 9	7.39	..	7.40	7.41·5	7.47	..	..	„ „
..	589	„ 10	21. 3.5	..	..	21.12	21.36	..	..	„ „
..	590	„ 19	11.28	11.43	12. 8	12. 9	12.40	1·0	0·4	
..	591	„ 20	3.39	..	..	3.51·5	4.2	..	..	Thickening of trace.
..	592	„ 22	8.54·5	..	..	8.59·5	9.10	..	..	„ „
..	593	„ 24	7.22	..	..	7.27	..	..	..	„ „
..	594	„ 24	11.33	..	11.42	11.49	11.53	1·0	0·4	
..	595	July 14	0.14·5	..	0.37·5	0.41·5	1. 1	1·0	0·4	
..	*596	„ 15	8.50	..	..	8.54·5	9. 0	..	..	Thickening of trace in N.–S.
..	*597	„ 15	11.58·5	..	12. 1	12.3	12.11	..	..	„ „ „
..	*598	„ 20	11.56	..	11.59	12. 1·5	12.35	..	..	„ „ „
..	599	„ 22	18.37	..	..	18.39	19.16	4·0	1·6	
..	600	Aug. 18	0.38	..	..	1.40	4¾	7±	2·8	*See* Plate II.
..	601	„ 19	7¾	..	..	10.29	11½	..	..	Thickening of trace.
..	*602	„ 25	12. 7	12.10	..	12.18·5	12.54	0·5	0·1	In N.–S.
..	*603	„ 25	13.55·5	14. 0·5	14. 3	14.12	16	2·0	0·4	„
..	*604	„ 26	..	..	..	7.13	8.18	0·5	0·1	In N.–S. Sheet changed at 6.40. Beginning lost.
..	*605	„ 30	3. 0	3.10	..	3.51·5	5	0·5	0·1	In N.–S.
..	*606	Sept. 7	19.15	..	..	19.58	21.40	..	..	Thickening of trace in N.–S.
..	607	„ 12	..	4.36	..	4.42	..	..	..	Record defective. Paper loose.
..	608	„ 14	11.18	..	..	12. 6	12.43	..	..	Thickening of trace.
..	609	„ 14	14.20	14.30·5	14.56	15 0	17¾	4·5	1·8	In E.–W. } A marked change of
		„ 14	14.20	14.31	..	14.59·5	17¾	1·6	0·6	In N.–S. } period of vibration occurred in E.–W. at 14d.48h, and in N.–S. at 14d.43h·5.
..	610	„ 17	7. 3	..	..	..	7. 9	..	..	Isolated tremor.
		„ 17	..	7.29	..	7.48·5	7.59	..	..	
..	*611	„ 20	17.59	..	..	..	18. 9	..	..	Isolated tremor.
		„ 20	..	18.25	18.34	18.44	19	0·5	0·3	In N.–S. only.
..	*612	„ 21	1.49·5	..	..	..	1.53	..	..	Isolated tremor.
		„ 21	..	2.11	..	2.17	2.39	..	..	In N.–S. only.
..	613	Oct. 2	0. 3	..	0.14	0.15·5	1.40	1·0	1·0	In E.–W. } A marked change in
		„ 2	0. 3	..	0.14	0.45·5	3	1·0	0·6	In N.–S. } period of vibration occurred in both booms at 0h.33m.
..	*614	„ 2	12.29·5	..	12.47	12.49	12.55	1·0	0·6	Very small movements in E.–W.
..	*615	„ 24	15. 2	..	15.13	15.18·5	15.58	1·5	0·9	In N.–S. only.
..	616	Nov. 19	7.27	..	7.38·5	7.41	9	3·0	3·0	
..	617	Dec. 19	1.35	..	..	1.45	2. 5	..	..	} Frequent thickenings of trace.
		„ 19	2. 8	..	..	2.27	3. 2	..	..	

PLATE 2.

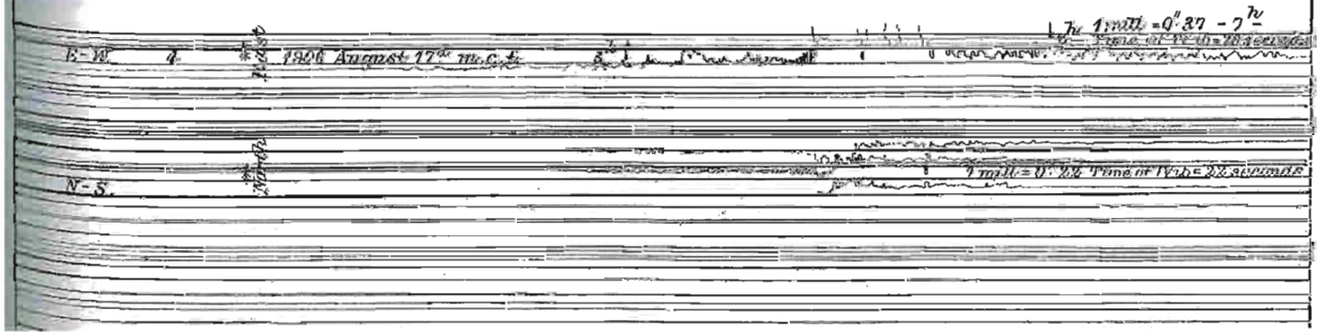
EARTHQUAKES RECORDED AT THE ROYAL ALFRED OBSERVATORY, MAURITIUS, DURING THE YEAR 1906.



1 m.m. = 0'·44 in E-W and 0'·58 in N-S booms.



1 m.m. = 0'·5 in E-W and 0'·35 in N-E boom.



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A. WALTER, F. R. A. S.—Director.

MAURITIUS :

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APPENDIX—*continued.*

APPENDIX 2.

RESULTS

OF

SEISMOLOGICAL OBSERVATIONS.

1907.

APPENDIX 2.

RESULTS

OF

SEISMOLOGICAL OBSERVATIONS,

1907.

Introduction.

The Seismograph used for the registration of unfelt earth movements is of the Milne pattern, recommended by the Seismological Committee of the British Association for the Advancement of Science, and described in the Annual Report of the Committee for the year 1896.

The instrument is mounted in the north-east corner of the Magnet Basement, on a concrete pillar which rises from a foundation of the same material, 8½ feet deep and 4 feet square. The pillar, which projects 4 feet above the floor, is 6 feet high and tapers from 4 feet square at the base to 1½ feet at the top. It is not in contact with the earth on any side, so that the instrument records the movements of the concrete foundation, the base of which is 10½ feet below the level of the floor and 22½ feet below the level of the ground.

On 1902, February 7, a second pendulum was added to the instrument for the registration of earth movements in a north-south direction, and arranged to record on the same strip of paper as the original pendulum.

On removal to the Magnet Basement on 1905, August 17, the instrument was orientated with its booms in an east-west direction, so that this component is now registered by the new pendulum, and the north-south component by the original pendulum.

For further particulars concerning the working of the instrument, reference may be made to the volumes for 1902 and 1903 (Appendix).

Particulars of 55 earthquakes registered during the year 1907 are given on pp. (ixxvii) and (lxxviii), and the seismograms of those recorded on January 4 and April 15 are reproduced on Plate 13.

In addition to earthquake movements, the instrument records gradual changes of level, for the study of which the ordinates of the seismograms are measured at every hour of the day (commencing at Mauritius mean midnight). The mean hourly ordinates in each month,

the progressive change, and daily ranges of level from January 1 to November 21 were converted into angular measure by the formulæ :—

$$\alpha = \cdot0422/\tau^2 - \cdot098 \text{ for the original pendulum,}$$
$$\alpha = \cdot0544/\tau^2 - \cdot122 \text{ for the new pendulum,}$$

where α is the angular value (in seconds) of 1 division of the scale and τ the time of vibration of the pendulum (in minutes).

These formulæ were deduced from simultaneous observations of the time of vibration and scale value at varying sensibilities, made in the month of August.

On November 23 new, truly spherical agate cups were fitted to the booms of the Seismograph, in place of the original cups which were conical. The bearing surfaces of the new cups are portions of spheres of 3 millimetres radius.

With the new cups the booms appear to vibrate more freely and the logarithmic decrement is less.

The following formulæ, for converting scale divisions into angular measure were deduced from observations made on November 26, 27, 29 and December 2.

$$\delta = \cdot0528/\tau^2 - \cdot000095/\tau^4 - \cdot2398 \text{ for the original pendulum,}$$
$$\delta = \cdot0520/\tau^2 - \cdot000107/\tau^4 - \cdot0786 \text{ for the new pendulum.}$$

The observed times of vibration of the booms during the year 1907 were as follows :—

Date, 1907.	Pendulum.		Date, 1907.	Pendulum.		Date, 1907.	Pendulum.	
	Original.	New.		Original.	New.		Original.	New.
January.	mins.	mins.	May.	mins.	mins.	September.	mins.	mins.
10	0·29	...	7	...	0·26	4	0·31	...
11	·32	0·25	8	0·35	...	19	·33	0·43
18	·29	·28	10	·27	·22	27	·36	·40
23	·26	...	13	...	·28	30	·37	·43
30	·35	·26	28	·30	·25			
February.			29	·35	·27	October.		
11	·28	·24	June.			1	·30	·43
March.			2	·35	...	4	·40	·40
3	·24	...	4	·31	·32	8	·33	·27
5	·30	·30	7	·36	·32	21	·27	·23
7	·34	...	11	·29	·30	27	·28	...
9	·44	·30				29	...	·33
12	·45	·32	July.			31	·26	·24
13	·45	·35	11	·28	·22			
18	·39	·30	13	·34	·29	November.		
23	·37	·22	18	·26	·32	2	·32	...
28	·30	·26	22	...	·29	6	·36	·35
April.			24	·31	·25	11	·29	·24
6	·40	·26	26	·26	·32	13	·38	·28
13	·39	...	August.			18	·30	·21
16	·40	·30	1	...	·33	20	·34	·39
20	·38	...	2	·28	·21	30	·42	·39
21	...	·36	7	...	·33			
26	·29	·28	10	·23	·26	December.		
27	...	·27	16	·30	·25	3	·38	...
28	·36	...	18	·30	·22	9	·33	...
May.			23	·33	·32	18	·29	·28
3	·31	·33	24	·27	·26	26	·31	...
4	·33	·27	26	·26	...	28	·29	·19

It will be seen that the time of vibration of both booms varies considerably. It is the practice, therefore, to determine it at short intervals, and use mean values for periods during which the variations are relatively small. It should be mentioned that the probable error of observation amounts to $0^m{\cdot}02$ when the time of vibration is small, or when the pendulum comes to rest too quickly, also the experiments indicate that the relation between a and τ depends to a small extent on the position of the pivot in the agate cup, owing to imperfections in the form of one or other, or both. For these reasons the adopted scale values may occasionally differ by 10 per cent. from the true value. This will affect all absolute values ; but in the case of mean monthly diurnal inequalities, the form of the curve, if not the amplitude, may be considered correct. For various reasons, in some months, only a few days' registers were available, the monthly means are therefore not strictly comparable, apart from errors in the adopted scale values.

The diurnal range of level given on pp. (lxxix)–(lxxxi) refers to the civil day, and the progressive change of level is the excess of the ordinate at 24^h over the ordinate at 0^h on each day, the sign (+) indicating a tilt to north or east, and the sign (−) a tilt to south or west.

The gradual tilting of the pillar is shown graphically on Plate 14. The diagram has been constructed by plotting the accumulated changes of level as rectangular co-ordinates from a fixed point. It is, however, incomplete, owing to the loss of register mentioned above. The total change of level during the year was probably greater than that shown in the diagram. The relatively rapid tilt to South after the introduction of new cups is worthy of note and suggests the possibility of instrumental change.

In determining the mean diurnal inequality of level for each month page (lxxxii), only those days have been included for which complete and undisturbed registers of both north and east components were available. The non-periodic variations have been eliminated by applying to each mean hourly value the correction—

$$\gamma = (h - 12)\ (x_0 - x_{24})/24,$$

where γ is the correction to be applied to the mean monthly values at the hour h, and x_0, x_{24}, the mean monthly values at the hours 0^h and 24^h respectively. Accidental irregularities have been eliminated by hand smoothing.

The monthly mean north and east components of tilt are shown graphically on Plates 15 and 15 (bis), and to illustrate more clearly the nature of the diurnal tilting of the pillar, vector diagrams for each month, showing the amount and direction of tilt from hour to hour, have been constructed by plotting the north and east components as rectangular co-ordinates from a fixed point (Plate 16).

The vector diagrams are widely different in different months ; though in each month a tilt to north or north-east from about 7^h to 17^h, and thence back to south or south-east, is shown, the movement being most rapid during the hottest hours of the day. The variation in the form of the curves from month to month is due partly to the large variation in the number of days' registers available in different months. For this reason the results for the year 1907 have not been subjected to Harmonic Analysis.

LIST of EARTHQUAKES recorded at the ROYAL ALFRED OBSERVATORY, MAURITIUS, in the YEAR 1907.

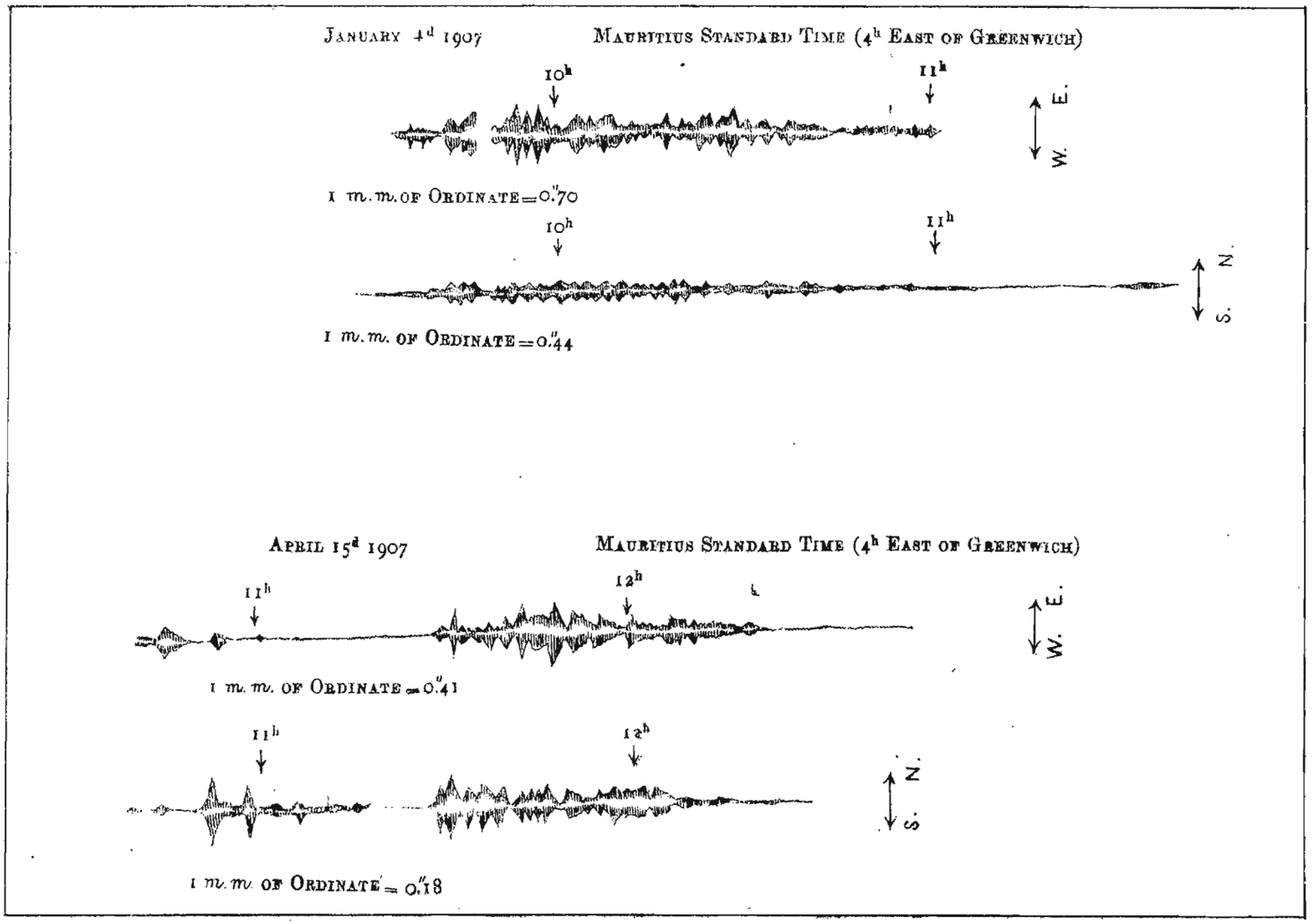
Shide Report Number.	Mauritius Register Number.	Date, 1907.	Time of Commencement of Preliminary Tremors (G.C.T.)	Time of Commencement of 2nd Phase (G.C.T.)	Time of Commencement of Large Waves (G.C.T.)	Time of Maximum (G.C.T.)	Time of End of Disturbance (G.C.T.)	Amplitude. Mills.	Amplitude. Arc.	Component.	Remarks.
		d.	h. m.	h. m.	h. m.	h. m.	h. m.		"		
1327	618	Jan. ... 2	11.25·0	...	...	11.29·0	11.36·5	1·0	0·2	N. - S.	Very slight in E.-W.
			...	11·55·5	...	12. 3·0	...	2·0	0·5		
1328	619	,, 4	5.31·5	...	5.38·0	5.55·0	7.32·5	4·0	1·2	E. - W.	*See* Plate III.
	620	,, 15	17.29·0	...	...	17.31·4	17.38·5	...	...	E. - W.	End in N.-S. uncertain.
			17.30·0	...	17.34·5	17.37·5	?	...	...	N. - S.	
	621	,, 27	18.13·2	...	...	18.14·2	18.15·7	...	...	N. - S.	Two independent thickenings of the trace.
			18.17·2	...	18.18·7	18.19·2	18.22·7	...	...		
	622	Feb.... 3	20.16·8	...	...	20.17·8	20.23·8	...	...	E. - W.	Commencement sudden in each component.
			20.27·8	...	20.29·8	20.30·3	20.35·3	...	...	N. - S.	
1347	623	,, 24	7.28·0	...	7.32·0	7.34·0	7.43·0	1·0	0·3	E. - W.	
	624	March 13	1.27·3	...	1.44·3	1.47·3	1.51·3	...	...	N. - S.	
	625	,, 18	18.48·0	...	...	18.49·0	18.51·0	0·6	0·2	N. - S.	Seismic origin doubtful.
	626	,, 24	0.25·5	...	...	...	0.27·5	1·0	0·2	E. - W.	
			0.25·5	...	0.26·5	0.27·5	0.33·0	1·0	0·4	N. - S.	
	627	,, 24	11.39·5	...	...	...	12.56·5	...	...	N. - S.	
	628	,, 24	19.26·5	...	...	19.27·5	19·29·5	1·0	0·2	E. - W.	Thickening of the trace.
			19.23·5	...	...	...	19.29·5	0·5	0·2	N. - S.	
1351	629	,, 29	21. 5·7	...	...	21.11·2	21.38·7	...	...	N. - S.	Several slight thickenings of trace.
	630	,, 31	8.43·1	...	...	...	8.56·1	...	...	N. - S.	Slight thickenings of trace.
1352	631	,, 31	22±	...	22.48·0	22.53·5	23. 3±	0·5	0·2	E. - W.	
			22.11·5	...	22.13·0	22.17·0	?	1·0	0·2	N. - S.	
	632	April... 4	0.39·2	...	...	0.40·0	1. 0±	1·0	0·2	E. - W.	
			0.37·5	...	...	0.41·0	0.47·0	0·5	0·2	N. - S.	
	633	,, 13	19.40·8	...	...	...	20.15·8	0·5	0·2	N. - S.	Irregular movements which do not appear to be of seismic origin.
1361	634	,, 15	6.27·5	...	6.45·0	6.46·0	7. 8·5	2·0	0·6	E. - W.	*See* Plate III.
			...	...	7·32·5	7.49·0	9.12·0	3·0	0·9		
1363	635	,, 19	...	...	...	0.35·9	...	?	...	E. - W.	Faint in E.-W.
			0.14·4	...	...	0.24·4	0.29·4	1·5	0·6	N. - S.	
	636	,, 23	10. 5·5	...	...	10. 7·0	10. 8·5	1·0	0·3	E. - W.	
			10. 7·5	...	...	...	10. 9·0	1·5	0·4	N. - S.	
	637	,, 24	12. 1·0	...	...	12. 3·0	12. 9·0	1·5	0·6	N. - S.	
	638	,, 25	20.44·5	...	...	...	20.52·0	...	...	N. - S.	Isolated thickenings.
			21.10·5	...	...	...	21.20·5	...	...		
	639	May... 2	18.11·0	...	...	18.14·0	18·19·0	1·0	0·3	N. - S.	
	640	,, 5	3.10·3	...	...	3.13·8	3.16·3	0·5	0·2	E. - W.	
	641	,, 6	1.46·8	...	...	1.47·8	1.51·3	0·5	0·2	N. - S.	
	642	,, 11	20.39·6	...	...	20.40·1	20.44·1	0·5	0·2	E. - W.	
1386	643	,, 25	12.10·9	12.26·4	12.31·4	12.34·9	12.53·4	0·5	0·2	E. - W.	A max in 2nd Phase at 12h 28m 9.
1389	644	,, 31	13.10·5	13.12·5	13.17·5	13.19·5	13.54·5	...	...	N. - S.	indistinct in E.-W.
1390	645	June... 1	9.46·0	9.52·5	9.57·0	10. 3·0	10.42·0	...	...	E. - W.	
			9.42·5	...	9.52·5	9.54·5	9.43·0	1·5	0·5	N. - S.	

LIST of EARTHQUAKES recorded at the ROYAL ALFRED OBSERVATORY, MAURITIUS, in the YEAR 1907.—*concluded.*

Shide Register Number.	Mauritius Register Number.	Date, 1907.	Time of Commencement of Preliminary Tremors (G.C.T.)	Time of Commencement of Principal Phase (G.C.T.)	Time of Commencement of Large Waves (G.C.T.)	Time of Maximum (G.C.T.)	Time of End of Disturbance (G.C.T.)	Amplitude. Mills.	Amplitude. Arc.	Component.	Remarks.
		d.	h. m.	h. m.	h. m.	h. m.	h. m.		″		
1393	646	June... 5	...	...	4.38·0	4.44·0	5. 6·5	2·0	0·4	E. - W.	Register at beginning lost.
	647	„ 6	0.18·1	...	...	0.21·1	0.24·6	...	...	E. - W.	
			0.20·1	...	...	0.21·1	0.23·1	...	...	N. - S.	
1405	648	„ 25	18.16·0	...	...	18.16·5	19. 2·0	0·5	0·2	N. - S.	
	649	„ 29	6. 8·3	...	...	6.14·8	6.25·3	...	...	E. - W.	
1410	650	July ... 4	9.36·0	...	9.46·5	9.47·5	9.54·5	0·5	0·2	E. - W.	
1414	651	„ 9	19.16·7	...	19.32·7	19.36·2	19.53·7	0·5	0·2	E. - W.	
1419	652	„ 20	13.51·3	14. 0·8	14.20·3	14.23·8	14. ¾·	1·0	0·3	E. - W.	
			14. 0·8	...	...	14.11·8	...	...	...	N. - S.	
	653	„ 21	7. 4.0	...	...	...	7. 8·0	...	...	N. - S.	
1422	654	„ 29	1. 0·8	...	1.13·3	1.14·3	1.34·3	...	...	E. - W.	
			1. 0·8	...	...	...	1.51·3	...	...	N. - S.	
1424	655	„ 29	19.48·3	19.54·3	20. 1.3	20. 4·3	20.24·3	...	...	E. - W.	Very slight in N.-S.
1428	656	Aug.... 5	6. 7·0	...	6.24·0	6.24·5	6.27·5	...	...	E. - W.	Not registered in N.-S.
		„ 5	7. 3·0	...	7. 7·0	7. 8·0	...	0·3	0·1	E. - W.	
			7. 3·0	...	7. 5·5	7. 8·5	7.10·0	0·3	0·1	N. - S.	
1431	657	„ 9	19.55·5	...	...	20. 3·5	20.16·5	...	...	E. - W.	Not registered in N.-S.
1433	658	„ 17	17.50·0	...	...	17.57·5	18. 5·5	...	...	N. - S.	Register lost in E.-W.
1452	659	Sep. ... 27	10. 7·4	...	...	...	10.17·4	...	...	E. - W.	Slight thickenings of the trace.
	660	Oct. ... 1	11.10·3	...	...	...	11.35·3	...	...	E. - W.	Not registered in N.-S.
1454	661	„ 4	10.45·0	...	...	10.50·0	10.59·0	0·5	0·2	N. - S.	Register lost in E.-W.
1460	662	„ 11	15. 9·5	...	15.28·5	15.32·0	...	...	...	E. - W.	
		„ 11	15. 9·5	...	15.26·0	15.33·5	...	...	...	N. - S.	
1463	663	„ 16	14.45·5	15.23·5	15.34·0	15.42·0	...	1·0	0·3	E. - W.	
			...	15.29·0	15.34·5	15.46·5	...	1·3	0·4	N. - S.	
	664	„ 17	4.31·0	...	...	...	4.34·0	...	...	N. - S.	Slight thickening of the trace.
1468	665	„ 21	...	...	...	6.44·0	...	...	...	N. - S.	Beginning lost.
	666	„ 26	18. 9·5	...	...	18.11·5	18.32·0	0·5	0·2	E. - W.	
		„ 26	18.10·0	...	...	18.11·5	...	0·5	0·2	N. - S.	
1475	667	„ 27	7.32·5	...	...	7.52·5	7.59·0	...	...	E. - W.	
		„ 27	7.32·5	...	...	7.52·5	7.59·0	...	...	N. - S.	
	668	Nov.... 12	7.53·0	...	...	7.57·5	8. 2·0	...	...	N. - S.	
	669	„ 21	20.17·8	20.23·3	...	20.20·8	21.50·3	3·0	1·2	E. - W.	
		„ 21	20.18·8	20.32·3	...	20.24·3	...	3·5	1·2	N. - S.	
	670	„ 29	6.45·0	...	...	...	6.55·0	...	...	N. - S.	
	671	Dec.... 3	4.55·9	...	...	...	5. 0·9	...	...	E. - W.	
1509	672	„ 15	17.58·5	18.11·0	18.15·0	18.17·0	18.37·0	1·0	0·3	N. - S.	Very slight in E.-W.

PLATE 13.

EARTHQUAKES RECORDED AT THE ROYAL ALFRED OBSERVATORY, MAURITIUS



RESULTS

OF THE

MAGNETICAL AND METEOROLOGICAL OBSERVATIONS

MADE AT

THE ROYAL ALFRED OBSERVATORY, MAURITIUS,

IN THE YEAR

1908.

UNDER THE DIRECTION OF

T. F. CLAXTON, F.R.A.S.

MAURITIUS :

PRINTED BY THE GOVERNMENT PRINTING ESTABLISHMENT.

1911.

PAGE

APPENDIX 2:—*concluded.*

RESULTS OF SEISMOLOGICAL OBSERVATIONS.

APPENDIX 2.

RESULTS

OF

SEISMOLOGICAL OBSERVATIONS.

1908.

APPENDIX 2.

RESULTS

OF

SEISMOLOGICAL OBSERVATIONS,

1908.

Introduction.

The Seismograph used for the registration of unfelt earth movements is of the Milne pattern, recommended by the Seismological Committee of the British Associatiou for the Advancement of Science, and described in the Annual Report of the Committee for the year 1896.

The instrument is mounted in the north-east corner of the Magnet Basement, on a concrete pillar which rises from a foundation of the same material, 8½ feet deep and 4 feet square. The pillar, which projects 4 feet above the floor, is 6 feet high and tapers from 4 feet square at the base to 1½ feet at the top. It is not in contact with the earth on any side, so that the instrument records the movements of the concrete foundation, the base of which is 10½ feet below the level of the floor and 22½ feet below the level of the ground.

On 1902, February 7, a second pendulum was added to the instrument for the registration of earth movements in a north-south direction, and arranged to record on the same strip of paper as the original pendulum.

On removal to the Magnet Basement on 1905, August 17, the instrument was orientated with its booms in an east-west direction, so that this component is now registered by the new and the north-south component by the original pendulum.

For further particulars concerning the working of the instrument, reference may be made to the volumes for 1902 and 1903 (Appendix).

Particulars of 55 earthquakes registered during the year 1908 are given on pp. (lxxxiii) and (lxxxiv).

In addition to earthquake movement the instrument records gradual changes of level, for the study of which the ordinates of the seismograms are measured at every hour of the day (commencing at midnight Mauritius Standard Time). The mean hourly ordinates in each month,

the progressive change, and daily ranges of level are converted into angular measure by the formulæ :—

$$a = \cdot0528/\tau^2 - \cdot000095/\tau^4 - \cdot2398 \text{ for the original pendulum,}$$
$$a = \cdot0520/\tau^2 - \cdot000107/\tau^4 - \cdot0786 \text{ for the new pendulum,}$$

where a is the angular value (in seconds) of 1 division of the scale, and τ the time of vibration of the pendulum (in minutes).

These formulæ were deduced from simultaneous observations of the time of vibration and scale value at varying sensibilities, made in the months of November and December 1907.

On 1907, November 23, new, truly spherical agate cups were fitted to the booms of the seismograph, in place of the original cups which were conical. The bearing surfaces of the new cups are portions of spheres of 3^{mm} radius.

The observed times of vibration of the booms during the year 1908 are given below.

Date, 1908.	Pendulum.		Date, 1908.	Pendulum.		Date, 1908.	Pendulum.	
	Original.	New.		Original.	New.		Original.	New.
January.	mins.	mins.	May.	mins.	mins.	September.	mins.	mins.
9	0·307	0·240	7	0·292	0·327	17	0·320	0·363
15	·323	·320	15	·363	·385	23	·323	·381
21	·327	·280	21	·376	·312	30	·332	·358
29	·337	·263	30	·345	·363			
February.			June.			October.		
5	·353	·340	5	·321	·348	10	·317	·331
12	·360	·317	13	·341	·369	17	·346	·307
19	·317	·300	20	·335	·372	24	·358	·376
			26	·329	·362	31	·345	·325
March.			July.			November.		
7	·357	·334	3	·333	·331	7	·312	·327
17	·340	·320	10	·361	·340	14	·342	·352
28	·340	·375	17	·328	·336	28	·343	·371
			25	·343	·378			
			31	·333	·383			
April.			August.			December.		
4	·317	·403	8	·345	·372	10	·324	·271
10	·360	·320	22	·344	·310	21	·296	·354
24	·357	·327	31	·319	·366	29	·311	·371

It will be seen that the time of vibration of both booms varies considerably. It is the practice, therefore, to determine it at short intervals, and use mean values for periods during which the variations are relatively small. It should be mentioned that the probable error of

observation amounts to $0^m{\cdot}02$ when the time of vibration is small, or when the pendulum comes to rest too quickly, also the experiments indicate that the relation between α and τ depends to a small extent on the position of the pivot in the agate cup, owing to imperfections in the form of one or other, or both. For these reasons the adopted scale values may occasionally differ by 10 per cent. from the true value. This will affect all absolute values ; but in the case of mean monthly diurnal inequalities the form of the curve, if not the amplitude, may be considered correct. For various reasons, in some months only a few days' registers were available ; the monthly means are therefore not strictly comparable, apart from errors in the adopted scale values.

The diurnal range of level given on pp. (lxxxv) to (lxxxvii) refers to the civil day, and the progressive change of level is the excess of the ordinate at 24^h over the ordinate at 0^h on each day, the sign (+) indicating a tilt to north or east, and the sign (−) a tilt to south or west.

The gradual tilting of the pillar is shown graphically on Plate 4. The diagram has been constructed by plotting the accumulated changes of level as rectangular co-ordinates from a fixed point. It is, however, incomplete, owing to the loss of register mentioned above. The total change of level during the year was probably greater than shown in the diagram. The tilt to south which commenced on 1907, December 13, continued until the end of March, after which there was a general trend to westward till April 20, then by irregular wanderings to northward till June 26. A more rapid tilt to eastward then followed, and after irregular movements between August 4 and September 1 the tilt was generally northward until November 30, after which the tendency was to the south-south-eastward.

In determining the mean diurnal inequality of level for each month, page (lxxxviii), only those days have been included for which complete and undisturbed registers of both north and east components are available. The non-periodic variations have been eliminated by applying to each mean hourly value the correction—

$$\gamma = (h - 12)\,(x_0 - x_{24})/24,$$

where γ is the correction to be applied to the mean monthly value at the hour h, and x_0, x_{24}, the mean monthly values at the hours 0^h and 24^h respectively.

The monthly mean north and east components of tilt are shown graphically on Plates 5 and 6, and to illustrate more clearly the nature of the diurnal tilting of the pillar, vector diagrams for each month, showing the amount and direction of tilt from hour to hour, have been constructed by plotting the north and east components as rectangular co-ordinates from a fixed point (Plate 7).

The vector diagrams are widely different in different months ; though the turning points occur at about the same time in each month. The principal features were the large east component in July, accompanied by a gradual tilt to East, the small amplitude of motion in January and February in both components, and the similarity of the curves for the last six months of the year.

List of Earthquakes recorded at the Royal Alfred Observatory, Mauritius, in the Year 1908.

Milne Register Number.	Mauritius Register Number.	Date. 1908.	Time of Commencement of Preliminary Tremors (G.C.T.)	Time of Commencement of 2nd Phase (G.C.T.)	Time of Commencement of Large Waves (G.C.T.)	Time of Maximum (G.C.T.)	Time of End of Disturbance (G.C.T.)	Amplitude. Mills.	Amplitude. Arc.	Component.	Remarks.
		d	h. m.	h. m.	h. m.	h. m.	h. m.		"		
...	673	Jan. ... 11	3.46·5	4.12·5	...	4.26·5	5.12·5	0·5	·40	E. - W.	
			3.57·5	...	4.12·0	4.14·0	4.50·5	1·0	·35	N. - S.	
...	674	„ 27	16.24·4	...	...	16.35·4	16.38·4	...	...	E. - W.	Thickening of trace.
...	675	„ 29	21.12·8	...	...	...	21.30·8	...	...	E. - W.	Thickening of trace.
			21. 8·3	...	...	...	21.15·8	...	...	N. - S.	Thickening of trace.
...	676	„ 30	7.56·5	...	...	8. 1·5	8. 6·5	...	...	E. - W.	
1534	677	Feb. ... 4	6.22·3	...	...	...	6.29·3	0·5	·20	E. - W.	Register faint in N.-S.
1540	678	„ 9	18.43·8	...	...	...	19. 4·8	...	...	...	Irregular thickenings in both E.-W. and N.-S.
1543	679	„ 11	14.10·6	...	...	...	14.20·1	...	...	E. - W.	Slight thickening of trace.
			14.11·6	...	...	...	14.18·6	...	...	N. - S.	Slight thickening of trace.
...	680	„ 24	11.52·0	...	...	11.55·5	12. 0·0	0·5	·25	E. - W.	Slight in N.-S.
1551	681	March 13	18.16·4	...	...	18.22·4	18.28·9	0·7	·14	N. - S.	Slight in E.-W.
1553	682	„ 15	9.37·2	...	...	...	9.43·7	...	...	E. - W.	Isolated tremor.
			10. 5·7	...	10.11·2	10.16·7	10.34·7	0·5	·23	E. - W.	Very slight movements in N.-S.
1563	683	„ 26	23.27·4	...	...	0.31·4	...	...	...	E. - W.	Boom disturbed ; anomalous vibrations
			23.25·4	...	23.47·4	0.28·4	1.32·4	5·0±	1·00±	N. - S.	2nd max occurred at $0^h.\ 35^m.9$ (6.0±) mills.
1564	684	„ 27	5. 3·6	5.10·1	5.17·1	5.21·1	5.36·5	1·0	·20	N. - S.	Slight in E.-W.
1570	685	April 10	0. 4·6	...	...	0.18·1	0.27·6	0·8	·32	E. - W.	Very slight in N.-S.
1578	686	May ... 5	6.36·7	...	6.51·2	6.52·7	7.14·7	5·0±	1·75±	E. - W.	
			6.37·2	...	6.47·2	6.49·7	7.12·2	3·0	·60	N. - S.	
1579	687	„ 5	11.19·7	...	11.23·7	11.25·7	11.29·7	1·0	·20	N. - S.	Slight in E.-W.
1585	688	„ 15	9.47·3	...	...	9.53·8	10. 7·0	0·5	·18	E. - W.	Thickening of the trace.
			9.46·3	...	...	...	10. 1·3	0·5	·10	N. - S.	Thickening of the trace.
...	689	„ 20	4. 6·6	...	...	...	4. 9·6	...	...	E. - W.	Seismic origin uncertain.
...	690	„ 23	0. 3·3	...	...	0. 4·3	0. 9·8	1·1	·22	N. - S.	Slight and irregular in E.-W. Seismic origin uncertain.
...	691	„ 25	9.42·5	...	...	...	9.47·0	0·5	·18	E. - W.	Slight in N.-S.
...	692	„ 31	20.13·0	...	...	20.19·0	20.27·0	1·5	·30	N. - S.	
...	693	June... 24	15.29·6	...	...	15.38·1	15.42·6	...	...	E. - W.	
...	694	July ... 8	13.44·0	...	...	...	13.56·0	...	...	N. - S.	
...	695	„ 15	7.47·4	...	...	7.49·9	7.56·4	...	...	...	Anomalous movements in both components. Seismic origin doubtful.
...	696	„ 26	16.18·3	...	...	16.27·8	16.32·3	0·5	·18	E. - W.	
			16.19·3	...	...	16.24·8	16.31·3	0·5	·10	N. - S.	
...	697	Aug.... 12	16.16·3	...	...	...	16.20·3	...	...	E. - W.	Isolated thickenings.
			16.32·3	...	...	...	16.46·3	...	...		
			16.15·3	...	...	...	16.20·3	...	...	N. - S.	Isolated thickenings.
			16.35·3	...	...	...	16.38·3	...	...		

LIST of EARTHQUAKES recorded at the ROYAL ALFRED OBSERVATORY, MAURITIUS, in the YEAR 1908.—*continued.*

Shide Register Number.	Mauritius Register Number.	Date, 1908.	Time of Commencement of Preliminary Tremors (G.C.T.)	Time of Commencement of 2nd Phase (G.C.T.)	Time of Commencement of Large Waves (G.C.T.)	Time of Maximum (G.C.T.)	Time of End of Disturbance (G.C.T.)	Amplitude. Mills.	Amplitude. Arc.	Component.	Remarks.
		d	h. m.	h. m.	h. m.	h. m.	h. m.		"		
...	698	Aug.... 12	19. 6·4	...	...	...	19.26·4	...	...	...	In both components.
...	699	,, 14	1.49·5	...	...	...	2.17·5	...	...	E. - W.	
			2. 3·0	...	...	...	2.20·0	...	...	N. - S.	
...	700	,, 17	11. 0·6	...	...	11.17·1	11.11·6	3·0	·90	E. - W.	
			11. 0·6	...	...	11.16·1	11.51·6	2·5	·55	N. - S.	
...	701	,, 20	10. 9·1	...	...	...	10.33·1	0·6	·18	E. - W.	
			10.20.1	...	...	...	10.36·1	1·5	·33	N. - S.	
...	702	,, 25	21. 5·5	...	...	21. 8·5	21.12·0	...	...	N. - S.	
...	703	Sept. 23	7.25·1	...	...	7.29·6	7.38·1	1·0	·30	E. - W.	Slight in N.-S.
1628	704	,, 28	6.56·0	...	...	...	7.10·0	...	...	E. - W.	
...	705	Oct. 7	1.31·0	...	...	1.37·0	1.45·0	1·0	·35	E. - W.	Slight in N.-S.
1632	706	,, 13	6.27·3	...	6.34·3	6.39·3	7. 3·3	1·0	·35	E. - W.	
		,,	6.26·3	...	...	6.28·3	7. 5·3	0·5	·11	N. - S.	Another max at $6^h.34^m.8$.
1633	707	,, 14	15.58·5	...	...	...	16. 6·0	...	...	E. - W.	Slight thickening of trace.
		,,	15.53·5	...	...	...	16. 4·0	...	...	N. - S.	
...	708	,, 19	7.47·6	...	...	7.49·6	7.55·0	1·0	·35	E. - W.	
		,,	7.48·6	...	...	7.51·0	7.54·0	1·0	·21	N. - S.	
1637	709	,, 24	21.35·0	...	...	...	21.36·5	...	...	N. - S.	Very slight thickening of trace.
...	710	,, 25	8.23·5	...	...	...	8.27·0	...	...	E. - W.	,, ,, ,,
			8.24·0	...	...	...	8.29·5	...	...	N. - S.	,, ,, ,,
1638	711	Nov.... 2	5.24·0	5.31·0	5.37·5	5.40·0	6.30·0	2·5	·88	E. - W.	
			5.26·0	5.31·5	5.37·5	5.39·0	6.15·0	1·0	·22	N. - S.	
...	712	,,	7.36·0	...	7.42·5	7.44·5	7.54·5	...	...	E. - W.	Thickening of trace.
			7.41·0	...	...	7.44·0	7.50·0	...	...	N. - S.	,, ,,
1640	713	,, 6	14.54·4	...	...	...	15. 0·4	...	...	E. - W.	,, ,,
			14.53·4	...	...	14.57·4	15. 2·4	...	...	N. - S.	
1642	714	,, 9	16. 1·1	...	...	16. 5·1	16.12·1	...	...	E. - W.	
			16. 1·1	...	...	16. 5·1	16. 9·1	...	...	N. - S.	
1644	715	,, 11	13.14·4	...	...	...	13.20·9	...	...	E. - W.	Isolated thickening of trace.
			13.28·9	...	...	13.35·4	13.50·4	...	...		
			13.14·9	...	...	13.30·4	13.41·9	...	...	N. - S.	
...	716	,, 17	10.48·8	...	...	10.51·8	10.55·3	...	...	E. - W.	
...	717	,, 20	8.18·7	...	...	...	8.20·7	...	...	E. - W.	
...	718	,, 21	3. 7·4	...	...	...	3. 8·9	...	...	E. - W.	
1650	719	,, 23	13. 2·1	...	...	...	13.48·1	...	...	E. - W.	Several slight thickenings of trace.
			13. 3·1	...	...	...	13.29·1	...	...	N. - S.	
1652	720	,, 24	12.19·9	...	...	...	12.24·9	...	...	E. - W.	
			12.19·4	...	...	12.23·4	12.26·4	...	...	N. - S.	
...	721	,, 31	23.10·5	...	...	...	23.19·0	...	...	E. - W.	
...	722	Dec. ... 1	3.21·0	...	...	...	3.26·0	...	...	E. - W.	Very slight thickening of trace.
...	723	,, 10	10.34·7	...	...	...	10.36·2	...	...	E. - W.	,, ,, ,,
1659	724	,, 12	13.14·7	13.23·7	13.30·7	13.31·7	$18\frac{4}{5}$	2·0	·62	E. - W.	
			13. 7·7	13.15·7	13.26·2	13.30·2	$18\frac{1}{5}$	1·0	·27	N. - S.	
1660	725	,, 12	19.14·4	...	...	...	19.49·9	...	...	E. - W.	Several slight thickenings of trace.
			19.14·4	...	...	...	19.44·9	...	...	N. - S.	
1663	726	,, 18	15.49·0	15.51·0	...	15.56·0	16.55·0	1·5	·47	E. - W.	
			15.45·5	...	15.53·0	15.55·0	16.15·5	2·0	·54	N. - S.	Isolated thickening
			16.22·0	...	...	16.27·5	16.35·0	...	...		
1670	727	,, 23	4.30·7	...	...	4.41·2	4.50·7	0·4	·12	E. - W.	

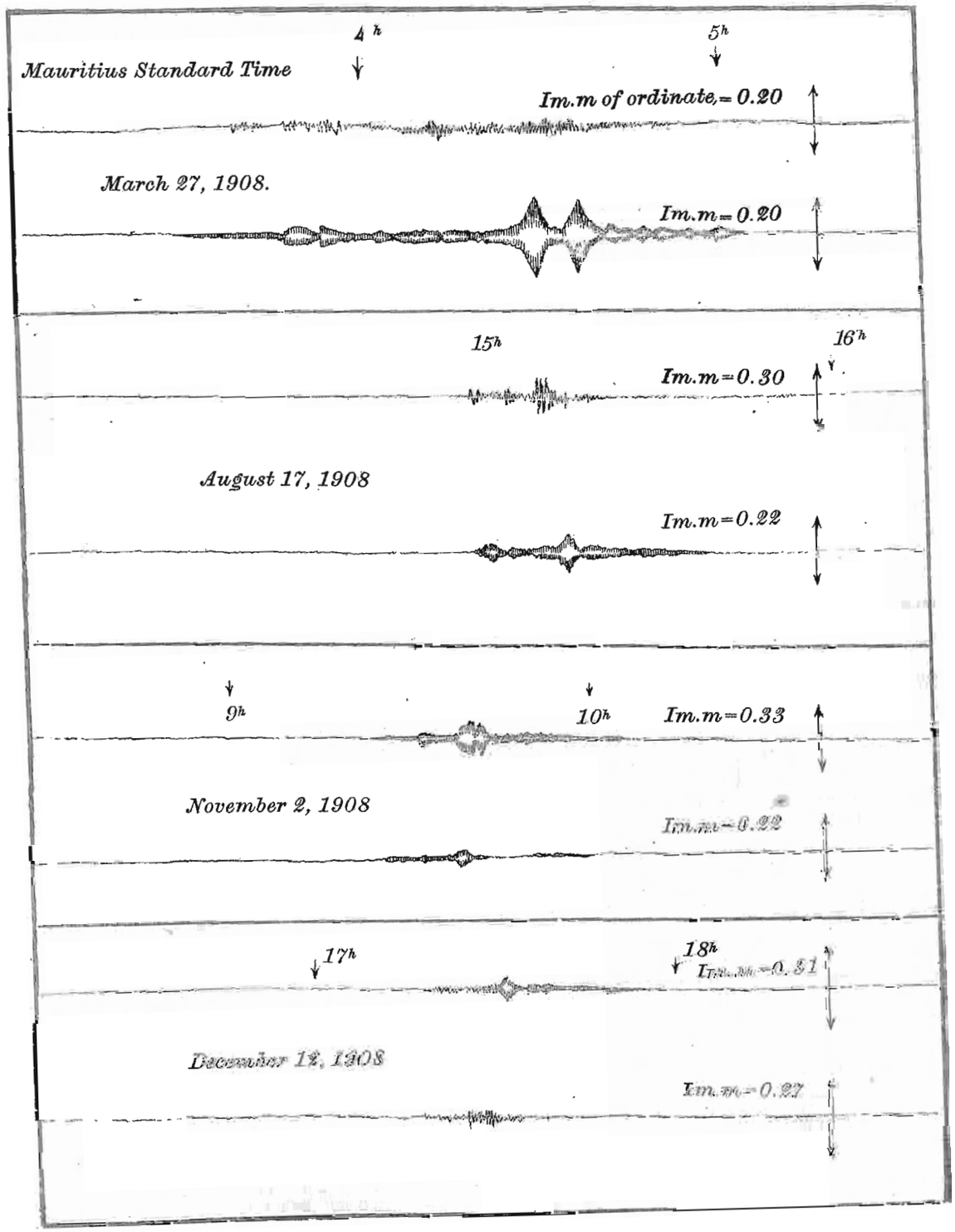
DIURNAL RANGE and PROGRESSIVE CHANGE of LEVEL (NORTH and EAST COMPONENTS) as derived from the PHOTOGRAPHIC RECORDS of a MILNE SEISMOGRAPH. (*The Unit in the Table is* 0″·01.)

1908.

Day of Month.	January.				February.				March.				April.			
	Diurnal Range of Level.		Progressive Change of Level.		Diurnal Range of Level.		Progressive Change of Level.		Diurnal Range of Level.		Progressive Change of Level.		Diurnal Range of Level.		Progressive Change of Level.	
	North Component.	East Component.	North Component.	East Component.	North Component.	East Component.	North Component.	East Component.	North Component.	East Component.	North Component.	East Component.	North Component.	East Component.	North Component.	East Component.
1	...	...	...	...	24	16	− 24	− 8	...	...	...	...	11	160	0	−152
2	...	...	− 95	− 64	27	39	− 27	+ 16	...	...	...	...	14	192	− 11	−192
3	50	48	− 50	− 48	...	...	...	...	...	...	...	...	14	...	0	− 40
4	25	48	− 20	− 32	20	31	− 17	− 31	...	...	−176	+ 45	...	...	...	...
5	25	32	+ 25	+ 32	...	...	...	− 8	...	...	−260	+ 45	...	...	+ 7	+144
6	45	32	− 20	+ 32	17	23	− 17	− 8	80	45	− 80	+ 45	18	136	+ 7	+ 24
7	30	16	− 30	0	7	23	− 7	0	...	...	− 12	+ 18	22	264	+ 4	−232
8	30	80	− 30	+ 80	20	16	0	− 16	44	54	− 44	+ 54	14	176	− 7	−152
9	45	16	− 45	+ 16	20	23	+ 10	+ 16	52	9	− 52	+ 9	22	160	+ 18	−112
10	35	16	− 35	+ 16	10	8	+ 3	0	84	63	− 84	+ 63	65	160	+ 61	−144
11	40	64	− 40	− 64	10	16	+ 3	+ 16	36	45	− 20	+ 45	54	...	+ 54	+ 88
12	20	48	0	+ 32	31	8	+ 10	+ 8	48	9	− 48	+ 9	32	72	+ 32	+ 72
13	45	16	− 45	+ 16	...	...	− 35	+ 23	12	36	− 12	+ 36	...	...	+ 4	+ 56
14	30	32	− 30	− 32	17	16	− 17	+ 8	32	18	− 32	+ 18	29	...	+ 25	...
15	20	11	− 10	− 11	41	40	+ 22	+ 40	...	...	− 8	+ 9	36	...	+ 36	+ 16
16	30	0	0	0	17	...	− 6	+ 10	...	...	− 8	+ 9	22	48	+ 14	+ 24
17	55	0	+ 45	0	...	...	− 6	+ 20	8	18	− 8	+ 9	22	24	+ 22	+ 24
18	40	11	+ 40	+ 11	6	20	0	+ 10	...	...	− 36	+ 27	11	72	− 4	− 64
19	20	22	− 15	+ 22	52	10	+ 41	0	16	9	− 16	+ 9	11	64	− 25	− 56
20	25	22	− 25	+ 22	...	...	+ 35	+ 20	...	...	...	...	18	64	+ 7	− 24
21	35	...	− 35	−121	20	10	+ 14	0	...	...	...	...	18	40	0	− 16
22	...	...	...	...	...	...	− 3	− 10	...	...	...	...	25	32	− 25	+ 16
23	...	99	− 30	− 99	17	30	+ 14	− 20	...	...	...	...	115	152	−115	−104
24	55	44	− 55	− 44	20	30	+ 3	+ 10	...	...	...	...	187	...	−187	−712
25	80	44	− 65	− 44	24	0	+ 17	0	32	129	− 32	− 17	...	...	− 94	−408
26	...	...	− 75	+ 11	...	...	...	...	12	134	− 4	− 28	...	...	− 54	...
27	50	11	− 50	+ 11	...	...	...	...	12	106	− 12	− 39	...	...	+ 72	+192
28	35	11	− 35	− 11	...	...	...	...	12	73	− 8	+ 73	61	96	+ 61	+ 88
29	15	0	− 15	0					...	...	...	...	43	72	+ 40	+ 72
30	40	11	− 40	+ 11					...	...	...	...	18	48	0	+ 40
31	85	11	− 85	0					...	...	− 12	+ 28				
Mean	38·7	28·7	−29·8	− 8·9	21·1	19·4	+ 0·6	+ 4·0	34·3	−53·4	−45·9	+22·2	36·7	106·9	− 2·0	−57·5
Since			−865	−258	...	...	−852	−162			−1816	+305	...	...	−1874	−1247

PLATE 3

EARTHQUAKES RECORDED AT THE ROYAL ALFRED OBSERVATORY, MAURITIUS, DURING THE YEAR 1908.



RESULTS

OF THE

MAGNETICAL AND METEOROLOGICAL OBSERVATIONS

MADE AT

THE ROYAL ALFRED OBSERVATORY, MAURITIUS,

IN THE YEAR

1909.

UNDER THE DIRECTION OF

T. F. CLAXTON, F.R.A.S.

AND EDITED BY

A. WALTER, F. R. A. S.—Director.

MAURITIUS :

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1913.

PAGE.

APPENDIX—*concluded.*

RESULTS OF SEISMOLOGICAL OBSERVATIONS :

APPENDIX 2.

RESULTS

OF

SEISMOLOGICAL OBSERVATIONS.

1909.

APPENDIX 2.

RESULTS

OF

SEISMOLOGICAL OBSERVATIONS,

1909.

Introduction.

The Seismograph used for the registration of unfelt earth movements is of the Milne pattern, recommended by the Seismological Committee of the British Association for the Advancement of Science, and described in the Annual Report of the Committee for the year 1896.

The instrument is mounted in the north-east corner of the Magnet Basement, on a concrete pillar which rises from a foundation of the same material, 8½ feet deep and 4 feet square. The pillar, which projects 4 feet above the floor, is 6 feet high and tapers from 4 feet square at the base to 1½ feet at the top. It is not in contact with the earth on any side, so that the instrument records the movements of the concrete foundation, the base of which is 10½ feet below the level of the floor and 22½ feet below the level of the ground.

On 1902, February 7, a second pendulum was added to the instrument for the registration of earth movements in a north-south direction, and arranged to record on the same strip of paper as the original pendulum.

On removal to the Magnet Basement on 1905, August 17, the instrument was orientated with its booms in an east-west direction, so that this component is now registered by the new pendulum, and the north-south component by the original pendulum.

For further particulars concerning the working of the instrument, reference may be made to the volumes for 1902 and 1903 (Appendix).

Particulars of 94 earthquakes registered during the year 1909 are given on pp. (lxxix) and (lxxx), and the seismograms of those recorded on are reproduced on Plate 5.

In addition to earthquake movements, the instrument records gradual changes of level, for the study of which the ordinates of the seismograms are measured at every hour of the day commencing at midnight (Mauritius Standard Time). The mean hourly ordinates in each month,

the progressive change, and daily ranges of level are converted into angular measure by the formulæ :—

$$\alpha = \cdot0528/\tau^2 - \cdot000095/\tau^4 - \cdot2398 \text{ for the original pendulum,}$$
$$\alpha = \cdot0520/\tau^2 - \cdot000107/\tau^4 - \cdot0786 \text{ for the new pendulum,}$$

where α is the angular value (in seconds) of 1 division of the scale and τ the time of vibration of the pendulum (in minutes).

These formulæ were deduced from simultaneous observations of the time of vibration and scale value at varying sensibilities, made in the month of November and December 1907.

On 1907, November 23 new, spherical agate cups were fitted to the booms of the Seismograph, in place of the original cups which were conical. The bearing surfaces of the new cups are portions of spheres of 3 millimetres radius.

The observed times of vibration of the booms during the year 1909 are given below.

Date, 1909.	Pendulum.		Date, 1909.	Pendulum.		Date, 1909.	Pendulum.	
	N.-S.	E.-W.		N.-S.	E.-W.		N.-S.	E.-W.
January.	mins.	mins.	May.	mins.	mins.	August.	mins.	mins.
9	0·38	0·38	19	...	0·33	10	0·45	...
13	·42	·32	22	0·35	·33	12	·45	0·47
18	...	·33	27	...	·33	19	·47	...
23	·40	·36	28	·26	...	22	·45	...
						23	...	·53
February.			June.			28	·40	...
4	·37	·35	1	·70	...			
8	·47	·37	4	...	·33			
28	·37	·34	7	...	·35	September.		
			9	·37	...	3	·43	...
March.			14	...	·33	13	...	·47
8	·40	...	15	·32	·33	27	...	·47
10	·45	·33	17	·30	...			
13	...	·37	24	...	·45			
20	·45	...	25	·37	...	October.		
22	...	·33				5	...	·37
23	·41	...	July.			15	...	·30
31	·45	·42	8	·47	...	20	...	·33
			10	·50	·45	23	·30	...
April.			13	·50	...	26	·25	·37
3	·43	·37	15	...	·48			
7	·40	·33	17	...	·47			
13	·38	·33	19	·50	...	November.		
20	...	·37	24	...	·48	3	·24	·37
23	·39	·33	25	·50	...	11	...	·35
			27	...	·45	13	...	·30
May.			28	·50	...			
1	·40	·33						
4	·38	·33	August			December		
10	·37	·33	3	·37	...	5	...	·32
11	·33	...	4	·45	...	16	...	·33
12	...	·33	5	...	·45	30	·24	·35
15	·40	...	8	...	·40			

The time of vibration of the booms is determined by eye and ear observations generally once a week, but in addition to this, measurements are made on the photographic register whenever the booms, have been disturbed by the observer, accidentally or otherwise.

It will be seen that the time of vibration of both booms varies considerably. In deriving the values given in the tables on pp (lxxxi)–(lxxxiv) the mean time of vibration is used for periods during which the variations are relatively small. It should be mentioned that the probable error of observation amounts to $0^m{\cdot}02$ when the time of vibration is small, or when the pendulum comes to rest too quickly, also the experiments indicate that the relation between a and r depends to a small extent on the position of the pivot in the agate cup, owing to imperfections in the form of one or other, or both. For these reasons the adopted scale values may occasionally differ by 10 per cent. from the true value. This will affect all absolute values ; but in the case of mean monthly diurnal inequalities, the form of the curve, if not the amplitude, may be considered correct. For various reasons, in some months, only a few days' registers were available; the monthly means are therefore not strictly comparable, apart from errors in the adopted scale values.

The diurnal range of level given on pp. (lxxxi)–(lxxxiii) refers to the civil day, and the progressive change of level is the excess of the ordinate at 24^h over the ordinate at 0^h on each day, the sign (+) indicating a tilt to north or east, and the sign (—) a tilt to south or west.

The gradual tilting of the pillar is shown graphically on Plate 6. The diagram has been constructed by plotting the accumulated changes of level as rectangular co-ordinates from a fixed point. It is, however, incomplete, owing to the loss of register mentioned above. The total change of level during the year was probably greater than that shown in the diagram. The boom tilted irregular to the S.E. until the middle of April ; from the middle of April until the middle of August, Northward, and then North-Eastward until the end of the year.

In determining the mean diurnal inequality of level for each month page (lxxxiv), only those days have been included for which complete and undisturbed registers of both north and east components were available. The non-periodic variations have been eliminated by applying to each mean hourly value the correction—

$$\gamma = (h - 12)\ (x_0 - x_{24})/24,$$

where γ is the correction to be applied to the mean monthly values at the hour h, and x_0, x_{24}, the mean monthly values at the hours 0^h and 24^h respectively.

The monthly mean north and east components of tilt are shown graphically on Plates 7 and 8, and to illustrate more clearly the nature of the diurnal tilting of the pillar, vector diagrams for each month, showing the amount and direction of tilt from hour to hour, have been constructed by plotting the north and east components as rectangular co-ordinates from a fixed point (Plate 9).

On the whole, the vector diagrams for the different months of 1909, show very much the same characteristics ; a steady tilt to S.E. until 7^h or 8^h with a return to the N.W. until 15^h or 16^h. The most disturbed months were January and June ; in the former month the N.S. component predominated, while in the latter the E.W. component predominated, but the movements were very irregular.

LIST of EARTHQUAKES recorded at the ROYAL ALFRED OBSERVATORY, MAURITIUS, in the YEAR 1909.

Slide Register Number.	Mauritius Register Number.	Date, 1909.	Time of Commencement of Preliminary Tremors (G.C.T.)	Time of Commencement of Principal Phase (G.C.T.)	Time of Commencement of Large Waves (G.C.T.)	Time of Maximum (G.C.T.)	Time of End of Disturbance (G.C.T.)	Amplitude. Mills.	Amplitude. Arc.	Component.	Remarks.
		d.	h. m.	h. m.	h. m.	h. m.	h. m.		"		
1676	728	Jan.... 3	22. 5·7	...	...	...	22.37·7	...	...		Slight thickenings in both E.-W. and N.-S.
	729	„ 17	3.49·0	...	...	3.52·5	3.56·0	...	...	E. - W.	
1695	730	„ 21	3.15·1	...	...	3.18·6	3.23·1	...	...	E. - W.	In N.-S. very slight.
1701	731	„ 23	2.58·0	...	...	3.18·0	?	1·0	...	E. - W.	
			2.58·0	3. 7·0	3.14·5	3.21·0	?	0·9	...	N. - S.	
	732	„ 28	20.43·7	...	...	...	20.57·7	...	...	E. - W.	Irregular thickening in E.-W. only. Seismic origin uncertain.
	733	„ 29	0. 3·7	...	...	...	0.14·7	...	...	E. - W.	
1707	734	„ 29	1.29·7	...	...	1.34·3	1.51·7	...	...	E. - W.	
	735	Feb. ... 2	8.19·9	...	...	...	8.22·9	...	...	N. - S.	
	736	„ 3	23.25·3	...	...	...	23.30·3	...	...	E. - W.	
	737	„ 5	10.40·2	...	...	...	10.43·2	...	...		Irregular thickening in both : probably not of seismic origin.
1715	738	„ 22	9.41·9	...	9.50·4	9.50·9	...	1·1	...	E. - W.	
				...	...	10.23·4	...	0·6	...	E. - W.	
				...	...	9.51·9	...	...	...	N. - S.	
				...	...	10. 2·9	...	...	...	N. - S.	
1738	739	„ 26	12.15·9	...	...	...	12.19·9	...	...	E. - W.	In N.-S. very slight.
	740	„ 26	17.57·9	...	...	...	18.39·9	...	...	E. - W.	Slight irregular thickening.
			17.30·9	...	...	...	18.35·9	...	...	N. - S.	
	741	„ 27	8.35·2	...	...	...	8.52·2	...	...	E. - W.	Seismic origin uncertain.
	742	Mar.. 7	18.24·0	...	...	...	18.36·0	...	...	E. - W.	
			18.24·5	...	...	...	18.31·5	...	...	N. - S.	
1753	743	„ 8	11.55·5	...	12.16·5	12.19·5	12.31·5	0·6	...	E. - W.	In N.-S. very slight.
1758	744	„ 12	23.42·5	...	...	0.14·0	?	...	...	E. - W.	Occasional thickening.
		„ 13	0. 0·5	...	...	0.14·5	0.29·5	...	...	N. - S.	
1760	745	„ 13	14.48·5	...	...	15.22·5	17.17·0	0·8	...	E. - W.	Frequent movements.
	746	„ 17	10.33·7	...	...	...	10.40·2	...	...	E. - W.	Irregular thickening in E.-W. in N.-S. very slight.
1763	747	„ 17	23. 6·2	...	23.24·7	23.28·2	0. 8·7	2·5	...	E. - W.	In N.-S. very slight and irregular
	748	„ 20	14.28·4	...	...	...	14.32·4	...	...	E. - W.	
1772	749	April 10	5.50±	...	6.19·8	6.24·8	8.±	1·5	...	E. - W.	
1773	750	„ 10	19.11·3	...	20.31·8	20.34·5	...	0·6	...	E. - W.	In N.-S. slight. Beginning and end uncertain.
			...	...	...	20.36·8	...	0·5	...	N. - S.	Frequent small movements.
1774	751	„ 11	4.19·3	...	...	4.23·3	4.30·3	...	...	E. - W.	
1788	752	„ 25	22.25·1	...	...	22.30·1	...	...	...	E. - W.	
		„ 25	?	...	...	23.18·1	23.35·6	...	...	E. - W.	
	753	„ 26	20.46·3	...	...	...	20.52·3	...	...		
1790	754	„ 27	13. 4·8	13.22·8	13.27·3	13.29·8	14.38·8	3·0	...	E. - W.	Irregular movements in both.
			...	...	...	13.29·8	...	...	...	N. - S.	
	755	May... 2	7.45·7	...	...	7.53·2	8.12·7	...	...	E. - W.	
1793	756	„ 2	19. 4·7	...	...	19.10·2	19.20·2	0·6	...	E. - W.	
	757	„ 2	22.16·4	...	...	22.20·4	22.24·4	...	...	E. - W.	In N.-S. very slight.
		„ 2	22.18·4	...	...	22.20·4	22.23·4	...	...	N. - S.	Slight thickenings.
	758	„ 2	22.42·4	...	...	22.47·4	22.51·4	...	...	E. - W.	
		„ 2	22.43·4	...	...	22.46·9	22.51·4	...	...	N. - S.	Slight thickenings.
	759	„ 3	0.15·4	...	...	0.19·4	0.23·4	...	...	E. - W.	
		„ 3	0.16·9	...	...	0.18·9	0.24·4	...	...	N. - S.	
	760	„ 10	13. 4·3	...	...	...	13.16·3	...	...	E. - W.	
	761	„ 10	20.19·4	...	...	20.23·9	20.31·9	...	...	E. - W.	Irregular thickenings.
	762	„ 12	1.13·2	...	...	1.25·2	1.40·2	1·0	...	E. - W.	Slight in N.-S.
1812	763	„ 17	8.21·6	...	...	8.32·1	8.53·1	1·0	...		In N.-S. thickening with maximum at $1^{h}21^{m}\cdot2$.
1825	764	„ 25	5.33·0	...	...	5.37·5	5.48·0	...	...	E. - W.	All movements very irregular.
1826	765	„ 26	2.45·8	...	...	2.53·8	3. 0·8	...	...	E. - W.	Times refer to both components.
1832	766	„ 30	21.21·7	...	...	21.43·7	22. 5·7	0·5	...	E. - W.	
	767	June... 4	18.49·8	...	...	18.57·8	19. 6·3	5.±	...	E. - W.	In N.-S. maximum at $19^{h}7^{m}\cdot3$.
1851	768	„ 8	?	...	6.41·8	6.47·3	?	2·0	...	E. - W.	In N.-S. very slight.
1852	769	„ 9	1.21·9	...	...	1.28·9	1.51·9	...	...	E. - W.	

LIST of EARTHQUAKES recorded at the ROYAL ALFRED OBSERVATORY, MAURITIUS, in the YEAR 1909.—*concluded.*

Shide Register Number.	Mauritius Register Number.	Date, 1909.	Time of Commencement of Preliminary Tremors (G.C.T.)	Time of Commencement of 2nd Phase (G.C.T.)	Time of Commencement of Large Waves (G.C.T.)	Time of Maximum (G.C.T.)	Time of End of Disturbance (G.C.T.)	Amplitude. Mills.	Amplitude. Arc.	Component.	Remarks.
		d.	h. m.	h. m.	h. m.	h. m.	h. m.		″		
	770	June... 12	20.41·2	...	...	20.58·2	21.46·2	...	...	E. - W.	
	771	,, 18	19.28·0	...	...	...	19.42·0	...	...	E. - W.	
	772	,, 22	9.35·0	...	...	...	9.50·0	...	...	E. - W.	Boom much disturbed, seismic origin uncertain.
	773	,, 25	0.51·2	...	...	...	1.51·2	...	...	E. - W. N. - S.	Many irregular movements which do not appear to be of seismic origin.
1910	774	,, 27	...	...	...	8. 8·8	8.36·3	0·9	...	E. - W.	In N.-S. slight.
	775	,, 29	16.48·7	...	...	...	16.54·7	...	...	E. - W.	Irregular movements.
	776	July... 2	8.31·9	...	...	...	12.31·9	...	...	E. - W.	Frequent thickenings : seimic origin uncertain.
	777	,, 2	23.50·7	...	...	...	0.37·2	...	...		Isolated thickenings in both components.
	778	,, 3	...	...	...	6.12·7	...	...	...	E. - W.	Irregular thickenings : seimic origin uncertain.*
			...	...	...	7.27·7	...	...	...	N. - S.	
1934	779	,, 5	...	...	...	22.34·5	...	...	...		Irregular movements in both components.
	780	,, 7	...	...	...	7.24·7	...	...	...		Irregular movements ,,.
	781	,, 7	...	...	...	10.10·7	...	...	...	N. - S.	
1944	782	,, 7	21.48·8	...	...	21.55·8	22. 4·3	4·0	...	E. - W.	
			21.48·3	...	...	21.55·8	21.55·8	4·+	...	N. - S.	
1980	783	,, 26	11. 9·2	...	...	11.12·2	11.17·2	...	...	E. - W.	
1982	784	,, 30	11.16·1	...	12.10·6	12.13·6	13.19·6	1·4	...	E. - W.	
			11.28·1	...	11.32·6	11.33·1 11.52·6	13. 7·6	1·3 1·1	... ...	E. - W.	
1985	785	,, 31	20. 5·4	...	20.38·9	20.41·9	21.28·4	0·6	...	E. - W.	In N.-S. frequent thickenings.
	786	Aug.... 7	17.45·3	...	...	17.51·3	17.56·3	...	...	E. - W.	In N.-S. slight.
	787	,, 15	9. 1·7	...	...	...	9. 6·7	...	...	N. - S.	Small irregular movements.
	788	,, 16	8.10·5	...	...	8.14·5	8.17·5	1·1	...	E. - W.	In N.-S. thickening of trace.
	789	,, 25	10. 8·8	...	...	...	10.14·8	...	...		Irregular movements in both.
2071	790	Sep.... 8	17.50·8	...	...	17.55·8	18. 5·8	...	...	E. - W.	
	791	,, 16	19. 1·2	...	...	19.11·7	19.17·2	0·6	...	E. - W.	
	792	,, 19	14.34·6	...	...	14.36·6	14.40·6	...	...	E. - W.	Irregular movements.
	793	,, 22	15.57·8	...	...	...	16. 9·8	...	...	N. - S.	
	794	,, 23	6.37·9	...	...	6.43·4	6.58·9	0·6	...	N. - S.	Very slight in E.-W.
2108	795	Oct.... 4	14.29·5	...	...	...	14.34·5	...	...	E. - W.	
	796	,, 21	0. 0·1	...	0· 5·1	0· 6·1 0·11·1	0.54·1	1·0 1·0	...	E. - W.	
2117		,, 20-21	23.55·1	...	0· 7·1	0· 9·6	0.44·6	1·2	...	N. - S.	
	797	,, 28	4.17·2	...	...	4.20·7	4.35·7	0·5	...	E. - W.	
	798	,, 31	11.50·5	...	...	11.51·5	12.20·5	0·8	...	E. - W.	
2132											
2134	799	Nov.... 8	21.18·5	...	...	21.22·5	21.28·5	...	...	E. - W.	
	800	,, 10	6.25·2	...	...	6.52·2	...	0·7	...	E. - W.	Additional max. in E.-W. $6^h37.^m7$ and 7^h0^m5 sheet changed at $11^h.36^m$.
2137		,, 10	...	...	...	6.37·7	...	1·0	...	N. - S.	
	801	,, 12	20. 9·9	...	...	20.13·4	20.17·9	...	...	E. - W.	
	802	,, 16	...	...	...	19.16·7	...	...	...	E. - W.	
	803	,, 24	7.26·3	...	...	7.29·3	7.32·3	...	...	E. - W.	
	804	,, 29	3.38·5	...	...	3.40·5	4. 0·5	...	...		Irregular movements in both.
	805	Dec.... 4	17. 9·7	...	...	17.11·7	17.16·7	...	...	E. - W.	
	806	,, 8	9.50·4	...	...	9.56·9 9.59·9	10. 9·4	...	...	E. - W.	
2160											
2161	807	,, 9	16. 0·3	...	16.30·8	16.34·3 16.36·8	...	2·0 2·0	...	E. - W.	Continued for some hours after.
	808	,, 9	21.56·9	...	...	22.28·4	...	1·0	...	E. - W.	
	809	,, 9	23.45·9	...	...	0. 1·4	1. 0·9	0·5	...	E. - W.	
2180		,, 9	23.54·4	...	...	23.55·9	0. 4·9	1·0	...	N. - S.	
	810	,, 22	13.41·9	...	...	13.47·9	14. 4·9	0·5	...	E. - W.	
	811	,, 23	23. 4·5	...	...	23.11·0	23.18·5	0·5	...	E. - W.	

* From July, to 7 the booms were more or less disturbed by workmen.

PLATE 5.

EARTHQUAKES RECORDED AT THE ROYAL ALFRED OBSERVATORY, MAURITIUS.

DURING THE YEAR 1909.