1929

THE COLOMBO OBSERVATORY.

REPORT OF THE SUPERINTENDENT OF THE OBSERVATORY.

TABLE OF CONTENTS.

Staff.—Mr. A. J. Bamford was on leave from February 13 to November 11. While in Europe he attended the Conference of Meteorologists of the Empire in London in August and the International Conference at Copenhagen in September.

During his absence Mr. H. Jameson acted as Superintendent and Mr. D. T. E. Dassanayake as Assistant Astronomer.

Buildings.—An extension of the main building was made east of the transit room, to include a library and new storeroom.

ASTRONOMICAL EQUIPMENT AND WORK.

The astronomical activities of this Observatory are mainly limited to time work, but include some investigations arising therefrom. At present these are chiefly in connection with atmospheric distortion of observations.

The main instruments have been unchanged. The Cooke transit (4-inch object glass with travelling micrometer) and the Borrel chronograph continued to be in use for clock stars.

As the building operations incidental to the new library were adjacent to the transit room, clock star observations were suspended during the time when they were in progress, the clocks being rated by means of the Bordeaux and Rugby vernier signals. During 1927 and 1928 the number of clock stars had been increased, in an attempt to analyze the variations between their results and those obtained from the European vernier signals. It was felt that a continuation of this analysis, while building work was in progress, would be of little value owing to the unknown effect of the complication thus introduced, and in addition there would have been a risk of grit from the building operations getting into working parts of the transit instrument. It is worthy of note, however, that when the instruments was brought into use again after the new rooms had been completed its level had changed by 62 seconds of arc in the direction of a sinkage on the east side, *i.e.*, the side where the new rooms had been added.

Fournier sidereal clock No. 72 (invar pendulum) continued to be the chief ratekeeper, and has now been in use over twenty years. In March it was taken down for overhaul, and some worn bearings tapped. Its rate during the latter part of the year has proved that this work was carried out successfully.

The Cooke mean time clock, which had been used for the wireless time signals throughout 1928, stopped twice in January. The actual stoppages were due to the electric wiping contact exerting too much pressure, but their occurrence showed that the clock had a very small margin of power, chiefly due to worn bearings. The bearings were tapped as an immediate measure, but replaced by new ones in July.

The Dent mean time clock, which had been repaired in 1928, required no attention to its clockwork, but a new and improved electric contact was added to it in March, in anticipation of its having to be used consistently for the wireless signals while the Cooke clock was down for repairs.

Fournier clock No. 70 started and ended the year as a sidereal, but was converted to a mean time clock for a couple of months while the Cooke clock was out of action. This was to ensure that at least two mean time clocks should be in commission and capable of sending the wireless signals. As a matter of fact it was not called upon in its capacity of " understudy," as the Dent clock proved equal to all the demands made on it.

Time Ball and Synchronization.—The Time Ball at the Master Attendant's Office was dropped, as before, at 9 A.M., 1 P.M., and 4 P.M., Ceylon standard time (3.30, 7.30, and 10.30 Greenwich mean time) on ordinary week days, and at 9 A.M. only on Sundays and public holidays. During the year there were 944 successful signals and only 3 failures.

These signals represent co-operation between four departments (Survey, Telegraph, Harbour Engineer's, and Master Attendant's), and the most vulnerable part has always been the electric transmission between the Observatory and Master Attendant's Office. The three failures all appear to have been due to trouble in this section, but the emphasis lies, not in their existence, but in the fact that they were limited to so few as three. In 1926 there was only one failure, and 1929 comes next in order of completeness.

Synchronizing signals were sent daily to the Central Telegraph Office, whence a further distribution of time signals was made. These were sent at 7.55 and 15.55 on ordinary week days, and 8.54 on Sundays and public holidays. A test measurement was in all cases made immediately after the setting signals, and enabled the Observatory staff to verify that the setting signal had done its work satisfactorily, and if necessary to report any defect by telephone. The method is that when the master clock points to 56 minutes past any hour a contact in it short circuits the relay. From a few seconds before 7.56 (or 8.56 or 15.56) a contact is made at the Observatory, sending current in the

reverse direction to that used for the setting signal. As the relay at the Central Telegraph Office is a polarized one, this has no effect on the relay, but the amount of the current in milliamperes can be read on the Observatory meter. The key is kept down, and when the Central Telegraph Office master clock shows 7.56 the fact is shown at the Observatory by a sudden increase in current due to the cutting out of the relay. Indications by this method have shown a distinct improvement in 1929 over those in 1928.

The clock in the lighthouse at the Chatham street-Queen street corner was synchronized by having its relay in series in the time ball circuit.

Its strike is broadcasted daily at noon, and the opportunity is taken to note its error on the Observatory receiving set. This error was recorded as less than 5 seconds on considerably over 95 per cent. of the observations. On three occasions the clock stopped, owing to the relay closing at a time when no current was sent from the Observatory. As the relay is normally protected from stray currents by a shunt, these stoppages appear to be mechanical rather than electrical in origin, and were probably due to vibration from the floors above. The existence of such vibration can easily be accounted for both from the striking bells of the clock itself and the heavy apparatus connected with the lighthouse. The relay has now been moved to a bracket fixed directly on to the main wall of the tower. On November 26 the clock was definitely stopped for overhaul and the insertion of new standards to support the crown wheel. It was restarted on November 30, but not used for wireless broadcast until it had shown that it had settled down to a steady rate on December 3.

Issue of Wireless Time Signals.—These were sent out twice daily in the old International or "Onogo" code from the Welikada Wireless Station. The morning signal is from 11.27–11.30 Ceylon standard time (5.57–6.00 Greenwich mean time) on 2,300 metres C.W., and the evening one at 22.27–22.30 (16.57–17.00 Greenwich mean time) on 600 metres, I.C.W.

The contacts for the actual dots and dashes of the wireless signal are made by metal pieces sunk in the rim of an ebonite drum at the Welikada Wireless Station. This drum is released at 11.27.00 or 22.27.00 by a signal from the Observatory, and during the 3 minutes it is in action is kept in beat with second-by-second signals from the Observatory mean time clock.

A chronograph at the Wireless Station records both the impulses from the Observatory and the movements of the drum. This chronograph, though very useful, does not meet every contingency (*e.g.*, it would give no immediate warning if the drum dropped a second and went on exactly one second slow) and as a further safeguard, every outgoing signal is listened to on the receiving set at the Observatory by the officer who is responsible for sending the impulse that starts the signal. This officer is in direct telephonic communication with the Wireless Station, and the decision as to whether a signal may be passed as correct or not rests with him.

In the case of a failure, the words "time signal failed" are sent out in Morse immediately afterwards.

In 1929 there were 720 successful signals out of a possible 730. It will be noticed that there is no curtailment on Sundays or public holidays. Of the ten failures, one was an intentional omission owing to the wireless transmitting apparatus being occupied otherwise, and two were probably correct, but were not certified as such owing to their not being heard on the Observatory receiving set. In the other cases the synchronized drum at Welikada seems to have been the main seat of trouble.

This work involves close interaction with the Telegraph Department, and I gladly record my appreciation of the way in which the officers concerned have co-operated in maintaining the service.

Longitude Determinations.—Comparisons between time as determined by clock stars and by the Bordeaux and Rugby vernier wireless signals were continued, but as explained above were restricted considerably during building operations.

Meteorological Equipment and Work.

The 16 climatological stations that were in action in 1928 were maintained, and in addition the equipment of the four new stations whose establishment was recommended by the Airship Mission in 1927 was completed this year. These stations (Negombo, Chilaw, Tabbowa, and Ridiyagama) have now Dines self-recording anemometers, as well as large Stevenson screens with the ordinary thermometers and self-recording thermographs, hygrographs, and pluviographs. In these cases the masts, huts, &c., were erected by the Government Factory and the instruments assembled by the Observatory staff. A certain amount of trouble has been experienced in getting satisfactory traces at some of the outlying stations, but such difficulties are gradually being overcome. At Chilaw and Negombo the sites are close to the sea, and the problem of corrosion promises to be severe. This is particularly the case at Chilaw, where the hair hygrograph shows a distinct saline encrustation.

The new Dines anemometer for Colombo was not installed at the Observatory, where the old anemobiagraph is still in use, but at the Pilot Station on the end of the south-west breakwater. As inland sites go, the Observatory compound is a good one, but the readings from the Pilot Station have been consistently higher than those at the Observatory, and emphasize the difference in friction between the surface of the sea and that of even level park land, such as surrounds the Observatory.

At the 16 main climatological stations observations were taken at 9.30 A.M. and 3.30 P.M. daily. In addition observations were also taken at Colombo, Trincomalee, and Hambantota at 7 A.M. and 7 P.M., and at Nuwara Eliya at 7 A.M. The 7 A.M. observations are taken primarily for co-operation with India, while those at 7 P.M. are taken for use in preparing the evening wireless report for issue from Colombo.

The chief changes in outstation observers during the year were at Nuwara Eliya and Galle. At Nuwara Eliya the observers are now drawn from the staff of the Tea Research Institute, and I wish to put on record my appreciation of the help given by Mr. T. Eden in this connection. The work at this station has been extended to include the dispatch of a daily telegram to India.

At Galle the "state of sea" has been reported from the Signal Station for some years, while the other observations were taken by a clerk in the Public Works Department, but during 1929 the whole of the meteorological work was transferred to the Master Attendant's Department.

At the other main stations there were a few changes in personnel, but not in the Departments from which they were drawn.

The pin diagrams and other systems of checking at Colombo were maintained without any great change in method.

Fifteen clerks of the Survey Department and one member of the Master Attendant's Department came to the Observatory for training prior to taking up duties as outstation observers.

Wireless Weather Reports.—The chief daily weather report and forecast was prepared each morning in time to be broadcasted *en clair* at noon. It subsequently appeared in the " Post Office Daily List " and in the local newspapers.

The chief material for this report was provided by the morning telegrams from 14 climatological outstations, the Colombo observations, including the morning pilot balloon flight, and such ships' messages as were available. Other sources of information were the telegram from Pamban and the figures from 13 stations in Ceylon that are not fully equipped climatological stations, but from which the morning measurement of rainfall is wired.

Weather reports prepared avowedly with a view to shipping, and hence omitting any discussion of rainfall over the Island, were sent out in Morse immediately after the time signals at 11.30 A.M. and 10.30 P.M. These messages deal with the immediate neighbourhood of Ceylon in considerably more detail than can be expected in the Indian messages, which avowedly have to summarize the outstanding features over big areas. By kind permission of the Director-General of Observatories, copies of the Indian messages are received at Colombo, and use is made of any relevant parts, but the main sources of information for the reports from Colombo are the Ceylon readings (both surface and upper air) and wireless messages received direct from ships.

Their efficiency thus depends greatly on the amount of information received from ships, and I am glad to report that the number of such messages in 1929 showed a slight increase over the numbers during either of the two previous years. I am very glad to take this opportunity of expressing my thanks to the various captains and other officers concerned, especially as I am aware that almost inevitably some of the acknowledgments sent by letter fail to reach the addressees.

The number of telegrams received from different ships of course varies considerably, and I should like to put in a special word of thanks to those concerned on the ss. Badarpur and Aungban. Not only do these vessels head the list with regard to the number of telegrams received in 1929, but in each of the last few years they have been among the most consistent suppliers of information.

Other vessels from which over 20 telegrams were received in 1929 were the ss. Magdapur, Meerkerk, Dara, and Christian Huygens.

The full list of ships from which messages were received in 1929 includes ss. Abadan, Achilles, Akbar, Alderamin, Amboise, André Lebon, Arracan, Athelprince, Athos II., Auditor, Aungban, Automedon, Azay-le-Rideau, Badarpur, Bali, Ballarat, Baradine, Barrabool, Begum, Bellerophon, Bendigo, Boschdijk, Breedijk, H.M.S. Bridgewater, ss. British Mariner, California, Carnarvonshire, H.M.S. Carysfort, ss. Cathay, Chenab, Chenonceaux, Chickerk, Chindwara, Christian Huygens, City of Athens, City of Baroda, City of Calcutta, City of Carlise, City of Delhi, City of Manchester, City of Sparta, Clan Macquarrie, H.M.S. Cleopatra, ss. Clydefield, Comorin, H.M.S. Cumberland, ss. Dara, H.M.S. Dartmouth, ss. Deebank, Delta, Derbyshire, Deucalion, Diomed, Dogra, Durban Maru, H.M.S. Effingham, ss. Elax, Elpenor, H.M.S. Emerald, Enterprise, Foxglove, ss. Fulda, Gamaria, Gambada, Gambhira, Gandara, Garbeta, Glenamoy, Gloucestershire, Goalpara, Golconda, Gorontalo, Gretafield, Grotius, Gurna, Hakusan Maru, Havildar, Hobson Bay, Holywell, Homefield, Insulinde, Investigator, Jaladuta, Jalapalaka, Jalarashmi, Jalatarang, Jalaveera, Jan Peiterszoon Coen, Johan De Witt, Jutland, Kalyan, Karagola, Karimoen, Karmala, Karoa, Kashgar, Kedoe, Khosrou, Khyber, Kohinur, Koningin der Nederlanden, Kota-Radja, Lancashire, Laomédon, Largs Bay, Leicestershire, C. Lopez y. Lopez, Macedonia, Macharda, Magdapur, Mahout, Mahsud, Maihar, Makalla, Malakuta, Malancha, Maloja, Malwa, Mandala, Mangalore, Manipur, Manora, Mapia, Margha, Marken, Mashobra, Masimpur, Matheran, Matra, Mexico, Medon, Meerkerk, Mentor, Meonia, Merkara, Moena, Moldavia, Mongolia, Mooltan, Morea, Morvada, Nagina, Nagoya, Nankin, Nawab, Nellore, Nirvana, Nizam, Novara, Nowshera, Nurjehan, Nurmahal, Orama, Orford, Orna, Oronsay, Orsova, Osterley, Otaki, Oxfordshire, Pasha, Pegu, Palembang, Peleus, Pembrokeshire, Perseus, Poelaulout, President Garfield, President Wilson, Prinses Juliana, Rajputana, Rhexenor, Risaldar, Salawati, Saleier, Samarinda, H.M.S. Sandwich, ss. Santos Maru, Sarpedon, Sauer Land, Schiekerk, Selma City, Sembilan, Shuja, Shwedagon, Sikh, Silverguava, Simaloer, Singu, Soemba, Sommelsdijk, Stadsdijk, Staffordshire, Streefkerk, Surada, Tambora, Teiresias, Temple, Texel, H.M.S. Titania, Toba, Toloa, Trier, Ville de Strasbourg, War Brahmin, Warora, Weissenfels, Winton, Yorkshire, and Zosma.

Rain Gauges and Volunteer Observers.—Rainfall figures appear in this report from 370 stations. These include the stations that report daily, at which the observers receive an allowance, but the great majority of them are maintained voluntarily, and I am glad to take this opportunity of thanking all who have co-operated in this work.

The new stations started during the year include four under the Agricultural Department and one each under the Forest, Irrigation, and Railway Departments, one at Mullaittivu Kachcheri, and one at Dompe, where the observer is the Sub-Postmaster (Mr. D. E. P. Suriapperuma), besides eight gauges on estates, viz., Carchilmally (Mr. H. Leigh), Dabar (Mr. R. Smerdon), Halwatura (Mr. J. Shirley), Kahagalla (Mr J. G. Bridges), Kirimetiya (Mr. H. V. Greer. This gauge is really the successor to the one on Old Medagama), Kokkawita (Mr. M. D. Fernando), Narangalla (Mr. C. S. Peter), St. Leonards on Sea, Elpitiya (Mr. A. C. R. Welsh).

While it is not possible to mention all the voluntary helpers individually, I wish to put in a special note of thanks to some of those who have done a great deal more than supply monthly summaries of their daily rainfall figures. Notable among these are—Mr. J. A. Coombe for his barometer and temperature readings, besides several messages containing special comments on unusual conditions. Mr. E. E. Megget (Detanagalla) and Mr. Ross Wyllie (Oakwell) for sunshine records. Mr. A. C. Tutein

Nolthenius and Mr. O. S. Agar (West Haputale) and Mr. H. Jones and Mr. J. G. Grimwood (Hope) for anemometer figures, Mr. W. W. Birtill and Mr. R. H. Freeman (Yataderiya), Mr. Allen Cormode (Rayigam), and Mr. C. Pern (S. Wanarajah) for special reports of heavy rain in their areas. Messrs. J. J. Hay (Panilkande), H. A. McLaren (Gikiyanakanda), and D. C. Mortimer (St. Martin's) for entering daily telegrams sent from their estates, and Mr. G. Huntley (Vincit) and Mr. H. F. Dalton (Theydon Bois) whose climatological notes have been particularly interesting.

Mention must also be made of the climatological station maintained by the Rubber Research Institute at Culloden. The only figures from this station included in this report are the rainfall ones, but other records have also been received and it is hoped that figures from it will be incorporated in similar reports when the station has been in existence long enough to have definite temperature averages.

Co-operation with Indian Meteorological Department.—Telegrams from Colombo, Trincomalee, and Hambantota have been sent to India at 7 A.M. each morning for several years. In 1929 similar telegrams were also sent from Nuwara Eliya, while extra storm warning telegrams were also sent from the three coast stations at various times when asked for by the Indian Meteorological Department. The numbers of such extra telegrams sent in 1929 were: Colombo 133, Trincomalee 97, and Hambantota 67. These figures were decidedly greater than in the previous year. It is worth noting that although in this year there was less rain than usual of typically cyclonic type over Ceylon itself, there was a certain amount of cyclonic activity in the neighbourhood—in fact a definite depression centre off the north-east of Ceylon is often productive of peculiarly dry weather over the Island.

A considerable number of the results of pilot balloon flights were telegraphed to India, and the majority of the messages received from ships were also forwarded. In addition, telegrams were also sent whenever the general appearance of the 9.30 synoptic chart showed anything worthy of such treatment.

By the courtesy of the Director-General of Observatories, India, copies of all broadcasts sent by him to the Navy Wireless Station at Matara were also delivered to the Observatory. In addition, copies of the daily morning telegram from Pamban were also sent here and proved of considerable value, owing to the way in which strong wind often blows down the Gulf of Mannar, and so produces distinctly rougher weather between Colombo and Cape Comorin than is indicated by the shore readings at Colombo alone.

Upper Air Work.—Pilot balloons made of rubber were in use throughout the year, the tail method of observation being used. Considerable trouble was experienced owing to the quality of the balloons, many of which burst during inflation, and as a result the total number of flights was only 482, or over a hundred less than last year.

Requests in English, Sinhalese, and Tamil that the finder would return the tail were attached during the south-west monsoon, and 50 tails were returned as a result. This number, which is almost identical with the figure for 1928, represents just over 20 per cent. of the tails to which the request was attached.

The request is not attached during those months of the year in which a normal flight ends over the sea. In these months the request would be, at best, superfluous, and may mean that the reward of Re. 1 is paid in cases of short flights that are observed in the theodolite till the balloon bursts, and with regard to which the finding of the fallen balloon gives no added information.

Averages of pilot balloon flights have been published in Part 3 of Vol. I. of the Ceylon Journal of Science (Section E). The results of this year's observations are shown in plate VIII. at the end of this report. A comparison between it and the corresponding plate for the previous year shows the general similarity in type, but emphasizes the way in which the local circulation and afternoon thunderstorms dominated April. In that month the proportion of calms at the surface in the morning was unusually high, and coupled with an almost complete absence of calms in the afternoon when the sea breeze had got into action.

Vertical Temperature Gradient.—By the courtesy of the Chief Engineer, Telegraphs, and his staff, three thermographs were installed at the Wireless Station in February. Of these, two are in louvred boxes that are hoisted on one of the masts that carries the aerial, and their approximate altitudes are 260 ft. and 130 ft. respectively. The third is in a Stevenson screen at the base.

As the result of a conversation that I had with Mr. M. A. Giblett while in England, another thermograph has now been added at a height of 50 ft. As the mast was being painted in December, regular returns from this instrument were not available till January, 1930.

All the thermographs have weekly drums and are standardized weekly, by comparison with a psychrometer, when the charts are changed.

Figures from these thermograph records are not given in this report, but will probably be published, when more are available, in the Ceylon Journal of Science. It may be mentioned, however, that inversions of temperature are well marked, especially near dawn, and a particular feature of the curves is the way in which, when the thermograph at ground level is showing a steady decrease at night, the upper ones often show distinct rises.

An allied piece of work is referred to below under Special Investigations (*c*).

Special Investigations.—Several investigations were in progress during the year, with regard to which no summary of results has yet been published. These include among others—

(*a*) Temperature of Rainfall Measurements, which Mr. Jameson continued along the lines he has adopted since 1926. In 1929 he amplified them by the use of a thermograph as well as minimum thermometers.

(*b*) Rain Gauge Comparison Experiments: These were continued with slight additions.

(c) Refraction Experiments: The old Coudé transit instrument, whose use as such was discontinued many years ago, received a new lease in life, being mounted as a simple telescope pointing to the top of the wireless masts over a mile away. By reading the spirit level on its axis and the micrometer in its eye piece, a series of readings has been commenced of the apparent altitude of this point. The mean value of the angle of elevation is slightly over 2°. The object of the experiment is twofold. In the first place it may be regarded as an auxiliary to the work done in collecting data for possible use in connection with airships, since the variation in refraction should give some information as to the gradient of atmospheric buoyancy in the few hundred feet near the surface, but in the second place it may be regarded as an auxiliary to the analysis of distortion of star observations that has arisen from the transit instrument work. In this, the crucial question is whether we must consider the atmospheric stratification as so nearly horizontal that refraction corrections are purely vertical, or whether systematic distortions can be allowed for in meridian clock star observations.

The variations of the refraction of the ray from the Observatory to the top of the wireless mast can be produced either by horizontal or non-horizontal stratification, but comparison of the micrometer readings of the absolute refraction with the direct thermograph readings on the mast should enable this point to be analyzed further than is possible by either set of observations alone.

Seasonal Correlation.—A good deal of misunderstanding still survives owing to the multiple interpretations put on the word *monsoon* by different people, and it is therefore well to explain exactly what is referred to in this (and other recent Observatory publications) in connection with monsoon forecasting, under the name of total monsoon rainfall, viz., the total rainfall from May to September, inclusive, on the windward side of the hills, which is the area in which the rainfall averages of those months are high. The actual stations used are Annfield, Blair Athol, Caledonia, Delwita, Dunsinane, Hatton, Holmwood, Helboda, Kandy, Katugastota, Labookelle, Luccombe, Maskeliya, Matale, New Forest, Norwood, Nuwara Eliya, Peradeniya, Pussellawa, Sandringham, Sogama, South Wanarajah, Vicarton, Yarrow.

The method used is to express the actual rainfall at each station for those five months as a percentage offset from the average at that station for those months. These percentage offsets (with their proper sign) are then averaged, the resulting average percentage offset being used as an index of the particular year's monsoon rainfall.

The periodicity curves did not suggest a great variation from average for the 1929 monsoon.

February temperatures have shown appreciable correlation, low temperatures in that month frequently being associated with a subsequent low monsoon rainfall. The temperatures in February, 1929, were about equally divided above and below their averages, so that here again the indications were that the monsoonal rainfall would not be far from normal.

However, the inverse relationship between the intensity of the April thunderstorms and the subsequent monsoon is perhaps the best marked correlation of the three, and here April gave a very distinct indication, as the rainfall of that month was exceptionally heavy. Taking this fact in conjunction with the two above, Mr. Jameson, who was in charge at Colombo, gave as his forecast that " an average or a deficient monsoon rainfall is more likely than one in excess".

Plate II. in this report shows that this was very well borne out by the actual figures of May to September.

Publications.

The present report is on the same lines as its predecessors, and gives among other things the rain gauge figures from 370 stations. The latter part of it includes the tables that also appear in the Ceylon Blue Book. The chief additions this year are the inclusion of sunshine figures and an increase in the table of rainfall intensities.

Routine publications have been similar to those of last year, and included daily reports in the " Post Office Daily List " and newspapers, and monthly summaries in the *Government Gazette* and Tropical Agriculturist.

It must be remembered that a good many observations are made here which are not published in the report and Blue Book owing to exigencies of space and the expense of printing. Among these may be mentioned measurements of amount of cloud, surface and underground temperatures, evaporation, &c. Information on these points can be obtained on application to the Observatory.

Part 3 of Volume I. of Section E of the Ceylon Journal of Science was published on July 5, and contained papers or notes on the following :—

The Climate of Western Ceylon (including Upper Air Summaries), The Interaction of a Mild Depression and the South-west Monsoon, Distortion of Clock Star Observations, the Relation between the Direction of the Surface Monsoon Wind and Barometer Gradient, Monsoon Periodicities, and Kelani Floods.

Mr. H. Jameson read a paper in May before the Ceylon Engineering Association on " The Relation between the Maximum Rainfall in a Day and the Maximum Rainfall in a Few Hours". He also contributed a note to the (English) Meteorological Magazine on " Small Upper Air Velocities at Colombo". A paper of his on the " Mean Maximum Rainfall in Time t " appeared in the January number of the Quarterly Journal of the Royal Meteorological Society.

While on leave in England, I read a paper on " Vertical Air Currents as measured by Pilot Balloons " before the Royal Meteorological Society, and also spoke before the Royal Astronomical Society on the distortion of clock star observations by meteorological causes. This was not a formal paper, but a brief resumé of the ground covered in the several papers on the distortion of star observations which had appeared in the Ceylon Journal of Science, though it included a few points that had arisen since the last number of that Journal went to print.

As in previous years, publications have been received from a number of observatories and other organizations. While their receipt has been acknowledged individually by letter, I am glad to take this opportunity of thanking the donors collectively. The list is as follows :—

INTERNATIONAL.

League of Nations, Health Section, Eastern Bureau, Singapore :—

Weekly Fascicules, 1928, December 22nd–1929, December 7th.

Commission Internationale de Longitudes par T. S. F. :—

"La Revision des Longitudes Mondiales," October–November, 1926.

International Meteorological Organization :—

Commission for Synoptic Weather Information :—

Report of the seventh meeting, London, May, 1928.
List of meteograms of ships, January 1–15, 1928.
List of meteograms of ships on sea February 15–28, 1929.
Corrigenda of the Report of the Seventh Meeting, London, May, 1928.

Secrétariat Du Comité Meteorologique International :—

Publications Nos. 1 and 2.

International Research Council :—

Second report of the Commission appointed to further the Study of Solar and Terrestrial Relationships.

International Kommission for die Erforschung der freien Atmosphare :—

Lists Nos. 1d, 2c, 3b, 4a, 5, and 6.

Internationale Union Géodésique et Géophysique :—

Bulletins Géodésiques, January–June, 1929.

AFRICA.

Helwan Observatory :—

Bulletin No. 34.

Service Botanique de Tunisie :—

Annales, Tome V, Fasc. 2.

Mauritius.

Royal Alfred Observatory :—

The Cyclone Season, 1927–28.
Monthly Magnetical and Meteorological Observations, January–December, 1928.

AMERICA (NORTH).

Canada.

Toronto Observatory :—

Meteorological and Magnetical Observations, 1927.

Jamaica.

William H. Pickering, Esq., Mandeville :—

Reprints from Popular Astronomy (4 papers).

United States of America.

U. S. Department of Agriculture :—

Weather Review, 1928, September–December ; 1929, January–July.
Index to Volume 56.

New York Meteorological Observatory :—

Monthly Reports, 1928, October–December ; 1929, January–August.
Annual Tables for 1928.

U. S. Coast and Geodetic Survey :—

Manual of Second and Third Order Triangulation and Traverse.
Special Publication No. 138.

Jesuit Seismological Association, Central Station :—

Preliminary Bulletins, Earthquakes of 1928, November 20 to 1929, November 18.

Seismological Station of St. Louis :—

Bulletins, 1928, August–1929, May.
Bulletin for the Year 1928.

Regis College, Denver :—

Records, 1928 No. 8 and 1929 Nos. 1 and 2.

Lick Observatory :—

Bulletins Nos. 407–417.
Registration of Earthquakes at Berkely and Lick Observatory, 1928, April 1 to 1929, March 31.

Carnegie Institution of Washington, Department of Terrestrial Magnetism :—

Annual Report, 1927–28.
List of Publications, 1928.
Summary of Magnetic Survey Work, 1905–26.
Latest Annual Values of the Magnetic Elements at Observatories.
Reprints from scientific journals, by Wait, Brickwedde, and Hall ; Parkinson (two papers) ; Dahl and Gebhard ; Breit, Tuve, and Dahl ; Ennis ; Fleming ; Gunn ; Ault (five papers) ; Peters ; Fisk and Fleming ; Kassner ; Wolfer ; Fisk ; Gish ; Hafstad and Tuve ; McComb and Huff.

Smithsonian Institute :—

World Weather Records, Errata to Vol. 79.

Florissant Seismological Station :—

Bulletins, 1929, January–September.

Bureau of Standards, Washington :—

Scientific Paper, No. 534.

F. R. Moulton, Esq., Chicago, Illinois :—

"The Planetesimal Hypothesis."

Gonzaga Seismological Station :—

Bulletin, 1928, October.

AMERICA (SOUTH).

Bolivia.

La Paz Observatory :—

Seismological Bulletins, 1928, July–December ; 1929, January–April.

Sucre Observatory :—

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Seismograph.

The Milne Shaw seismograph was in use throughout the year. A second clock that has been added outside the main casing was used to give the carriage of the recording drum its horizontal movement, while the inner clock was used for rotation only. There were a few stoppages on account of trouble with the clocks, but none of them were protracted.

The coupling was maintained at the 250 magnification throughout and measurements of period, damping ratio, and sensitivity were made at least once a month. A period of 12 seconds was aimed at, but required fairly frequent adjustment.

Measurements of the damping ratio varied from 1 in 16.0 to 1 in 28.5. The sensitivity was usually about 60. mm per second of arc, the extreme measurements during the year being 74 and 44.

The list below is restricted to definite shocks and contains no reference to a great number of small traces that were also recorded. The regular diurnal movement of the pillar, which had not been very apparent on the old instrument since the new transit room was built, shows quite definitely on the new one, now that the clock drive is sufficiently regular to make this possible.

No.	Date. 1929.	P. H. M. S.	S. H. M. S.	L. H. M. S.	Maximum. H. M. S.	End. H. M.	Amplitude. M. M.	Remarks.
	January							
1304 ..	1	.. 13 42 21..	13 53 51..	14 3 1	M_1 14 5 16..	15 24..	1·0..	—
					M_2 14 11 46..	— ..	1·0..	—
1305 ..	8	.. 7 31 49..	7 38 34..	7 44 39..	7 46 4..	8 36..	1·0..	—
1306 ..	13	.. 0 14 40..	0 24 4..	0 34 52..	— ..	4 0	10·0..	Maximum lost during the changing of film
1307 ..	16	.. 8 13 49..	8 20 29..	8 26 14..	8 29 49.. to 8 30 49	—	1·5..	Maximum lost during the hour time mark
1308 ..	17	.. 12 0 50..	Elusive ..	12 52 50..	13 7 20..	15 46..	1·5..	—
1309 ..	20	.. 15 2 55..	15 9 45..	— ..	— ..	17 18..	— ..	L and M difficult to read, amplitude being too small
1310 ..	24–25	.. 20 56 21..	Elusive ..	21 49 21..	22 9 23..	0 21..	4·0..	—
1311 ..	30	.. 17 2 21..	17 9 11..	17 17 16..	17 20 28..	18 6..	0·7..	—

No.	Date. 1929.	P. H. M. S.	S. H. M. S.	L. H. M. S.	Maximum. H. M. S.	End. H. M.	Amplitude. M.M.	Remarks.
	February							
1312	1	17 20 21	17 21 21	17 26 41	17 33 33	20 6	19·5	—
1313	2	0 14 22	0 29 2	0 51 52	0 54 34	4 4	3·0	—
1314	10	15 52 51	Elusive	16 55 21	17 12 51	18 30	1·3	—
1315	15	5 49 3	5 55 32	6 2 17	6 9 22	7 28	1·0	—
1316	17	20 48 52	20 52 37	20 55 22	20 56 7	22 26	2·0	—
1317	22–23	21 1 20	21 11 45	21 37 35	21 51 8	0 12	4·5	—
1318	26	9 7 3	9 26 18	9 47 8	10 5 18	11 52	1·5	—
	March							
1319	1	8 0 47	—	—	8 42 32	10 17	0·6	—
1320	7	Record lost			2 52 30	7 5	11·5	The beginning is lost, and the M is that of the maximum of the trace recorded
1321	7	10 46 20	11 16 40	11 19 8	11 25 30	13 27	1·3	—
1322	8	10 59 45	—	—	11 13 5	13 7	0·8	—
1323	9	Record lost			2 50 20	5 24	0·7	Record lost from 0h. 36m.–2h. 42m. In this the beginning of a shock coming after 0h. 36m. was lost, and the M and the corresponding Amp. given here is that of the maximum of the trace that was recorded after 2h. 42m.
1324	9	11 6 0	11 22 5	11 35 32	11 47 30	14 0	2·7	—
1325	21	0 50 49	—	—	2 16 37	3 10	0·7	—
1326	22	3 4	3 17	3 23	3 26	4·5	0·6	Times are approximate, as the time marking device failed
1327	25	14 50 33	14 58 0	15 1 56	15 4 12	16 57	1·3	—
1328	28	20 35 52	—	21 2 37	21 18 7	23 1	0·7	—
	April							
1329	8	10 24 9	10 28 41	10 40 28	10 45 14	12 4	0·9	—
1330	9	4 0 20	4 7 50	4 11 20	4 15 25	5 48	1·0	—
1331	30	18 51 47	—	—	18 59 47	19 58	0·9	—
	May							
1332	5	17 0 18	17 6 33	17 8 48	17 12 43	18·5	1·9	End given to the nearest tenth of an hour
1333	6	5 18 20	5 25 30	5 34 20	5 41 50	7 15	0·9	—
1334	7	16 44 58	16 52 48	17 5 48	17 8 13	18 30	1·3	—
1335	18	6 46 49	6 54 3	7 2 14	7 8 24	8 11	2·5	—
1336	20	5 6 17	5 16 46	5 38 31	Not pronounced	7 54	0·4	—
1337	21	16 44 49	16 52 49	17 1 14	17 13 4	19 50	2·1	—
1338	22	20 12 49	—	—	20 50 7	22 45	0·7	—
1339	26	8 51 19	—	—	9 17 4	10 28	0·8	—
1340	26–27	22 56 29	23 7 59	23 27 39	23 48 49	2 14	31·0	—
1341	30	10 3 0	Elusive	10 50 4	11 9 19	—	1·3	—
	June							
1342	2	21 48 0	21 55 38	22 1 48	22 4 28	Record lost	0·6	—
1343	3	20 42 49	20 48 35	20 54 39	20 55 59	—	1·4	—
1344	4	15 23 38	15 29 48	15 38 10	15 38 38	—	1·2	—
1345	13	Record lost	0 46 34	Record lost	1 18 29	—	1·7	During the shock the clock rotating the drum had stopped twice
1346	13–14	23 9 8	23 15 43	23 28 36	23 29 58	0 14	0·7	—
1347	16	A shock after 10h. 30m.—Amplitude being Times of phases uncertain.					31·5	—
1348	17	10 24 51	—	—	10 49 34	11 26	0·7	—
1349	19	A shock of amplitude 1·5 m.m. before 11h. 50m. Times of phases uncertain.						
1350	27	eP13 1 31 S13 11 44		13 36 56	13 43 57	18 4	19·5	—
		iP13 5 57 SR13 31 39		—	—	—	—	—
1351	30	2 53 20	2 59 48	3 3 18	3 14 28	4 49	1·9	—
	July							
1352	4	9 23 0	9 31 20	9 45 20	9 46 48	11 14	3·3	—
1353	5	14 32 15	14 43 0	15 11 12	15 24 8	17 50	3·0	—
1354	5–6	—	—	—	23 34 10	1 28	1·5	P, S, L are difficult to give as trace is superimposed owing to the slowing down of the clock
1355	6	2 18 30	—	—	3 1 20	3 55	0·6	—
1356	6	10 5 30	—	—	10 57 50	11 50	0·7	—
1357	7–8	21 36 30	21 47 30	22 2 30	22 19 0	1 10	5·5	—
1358	13	7 49 30	7 52 30	7 55 30	7 59 25	8 45	1·5	—
1359	13	15 2 0	15 10 55	15 25 0	15 32 48	15 59	0·5	—
1360	14	9 47 48	9 58 12	10 12 30	10 26 45	11 39	2·0	—
1361	15	7 57 25	8 0 25	8 7 17	M_1 8 11 10	9 15	1·7	—
					M_2 8 13 36	—	1·7	—
1362	17	8 50 38	9 2 0	9 23 42	M_1 9 35 45	—	0·9	—
					M_2 9 40 57	—	0·9	—
1363	23	19 7 15	—	—	19 38 57	20 17	1·0	—
1364	25	0 31 30	—	0 36 30	0 38 50	Lost	0·8	Last during changing film
1365	26–27	23 7 12	—	—	23 30 57	0 23	0.7	—

No.	Date. 1929.	P. H. M. S.	S. H. M. S.	L. H. M. S.	Maximum. H. M. S.	End. H. M.	Amplitude. M.M.	Remarks.
	August							
1366 ..	1	.. 5 5 2..	— ..	— ..	— ..	7 7..	— ..	Trace lost due to failure of light.
1367 ..	8	.. 13 1 48..	13 5 29..	13 9 41..	13 10 11..	15 49..	17·5..	—
1368 ..	19	.. 2 51 17..	2 57 44..	3 8 9..	3 12 19..	4 30..	2·7..	—
1369 ..	19	.. 10 46 49..	— ..	— ..	10 48 49..	11 30..	0·7..	—
1370 ..	19	.. 20 59 17..	— ..	— ..	21 13 44..	21 38..	0·6..	—
1371 ..	20	.. 16 53 3..	— ..	— ..	17 7 36..	17 38..	1·0..	—
1372 ..	28	.. 18 59 50..	19 12 20..	19 25 5..	19 45 10..	20 43..	1·0..	—
	September							
1373 ..	2	.. 11 21 9..	11 27 49..	11 40 19..	11 46 19..	12 45..	1·5..	—
1374 ..	3	.. 12 11 10..	12 13 30..	12 17 42..	12 18 10..	13 11..	1·4..	—
1375 ..	9	.. 3 32 49..	3 36 34..	— ..	3 43 9..	4 25..	0·8..	—
1376 ..	10	.. 20 37 50..	— ..	— ..	20 45 40..	21 35..	0·8..	—
1377 ..	17	.. 19 43 36..	19 53 35..	20 8 50 M_1	20 29 30..	22 42..	1·4..	—
				M_2	20 33 35..	— ..	1·4..	—
	October							
1378 ..	5	.. 2 49 19..	— ..	— ..	3 13 4..	4 24..	0·8..	—
1379 ..	5	.. 17 11 49..	— ..	— ..	17 50 34..	18 30..	1·0..	—
1380 ..	6	.. 8 3 50..	— ..	— ..	9 0 35..	10 38..	1·0..	—
1381 ..	8	eP 17 34 30..	— ..	— ..	18 29 35..	19 47..	1·0..	—
		iP 17 40 50						
1382	16	.. 20 33 5..	20 37 35..	20 45 55..	20 46 50..	21 50..	2·5..	—
1383 ..	19	.. 10 32 29..	10 46 4..	11 21 29..	11 40 34..	13 12..	2·8..	—
1384 ..	24	.. 6 42 5..	6 48 30..	6 56 20..	6 59 0..	7 42..	1·0..	—
1385 ..	29	.. 5 59 19..	— ..	— ..	6 14 9..	6 50..	0·9..	—
	November							
1386 ..	5	.. 11 46 35..	11 53 20..	11 58 50..	12 4 20..	12 36..	1·0..	—
1387 ..	13	.. 0 40 49..	0 50 19..	— ..	1 6 29..	1 30..	1·1..	Film was changed between 0h. 58m. and 1h. 6½m.: the true maximum may have occurred during this period
1388 ..	15	.. 19 0 49..	19 9 19..	19 22 19..	19 30 4..	22 25..	3·2..	—
1389 ..	17	.. 3 51 39..	3 58 19..	4 6 34..	4 10 9..	— ..	6·3..	The end is lost in the beginning of the following shock
1390 ..	17	.. — ..	— ..	— ..	6 30 9..	7 20..	0·7..	P is lost in the end of the preceding shock
1391 ..	18	.. 5 49 19..	5 56 39..	6 7 49..	6 14 39..	6 50..	1·0..	—
1392 ..	18–19	.. 20 50 49..	21 7 29..	21 34 49..	21 43 34..	0 9..	6·5..	—
1393 ..	23	.. 0 11 44..	0 19 44..	0 33 34..	0 37 29..	2 19..	0·8..	—
	December							
1394 ..	6	.. — ..	— ..	12 20 49..	12 31 49..	13 29..	0·5..	P is lost in the micro-seisms
1395 ..	6	.. 17 2 39..	17 11 34..	17 30 49..	17 42 54..	19 23..	2·2..	—
1396 ..	6	.. 20 39 19..	20 46 4..	21 5 24..	21 17 24..	22 58..	1·4..	P probably earlier
1397 ..	9	.. 6 53 20..	— ..	6 57 20..	6 58 28..	10 21..	24·0..	—
1398 ..	17	.. 11 11 20..	11 22 0..	11 42 2..	11 51 0..	15 51..	36·0..	—
1399 ..	18	.. 7 11 50..	— ..	— ..	7 26 10..	7 50..	0·6..	—
1400 ..	24	.. 15 56 59..	— ..	— ..	Not pronounced	16 15.. (about)	0·3..	—
1401 ..	31	.. 1 14 9..	1 22 24..	1 35 19..	1 42 1..	2 14..	0·6..	—
1402 ..	31	.. 4 31 59..	— ..	— ..	4 48 39..	5 59..	0·6..	—

Weather Summary, 1929.

The outstanding meteorological features of the year were heavy inter-monsoon rains in April, and a deficient south-west monsoon rainfall. Depressional activity was not at all marked during the year.

The yearly totals were nearly everywhere in deficit, the chief exceptions being the eastern flank of the main hill-range, and a district which can be roughly described as the Puttalam-Anuradhapura-Mannar triangle.

Summarizing the months separately :—

In January the rainfall was markedly in deficit over the greater part of the Island, the deficits being greatest to the north-east of the hills, where the January rainfall is usually heaviest. However, local thunderstorm activity was above normal in parts of the south-west of the Island, more particularly in a narrow strip just in lee of the hills. An interesting feature of the month's weather was the occurrence of very low night temperatures at Nuwara Eliya, a minimum air reading of 27·3°F. on the 14th being nearly a record for that station, while minimum air readings of 63·3, 64·0, and 63·4 at Colombo, on the 14th, 15th, and 16th, were very little above the lowest on record there.

February, normally a dry month, with low rainfall averages, had, on the whole, rather more rain than January. The rainfall was above normal over the greater part of the south-west of the Island, but was elsewhere generally below normal, the most marked exception being a coastal strip running south from Batticaloa. Low night temperatures were again recorded on several occasions at Nuwara Eliya, the lowest reading recorded during the month being 28·7°Fb.

In March excesses and deficits were irregularly distributed, but on the whole the Island showed excess of rain.

The local thunderstorm type of rain that is customary at this season was unusually well developed in April, with the result that the rainfall for the month was nearly everywhere above normal, and at many places considerably above normal, several rain gauge stations exceeding their previous record for the month. For example, the April total at Colombo Observatory, 18·66 inches, was the highest recorded at that site since observations were started there, in 1908. The greatest excesses above normal were to the west of the hills, and in the adjoining low-country, where excesses of 10 to 20 inches were common, in districts near, and to the north-east of Puttalam, and in a patch of country on the north-east flank of the hills. A few rainfalls in deficit were recorded, mainly in the Southern Province and in the south of Sabaragamuwa.

In May excesses and deficits were almost equally distributed over the Island, deficits predominating in the south-west, and excesses elsewhere·

The deviations of the June rainfall from average in the south-west of the Island were irregular. While a large part of that region was in deficit, a good deal of the Kelani Valley and the Kandy district were in excess. In the neighbourhood of Kurunegala the rainfall was in deficit. In the rest of the Island, where the average June rainfall is small, excesses and deficits were both small.

Rainfall during July was nearly everywhere in deficit, the only exceptions worth noting being a few stations on the western slopes of the hills, which showed slight excess.

Augu t, too, showed deficient rainfall over the greater part of the Island, the deficits being most marked in the south-west. A number of stations in the north-east of the Island, and several stations in Uva, however, showed excess.

The rainfall of September was generally below normal in the south-western districts of the Island, while elsewhere it was generally above normal. The second half of the month was much wetter than the first. The drought at Colombo, which had lasted for over two months, and was one of the worst on record for this time of year, terminated about the middle of the month.

Taking the south-west monsoon as a whole, the rainfall from May to September, inclusive, was in deficit over the greater part of the south-western quadrant of the Island, while elsewhere it was mainly in excess, more particularly in the lee of the hills. The country south of Batticaloa and the Jaffna Peninsula, however, reported deficits.

The rainfall of October was nearly everywhere below normal, deficits of 10 to 15 inches being common in the centre of the Island. South-west monsoon conditions persisted till after the middle of the month, but about the 21st inter-monsoonal conditions set in, with a marked increase in the tendency towards local afternoon and evening thunderstorms.

The rainfall of November was distributed rather irregularly and included a large proportion of thundershowers. No definite depression passed over Ceylon, but more than one came near enough to influence the rainfall. Such influence was usually in the direction of increased rain, but the two days with least rain were the 29th and 30th, on which the lack of rain was mainly due to a depression at sea north-east of the Island. Deficits were rather more numerous than excesses, and were most marked in the Western Province, and in the south of Sabaragamuwa. Excesses were most frequent in the North-Central and Southern Provinces.

Rain was fairly widespread during the first half of December, but there was very little from the 14th to the 21st, after which it was again general until the end of the month. Excesses predominated in the southern half of the Island, and deficits elsewhere, except in the Jaffna Peninsula and adjoining districts. Depressional activity was not very marked, and a rough description of the general distribution of rain can be given by saying that it suggested the normal distribution of January rather than that of December.

The following table gives rainfall figures from 370 stations. To save overcrowding the maps many names are shortened and a list of such abbreviations will be found after page Y 16. In some cases where two gauges are so near that it is unnecessary to show them separately on a map on the scale of 24 miles per inch, only one name is given and a cross reference is given in the table, *e.g.*, Ledgerwatte is abbreviated to Le. The adjacent gauge at Narangalla is not shown separately on the maps, but in the table the entry Narangalla (Ledgerwatte) indicates that the site of Narangalla is close to Ledgerwatte.

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Superintendent.

Colombo, February 13, 1930.

Return of Rainfall in Ceylon during 1929, and the Means during different Periods. (See last paragraph on page 11.)

Station and Abbreviation used on Maps.	Height above mean Sea Level.	Year.	Jan.		Feb.		March.		April.		May.		June.		July.		August.		Sept.		Oct.		Nov.		Dec.		Total for the Year.		Greatest Quantity registered in any 24 hours.	
			Inches.	Days.	Inches.	Days.	Inches.	Days.	Inches.	Days.	Inches.	Days.	Inches.	Days.	Inches.	Days.	Inches.	Days.	Inches.	Days.	In hes.	Days.	Inches.	Days.	Inches.	Days.	Inches.	Days.	Inches.	Dates.
	Feet.																													
Alagalla (Al.) ..	1,062	1929 ..	1·59	3	0·52	2	6·01	10	14·24	21	2·89	5	9·96	14	8·39	19	1·93	9	8·26	20	5·53	13	17·08	17	5·04	12	81·44	145	3·80	Nov. 25 to 26.
		means during 18–19 years	5·79	9	1·84	2	6·11	7	9·08	12	8·91	9	11·51	17	7·80	12	5·30	9	8·21	11	15·49	16	13·05	14	9·35	10	102·43	128	9·82	June 24 to 25, 1911.
Allai Tank ..	20	1929 ..	1·95	4	3·59	2	4·51	6	5·53	10	5·53	4	0·00	0	1·53	2	6·02	7	3·67	9	8·26	11	13·49	19	15·95	18	70·03	92	3·71	May 3 to 4.
		means during 54 years ..	8·49	9	2·49	3	2·33	3	1·98	4	2·83	4	1·37	1	1·75	2	4·24	4	4·60	5	8·87	11	15·89	15	18·41	15	73·24	77	9·11	Nov. 17 to 18, 1906.
Alutnuwara ..	300	1929 ..	3·84	2	3·93	6	6·53	16	11·69	28	7·28	9	0·39	2	0·06	1	0·62	5	6·54	10	4·53	7	12·14	18	21·16	20	78·71	124	3·42	Jan. 23 to 24.
		means during 30 years ..	15·39	14	4·95	7	5·34	8	5·02	9	2·80	6	0·59	2	1·24	2	2·00	3	2·88	5	11·65	15	13·98	16	16·83	17	82·68	104	9·92	Jan. 17 to 18, 1913.
Ambalantota ..	15	1929 ..	0·40	1	0·35	2	5·14	7	5·44	8	2·40	5	1·90	8	1·02	5	0·13	2	5·47	10	0·60	4	23·23	23	9·16	9	55·24	84	5·27	Nov. 4 to 5.
		means during 8 years ..	3·87	6	1·35	3	4·87	8	2·53	5	3·42	6	2·96	8	2·41	6	0·86	5	3·50	8	4·32	9	8·94	13	5·45	9	44·48	82	5·27	Nov. 4 to 5, 1929.
Ambanpitiya (Am.) ..	663	1929 ..	3·55	6	2·00	4	8·67	9	22·13	27	5·45	11	14·72	23	6·30	19	3·42	9	10·90	19	12·06	18	18·19	16	2·35	13	109·74	174	4·03	Sept. 19 to 20.
		means during 58 years ..	3·38	6	2·67	4	6·81	10	10·67	15	10·63	15	12·83	20	8·34	17	6·56	16	8·59	16	17·36	21	13·82	17	7·31	11	108·97	167	16·65	Aug. 7 to 8, 1886.
Ambepussa ..	—	1929 ..	4·35	9	0·71	5	10·21	11	23·99	26	13·02	21	11·49	25	4·21	21	1·01	6	10·36	21	10·99	16	19·03	22	3·57	12	112·94	195	5·57	Nov. 16 to 17.
		means during 2 years ..	5·93	8	2·16	6	6·92	8	19·83	21	8·19	17	9·73	23	8·09	19	3·15	16	6·15	18	18·00	22	17·02	25	7·14	12	112·26	193	5·57	Nov. 16 to 17, 1929.
Amparai Tank ..	90	1929 ..	0·11	2	2·28	6	4·79	14	4·47	11	2·91	8	0·52	3	0·20	3	0·74	2	1·80	7	6·35	9	9·32	21	23·02	18	56·51	104	6·00	Dec. 23 to 24.
		means during 54 years ..	14·54	12	4·77	5	3·47	5	3·19	6	3·67	5	2·10	3	1·88	3	2·86	5	4·24	6	8·73	12	12·39	14	18·11	15	79·94	91	19·20	Dec. 7 to 8, 1881.
Andankulam Tank, Trincomalee	40	1929 ..	3·56	5	3·70	1	1·87	4	6·73	8	2·03	3	0·00	0	1·26	2	5·00	8	6·30	12	5·32	7	9·34	10	13·60	18	58·71	78	3·70	Feb. 7 to 8.
		means during 39 years ..	7·70	9	1·71	3	1·70	3	1·63	4	2·07	3	0·83	1	1·57	3	2·98	5	3·42	6	6·68	11	13·95	15	14·93	15	59·19	79	9·70	Dec. 27 to 28, 1921.
Annfield Estate, Dikoya (An.)	4,300	1929 ..	3·18	5	0·87	4	6·58	10	14·51	25	5·21	15	15·33	24	13·21	27	3·25	19	9·02	23	6·44	16	7·60	19	7·63	16	92·83	203	1·96	Apr. 20 to 21.
		means during 42 years ..	3·97	10	2·22	6	6·26	12	9·38	17	8·73	17	16·28	25	15·44	26	11·23	23	10·62	21	12·57	22	9·61	18	6·17	13	112·49	210	8·79	Oct. 4 to 5, 1913.
Anningkanda Estate, Deniyaya	1,550	1929 ..	8·35	11	7·50	13	11·60	26	12·02	25	7·33	22	10·33	26	4·25	24	2·71	11	8·85	21	10·70	20	19·18	28	11·50	23	114·32	250	3·44	Jan. 7 to 8.
		means during 52 years ..	8·85	13	7·28	11	10·68	16	12·78	18	12·55	17	13·10	22	9·20	18	7·84	17	10·82	17	16·03	21	17·48	21	13·54	19	140·13	209	7·98	Oct. 27 to 28, 1906.
Anuradhapura — Survey Office	295	1929 ..	0·55	4	0·14	2	3·91	9	11·81	21	2·87	6	0·84	7	0·00	0	0·23	1	13·75	13	6·96	13	12·81	24	4·51	17	58·38	117	3·21	Sept. 23 to 24.
		means during 60 years ..	3·96	9	1·52	4	2·88	7	6·76	13	3·35	7	1·28	4	1·31	3	1·69	4	3·17	6	9·51	16	10 75	18	8·59	16	54·76	106	9·32	May 20 to 21, 1891.
Anuradhapura — Experiment Station	295	1929 ..	0·48	3	0·67	2	3·96	9	9·91	17	2·66	4	0·59	4	0·00	0	1·50	3	12·05	9	4·58	9	12 17	17	3·77	12	52·34	89	3·21	Apr. 21 to 22,
		means during 6–7 years..	6·95	8	1·22	3	4·01	8	5·48	9	3·20	6	0·20	1	1·23	2	1·00	2	5·94	6	7·09	11	11·39	15	7·58	12	55·30	83	7·56	Dec. 27 to 28, 1928.
Arachchi Amuna ..	135	1929 ..	2·25	4	2·71	5	7·59	16	5·85	16	3·77	12	4·67	21	3·04	17	1·88	8	4·15	13	4·96	9	17·86	27	9·09	18	67·82	166	2·55	Nov. 26 to 27
		means during 13 years ..	3·94	10	2·42	6	7·63	12	5·31	10	5·77	12	5·51	17	4·55	14	3·87	13	5·35	13	6·19	14	10·34	16	9·52	15	70·39	151	7·40	Dec. 27, 1919.
Aranayaka (Ar.) ..	1,000	1929 ..	4·11	4	2·18	5	4·46	10	20·66	23	2·65	13	15·92	22	9·49	21	1·42	9	4·81	17	5·94	16	15 27	20	4·60	10	91·51	170	4·03	June 24 to 25.
		means during 24 years ..	4·31	8	1·96	3	6·26	10	7·97	12	6·94	11	13·73	20	11·12	18	7·79	15	8·25	14	13·83	19	11·39	17	7·21	11	100·76	158	9·30	Oct. 4 to 5, 1913.