*Slaate*. —Drought becoming serious. All crops, except few under water, past recovery. Cattle falling off in condition. The lambing has been very fair, but unless rain falls very shortly, we stand to lose the lambs. Wind and dust is the rule just now.

*Durban*. —Rain fell on 12 days. The total fall (1.16 in.) being below the average for 30 years by 3.30 inches.

**NOVEMBER.**

*Groot Drakenstein*. —South-Easterly winds very prevalent during the month; blew on 20 days, rising from strong breeze to a gale at times. An universal feature was that it was for the most part accompanied by overcast or cloudy weather, and even slight rain on the 12th, which, however, dried up as soon as it fell.

*Worcester*. —Forage good and plentiful. Potatoes also good crop. Fruit and vines promise well.

*Anenous.* —Heavy banks of fog have been blown up from the Westward, commencing at sunset, but dispersing at sunrise. The last few days of the month were very hot, caused by the Easterly wind, but at sunset a Southerly breeze usually sprang up which made the evenings pleasantly cool.

*Klipfontein (Namaqualand).* —A very good harvest.

*Port Elizabeth*. —On the 13th of the month an all-day strong Easterly wind, calmed down at sunset; then at 8 p.m. wind suddenly came in from S.E. and increased to a 52-mile per hour gale between 10 p.m. and midnight, with a tremendous sea and heavy pouring rain, causing six sailing vessels to be wrecked and 13 other sailing vessels and several steamers to lose anchors, cables and breaking windlasses.

*Swellendam*. —Extensive damage done to the potato crop. Several acres of potatoes rotting is the ground; too much rain.

*Victoria Park, P.E*.—Grand rain during the month; too much on the pot clay, but grand on the limestone. No damage in the Park.

*Witteklip*. —The heavy rain in the middle of the month will destroy the oat crop now cut, and still lying on the ground.

Graaff-Reinet. —Veld around the town looking well. Hailstorm, lasting 20 minutes, passed a few miles to the South at 6 p.m. on the 20th, doing considerable damage.

*Boschfontein*. —Very windy month—prevailing direction, N.W.

*Kleinhaasfontein.* —Very little wind during the month; weather cool.

*Maraisburg*. —Very windy and dusty throughout the month.

*Richmond*. —A most peculiar month, on account of the constant and great variation in temperature. Rain badly needed. Stock in very poor condition. All fruit and vegetables in town and district destroyed by the heavy frost on the 15th.

*Karree Kloof*—Country very dry.

*The Halt*—Drought most severely felt. Stock in very low condition.

*Van Wyk' s Vlei.* —Prevailing wind, Westerly. Drought being more severely felt. Wells dry up daily.

*Evelyn Valley*. —The rainfall this month (20.66 in.) was the greatest ever recorded at this station. The next greatest fall was 16.44 in. in December, 1900, this month's fall being an excess of 4.22 in.

*Carnarvon Farm.* —Windy days, 13; frosts, 2 cloudless day, 1. The big storm of the 27th was quite local , – mile wide, 2 miles long.

*Herschel*. —The drought has now been broken, as more heavy rains are expected.

*Lady Frere*. —The drought which has prevailed for some time is now quite broken up and both natives and farmers are busy ploughing in mealies etc.

*Sterkspruit.* — Country all round seems considerably improved by the two rains at the end of the month.

*Kokstad.* — Country beautifully green. Farmers busy ploughing and sowing mealies. No diseases

*Maclear.* —All through the month the weather has been intensely cold. Cold East winds blowing almost every day, followed by cold drizzling rains.

*Durban.* — Rain fell on 19 days, the total fall (8.99 in.). being above the average for 30 years by 3.99 in.

**DECEMBER.**

*Groot Drakenstfin*. —The intense heat on the 17th and 18th of the month scorched grapes badly, and certain varieties of fruit.

*Dunbrody*. —Wind almost invariably from the S.W. in the afternoon. Sun's heat extraordinary; maximum for month in shade, 107°. Crops again ruined.

*Dunedin.* —Drought becoming more serious every day.

*Graaff-Reinet*. —Drought continuing to North of town. Strong wind from S.W. usually comes up between 6 and 7 p.m.

*Boschfontein.* —Chief features of month were light variable winds, accompanied by " Dust Devils." Clouds gathered almost every day, but with small results. Effects of drought becoming terrible. Dams have been empty the whole year, and springs, in many cases. ceased to flow. As year dies, the outlook could hardly be worse.

*Karree Kloof.* —Country very dry.

*Van Wyk's Vlei.* —Prevailing winds, Westerly. Drought unabated, but herbage putting out shoots. A few scabby goats to be seen. Water sometimes very scarce.

*Alexandria.* —Rust played havoc with the wheat crop, which, with a few exceptions, is quite a failure. Other crops excellent. No prevalent disease.

*Fort Fordyce.* —Wheat and forage all going with rust where at all late, and the remainder a very light crop.

*Stutterheim.* —No locusts reported in Division. Veld good. Cattle fairly well.

*Carnarvon Farm.* —This has been the driest December for many years. Total rainfall for 1903 only 12.56 in. Also a dry record for last decade. Taken all round this has been, for agriculture and stock, the worst year in the memory of man. It is universally admitted that the great drought of 1862 was not nearly so disastrous as this, and 1904 comes in with a still unbroken drought in many parts.

*Thibet Park.* —Most severe drought ever known in these parts, and very poor prospects for the coming season.

*Kokstad*. — Days generally hot and muggy. Several sheep killed by lightning. Much more rain wanted for crops.

*Maclear*. —The terrific hailstorm on the 28th was very destructive to gardens and fruit trees; most of the fruit beaten off the trees.

*Tubankulu.* —Exceptionally hot weather was experienced during the month.

*Durban*. —Rain fell on 20 days, the total fall (5.33 in.) being above the average for 30 years by 0.59 in.

**REPORT OF THE METEOROLOGICAL OBSERVATIONS TAKEN AT KENILWORTH, KIMBERLEY, DURING THE YEAR 1903**.

*To the Secretary of the Meteorological Commission.*

SIR, —In accordance with your request, I have prepared, and give below, a return of the more important routine meteorological observations made by me during the year 1903, for publication in the Annual Report of the Meteorological Commission.

The mater included in the report is divided into two parts, namely, (1) Daily tables. and (2) Appendices giving hourly and monthly summaries.

In the Observation, Col.1 gives the daily readings of the Standard Barometer, reduced to 32°, at viii. The Standard Barometer is by Negretti and Zambra, No. 1921, with a Kew verification. In this fine instrument the cistern is fixed, while the scale-which terminates in a fine zero point of ivory-is caused to slide up and down the frame by means of a rack and pinion. The inside diameter of the tube is about 0.7 inch. Monthly and Annual pressure valves derived from the indications of the Standard are given for three different hours (*i.e*. at viii., xiv., and xx.) in Appendix 2.

Column 2 of the Observations gives the mean pressure of the day derived from the hourly values measured on the Photo-barograms, beginning at midnight ending at xxiii. The Barograph is a very good one of the usual pattern, by Negretti and Zambra. The rays from a paraffin lamp are reflected from a concave spherical mirror through a condenser, passing across the Torricellian vacuum, between the jaws of a long, narrow, vertical slit, whence a compound camera objective brings them to a focus upon a sheet of bromide paper wrapped round a rotating drum. By means of a piece of mechanism attached to the clock a shutter cuts off the light for a few minutes every two hours, forming upon the barograms a series of equidistant narrow white lines as time indicators. Temperature compensation is effected by the agency of a delicate system of zinc and glass rods so arranged as to cause the base-line of reference photographed upon the barograms to rise and fall as the temperature varies. The charts are changed every second day at xxiii., and developed and measured every one or two weeks. The hourly ordinates are measured with a metal templet to the nearest .005 inch, and are converted into approximately true pressures in inches after comparison with the regular control observations, taken three times daily, of the Standard Barometer. Ultimately, therefore, the results may be regarded as very nearly the same as those from hourly observations with the Standard would be. In case of any temporary failure of the photographic record, the pressures may be interpolated either from readings of the Standard or from a Recording Aneroid by Ross, according as the failure was or was not anticipated. This supplementary aid was used twice during the year: on Aug. 12, when the record was interrupted for some reason unknown from 1 a.m. to 4 a.m.; on Sept. 29, when the record was faulty.

Appendix 1 gives the hourly mean pressures month by month, for the year, and also the greatest and least of the mean daily pressures; the extremes of pressure appear in Appendix 3.

The mean pressure for the year, 26.115 inches, is less even than it was in 1902. The total range is three-quarters of an inch.

All the Barometers are mounted in an outside room of raw brick whose walls are nearly a foot thick. It has no window, but is well ventilated. The diurnal range of temperature in this room is about 5°.

Columns 3 and 4 of the Observations give the respective Minimum and Maximum Shade Temperatures of the day. The thermometers from which they are derived are of Negretti and Zambra's standard pattern, and are Kew verified. They are; -

Standard Maximum, No. 81,229, mounted 5 ft. 2 in. above the ground. Index-error = —0°.1 at 32°.

Standard Minimum, No. 81,580, mounted 4 ft. 9 in. above the ground. No index-error.

Standard Minimum, No. 81,592, mounted 4 ft. 4 in. above the ground. No index-error.

Up to December 31, 1903, so far as could be ascertained, the zero point of the Standard Maximum was not appreciably displaced.

These thermometers are mounted in a large, handsome, single-louvred wooden screen, of 8 x 8 x 8 feet, about 2 feet from the louvres, and so arranged as to be as nearly as possible, consistently with firmness and security, floating in free air. A board behind and below them serves to cut off possible radiation from the ground.

The lowest Shade Temperature registered was 23°.5, on July 19th. The highest Shade Temperature registered was 102°.0, on Jan. 19th. The lowest mean daily temperature from hourly observations was 38°.8, June 27th; the highest was 84°.8. Jan. 20. On two occasions, both in June, the mean daily shade temperature was below 40°; eight times in January and twice in December it exceeded 80°. The temperature of the air fell below freezing twice in May, thirteen times in June, ten times in July, four times in August, and once in September.

Comparison observations are taken with Kew-verified Maximum and Minimum Thermometers in an old-fashioned Stevenson Screen. The extreme range of tempera-ture during the year in this Screen was from 22°.4 to 103°.0.

The readings of Maximum and Minimum Shade Temperature are taken at xxiii., and an additional reading of at viii., for the Minimum Shade Temperature of the night hours only. This last is for the purposes of comparison with the Minimum Temperature on the ground. A list of such differences as have occurred during the year between the Minimum for the whole day of 24 hours (xxiii. —xxiii.), and that for the night hours only, is given in Table 1. It will be useful whenever the daily values of m-mg are required. During four nights in the year the temperature remained above 70°.

In Appendix 4 will be found the mean and extreme readings of m, M, M-m, (M + m), and ma, for the Large Screen.

Column 5 of the Observations gives the Mean Dry Bulb Temperature of the day, and Column 6 the Mean Wet Bulb, derived from the 24 hourly readings beginning at midnight and ending at xxiii. About two-thirds of these are from eye-observations of a Standard; the others are obtained from the readings of two sets, of twelve each of Negretti and Zambra's patent Reversing Thermometers, with long, slender, cylindrical bulbs, one set mounted for Dry Bulb Observations, the other for Wet. These Thermometers are in the Large Screen.

The Standard readings are taken from two Kew-verified Board of Trade Thermometers with short cylindrical bulbs, mounted together in the usual way to form a Psychrometer.

Control and comparative Dry and Wet Bulb Observations are secured by: -

1. A Psychrometer, with spherical bulbs;

2. A small Reversing Psychrometer, with spherical bulbs which can be set to register at any assigned hour;

3. A Richard Thermograph: and

4. A Richard Hygrograph.

Each of the two last marks a continuous record upon a drum rotating once in 24 hours, Their hourly ordinates are compared with the corresponding registrations of the Reversers for every hour at which the Standards are not read, and readings are interpolated from their records when necessary. Such interpolation was made at 28 separate hours during the year, on 27 of which the Reversing Wet Bulbs were frozen up.

Columns 7 and 8 of the Observations give respectively the daily mean dew points and humidity-percentages deduced from the simultaneous readings of Dry and Wet Bulbs by the aid of the Greenwich Factors. The mean dew points so obtained are probably less than l' in error, but individual dew points in very dry calm air may err considerably. Appendices 6, 7, 8, 9 give respectively the hourly means of Dry Bulb, Wet Bulb, Dew Point, and Humidity for the year.

The year was dry throughout. The quantity of aqueous vapour in the air was at its maximum for the day on Feb. 5th, the dew point on this day averaging 63°•1. The mean dew point for the year was only 40°.4, *i.e.,* 2°.3 less than it was in 1902. The relative humidity was more than 5% less.

Column 9 of the Observations gives the minimum radiation temperature during the night hours over short grass. The Spirit Thermometer used for this purpose has a spherical bulb, and is mounted upon a stand which raises it about three inches above the ground.

Comparison observations are taken with a similar instrument resting upon the grass. Usually the Thermometer touching the grass registers much the lower temperature, particular) in winter when the top growth is dead, but occasionally, on a wet night, it may be the other way about. The last column of Appendix 4 gives the lowest temperature on grass for each month.

Although the winter nights of 1903 were much more cloudy than those of 1902, nocturnal radiation was much more intense in 1903. The temperature on the grass fell to 20° and under 26 times as compared with only 5 times in 1903.

Column 10 of the Observations gives the maximum temperature in the sun registered by a Black Bulb Thermometer in *vacuo*, mounted on a tripod about five feet above the ground. Observations with the Black Bulb Thermometer have been singularly unfortunate throughout the year. In October, 1902, the very good Black Bulb previously in use was broken and replaced by the reserve thermometer. This not always acting well, was soon replaced by the old Black Bulb over from the estate of the late Mr. G.J. Lee, while new thermometers were ordered from England. The latter were much delayed, and arrived broken, and duplicates were not available for the rest of the year. Meanwhile it was becoming evident that Lee thermometer was registering lower temperatures than might have been expected. Its outer glass bulb was perhaps a little defective from the first; but it seems to have been made worse before it came here, by being (probably) habitually wiped with a hand-kerchief or wash-leather, so that the surface of the glass was roughened. In consequence the solar maximum temperatures given in Column 10, and Appendix 4, average about 7° too low. In course of years the weathering effect of many dust-storms will inevitably spoil the glass sheath of a Black Bulb Thermometer in *vacuo*; but appreciable deterioration may be considerably postponed if the instrument be treated gently. A dusty thermometer should be rinsed in clean rain or distilled water. No other treatment is likely to be necessary in South Africa. It should never be touched with a duster.

Appendix 4 contains the monthly means and extremes of radiation minima, together with the mean and extreme daily ranges of m-m; the monthly means and extremes of solar maxima, together with the mean and extreme daily ranges of S—M.

Earth temperatures under bare sand have been observed at five different depths from one inch to six feet. The temperatures at one inch are obtained from the readings of registering Maximum and Minimum Thermometers pushed into long horizontal copper pipes sunk beneath the surface, the axes of which are one inch deep. The results seem to be fairly trustworthy, albeit the Minimum Thermometer requires careful watching. The temperatures of deeper levels are obtained by Symons's method from slow action Thermometers hung by chains in vertical iron pipes.

Four sets of readings of earth temperatures are made daily, viz.: -

At VIII., 1 foot, 2 feet:

’’ XIV., 1 foot, 2 feet;

’’XX., 1 foot, 2feet, 4 feet, 6 feet;

’’ XXIII., 1 inch (maximum and minimum).

Columns 11-16 of the Observations give daily readings of earth temperature at one inch (maximum and minimum), at one foot and two feet, read at xiv., at four feet and six feet read at xx. Monthly and Annual means appear in Appendix 5.

The following are the observed ranges of Earth Temperature during 1903: -

At 1 inch, from 25°.2 to 146°.8;

’’ 1 foot, ’’ 44.4 to 92.0;

’’ 2 feet, ’’ 51.0 to 85.0;

’’ 4 feet, ’’ 57.6 to 77.0;

’’ 6 feet, ’’ 60.1 to 74.0.

These ranges are at each depth greater than those of 1902.

Column 17 of the Observations contains the daily amounts of sunshine, in minutes, taken from the records of a Jordan, Twin, Hemi-cylinder, Photographic Recorder ; and Column 18 contains the corresponding quantities taken from the records of a Campbell-Stokes Burning-glass Recorder. Both Sunshine Recorders stand together upon a bracket attached to the Anemometer post, about 40 feet above the ground. Their records begin to be seriously interfered with by growing trees.

Monthly summaries of Sunshine appear in Appendices 10 and 11. The percentages in the columns following the monthly totals show the monthly ratios of the duration of Sunshine recorded, to the total amount that would he recorded by a perfect instrument under a cloudless sky.

The Campbell-Stokes record was broken from January 1-7, in consequence of the supply of cards having run out. For the purpose of making up the monthly totals the missing values have been interpolated from the Jordan record.

Column 19 of the Observations gives the average amount of cloud, expressed in percentages of the visible hemisphere, from observations made at viii., xi., xiv., xvii., xx., and xxiii.: the summary appearing in Appendix 10. The sum of Sunshine *plus* cloud for the daylight hours is 111%, which is nearly the same as in previous years.

The routine observations of evaporation have been continued as usual. Three instruments are in regular use.

1. A Piche Atmometer of the usual form, hung in the Large Screen.

2. An iron Tub about 14 inches diameter and 18 inches deep, standing alone in a Louvred Screen.

3. A circular steel tank about 46 inches diameter and 29 inches deep, placed in the centre of a cemented brick cistern of about seven feet square.

Daily amounts of evaporation from the Tank are given in Column 20 of the Observations; the monthly summaries of hourly rates in Appendix 12. Appendix 13 gives the monthly summaries of evaporation from the other gauges, together with the highest and lowest values observed on any day.

Appendix 14 gives the monthly totals of rainfall in hourly values, and also the hourly frequency for the year. These values are got partly from the Raingauge, and partly from the records of the Evaporation Tank. A Rainguage to register the hourly fall of rain has been constructed by Mr. H. Neal from a design by the Rev. P. King (now Rector of Vrvburg). Through unavoidable delay it is not yet in thorough working order.

Column 21 of the Observations gives the daily quantities of rainfall collected in an eight-inch M.O. Gauge, whose rim is three feet above the surface of the ground. It is read at viii. and xx., the latter hour being here considered the end of a rain-day of 24 hours. The quantity .000 appearing here and there signifies rain of too small a quantity to admit of measurement-*i.e*., something less than .005 inch.

The " Comparative Table of Rainfall” in Appendix 15 contains complete records from the Premier. Bultfontein, Du Toits Pan, De Beers, and Kimberley Mines, from the Bultfontein Floors, and from Kenilworth. The Mine and Floors Gauges are "Snowdon” five inch, and are read at viii. Some of them are badly in need of inspection.

The Kenilworth return in Appendix 15 is made up as follows: -

Night rain from xx. to viii.;

Day rain from viii. to xx.;

Total rain for days ending at xx.;

Maximum fall for days ending at xx.;

B. The number of days upon which .005 inch, or more, rain fell;

A. The number of days upon which any rain fell, including falls of .000 inch.

The last Column of the Observations gives the velocity of the wind in miles per day. It is derived from the records of a Robinson Anemometer, whose cups are 42 feet above the ground. The recording part of this instrument was designed and made for me by Mr. W. Henderson, formerly of the De Beers Company. It is very trust-worthy, and gives an excellent record. Monthly summaries appear in Appendix 16.

Wind directions, and a rough idea of wind-pressures are recorded by an Osler Anemograph For want of a duplicate anemometer occasional hours of wind-direction are lost now and then.

Appendix 17 contains the approximate hourly distribution of electrical phenomena for the year from eye and ear observations. The amounts given between vi. and midnight cannot he far short of completeness; but it has not been possible to set a regular watch for lightning between midnight and vi.

The time system used is, as before, for the meridian of 22 ° E. The approximate position of the Observatory is: -

Long., 24° 27' E.

Lat., 28° 42' S.

Altitude, about 3,950 feet.

The arrangements for preventing any break in the records remain the same. Mrs. Sutton watches the instruments and takes necessary control observations during my absence. Mr. H. Neal maintains an acquaintance with the routine so as to take charge when required. I am responsible for all the computing and clerical work.

J. R. SUTTON, M.A., F.R. Met. S.

TABLE I.-List of occasions upon which the Minimum Shade Temperature of the 24 hours ending at XXIII differed from that of the 9 hours ending at VIII.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 1903. | Min. in Shade | | 1903. | Min. in Shade | |
| XXIII. | Night hours only  VIII. | XXIII. | Night hours only  VIII. |
| Jan. 3… … | 64.0 | 70.9 | June 9… … | 40.0 | 47.0 |
| ’’ 5… … | 63.6 | 63.9 | ’’ 26… … | 35.2 | 37.5 |
| ’’ 23… … | 63.8 | 74.0 | July 17… … | 34.9 | 40.0 |
| Feb 4… … | 66.0 | 66.9 | Aug. 11… … | 43.3 | 54.0 |
| ’’ 8… … | 58.5 | 62.5 | ’’ 16… … | 43.3 | 46.7 |
| ’’ 12… … | 69.8 | 70.4 | ’’ 29… … | 41.2 | 43.1 |
| ’’ 24… … | 65.0 | 65.9 | Sept. 12… … | 55.0 | 56.6 |
| ’’ 25… … | 63.2 | 64.5 | ’’ 13… … | 40.0 | 44.5 |
| March 23… … | 56.4 | 61.1 | Oct. 16… … | 54.8 | 58.4 |
| April 1… … | 49.8 | 50.0 | ’’ 26… … | 52.0 | 54.8 |
| ’’ 28… … | 46.0 | 47.5 | Nov. 13… … | 62.5 | 64.0 |
| May 5… … | 50.0 | 52.0 | ’’ 24… … | 59.8 | 60.0 |
| ’’ 14… … | 37.5 | 48.7 | ’’ 27… … | 53.8 | 63.1 |
| ’’ 27… … | 40.9 | 45.6 | Dec. 12… … | 63.5 | 63.7 |
| June 4… … | 35.6 | 40.0 | ’’ 19… … | 69.5 | 70.4 |