

MONTHLY METEOROLOGICAL TABLE

Deduced from observations taken at Tiberias, by Mr. LAWIN, at about 652 feet below the level of the Mediterranean, and 30 feet above the level of the Sea of Galilee, open on all sides. Latitude, 32° 48' N.; Longitude, 35° 34' E.

Table with columns for Months, Pressure of atmosphere, Temperature of the air, 8 a.m. (Mean reading, Vapour, Degree of humidity), 4 p.m. (Mean reading, Vapour, Degree of humidity), and Rain. Rows include months from 1897 to Means, and numbered columns 1-32.

## RESULTS OF METEOROLOGICAL OBSERVATIONS TAKEN AT TIBERIAS IN THE YEAR 1897.

By JAMES GLAISHER, F.R.S.

THE numbers in column 1 of this table show the highest reading of the barometer in each month; the highest appear in the winter, and the lowest in the summer months; the maximum for the year was 31·120 inches, in November, and the next in order 31·082 inches, in January.

In column 2 the lowest reading in each month is shown; the minimum for the year was 30·230 inches, in August; and the next in order 30·231 inches, in July.

The range of readings in the year was 0·890 inch. The range in the morning observations was 0·843 inch, being 0·088 inch greater than the range at Jerusalem.

The numbers in the 3rd column show the extreme range of readings in each month; the smallest was 0·263 inch, in July, and the next in order 0·276 inch, in August; the largest was 0·779 inch, in February, and the next in order 0·720 inch, in January.

The numbers in columns 4 and 5 show the mean monthly reading of the barometer at 8 a.m. and 4 p.m.; and those in column 6 the lower reading at 4 p.m. than at 8 a.m.; the smallest difference between these two readings was 0·041 inch, in November, and the next in order 0·048 inch, in December; the largest was 0·095 inch, in October; and the next in order 0·089 inch, in September. In England in January the readings at 8 a.m. and 4 p.m. are practically the same; in all other months the reading at 4 p.m. is lower than at 8 a.m.; the greatest difference is 0·025 inch, in June. The mean for the year at Tiberias was 0·066 inch, being about three times greater than in England.

The numbers in the 7th column show the mean monthly pressure of the atmosphere; the highest was 30·749 inches, in December, and the next in order 30·746 inches, in February; the lowest was 30·375 inches, in July, and the next in order 30·406 inches, in August. The mean for the year was 30·600 inches.

The highest temperature of the air in each month is shown in column 8. The first day in the year the temperature reached 90° was on April 2nd, and there was 1 other day in April on which the temperature reached or exceeded 90°; in May, on 6 days; in June, on 27 days; in July, August, and September it reached or exceeded 90° on every day; and in October, on 18 days; thus the temperature reached or exceeded 90° on 145 days during the year. At Jerusalem the temperature did not reach 90° till June 7th, and there were only 16 days in the year on which the temperature was as high as 90°. At Tiberias the temperature was 102° on June 7th, and reached or exceeded 100° on 2 other days in this month; in July, on 7 days; in August, on 1 day; in September, on

9 days ; and in October, on 1 day ; thus on 21 days in the year the temperature reached or exceeded  $100^{\circ}$ . The highest temperature in the air at Tiberias was  $109^{\circ}$  ; on September 19th ; at Jerusalem it was  $99^{\circ}$  , on September 23rd.

On February 14th, 1898, Dr. Torrance wrote saying that he was sorry to state that he just discovered that the minimum thermometer observations made during the year 1897 are untrustworthy, and that he had come to the conclusion that, though probably many of the observations are accurate, they cannot be relied upon ; consequently, columns 9, 10, 12, and 13 are blank.

It has been remarked in every year that the mean of the dry-bulb thermometer observations at 8 a.m. in every month agree very closely with the simple mean of the maximum and minimum thermometers, and that the mean temperature could be inferred from the observations at 8 a.m.

The table opposite (p. 73) shows the means of seven years' observations. It will be seen that the mean monthly temperature was generally a little higher than the mean reading of the dry-bulb at 8 a.m. By the application of these numbers to those in column 15 in the general table, the values in column 14 have been inferred.

In column 11 the mean of all the high day temperatures in each month is shown. The lowest was  $63^{\circ}6$  in January, being  $11^{\circ}4$  higher than that at Jerusalem ; the next in order were  $65^{\circ}4$  in December, and  $69^{\circ}1$  in February ; the highest was  $99^{\circ}4$  in July ; and the next in order  $99^{\circ}1$  in September, and  $96^{\circ}6$  in August. At Jerusalem the lowest were  $51^{\circ}$  in December,  $52^{\circ}2$  in January, and  $52^{\circ}8$  in February ; the highest were  $88^{\circ}6$  in September,  $85^{\circ}5$  in July, and  $82^{\circ}8$  in August.

The mean temperature of the air in each month is shown in column 14. The lowest was  $56^{\circ}$  in January, the next in order were  $58^{\circ}8$  in February, and  $58^{\circ}9$  in December ; the highest was  $88^{\circ}2$  in July, and the next in order were  $87^{\circ}8$  in August, and  $87^{\circ}1$  in September. At Jerusalem the lowest temperatures were  $46^{\circ}3$  in December,  $47^{\circ}$  in February, and  $47^{\circ}1$  in January ; the highest were  $77^{\circ}9$  in September,  $76^{\circ}8$  in July, and  $73^{\circ}0$  in August. At Tiberias the mean temperature increased month by month to the maximum in July, then decreased month by month to the end of the year. At Jerusalem the mean temperature increased from February to July, decreased from July to August, increased from August to the maximum in September, then decreased month by month to the end of the year. At Tiberias the yearly value was  $72^{\circ}6$  ; at Jerusalem it was  $61^{\circ}3$ .

The numbers in the 15th and 16th columns are the mean readings of a dry- and wet-bulb thermometer, taken daily at 8 a.m. If those in column 15 be compared with those in column 14, it will be seen that those in column 15 were of the same value in April, a little higher in March and September, and a little lower in all other months. The mean for the year was  $72^{\circ}1$ , being  $0^{\circ}5$  less than the mean of column 14. In the year 1890 the mean of the dry-bulb was  $1^{\circ}1$  lower than that of the

*Means of the Seven Monthly Mean Temperatures, as found from the Maximum and Minimum Temperatures only, in the preceding Seven Years, viz., 1890 to 1896, and the Monthly Mean of the Dry-Bulb Thermometer at 8 a.m. in the same Years, and showing the Excess of Mean Temperature over that at 8 a.m. in each Month.*

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
Mean temperature .. .. .	56·3	57·7	61·9	68·5	77·1	83·3	87·3	88·2	84·1	79·6	69·4	61·4
Mean reading of dry-bulb at 8 a.m. .. ..	55·2	57·6	62·5	68·5	76·4	82·2	86·7	86·9	84·3	79·4	68·4	60·7
Excess of mean temperature over that at 8 a.m.	+1·1	+0·1	-0·6	0·0	+0·7	+1·1	+0·6	+1·3	-0·2	+0·2	+1·0	+0·7

maximum and minimum thermometers; in 1891 it was  $1^{\circ}5$  lower; in 1892,  $0^{\circ}4$  higher; in 1893,  $0^{\circ}7$  lower; in 1894,  $0^{\circ}5$  lower; and in 1895,  $0^{\circ}1$  lower; the mean of the six differences is  $0^{\circ}6$ ; and therefore the mean temperature of the year may be approximately determined by a single reading of the thermometers taken daily at 8 a.m.

The numbers in the 17th column are the temperature of the dew-point, or that temperature at which the air would be saturated by the quantity of vapour mixed with it; the smallest difference between these numbers and those in column 15 was  $3^{\circ}8$  in January, and the largest  $18^{\circ}9$  in September.

The numbers in column 18 show the elastic force of vapour, or the length of a column of mercury in inches corresponding to the pressure of vapour; the smallest was  $0\cdot330$  inch in February, and the largest  $0\cdot749$  inch in July.

In column 19 the weight in grains of the water in a cubic foot of air is shown; it was as small as  $3\cdot7$  grains in February, and as large as  $7\cdot9$  grains in July.

In column 20 the additional quantity of water required to saturate a cubic foot of air is shown; it was as small as  $0\cdot7$  grain in January, and as large as  $6\cdot4$  grains in September.

The numbers in column 21 show the degree of humidity of the air, saturation being represented by 100; the largest number is 87 in January, and the smallest 54 in September.

The numbers in column 22 show the weight in grains of a cubic foot of air, under the mean atmospheric pressure, temperature, and humidity of the air; the largest number was in January, decreasing to the smallest in July, then increasing again to the end of the year.

In columns 23 and 24 are the mean readings of a dry- and wet-bulb thermometer taken daily at 4 p.m. By comparing the numbers in column 15 with those in column 23, the increase of temperature from 8 a.m. to 4 p.m. is shown; in November the increase was only  $2^{\circ}4$ , and in May it was as much as  $7^{\circ}3$ .

In column 25 the temperature of the dew-point at 4 p.m. is shown. By comparing these numbers with those in column 17, it will be seen that the temperature of the dew-point in the months of January and February was higher than at 8 a.m., and lower than at 8 a.m. in all other months. The numbers in this column are smaller than those in column 23, by  $7^{\circ}4$  in January, increasing to  $28^{\circ}9$  in September, decreasing to  $15^{\circ}$  in December; these differences between the temperature of the air and that of the dew-point are very much larger than those at 8 a.m., being in several months more than twice as large.

On several days during the months of April, May, June, July, August, September, and October, at 4 p.m., the reading of the dry-bulb thermometer exceeded that of the wet by  $20^{\circ}$  or more, and the temperature of the dew-point was from  $32^{\circ}1$  to  $52^{\circ}4$  lower than the temperature of the air, as shown by the following table:—

Month and Day.	Reading of		Temperature of the Dew Point.	Temperature of the Dew Point below Dry.
	Dry.	Wet.		
	°	°	°	°
April 10 .. ..	85·0	65·0	51·9	33·1
18 .. ..	86·0	66·0	53·0	33·0
May 7 .. ..	89·0	69·0	56·4	32·6
18 .. ..	89·0	67·0	53·1	35·9
20 .. ..	88·0	68·0	55·2	32·8
24 .. ..	90·0	69·0	55·8	34·2
June 6 .. ..	96·0	70·0	54·7	41·3
7 .. ..	94·0	72·0	58·7	35·3
8 .. ..	94·0	71·0	57·1	36·9
July 5 .. ..	95·0	71·0	56·6	38·4
8 .. ..	94·0	74·0	61·9	32·1
18 .. ..	95·0	72·0	58·2	36·8
19 .. ..	95·0	74·0	61·4	33·6
22 .. ..	95·0	74·0	61·4	33·6
Aug. 25 .. ..	96·0	75·0	62·6	33·4
27 .. ..	93·0	71·0	57·6	35·4
28 .. ..	96·0	75·0	62·6	33·4
Sept. 12 .. ..	103·0	80·0	67·3	35·7
19 .. ..	100·0	72·0	56·0	44·0
20 .. ..	107·0	74·0	56·5	50·5
21 .. ..	101·0	71·0	54·2	46·8
22 .. ..	106·0	72·0	53·6	52·4
23 .. ..	101·0	71·0	54·2	46·8
27 .. ..	92·0	72·0	59·7	32·3
28 .. ..	94·0	73·0	60·3	33·7
Oct. 3 .. ..	92·0	68·0	53·1	38·9
4 .. ..	93·0	72·0	59·2	33·8
5 .. ..	96·0	71·0	56·2	39·8

In column 26 the elastic force of vapour is shown, and by comparing the values with those in the same month at 8 a.m. we find that it was smaller at 4 p.m. in the months from March to December, and larger than at 8 a.m. in January and February.

In column 27 the amount of water in a cubic foot of air at 4 p.m. is shown; the amount was less than at 8 a.m. in the months from April to October and in December, of the same value in both February and March, and larger than at 8 a.m. in the remaining months.

In column 28 the amount of water required to saturate a cubic foot of air was as large as 10·4 grains in September, 9 grains in July, and 8·6 grains in August, and smaller than 2 grains in January.

In column 29 the degree of humidity is shown; the driest months are from April to October, the value for these months varying from 39 in September, to 48 in April.

In column 30 the weight of a cubic foot of air is shown; the smallest was 507 grains, in August, and the largest 547 grains, in both January and December.

In column 31 are given the number of days of rain in each month ; the greatest number was 14, in February. The total number in the year was 57. At Jerusalem rain fell on 72 days.

In column 32 the monthly fall of rain is given. The heaviest fall of rain on one day in the months from January to April was 2·72 inches, on January 5th ; and the next in order were 2·30 inches on January 2nd, and 2 inches on March 22nd. No rain fell from May 25th till October 29th, making a period of 156 consecutive days without rain. The fall of rain on both December 3rd and 12th was 1·00 inch. The heaviest monthly fall in the year was 11·21 inches, in January, and the next in order, 6·74 inches, in December. The total fall for the year was 27·72 inches. At Jerusalem the total fall for the year was 41·62 inches.

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## RESULTS OF METEOROLOGICAL OBSERVATIONS TAKEN AT JERUSALEM IN THE YEAR 1897.

By JAMES GLAISHER, F.R.S.

THE numbers in column 1 of this table show the highest reading of the barometer in each month ; of these the highest, as usual, are in the winter, and the lowest in the summer months ; the maximum for the year was 27·735 inches, in November, and the next in order, 27·680 inches, in January. The highest reading in the preceding 36 years, viz., 1861 to 1896 inclusive, was 27·816 inches, in December, 1879.

In column 2 the lowest reading of the barometer in each month is shown ; the minimum for the year was 26·980 inches, in March, and the next in order, 27·119 inches, in January. The lowest reading in the preceding 36 years was 26·970 inches, in March, 1896.

The numbers in the 3rd column show the extreme range of readings in each month ; the smallest was 0·159 inch, in October, and the next in order, 0·178 inch, in July ; the largest was 0·641 inch, in March, and the next in order, 0·561 inch, in January. The mean monthly range for the year was 0·347 inch. The mean for the preceding 36 years was 0·310 inch.

The range of barometer readings in the year was 0·755 inch. The largest range in the preceding 36 years was 0·742 inch, in 1876 ; and the smallest, 0·491 inch, in 1883.

The numbers in the 4th column show the mean monthly pressure of the atmosphere ; the highest was 27·505 inches, in November, and the next in order, 27·475 inches, in December ; the lowest was 27·262 inches, in July, and the next in order, 27·289 inches, in August. The mean yearly pressure was 27·394 inches. The highest mean yearly pressure in the preceding 36 years was 27·442 inches, in 1863, and the lowest, 27·357 inches, in 1894. The mean for the 36 years was 27·390 inches.