Comparative table of rainfall for October.

(Based upon the average stations only.)

Divisions.	Relative area.	Number of stations.	Rainfall.	
			Average.	1901.
			Inches.	*Inches.*
Northeastern division	25	21	15.12	12.99
Northern and subcentral division	22	52	7.81	7.92
Western-central division	26	22	13.42	9.09
Southern division	27	32	12.37	9.02
General means	100	127	12.18	9.76

In taking the average rainfall Mr. Hall uses only those stations for which he has several years of observation, so that the column of averages represents fairly well the normal rainfall for each division, while the column for the current month represents the average rainfall at those same stations. The relative areas of the divisions are very nearly the same and are given in the preceding table as expressed in percentages of the total area of Jamaica. The number of rainfall stations utilized in each area varies slightly from month to month, according as returns have come in promptly or not, but will not differ greatly from the numbers in the second column of the table.

Jamaica, W. I, climatological data, November. 1901.

	Negril Point Lighthouse.	Morant Point Lighthouse.
Latitude (north)	18° 15′	17° 55′
Longitude (west)	78° 23′	76° 10′
Elevation (feet)	33	8
Mean barometer { 7 a. m.	29.918	29.906
Mean barometer { 3 p. m.	29.864	29.860
Mean temperature { 7 a. m.	76.3	.....
Mean temperature { 3 p. m.	83.1	.....
Mean of maxima	85.9	.....
Mean of minima	73.6	.....
Highest maximum	89.0	.....
Lowest minimum	64.0	.....
Mean dew-point { 7 a. m.	70.0	.....
Mean dew-point { 3 p. m.	71.1	.....
Mean relative humidity { 7 a. m.	81.0	.....
Mean relative humidity { 3 p. m.	67.0	.....
Total rainfall (inches)	0.79	11.40
Average wind direction { 7 a. m.	nne.	n., nne.
Average wind direction { 3 p. m.	n., nne.	n., nne.
Average hourly velocity, miles { 7 a. m	10.7	14.2
Average hourly velocity, miles { 3 p. m	15.7	15.1
Average cloudiness (tenths):		
7 a. m. { Lower clouds	0.6	1.5
7 a. m. { Middle clouds	2.3	2.2
7 a. m. { Upper clouds	3.5	1.2
3 p. m. { Lower clouds	0.0	2.8
3 p. m. { Middle clouds	5.6	1.9
3 p. m. { Upper clouds	1.5	0.9

NOTE.—The pressures are reduced to standard temperatures and gravity, to the Kew standard, and to mean sea level. The thermometers are exposed in Stevenson screens.

Comparative table of rainfall for November.

(Based upon the average stations only)

Divisions.	Relative area.	Number of stations.	Rainfall.	
			Average.	1901.
			Inches.	*Inches.*
Northeastern division	25	21	10.91	23.14
Northern and subcentral division	22	52	5.73	8.97
Western-central division	26	20	6.06	4.36
Southern division	27	31	4.73	3.62
General means	100	124	6.86	10.02

CUMULUS CLOUDS FORMED BY SMOKE.

By W. H. MITCHELL, Bayonne, N. J.

During the field maneuvers and meteorological kite ascension of the Bayonne kite corps at their field station, November 28, 1901, a large column of smoke was observed to the northward.

It was 11:30 a. m. when the smoke was first noticed, and while the members were speculating as to the location of the fire the crest of the smoke column suddenly became capped with the white vapor of the cumulus cloud formation.

Afterward the smoke evidently rose higher than the white vapor between the observers and the new formed cloud so that for a few moments it was invisible, only to reappear later.

Finally the smoke dissipated, leaving the new formed cloud alone in the northern sky, and increasing in size. It was visible for nearly two hours before it finally disappeared from view.

The fire was slightly west of north from Bayonne and several miles distant. The minimum temperature of the day at Bergen Point was 18°, the maximum 27°. Sky absolutely clear at the time.

CLIMATOLOGY OF COSTA RICA.

Communicated by H. PITTIER, Director, Physical Geographic Institute.

TABLE 1.—*Hourly observations at the Observatory, San Jose de Costa Rica, during November,* 1901.

Hours.	Pressure.		Temperature.		Relative humidity.		Rainfall.		
	Observed, 1901.	Normal, 1889-1900.	Observed, 1901.	Normal, 1889-1900.	Observed, 1901.	Normal, 1889-1900.	Observed, 1901.	Normal, 1889-1900.	Duration, 1901.
	660+ *Mm.*	660+ *Mm.*	° *C.*	° *C.*	%	%	*Mm.*	*Mm.*	*Hrs.*
1 a. m	4.38	3.10	16.64	17.05	89	92	8.8	2.0	3.66
2 a. m	4.01	2.73	16.47	16.81	88	92	6.0	2.0	5.00
3 a. m	3.77	2.60	16.24	16.65	88	92	8.5	1.1	4.08
4 a. m	3.77	2.54	16.20	16.53	89	92	11.5	0.7	3.92
5 a. m	3.98	2.80	16.15	16.44	88	92	6.9	1.1	3.00
6 a. m	4.33	3.23	16.10	16.38	89	91	4.4	2.7	3.00
7 a. m.	4.70	3.57	17.45	17.68	82	86	3.2	0.3	3.00
8 a. m	5.00	3.98	18.90	19.52	76	80	3.6	1.2	3.00
9 a. m	5.16	4.18	20.37	21.49	73	75	1.0	1.8	1.42
10 a. m	5.14	4.08	21.63	22.03	71	70	1.9	1.3	1.17
11 a. m	4.79	3.75	22.38	23.75	70	70	2.4	2.1	1.83
12 m	4.19	3.15	22.93	24.05	70	70	1.1	2.6	1.33
1 p. m	3.65	2.57	22.61	23.94	70	71	2.1	7.2	1.67
2 p. m	3.19	2.05	22.19	23.31	73	74	7.5	14.7	5.00
3 p. m	3.02	1.85	21.39	22.36	76	77	3.9	20.0	5.41
4 p. m	3.13	1.97	20.27	21.22	80	81	18.6	18.7	5.99
5 p. m	3.41	2.24	19.08	20.15	80	85	22.9	19.3	4.16
6 p. m	3.74	2.66	18.37	19.30	85	87	15.1	21.0	5.08
7 p. m	4.26	3.19	18.06	18.65	86	89	12.4	10.8	5.06
8 p. m	4.67	3.62	17.86	18.33	86	89	12.1	8.5	4.27
9 p. m	5.00	3.92	17.72	18.05	86	90	2.0	5.4	2.50
10 p. m	5.08	3.99	17.51	17.72	87	91	6.1	4.9	1.67
11 p. m	5.04	3.86	17.32	17.42	87	91	11.6	2.5	1.24
Midnight	4.80	3.55	16.95	17.19	88	92	9.1	2.4	2.19
Mean	664.26	663.08	18.78	19.44	82	84	.....	.....	.....
Minimum	661.1	659.33	14.0	11.2	53	.....	.....	.....	.....
Maximum	666.9	667.22	29.3	29.0	100	.....	16.4	.....	.....
Total	.....	.....	.....	.....	.....	.....	182.7	154.2	78.65

REMARKS.—The barometer is 1,169 meters above sea level. Readings are corrected for gravity, temperature, and instrumental error. The dry and wet bulb thermometers are 1.5 meters above ground and corrected for instrumental errors. The hourly readings for pressure, wet and dry bulb thermometers, are obtained by means of Richard registering instruments, checked by direct observations every three hours from 7 a. m. to 10 p. m. The hourly rainfall is as given by Hottinger's self-register, checked once a day. Under maximum, the greatest hourly rainfall for the month is given. The standard rain gage is 1.5 meters above ground. In the Costa Rican system the San Jose local time is used, which is $0^h\ 36^m\ 13^s$ slower than seventy-fifth meridian time.

Notes on the weather.—At San Jose the average pressure was above, and the average temperature below the normal, but the maximum temperature was the highest ever recorded for November. The relative humidity was slightly below the normal and the hours of sunshine were only about two-thirds of the normal number. Altogether November was quite abnormal as compared with the usual weather in San Jose at this

period of the year. On the Pacific slope the rainfall was slightly above the normal; on the Atlantic slope heavy showers caused inundations at several places; at Cariblanco, toward the headwaters of the Sarapiqui River, the amount of rainfall was 1,326 millimeters, which is the greatest monthly amount ever recorded at a Costa Rican station.

Notes on earthquakes.—November 1, 6h 34m a. m., light shock, NNW–SSE, intensity II, duration 8 seconds. November 2, 5h 06m a. m., light shock, NNW–SSE, intensity II, duration 6 seconds. November 5, 7h 10m a. m., very light tremors.

TABLE 2.

Time.	Sunshine.		Temperature of the soil at depth of—					Cloudiness observed, 1901.
	Observed, 1901.	Normal, 1889–1900.	0.15 m.	0.30 m.	0.60 m.	1.20 m.	3.00 m.	
	Hours.	*Hours.*	° C.	° C.	° C.	° C.	° C.	%
7 a. m.	2.50	4.81	19.60	19.52	20.74	21.26	21.40	66
8 a. m.	11.41	16.82	.....	.....	.....	.....	.....	.....
9 a. m.	13.42	19.65	.....	.....	.....	.....	.....	.....
10 a. m.	11.01	18.29	19.88	19.88	20.77	21.25	.....	79
11 a. m.	9.08	16.69	.....	.....	.....	.....	.....	.....
12 m.	9.83	14.34	.....	.....	.....	.....	.....	.....
1 p. m.	8.91	13.40	20.08	20.02	20.83	21.29	.....	80
2 p. m.	10.18	13.38	.....	.....	.....	.....	.....	.....
3 p. m.	7.31	12.11	.....	.....	.....	.....	.....	.....
4 p. m.	6.00	9.27	20.10	20.02	20.76	21.23	.....	88
5 p. m.	2.64	4.68	.....	.....	.....	.....	.....	.....
6 p. m.	0.17	0.71	.....	.....	.....	.....	.....	.....
7 p. m.	.....	.....	20.09	20.03	20.71	21.22	.....	78
8 p. m.	.....	.....	.....	.....	.....	.....	.....	.....
9 p. m.	.....	.....	.....	.....	.....	.....	.....	.....
10 p. m.	.....	.....	19.99	20.01	20.75	21.22	.....	72
11 p. m.	.....	.....	.....	.....	.....	.....	.....	.....
Midnight	.....	.....	.....	.....	.....	.....	.....	.....
Mean	.....	.....	19.96	19.98	20.77	21.24	21.40	78
Total	92.46	144.15	.....	.....	.....	.....	.....	.....

TABLE 3.—*Rainfall at stations in Costa Rica, November*, 1901.

Stations.	Amount	No. rainy days.	Stations.	Amount.	No. rainy days.
	Mm			*Mm.*	
1. Sipurio (Talamanca)	288	26	14. Juan Vinas	337	22
2. Boca Banano	483	28	15. Santiago	396	27
3. Limon	258	19	16 Paraiso	172	15
4. Swamp Mouth	590	5	17. Las Concavas	219	20
5. Zent	385	17	18. Cartago	193	17
6. Gute Hoffnung*	*	*	19. Tres Rios	204	15
7. Siquirres	567	20	20. S. Francisco G	179	17
8. Guapiles	662	28	21. San Jose	183	18
9. Sarapiqui	1,326	27	22. La Verbena	461	14
10. San Carlos	545	21	23. Nuestro Amo	118	11
11. Las Lomas	604	18	24. Alajuela	210	11
12. Peralta	372	19	25. San Isidro Alajuela	271	16
13. Turrialba	329	19	26. Cachi	194	15

*Not received.

THE REDUCTION OF RECORDS OF RAIN GAGES.

By Prof. MARK S. W. JEFFERSON, State Normal College, Ypsilanti, Mich., dated December 4, 1901.

The time has come to apply corrections to readings of rain gages before entering the figures on maps or tables that are meant to give information about the distribution of actual rainfall. The work of determining these corrections should be given to men of special training in meteorology, with time for the work and abundant data of such sort as have been hitherto collected.

The mere accumulation of rain gage readings is no longer acceptable to students. Additional observations ought to give greater and greater accuracy to our knowledge, and this is not true of lengthening series of observations in which large and varying errors have been allowed to remain.

We must look to Government bureaus for systematic quantitative studies and to students who have ready access to large libraries for their elaboration and the development of statements of law.

The fact that rain catch diminishes in some proportion to strength of wind is quite certain and it now only remains to apply such empirical corrections as the very interesting one suggested on page 182 of the Editor's paper[1] on "The determination of the true amount of precipitation." It would seem to be proper to apply that formula, as he suggests, to all the individual rains of a locality, to see if there is the expected elimination of local and annual discordances.

There must be abundant data in the office of the Weather Bureau for such investigations, and the prevalent use of city house tops as gage stations would seem to demand the application of corrections. I hope some further studies will be made.

I believe a more serious defect in published rainfall data is connected with the principle involved in atmospheric precipitation in general, i. e., that hill precipitation must tend to exceed that of neighboring lowlands. Of course all the officials of the Bureau are perfectly familiar with this fact, but the publications of the Bureau do not show that it is properly kept in mind. Maps should not be labeled normal annual precipitation if they represent merely low gage collections. A geographer must distinguish mountain masses by deeper shades on a rainfall map, whether gages have ever been set up on their summits or not, since never has a mountain been gaged without yielding greater rainfall than the valleys.

Mr. Gannett drew a rainfall map for Mr. Newell's "Results of stream measurements," Fourteenth Annual Report United States Geological Survey, 1892–93, p. 152, which looks far more satisfactory in this respect than the Mean Annual Precipitation Map in the Report of the Chief of the Weather Bureau, 1896–97, p. 320. Mr. Gannett's data were obtained from the Weather Bureau, and perhaps the Bureau's maps of the same date were better than the later ones. This superiority I find on Mr. Gannett's map, in spite of its smallness, in the representation of the precipitation of the Adirondacks and the White Mountains; it also shows the influence of topography in Oregon, Washington, and Colorado. If the later map (1896–97) is to be believed, subsequent observations must have shown Gannett's map to be in error.

We are not limited to rain gages for our knowledge of rainfall. Table V, on page 358 in the Weather Bureau Report for 1896–97 above referred to, gives figures for eleven New England stations which may be supposed to represent the data from which the map is constructed. Now these stations are at elevations varying between 11 and 850 feet, an average of 175 feet above the level of the sea. It is at once clear that this is far below the average elevation of New England, and must represent considerably less than the average rainfall. On page 359 we find the statement—

> While the mountain system of New England does not greatly modify the rainfall conditions, it plays an important part in the water supply of the towns and cities that cluster along the larger rivers. Virgin forest covers in great part the mountain slopes over a considerable area, thus conserving to a certain extent the rains of summer and the snows of winter.

The rainfall conditions referred to are plainly those of the valleys, and only the low valleys at that. The propriety of assuming these low valleys as typical of New England is evident in one sense only, that of being the seat of population. For agriculture and forest growth the mountains do greatly modify rainfall conditions, since if the mountains were not there the rainfall would be very much less. On the next page we learn that Mount Washington has 83.5 inches, with "some uncertainty attached to these figures owing to the well known difficulties experienced in measuring precipita-

[1] Extract from Bulletin No. 7, Forestry Division, United States Department of Agriculture. See also MONTHLY WEATHER REVIEW, October, 1899, Vol. XXVII, p. 464.