Annual average at Gamboa, 1.00; annual average at Bohio, 0.92.

Without placing too great reliance on these figures, we may, from the well-marked differences between the results for the dry season and those for the rainy season, conclude that during the rainy season the Chagres must receive a great deal of water from the soil by infiltration. This is ordinarily the case with rivers flowing through similar regions. In fact, we already knew this by observing considerable outflows of water occurring in January, although there were no rains. This condition is very advantageous to the canal as regards the supply of water for the summit level during the dry season.

It may be further remarked that these annual mean ratios agree well with results well known in the United States, where the following figures are accepted:*

For rivers flowing from mountains or steep, rocky hills...	0.80 to 0.90
In forests and swampy regions.....	0.60 to 0.80
In undulating meadows with forests.....	0.50 to 0.70
In cultivated flat prairies.....	0.45 to 0.60

Fig. 1 represents the outflow and the amount of rainfall given by the above tables and the correlated positions of the sun in its annual course.

ADDENDUM, DATED DECEMBER 14, 1899.

During the current year observations have been resumed at Alhajuela, including daily measurements of discharge, automatic water level records, the rainfall, and hourly registrations by a self-registering thermometer and barometer. The usual records have been continued at Gamboa and Bohio. Rating tables, giving the discharges corresponding to the the different water levels, have been prepared at all three posts based for Alhajuela on over 350, for Gamboa on over 1,450, and for Bohio on over 1,000 actual gagings. As a check on the daily discharge measurements the volumes are computed, from these rating tables, at two-hourly intervals, thus correcting for any sudden changes in water level by day or by night, and determining the discharge with extreme accuracy.

These more elaborate discharge determinations, together with the additional rainfall observations at Alhajuela, furnish data for a more exact estimate of the ratio between rainfall and drainage than was possible in the foregoing study. The automatic water levels and the rainfall observations at Alhajuela were begun last June, and the numerical data to date (the mean monthly discharge in cubic meters per second, and the monthly rainfall in millimeters) are given in the following table:

TABLE 6.

Month.	Bohio.		Gamboa.		Alhajuela.		Colon.
	Discharge.	Rainfall.	Discharge.	Rainfall.	Discharge.	Rainfall.	Rainfall.
1899.							
July	112	451	73	240	61	297	763
August	162	330	113	278	91	259	376
September	120	226	83	342	66	305	186
October	140	491	89	202	73	301	382

The desired ratio between precipitation and drainage at Bohio (and similarly at Gamboa) has been found by dividing the mean monthly discharge there, as determined at two-hourly intervals, by the sum of the products of the mean rainfall at Bohio and Gamboa, at Gamboa and Alhajuela, and at Alhajuela and Colon multiplied by the areas of their several basins. The results for the four months now available are in so good accord with the above 7-year table, that its general trustworthy character seems to be confirmed, as appears from the figures in Table 7.

*Hydraulic and Water Supply Engineering. By J. T. Fanning, C. E., page 77.

TABLE 7.

Month.	Ratio at Bohio.		Ratio at Gamboa.	
	Calculated.	Above table (mean of 7 years).	Calculated.	Above table (mean of 7 years).
1899.				
July	0.42	0.58	0.40	0.65
August	0.84	0.70	0.94	0.64
September	0.73	0.80	0.90	0.63
October	0.65	0.94	0.68	0.86
Means	0.66	0.75	0.73	0.70

But a knowledge of the discharge at these three important posts enables the value of the ratio between downfall and drainage to be computed, independently, for the two basins lying between Bohio and Gamboa, and between Gamboa and Alhajuela, of which the areas are more accurately known than that of the Upper Chagres. Moreover, the rainfall having been noted at each of their extremities, the mean values are probably better determined. These local ratios, based on the contributions of the lower tributaries and the corresponding rainfall, are found to be the following: For the basin between Bohio and Gamboa (250 square miles), in July it was 0.47; in August, 0.66; in September, 0.52; and in October, 0.61, giving a mean of 0.57. For the basin between Gamboa and Alhajuela (130 square miles), it was in July 0.36; in August, 0.65; in September, 0.48, and in October, 0.45, giving a mean of 0.49. Thus, in whatever way computed, the numerical value of this ratio in the valley of the Chagres varies only within limits usual in such districts, and thus indirectly furnishes a new confirmation of the accuracy which characterizes the hydraulic and other investigations of the New Panama Canal Company.

COMPARATIVE RAIN GAGE READINGS AT ATLANTA, GA.

By ALFRED J. HENRY, Chief of Division.

A series of comparative measurements of the rainfall at several points in Atlanta, Ga., extending over eleven months, has just been completed.

The Weather Bureau Office in that city was moved to the United States Customhouse, May 1, 1891. The customhouse is provided with a hip roof, surmounted by a tower. The wind instruments were given a satisfactory exposure on the top of the tower, but it was not possible to secure a position for the rain gage that should be fully removed from the influence of the tower. It was known that the position of the gage was faulty and gave deficient measurements of precipitation with northeast winds, but the amount of the deficit was a matter of conjecture until after the recent comparative measurements were begun. A rain gage was taken to the residence of the official in charge of the station, about a mile northeast of the customhouse, and given a good ground exposure. The measurements at the two locations, customhouse and the residence of the official in charge, (which for convenience will be designated A and B, respectively), were as follows: February 1899, A, 6.62 inches; B, 7.88 inches. March, A, 5.38 inches; B, 7.06 inches. April, A, 1.71 inches; B, 2.09 inches. The discrepancy between the catch at A and B, respectively, may be attributed in part to the effect of the tower at A, and in part to the fact that ground exposures catch, on the average, from 5 to 10 per cent more rain than roof exposures.

In May, 1899, an option was secured on quarters in the Prudential Building, which, it may be remarked, is provided with a flat roof and offers fairly good exposures for the various instruments used by the Weather Bureau, but the removal of the station to the Prudential Building was not accomplished until July 1, 1899.

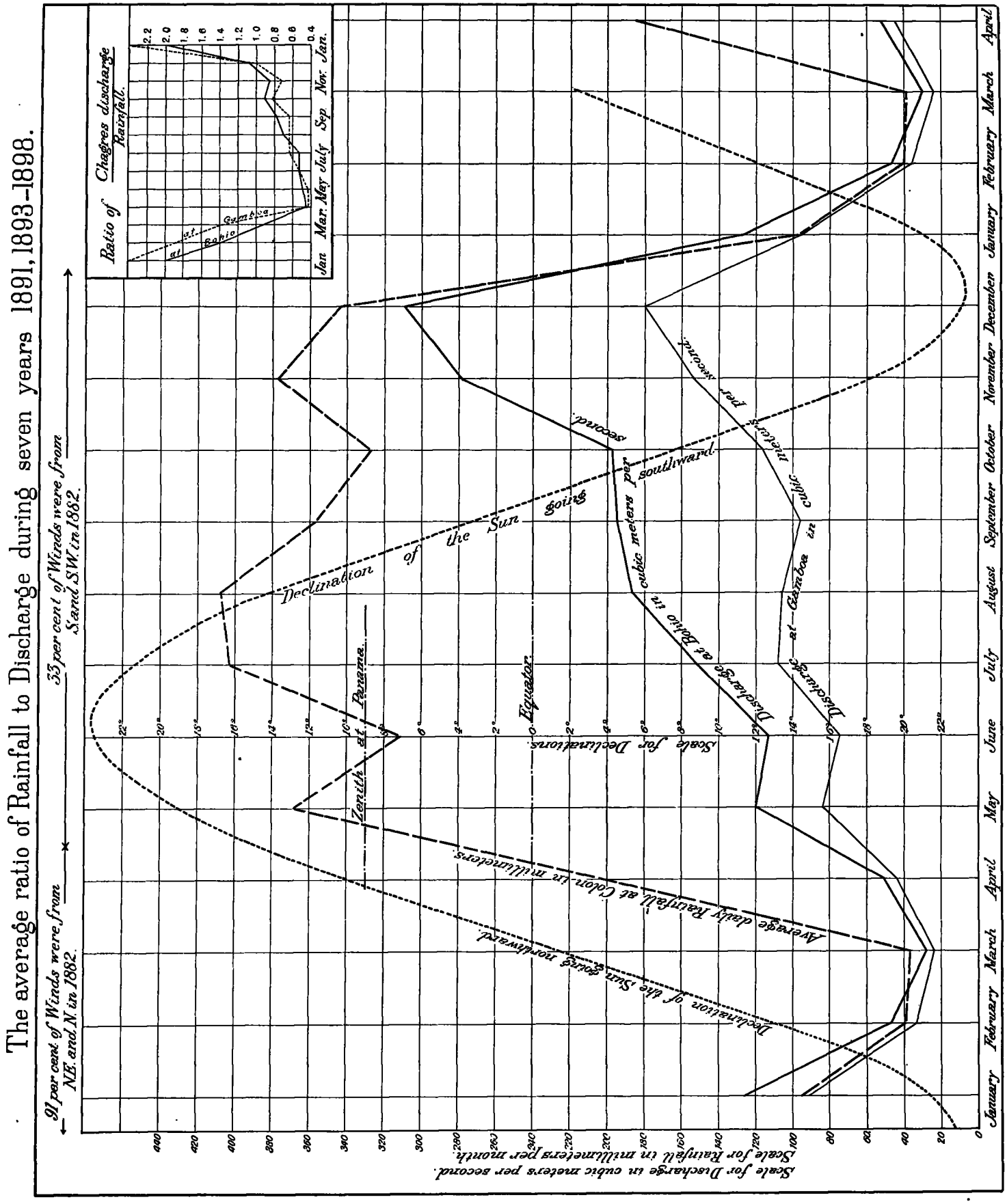

FIG. 1.

Comparative readings between the gage on the customhouse and the roof of the Prudential Building were begun on May 1, 1899, and continued until the end of the year. The catch of the gage on the Prudential Building seems to be about 21 per cent larger than that of the gage on the customhouse. The monthly amounts in the two locations, viz., customhouse, A, and Prudential Building, B, are as follows: May, A, 1.21 inches; B, 1.44 inches. June, A, 1.46 inches; B, 1.56 inches. July, A, 4.68 inches; B, 6.42 inches. August, A, 2.14 inches; B, 3.11 inches. September, A, 2.21 inches; B, 2.27 inches. October, A, 3.19 inches; B, 3.71 inches. November, A, 2.36 inches; B, 2.65 inches. December, A, 3.71 inches; B, 4.15 inches.

The record of precipitation at the Atlanta station from May 1, 1891, to the date of removal to the Prudential Building is probably deficient by amounts varying from 15 to 20 per cent of the recorded catch, or 25 per cent of the true rainfall.

MEXICAN CLIMATOLOGICAL DATA.

Through the kind cooperation of Señor Manuel E. Pastrana, Director of the Central Meteorologico-Magnetic Observatory, the monthly summaries of Mexican data are now communicated in manuscript, in advance of their publication in the Boletin Mensual. An abstract, translated into English measures, is here given, in continuation of the similar tables published in the MONTHLY WEATHER REVIEW since 1896. The barometric means have not been reduced to standard gravity, but this correction will be given at some future date when the pressures are published on our Chart IV.

Mexican data for November, 1899.

Stations.	Altitude.	Mean barometer.	Temperature. Max.	Min.	Mean.	Relative humidity.	Precipitation.	Prevailing direction. Wind.	Cloud.
	Feet.	*Inch.*	° *F.*	° *F.*	° *F.*	%	*Inch.*		
Colima	.....	.....	90.9	59.5	76.6	.....	.....	.....	.....
Culiacan Rosales (E. d. S.)	112	29.73	96.6	54.5	75.7	51	0.07	w.	s.
Leon (Guanajuato)	5,934	29.95	75.9	34.3	58.6	56	0.14	nnw.	sw.
Merida	50	29.93	95.4	57.9	75.7	73	0.39	ne.	e.
Mexico (Obs. Cent.)	7,472	23.04	72.5	39.6	57.0	61	0.43	nw.	ne.
Morelia (Seminario)	6,401	23.95	76.1	41.7	59.2	69	0.04	wsw.	w.
Saltillo (Col. S. Juan)	5,399	24.78	75.2	37.2	54.5	67	0.62	s.	sw.
San Isidro (Hac. de Guanajuato)	.....	.....	68.0	51.8	.....	.....	0.25	.....	.....
Silao	6,063	24.27	72.9	42.3	61.3	56	0.35	wsw.	sw.
Zapotlan (Seminario)	5,078	25.09	80.8	42.4	62.3	61	T.	se.	se.

Mexican data for December, 1899.

Stations.	Altitude.	Mean barometer.	Temperature. Max.	Min.	Mean.	Relative humidity.	Precipitation.	Prevailing direction. Wind.	Cloud.
	Feet.	*Inch.*	° *F.*	° *F.*	° *F.*	%	*Inch.*		
Culiacán Rosales (E. d. S.)	112	29.78	87.4	53.2	70.0	61	4.48	w.	.....
Durango (Seminario)	6,243	24.06	78.8	26.6	54.3	49	0.64	sw.	w.
Leon (Guanajuato)	5,934	24.32	75.9	32.5	56.1	50	0.04	sse.	sw.
Mexico (Obs. Cent.)	7,472	23.06	71.1	35.6	54.7	51	T.	nw.	ne.
Morelia (Seminario)	6,401	23.98	75.6	39.9	57.7	61	.....	ene.	sw.
Puebla (Col. Cat.)	7,112	23.39	73.9	34.7	57.9	73	.....	ene.	sw.
Saltillo (Col. S. Juan)	5,399	24.80	70.3	29.3	49.8	66	1.03	s.	sw.
San Isidro (Hac. de Guanajuato)	.....	.....	68.0	54.5	.....	.....	.....	.....	.....
Silao	6,063	24.30	72.3	41.9	56.3	52	T.	wsw.	w.
Zapotlan	5,078	25.11	79.5	42.3	61.3	57	0.18	se.	w.

DATE OF COLD FRIDAY.

By ALFRED J. HENRY, Chief of Division.

A correspondent writing from Columbus, Ohio, asks us to fix the date of Cold Friday. Our correspondent remarks that his grandfather was buried on that day in Jefferson County, Ohio, about the year 1806. We infer, therefore, that the term Cold Friday must refer to a day of extreme cold that was felt in Ohio, at least, and over we know not how much greater extent of territory. Meteorological observations were not made west of the Alleghenies in 1806, or for a number of years thereafter. On the eastern fringe of the United States there was no remarkably cold weather in 1806, but there was a cold spell in 1807, and another of greater severity in 1809. In looking over the available lists of dates of great cold we find a reference to Cold Friday in a report of the weather previous to 1830, compiled by the late Major W. H. Gardner, of Mobile, Ala. Major Gardner states that February 7, 1807, was known for many years as Cold Friday by reason of the low temperature reached that day. The location of the great cold is given as the Middle States.

Further information respecting the intensity of the cold experienced and its geographical distribution will be gladly received.

OBSERVATIONS AT HONOLULU.

Through the kind cooperation of Mr. Curtis J. Lyons, Meteorologist to the Government Survey, the monthly report of meteorological conditions at Honolulu is now made partly in accordance with the new form, No. 1040, and the arrangement of the columns, therefore, differs from those previously published.

Meteorological observations at Honolulu, December, 1899.

The station is at 21° 18′ N., 157° 50′ W.

Pressure is corrected for temperature and reduced to sea level, and the gravity correction, —0.06, has been applied.

The average direction and force of the wind and the average cloudiness for the whole day are given unless they have varied more than usual, in which case the extremes are given. The scale of wind force is 0 to 12, or Beaufort scale. Two directions of wind, or values of wind force or amounts of cloudiness, connected by a dash, indicate change from one to the other.

The rainfall for twenty-four hours has always been measured at 10:29 p. m., not 1 p. m., Greenwich time, on the respective dates.

The rain gage, 8 inches in diameter, is 1 foot above ground. Thermometer, 9 feet above ground. Ground is 43 feet, and the barometer 50 feet above sea level.

Date.	Pressure at sea level.	Temperature. Dry bulb.	Wet bulb.	During twenty-four hours preceding 1 p. m., Greenwich time, or 2:29 a. m., Honolulu time. Temperature. Maximum.	Minimum.	Means. Dew-point.	Relative humidity.	Wind. Prevailing direction.	Force.	Average cloudiness.	Sea-level pressures. Maximum.	Minimum.	Total rainfall at 9 a. m., local time.
	*	†	†			‡	‡		§				
1	29.94	63	62.5	80	66	64.0	73	ne.	3	2	30.03	29.92	0.00
2	29.93	62	61	81	63	63.3	76	sw-n.	1-0	3	30.01	29.88	0.00
3	29.96	62	60.5	79	61	62.0	78	sw-n.	1-0	2	30.06	29.94	0.00
4	29.97	72	64.5	80	61	61.7	73	nne.	1-0	1-0	30.01	29.92	0.00
5	30.03	68	66.5	81	67	61.0	66	ne-sw.	2-0	5	30.06	29.93	0.01
6	30.06	73	63	78	65	63.0	74	ne.	0-1	8-3	30.08	29.99	0.00
7	30.06	72	65	78	67	59.0	57	ne.	3	3	30.10	29.99	0.00
8	29.98	66	62	79	71	62.7	67	ne.	3	5	30.09	29.96	0.00
9	29.95	65	61.5	81	65	62.7	69	se-w.	2	3	30.05	29.94	0.00
10	29.87	67	63.5	80	64	61.5	70	s.	1-0	4	29.99	29.85	0.00
11	29.90	68	66.5	78	66	66.0	81	w-s.	1-0	6-10	29.94	29.85	0.02
12	29.91	72	68	78	68	66.3	79	nne.	0-3	6-3	29.97	29.87	0.01
13	29.88	70	67.5	80	71	64.7	74	nne.	2-0	2	29.98	29.87	0.00
14	29.82	69	65	81	67	65.5	75	sw.	2-0	1-10	29.91	29.82	0.00
15	29.82	65	63	83	68	64.3	76	sw-n.	2-0	1	29.88	29.79	0.00
16	29.86	72	69	82	64	64.7	78	se-sw.	1	2	29.92	29.84	0.02
17	29.90	63	62	81	67	68.5	81	s-w.	1	6	29.93	29.85	0.12
18	29.91	62	61	79	62	63.7	80	w.	1-0	2-0	29.94	29.85	0.00
19	29.95	62	61	79	61	60.7	74	sw.	1	1	29.98	29.87	0.00
20	29.98	69	65	83	61	63.5	77	se.	1	4	30.04	29.94	0.01
21	29.96	64	62	80	67	64.5	75	se.	1	4	30.04	29.94	0.00
22	29 99	68	62	81	63	62.5	74	sw-w.	1-0	0-2	30.04	29.96	0.00
23	30.03	69	64.5	82	63	61.7	66	ne.	1	1	30.08	29.97	0.00
24	29.99	73	66	80	65	60.3	68	nne.	2-2	1-3	30.08	29.96	0.01
25	29.93	70	64	79	72	62.3	65	ne.	3-5	3	30.04	29.93	0.00
26	29.81	70	65	79	67	62.0	68	ne-se-n.	2-0	2-10	29.94	29.79	0.01
27	29.80	63	61.5	78	65	62.5	76	nw-se.	1-0	10-0	29.84	29.74	0.00
28	29.81	72	65.5	81	62	61.5	70	se.	2	1-9	29.86	29.74	0.00
29	29.74	70	69	78	70	64.5	73	se.	3	10-9	29.86	29.73	0.10
30	29.75	69	68	79	69	69.7	87	s-sw.	2	10	29.80	29.72	1.44
31	29.79	65	61	78	68	68.7	85	nw-sw.	2-0	10-4	29.84	29.73	0.00
Sums	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.75
Means	29.913	67.7	64.1	79.8	65.9	63.5	73.6	.....	1.3	4.0	29.979	29.873	....
Departure	—.037	.....	.....	.....	.....	+1.0	—0.3	.....	.....	0.0	.....	.....	—2.91

Mean temperature for December, 1899 (6+2+9)+3=72.°1; normal is 71.5°. Mean pressure for December (9+3)+2 is 29.926; normal is 29.963.

*This pressure is as recorded at 1 p. m., Greenwich time. †These temperatures are observed at 6 a. m., local, or 7:29 p. m., Greenwich time. ‡These values are the means of (6+9+2+9)+4. §Beaufort scale.