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U. S. DEPARTMENT OF COMMERCE
LUTHER H. HODGES, Secretary
WEATHER BUREAU
F. W. REICHELDERFER, Chief

CLIMATOGRAPHY OF THE UNITED STATES NO. 81-45

DECENNIAL CENSUS OF UNITED STATES CLIMATE—

MONTHLY NORMALS OF TEMPERATURE AND PRECIPITATION

PUERTO RICO AND VIRGIN ISLANDS

(includes SWAN ISLAND)

WASHINGTON, D. C.:1962

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PREFACE

The climatological standard normals presented in this publication are based on records for the 30-year period 1931-1960 inclusive. For the first time, normals have been computed for substations and divisions using a base period identical to that used for first-order stations.

Previous normals were published in Weather Bureau Technical Paper No. 31, "Monthly Normal Temperatures, Precipitation, and Degree Days," and were based on records for the period 1921-1950. Earlier sets of normals are described in [1].

This is the first series of publications resulting from the project "The Decennial Census of United States Climate, 1960." The project is a continuation of earlier censuses of the climate of the United States that date back to the early 19th Century and are described in [2]. Future publications of this project will be listings of daily normals of temperature, and degree days; summaries of hourly observations; and listings of monthly divisional averages of temperature and precipitation.

Units used in this publication are degrees F. for temperatures, and inches for precipitation.

Standard Normals for Weather Bureau First Order Stations

A normal of a climatological element is an arithmetic mean for a specific period of record which estimates the true mean of the element at the current exposure of the meteorological instrument measuring the element. The true mean is the mean of all possible observations (population) at the current exposure. It is from this population that future observations will come, not from values in the past record. This is what makes it important to obtain an estimate of this mean. The true mean can never be known exactly but must be estimated from a sample of the past record ([3] p. 53 section 4.3). The normals presented here are estimates of the true mean obtained from the 30-year sample record 1931-1960. They are called standard normals because they conform to the World Meteorological Organization standard for climatological normals.

If no exposure changes have occurred at a station the normal is estimated by simply averaging the 30 values from the 1931-1960 record. Since it is next to impossible to maintain a multiple purpose network of meteorological stations without having exposure changes, it is first necessary to find and evaluate these changes and then make adjustments for them if necessary.

Heterogeneities in record due to exposure changes are found in two ways: by determining them from the station histories and by use of statistical tests. The statistical test when standardized for the purpose is easy to apply and will often find heterogeneities which are not defined by the station histories as well as those which have been so determined. Two statistical tests were employed: one for temperature and the other for precipitation. These are described in [4].

After the periods of heterogeneity have been determined, adjustments are applied to remove the heterogeneities introduced into the mean. This is done by comparing the record at the base station, for which the normal is desired, to the record at a supplementary station with a homogeneous period which covers the heterogeneous period at the base station. The difference method is applied to the monthly average maximum and minimum temperatures and the ratio method to the monthly total precipitation. A weighted average of the various partial means of the adjusted and unadjusted record is then prepared to give the normal. Brief discussions of the methods of adjustment are found in [3] (p. 49, section 4.24).

Normals for Substations and Divisions

Normals for substations were computed somewhat differently than those for first-order stations. Monthly substation normals are the simple arithmetic averages of the monthly values of temperature and precipitation for the period 1931-1960. These were computed for only those substations that were active during the entire period and no attempt was made to adjust for minor changes in location of the observing site, or for changes in the time of observation. Normals were not computed for substations that were moved a significant distance during the 1931-1960 period. Missing values in the data series were estimated by methods described in [5]. Substations whose locations were essentially unchanged during the 1931-1960 period are identified in the tables.

Monthly divisional normals are the means of the monthly divisional averages of temperature and precipitation for the period 1931-1960. In calculating the monthly divisional averages, all of the stations in the division that furnished both temperature and precipitation data during the particular month were used. The averages therefore were obtained from a variable station sample. As a result, the divisional normals often differ from the averages of the normals for stations in the division.

Annual substation and divisional normals are the averages of the 12 monthly temperature normals and the sums of the 12 monthly precipitation normals.

References

1. U. S. Weather Bureau, "History of Climatological Publications," Key to Meteorological Records Documentation No. 4.1, Washington, D. C., 1958.

2. H. E. Landsberg, "The Decennial United States Census of Climate 1960 and Its Antecedents," Key to Meteorological Records Documentation No. 6.2, U. S. Weather Bureau, Washington, D. C., 1960.

3. U. S. Weather Bureau, Climatology at Work, Gerald L. Barger, ed., Washington, D. C., 1960.

4. H. C. S. Thom, "Tests of Significance for Temperature and Precipitation Normals," U. S. Weather Bureau Manuscript, 1961.

5. U. S. Weather Bureau, Administrative Manual, Vol. III, Chap. C-05, paras. C-0509 and C-0510.

NOTES

1. Station Names

In Table I, "AP" after the city name indicates "airport station." "CO" indicates "city office station." Figures and letters following the station name indicate a rural location, and refer to the distance and direction of the station from the nearest post office.

# indicates a station whose location has been essentially unchanged during the period 1931-1960.

H indicates the ground elevation of the station in feet above sea level, as of December 31, 1960.

G indicates the elevation at hygrothermometer site (where different from "H").

T indicates the height of the thermometer in feet above the ground as of December 31, 1960.

/NO TEST/ indicates that significant difference tests were not made.

2. Table Content

* indicates that the departure of the 1951-60 record from the 1921-50 normal is statistically significant, but through the adjustments for changes in location and exposure the absolute difference between old and new normals may even in these cases be very small.

T in the data tables indicates a monthly precipitation amount of only a trace.

February monthly normals are for a 28-day month.

TABLE I - NORMALS FOR FIRST ORDER STATIONS

PUERTO RICO

STATION		JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	ANNUAL
#SAN JUAN CO	H 47 T 6	√NO TEST/												
	MAX TEMP	79.9	80.0	81.0	81.8	83.4	84.4	84.2	85.3	85.8	85.5	83.5	81.4	83.0
	MIN TEMP	70.3	70.1	71.0	72.2	74.1	75.4	76.0	76.2	75.6	74.9	73.7	72.0	73.5
	AVG TEMP	75.1	75.1	76.0	77.0	78.8	79.9	80.1	80.8	80.7	80.2	78.6	76.7	78.3
	PRECIP	4.13	2.70	2.07	3.89	7.16	5.83	6.02	6.34	6.04	5.24	6.05	4.89	60.36
SAN JUAN AP	H 15 T 7	√NO TEST/												
	MAX TEMP	81.3	81.8	83.1	84.0	85.8	87.1	87.1	87.8	87.8	87.1	85.0	82.7	85.0
	MIN TEMP	67.4	67.0	67.5	69.2	71.5	72.9	73.7	74.0	73.2	72.8	71.4	69.6	70.9
	AVG TEMP	74.4	74.4	75.3	76.5	78.7	80.0	80.4	80.9	80.5	80.0	78.2	76.2	78.0
	PRECIP	4.70	2.90	2.20	3.72	7.12	5.66	6.25	7.13	6.76	5.83	6.49	5.45	64.21
SWAN ISLAND WB	H 31 T 7	√NO TEST/												
	MAX TEMP	82.6	83.0	84.7	86.3	87.3	86.8	87.3	88.4	88.5	86.8	84.7	83.2	85.8
	MIN TEMP	73.9	73.8	75.3	76.6	77.6	77.7	77.6	77.8	77.4	76.5	75.4	74.2	76.2
	AVG TEMP	78.3	78.4	80.0	81.5	82.5	82.3	82.5	83.1	83.0	81.7	80.1	78.7	81.0
	PRECIP	3.44	1.16	.63	.84	3.30	6.46	4.20	3.66	5.19	9.70	7.39	5.44	51.61

TABLE II - NORMALS BY CLIMATOLOGICAL DIVISIONS

TEMPERATURE (°F)

STATIONS (By Divisions)	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	ANNUAL
NORTH COASTAL													
#ARECIBO 2 ESE	73.9	73.6	74.6	76.0	78.1	79.4	79.9	80.2	80.2	79.5	77.7	75.6	77.4
#BARCELONETA 2 NNW	•	•	•	•	•	•	•	•	•	•	•	•	•
#DORADO 4 W	74.5	74.5	75.4	76.8	78.6	79.9	79.8	80.3	80.2	79.4	77.7	75.8	77.7
#QUEBRADILLAS	•	•	•	•	•	•	•	•	•	•	•	•	•
#RIO PIEDRAS	73.8	73.4	74.8	76.0	78.1	79.5	79.7	80.0	79.8	79.2	77.3	75.2	77.2
#SAN JUAN CO	75.1	75.1	76.0	77.0	78.8	79.9	80.1	80.8	80.7	80.2	78.6	76.7	78.3
SAN JUAN AP	74.4	74.4	75.3	76.5	78.7	80.0	80.4	80.9	80.5	80.0	78.2	76.2	78.0
DIVISION	74.3	74.1	75.2	76.6	77.5	79.9	80.2	80.5	80.3	79.6	77.9	75.9	77.7
SOUTH COASTAL													
#AGUIRRE	77.0	76.8	77.6	78.9	80.4	81.6	82.2	82.5	82.2	81.7	80.4	78.5	80.0
#CENTRAL SAN FRANCISCO	•	•	•	•	•	•	•	•	•	•	•	•	•
#ENSENADA	•	•	•	•	•	•	•	•	•	•	•	•	•
#PONCE	76.1	75.8	76.6	78.2	79.7	80.9	81.5	81.6	81.4	80.7	79.4	77.6	79.1
#POTALA	•	•	•	•	•	•	•	•	•	•	•	•	•
#SABATER	•	•	•	•	•	•	•	•	•	•	•	•	•
#SANTA ISABEL 3 NW	•	•	•	•	•	•	•	•	•	•	•	•	•
#SANTA RITA	•	•	•	•	•	•	•	•	•	•	•	•	•
#YAUCO 1 S	•	•	•	•	•	•	•	•	•	•	•	•	•
DIVISION	76.1	75.9	76.7	78.2	77.7	80.9	81.6	81.6	81.4	80.8	79.5	77.7	79.0
NORTHERN SLOPES													
#CALERO CAMP	•	•	•	•	•	•	•	•	•	•	•	•	•
#CANOVANAS 2 N	74.0	73.7	74.9	76.6	78.5	79.5	79.4	80.6	79.9	79.2	77.5	75.5	77.5
#FAJARDO	76.0	75.9	77.0	78.4	80.0	81.2	81.7	81.9	81.3	80.5	79.2	77.5	79.2
#ISABELA 4 SW	73.5	73.4	74.5	75.5	77.1	78.3	79.1	79.1	78.9	78.3	77.0	75.1	76.7
DIVISION	74.3	74.1	75.3	76.8	77.1	79.6	80.0	80.3	79.9	79.2	77.7	78.7	77.5
SOUTHERN SLOPES													
#CABO ROJO	•	•	•	•	•	•	•	•	•	•	•	•	•
#GUAYABAL RESERVOIR	•	•	•	•	•	•	•	•	•	•	•	•	•
#GUAYAMA	78.5	78.4	79.1	80.3	81.3	82.5	82.7	83.3	82.9	82.5	81.4	79.8	81.0
#HUMACAO 1 SW	73.0	73.6	75.1	77.2	78.8	80.2	80.2	80.3	79.8	78.8	76.6	74.1	77.3
#JOSEFA	•	•	•	•	•	•	•	•	•	•	•	•	•
#JUANA DIAZ CAMP	76.5	76.3	77.0	78.2	79.5	80.8	81.8	81.5	80.7	80.2	79.1	77.7	79.1
#MAYAGUEZ	74.4	74.8	75.7	76.9	78.3	79.3	79.5	79.6	79.5	78.8	77.2	75.7	77.5
#PATILLAS DAM	•	•	•	•	•	•	•	•	•	•	•	•	•
#SAN GERMAN	74.6	74.6	75.4	76.9	78.6	80.0	79.9	80.0	79.9	79.2	77.6	75.8	77.7
#YABUCOA 1 NE	•	•	•	•	•	•	•	•	•	•	•	•	•
DIVISION	75.4	75.4	76.3	77.7	78.3	80.3	80.5	80.8	80.4	79.7	78.3	76.6	78.3
EASTERN INTERIOR													
#CARITE CAMP TUNNEL	69.6	69.4	70.4	71.1	72.2	73.3	73.8	74.7	74.6	74.1	73.0	71.2	72.3
#CAYEY 1 NW	69.1	69.3	71.0	73.0	74.6	75.5	76.0	76.2	75.8	74.8	73.0	70.9	73.3
#CIDRA 3 E	•	•	•	•	•	•	•	•	•	•	•	•	•
#JAJOME ALTO	•	•	•	•	•	•	•	•	•	•	•	•	•
#JUNCOS 1 E	•	•	•	•	•	•	•	•	•	•	•	•	•
#RIO BLANCO UPPER	•	•	•	•	•	•	•	•	•	•	•	•	•
DIVISION	70.7	70.5	71.8	73.4	74.3	76.1	76.5	76.9	76.7	75.9	74.3	72.2	74.1
WESTERN INTERIOR													
#COLOSO	74.1	73.9	75.0	76.5	78.4	79.6	80.2	80.3	79.9	79.2	77.8	75.8	77.6
#GARZAS DAM	•	•	•	•	•	•	•	•	•	•	•	•	•
#GUAJATACA DAM	•	•	•	•	•	•	•	•	•	•	•	•	•
#GUINEO RESERVOIR	•	•	•	•	•	•	•	•	•	•	•	•	•
#LARES	71.9	71.7	72.8	73.8	75.3	76.4	76.9	77.4	77.0	76.5	75.3	73.3	74.9
#MARICAO	•	•	•	•	•	•	•	•	•	•	•	•	•
#TORO NEGRO PLANT 2	•	•	•	•	•	•	•	•	•	•	•	•	•
DIVISION	70.9	70.8	71.6	73.0	74.2	76.2	76.7	77.0	76.6	75.9	74.4	72.3	74.1
OUTLYING ISLANDS													
DIVISION	76.7	77.0	77.4	78.8	79.9	81.7	82.3	82.6	82.1	81.5	80.0	77.9	79.8
VIRGIN ISLANDS													
#CHARLOTTE AMALIE 2	77.1	76.8	77.7	78.9	80.3	81.9	82.5	82.9	83.6	81.9	80.5	78.7	80.2
DIVISION	76.5	76.3	77.2	78.4	78.1	81.2	81.8	82.0	81.4	80.8	79.6	77.7	79.3
SWAN ISLAND WB	78.3	78.4	80.0	81.5	82.5	82.3	82.5	83.1	83.0	81.7	80.1	78.7	81.0

PRECIPITATION (In.)

STATIONS (By Divisions)	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	ANNUAL
NORTH COASTAL													
#ARECIBO 2 ESE	4.25	3.27	2.57	3.77	7.40	4.24	4.14	4.96	4.98	5.58	5.58	4.79	55.53
#BARCELONETA 2 NNW	4.93	3.27	2.72	4.17	6.46	4.58	4.71	5.82	5.08	5.29	5.78	5.03	57.84
#DORADO 4 W	5.83	3.25	2.48	4.41	6.78	5.26	7.02	6.65	5.69	5.31	6.28	6.18	65.14
#QUEBRADILLAS	4.07	3.29	3.18	4.68	8.04	5.00	3.98	5.47	5.46	5.34	5.72	4.69	58.92
#RIO PIEDRAS	4.90	3.86	2.68	4.61	8.31	6.88	8.30	8.92	8.29	7.07	6.62	5.92	76.36
#SAN JUAN CO	4.13	2.70	2.07	3.89	7.16	5.83	6.02	6.34	6.04	5.24	6.05	4.89	60.36
SAN JUAN AP	4.70	2.90	2.20	3.72	7.12	5.66	6.25	7.13	6.76	5.83	6.49	5.45	64.21
DIVISION	4.76	3.32	2.73	4.32	7.35	5.66	6.07	6.78	6.10	5.82	5.90	5.30	64.09
SOUTH COASTAL													
#AGUIRRE	1.07	1.29	.76	2.37	4.94	4.73	4.17	5.28	5.93	5.77	4.36	2.10	42.77
#CENTRAL SAN FRANCISCO	.74	1.24	.72	1.83	4.20	3.08	2.90	4.55	6.20	5.19	3.40	1.24	35.29
#ENSENADA	.70	1.28	1.02	1.95	4.13	2.69	2.60	3.72	5.71	4.55	3.88	1.66	33.89
#PONCE	.86	1.07	.61	2.28	4.49	3.51	2.74	4.69	5.93	5.31	3.70	1.34	36.43
#POTALA	.79	1.05	.67	2.07	4.71	3.34	3.00	4.34	6.42	5.70	3.46	1.45	37.00
#SABATER	.82	1.12	.75	2.22	4.55	4.43	3.70	4.74	5.93	5.99	3.71	1.96	39.92
#SANTA ISABEL 3 NW	.86	.95	.50	1.70	4.42	3.92	2.74	4.44	5.91	5.14	3.11	1.38	35.07
#SANTA RITA	.59	1.40	.93	2.28	4.15	2.77	2.46	4.19	5.72	5.12	3.75	1.75	35.11
#YAUCO 1 S	.72	1.46	.87	2.02	4.82	3.22	2.75	4.46	6.50	5.68	3.74	1.41	37.65
DIVISION	.87	1.21	.79	2.11	4.47	3.50	3.02	4.71	6.12	5.51	3.74	1.71	37.76
NORTHERN SLOPES													
#CALERO CAMP	3.18	2.68	2.92	4.37	7.68	7.07	4.80	6.14	5.78	6.30	4.45	3.69	59.06
#CANOVANAS 2 N	4.96	3.57	2.82	4.50	8.25	7.08	7.80	7.65	7.28	6.18	6.79	6.01	72.84
#FAJARDO	3.40	2.78	2.32	4.32	7.97	6.12	6.06	6.80	7.75	8.01	6.08	4.40	66.01
#ISABELA 4 SW	3.80	3.34	3.25	4.84	8.44	7.54	5.00	6.68	6.90	6.52	5.42	4.32	66.05
DIVISION	4.17	3.28	2.80	4.50	8.13	6.56	5.85	6.77	7.11	6.61	5.87	4.85	66.50
SOUTHERN SLOPES													
#CABO ROJO	2.33	2.19	3.23	4.92	7.33	4.00	6.47	8.29	8.48	7.20	5.84	3.74	64.02
#GUAYABAL RESERVOIR	1.36	1.91	1.49	3.76	6.26	4.37	3.98	6.59	9.45	8.76	5.58	2.18	55.69
#GUAYAMA	2.09	1.81	1.27	3.26	6.85	4.80	5.75	6.55	8.69	7.70	5.57	3.50	59.84
#HUMACAO 1 SW	4.23	3.30	2.87	5.22	10.26	9.53	8.65	9.41	10.87	9.96	8.16	5.59	88.05
#JOSEFA	1.62	1.57	1.01	2.84	6.02	5.78	4.63	6.18	7.46	6.89	5.89	3.15	53.04
#JUANA DIAZ CAMP	1.22	1.52	.95	2.64	5.00	3.89	3.51	5.56	8.00	6.85	4.50	2.00	45.64
#MAYAGUEZ	1.91	1.64	3.50	4.68	8.45	8.52	9.60	10.08	11.01	8.50	5.63	2.60	76.12
#PATILLAS DAM	3.01	2.28	1.69	3.88	8.65	8.57	6.95	7.78	9.53	9.06	6.56	4.36	72.32
#SAN GERMAN	2.52	2.64	3.09	5.25	7.19	3.89	5.91	7.73	9.96	9.21	6.74	3.90	68.03
#YABUCOA 1 NE	4.38	3.45	2.70	5.13	10.46	8.76	7.94	9.44	10.51	10.47	8.22	6.80	88.26
DIVISION	2.59	2.27	2.13	4.09	7.75	6.40	6.34	7.79	9.49	8.61	6.32	3.93	67.71
EASTERN INTERIOR													
#CARITE CAMP TUNNEL	4.20	3.40	2.57	5.26	9.66	8.79	8.92	8.65	10.86	9.71	7.18	5.39	84.59
#CAYEY 1 NW	3.28	2.66	1.81	3.85	6.66	5.36	6.15	6.35	7.89	7.03	4.99	3.89	59.92
#CIDRA 3 E	4.17	3.10	2.18	4.61	7.05	6.11	7.25	7.32	8.14	7.07	5.61	4.27	66.98
#JAJOME ALTO	3.69	3.25	2.49	4.50	8.06	7.54	7.76	7.46	9.79	8.71	6.01	4.90	74.16
#JUNCOS 1 E	2.74	2.51	1.52	3.34	7.41	7.32	6.36	7.85	9.28	7.58	5.43	4.38	65.72
#RIO BLANCO UPPER	10.67	9.68	6.65	10.30	16.41	14.67	14.00	15.63	17.06	16.05	14.19	13.67	159.18
DIVISION	4.81	3.93	2.81	5.22	9.53	8.47	8.12	9.11	10.47	9.46	7.63	6.24	85.80
WESTERN INTERIOR													
#COLOSO	2.50	2.10	2.99	5.95	11.64	11.75	9.77	11.44	10.20	7.98	5.02	2.55	83.77
#GARZAS DAM	2.90	2.97	3.39	6.15	10.97	7.34	8.18	11.98	12.89	13.63	7.66	3.96	92.02
#GUAJATACA DAM	3.82	3.22	3.48	6.22	11.21	7.87	5.82	7.87	8.99	8.46	5.64	4.24	76.84
#GUINEO RESERVOIR	4.08	4.28	4.37	8.35	16.45	9.08	7.70	12.43	15.76	16.17	8.76	5.00	112.63
#LARES	3.22	3.06	4.03	8.28	15.96	8.59	7.54	10.62	12.12	11.80	6.81	3.85	95.08
#MARICAO	2.67	2.94	4.62	7.56	12.85	8.36	9.95	14.06	14.16	13.70	7.20	5.84	101.91
#TORO NEGRO PLANT 2	4.34	4.47	3.05	7.47	14.95	7.49	6.46	11.92	15.96	15.65	8.22	4.88	105.72
DIVISION	3.55	3.37	3.46	6.97	11.63	7.23	6.85	10.12	11.43	10.77	7.01	4.33	86.32
OUTLYING ISLANDS													
DIVISION	2.16	1.65	1.60	2.62	4.51	3.83	3.46	4.20	5.27	5.22	4.78	3.36	42.74
VIRGIN ISLANDS													
#CHARLOTTE AMALIE 2	2.87	1.91	1.39	2.53	4.95	3.30	3.47	4.88	6.04	5.51	4.89	3.27	44.75
DIVISION	2.70	1.78	1.67	2.65	4.49	3.30	3.73	4.49	6.18	5.56	4.84	3.33	44.32
SWAN ISLAND WB	3.44	1.16	.63	.84	3.30	6.46	4.20	3.66	5.19	9.70	7.39	5.44	51.61

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