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PRECIPITATION AND TEMPERATURE IN WASHINGTON, D. C., FOR 1950 AND 1951

BY
C. G. ABBOT
Research Associate, Smithsonian Institution

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A. PRECIPITATION AT WASHINGTON

Referring to previous publications,[1] I have predicted in January of each year, for several years, about 155 dates throughout the year when average daily precipitation in Washington, D. C., should exceed that quantity for all other dates of the year. In 1950, for the seventeenth consecutive year, this expectation was verified.

TABLE 1.—*Statistics of Washington precipitation, 1950*

(Values in inches)

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
Average per day } Pfd.	0.054	0.095	0.151	0.088	0.296	0.013	0.182	0.223	0.399	0.094	0.186	0.142	0.153
Average per day } All other.	0.058	0.095	0.113	0.031	0.288	0.175	0.149	0.122	0.071	0.119	0.005	0.091	0.103
Ratio $\frac{\text{Pfd.}}{\text{Other}}$	0.94	0.99	1.35	2.80	1.03	0.07	1.22	1.83	5.62	0.79	35.09	1.57	1.49
Total ppt.	1.74	2.68	4.05	1.87	5.96	3.14	5.11	5.30	6.73	3.33	2.87	3.69	46.47
Normal ppt.	3.55	3.27	3.75	3.27	3.70	4.13	4.71	4.01	3.24	2.84	2.37	3.32	42.16
Percent of normal..	49	82	108	57	161	76	108	132	208	117	121	111	110

Tabulations had indicated that the ratio for average daily precipitation, $\frac{\text{preferred dates}}{\text{all other dates}}$, should be 142 percent. The average observed ratio for 17 years is 147 percent, and for 1950 it was 149 percent.

Preferred days of 1950 had a higher average precipitation than all other days in all months but January, February, June, and October. In February the ratio was sensibly 1.00. In October, if the heavy rainfall of October 23, which fell between midnight and early morning, had occurred 2 hours earlier, the ratio would have exceeded

[1] Especially Smithsonian Misc. Coll., vol. 104, Nos. 3 and 5, 1944; vol. 111, No. 17, 1950.

Errata.—In the last-cited publication, table 1, Normal ppt., year, for "42.46" read "42.16": and in table 2, under Sept., for "26" read "27"; Oct., for "23" read "24"; Nov., for "19" read "20"; Dec., for "16" read "17." In footnote 3, p. 2, for "949" read "1949."

unity. Had it occurred 6 hours earlier, the ratio for October would have been about 11.5 instead of 0.79.

Table 2 gives the dates for 1951 when the average daily precipitation in Washington is expected to exceed the average daily precipitation in this city on all other days. In the first column are given

TABLE 2.—*Predicted dates when average daily precipitation should exceed average daily precipitation for all other dates for the year 1951 in Washington, D. C.*

"Preferred" cycle places	Jan.	Feb.	Mar.	Apr.	May	June
I	24	20	19	15	12	8
II	25	21	20	16	13	9
III	26	22	21	17	14	10
IV	27	23	22	18	15	11
V	1, 28	24	23	19	16	12
XII	8	4	3, 30	26	23	19
XIII	9	5	4, 31	27	24	20
XV	11	7	6	2, 29	26	22
XVII	13	9	8	4	1, 28	24
XVIII	14	10	9	5	2, 29	25
XXII	18	14	13	9	6	2, 29
XXVI	22	18	17	13	10	6
XXVII	23	19	18	14	11	7

"Preferred" cycle places	July	Aug.	Sept.	Oct.	Nov.	Dec.
I	5	1, 28	24	21	17	14
II	6	2, 29	25	22	18	15
III	7	3, 30	26	23	19	16
IV	8	4, 31	27	24	20	17
V	9	5	1, 28	25	21	18
XII	16	12	8	5	1, 28	25
XIII	17	13	9	6	2, 29	26
XV	19	15	11	8	4	1, 28
XVII	21	17	13	10	6	3, 30
XVIII	22	18	14	11	7	4, 31
XXII	26	22	18	15	11	8
XXVI	3, 30	26	22	19	15	12
XXVII	4, 31	27	23	20	16	13

in Roman numerals the day numbers of the 27-day cycle when higher precipitation is expected. These values arise from the statistical study, 1924 to 1941, cited below. The other columns give the actual days in the 12 months of 1951 when these Roman cycle dates will occur. In other words, the remaining columns give the "preferred" dates for 1951. While it is expected that for the entire year 1951 the "preferred" dates will yield higher average precipitation than all others, and even that this will be so for most of the individual months of 1951, the probability that any individual "preferred" day will yield precipitation is scarcely above 50-50.

The basic tabulation, on which table 2 rests, began with January 1924 and ended with December 1941. The length deduced for the precipitation cycle is 27.0074 days. In 366 cycles of this length there are 9884.7084 days. From January 1, 1924, to December 31, 1950. there are 9,862 days. Hence the 367th cycle begins January 24, 1951, as given in Table 2.[2]

B. TEMPERATURE AT WASHINGTON

In previous papers [3] I have drawn attention to a regular periodic variation of 6.6485 days' length in the output of radiation from the sun. Though quite regular intervals occur in the solar variation, terrestrial responses thereto are sometimes 1, 2, or rarely 3 days from their expected dates. This is due to the complexity of the atmospheric constituents and reactions. All terrestrial responses to solar impulses are subject to lag. For instance, the warmest part of the day occurs 1 to 6 hours after noon at various stations of the earth. The lag is not constant from day to day at any station. Hence, from analogy, the irregularity of terrestrial responses to the 6.6485-day solar variation is not surprising. Nevertheless they are notable in magnitude. As shown in earlier papers they range from 2° to 20° F. in the temperature of Washington.

Notwithstanding the differences in lag just referred to, which cause displacements of the terrestrial responses, it seemed to me worth while, in January 1948, to predict for the ensuing year the 55 dates when minima of temperature with respect to surrounding days might be anticipated in Washington. In doing so I recognized that actual minima would sometimes fall 1, 2, or even rarely 3 days from the dates predicted. In January 1949 the prediction was compared with the event with fair verification.

In table 3 I give the dates predicted for minima of Washington temperatures in 1950, and the dates when minima occurred. I also give the dates predicted for minima in 1951. In these cases the predicted dates tabulated are those within a half day of the accurately computed minima, based on a period of 6.6485 days, with the zero date January 17.0000, 1946.

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[2] I.e., January 1 +23 days = January 24.

[3] Smithsonian Misc. Coll., vol. 107, No. 4, 1947; vol. 111, No. 6, 1949; vol. 111, No. 13, 1949.

In order to show how definitely the period reveals itself in Washington temperatures, and recurs on the average on time, I give in figure 1 the frequency of occurrence of minima within certain intervals of time from the accurately computed minima, covering the whole year of 1950.

TABLE 3.—*Dates in 1950 when minima in Washington temperatures were predicted and observed, and dates predicted in 1951*

	January	February	March	April
1950 predicted ..	5 12 19 25	1 8 14 21 28	6 13 20 26	2 8 15 22 28
1950 observed ...	8 12 20 28 31	4 8 14 20 26	3 9 14 19 23 26 30	6 9 14 21 25 30
1951 predicted ..	6 13 19 26	2 8 15 22 28	7 14 20 27	3 10 17 23 30
	May	**June**	**July**	**August**
1950 predicted ..	5 12 18 25	1 7 14 21 27	4 11 17 24 30	6 13 19 26
1950 observed ...	8 12 20 25 28	5 12 18 22 28	6 12 15 21 26	5 13 22 27
1951 predicted ..	7 13 20 27	2 9 16 22 29	6 12 19 25	1 8 14 21 28
	September	**October**	**November**	**December**
1950 predicted ..	2 8 15 22 28	5 12 18 25	1 7 14 21 27	4 10 17 24 30
1950 observed ...	5 9 13 17 22 24	6 14 21 26	6 12 18 21 26	6 13 20 27
1951 predicted ..	3 10 17 22 29	6 12 19 26	1 8 15 21 28	4 11 18 24 31

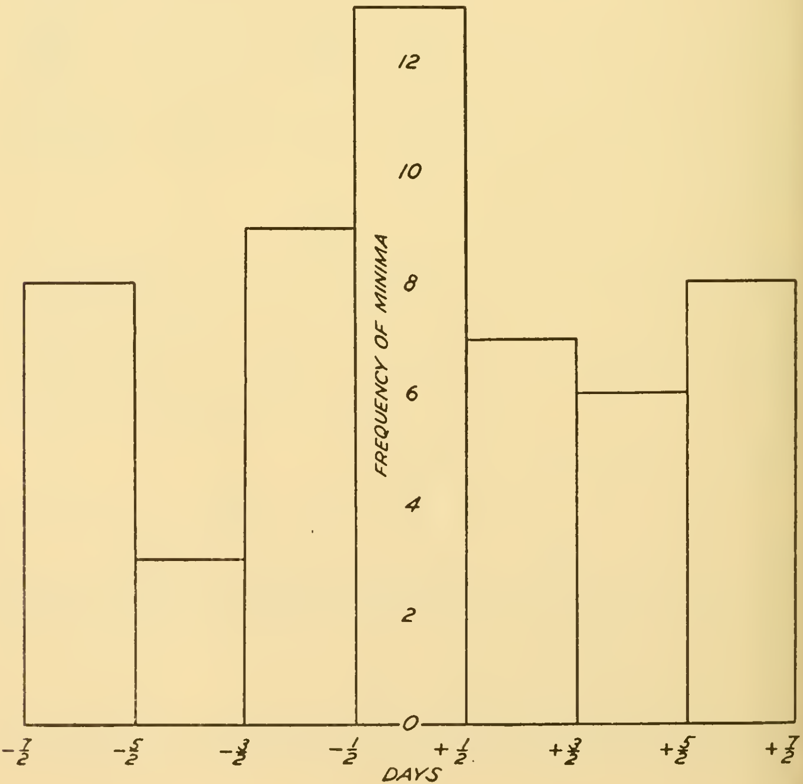

FIG. 1.—Relative frequency with which temperature minima occurred in 1950 in Washington within certain days of predicted minima.

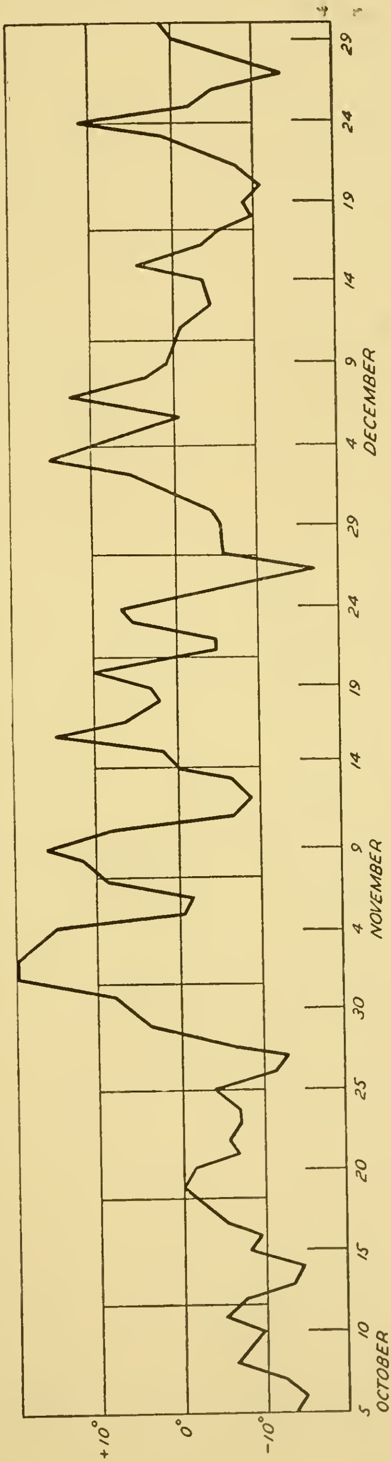

FIG. 2.—Daily departures from normal temperatures at Washington, October 5 to December 30, 1950, and dates when minima of temperature were predicted from period of 6.6485 days.

Again, to show how the observed minima seesaw around the predicted dates, I plot in figure 2 the actual daily departures from Washington mean temperatures, from October 5 to December 31, 1950, along with accurately computed predicted minima. The first periods, October 6 to 27, occur too late. Then the minima come several days too early, from October 27 to November 18. There follows a time of transition from November 18 to 30. New conditions prevail from December 1 to the end of the year. In this time the minima arrive about 3 days late.

These seesawing transitions lessen the value of the 6.6485-day period for forecasting purposes, but of its veridity in Washington temperatures there can be no doubt. Its accuracy is proved by the agreement of average recurrences of 1950 with the computed times, notwithstanding a lapse of five years, 1946-50.