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PERIODIC INFLUENCES ON WASHINGTON AND NEW YORK WEATHER OF 1949 AND 1950

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A. PRECIPITATION AT WASHINGTON

In Smithsonian Miscellaneous Collections,[1] I have traced the influence of a cycle of 27.0074 days on Washington precipitation. This cycle is thought to be associated with the rotation period of the sun. Dates were assigned when it was expected that, on the whole, greater average precipitation would fall in Washington than on the average of all other dates. In 1949, for the sixteenth consecutive year, this proved to be so. The ratio of average daily precipitation on preferred dates of 1949 to average daily precipitation on all other dates was 1.56. Basic statistical study of the years 1924 to 1941, inclusive, indicated the expected ratio to be 1.42. The average ratio for 16 years ending with 1949 is 1.47. In detail the year 1949 yielded the following values:

TABLE 1.—*Statistics of Washington precipitation, 1949*

(Values in inches)

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
Average per day { Pfd.	0.219	0.143	0.207	0.098	0.229	0.044	0.070	0.269	0.209	0.024	0.025	0.067	0.137
Average per day { All other	0.118	0.090	0.053	0.040	0.139	0.077	0.220	0.000	0.039	0.0161	0.025	0.043	0.088
Ratio Pfd./Other	1.86	1.59	3.90	2.45	1.65	0.57	0.32	*	5.40	0.15	1.00	1.57	1.56
Total ppt.	5.08	3.21	3.96	2.01	5.65	1.85	4.57	4.57	3.55	3.21	0.74	1.72	40.12
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	42.46
Percent of normal	143	98	106	61	153	45	97	114	110	113	31	52	94

* Infinitely large.

Preferred days of 1949 had a higher average precipitation than all other days in all months but June, July, and October.[2]

[1] Smithsonian Misc. Coll., vol. 104, Nos. 3 and 5, 1944; vol. 110, No. 4, 1948; vol. 111, No. 5, 1949.

[2] In November recorded rainfall averaged the same in both groups, but traces of rain fell on 4 preferred days and on only 3 other days. During July and August rain fell copiously in northern Washington, and nearby, on preferred days when none was recorded at the Weather Bureau.

Table 2 gives the dates for 1950 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 in Roman numerals the day numbers of the 27-day cycle when higher

TABLE 2.—*Predicted dates for the year 1950 when average daily precipitation should exceed average daily precipitation of all other dates of the year 1950 in Washington, D. C.*

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

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

precipitation is expected. These values arise from the statistical study, 1924 to 1941, above mentioned. The other columns give the actual days in the 12 months of 1950 when these Roman cycle dates will occur. In other words the remaining columns give the "preferred" dates for 1950. While it is expected that for the entire year 1950 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 1950, the probability that any individual "preferred" day will yield

precipitation is scarcely above 50-50. Recent press accounts of surprising accuracy in these predictions for individual days of past years refer merely to lucky happenings.

The basic statistical tabulation from 1924 to 1941, to which I referred above, and on which table 2 is based, began January 1, 1924. The length deduced for the cycle is 27.0074 days. In 352 cycles of this length there are 9506.6048 days. In the years 1924 to 1949, inclusive, there were 9497 days. Hence the Roman cycle date I falls on January 11, 1950, as given in table 2, being 10 days later in January than the original Roman cycle date I, which fell on January 1, 1924.

B. TEMPERATURE AT WASHINGTON

In previous papers I have drawn attention to a regular periodic variation of 6.6485 days' length in the output of radiation from the sun.[3] 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 from 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. This statement will be found confirmed in figures 2 and 3.

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. Figure 1 shows the numbers of days when the observed minima coincided, or fell 1, 2, or 3 days from the predicted dates in 1948.

The published predictions for 1948 and 1949 (above cited) were made with the original value of the length of the period. I now give in table 3 new dates to replace those published for 1949 in a previous

[3] Smithsonian Misc. Coll., vol. 107, No. 4, 1947; vol. 111, No. 6, 1949; vol. 111, No. 13, 949. The period was originally determined as 6.6456 days. But in the last of the three papers cited a correction of 0.0029 days was found, thus making the preferred period 6.6485 days.

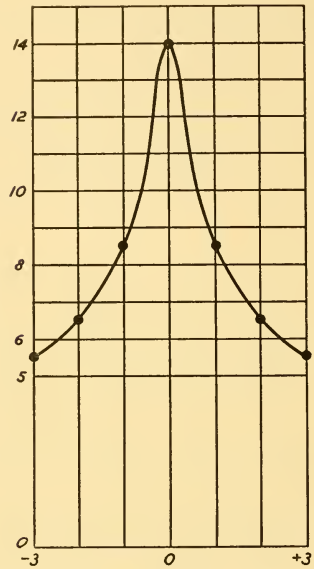

FIG. 1.—Frequency of minima, —3 to +3 days from dates predicted in 1948.

TABLE 3.—*Corrected dates in 1949 and 1950 when minima were due in Washington temperatures*

	1949					1950				
Jan.	5	11	18	25	31	5	12	19	25	
Feb.	7	14	20	27		1	8	14	21	28
Mar.	6	12	19	25		6	13	20	26	
Apr.	1	8	14	21	28	2	8	15	22	28
May	4	11	18	24	31	5	12	18	25	
June	7	13	20	27		1	7	14	21	27
July	3	10	17	23	30	4	11	17	24	30
Aug.	5	12	19	25		6	13	19	26	
Sept.	1	8	14	21	28	2	8	15	22	28
Oct.	4	11	18	24	31	5	12	18	25	
Nov.	7	14	20	26		1	7	14	21	27
Dec.	3	10	16	23	30	4	10	17	24	30

paper. They are based on the corrected period, 6.6485 days, and assuming January 17.0000, 1946, as the basic date of temperature minimum at Washington.

In checking the results for 1949 I prepared a table of 7 columns and 55 lines. The departures from normal temperatures for dates

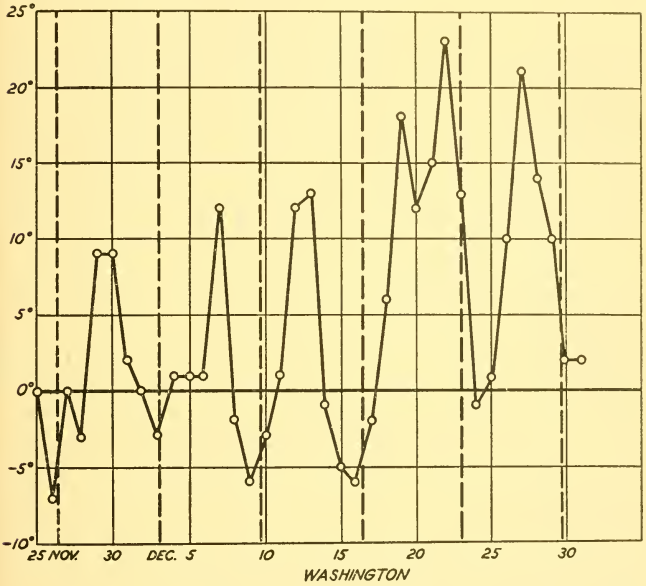

FIG. 2.—Temperature departures from normal at Washington, December 1949. Dotted lines indicate predicted dates for minima.

predicted to yield minima of Washington temperatures according to table 3, I entered in the fourth column. In each of the 55 lines I then entered the departures for the 3 preceding and 3 following days, along with the central predicted date. This made up a table of 7 columns and 55 lines. In this way 20 days were used twice, owing to overlapping. To obviate this defect, I cut off the temperature departures on overlapping dates, alternately from the first and the seventh columns, removing 10 departures from each of these columns. From this table, which to save printing I do not publish, I found the column in each line which carried the minimum temperature for that

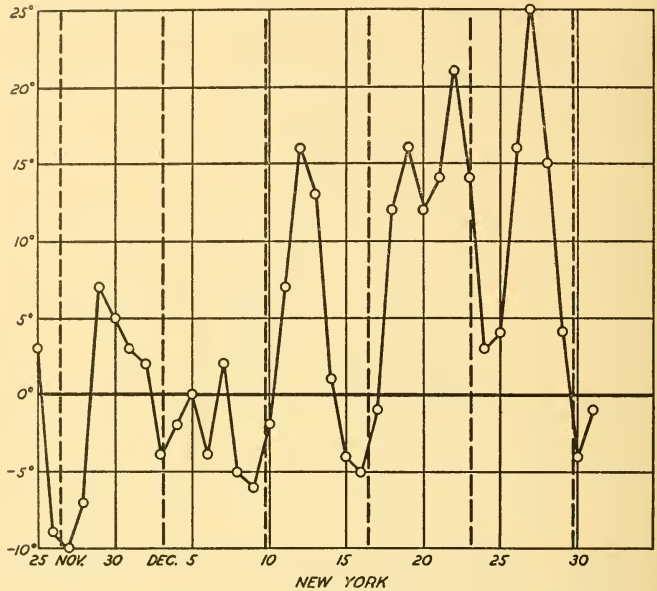

FIG. 3.—Temperature departures from normal at New York, December 1949. Dotted lines indicate predicted dates for minima.

line, and then took the sums for each column. The results are shown in table 4.

TABLE 4.—*Frequency of minima of Washington temperatures with respect to the dates of predicted minima of 1949*

Days from predicted dates.....	−3	−2	−1	0	+1	+2	+3
Numbers of days of minima.....	5	11	4	11	9	9	6

I also took the mean values of the departures of temperature from normal for the 7 columns of the table of 55 lines. These results are given in table 5.

TABLE 5.—*Average temperature departures at Washington with respect to the dates of predicted minima of 1949*

Days from predicted dates.....	−3	−2	−1	0	+1	+2	+3
Average temperature departures...	4°.46	5°.16	4°.87	5°.42	3°.96	3°.60	3°.87

It is clear that the prediction for 1949 was less successful than that for 1948, illustrated in figure 1. In other words, the displacements

of temperature minima from dates expected to suit the solar period of 6.6485 days were more considerable in 1949 than in 1948. These displacements, as explained above, are attributed to the complexities of atmospheric reactions. I postpone further remarks to the "Discussion" below.

C. NEW YORK TEMPERATURES

As shown in a previous paper,[4] a comparative study of Washington and New York temperatures over the interval of 21 years, 1928 to 1948, with reference to the solar period of 6.6485 days, indicated that this solar variation strongly affected the temperatures in both cities, and almost identically. By the kindness of E. J. Christie, Meteorologist in Charge at New York, I have received Form 1030 for the year 1949, which gives the daily departures from normal temperatures there. I have treated these data exactly as I have described above for Washington. The results are given in tables 6 and 7.

TABLE 6.—*Frequency of minima of New York temperatures with respect to the dates of predicted minima of 1949*

Days from predicted dates	−3	−2	−1	0	+1	+2	+3
Numbers of days of minima	9	4	6	11	13	4	8

TABLE 7.—*Average temperature departures at New York with respect to the dates of predicted minima of 1949*

Days from predicted dates	−3	−2	−1	0	+1	+2	+3
Average temperature departures	4°.35	4°.49	4°.75	4°.73	3°.53	3°.76	4°.00

D. DISCUSSION OF TEMPERATURES

Neither at Washington nor at New York does the year 1949 show, as a whole, a clear indication of the importance of the solar variation of 6.6485. Were it not for the extensive evidence given in Smithsonian Miscellaneous Collections, vol. 111, No. 13, one would conclude from the year 1949, alone, that this supposed periodic temperature effect is illusory. Certainly one would be inclined to conclude that the period offers little promise of being a useful means for predicting temperatures a year in advance, as was attempted with some success in 1948.

But individual months, even of 1949, give a different impression. In figures 2 and 3 I give for Washington and New York the actual marches of departures from normal Fahrenheit temperatures, from November 25 to December 31, 1949. In both figures the dotted lines

[4] Smithsonian Misc. Coll., vol. 111, No. 13, 1949.

are drawn exactly on the dates when minima of temperatures should arrive, counting intervals of 6.6485 days from January 17.0000, 1946. The December minima in these figures 2 and 3 all fall within 1 day or less of the expected dates. As shown in Smithsonian Miscellaneous Collections, vol. 111, No. 13, so in figures 2 and 3, the two cities behave almost identically. The average range of the periodic fluctuation is 18°6 F. at Washington, and 18°0 F. at New York. This is about at the maximum for the year. In July, as stated in Smithsonian Miscellaneous Collections, vol. 111, No. 13, the range is much less. But surely one may conclude that, though not as yet thoroughly available for long-range temperature prediction, the period of 6.6485 days is a major factor in weather.