

Reply

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2 May 1962

The explanation suggested by Hannan for the association I found between the three rainfall series is an interesting one but appears to raise more questions than it answers. Further examination of widespread rainfall data seems to be required. Earlier Shapiro and MacDonald (1961) commented on the nature of the evidence

TABLE 1. Spectral analysis of 12 years of total daily rainfall for the United States.

Frequency (cycles per 800 days)	Relative variance
10	0.00371
11	0.00484
12	0.00574
13	0.00538
14	0.00424
15	0.00436
16	0.00495
17	0.00516
18	0.00602
19	0.00712
20	0.00657
21	0.00689
22	0.00618
23	0.00561
24	0.00463
25	0.00389
26	0.00545
27	0.00668
28	0.00461
29	0.00440
30	0.00410
31	0.00475
32	0.00516
33	0.00368
34	0.00354
35	0.00498
36	0.00616
37	0.00580
38	0.00636
39	0.00773
40	0.00648
41	0.00441
42	0.00396
43	0.00458
44	0.00470
45	0.00349
46	0.00314
47	0.00251
48	0.00269
49	0.00521
50	0.00725

presented regarding singularities and the writer is now engaged with them in a joint effort to answer some of the questions that have been raised. It is hoped that a report on this investigation can be published soon but in the meantime it is of interest to examine the results of a spectral analysis of the daily values of the U. S. rainfall index for the period 1 January 1950 to 31 December 1961. Table 1 shows the relative power for frequencies ranging from 10 cycles per 800 days to 50 cycles per 800 days. Although there is a slight peak at $f=39$, which corresponds to a period of about 20.5 days, it is not appreciably higher than several others in the same range. However, if the oscillations in the series which produced this relative peak tend to be phase-locked with the annual cycle, then the daily means for the 12-yr period might be expected to show evidence of a true periodicity with 18 cpy.

In regard to the daily mean series of World Rainfall constructed by Bowen, an analysis does indicate a marked oscillation with a frequency of about 18 cpy. Since these data presumably were obtained by computing three-day running means of daily departures from the monthly mean, it might be desirable to explore the possibility that this cycle was introduced by the method of processing the data.

REFERENCE

Shapiro, Ralph, and Norman Macdonald, 1961: A test of the reality of rainfall singularities. *J. Meteor.*, **18**, 704-705.