THE COEFFICIENT OF PERSISTENCE

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In connection with Besson's note on the probability of rain,[6] following one or more days of rain, at Paris, similar tables and calculations may be of interest for an interior station of the United States, as showing the difference in the rainfall régimes in different climatic regions, and as affording a test of the value of his coefficient of persistence.

Three tables prepared in the same way as those of Besson are here presented for Lincoln, Nebr., for the 30-year period, 1894–1923. All traces of precipitation are included in the reckoning, as appears to be the case in Besson's tables. A fourth table is added in which only days with 0.01 inch or more of precipitation are counted. The total number of days of observation is 10,956, and the total number of rainy days, including traces, is 4,312, making the general probability, 0.394.

TABLE 1.—*Number of groups, S, of k consecutive days of rain*

k	1	2	3	4	5	6	7	8
S (observed)	863	588	234	138	76	31	23	10
S (calculated)	1,586	627	247	97	38	15	6	2
k	0	10	11	12	13	14	15	16
S (observed)	8	4	4	2	0	0	0	2
S (calculated)	0.8	0.3	0.1	0.04	0.02	0.01	0.004	0.002

TABLE 2.—*Probability, p_k, of rain when it is known to have rained the k preceding days*

k	1	2	3	4	5	6	7	8	9	10	11
p_k	0.54	0.52	0.56	0.56	0.58	0.62	0.61	0.61	0.64	0.62	0.60

TABLE 3.—*Monthly and annual values of the coefficient of persistence, R*

	J	F	M	A	M	J	J	A	S	O	N	D	Year
p	0.37	0.38	0.37	0.48	0.49	0.50	0.42	0.42	0.38	0.33	0.29	0.30	0.394
p_1	.52	.56	.52	.60	.60	.59	.50	.46	.53	.54	.52	.31	.540
R	.24	.29	.24	.23	.22	.18	.14	.07	.24	.31	.32	.30	.241

[6] MONTHLY WEATHER REVIEW, June 1924, 50: 308.

TABLE 4.—*Monthly and annual values of the coefficient of persistence, R, traces omitted*

	J	F	M	A	M	J	J	A	S	O	N	D	Year
p	0.17	0.19	0.22	0.31	0.37	0.37	0.27	0.29	0.28	0.21	0.16	0.18	0.252
p_1	.33	.43	.34	.47	.51	.44	.35	.36	.48	.45	.41	.39	.421
R	.19	.30	.15	.23	.22	.11	.11	.10	.28	.30	.30	.26	.226

There are no such long rainy periods at Lincoln as at Paris, but Table 1 shows the same general characteristics, with the first three groups decreasingly less numerous than indicated by the law of probability, and the others increasingly more numerous. The effective probabilities of rain following one or more days of rain, as shown in Table 2, are not so great as those at Paris, but show a similar trend and a similar relation to the general probability. At Paris p_1 is 134 per cent of p, and at Lincoln it is 137 per cent.

The cœfficients of persistence, as set out in Table 3, show the contrast in the character of the rain at the two cities. The annual cœfficient, 0.24, at Lincoln is only 63 per cent of that at Paris, and perhaps gives a fair indication of the general difference between the two places in the persistence of rain, but there is a further difference shown in the monthly values. In the months of June, July, and August, when practically all the rain falls in thundershowers, the probability of rain after one day of rain is very little greater than the general probability, especially in August, but in the fall and early winter months there is a definite and marked increase in the cœfficient, while from January to May[7] the rains are more persistent than the midsummer rains but less so than the autumn rains. By omitting traces, as in Table 4, the probabilities are reduced but the cœfficients are not much altered. In each case the difference in type between the summer and autumn precipitation is distinctly shown.

This simple mathematical expression, the cœfficient of persistence, thus appears to offer a valuable and definite means of characterizing one aspect of rainfall, but it is evident that the use of a single annual cœfficient is less valuable at Lincoln that at Paris. It is, in fact, entirely inadequate at Lincoln, and monthly or seasonal cœfficients must be used.

[7] Mostly cyclonic rains occur in these months.—*Ed.*

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SIR NAPIER SHAW, F. R. S.

If the Earth Went Dry

The phenomena of the general circulation of the atmosphere depend fundamentally upon warming at the surface by the sun's rays and on cooling these [?] by outward radiation; but the dominant factor of weather is the modification due to water vapor in the air. In this paper, in order to clear ideas, the reader is invited to regard these two aspects of thermal influence as distinct, and to consider the effect of dry heat alone. We thus form an idea of what the general circulation would be if there were no water vapor at all in the air.

The subject is hypothetical, inasmuch as the actual circulation is generally affected by the condensation or evaporation of water, but its discussion is not necessarily sterile. It is an exercise in some important points of thermal economy; in deserts the conditions postulated are approximately realized, and yet winds, dust storms, and "dust-devils" are not infrequent there; and in the large part of the atmosphere where the temperature is below 270 *t* the relative amount of water vapor, though not by any means without function, is too small to play the dominant rôle.

It is assumed that "dry" air (except for dust) would be perfectly transparent. Radiation received by a perfect absorber normal to the sun's rays would be 135 kilowatts per square dekameter (subject to small variations of the solar constant), and the loss of heat from a surface radiating perfectly (subject to local variation on account of dust) would be $.572 \times (t/100)^4$ kw., and range from 9 kilowatts per $(10\ \text{meter})^2$ for 200 *t* to 46 for 300 *t*. A table is given of the temperatures (between 200 *t* and 402 *t*) at which the loss from a radiating surface would balance the income for given solar altitudes.

The technical discussion is in five sections:

1. A survey of the thermal processes operative in the absence of water vapor: (*a*) The katabatic effect of inclined surfaces cooling in the polar night; (*b*) the slow thermal convection, upward, by the building up of layers of dry air in convective equilibrium over flat solarized surfaces (incidentally the question of superheated air