Wet and Dry Periods of Annual Flow Series[b]

Discussion by Jerson Kelman[2] and Pedro Guerrero[3]

This paper gives an interesting description of the applicability of the run length concept in water resources planning. The author has made use of the random variable "run length in an infinite population." However, it is likely that knowledge about the probability distribution of the "longest run length in a finite population" will be of better use for the water resources planner. The latter has been studied by the second writer and Yevjevich (9).

The author claims to have developed an explicit analytical formulation of the probability distribution of the "run length in an infinite population" for the case of Gaussian—lag one—Markov processes. However, he has simplified the problem by dichotomizing the variables into two states. Then he seeks for the solution of the associate Markov chain, for which solutions have been presented by Cox and Miller (8) and Heiny (10).

The critical point in the derivation occurs when Eq. 13 is substituted into Eq. 4. Without loss of generality, let us take $k = j = 1$. Then Eqs. 4 and 13 can be read as

[a]October, 1976, by Pablo Kleiman (Proc. Paper 12444).
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$$P(1^-, 1^+) = \int_{-\infty}^{x_0} \int_{x_0}^{\infty} f(x_1, x_2)\, dx_1\, dx_2 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (44)$$

$$f(x_1, x_2) = f(x_1)\, f(x_2|x_1) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (45)$$

Replacing Eq. 13 in Eq. 4, obtains

$$P(1^-, 1^+) = \int_{-\infty}^{x_0} \int_{x_0}^{\infty} f(x_1)\, f(x_2|x_1)\, dx_1\, dx_2 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (46)$$

However, the same probability is expressed by the author (from Eq. 14) as

$$P(1^-, 1^+) = \int_{-\infty}^{x_0} f(x_1)\, dx_1 \int_{x_0}^{\infty} f(x_2|x_1)\, dx_2 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (47)$$

The difference, it seems to us, is due to the fact that a separation of variables was made in the integration process, which is not correct for the case of dependent variables.

Appendix.—References

8. Cox, D. R., and Miller, H. R., *The Theory of Stochastic Processes*, John Wiley and Sons, Inc., New York, N.Y., 1968.
9. Guerrero Salazar, P., and Yevjevich, V., "*Analysis of Drought Characteristics by the Theory of Runs*," *Hydrology Paper No. 80*, Colorado State University, Fort Collins, Colo., 1975.
10. Heiny, R., "Stochastic Variables of Surplus and Deficit," thesis presented to Colorado State University, at Fort Collins, Colo., in 1968, in partial fulfillment of the requirements for the degree of Doctor of Philosophy.