65b

Flood Peaks from Small Southwest Range Watershed

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With discussion by Thomas L. Brown, Dept. of Civ. Engrg., Howard Univ., Wash. D.C., and William H. Sammons, M. ASCE, Hydraulic Engr., Central Tech. Unit, Soil Conservation Service, USDA, Hyattsville, Md.

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Runoff on the 67-sq-mile Alamogordo Creek Experimental Watershed near Santa Rosa, New Mexico is generated from storm precipitation with greatly differing characteristics. Five exceptional runoff-producing storms have occurred on the watershed in the 14 yr of record. Three of these were intense, short-lived thunderstorms, and the other two were frontal events of several days' duration. The highest runoff peak discharge was produced during a frontal-convective storm on the afternoon of June 5, 1960. A weak, fast-moving cold front, combined with strong afternoon convective heating, produced over 4 in. of rainfall at the storm center. At one gage, rainfall exceeded 3 in. in 15 min. The second largest discharge also resulted from precipitation associated with the combination of a cold front and afternoon convective heating.

Experience with precipitation in this area indicates that the U.S. Weather Bureau 6-hr maximum point rainfall values are probably about what the 2-hr values should be. The 6-hr values actually represent a compromise between a storm population represented by the longer lasting, lower intensity frontal storms and one represented by the intense thunderstorms. The longer duration storms produce the flood peaks from watersheds with drainage areas larger than 100 sq miles. Thunderstorms produce the flood peaks from smaller watersheds. If return periods from the two populations are determined separately and plotted as separate lines on the same graph, they might be expected to cross at about 6 hr.

The maximum annual peak discharge and the associated runoff volume were analyzed and fitted to a number of theoretical frequency distributions. The correlation coefficient between the peak discharge and its runoff volume was 0.94; which is

highly significant statistically. Similar results have been observed on ephemeral streams in southeastern Arizona.

An χ^2 goodness-of-fit test was used to test the agreement of theoretical distributions with the observed data. Using this test, the log-normal distribution gave the best fit. The 20-yr flood was estimated to be 8,700 cfs, and the 50-yr flood was estimated to be 14,500 cfs with this distribution. For these same return frequencies, the other frequency methods ranged from 5,070 cfs to 11,500 cfs and from 6,500 cfs to 30,000 cfs for the 20-yr and 50-yr floods, respectively. The variability for the estimated discharges for the longer return periods is to be expected for short records having wide variations in the annual peak discharges and having standard deviations considerably larger than the mean value.

The discussion by Brown and Sammons is an invaluable supplement to the paper. Using data from the original paper, they demonstrated the changes in the recurrence interval values by excluding outliers. The discussion also had excellent examples of the recurrence interval values obtained using the maximum likelihood estimation, best linear unbiased estimation, and best linear invariant estimation methods for fitting the sample data to the various probability distribution functions.