7.7 BULLETIN 17B FLOOD FREQUENCY ANALYSIS METHODOLOGIES

The Hydrology Committee of the former U.S. Water Resources Council developed guidelines for flood frequency analysis to be followed consistently by the federal water agencies. Each of the major water agencies was represented on the committee. The guidelines were published as Bulletin 17 in 1976 and in revised form as Bulletin 17B in 1982 (Interagency Advisory Committee on Water Data, 1982) and continue to be followed by the federal water agencies and professional water resources engineering community. The log-Pearson type III distribution is adopted for modeling peak flows. Although Bulletin 17B was developed specifically for peak annual discharge, the general methodology is applied to other random variables as well.

7.7.3 Skew Coefficient (see Section 11.11 in Gupta, 2017)

The sample mean, standard deviation, and skew coefficient are computed for the logarithms of the observed annual peak flows based on Eqs. 7.15, 7.16, and 7.17.(*) The skew coefficient is particularly sensitive to extreme flood events due to the cube term in Eq. 7.17. Skew coefficient estimates from small samples may be highly inaccurate. Therefore, Bulletin 17B outlines a procedure for developing regionalized skew coefficients based on at least 40 gaging stations located within a 160-km (100-mi.) radius of the site of concern, with each having at least 25 years of data. If this procedure is not feasible, the generalized skew map reproduced as Fig. 7.3 is provided as an easier but less accurate alternative. This map of generalized logarithmic skew coefficients for peak annual flows was developed from skew coefficients computed for 2,972 gaging stations, all having at least 25 years of record, following procedures outlined in Bulletin 17B. Depending on the number of years

(*)

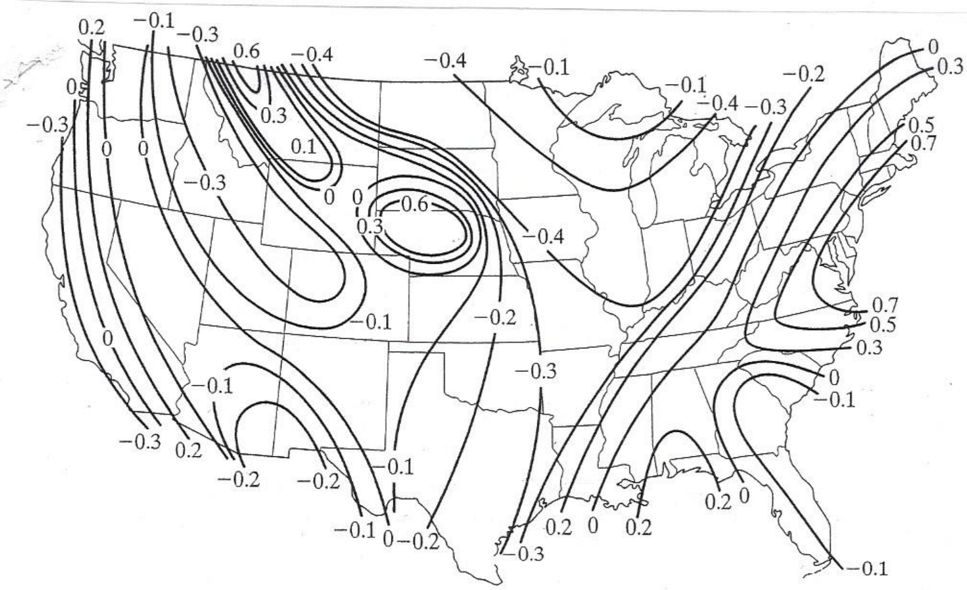

Figure 7.3 Generalized skew coefficients of the logarithms of annual maximum streamflow were developed by the Interagency Advisory Committee on Water Data (1982). > Fig. 11.7 in Gupta, 2017

of gage record, regionalized skew coefficients are used either in lieu of or in combination with values computed from observed flows at the particular stream gage of concern.

Equations 7.29 and 7.30 allow a weighted skew coefficient G_W to be computed by combining a regionalized skew coefficient G_R and station skew coefficient G.

$$G_W = \frac{(MSE_R)(G) + (MSE_S)(G_R)}{MSE_R + MSE_S} \quad \textbf{(7.29)}$$

$$MSE_S = 10^{[A - B(\text{Log}_{10}(N/10))]} \quad \textbf{(7.30)}$$

$$A = -0.33 + 0.08|G| \quad \text{if} \quad |G| \leq 0.90$$

$$A = -0.52 + 0.30|G| \quad \text{if} \quad |G| > 0.90$$

$$B = 0.94 - 0.26|G| \quad \text{if} \quad |G| \leq 1.50$$

$$B = 0.55 \quad \text{if} \quad |G| > 1.50$$

Eqs. 11.11, 11.12, 11.13 in Gupta, 2013

The station skew G is computed from observed flows at the station of interest using Eq. 7.17. The regional skew G_R is either developed from multiple stations following procedures outlined in Bulletin 17B or read from Fig. 7.3 also supplied by Bulletin 17B. MSE_S denotes the mean square error of the station skew. MSE_R is the mean square error of the regional skew. If G_R is taken from Fig. 7.3, the MSE_R is 0.302.

Example 7.8

Determine a weighted skew coefficient for the Mississippi River at St. Louis by combining the station skew G of −0.427 computed in Example 7.5 and the regional skew G_R of −0.40 read from Fig. 7.3. The MSE_R for Fig. 7.3 is always 0.302.

$$A = -0.33 + 0.08|G| = -0.33 + 0.08|-0.427| = -0.296$$

$$B = 0.94 - 0.26|G| = 0.94 - 0.26|-0.427| = 0.829$$

$$MSE_S = 10^{[-0.296 - 0.829(\text{Log}_{10}(66/10))]} = 0.106$$

$$G_W = \frac{(MSE_R)(G) + (MSE_S)(G_R)}{MSE_R + MSE_S} = \frac{(0.302)(-0.427) + (0.106)(-0.40)}{0.302 + 0.106} = -0.420$$

With $G = -0.427$ from Example 7.5 or $G_W = -0.420$, the 10-year and 100-year discharges are 21,600 m^3/s and 28,300 m^3/s. Thus, there is no change.

SOURCE: Wurbs & James (2012)