storms across barriers higher than about 800 m above the elevation of the observed storm site is generally avoided because of their dynamic influence on storms. Also, barrier adjustments are not used in transposing local, short duration, intense thunderstorms, which can draw in moisture trapped by the barriers prior to the storm. The example of storm transposition presented in the next section includes a barrier adjustment.

2.6.4 Example of storm transposition and maximization

2.6.4.1 Hypothetical situation

Assume that synoptic weather charts associated with major storms indicate that the hypothetical storm pattern shown in Figure 2.7 is transposable to the project basin shown in the same illustration. The average elevation of the storm area is 300 m. The average elevation of the moisture-inflow (south) side of the basin is 700 m, with no intervening orographic barriers. The representative persisting 12-hour storm dewpoint (section 2.2.4) is 23°C, which was observed at a site (Figure 2.7) located at an elevation of 200 m and a distance 200 km from the storm centre on a bearing of 170° (section 2.6.1.1). Reduction of this dewpoint to the 1 000-hPa level (Figure 2.1) yields 24°C.

2.6.4.2 Computation of adjustment factor

The adjustment factor, or ratio, is computed as follows:

$$r = \left(\frac{W_{26}}{W_{24}}\right)_{300} \# \left(\frac{W_{23}}{W_{26}}\right)_{300} \# \frac{(W_{23})_{700}}{(W_{23})_{300}} = \frac{(W_{23})_{700}}{(W_{24})_{300}} \tag{2.6}$$

where the subscripts within parentheses refer to the 1 000-hPa dewpoints for which the precipitable water W is computed, and the subscripts outside parentheses refer to the various pertinent ground elevations forming the bases of the atmospheric columns for which W is computed. Thus, the term $(W_{26}/W_{24})_{300}$ represents moisture maximization at the storm site; $(W_{23}/W_{26})_{300}$ is the adjustment for the difference in maximum dewpoints between the original and transposed locations; and $(W_{23})_{700}/(W_{23})_{300}$ is the elevation adjustment. Multiplication of all these terms leads to a simple result that all the required adjustments are implicit in the single term $(W_{23})_{700}/(W_{24})_{300}$. Referring to Tables A.1.1 and A.1.2 in Annex 1 for a column top of 300 hPa:

$(W_{23})_{700} = 67.0 - 13.0 = 54.0$ mm

$(W_{24})_{300} = 74.0 - 6.00 = 68.0$ mm.

Hence, $r = 54.0/68.0 = 0.79$.

If the alternative procedure for adjusting for moisture depletion were used (section 2.3.4.2), the adjustment factor would be computed as follows:

$$r = \frac{\left(W_{26} \# \frac{q_{300}}{q_{s1}}\right)}{\left(W_{24} \# \frac{q_{300}}{q_{s1}}\right)} \# \frac{\left(W_{23} \# \frac{q_{300}}{q_{s1}}\right)}{\left(W_{26} \# \frac{q_{300}}{q_{s1}}\right)} \# \frac{\left(W_{23} \# \frac{q_{700}}{q_{s1}}\right)}{\left(W_{23} \# \frac{q_{300}}{q_{s1}}\right)} = \frac{\left(W_{23} \# \frac{q_{700}}{q_{s1}}\right)}{\left(W_{24} \# \frac{q_{300}}{q_{s1}}\right)} \tag{2.7}$$

If this is evaluated using Tables A.1.3 and A.1.4, the result is as follows:

$$r = \frac{\left(69.7 \# \frac{16.3}{18.0}\right)}{\left(74.3 \# \frac{18.4}{19.1}\right)} = 0.86$$

This result provides a lesser reduction than assuming all of the moisture is removed by the increased elevation.

If an extensive orographic barrier (section 2.6.3) of, for example, 1 000 m in mean elevation lay between the observed storm site and the project basin, $(W_{23})1000$ would be substituted for $(W_{23})_{700}$ and ratio r would then be $(68.0 - 18.0)/(74.0 - 6.00) = 0.74$. The appropriate ratio is then applied to values for a range of area sizes both larger and smaller than the basin size from storm DAD data like those of Table 2.2. Since the elevation of the barrier is higher than discussed in section 2.3.4.2, the alternate procedure discussed by Hart (1982) is not used.

Another alternative procedure for moisture adjustment for storm transposition was used in a study for central and western United States (Miller and others, 1984*b*). In this study, plots of maximum observed point precipitation amounts versus elevation did not disclose any consistent variation of precipitation over limited ranges of elevations. Thus no adjustment was made for storm precipitation amounts for small areas for changes in elevations of about 300 m or less. For higher elevation changes, adjustments based on the total variation in precipitable water amounts produced amounts that seemed unrealistic, based upon observed storm experience. The vertical transposition adjustment then was restricted to one-half the variation in precipitable water for those changes in elevation that exceed 300 m. This can be expressed mathematically as:

$$R_{VT} = 0.5 + 0.5\left(\frac{W_{P_{\max,TL,TE}}}{W_{P_{\max,TL,SE\,!\,300}}}\right) \tag{2.8}$$