estimates. The examples presented in sections 5.3.2, 5.3.3, 5.3.4, 5.3.6 and 5.3.7 of this chapter were selected to represent a variety of conditions.

Another approach is the orographic separation method. In this approach, the convergence and orographic components of PMP are estimated separately and then combined. PMP estimates made by this method using a laminar flow model to estimate orographic PMP (United States Weather Bureau, 1961*a*, 1966), were discussed in detail in sections 3.2 and 3.3, and are not included here. The alternative procedure mentioned in section 3.1.6.1 for use of the orographic separation method (Hansen and others, 1977) is described in section 5.3.5.

5.3.2 PMP for drainages up to 259 km^2 in the Tennessee River basin

A procedure for determining PMP for the entire eastern half of the Tennessee River basin above Chattanooga, Tennessee, was described in section 3.4.2. The western half is comprised of relatively low rolling hills. Generalized PMP estimates have been made for the entire basin for drainages up to about 7 800 km^2 (Zurndorfer and others, 1986). Because of a specific requirement for generalized PMP estimates for small basins up to about 259 km^2 and the fact that different types of storms are likely to produce PMP over small and large areas, separate investigations were conducted for small basins and for drainages between 259 and 7 800 km^2. Only the estimates for the eastern half of the entire basin are described in this manual. The eastern half is referred to hereafter as the project basin. This section deals with estimates for the small basins. For the larger basins the estimates are discussed in section 5.3.3.

5.3.2.1 Outstanding rainfalls over the eastern United States

A record of 80 outstanding point rainfalls in the period 1924–1982 in or near the project basin, including a few estimates based on runoff computations, yielded a 1-hour amount and several 2- and 3-hour amounts of about 300 mm. Approximate elevations ranging from 200 to over 1 200 m were determined for most of these storms. No unique rainfall–elevation relation was evident. This suggested a procedure for estimating PMP that did not overemphasize orographic influences on short-duration rainfalls. Neither was there any discernible geographic distribution of these outstanding values.

In order to supplement the basin data, a survey was made of intense small-area short-duration storms from several hundred storm studies for the eastern half of the United States. Attention was given to all storms with 6-hour 25.9-km^2 rainfall exceeding 250 mm, particularly to those exceeding 350 mm. Some of these had durations of 24 hours. A study of 60 of the more severe storms indicated that most of them intensified during the night hours. This suggested that factors more important than daytime heating were generally responsible for these outstanding storms.

Information gained from the above investigations led to the following conclusions regarding small-area PMP storm types for the project basin:

(a) The PMP storm type situation would involve a continuation of geographically fixed thunderstorms throughout a 24-hour period;
(b) The PMP-type thunderstorm for durations of 1 hour or less shows only a small orographic effect, while that for the longer durations would be likely to produce more rainfall on slopes and adjacent valleys than over flat areas with no nearby slopes.

5.3.2.2 Local topographic classification

Examination of major storm sites on large-scale topographic maps (1 : 24,000) led to the following topographic classifications:

(a) Smooth: Few elevation differences of 15 m in 0.5 km;
(b) Intermediate: Elevation differences of 15 to 50 m in 0.5 km;
(c) Rough: Elevation differences exceeding 50 m in 0.5 km.

Although the entire south-eastern portion of the project basin is classified as rough, there were variations in rainfall potential across the area. Some peaks reached almost 2 000 m and some ranges sheltered large valleys, which required consideration of other features besides roughness in order to assess the topographic effects on the intense summer rainfalls. The effect of local topography on rainfall is discussed in section 5.3.2.3.

5.3.2.3 Broad-scale topographic effects

Broad-scale topographic effects on rainfall were determined by analysis of maps of maximum observed and 100-year daily rainfalls. Mean annual and seasonal precipitation maps were also examined. After some experimentation, the following concepts evolved and were adopted:

(a) First upslopes: A mountain slope facing the lowlands in a direction east to south-west