CHAPTER 5

GENERALIZED ESTIMATES

5.1 INTRODUCTION

Methods for estimating PMP discussed in Chapters 2 and 3 can be used for individual watersheds and large regions that include numerous watersheds of various sizes. For the latter case, the estimation is called generalized or regional estimation. Some studies of regional generalization for PMP estimation for small watersheds are also performed using hydrometeorological methods (storm maximization and storm transposition), statistical estimation methods and frequency analysis methods. Generalized estimation is highlighted by the regional generalization (smoothing) of PMP estimates for watersheds of various sizes in a large region. It also includes the generalization of storm depth–area–duration (DAD) curves, the generalization (ellipses or circles) of the spatial distribution of PMP and the generalization (single-peak) of the temporal distribution of PMP.

Generalized estimates can be expressed with two similar modes. The first mode is the isoline map, which shows regional changes in PMP for a particular duration for watersheds with a particular size. Such an isoline map is the generalized or regional map of PMP. The second mode establishes a series of correlations that enable users to determine a PMP estimate for any ideal watershed. It may also draw one or more topographical change index maps of PMP for a particular duration for a particular part or regional area. Isoline maps are often used for non-orographic regions. The second mode is often used in watersheds where topography plays a critical role in the precipitation process.

In hydrometeorological practices today, people (Kennedy, 1982; Myers, 1967; Natural Environment Research Council (NERC), 1975; Rakhecha and Kennedy, 1985) tend to perform studies of regional generalization (Hansen and others, 1977; Miller, 1963; Miller and others, 1984*b*; Schreiner and Riedel, 1978; Schwarz, 1963; United States Weather Bureau, 1961*a*, 1961*b* and 1966; Zurndorfer and others, 1986; Ministry of Water Resources of the People's Republic of China, Ye and Hu, 1979; Minty and others., 1996), and then use the results or methods (United States National Weather Service, 1984; Hansen and others, 1982; Rakhecha and Kennedy, 1985; Zurndorfer and others, 1986) to estimate PMP for individual watersheds (Fenn, 1985; Miller and others, 1984*a*; Rakhecha and Kennedy, 1985; Zurndorfer and others, 1986; Minty and others, 1996). Studies of regional generalization are time-consuming and costly, but have the following benefits:

(a) Maximum use can be made of all data over a region;
(b) Regional, durational and areal smoothing is done in a consistent fashion for the region;
(c) Consistency between estimates for basins in the region is maintained;
(d) Once completed, the best estimates for individual basins can be made accurately and easily.

The application of generalized estimation usually comes with a number of restrictions. Topographical changes tend to increase along with area sizes in watersheds, complicating the drawing of generalized PMP maps, especially in orographic regions. Owing to such difficulties, generalized estimation is usually confined to orographic regions smaller than 13 000 km^2 and non-orographic regions smaller than 52 000 km^2. In addition, durations of PMP estimates are confined to less than 72 hours, because if precipitation durations are longer than 72 hours, it is hard to express the spatial distribution with a set of concentric ellipses and the temporal distribution with a single-peak process.

5.1.1 Base maps

The choice of a suitable map base for developing and depicting the series of isohyetal maps for various area sizes and durations or the index charts for generalized estimates of PMP depends chiefly on the size of the region for which the estimates are to be made, the topography, and on the degree of detail to be shown on the final maps. Base maps with a scale of around 1 : 2 500 000 may be adequate for many non-orographic – that is, not extremely mountainous – regions, while a smaller scale, say 1 : 5 000 000, might be adequate for very flat terrain. Regions of rugged orography require a larger scale, usually no less than 1 : 1 000 000. Whatever the scale, the base maps should show the topography of the region. The final maps used for displaying the estimates may be reduced considerably, of course, but not so much as to make it difficult for the user to locate a basin for which an estimate is required. For this reason, the final maps should