SUMMARY

Probable maximum precipitation (PMP) is defined as the greatest depth of precipitation for a given duration meteorologically possible for a design watershed or a given storm area at a particular location at a particular time of year, with no allowance made for long-term climatic trends.

The first and second editions of this manual were published in 1973 and 1986, respectively. The current edition keeps a majority of the content from the second edition. Newly added content in this third edition primarily results from experiences, since 1986, in directly estimating PMP for the requirements of a given project in a design watershed on probable maximum flood (PMF) in China, the United States of America, Australia and India.

The methods used in China are characterized by integrating hydrological analysis and calculation into estimation of PMP/PMF. The current knowledge of storm mechanisms and their precipitation-producing efficiency remains insufficient to allow precise evaluation of limiting values of extreme precipitation. PMP estimates, therefore, must still be considered approximations. The accuracy, or reliability, of an estimate fundamentally depends on the amount and quality of data available and the depth of analysis.

Procedures for estimating PMP cannot be standardized. They vary with the amount and quality of data available, basin size and location, basin and regional topography, storm types producing extreme precipitation, and climate. There are many regions in various parts of the world for which PMP has never been estimated. It would be impossible at this time to prepare a manual covering all the problems that could possibly be encountered. Nor would it be practicable to prepare a manual that covers all the situations for which past estimates were derived. As a result, this manual introduces some basic models, or basic methods and the conditions under which they are applied, and highlights issues for attention. It is important for professionals to be flexible when using the methods in actual situations. In some cases it is appropriate to make parallel estimates using more than one method, followed by comprehensive analysis in order to acquire reasonable PMP estimates.

The purpose of PMP estimation is to determine PMF for a particular project in a design watershed. There are now two classes of PMP estimation methods. The first class (the indirect method) uses an approach based on storm area. This approach determines PMP for the storm area (the area surrounded by isohyets) and then converts it into PMP for the collecting area of a particular project in the design watershed. Methods introduced in Chapters 2 and 3, and 4, 5 and 6 in particular, mostly fall into this class. The second class (the direct method) adopts an approach based on watershed area. This approach directly estimates PMP for the collecting area of a particular project in the design watershed. Methods introduced in Chapter 7 are in this class, and those in Chapters 2 and 3 are also applicable.

In Chapters 2, 3 and 5, the manual introduces methods for PMP estimation that are widely applicable in middle latitudes to watersheds with areas less than 13 000 km^2 in orographic regions and those with areas less than 50 000 km^2 in non-orographic regions. The methodologies used in middle latitudes are, in most cases, also applicable to tropical regions. Since PMP procedures for tropical regions have not been as extensively applied as in middle latitudes, some possible modifications to traditional procedures have been suggested in Chapter 6.

Methods introduced in Chapter 7 are applicable to PMP estimation for watersheds with various areas and various precipitation durations in orographic and non-orographic regions where floods are caused by storms. In this chapter, some important issues relating PMF estimation are also introduced in a simple manner.

The procedures are illustrated by examples from actual studies done by the National Weather Service (formerly United States Weather Bureau), National Oceanic and Atmospheric Administration, United States Department of Commerce, the Australian Bureau of Meteorology, and water and power authorities in China and India. The examples were chosen to (a) represent a variety of problems; (b) capitalize on studies published in widely distributed and accessible reports; and (c) reflect the availability of basic material such as photographic prints (which minimized the time and cost of preparing the manual). The examples given cover