7.7.3 Storm simulation method based on an historical flood

7.7.3.1 Introduction

Historical floods are extraordinary floods that are typically greater than observed records, found through field surveys, literature and archival research. Their return periods are typically more than 100 years with a minority of them more than 1 000 years.

For historical floods in some countries, the flood hydrograph and major characteristics of corresponding storms can be determined for the peak flood and also the flood volume. Such historical floods can be used to derive PMP/PMF through the storm simulation method for historically extraordinary floods (Zhao and others, 1983; Jin and Li, 1989).

This method can also be used to derive PMP/PMF for some large watersheds where hydrological stations were set up early. This is only the case if the largest flood in the observed data occurred in the early period of the hydrological station and there were scarce rainfall stations at that time, making it hard to use it to derive PMP/PMF.

7.7.3.2 Principles

Storms corresponding to rare historical extraordinary floods can be regarded as high-efficiency storms. If those high-efficiency storms can be reconstituted through trial calculations with the watershed rainfall runoff model, followed by moisture maximization, then PMP is determined (Wang, 1999, 2005*a*). Conversion of the PMP into a flood yields PMF.

7.7.3.3 Procedure

The peak flood, the flood hydrograph and the major source region of the historical extraordinary flood are known conditions. The spatio-temporal distribution and the representative dewpoint of its corresponding storm need to be determined.

7.7.3.3.1 *Estimation of the spatio-temporal distribution of the storm corresponding to the historical flood*

Key points on methods for estimating the spatio-temporal distribution are as follows:

(a) The weather cause (including the circulation type and the storm weather system), the storm

Table 7.9. Watershed profiles for four key projects in China

River		*Yellow River*	*Yellow River*	*Yalongjiang River*	*Lancang River*
Project		*Qikou*	*Sanmenxia*	*Ertan*	*Manwan*
Watershed area (km^2)		430 900	688 421	116 360	114 500
River length (km)		3 893	4 439	1 467	1 579
Maximum straight line length of the watershed (km)	West–east	1 470	1 480	137*	104*
	North–south	480	870	950*	1 100
Major reach	Name	Hekou Town, Qikou	Hekou Town, Sanmenxia	Ya'an, Xiaodeshi	Liutongjiang River, Jiajiu
	Area (km^2)	44 934	320 513	50 633	31 600
Climatic features	Major reach	Subtropical monsoon climate	Subtropical monsoon climate	Transitional frigid zone to subtropical zone climate	Transitional frigid zone to subtropical zone climate
	Upstream section within the reach	Qinghai-Tibet Plateau climate	Qinghai-Tibet Plateau climate	Qinghai-Tibet Plateau climate	Qinghai-Tibet Plateau climate
Major weather systems for extraordinary storms	Major reach	South-east shear line	South-west–north-east shear line	Shearing vorticity	Monsoon depression typhoon and subtropical anticyclone edge
	Upstream section within the reach	South-west–north-east shear line	Same as above, but different occurrence time	Westerly trough shearing vorticity	Low vortex and shearing

* Average watershed width and length