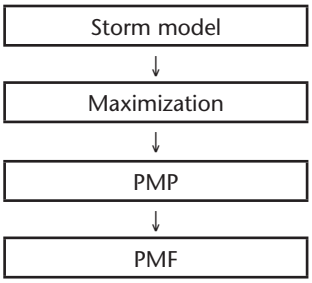
value K_m. Storm transposition correction is carried out with the mean value $\overline{X}_n$ and the variation coefficient C_{vn} at the design station (Wang, G. 2004).

The PMP derived by the above procedure is for a point (assumed as the storm centre), and the areal mean PMP of the design watershed can be obtained from the storm-point area relationship map.

The methods described in Chapter 4 are examples of a statistical estimation method.

1.4.3.2 Approach based on watershed area

The main steps of this approach for PMP estimation are (Wang G., 1999, 2004):



Storm model is a typical storm or ideal model that reflects the characteristics of extraordinary storms of the design watershed, which pose serious threats to flood control in the project. Depending on its sources, it can be categorized as a local model, transposition model, combination model or inferential model. The implications of these models are the same as described in section 1.4.2.2.

Maximization means maximizing the storm model. When the storm model is a high-efficiency storm, only moisture maximization is performed, otherwise both the moisture factor and the dynamic factor need to be maximized.

PMP is the possible maximum precipitation over a design watershed derived from maximization of the storm model.

PMF is the possible maximum flood converted from the PMP over a design watershed.

Methods described in Chapter 7 are examples of this approach. The convergence model and the laminar model are briefly introduced in Chapters 2 and 3 but as they are more theoretical, the two models are not mentioned again in Chapter 7.

These methods, especially those introduced in Chapter 7, require close cooperation between hydrological and meteorological staff.

1.5 STORM AND FLOOD DATA

As data on extraordinary storms and floods form the basis for estimating PMP/PMF, it is necessary to extensively collect, process and analyse them. Analysis focuses on the magnitude of numerical values, the spatial-temporal distribution pattern and the synoptic cause. Areal mean rainfall is calculated based on observed rainfall of heavy storms in the watershed. Radars and satellites can provide additional and recent observed rainfall data. Telemetry data are now available and especially useful for regions with scarce data (see for example http://www.ecmwf.int and http://www.cdc.noaa.gov/cdc/reanalysis/reanalysis.shtml).

Areal mean rainfall is used to develop the DAD curves. Depth–area–duration analysis is performed using the method described in the *Manual for Depth–Area–Duration Analysis of Storm Precipitation* (WMO-No. 237). The method facilitates determining the average precipitation depth of a storm over a given area for a particular time. In PMP studies, the analysis method is extremely useful in studying the hydrological characteristics of a watershed.

Data and information on historical extraordinary storms and floods obtained from field surveys and historical literature should be collected and analysed as rigorously as possible. It should be noted that, particularly when dealing with early, unusual records, great effort should be made to verify the information. In any analysis, the storm volume, its spatial and temporal distributions, and the causative factors of each extraordinary storm should be carefully determined. Similarly, for each extraordinary flood, its peak flood, flood volume, temporal distribution and flood source region should also be determined as clearly as possible.

1.6 ACCURACY OF PMP/PMF ESTIMATION

The accuracy of PMP/PMF estimation rests on the quantity and quality of data on extraordinary storms and floods and the depth of analysis and study. Nonetheless, it is impossible to give precise values for PMP and PMF. As yet, there are no methods to quantitatively assess the accuracy of PMP and PMF. Presently, it is most important to analyse, compare and harmonize results of PMP/PMF from multiple perspectives. This task is called a consistency check in the United States (Hydrometeorological Reports 55A, 57 and 59: Hansen and others, 1988; Hansen and others,