which to determine the time and spatial distribution of the PMP in calculating the design flood.

2.10 SEASONAL VARIATION OF PMP

2.10.1 Introduction

In those regions where the maximum flood is likely to result from a combination of snowmelt and rainfall, it is necessary to determine the seasonal variation of PMP so that various combinations for different times of the melting season can be evaluated and the most critical combination determined. For example, in a particular region, maximized June storms may provide the controlling points for PMP, but optimum combinations of accumulated snow on ground and melting rates may be found in April. It is then necessary to estimate PMP for April. Since it is not known exactly what time of year is most critical for the maximum snowmelt and rain flood, the usual procedure is to determine the seasonal variation curve of PMP for the entire snowmelt season. The curve then permits a ready adjustment of PMP for use in assessing flood situations at various times during the melting season in order to determine the most critical flood.

There are various ways of determining the seasonal variation of PMP. The more common procedures are discussed here. Selection of a procedure depends on data available. Whenever possible, it is advisable to use several procedures in developing a seasonal variation curve. Cautionary remarks on the representation and use of seasonal variation curves are given in section 2.13.5.

2.10.2 Observed storms

The best way to determine the seasonal variation of PMP requires a relatively large number of storms for which DAD data are available and that are fairly well distributed throughout the melting season. Different variations are usually found for small and large areas and for short and long durations. It is, therefore, important to base the seasonal variation on data consistent with the basin size and critical rainfall duration. Because of this, it is often advisable to construct a set of curves rather than a single one. The storm rainfall for a particular size of area and duration is then maximized for moisture, as described in sections 2.3 and 2.6. The maximized data are then plotted against the date of storm occurrence, and a smooth envelope curve is drawn. The rainfall scale is usually converted to a percentage scale expressing the PMP as a percentage of the peak value or the value for some particular time of year.

2.10.3 Maximum persisting 12-hour dewpoints

The seasonal variation of maximum persisting 12-hour dewpoints may be used also to determine the seasonal variation of PMP. This procedure is more applicable to localized thunderstorm PMP than to PMP for large areas and long durations. Precipitable water is computed for the individual maximum 12-hour dewpoints throughout the critical season, or it may be computed for values read from their seasonal variation curve, like Figure 2.3. A shortcoming of this procedure is that it will almost always indicate a peak PMP value in summer, even in regions where summers have little or no rainfall and major storms occur in winter. It cannot be used under these conditions unless wind is also considered (see section 2.10.4).

2.10.4 Moisture inflow

In those regions where summers are dry and major storms occur only in the cold half of the year, the seasonal variation of maximum precipitable water (section 2.10.3) gives a false indication of the seasonal variation of PMP when used alone. A wind factor is also required to develop a representative seasonal variation of PMP.

Figure 2.13 shows a seasonal variation curve developed for PMP in the Upper Tigris River basin, where in summer there is very little rain. While the maximum dewpoint and precipitable water curves tend to show minimum values during the cold season, climatological records show that in this region all major general-type storms occur in that season. Weather charts indicate that the heaviest precipitation occurs with surface winds in the south-eastern and south-western quadrants. A survey of a long record of surface winds yielded the maximum 24-hour wind curve in Figure 2.13, part C, which shows peak values in January and February. Multiplication of precipitable water values by wind speed resulted in the moisture-inflow index curve shown in part D. The double peak was confirmed by outstanding recorded storms.

2.10.5 Daily station precipitation

An indication of the seasonal variation of PMP may be easily obtained from monthly-maximum daily station rainfall amounts. The use of average maximum values for several stations rather than from a single station is advisable for larger basin sizes. In