moisture-inflow index. The advantage in this is that the resulting moisture-inflow index curve presents a more readily visualized seasonal variation of PMP (Figure 2.13, part D) than when moisture and wind speed curves are examined separately. Also, when the seasonal variation curves are expressed in terms of percentage of the peak or other value, the moisture-inflow index curve provides a single percentage value for adjusting PMP values for any particular time of year.

2.5 STORM TRANSPOSITION

2.5.1 Introduction

The outstanding rainstorms in a meteorologically homogeneous region surrounding a project basin are a very important part of the historical evidence on which a PMP estimate for the basin is based. The transfer of storms from locations where they occurred to other areas where they could occur is called storm transposition.

Explicit transposition limits refer to the outer boundaries of a region throughout which a storm may be transposed with only relatively minor modifications of the observed storm rainfall amounts. The area within the transposition limits has similar, but not identical, climatic and topographic characteristics throughout. More restricted transposition limits may be defined if a region has a long record of precipitation measurements from a relatively dense network of gauges and has experienced many outstanding storms. Where the record of storms is more limited, either because of a sparse raingauge network or because of very infrequent occurrence of severe storms during the period of record, then more liberal, though perhaps slightly less reliable, transposition limits must be accepted. A transposition adjustment is a ratio by which the storm-rainfall amounts are multiplied to compensate for differences between conditions at the storm site and those at the project basin.

The restrictions imposed by explicit transposition limits can sometimes result in discontinuities in PMP estimates made for nearby basins. This can result from transposition of storms to one basin but not to the other. Fluid dynamics indicate that the atmosphere does not create vertical walls (or step functions) to extreme storm conditions. Thus, when boundary problems are created by limitations on storm history and transposition boundaries it is necessary to postulate how the atmosphere is "limited" in the region beyond the explicit transposition limits of the larger storm values. If reasonable explanations cannot be found, regional, areal or durational smoothing is used to eliminate these discontinuities. Implicit transposition is the term given to this smoothing. This is discussed further in sections 2.8 and 5.2.3.

As for the transposition range, storms of some types were transposed over long distances, even intercontinentally, in some studies. For example, in HMR 46 (United States Weather Bureau, 1970), compiled by the United States in 1970, typhoon storms in south-eastern United States that were generated on the Atlantic Ocean were transposed to the Mekong River Basin in Southeast Asia (see section 6.2.2 for details). Design organizations in China also transposed the above-mentioned typhoon storms that occurred in the United States to the Daguangba Project on Hainan Island in 1987. In short-duration, small-area PMP estimation in Australia, thunderstorm rains from the United States in the northern hemisphere were transposed to Australia in the southern hemisphere (Australian Bureau of Meteorology, 1985).

2.5.2 Steps in transposition

The transposition procedure involves the meteorological analysis of the storm to be transposed, the determination of transposition limits, and the application of the appropriate adjustments for the change in storm location. The procedure may be divided into four steps, as in the following paragraphs.

2.5.2.1 The storm

The first step in transposing a storm is to identify clearly when and where the heaviest rainfall occurred and the approximate causes in terms of synoptic meteorology. An isohyetal chart, a few key mass rainfall curves, and weather maps serve these purposes. The isohyetal chart may be a simple one, since its primary function is to identify the storm location. Routinely available weather maps may be sufficient to identify the storm causes, especially if the precipitation is closely associated with either a tropical or an extratropical cyclone. In other instances, a detailed analysis may be necessary to identify causes.

2.5.2.2 Region of influence of storm type

The second step is to delineate the region in which the meteorological storm type identified in step 1 is both common and important as a producer of precipitation. This is done by surveying a long series of daily weather charts, or available