2.13.6 **Areal distribution**

Two methods of establishing the areal distribution of what may be termed the PMP storm were described in section 2.11. The first, which involves the use of an observed storm pattern maximized by the sliding technique (section 2.11.2), usually equals PMP for only one duration and size of area. The second method, which is used with idealized storm patterns, requires PMP values for the basin area to be equalled for all durations (section 2.11.3). Values for areas smaller than the total basin area are set at less than PMP by the use of within-storm deptharea curves shaped according to observed storms. In general, the larger the basin, the larger the difference between PMP and within-storm curve values for any given area smaller than the basin (Figure 5.10). Conversely, the difference decreases as basin size decreases, so that for basins of no more than a few hundred square kilometres, the areal distribution is frequently accepted as conforming to the PMP curves.

If meteorological conditions are the same, there may seem to be no reason why the rainfall potential over a 100 km^2 area in a 25 000 km^2 basin, for example, should be less than that over a 100 km^2 area in a 5 000 km^2 basin. In the regions where such within-storm curves have been developed, however, storms producing large rainfall depths over areas of 25 000 km^2, in general, do not have embedded large convective cells. In contrast, storms that produce maximum values over areas of approximately 5 000 km^2 are more convective in nature with large amounts over small areas within the storm. For this reason, these within-storm curves indicate lesser small-area depths as basin size increases. The within-storm curves are patterned after actual storms that have occurred over a region and reflect actual storm rainfall distributions. This relation may not be valid in other regions and actual storms must be examined to determine appropriate within-storm curves for any study. The effect of small-area depths on total basin rainfall volume decreases as basin size increases.

An important restriction on the construction of depth–area curves is that their slopes should nowhere indicate a decrease in rainfall volume with increasing area. This applies to all deptharea curves, including PMP.

While most examples of PMP estimation presented in this manual involve areal distribution based on within-storm curves, it should not be inferred that this is the recommended method. Whether the areal distribution is based on an observed storm maximized by the sliding technique, on within-storm curves, on PMP depth–area curves, or on other methods depends on the judgement of the meteorologists, hydrologists and engineers involved in the development of the design for a hydrological structure. A variety of different methods are normally used by the meteorologist to develop estimates of rainfall distribution over the basin. The estimates are then reviewed to ensure they are consistent with storm experience. The hydrologist and/or engineer will then apply the various rainfall distributions to determine which is most hydrologically critical for the design of a particular structure.