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Root selection methods in flood analysis

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Abstract. In the 1970s, de Laine developed a root-matching procedure for estimating unit hydrograph ordinates from estimates of the fast component of the total runoff from multiple storms. Later, Turner produced a root selection method which required only data from one storm event and was based on recognising a pattern typical of unit hydrograph roots. Both methods required direct runoff data, i.e. prior separation of the slow response. This paper introduces a further refinement, called root separation, which allows the estimation of both the unit hydrograph ordinates and the effective precipitation from the full discharge hydrograph. It is based on recognising and separating the quicker component of the response from the much slower components due to interflow and/or baseflow. The method analyses the z-transform roots of carefully selected segments of the full hydrograph. The root patterns of these separate segments tend to be dominated by either the fast response or the slow response. This paper shows how their respective time-scales can be distinguished with an accuracy sufficient for practical purposes. As an illustration, theoretical equations are derived for a conceptual rainfall-runoff system with the input split between fast and slow reservoirs in parallel. These are solved analytically to identify the reservoir constants and the input splitting parameter. The proposed method, called "root separation", avoids the subjective selection of rainfall roots in the Turner method as well as the subjective matching of roots in the original de Laine method.

Keywords: unit hydrograph,identification methods, z-transform, polynomial roots, root separation, fast andslow response, Nash cascade

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