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Regional analysis using the Geomorphoclimatic Instantaneous Unit Hydrograph

M. J. Hall[1], A. F. Zaki[2], and M. M. A. Shahin[1]
[1]International Institute for Infrastructural, Hydraulic and Environmental Engineering, PO Box 3015, 2601 DA Delft, The Netherlands
[2]Water Resources Research Institute, National Water Research Centre, El-Qanater El-Khairyya, Egypt 13621
Email for corresponding author: mjh@ihe.nl

Abstract. The construction of design flood hydrographs for ungauged drainage areas has traditionally been approached by regionalisation, i.e. the transfer of information from the gauged to the ungauged catchments in a region. Such approaches invariably depend upon the use of multiple linear regression analysis to relate unit hydrograph parameters to catchment characteristics and generalised rainfall statistics. The concept of the geomorphological instantaneous unit hydrograph (GIUH), in relating the shape and scale of the catchment transfer function to stream network topology and channel characteristics, offers an alternative methodology. GIUH derivation depends upon a series of assumptions, including that of estimating a "characteristic velocity"; these continue to attract attention and debate. However, if this velocity is expressed in terms of the kinematic wave approximation, the peak and time-to-peak of the IUH may be expressed in terms of a group of catchment and channel characteristics and the intensity of rainfall excess, giving the so-called geomorphoclimatic IUH (GCIUH). Previous studies involving the GCIUH have developed a single IUH relating to the total duration of rainfall excess. In this study, the rainfall excess duration was divided into several (equal) time increments, with separate IUHs being generated for each interval. This quasi-linear approach was applied to 105 storm events from nine catchments in the south-west of England, ranging in size from 6 to 420 $(km)^2$. The results showed that, providing the time interval chosen is fine enough to capture the shape of the runoff hydrographs, a comparable level of goodness-of-fit can be obtained for catchments covering a range of about 1:75 in area. The modified GCIUH approach as described is therefore recommended for further investigation and intercomparison with regression-based regionalisation methods.

Keywords: floods; geomorphology; rainfall-runoff modelling

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