



Derivation of Geomorphological Instantaneous Unit Hydrographs for Ungauged Sites based on Catchment Self Similarity Properties

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Hydrologists extensively use Horton-Strahler (H-S) scheme for ordering (classification) of streams in a catchment. The ordered network forms the basis to determine H-S ratios that find use in modeling hydrological response of the catchment and in establishing relations with the fractal nature of channel network in the catchment. However, utility of H-S ratios has attracted criticism owing to (i) their dependence on the threshold area used for initiation of stream network and (ii) their sensitivity to the position of outlet of catchment. This implies that estimates of H-S ratios and inferences drawn from analysis of a river network that is classified based on H-S ordering scheme are conditional on threshold area, which is undesirable. To overcome these limitations, researchers are dedicating their efforts to arrive at an effective strategy that alleviates the dependence of H-S ratios on threshold area used for extraction of stream network in a catchment. Recently, Moussa (2009) proposed that artefacts associated with estimation of H-S ratios could be overcome if self-similarity properties are applicable to channel network. Equivalent H-S ratios that are independent of threshold area could be estimated for a catchment by using morphometric descriptors determined based on self-similarity properties of channel network in the catchment. Moussa (2009) examined applicability of self-similarity properties on seven catchments in France having area ranging from 738 sq.km to 5346 sq.km. There is dearth of attempts to examine potential of the strategy outside France. In this perspective, hypothesis of self-similarity is verified for stream networks in 201 catchments located in Mahanadi, Godavari, Krishna and Cauvery river basins, whose sizes vary from 160 sq.km to 311,150 sq.km. The river basins cover about 794,515 sq.km area in central and southern parts of India. Results indicated that self-similarity based strategy is effective for the Indian catchments irrespective of their size. Results obtained from the investigations would be presented and discussed. Further, utility of information determined on morphometric descriptors of the catchments in estimating equivalent H-S ratios and subsequently constructing Geomorphological Instantaneous Unit Hydrographs (GIUH) for various ungauged locations in the study area would be demonstrated.