

GEOMORPHOLOGICAL INSTANTANEOUS UNIT HYDROGRAPH (GIUH)

Estimation of runoff response from ungauged catchments has been an important subject of research for planning, development and operation of water resources projects. Conventional techniques of derivation of unit hydrograph (UH) require historical rainfall-runoff data. Due to obvious reasons, adequate runoff data are, generally, not available for many of the small-size catchments and indirect inferences through regionalization are sought for such ungauged catchments. For the estimation of runoff in ungauged catchments resulting from a rainfall event, Geomorphological Instantaneous Unit Hydrograph (GIUH) approach is getting popular because of its direct application to an ungauged catchment. It avoids adoption of tedious methods of regionalization of unit hydrograph, wherein the historical rainfall-runoff data of a number of gauged catchments are required to be analysed.

As a first step in the direction of using geomorphologic characteristics for estimation of runoff, the concept of a triangular shaped GIUH was introduced by Rodriguez-Iturbe and Valdes in the year 1979. The GIUH approach has many advantages over the regionalization

techniques. It avoids requirement of flow data and computations for neighboring gauged catchments in the region as well as updating of the parameters. Another advantage of GIUH approach is its potential of deriving the UH using only the information obtainable from topographic maps or remote sensing, possibly linked with Geographic Information System (GIS) and Digital Elevation Model (DEM).

TECHNOLOGY

The GIUH derived from geomorphological characteristics of a catchment has been related to the parameters of Clark IUH model as well as Nash IUH model for deriving its complete shape through non-linear optimisation. The DSRO hydrographs estimated by the GIUH based Clark and Nash models may be compared with the DSRO hydrographs computed by the Clark IUH model option of the HEC-1 package and the original Nash IUH model by employing some of the commonly used error functions. Sensitivity analysis of the GIUH based models may be conducted with the objective to identify the geomorphological and other model parameters which are more sensitive in estimation of peak of unit hydrographs computed by the GIUH based models, so that these parameters

may be evaluated with more precision for accurate estimation of flood hydrographs for the ungauged catchments. For applying this technique, the required geomorphological parameters of a catchment may be computed manually or through GIS software.

This approach has been applied to some of the sub-basins, such as Ajay River basin up to Sarath in Jharkhand, Krishna-Wunna sub-basin up to bridge No. 807 in Godavari basin in Maharashtra, Tons River basin up to Kishau dam site in Uttranchal, and some sub-basins of river Narmada.

ENVIRONMENTAL IMPACT

As this methodology is meant for estimation of floods or design floods for ungauged catchments, it does not have any adverse impact on the environment.

ECONOMICS

Overestimation of design flood results in increase in the cost of a hydraulic structure whereas under estimation of design flood may increase the risk of failure of a hydraulic structure. The

technology may be applied to provide rational estimate of design flood, particularly for the small ungauged catchments, as a large number of small-size catchments are ungauged in India. Thus, the technology will be helpful for planning, designing, and operation of water resources projects in the ungauged catchments. Furthermore, the technology may also be applied for designing small culverts, bridges, cross-drainage works and flood protection structures. From the application of this technology, there will be intangible benefits.

BENEFICIARIES

Engineers, scientists and other professionals involved in planning, design and operation of water resources projects and flood management works will be the beneficiaries.

INTELLECTUAL PROPERTY RIGHTS

The GIUH based Clark and Nash models have been developed at the National Institute of Hydrology, Roorkee. Therefore, the Institute reserves the IPR of this technology.