

INTISARI

Perkiraan hidrograf banjir pada daerah aliran sungai (DAS) tak terukur dapat dilakukan menggunakan hidrograf satuan sintetik (HSS). Penurunan rumus-rumus empirik HSS umumnya didasarkan pada dua pendekatan, yaitu pengaruh faktor karakteristik DAS dan faktor geomorfologi DAS dalam proses alihragam hujan-aliran tanpa memerlukan data hujan dan aliran terukur. HSS perlu dikaji kinerjanya sebelum digunakan untuk hitungan banjir rancangan, agar diperoleh besaran rancangan hidrologi yang akurat.

Pada penelitian ini dilakukan kajian hasil penurunan HSS menggunakan metode *Geomorphological Instantaneous Unit Hydrograph* (GIUH) dan GAMA I berdasarkan beberapa faktor geomorfologi dan fungsi distribusi probabilitas untuk menurunkan hidrograf satuan di dua DAS di daerah tangkapan air Waduk Wonogiri, Jawa Tengah, yakni DAS DAS Solo Hulu dan DAS Wiroko. Parameter fisik DAS diperoleh dari data *ASTER Global DEM V3* yang diolah menggunakan perangkat lunak *Watershed Modeling System* dan *ArcMap*. Hitungan hidrograf limpasan langsung dilakukan menggunakan hasil HSS model GIUH orde 5, GIUH orde 4 dan GAMA I dengan hujan efektif dari data hujan permukaan terukur.

Evaluasi ketelitian HSS model GIUH dan GAMA I didasarkan pada tiga karakteristik pokok hidrograf satuan, yaitu debit puncak, waktu puncak dan waktu dasar. Hasil penelitian menunjukkan bahwa penetapan orde sungai yang lebih tinggi dapat meningkatkan ketelitian HSS model GIUH. Perbandingan HSS model GIUH orde 5 dengan hidrograf satuan terukur menunjukkan ketelitian yang baik untuk DAS Wiroko dengan persentase kesalahan debit puncak (Δq_p), waktu puncak (Δt_p), dan waktu dasar (Δt_b) masing-masing sebesar 19,7%; 0%; dan -18,18%. Selanjutnya evaluasi kinerja penggunaan HSS model GIUH dan GAMA I untuk hitungan hidrograf banjir didasarkan pada indikator statistik NSE, RME, dan RMSE. Kinerja kedua HSS belum dapat disimpulkan secara pasti, mengingat data hidrograf terukur yang digunakan sebagai acuan perlu dievaluasi lebih lanjut validitasnya.

Kata kunci: Hidrograf satuan sintetik, faktor geomorfologi DAS, karakteristik pokok hidrograf satuan, hidrograf banjir.

ABSTRACT

Estimates of flood hydrographs in ungauged watershed can be performed using synthetic unit hydrographs (SUH). The derivation of SUH's empirical formulas is generally based on two approaches, namely the basin characteristic factors and geomorphological factors in the process of rainfall-runoff transformation without requiring the observed data of rainfall and discharges. SUH needs to be examined on its performance before being used to calculate design flood, in order to obtain an accurate scale of hydrological design value.

In this study, studies have been conducted in the results of SUH derivation using Geomorphological Instantaneous Unit Hydrograph (GIUH) and GAMA I methods based on several geomorphological factors and probability distribution function to develop unit hydrographs at two watersheds in the catchment area of Wonogiri Reservoir, Central Java, namely Solo Hulu and Wiroko watersheds. The physical parameters of watershed are obtained from the data of the *ASTER Global DEM V3* that are processed using Watershed Modelling System and ArcMap software. The direct runoff hydrograph calculation was carried out using the SUH of GIUH method with 5th order, 4th order and GAMA I method in which the effective rainfall was obtained from the real occurrence of rainfall.

The accuracy of the SUH model of both GIUH and GAMA I methods was evaluated by observing three basic characteristics of unit hydrograph, i.e. peak discharge, time to peak and base time. The results show that the determination of the higher order of the rivers network can improve the accuracy of HSS the GIUH SUH model. Comparison of the 5th order of the GIUH SUH with observed unit hydrographs performs good thoroughness for Wiroko watershed with error percentage of peak discharge (Δq_p), time to peak (Δt_p), and base time (Δt_b) of 19.7%; 0%; and -18.18%, respectively. Further evaluation of the performance of the SHU GIUH and GAMA I methods for the determination of flood hydrographs was based on *NSE*, *RME*, and *RMSE* statistical indicators. The performance of both SUH has not yet been concluded for certainty, given that the observed hydrograph data used as a reference needs to be evaluated further in its validity.

Keywords: synthetic unit hydrographs, geomorphological factors of watershed, the basic characteristic of unit hydrograph, flood hydrograph.