Introducing Fractal Based Synthetic Unit Hydrograph ITS-2

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Synthetic Unit Hydrograph (SUH) is a transformation rainfall-runoff model that still popular to be used recently to estimate design flood for the purpose of water resources planning as well as hydraulic structures design. Usually SUH model is developed due to the lack, or even not availability, of hydrologic data such as discharge in river; therefore estimation of discharge to be calculated based on morphometry caracteristics of catchment area. Several SUH models have been applied to support water projects in Indonesia such as Snyder-Alexeyev, Nakayatsu, GAMA-1, Limantara, ITB-1 and others. Every SUH has advantage and disadvantage depend on the similarity of the catchment area condition with the original model development.

Instad of those above SUH's, assumption of fractal characteristics of the catchment area has been introduced in the new model of SUH ITS-2. The name of ITS-2 was adopted that the research was done at the Institut Teknologi Sepuluh Nopember (ITS), Surabaya, Indonesia. The SUH ITS-2 was developed using 8 catchment areas in West Sulawesi, Indonesia, that are Bahomoleo, Pinamula, Toaya, Bangga, Singkoyo, Tambun, Malino and Bunta. The area of catchment areas varies between 23.88 km^2 to 144.73 km^2. Similar with previous SUH models, three parameter formulas were derived and can be used to construct unit hydrograph that are time to peak (T_p), time base (T_b) and peak discharge (Q_p) as follows,

While: C_1 is time to peak coefficient, C_2 is time base coefficient and C_3 is coefficient of hydrograph form factor. Also L is river length, R_L is river length ratio, D is drainage nerwork density, A is catchment area, and S is main river slope.

Verification was done by using 3 rivers in Java and Bali Islands (Upper Ciliwung River, Citatih River and Badung River). Comparison between SUH GAMA-1, SUH ITB-1 and SUH ITS-2 were also done.