DESERT

DESERT
Online at http://jdesert.ut.ac.ir

DESERT 15 (2010) 33-43

Determining the effect of physical characteristics on flood hydrograph (Case study: Western section of Jazmurian Basin)

A. Salajegheh[a], S. Dalfardi[b*], M. Mahdavi[c], A. Bahremand[d], A. Afzali[e]

[a] Associate Professor, Faculty of Natural Resources, University of Tehran,Karaj, Iran
[b] Lecturer, Islamic Azad University of Jiroft, Jiroft, Iran
[c] Professor,Faculty of Natural Resource, University of Tehran, Karaj, Iran
[d] Assistant Professor, Gorgan University of Agricultural Sciences and Natural Resources, Gorgan, Iran
[e] Senior Expert, International Desert Research Center, University of Tehran, Semnan, Iran

Received: 6 February 2009; Received in revised form: 25 November 2009; Accepted: 1 January 2010

Abstract

Flood causes great and uncompressible damage to people's life and properties as well as environment each year in Iran. This research was carried out at the west section of Jazmurian basin that placed in the southeast of Iran. In this research physical characteristics such as area (A), perimeter (Pr), average elevation of basin (av.e), average slope (av.s), gravelious coefficient (G), length of main stream(L), pure slope of main stream(Pur), Lc, Tc and Tl for independent variables and hydrograph component such as Qp, Q25, Q50, Q75, Tp, T25, T50, T75 and Tb for dependent variables were used. For this the data of 12 hydrometric stations were used. Normality test was done by kolmograph- Smironov. After that using two and multiple variables regression analysis and with the use of modeling, the relation between dependent and independent variables were defined. The evaluation of hydrologic model behavior and Performance is commonly made and reported through comparisons of simulated and observed variables. Frequently, Comparisons are made between simulated and measured stream flow at the catchments outlet. Significant models are included the models that have correlation coefficient bigger than 0.325 at 1 percentage level and bigger than 0.250 at 5 percentage levels. We used three criteria such as RMSE, RE and CE for selecting the ultimate models. These models have less RMSE and RE and more CE .The results approve that with the use of physical characteristics of the basin we can determine the synthetic hydrograph. The results also show that the two- variable models have higher efficiency in estimating the discharge variables of the simulated hydrographs.

Keywords: Physical attributes; Hydrological modeling; Synthetic hydrograph; Dependent variable; Jazmurian basin; Iran

1. Introduction

The fact that the world faces water crises has become increasingly clear in recent years. Challenges remain widespread and reflect severe problems in the management of water resources in many parts of the world. These problems will intensify unless effective and concerted actions are taken"(WWAP, 2003). For appropriate design of hydraulic structures And flood control structures, information must be known about the hydrology of the system, such as peak discharge, runoff volume, and the time
to peak of large storm events. Many design applications including dams, spillways, detention basins, culverts, and urban storm water systems depend on this information. To accurately predict the peak discharge, runoff volume, and time to peak of design storms, the hydrological processes, which control the rainfall-runoff phenomenon, must be investigated. (Rahimian, 1995). If having enough statistical Data of flood, it can be done

* Corresponding author. Tel.: +98 913 248 8529,
Fax: +98 261 2227765.
E-mail address: d_s2358@yahoo.com

using frequency analysis of flood (Afshar 1990). Providing flood properties at the watersheds without statistical Data is very hard. Empirical formulas, Synthetic hydrograph, simulation methods, statistical estimation of maximum instantaneous are analyzed and flood indicator are used for supplying maximum of instantaneous flood in those watersheds without hydrometric station. Among these methods, some which result in simulating hydrograph are able to describe the exact details of flood (compolar & solodati, 1999). In other words important necessary properties of flood can be derived after determining the flood hydrograph. But most of the time because of hydrographs limitations, the design flood hydrograph is obtained by another way for applications (Afshar, 1990). We need to have discharge data as time series to illustrate hydrographs, since there are no enough discharge information and hydrometric stations and also because of the good mathematical relationships between catchment characteristics and hydrograph properties and components, we try to develop the synthetic hydrographs using the mentioned relationships. Dooge (1977) comments that many of first models were based on empirical equations developed under unique conditions and used in applications with similar conditions. An urgent need in hydrology is to apply models to predict in ungauged basins and hence traditional calibration of models is not possible (Sivapalan et al., 2003).Hydrological models are primarily predictive models, meaning they obtain a specific answer to a specific problem. Other models are developed to be investigative, meaning they increase our understanding of hydrological processes (O'Connell, 1991). There are many proposed models to calculate of synthetic hydrograph, they used for special condition and could not be used in different location (Afshar, 1995). The models are suitable instrument for decision making in hydrologic affairs and for developing these models doing accurate and effective watershed's assessment is necessary (Deal et al. 2008). Efficiency criteria are defined as mathematical measures of how well a model simulation fits the available observations (Beven, 2001). Models simplify the system and simulate watershed behaviors and represent the relations existed between the characteristics of basin and their hydrograph response. There for studying the affairs that take place in watershed and estimating its important outputs of it such as flood and sediment are of most important duties of watershed manager (Telvari 1996). There for hydrologic modeling provided by physical attributes can solve many of problems in relation with hydrologic studies. Because different location in our country are under risk of frequent floods, there for developing these models is very high value and with use of these models we can save our different natural and humanity resources.

2. Materials and methods

The Jazmurian watershed is located at southeast of Iran and is surrounded by Bazman, Jabalbarez, Hazar and Lalehzar mountains. It is bounded on the south by Bashagard Mountains. All of rivers and streams in this watershed are inflowing toward plain of Jazmoran. It's located between 56˚, 15΄ until 61˚, 23΄ east longitude and 26˚, 28́ until 29˚, 30́ north latitude. Its area is 69621 Km^2 of which about 32459 Km^2 is area of plains and fans, and 3000 Km^2 saltish area, wetlands and swamps. This research was carried out in northwest part of Jazmurian where the mountains are, and the main stream and rivers of the basin with an important role on flooding are located in this part. Baft and Esfandaghe plains are located at the farthest end of northwest of jazmurian watershed with high elevation. There are three cities including Jiroft, Baft and Iranshahr are located in this watershed.

The required information for this research includes 10 physical characteristics (Independent variables) and component of flood hydrograph (dependent variables). the information concerning flood hydrograph is obtained from Water Recourses Research Institute of Iran (TAMAB) and also Kerman's water department and physical characteristics are obtained from digitized topographic maps with scale of 1/50000 (sheets related to west section of Jazmurian).

12 hydrometric stations were selected at the studied location (Table 1). After collecting required information of to mentioned stations from related departments, hydrographs designed on coordinate axis and Hawk Belly hydrographs were selected.

Unfortunately because of different reasons such as taking unsuitable statistic data, most of hydrographs were unsuitable for modeling. In spite of this problem among the data of different stations, 91 hydrographs that were better for modeling were selected.

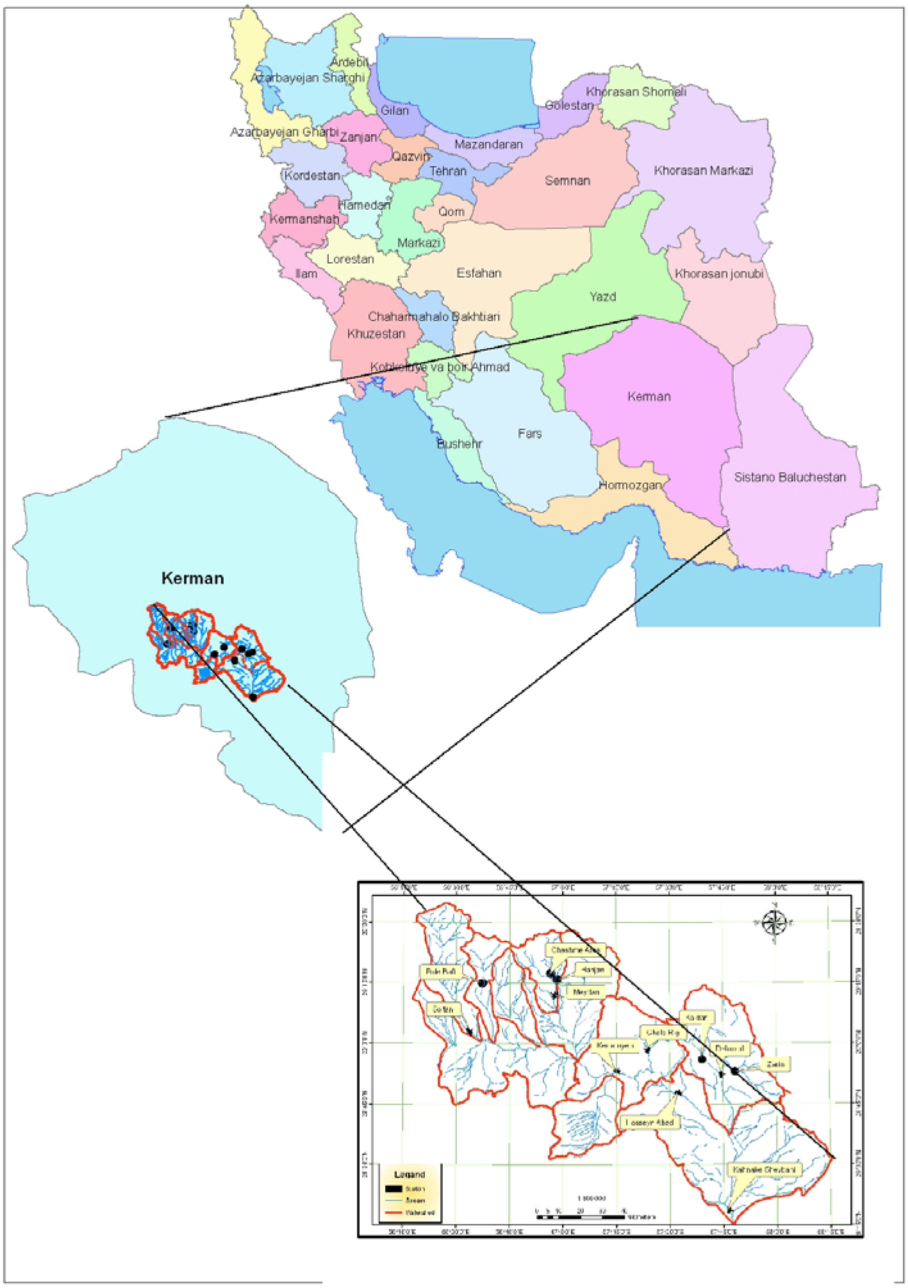

Fig. 1. Situation of the studied watershed

Table 1. Hydrometric stations in the studied watershed

No.	Name of station	River	Area (km^2)
1	Soltani	Soltani	935
2	Koldan	Rabor	191
3	Ghale rigi	Ramon	249
4	Konaroie	Halil rood	7600
5	Zarin	Saghder	330
6	Dehrod	Shor	1361
7	Hosein abad	Halil rood	8420
8	Meydan	Seyed morteza	520
9	Hanjan	Rodar	311.2
10	Pole Baft	Baft	261
11	Chashme Aroos	Rabor	100.4
12	Kahnake sheybani	Halil rood	12990

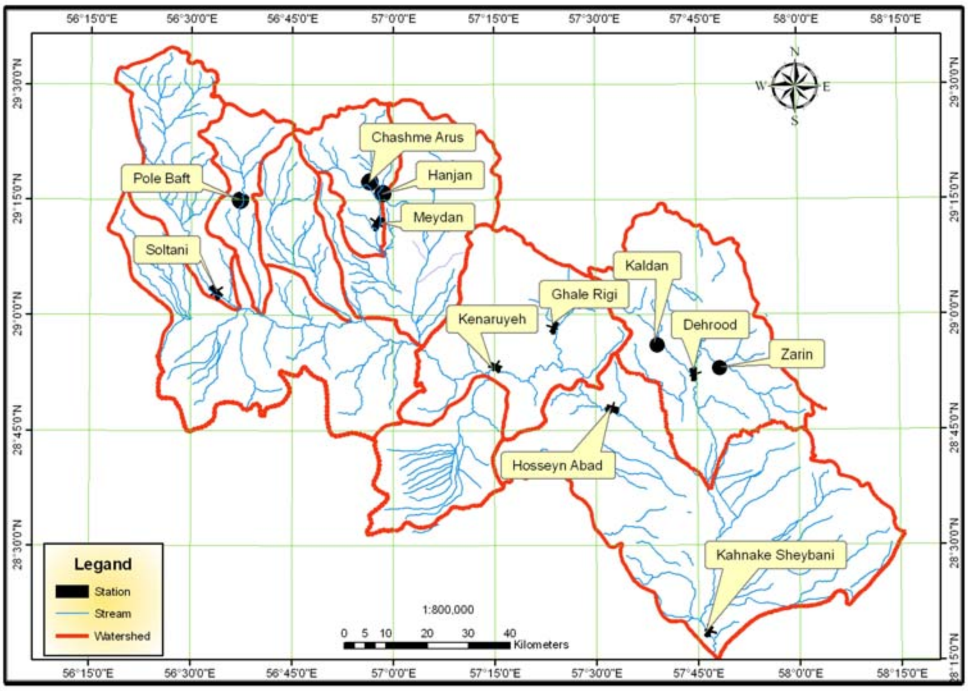

Fig. 2. Location of hydrometric stations in the study area

Peak discharge, base time, discharges of 25%, 50% and75% of the peak, time to peak, the times corresponded to discharge of 25%, 50% and 75% that are important component of hydrograph (Snyder 1938 & Gupta et al, 1986) were selected for developing hydrologic models. These variables were extracted from available hydrographs. Hydrographs were plotted on coordinate system and then dependent variables were extracted. Hygrograph's component as dependent variable and physical attributes as independent variables were used for modeling and providing synthetic hydrograph by soft ware SPSS.

Two and multiple regression, were used to determine relationships between dependent and independent variables with the intention of determination and assessment of main factors controlling hydrograph components and also homogeneity of accepted stations. SPSS 13 software was applied for statistical analysis (Esmailian, 2002). Regarding to degree of freedom (n-2), the models which its correlation coefficient were equal or more than 0.250 and 0.325 in 1% and 5% level respectively were significant models (Mahdavi, 2002). The Colmograph- smironov test was used for normality of data. Also homogeneity test for variance of error were used by plotting values of standard error against values of standardized prediction. The accepted points were tested for being monotonous and uniform, and no self correlation test between errors was done using Durbin – Watson test with acceptable values near 2. Also analysis of outliers by use of casewise diagnostics test and occurrence of studied values was done within a range of 3 times of standard deviation (Mozayan, 2003). The regression models were indeed developed from finding direct relations among variables or their changed forms.

Therefore pair relations between variables in states of linear , logarithmic , inverse ,two degree , three degree , complex, power, s curve , growth curve and exponential were studied and suitable models related to each of these state were selected (mozayan, 2003). To determine linear relation between dependent and independent variables, polygonal linear relation test was used (Affifi and Clark, 1995) involving one formula containing relation between one of depended variables with all of independent variables.

Ultimately for selecting suitable model and most effective related independent variables, multiple linear regressions were implemented in three ways: stepwise, back ward and forward methods. Therefore for each of dependent variables one, two or several significant formulas were developed. And then regarding to the freedom degree n-2 and significant level, formula with significant correlation coefficient were distinguished. For achieving final models of each dependent variable, important assessment criteria such as adjusted coefficient of determination (adjusted R^2), relative error of estimation and approval (RE), residual mean square error (RMSE) and finally coefficient efficiency (CE) were used (Formula 1-3).

$$RE = \left| \frac{Yo - Y_e}{Yo} \right| \times 100$$

$$RMSE = \sqrt{\frac{\sum_{1}^{i=1}(Y_o - Y_e)^2}{n}}$$

$$C_E = \frac{\frac{1}{n}\sum_{n}^{i=1}(Q_o - Q_o^-)^2 - \frac{1}{n}\sum_{n}^{i=1}(Q_o - Q_e)^2}{\frac{1}{n}\sum_{n}^{i=1}(Q_o - Q_o^-)} \qquad (1\text{-}3)$$

Where in this formula RE= relative error in percentage, RMSE=residual mean square error, Ye=estimated value of dependent variable, Yo=observed value of dependent variable, n=the number of variable, Qo= observed value of discharge, Qe= estimated value of discharge, $\overline{Q}o$ =mean observed value of discharge.

Final selection of extracted models were accomplished by less relative error of estimation and approval and residual mean square error and more coefficient efficiency and adjusted coefficient of determination.

3. Results

Determination of the best relationship between hydrograph components and physical characteristics of watershed is the main objective of this research. With these relationships, the hydrograph components can be calculated using physical characteristics of the catchment. For achieving this objective after determining dependent and independent variables the relationships between these variables were determined by two and multiple variable regression. Evidently in equal condition, the models with more adjusted coefficient of determination, less estimation and approval error and less number of independent variables were selected as the best models. Multiple variable regressions, linear and nonlinear models were extracted using spss (tables 2 and 3). In each table the formulas accompanied by adjusted coefficient of determination and correlation coefficient were given. Based on the correlation coefficient, the significant or not significant models were distinguished. Adjusted coefficient of determination showed that how many percentages of dependent variables were explained by independent variabls. As it can be seen from the tables, the discharges components with time components have bigger adjusted coefficient of determination in terms of meaningful significance, therefore they were better for modeling purpose. From statistical point, the two-variable regression showed to be better than other methods, based on its high adjusting coefficient of determination. The ultimate models were chosen from two variable models with higher efficiency coefficient. With attention to adjusted coefficient of determination in two variable regressions (table 2) it was observed that in formula with more adjusted coefficient of determination, two independent variables including area and perimeter are the most effective for explanation of dependent variables. in linear regression models the adjusted coefficient of determination equal to 0.018 and correlation coefficient equal to 0.26 has the lowest adjusted coefficient of determination that is for T25 (model no.9) and opposite of it the adjusted coefficient of determination equal to 0.135 and correlation coefficient equal to 0.387 has the highest adjusted coefficient of determination that is for Q25 (the model No.47).

Table 3 shows the result of linear regression from this table it shown that exception of models No.19 and No.20 connected with Tb , the models connected with discharge related to time has more adjusted coefficient of determination which it correspond to result of non curve linear regression. Three method of stepwise, backward and forward were used by linear regression that back ward was more significant. The lowest r^2 is for Tp (model No.13) and the highest r^2 for Tb (model No.19). In linear regression also discharge component has more adjusted R^2 relative to the time component.

Table 2. Result of prevalent two variable regression models

Row	Formula	Adjusted Coefficient of determination (Ad.R.S)	Correlation Coefficient (r)
1	Tp=150.466+(0.207A)+(-4.3E-0.005A2)+(2.14E-0.009A3)	0.046	0.306
2	T50=e(3.985+(-1053/lc))	0.027	0.260
3	Tb=29.164+(0.006A)+(-106E-0.006A2)+(9.11E-0.011A3)	0.067	0.337
4	Tp=-13.904+(4.068Pr)+(-0.014Pr2)+(1.27E-0.005Pr3)	0.048	0.309
5	T25=-29.778+(1.937Pr)+(-0.007Pr2)+(0.06E-0.006PR3)	0.028	0.276
6	Tb=22.3+(0.167Pr)+(-0.001Pr2)+(6.88E-0.007Pr3)	0.067	0.337
7	T50=-77511.3+76125.73G	0.051	0.258
8	T75= e(5.12+(-4.053/lc))	0.045	0.247
9	T25=-73.747+(156.872av.s)+(-34.771av.s2)+(2.174av.s3)	0.018	0.26
10	T25=e(3.479+(-1E+0.033/av.e))	0.019	0.252
11	TP=-29.933+(12.616L)+(-0.11L2)+0	0.065	0.335
12	T25=-29.571+(5.454L)+(-0.045L2)+0	0.027	0.274
13	Tb=20.3+(0.567L)+(-0.006L2)+(1.58E-0.005L3)	0.069	0.340
14	TP=-31.204+(108.137Tc)+(-7.927Tc2)+(0.145Tc3)	0.074	0.347
15	T25=-27. 545+(46.087Tc)+(-3. 358Tc2)+(0.061Tc3)	0.025	0.272
16	T50=23573. 344+3173.918Tc	0.046	0.249
17	T75=3358.087+40192.748log(Tc)	0.04	0.236
18	Tb=22.129+(3.991Tc)+(-3. 36Tc2)+(0.007Tc3)	0.064	0.332
19	Tp=-42. 329+(187.349Tl)+(-23.428Tl2)+(0.752Tl3)	0.075	0.348
20	T25=-33.16+(80. 335Tl)+(-9.96Tl2)+(0. 314Tl3)	0.027	0.275
21	T50=22795.618+5607.924Tl	0.045	0.246
22	Tb=21.598+(7.027Tl)+(-1.012Tl2)+(0.035Tl3)	0.064	0.333
23	TP=e(5.517+(-5.053/Lc))	0.056	0.269
24	T25=15.953+(5.5Lc)+(-0.052Lc2)	0.034	0.257
25	Tb=19471+(1.481Lc)+(-0.043Lc2)+0	0.03	0.280
26	Qp=0.23A0.332	0.119	0.395
27	Q25=0.887A0.332	0.120	0.366
28	Q50=1.784A0.332	0.119	0.365
29	Q75=2.679A0.331	0.119	0.365
30	Qp=e(4.28+(-77.694/Pr))	0.123	0.37
31	Q25=e(2.89+(-77.608/Pr))	0.123	0.371
32	Q50=e(3.587+(-77.691/Pr))	0.123	0.37
33	Q75=e(3.992+(-77.643/Pr))	0.122	0.37
34	Qp=6.562+(2.664G)	0.093	0.329
35	Q25=1.619+(2.682G)	0.095	0.332
36	Q50=3.282+(2.664G)	0.093	0.329
37	Q75=4.927+(2.664G)	0.093	0.329
38	Qp=4E+0.4av.e-0. 387	0.113	0.357
39	Q25=(1E+0.014)av.e-0.389	0.114	0.359
40	Q50=(2E+0.4)av.e-0.387	0.113	0.357
41	Q75=(3E+0.4av.e-0.387	0.113	0.357
42	Qp=e(4.409+(-3.243/Tc))	0.133	0.383
43	Q25=e(3.022+(-3.249/Tc))	0.097	0.385
44	Q50=e(3.716+(-3.242/Tc))	0.133	0.383
45	Q75=e(4.121+(-3.241/Tc))	0.132	0.383
46	Qp=e(4.433+(-2.03/Tl))	0.134	0.385
47	Q25=e(3.046+(-2.034/Tl))	0.135	0.387
48	Q50=e(3.74+(-2.03/Tl))	0.134	0.385
49	Q75=e(4.145+(-2.029/Tl))	0.134	0.385

Table 3. Result of prevalent linear regression models

Row	Method regression	Formula	Adjusted Coefficient of determination (Ad.R.S)	Correlation Coefficient (r)
1	S	Qp=-0.211A-0.149Pr+0.008G-0.14av.e-0.273L+0.031Pr-0.203Tc-0.206Tl-0.212Lc	0.094	0.331
2	B	Qp=-0.250Tl+0.36av.e-0.274Tc-0.096Lc-0.166L-0.161G+0.06Por-0.22av.s	0.124	0.392
3	F	Qp=-0.211A-0.149Pr+0.008G-0.14av.e-0.273L+0.031Por-0.203Tc+0.206Tl-0.212Lc	0.094	0.331
4	S	Q25=-0.21A-0.14Pr+0.014G-0.14av.e-0.273L+0.039Por-0.202Tc-0.206Tl-0.213Lc	0.096	0.333
5	B	Q25=-0.25Tl+0.037av.e-0.273Tc-0.098Lc-0.168L-0.15G+0.066Por-0.231av.s	0.125	0.393
6	F	Q25=-0.21A-0.149Pr+0.014G-0.14av.e-0.27L+0.039Por-0.202Tc-0.206Tl-0.213Lc	0.096	0.333
7	F	Q50=-0.211A-0.149Pr+0.008G-0.14av.e-0.272L+0.031Por-0.203Tc-0.206Tl-0.212Lc	0.094	0.331
8	B	Q50=-0.25Tl+0.036av.e-0.274Tc-0.096Lc-0.166L-0.161G+0.06Por-0.22av.s	0.124	0.392
9	S	Q50=-0.211A-0.149Pr+0.08G-0.14av.e-0.272L+0.031Por-0.203Tc-0.206Tl-0.212Lc	0.094	0.331
10	S	Q75=0.71A+0.11Pr+0.072G-0.141av.s+0.052L-0.13Por+0.079Tc+0.081Tl+0.103Lc	0.077	0.296
11	B	Q75=0.013Tl+0.041av.e+0.114av.s+0.012Tc-0.082L-0.002Lc-0.145G+0.144Por	0.130	0.387
12	F	Q75=0.071A+0.11Pr+0.072G-0.141av.s+0.052L-0.13Por+0.079Tc+0.081Tl+0.103Lc	0.077	0.296
13	B	Tp=0.297A- 106.848G36.635av.s +2.4E0.33av.e +7.207L+503.355Por-9.423Tc-11.06Lc +6.525Pr+0.487Qp	0.011	0.419
14	B	T25=0.061A+0.604L+1.067Pr+0.212Qp	0.047	0.333
15	B	T50=76135/730G	0.051	0.258
16	B	T50=0.398Tl+0.415Tc+0.02Qp+0.31G-0.016av.s+0.074Lc-0.048av.e+0.09L+0.185Por-0.964A	0.03	0.214
17	B	T50=-0.068A-0.059Pr +0.031Av.s +0.007av.e +0.027L+0.072Por +0.108Tc+0.099Tl+0.03Lc+0.013Qp	0.051	0.258
18	B	T75=0.365Tl+0.046Qp+0.381Tc+0.324G-0.043av.s+0.068Lc-0.066av.e+0.059L+0.17P-1.226A	0.023	0.198
19	B	Tb=-0.012A+0.0228Pr+1.06E-0.34av.e+0.442L-0.899Lc+0.062Qp	0.255	0.574
20	B	Tb=0.008A+0.148Pr+0.369L-0.752Lc+0.062Qp	0.248	0.557

The criteria of the coefficient efficiency (most important) (CE) , relative error (RE) and residual mean square error (RMSE) were used for selection of ultimately models that relative to other models included more CE and less RMSE and RE. For purpose of statistical for each dependent variable only one model that was the best statistical model (have more CE and less RE and RMSE) were selected (Table 4).

Table 4. ultimate regression models for estimation of hydrograph, s component

Row	Dependent variable	Formula	Correlation Coefficient (r)	Adjusted Coefficient of determination (Ad.R.S)	Coefficient efficiency (CE)	Residual mean square error (RMSE)	Relative error (RE)
1	Qp	Qp=e(4.28+(-77.694/Pr))	0.37	0.123	0.259	62.52	0.128
2	Q75	Q75=e(3.992+(-77.643/pr))	0. 37	0.122	0.259	62.54	0.128
3	Q50	Q50=e(3.587+(-77.691/Pr))	0.37	0.123	0.259	62.54	0.128
4	Q25	Q25=e(2.89+(-77.608/Pr))	0.371	0.123	0.252	62.42	0.124
5	Tp	Tp=e(5.517+(-5.053/Lc))	0.269	0.056	1.05	33.52	0.004
6	T75	T75=e(5.12+(-4.053/Lc))	0.247	0.045	1.50	27.03	0.27
7	T50	T50=e(3.985+(-1.054/Lc))	0.260	0.027	1.03	29.06	0.29
8	T25	T25=e(3.479+ (-1E+0.033/av.e))	0.252	0.022	0.852	23.284	0.07
9	Tb	Tb=21.598+(7.027Tl)+ (1.012Tl2)+(0.035Tl3)	0.333	0.064	0.954	23.29	0.01

Figure 3 shows relation of estimated maximum discharge by connected model with perimeter of different stations in studied watershed. It was observed that when perimeter increased, estimated maximum discharge also increased.

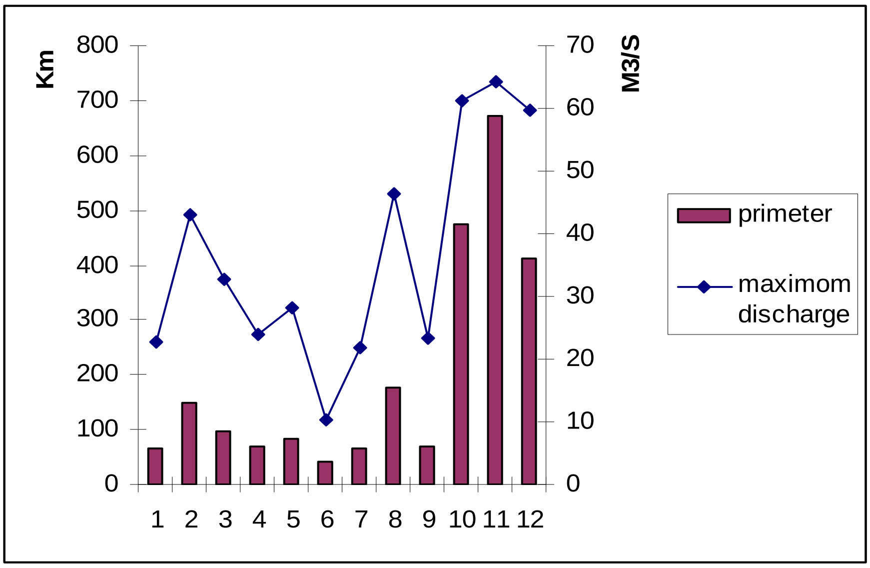

Fig. 3. Relation of perimeter with estimated maximum discharge

Graphic method was used for assessment extracted models by drawing observed hydrographs against synthetic hydrographs.

Observed hydrograph were extracted by taking average of hydrographs for different stations. Rising limb of synthetic hydrographs were extracted by using models of Table 4 and Falling limb of synthetic hydrograph (rising and falling limb have the constant slope) were extracted by Snyder method. Comparing and assessment of observed and synthetic hydrograph were showed in figures 4-13.

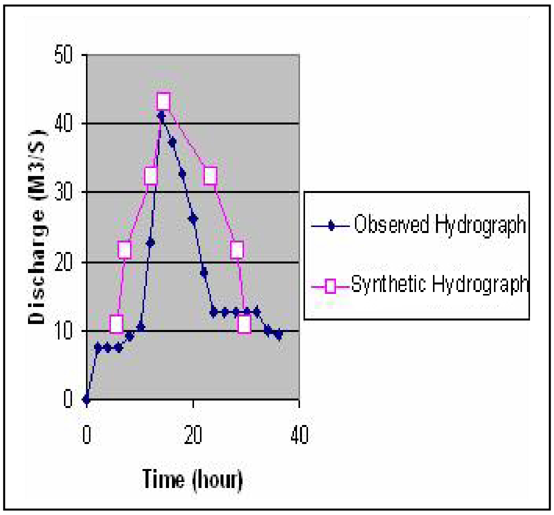

Fig. 4. observed and estimated hydrograph For to Soltani station

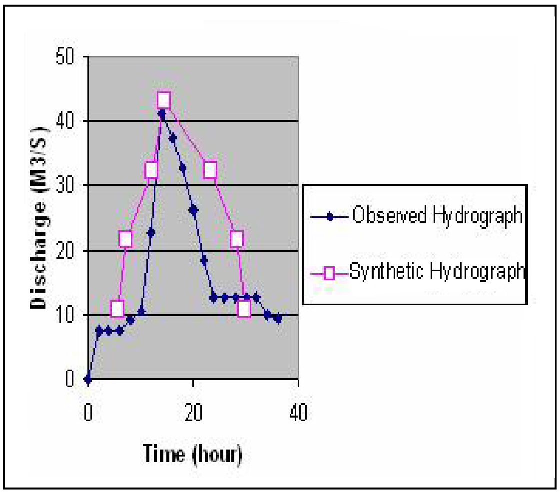

Fig. 5. observed and estimated hydrograph for to Dehrood station

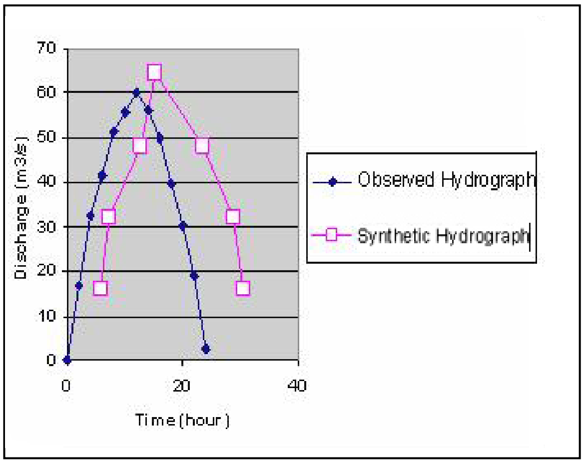

Fig. 6. observed and estimated hydrograph for to Kahnake sheybani station

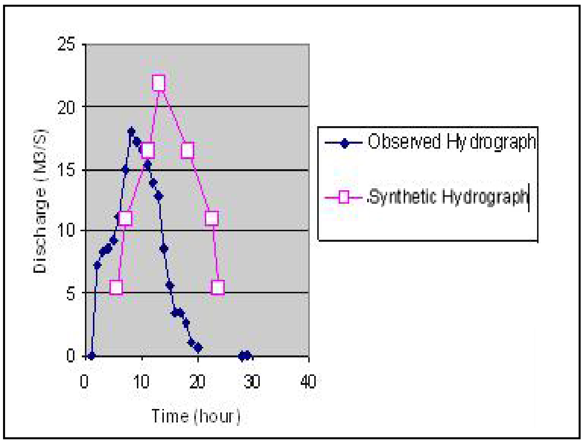

Fig. 7. observed and estimated hydrograph for to Koldan station

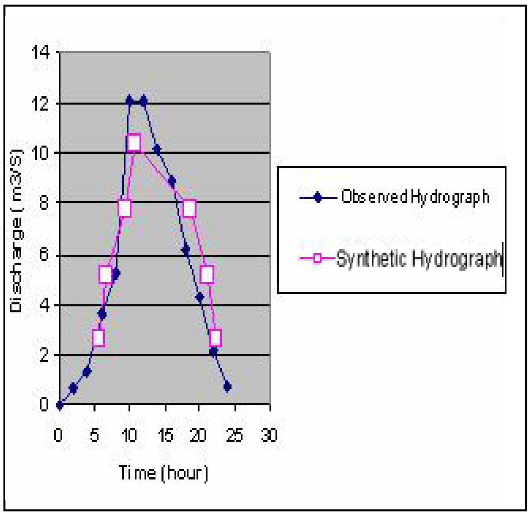

Fig. 10. observed and estimated hydrograph for to Chashme Aroos station

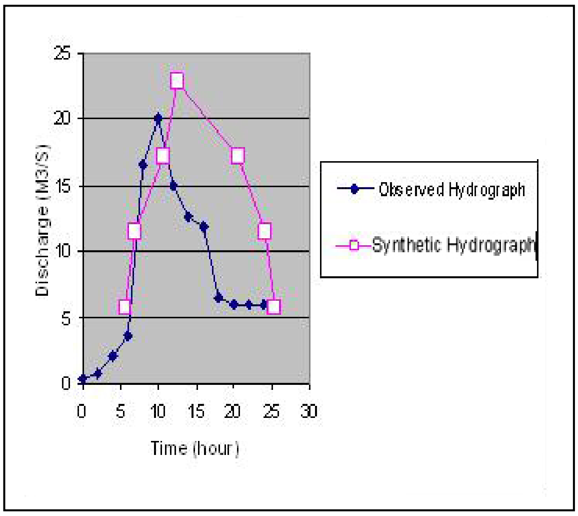

Fig. 8. observed and estimated hydrograph for to Zarin station

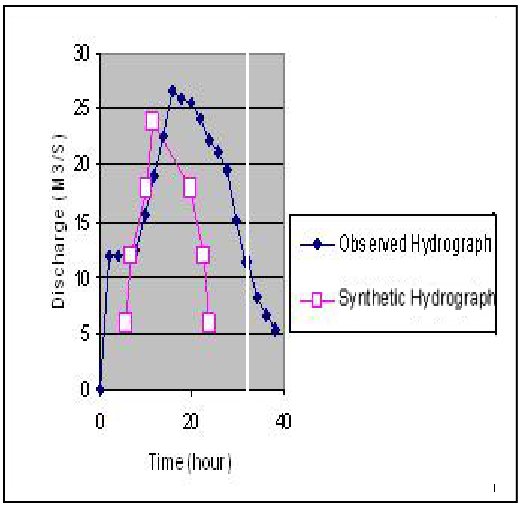

Fig. 11. observed and estimated hydrograph for to Ghale Rigi station

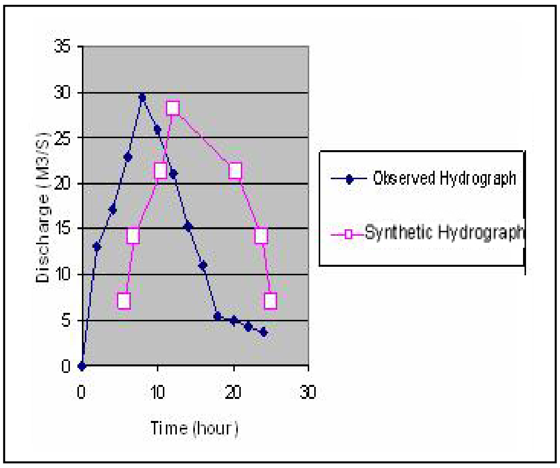

Fig. 9. observed and estimated hydrograph for to Hanjan station

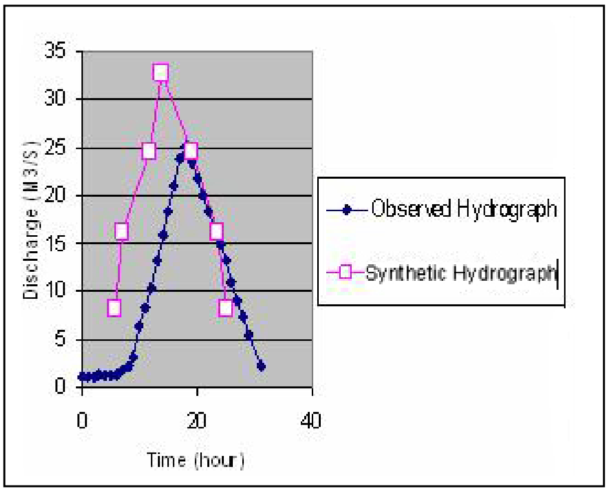

Fig. 12. observed and estimated hydrograph for to Meydan station

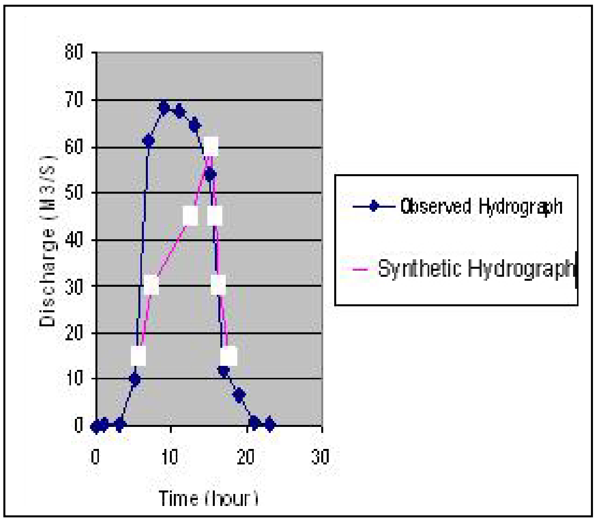

Fig. 13. observed and estimated hydrograph for to Konaroie station

4. Discussion and conclusion

Making models in this watershed beacuse of special situation, unsuitable dispersion and low rainfall consequently different discharge, unsuitable dispersion of station and the most important lowing hydrographs related to other location of the country with better condition is relatively hard. Results show Because of lowing variable and quensequently reducing inner relationship and range variable and using one variable for estimation dependent variable, for purpose of statistical, two variable regressions is better than multiple regressions (table 2 and 3). In addition unlinear relation some of two and several variable models for explanation of physical attribute of hydrograph were approval. In which it's correspond to Singh (1992) based on unlinear relation of hydrological variable. Totally extracted results based on simulation hydrograph by physical attributes are correspond to most of last research (such as guptaetal 1986, yen 1997, kalian etal 2003) although estimating variables different component of hydrograph maybe were different. Results of this research based on significant role perimeter and area on controlling maximum discharge of hydrograph is correspond to results of Fuller and Dicken based on following maximum discharge from watersheds area .

The results of accomplished research in some area of our country (Nekoimehr 1995, and Dindar hasso, 2000) also denote unability Snyder model in rehabilitation hydrograph and naturally inefficiency of accepted variables in mentioned method. on the other hand it can be deduced by doing analyzed with use of standardized regression coefficient connected to physical effective factors of watershed in multiple variable formula (table 3) that almost perimeter of watershed have the most controlling role on variable included: Q25, Q50, Q75. Area, gravelious coefficient, medium slope of watershed and LC are next controlling factors of mentioned variable.

Also it deduced by results of higher two variable regression formula in table 3 that time factors of hydrograph in studied watershed is controlled by LC and lag time . in addition intentional and unintentional errors of flood hydrograph have high effect on accomplished works and produced unhomogenity condition and unsuitable correlation between dependent and independent variable in which have to taked into consideration.

Different between extracted results and former result denoted necessity of location studies and consideration controlling variables of hydrograph component. by use of extracted results adding up that in spite of very low flood hydrograph for hydrologic analyzing due to scattering data , unmanagment information and also intricacy of governor condition , modeling by ten factors Included area, perimeter , mean elevation , mean slope, lengths of main stream, streams pure slope, gravelious coefficient, concentration time, lag time and LC can be accomplished. Totally it is resulted that possibility of modeling in this watershed and similar areas because of very irregular and unsuitable dispersion rainfall and unhomogenity of location condition related to more damped and with regular rainfall is harder. It should be have more stations and enough frequency of stations for better conditions of modeling.

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