International Journal of Constructive Research in Civil Engineering (IJCRCE)
Volume 3, Issue 4, 2017, PP 99-120
ISSN 2454-8693 (Online)
DOI: http://dx.doi.org/10.20431/2454-8693.0304010
www.arcjournals.org

A Study on the Effects of Earth Surface and Metrological Parameters on River Discharge Modeling Using SWAT Model, Case Study: Kasillian Basin, Mazandaran Province, Iran

Mohsen Ghane[1], Sayed Reza Alvankar[1], Saeid Eslamian[2], Kaveh Ostad-Ali-Askari[3*], Amir Gandomkar[4], Shahide Dehghan[4], Vijay P. Singh[5], Nicolas R. Dalezios[6]

[1]*Civil Engineering Department, South Tehran Branch, Islamic Azad University, Tehran, Iran*
[2]*Department of Water Engineering, Isfahan University of Technology, Isfahan, Iran*
[3*]*Department of Civil Engineering, Isfahan (Khorasgan) Branch, Islamic Azad University, Isfahan, Iran*
[4]*Department of Geography, Najafabad Branch, Islamic Azad University, Najafabad, Iran*
[5]*Department of Biological and Agricultural Engineering &Zachry Department of Civil Engineering, Texas A and M University, 321 Scoates Hall, 2117 TAMU, College Station, Texas 77843-2117, U.S.A.*
[6]*Laboratory of Hydrology, Department of Civil Engineering, University of Thessaly, Volos, Greece & Department of Natural Resources Development and Agricultural Engineering, Agricultural University of Athens, Athens, Greece.*

***Corresponding Author: *Dr. Kaveh Ostad-Ali-Askari*,** *Department of Civil Engineering, Isfahan (Khorasgan) Branch, Islamic Azad University, Isfahan, Iran. Emails: Koa.askari@khuisf.ac.ir, Kaveh.oaa2000@gmail.com*

Abstract: *In order to design and construct many of the hydraulic structures such as dams, there is a need to determine the amount of river discharge. In rivers without gauging stations, it is necessary to calculate their inflows by using the hydrological models. SWAT is one of the numerical models that are widely used for this purpose.*

For calculating the basin discharge, the model requires effective metrological data such as precipitation, temperature, wind speed, solar radiation and relative humidity on the one hand, and the data related to the basin surface such as curve number and roughness coefficient on the other hand.

In this research, Kasillian River discharge has been calculated as a case study and has been verified using data from Valikben hydrometric station, which is placed at the basin outlet. Furthermore, the impact of each input data on the calculation of water flow has also been studied.

Keywords: *SWAT, River Discharge, Precipitation, Solar Radiation, Wind Speed, Temperature*

1. Introduction

In order to construct dams, the monthly and annual inflow of rivers is an important factor in determination of the dam reservoir volume. The input water flow can be calculated by the hydrometric stations. In some regions with the lack of hydrometric stations, numerical models such as SWAT can be used in order to estimate the runoff flowing into the dam. These models perform complicated and very accurate calculations in a very short time.

2. Materials

The study area is located in the northern forests of Alborz, which includes the villages of Sangdeh, Darzikol, Soutkola, Valik Chal and Valik Ben. Kasilian basin is itself one of the sub-basins of Haraz basin and is the second basin that has been equipped by the Ministry of Energy in Iran. The area of Kasillian basin is about 66.81 square kilometers and the length of the main river is 16.8 kilometers. The basin of this river is located at the geographic coordinates of 36°-02´ to 36°-11´ of latitude and 53°-10´ to 53°-26´ of longitude. The gradients being used in this study in percent include -2, 1, 2-5, 8-12, 12-20, 30-60 and >60.

There is a hydrometric station at Valikben on the Kasillian River that has been established since 1970 with a longitude of 53°-17´ and a latitude of 36°-10´, which measures the river discharge. **Figure 1** shows the location of the Kasillian basin.

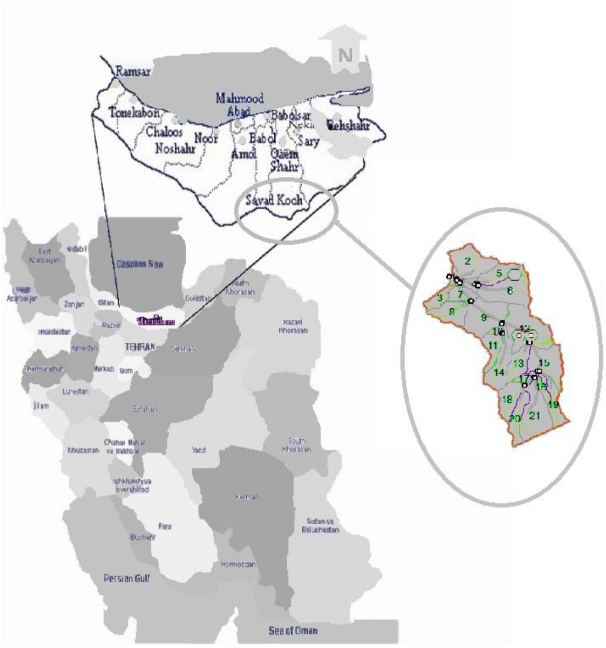

Figure1. *Position of Kasillian Basin*

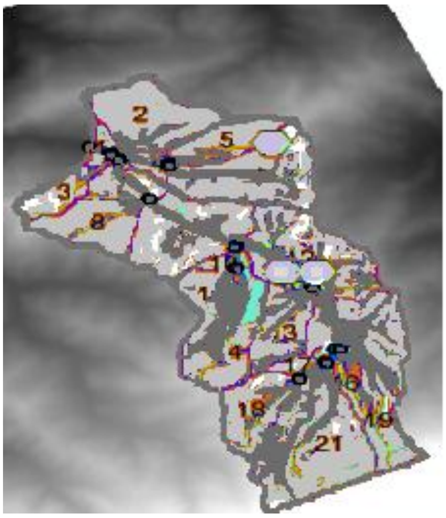

Figure2. *Digital Elevation Model for Kasilian River Basin of Savadkooh Region (Dem)*

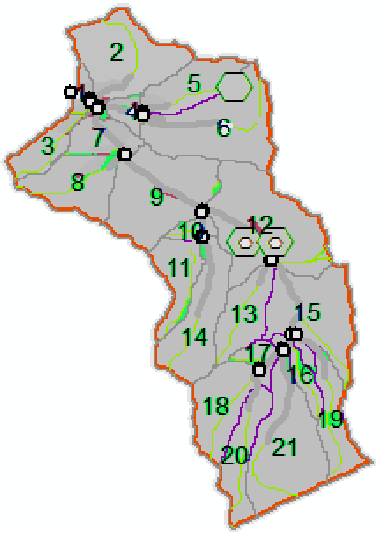

Figure3. *Land Use Map for Kasilian River Basin of Savadkooh Region (Land Use)*

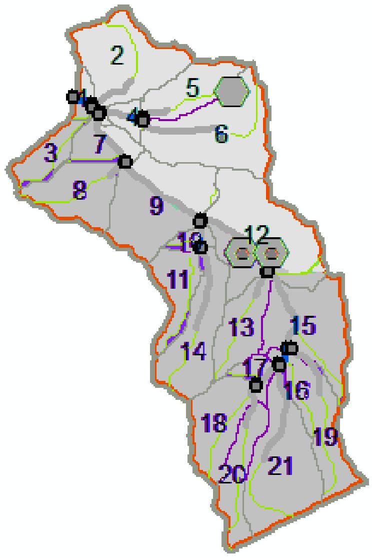

Figure4. *Map of Soil for Kasilian River Basin of Savadkooh Region (Soil)*

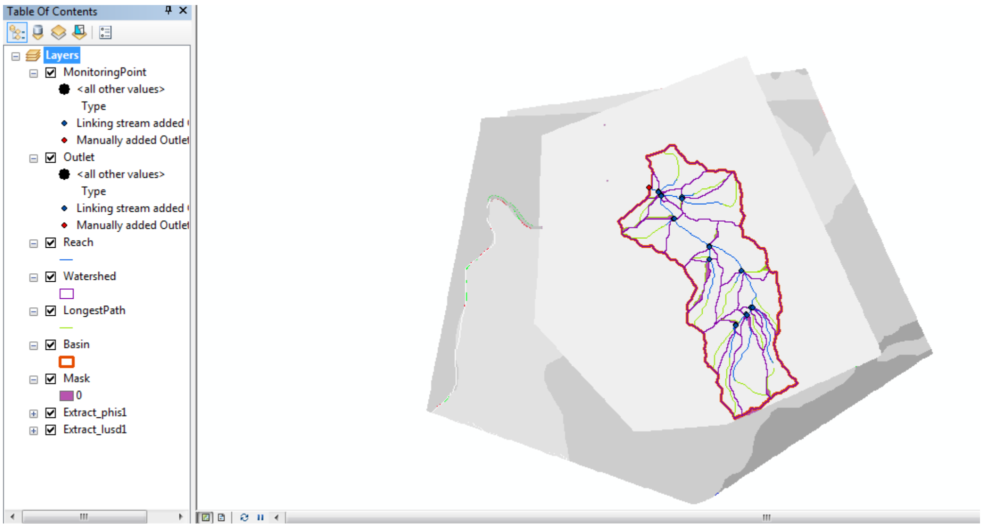

Figure5. *End of zoning the region under consideration*

In this model, the data including precipitation, temperature, solar radiation, wind speed, and relative humidity has been used in a statistical period of February 1978 to February 1989 to simulate the runoff. The mentioned statistical parameters of the Pole Sefid synoptic station data and Sangdeh and Darzikola climatology stations, Valik Chal rain gauge station and Valikben hydrometric station have been used.

2.1. An Introduction To SWAT Model

SWAT model was developed by The Agricultural Research Service (ARS), The US Department of Agriculture, (Grassland Soil and Water Research Laboratory) in Texas. This model simulates the river discharge. In order to estimate the river discharge, it is in need of climatic data such as precipitation, temperature, solar radiation, wind speed and relative humidity. This software requires at least temperature and precipitation data. The rest of the data can be simulated by the software. The necessary maps in the software include the soil, land use and Digital Elevation Model (DEM) maps. The SWAT model is performed in Arc GIS software.

Among the existing hydrologic models, the SWAT model is the most comprehensive model in simulation of the ruling processes on the basin surface. SWAT is a conceptual-distributive model, which has been initially designed for the large basins and has gradually been expanded for different purposes. The system of SWAT model has three main parameters including model inputs, model outputs and model main program.

The SWAT model includes 9 main parameters and about 22 secondary parameters, which simulates the following six hydrologic and biologic phenomena (Arnold et al, 1990).

1. Daily stream flow [discharge]
2. Daily sediment yield
3. [Monthly and Yearly] Water balance
4. Water [quality] pollution
5. Producing the agricultural product
6. Estimation of the production of pasture plant coverage through application of management of cattle grazing systems (Gholami, 1998)

For modeling objectives, one basin might be divided into many sub-basins. By dividing one basin into many sub-basins, SWAT model simulates the place details. In this model, each basin is divided into many sub-basins and each of the sub-basins into many Hydrologic Reaction Units (HRU), which are homogenous from the land use viewpoint and the soil features.

For measuring the monthly discharge in the SWAT method, there is a need to the measured monthly quantities in Synoptic, Climatology and rain gauge and hydrometric stations (such as daily rain, minimum and maximum of daily temperature, sun ray, wind speed, and relative humidity which in these cases in SWAT it is read in dbf).

2.2. Model Implementation Method

The SWAT software that specifies the river zoning and direction of the rivers and river discharge simulation has been used for the concerned project. In SWAT, there is a need to topography map and DEM map, the map of land use, the soil map and soil data for the concerned region and the data of Synoptic, Climatology and Rain gauges' stations and provision of look up table. (The necessary maps are for GIS and SWAT software and the smaller scale maps would be better. In addition, better results will be achieved for a larger number of years of data collection in Synoptic, Climatology and Rain gauges' stations).

All the three maps should have the same scale and unit so that in the SWAT software they could overlap. The metrological data should be stored in DATABASE of SWAT software (SWAT 2009. mdb). (It can be inserted into SWAT program) and data could be such as USERSOIL, WGN and … in SWAT 2009. mdb.

The followings steps should be taken:

1. Determination of the method of input data preparation into the model;
2. Modeling stages in ARCSWAT;
3. Model performance, data storage and output data.

The files of Arcsw at_documentation in Arcsw at help describe the performance methods and the files of swat-input-output.pdf and theoretical swat 2009 has been used.

The files should be in Excel form and to be inserted into part of SWAT database (swat2009.mdb). Then for the application in SWAT model, they should be used in form of dbf and txt files. The ending and beginning years of all input data into SWAT model should be equal. The quantity of rain data is in millimeter and it can be inserted in form of less than daily, monthly and annually. The data of Abali Synoptic Station has been used instead of Pole-Sefid Synoptic station, whose data is similar to the area under consideration.

These images have been cut due to the high capacity of DEM main files and land use and soil data so that they could better show the results in SWAT [1-24].

The cell-size of the map was considered as 50 in order to have all three maps in agreement with each other.

The type of land use and their numbers in the map should be noted down for connection to the SWAT. We considered two types of land use in the concerned basin including:

1. FRSD
2. FRSE

In addition, the type of soil and their numbers in the map should be noted down for connection to the SWAT.

Soil data should be taken by Soil Lab in the region and with regard to the type of soil in the map to be connected to it. Then, the soil data from the Soil Lab should be connected to the type of soil in the map. As soil data was not available, the world map of soil data was used.

The data related to Synoptic station was inserted. Because of the similarity in weather conditions in Abali and Pole-Sefid Synoptic Stations, and due to the fact that the Pole-Sefid data was not available, so Abali data was inserted for Pole-Sefid.

In addition, the daily rain data of two Climatology stations and two Rain gauge stations and the daily maximum and minimum temperature of SWAT of the two climatology stations (with the conversion into dbf or txt files) from 1979 to 1989 (11 years) was inserted and finally, the latitude and longitude of the concerned locations was inserted.

Then, the soil and land use and Synoptic map data should be connected to the map.

Using SWAT 2009 INPUT-OUTPUT file, land use data was connected to SWAT. Then, Synoptic data was inserted (it should be in agreement with the geographic legends of the land use, soil and DEM maps). The concerned files should be converted into dbf for conversion into SWAT.

For drainage gradient of the basin, the SCS method was used which divides the gradients into 5 classes (Table 4).

Table1. *Sample of Soil General Data*

OBJECTID	MUID	SEQN	SNAM	S5ID	CMPPCT	NLAYERS	HYDGRP	SOIL_ZMX	ANION_EXCEL	SOL_CRK	TEXTURE
203			Soil_1			2	C	1000	0.5	0.5	LOAM
204			Soil_2			2	C	1000	0.5	0.5	LOAM

Table2. *Sample of Data related to each of the Soil Horizons*

SOL_Z1	SOL_BD1	SOL_AWC1	SOL_K1	SOL_CBN1	CLAY1	SILT1	SAND1	ROCK1	SOL_ALB1	USLE_K1	SOL_EC1
300	1.3	0.175	9.23	1.7	21	49	30	0	0.0184	0.3108	0
300	1.3	0.175	9.23	1.7	21	49	30	0	0.0184	0.3108	0

The data which are surely needed includes the followings:

Number of layers= (NLAYERS)

Soil hydrologic groups (using infiltration and use) =HYDGRP

Soil depth related to all existing horizons(millimeter) (SOL_ZM)

Soil Texture=Texture

Note: The following data should be provided for all existing horizons in the basin soil units:

Thickness of Horizon 1 in millimeter=SOL_Z1

Soil Volume Density in Horizon 1(gram per cubic centimeter)

Water Accessible Capacity in Horizon 1 (mm) =SOL_AWC1

Saturation Electrical Conductivity in Horizon 1 (mm per hour) =SOL_K1

Organic Materials in Horizon 1 (%) =SOL_CBN1

Clay in Horizon 1(%) : CLAY 1

Silt in Horizon 1(%) =SILT1

SAND1=Sand in Horizon 1(%)

Table3. *Data related to Sputnik station and land use and soil*

ID	NAME	LAT	LONG	ELEVATION
1	POLSEFID	36.05	53.10	1350

VALUE	LANDUSE	LANDUSE
19	mix(bagh_lowforest)	FRSD
24	denseforest	FRSE

VALUE	NAME
13	SOIL_1
24	SOIL_2

Table4. *Gradient classification in SCS suggested method*

Gradient in percent	Gradient class
5-0	1
10-5	2
20-10	3
40-20	4
>40	5

Soil and land use data and gradient in HRU should be in agreement with each other. The data related to Synoptic station, temperature and rain was inserted in the write input table in the weather station section. Rain and temperature data are inserted on a daily basis. In the sub-basin data part, all the changes related to sub-basins can be applied and other changes related to SWAT can be applied in SWAT input edit part. In the last part, SWAT simulation can be performed upon the software data being completed and saved. All the saved data can be found in Table shoot at the SWAT output section.

2.3. The Effect of Soil Type

In this research, the optimum curve number and over land roughness coefficient of the basin surface has been studied. Out of the required metrological parameters, only precipitation data has been used first to obtain the optimum curve number and roughness coefficient of the flow in the basin. In the beginning, SWAT model was ran considering a curve number of CN2= 67 and an over land roughness coefficient of OV_N=0.1. The results can be seen in Figure 6.

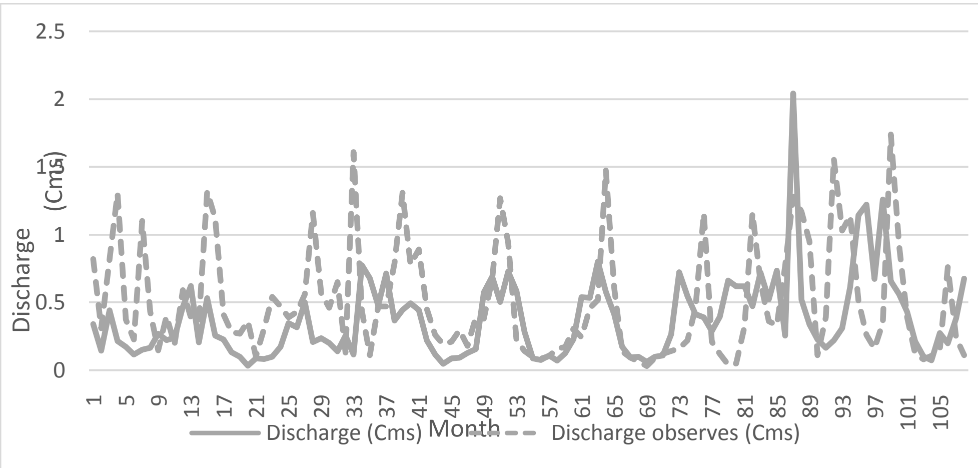

Figure6. *Simulated average discharge of SWAT model and average discharge being observed in Kasillian basin*

In order to optimize the parameters, different curve numbers (CN) and over land roughness coefficients have been used. The discharge equations using these parameters are shown in Tables 5 and 6, and Figs. 7 to 10. In a comparison to the recorded discharges in the gauging station and the calculated discharge, an optimum curve number of 67 and an over land roughness coefficient of 0.1

was obtained for the basin. Then, considering the two mentioned values, other input parameters of SWAT model in river discharge simulations were studied. The effect of metrological parameters on river discharge simulation in SWAT model was investigated separately or together and the results were compared to the observed discharges. It is worth noting that at this stage of calculations, only the precipitation data has been used as the model input data [25-56].

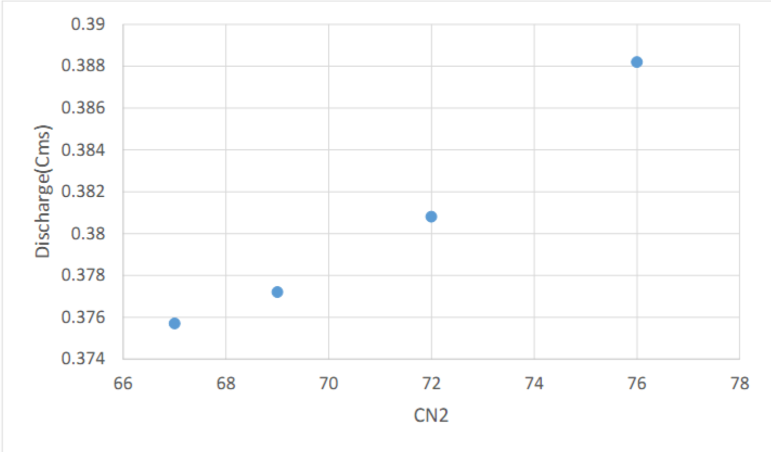

Figure7. *Changes of curve number as compared with the simulated discharge*

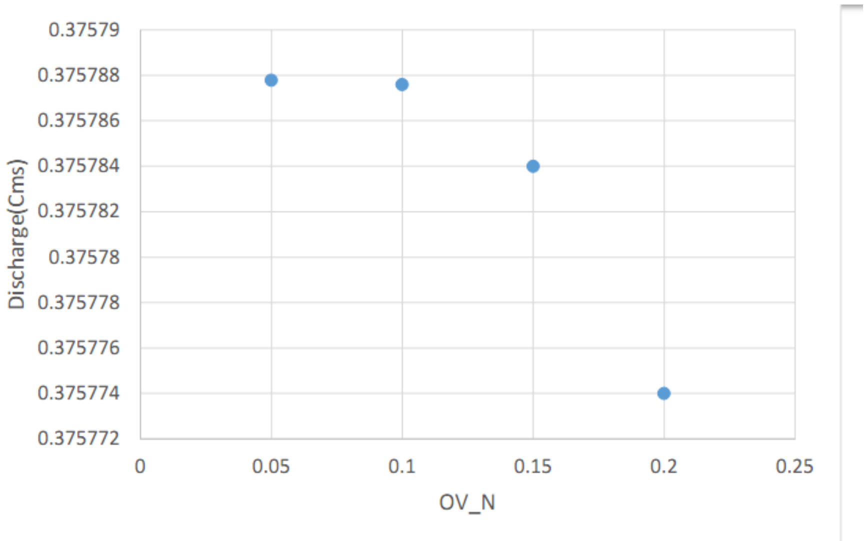

Figure8. *Changes of roughness coefficient as compared with the simulated discharge*

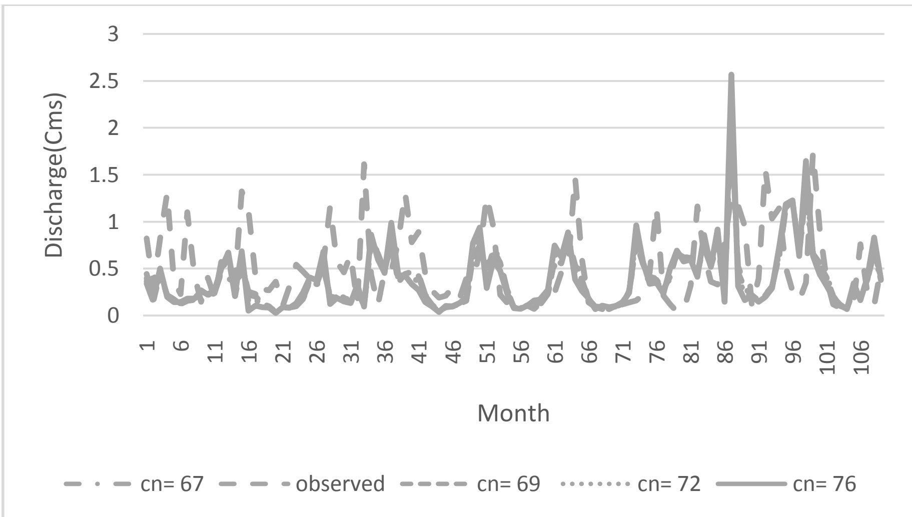

Figure9. *River discharge average from different curve number as compared with the observed discharge*

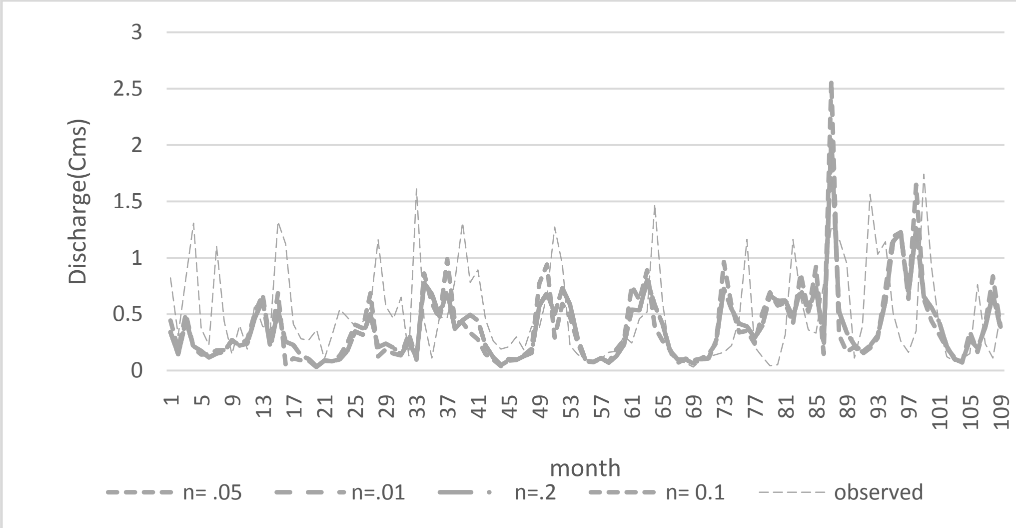

Figure10. *River discharge average with different basin over land roughness coefficient as compared with the observed discharge*

Table5. *The study of the impact of curve number on the calculated discharge average*

Curve Number	67	69	72	**76**
Simulated discharge average (m3/s)	0.475787	0.477227	0.38084	0.388203
Observed discharge average (m3/s)	0.4989532	0.4989532	0.4989532	**0.4989532**
Calculations errors (m3/s)	0.123166	0.121726	0.118113	**0.11075**

Table6. *The study of the impact of roughness coefficient on the calculated discharge average*

Basin Over land roughness coefficient	0.05	0.1	0.15	0.2
Simulated discharge average (m3/s)	0.375787	0.375787	0.375784	0.375774
Observed discharge average (m3/s)	0.498953	0.498953	0.498953	0.498953
Difference between the observed and simulated discharge average (cubic meter per second)	0.123166	0.123166	0.123169	**0.123179**

2.4. Running the Model Considering Other Metrological Parameters

At this stage, in addition to precipitation data, other metrological parameters including temperature, relative humidity, wind speed and solar radiations have been entered to SWAT model and an average discharge of 0.5704 m^3/s has been obtained, as can be seen in the first row of Table 7. As can be seen from the Table 7, the recorded discharge in the gauging station in the modeling period (February 1998 to February 1989) has been 0.4989 m^3/s and the calculation error was 0.0714 m^3/s corresponding to 14.32%.

Table7. *The observed and simulated monthly discharge average changes in the application of SWAT model with each of the input data*

Row	Input data	Simulated discharge	Observed discharge	Difference of observed and	Error Percentage

		average (cubic meter per second)	average (cubic meter per second)	simulated discharge average (Cubic meter per second)	
1	(Prc., Temp.,Rad.,Win.,RH)	0.5704225	0.498953704	0.071468796	14.32
2	(Pre. , Temp, Win, RH)	0.588334	0.498953704	0.089271	17.89
3	(Pre. Temp, Rad., Win)	0.293554	0.498953704	-0.205399	41.16
4	(Pre., Temp.,RH, Rad)	0.569122407	0.498953704	0.070168703	14.06
5	(Pre., Rad., Win., RH)	0.722399	0.498953704	0.447829	89.75
6	(Temp, Rad, Win, RH)	0.086537	0.498953704	-0.412416	82.65
7	(Temp, Rad, RH)	0.090831	0.498953704	-0.182043	36.48
8	(Temp, Rad, Win)	0.0254080	0.498953704	-0.473545	94.9
9	(RH, Rad, Win)	0.149367	0.498953704	-0.349586	70.6
10	(Prc., Temp, Win.,)	0.298773889	0.498953704	-0.200179815	40
11	(Pre., Temp., RH)	0.582392315	0.498953704	0.083438611	16.72
12	(Prc, Temp, Rad)	0.296394444	0.498953704	-0.20255926	41
13	(Prc, Temp)	0.300483333	0.498953704	-0.198470371	39
14	(Prc. , RH)	0.666655	0.498953704	0.167702	33.61
15	(Rad, RH)	0.154092	0.498953704	-0.344861	69.12
16	(Rad.,Win)	0.04151318	0.498953704	-0.457439	91.68
17	(Pre.)	0.388740926	0.498953704	-0.110212778	22.08
18	(Temp.)	0.121320904	0.498953704	-0.3776328	75.68
19	(Rad.)	0.044181033	0.498953704	-0.4547719	91.14
20	(Win)	0.251754	0.498953704	-0.247199	49.54
21	(RH)	0.482683	0.498953704	-0.01627	3.26

In order to study the effects of all the necessary metrological parameters on the calculated discharge in SWAT model, every input parameter to the model was removed. Model results are presented in other rows of Table 7. For example, row 2 of Table 7 shows that when the solar radiation data was not inserted into the model, the average calculated discharge was 0.588 and the calculation error increased to 17.89 percent. The third row of this table shows that when the relative humidity data was not inserted, the average of mean discharge of the period decreased and the calculation error was 41.16 percent. The fifth row shows that when the temperature data was not inserted to the model, discharge significantly increased and the error was 89.75 percent compared with the calculated value [57-98].

The sixth row shows that when the precipitation data was not inserted, the average of mean discharge of the period decreased and the error was 82.65 percent. The seventh row shows that when the precipitation and wind speed data was not inserted to the model, the average of mean discharge of the period decreased and the error was 36.48 percent.

The eighth row shows that when the precipitation and relative humidity data was not inserted, the average of mean discharge of the period decreased and the error was 94.4 percent. The ninth row shows that when the precipitation and temperature data was not inserted, the average of mean discharge of the period decreased and the error was 70.06 percent. In the eleventh row, by omission of the solar radiation and wind speed data, the average calculated discharge showed an error of 16.72 percent [99-115].

In the twelfth row, by omission of the relative humidity and wind speed data, the average of mean discharge decreased and the error was being 41 percent.

The thirteenth row shows that by inserting the precipitation and temperature data, the average of mean discharge of the period decreased and the error was 39 percent.

In the fourteenth row, by omission of the temperature, solar radiation and wind speed data, the average of mean discharge of the period increased and the error was 33.61 percent.

In the fifteenth row, by the omission of the temperature, relative humidity and wind speed data, the average of mean discharge of the period decreased and the error was 13.28 percent.

In the eighteenth row, by inserting the temperature and solar radiation input data, the average of mean discharge of the period decreased with an error of 94.8 percent.

In the twentieth row, by inserting the temperature and solar radiation input data, the average of mean discharge of the period decreased with an error of 4.66 percent.

In the twenty-third row, by inserting the precipitation data, the average of mean discharge decreased with an error of 22.08 percent.

In the twenty-fourth row, by inserting the temperature data, the average of mean discharge of the period decreased with an error of 75.68 percent.

In the twenty-seventh row, by inserting the relative humidity input data, the average of mean discharge of the period decreased with an error of 3.26 percent. The negative and positive values of the column before the last column show the decreased and increased simulated values of the discharge in comparison to the observed discharge values, respectively.

In Figure 11, the values of average monthly discharge that were calculated at eight different conditions of Table 7 are compared with the recorded discharge values in the gauging station. Figs. 12 and 13 show the plot of the calculated and recorded discharge values in the first to seventeenth rows of Table 7 [116-123].

3. Results

1. With an increase of 13.43 percent in the curve number, the simulated value of the average monthly discharge got 2.52 percent closer to the observed average discharge value.
2. With an increase of 0.15 in the over land roughness coefficient of the basin, the simulated discharge got 0.01 percent closer to the observed discharge.
3. According to Figs. 12 and 13, the precipitation, temperature and relative humidity data have a greater impact on the calculated discharges compared with the solar radiation and wind speed data.
4. Using all the metrological parameters, the average of mean discharge of the period increased with an error of 14.32 percent.
5. Figs. 12 and 13 show the effect of inserting the relative humidity input data on the average of mean discharge compared with other parameters (separately). By applying the (RH) and (Win, RH) parameters, the simulated average discharge by the model got closer to the observed value.
6. Figs. 12 and 13 show the effect of inserting the temperature input data on a decrease in the average of mean discharge.
7. With insertion of the temperature, rain, relative humidity, solar radiation and wind speed input data, the average of the observed monthly discharge decreased by 16 percent in comparison to the simulated average monthly discharge.
8. With insertion of the temperature and rain input data, the average of the observed monthly discharge increased by 38 percent in comparison to the simulated average monthly discharge.
9. With insertion of the temperature, rain and wind speed input data, the average of the observed monthly discharge increased by 40 percent in comparison to the simulated average monthly discharge.
10. With insertion of the temperature, rain, relative humidity and solar radiation input data, the average of the observed monthly discharge decreased by 14 percent in comparison to the simulated average monthly discharge.
11. With insertion of the temperature, rain, and relative humidity input data, the average of the observed monthly discharge decreased by 18 percent in comparison to the simulated average monthly discharge.
12. With insertion of the temperature, rain and solar radiation input data, the average of the observed monthly discharge increased by 40 percent in comparison to the simulated average monthly discharge.
13. With insertion of the temperature input data, the average of the observed monthly discharge increased by 75 percent in comparison to the simulated average monthly discharge.
14. With insertion of the rain input data, the average of the observed monthly discharge increased by 22 percent in comparison to the simulated average monthly discharge.
15. SWAT software presented an almost suitable results in the estimation of the average monthly discharge with regard to the input data of rain, temperature and other necessary data.

4. DISCUSSION

In 2012, Bastani Allah Abadi evaluated the SWAT2009 model in Kordan River and achieved acceptable results by river simulation and understanding the basin using SWAT model.

In 2003, Gholami used the SWAT model to simulate the monthly average discharge of Emameh basin, one of the Sub-basins of Jajerood River. The results showed that the model has a high sensitivity to the roughness of the land surface.

In 1933, Babaei and Sohrabi evaluated the SWAT model in calculation of Zayandehrood basin flow (1), (6). Omani et al. (1931) used the SWAT model for

simulation of the river flow in Qareh Sar sub-basin in the North-West of Karkheh River and showed a higher sensitivity analysis for the curve number parameter [1-7].

In 2005, Lin et al. calibrated the SWAT model for Atrova river basin in Kaneon with an area of 1680 square kilometers. The calibration results of the daily and monthly flows were satisfactory. The results showed that the model has a good performance in flow prediction.

In 1996, Binger simulated the runoff rate by the SWAT model in a basin in the north of Mississippi for 10 years. The SWAT model indicated acceptable results in simulation of daily and yearly runoff from some sub-basins with the exception of one sub-basin full of affluent trees.

In 2002, Khalil Ahmad et al. employed SWAT model in a research site near Nashra, which the results showed that the model has a high potential to forecast the undersurface flows under different climatic conditions, slant and soil.

In 2003, Van Lou and Garberch estimated the runoff under change of weather conditions for three sub-basins in experimental watershed of Little Vashina River in the south-west of Oklahoma by SWAT model. The results showed that SWAT can forecast the rate of runoff in dry, mean and humid conditions sufficiently.

In 2016, Ye Tuo et al. tested the same model. The outcome of the study cleared that precipitation is the main source of uncertainly and different precipitation datasets in SWAT models lead to the best different estimable ranges for the calibrated parameters.

In 2016, Sun Sook et al. used SWAT in Haean highland agricultural catchment (62.8 Km^2) which was the best area to test uplands above 600 m of elevation and it happened by using SWAT (soil and Water Assessment Tool). The result showed the RSM BMP indicating the sediment reduction of 3.0% for 6.0% runoff reduction up to 14.1% for 17.0% runoff reduction and T-P reduction of 1.3% for 6.0% runoff reduction up to 6.8% for 17% runoff reduction along with negative effect of total nitrogen (T-N) up to -3.7% for 12% runoff reduction.

The main focus of Bingqing Lin et al. (2015) using SWAT was on the Runoff responses to land use change with daily measurement. Jinjiang, as a natural area for collecting rainwater in southeast China with a humid sub-tropical climate, was used for simulations. Three stations lead to the reproduction of annual, monthly and daily runoff processes over nine years (2002-2010) and the result was satisfying.

Simly Dam watershed in Saon basin in the north-east of Islamabad was another place SWAT was applied for the Hydrology by Shimaa, M. Ghoraba in 2015. The model was calibrated from 1990 to 2001 and evaluated from 2002 to 2011. The aim of whole process was to simulate the stream flow. The evaluation resulted in a good performance for both calibration and validation periods between measured and simulated values of both annual and monthly scale discharge.

The Xedone River basin in an area of 7,224,61 km^2 in the southern part of Laos was evaluated by Bounhieng Vilaysane et al. who used SWAT model to predict stream flow in the river basin. The model was tested for two periods of 1993-2000 and 2001-2008 and the result was satisfactory both in monthly and daily phases of simulation and also in measured calibration and validation [124-193].

5. CONCLUSIONS

Application of SWAT model, its accuracy and scaling of Hydrological stream flow modeling in the Kasillian River was prospering and the results of the time period between February 1978 and February 1989 fulfills the accuracy and scaling expectancy. The SWAT modeling indicates signs of success in simulation for a period of one month and it would be applicable in the basin while shows capability of investigating climate and land changes. Moreover, projecting for probable dam construction and flood in future and managing them is possible by this model. Such management will not be separated from managing water resource in Kasillian River. Therefore, the SWAT model will be effective in the sustainable development of the country.

REFERENCES

[1] Ostad-Ali-Askari, K., Shayannejad, M. 2015, Study of sensitivity of Autumnal wheat to under irrigation in Shahrekord, Shahrekord City, Iran. International Journal of Agriculture and Crop Sciences, 8 (4), 602-605.

[2] Shayannejad, M., Akbari, N., Ostad-Ali-Askari, K. 2015, Study of modifications of the river physical specifications on muskingum coefficients, through employment of genetic algorithm. International Journal of Development Research, 5(3), 3782-3785.

[3] Ostad-Ali-Askari, K., Shayannejad, M. 2015, The Reviews of Einstein's Equation of Logarithmic Distribution Platform and the Process of Changes in the Speed Range of the Karkheh River, Khuzestan province, Iran. International Journal of Development Research, 5(3), 3786-3790.

[4] Ostad-Ali-Askari, K., Shayannejad, M., Ghorbanizadee-Kharazi, H. 2015, Assessment of artificial neural network performance and exponential regression in prediction of effective rainfall, International Journal of Development Research, 5(3),3791-3794.

[5] Shayannejad, M. Akbari, N. and Ostad-Ali-Askari, K. 2015, Determination of the nonlinear Muskingum model coefficients using genetic algorithm and numerical solution of the continuity. Int. J. of Science: Basic and Applied Research, 21(1),1-14.

[6] Ostad-Ali-Askari, K., Shayannejad, M. 2015, The Study of Mixture Design for Foam Bitumen and the Polymeric and Oil Materials Function in Loose Soils Consolidation. Journal of Civil Engineering Research, 5(2), 39-44. DOI: 10.5923/j.jce.20150502.04

[7] Sayedipour, M., Ostad-Ali-Askari, K., Shayannejad, M. 2015, Recovery of Run off of the Sewage Refinery, a Factor for Balancing the Isfahan-Borkhar Plain Water Table in Drought Crisis Situation in Isfahan Province-Iran. American Journal of Environmental Engineering, 5(2): 43-46. DOI: 10.5923/j.ajee.20150502.02

[8] Ostad-Ali-Askari, K., Shayannejad, M. 2015, Developing an Optimal Design Model of Furrow Irrigation Based on the Minimum Cost and Maximum Irrigation Efficiency. International Bulletin of Water Resources & Development, 3(2), 18-23.

[9] Ostad-Ali-Askari, K., Shayannejad, M. 2015, Presenting a Mathematical Model for Estimating the Deep Percolation Due to Irrigation. International Journal of Hydraulic Engineering, 4(1), 17-21. DOI: 10.5923/j.ijhe.20150401.03.

[10] Ostad-Ali-Askari, K., Shayannejad, M. 2015, Usage of rockfill dams in the HEC-RAS software for the purpose of controlling floods. American Journal of Fluid Dynamics, 5(1), 23-29. DOI: 10.5923/j.ajfd.20150501.03.

[11] Ostad-Ali- Askari, K., Shayannejad, M. 2015, The effect of heterogeneity due to inappropriate tillage on water advance and recession in furrow irrigation. Journal of Agricultural Science, 7(6), 127-136.

[12] Shayannejad, M., Ostad-Ali-Askari, K. 2015, Effects of magnetized municipal effluent on some chemical properties of soil in furrow irrigation. International Journal of Agriculture and Crop Sciences, 8(3), 482-489.

[13] Ostad-Ali-Askari, K., Shayannejad, M. 2015, Optimal design of pressurized irrigation laterals installed on sloping land. International Journal of Agriculture and Crop Sciences, ISSN 2227-670X. 8(5), 792-797.

[14] Ostad-Ali-Askari K, Shayannejad M, Eslamian S, Navab-Pour B. 2016, Comparison of solution of Saint-Venant equations by characteristics and finite difference methods for unsteady flow analyzing in open channel. International Journal of Hydrology Science and Technology, 6(3), 9-18.

[15] Ostad-Ali-Askari K, Shayannejad M, Eslamian S, et al. 2017, Deficit Irrigation: Optimization Models. Management of Drought and Water Scarcity. Handbook of Drought and Water Scarcity, Taylor & Francis Publisher, USA. Vol. 3. 1th Edition, pp: 373-389.

[16] Shayannejad M, Ostad-Ali-Askari K, Eslamian S, et al. 2017, Development of a new method for determination of infiltration coefficients in furrow irrigation with natural non-uniformity of slope. Sustain. Water Resour. Manag., 3(2): 163-169.

[17] Shojaei N, Shafaei-Bejestan M, Eslamian S, Marani-Barzani M, P. Singh V, Kazemi M, Ostad-Ali-Askari K. 2017, Assessment of Drainage Slope on the Manning Coarseness Coefficient in Mountain Area. International Journal of Constructive Research in Civil Engineering (IJCRCE), 3(1): 33-40.

[18] Bahmanpour H, Awhadi S, Enjili J, Eslamian S, Ostad-Ali-Askari K. 2017, Optimizing Absorbent Bentonite and Evaluation of Contaminants Removal from Petrochemical Industries Wastewater. International Journal of Constructive Research in Civil Engineering (IJCRCE), 3(2): 34-42.

[19] Shayannejad M, Eslamian S, Gandomkar A, Marani-Barzani M, Amoushahi-Khouzani M, Majidifar Z, Rajaei-Rizi F, Kazemi M, P. Singh V, Dehghan SH, Shirvani-Dastgerdi H.R, Norouzi H, Ostad-Ali-Askari K. 2017, A Proper Way to Install Trapezoidal Flumes for Measurements in Furrow Irrigation Systems. International Journal of Research Studies in Agricultural Sciences (IJRSAS), 3(7): 1-5.

[20] Dehghan Sh, Kamaneh S.A.A., Eslamian S, Gandomkar A, Marani-Barzani M, Amoushahi-Khouzani M, Singh V.P., Ostad-Ali-Askari K. 2017, Changes in Temperature and Precipitation with the Analysis of Geomorphic Basin Chaos in Shiraz, Iran. International Journal of Constructive Research in Civil Engineering (IJCRCE), 3(2): 50-57.

[21] Eslamian S, Mirabbasi-Najafabadi R, Ostad-Ali-Askari K. Advance Engineering Statistics (Simulation and Modeling of Uncertainty and Sensitivity Analysis). Kankash Publisher. First Edition, 2017. ISBN: 978-60 0-136-359-7. Isfahan, Iran.

[22] Ostad-Ali-Askari K, Shayannejad M. 2016, FLOOD ROUTING IN RIVERS BY MUSKINGUM'S METHOD WITH NEW ADJUSTED COEFFICIENTS. International Water Technology Journal, IWTJ, 6(3): 189-194.

[23] Ostad-Ali-Askari K, Eslamian S, Shayannejad M, et al. Groundwater Hydrodynamic. Horoufchin Publisher. First Edition, 2016. ISBN: 978-600-7419-53-3. Isfahan, Iran.

[24] Ostad-Ali-Askari K, Shayannejad M, Ghorbanizadeh-Kharazi H. 2017, Artificial Neural Network for Modeling Nitrate Pollution of Groundwater in Marginal Area of Zayandeh-rood River, Isfahan, Iran. KSCE Journal of Civil Engineering, 21(1):134-140. Korean Society of Civil Engineers. DOI 10.1007/ s1 2205-016-0572-8.

[25] Shayannejad M, Ostad-Ali-Askari K, Ramesh A, Singh V.P., Eslamian S. 2017, Wastewater and Magnetized Wastewater Effects on Soil Erosion in Furrow Irrigation. International Journal of Research Studies in Agricultural Sciences (IJRSAS), 3(8): 1-14. http://dx.doi.org/10.20431/2454-6224.0308001.

[26] Shayannejad M, Soltani-Toudeshki A.R, Arab M.A, Eslamian S, Amoushahi-Khouzani M, Marani-Barzani M, Ostad-Ali-Askari K. 2017, A Simple Method for Land Grading Computations and its Comparison with Genetic Algorithm (GA) Method. International Journal of Research Studies in Agricultural Sciences (IJRSAS), 3(8): 26-38.

[27] Mohieyimen P, Eslamian S, Ostad-Ali-Askari K, Soltani M. 2017, Climate Variability: Integration of Renewable Energy into Present and Future Energy Systems in Designing Residential Buildings. International journal of Rural Development, Environment and Health Research(IJREH), 1(2): 18-30.

[28] Shayannejad M, Ostad-Ali-Askari K, Eslamian S, et al. 2017, Flow Hydraulic Investigation of the Wastewater on the Soil and Magnetic Field Effects in This Field. International Journal of Constructive Research in Civil Engineering (IJCRCE), 3(3): 1-15.

[29] Shayannejad M, Eslamian S, Singh V.P., Ostad-Ali-Askari K, et al. 2017, Evaluation of Groundwater Quality for Industrial Using GIS in Mountainous Region of Isfahan Province, Koh-Payeh, Isfahan, Iran. International Journal of Constructive Research in Civil Engineering (IJCRCE), 3(3): 24-37.

[30] Eslamian S, P. Singh V, Ostad-Ali-Askari K, R. Dalezios N, Yihdego Y, et al. 2017, Assessment of Aridity Using Geographical Information System in Zayandeh-Roud Basin, Isfahan, Iran. International Journal of Mining Science (IJMS), 3(2): 49-61.

[31] Askari Z, Samadi-Boroujeni H, Fattahi-Nafchi R, Yousefi N, Eslamian S, Ostad-Ali-Askari K, P. Singh V, R. Dalezios N. 2017, Prediction Comparison of Flow Resistance in Channels with Rounded and Angular Coarse Rough Beds. American Research Journal of Civil And Structural, 3(1): 1-15.

[32] Ghane M, Alvankar S.R., Eslamian S, Amoushahi-Khouzani M, Gandomkar A, Zamani E, Marani-Barzani M, Kazemi M, Soltani M, Dehghan SH, P. Singh V, Ostad-Ali-Askari K, HaeriHamedani M, Shirvani-Dastgerdi H.R., Zalaki-Badil N. 2017, Sensitivity Analysis of Runoff Model by SWAT to Meteorological Parameters: A Case Study of Kasillian Watershed, Mazandaran, Iran. International Journal of Research Studies in Agricultural Sciences (IJRSAS), 3(10): 1-20.

[33] Shayannejad M, Abedi M.S., Eslamian S, Ostad-Ali Askari K, Gandomkar A, Cheng A, et al. 2017, The Contribution of Artificial Charging in Optimal Exploitation of Water Resources, Isfahan, Iran. InternationalJournal of Mining Science (IJMS), 3(3): 9-20.

[34] Eslamian S, Ostad-Ali Askari K, et al. 2017, Guidelines to Optimal Design of Furrow Irrigation Based on Plants, Soil and Furrow Specifications. International Journal of Constructive Research in Civil Engineering (IJCRCE), 3(4): 20-39.

[35] Galoie, M., Eslamian, S., and A. Motamedi, 2014, An Investigation of the Influence of a Retention Dam on Flood Control In a Small Catchment Area in Austria, Journal of Flood Engineering, Vol. 5, No. 1/2, 1–15.

[36] Hadizadeh, R., Eslamian, S. and Chinipardaz, R., 2013, Investigation of long-memory properties in streamflow time series in Gamasiab River, Iran', Int. J. Hydrology Science and Technology, Vol. 3, No. 4, 319–350.

[37] Amiri, M. J. and S. S. Eslamian, 2010, Investigation of climate change in Iran, Journal of Environmental Science and Technology, Vol. 3, No. 4, 208-216.

[38] Eslamian, S. S., M. Naderi-beni, M. M. Kohansal, S. Pouriamehr, and A. Nasri, 2014, Investigation of temperature and precipitation changes in Isfahan stations using parametric and nonparametric tests, The 4th International Conference on Environmental Challenges and Dendrochronologoy, Sari, Iran.

[39] Bazrkar, M. H., Zamani, N., Eslamian, S. S., 2014, Investigation of Landuse Impacts on Sediment Yield using a SWAT (Case Study: Chamgodalan Reservoir Watershed, Iran), Proceeding of 3rd ScienceOne International Conference on Environmental Sciences, UAE.

[40] Eslamian, S. S. and S. A. Gohari, 2006, Investigation of Flooding Process in South-Esfahan Basin, International Congress of Islamic World Geographers, Esfahan University, Isfahan.

[41] Eslamian, S. S., Ghoudarzi, A. and R. Nazari, 2006, Investigation of the Changes of Permeability, Physical and Chemical Characteristics of Sediment Basins for Artificial Recharge In Bagh-E-Sorkh Region, Shahreza, Isfahan, 22nd Annual International Conference on Soils, Sediments and Water, University of Massachusetts at Amherst, USA.

[42] Abedi-Koupai, J., Ghaheri, E., Eslamian, S.S. and Hosseini, H., 2013, Investigation the Kinetic Models of Biological Removal of Petroleum Contaminated Soil around Oil Pipeline Using Ryegrass, Water and Wastewater, Vol. 89, No. 1, 62-68.

[43] Ghasemi, A., Eslamian, S. S. and S. M. J. Nazemosadat, 2007, Impact of wind cooling on human comfortability in various regions of Iran, Journal of Research and Investigation of Literature and humanitarian Sciences Faculty, Vol. 24, No. 3, 13-26.

[44] Nasri, M., Najafi, A., Modarres, R. and S. S. Eslamian, 2007, Flood Regional Modelling in south-western Ardestan watershed, Journal of Research and Investigation of Literature and Humanitarian Sciences Faculty, Vol. 27, No. 6, 17-32.

[45] Godarzi, A, S. S. Eslamian and J. Abedi-Koupai, 2004, Investigation of Infiltration changes and physical and chemical characteristics of sediments in Bagh-e-sorkh Shahreza flood spreading strips, Journal of Research in Agricultural Sciences, Vol. 3, No. 1, 33-43.

[46] Nosrati, K., S. S. Eslamian and A. Shahbazi, 2004, Investigation of climate change effect on hydrologic drought, Journal of Agriculture, Vol. 6, No. 1, 49-56.

[47] Yousefi, N., Khodashenas, S. R., Eslamian, S. and Askari, Z. 2016. Estimating width of the stable channels using multivariable mathematical models, Arab. J. Geosci., Vol. 9, No. 321, DOI 10.1007 /s12 51 7-016-2322-0.

[48] Banihabib, M. E., Zahraei, A. and Eslamian, S., 2016. Dynamic Programming Model for the System of a Non- Uniform Deficit Irrigation and a Reservoir. Irrigation and Drainage, Vol. 66, No. 1, 71–81

[49] Zalewski, M., McClain, M. and Eslamian, S., 2016. New challenges and dimensions of Ecohydrology–enhancement of catchments sustainability potential, Ecohydrology and Hydrobiology, 16, 1–3

[50] Zalewski, M., McClain, M. and Eslamian, S., 2016. Ecohydrology–the background for the integrative sustainability science, Ecohydrology and Hydrobiology, No. 16, 71–73.

[51] Kouhestani, S., Eslamian, S.S., Abedi-Koupai, J. and Besalatpour, A.A., 2016. Projection of climate change impacts on precipitation using soft-computing techniques: A case study in Zayandeh-rud Basin, Iran. Global and Planetary Change, No. 144, 158–170.

[52] Teimouri, A., Eslamian, S. and Shabankare, A. 2016. Removal of Heavy Metals from Aqueous Solution by Red Alga Gracilaria Corticata as a New Biosorbent, Trends in Life Science, Vol. 5, No. 1, 236-243.

[53] Amiri, M.J., Hamidifar, H., Bahrami, M. and Eslamian, S. (2016) 'Optimisation of deficit-irrigation under variable seasonal rainfall and planning scenarios for rice in a semi-arid region of Iran', International Journal of Hydrology Science and Technology, Vol. 6, No. 4, 331–343.

[54] Salarijazi, M., Abdolhosseini, M., Ghorbani, K. and Eslamian, S. 2016, Evaluation of quasi-maximum likelihood and smearing estimator to improve sediment rating curve estimation', International Journal of Hydrology Science and Technology, Vol. 6, No. 4, 359–370.

[55] Amiri, M.J., Bahrami, M., Hamidifar, H. and Eslamian, S., 2016. Modification of furrow Manning's roughness coefficient estimation by finite difference technique under surge and continuous flow. International Journal of Hydrology Science and Technology, Vol. 6, No. 3, 226-237.

[56] Zahraei, A., Eslamian, S. and Saadati, S., 2016. The effect of water extraction time from the river on the performance of off-stream reservoirs. International Journal of Hydrology Science and Technology, 6(3): 254-265.

[57] Zareian, M. J. and Eslamian, S., 2016, Variation of water resources indices in a changing climate, International Journal of Hydrology Science and Technology, Vol. 6, No. 2, 173 – 187.

[58] Fathian, F., Dehghan, Z.., Eslamian, S., Adamowski, J., 2016, Assessing Irrigation Network Performance Based on Different Climate Change and Water Supply Scenarios: A Case Study in Northern Iran, International Journal of Water, Accepted.

[59] Fathian, F., Dehghan, Z.., Eslamian, S., 2016, Evaluating the impact of changes in land cover and climate variability on streamflow trends (case study: eastern subbasins of Lake Urmia, Iran), J. Hydrology Science and Technology, Vol. 6, No. 1, 1-26.

[60] Dalezios, N. R. and Eslamian, S, 2016, Regional design storm of Greece within the flood risk management framework, Int. J. Hydrology Science and Technology, Vol. 6, No. 1, 82–102.

[61] Kamali, M. I., Nazari, R., Fridhosseini, A., Ansari, H., Eslamian, S., 2015, The Determination of Reference Evapotranspiration for Spatial Distribution Mapping Using Geostatistics, Vol. 29: 3929–3940.

[62] Talchabhadel , R., Shakya, N. M. Dahal , V., and Eslamian, S., 2015, Rainfall Runoff Modelling for Flood Forecasting (A Case Study on West Rapti Watershed), Journal of Flood Engineering, Vol. 6, No. 1, 53-61.

[63] Yousefi, N., Safaee, A., Eslamian, S., 2015, The Optimum Design of Flood Control System Using Multivariate Decision Making Methods (Case Study: Kan River Catchment Basin, Iran), Journal of Flood Engineering, Vol. 6, No. 1, 63-82.

[64] Banihabib, M. E., Zahraei, A. and Eslamian, S., 2015, An integrated optimization model of reservoir and irrigation system applying uniform deficit irrigation, Int. J. Hydrology Science and Technology, Vol. 5, No. 4, 372–385.

[65] Fathian, F., Prasad, A. D., Dehghan, Z.., Eslamian, S., 2015, Influence of land use/land cover change on land surface temperature using RS and GIS techniques, Int. J. Hydrology Science and Technology, Vol. 5, No. 3, 195–207.

[66] Abedi-koupai, J., Mollaei, R., Eslamian, S. S., 2015, The effect of pumice on reduction of cadmium uptake by spinach irrigated with wastewater, Ecohydrology and Hydrobiology, Vol. 15, No. 4, 208-214.

[67] Kamali, M. I., Nazari, R., Faridhosseini, A., Ansari, H., Eslamian, S., 2015, The Determination of Reference Evapotranspiration for Spatial Distribution Mapping Using Geostatistics, Water Resources Management, 29:3929-3940.

[68] Valipour, M., Gholami Sefidkouhi, M. A., Eslamian, S., 2015, Surface irrigation simulation models: a review, Int. J. Hydrology Science and Technology, Vol. 5, No. 1, 51-70.

[69] Esmailzadeh, M., Heidarpour, M., Eslamian, S. , 2015, Flow characteristics of sharp-crested side sluice gate, ASCE's Journal of Irrigation and Drainage Engineering, Vol. 141, No. 7, 10.1061/(ASCE)IR.1943-4774.0000852.

[70] Zareian, M. J., Eslamian, S. and Safavi, H. R., 2015, A modified regionalization weighting approach for climate change impact assessment at watershed scale, Theor. Appl. Climatol., 122:497-516.

[71] Boucefiane A., Meddi M., Laborde J. P., Eslamian S. S., 2014, Rainfall Frequency Analysis Using Extreme Values, Distributions In the Steppe Region of Western Algeria, Int. J. Hydrology Science and Technology, Vol. 4, No. 4, 348-367.

[72] Valipour, M., Eslamian, S., 2014, Analysis of potential evapotranspiration using 11 modified temperature-based models, Int. J. Hydrology Science and Technology, Vol. 4, No. 3, 192-207.

[73] Meddi, M., Toumi, S., Assani, A. A., Eslamian, S., 2014, Regionalization of Rainfall Erosivity in Northern Algeria, Int. J. Hydrology Science and Technology, Vol. 4, No. 2, 155-175.

[74] Zohrabi, N., Massah Bavani, A., Goodarzi, E., S. Eslamian, 2014, Attribution of temperature and precipitation changes to greenhouse gases in northwest Iran, Quaternary International, Vol. 345, 130-137.

[75] Farshad F., Dehghan, Z., Eslamian, S., H. Bazrkar, 2015, Trends in hydrologic and climatic variables affected by four variations of Mann-Kendall approach in Urmia Lake basin, Iran, Hydrological Sciences Journal, DOI:10.1080/02626667.2014.932911.

[76] Fazlolahi, H. and S. S. Eslamian, 2014, Using wetland plants in nutrient removal from municipal wastewater, Int. J. Hydrology Science and Technology, Vol. 4, No. 1, 68–80.

[77] Farshad F., Dehghan, Z. and S. Eslamian, 2014, Analysis of Water Level Changes in Lake Urmia Based on Data Characteristics and Nonparametric Test, Int. J. Hydrology Science and Technology, Vol. 4, No. 1, 18–38.

[78] Varshney, L., Saket, R. K. and Eslamian, S., 2013, Power estimation and reliability evaluation of municipal waste water and self-excited induction generator-based micro hydropower generation system, Int. J. Hydrology Science and Technology, Vol. 3, No. 2, 176-191.

[79] Amiri, M. J., Abedi-Koupai, J., Eslamian, S., Mousavi, S. F. and Arshadi, M., 2013, Modelling Pb(II) adsorption based on synthetic and industrial wastewaters by ostrich bone char using artificial neural network and multivariate non-linear regression, Int. J. Hydrology Science and Technology, Vol. 3, No. 3, 221-240.

[80] Eslamian, S., Tarkesh Esfahany, S., Nasri, M. and Safamehr, M., 2013, Evaluating the potential of urban reclaimed water in area of north Isfahan, Iran, for industrial reuses, Int. J. Hydrology Science and Technology, Vol. 3, No. 3, 257-269.

[81] Ajigoh, E. and Eslamian, S., 2013, Nyando catchment GIS modeling of flood in undated areas, Journal of Flood Engineering, Vol. 4, No. (1-2), 77–86.

[82] Galoie, M., Zenz, G. and Eslamian, S., 2013, Determining the high flood risk regions using a rainfall-runoff modeling in a small basin in catchment area in Austria, Journal of Flood Engineering, Vol. 4, No. (1-2), 9–27.

[83] Bazrkar, M. H., Fathian, F., and Eslamian, S., 2013, Runoff modeling in order to investigate the most effective factors in flood events using system dynamic approach (Case study: Tehran Watershed, Iran), Journal of Flood Engineering, Vol. 4, No. 1-2, 39–59.

[84] Galoie, M., Zenz, G. and Eslamian, S., 2013, Application of L-moments for IDF determination in an Austrian basin, Int. J. Hydrology Science and Technology, Vol. 3, No. 1, 30-48.

[85] Rostamian, R., Eslamian, S. and Farzaneh, M. R., 2013, Application of standardised precipitation index for predicting meteorological drought intensity in Beheshtabad watershed, central Iran, Int. J. Hydrology Science and Technology, Vol. 3, No. 1, 63-77.

[86] Bahmani, R., Radmanesh, F., Eslamian, S., Khorsandi, M. and Zamani, R., 2013, Proper Rainfall for Peak Flow Estimation by Integration of L-Moment Method and a hydrologic model, International Research Journal of Applied and Basic Sciences, Vol. 4 No. 10, 2959-2967.

[87] Mirabbasi, R., Anagnostou, E. N., Fakheri-Fard, A. Dinpashoh, Y. and Eslamian, S., 2013, Analysis of meteorological drought in northwest Iran using the Joint Deficit Index, Journal of Hydrology, Vol. 492, 35–48.

[88] Gohari, A., Eslamian, S., Mirchi, A., Abedi-Koupaei, J., Massah-Bavani, A., Madani, K., 2013, Water transfer as a solution to water shortage: A fix that can blackfire, Journal of Hydrology, Vol. 491, 23–39.

[89] Haghiabi, A. H., Mohammadzadeh-Habili, J., Eslamian, S. S., and S. F. Mousavi, 2013, Derivation of Ewservior's Area-Capacity Equations Based on the Shape Factor, Iranian Journal of Science and Technology, Vol. 37, No. C1, 163-167.

[90] Gohari, A., Eslamian, S., Abedi-Koupaei, J., Massah-Bavani, A., Wang, D., Madani, K., 2013, Climate change impacts on crop production in Iran's Zayandeh-Rud River Basin. Science of The Total Environment, Vol. 442, 405-419.

[91] Saatsaz, M., Azmin Sulaiman, W. N., Eslamian, S., Javadi, S., 2013, Development of a coupled flow and solute transport modelling for Astaneh-Kouchesfahan groundwater resources, North of Iran, International Journal of Water, Vol. 7, No.1/2, 80 – 103.

[92] Saatsaz, M., Azmin-Sulaiman, W. N., Eslamian, S., Mohammadi, K., 2013, Hydrogeochemistry and groundwater quality assessment of Astaneh-Kouchesfahan Plain, Northern Iran, International Journal of Water, Vol. 7, No. 1/2, 44 – 65.

[93] Eslamian, S., Amiri, M. J., Abedi-Koupai, J. and S. Shaeri-Karimi, 2013, Reclamation of unconventional water using nano zero-valent iron particles: an application for groundwater, International Journal of Water, Vol. 7, No. 1/2, 1-13.

[94] Amiri, M.J., Abedi-koupai, J., Eslamian, S. S., Mousavi, S. F., Hasheminejad, H., 2013, Modeling Pb (II) adsorption from aqueous solution by ostrich bone ash using adaptive neural-based fuzzy inference system, J Environ. Sci. Health A Tox. Hazard Subst. Environ. Eng., Vol. 48, No. 5: 543-58.

[95] Biabanaki, M., Tabatabaei Naeini, A. and S. S. Eslamian, 2012, Effects of Urbanization on Stream Channels, Journal of Civil Engineering and Urbanism (JCEU), Vo. 2, No. 4, 136-142.

[96] Abdolhosseini, M., Eslamian, S., Mousavi, S. F., 2012, Effect of climate change on potential evapotranspiration: a case study on Gharehsoo sub-basin, Iran, Vol. 2 No. 4, 362-372.

[97] Farzaneh, M. R., Eslamian, S. S., Samadi, Z. and A. Akbarpour, 2012, An appropriate general circulation model (GCM) to investigate climate change impact, International Journal of Hydrology Science and Technology, Vol. 2, No. 1, 34-47.

[98] Eslamian, S., Abedi-Koupai, J. and M. J. Zareian., 2012, Measurement and modelling of the water requirement of some greenhouse crops with artificial neural networks and genetic algorithm, International Journal of Hydrology Science and Technology, Vol. 2, No. 3, 237-251.

[99] Sadeghi, S. H., Mousavi, S. F., Eslamian, S. S., Ansari, S. and F. Alemi, 2012, A Unified Approach for Computing Pressure Distribution in Multi-Outlet Irrigation Pipelines, Iranian Journal of Science and Technology, Vol. 36, No. C2, 209-223.

[100] Alaghmand, S., Bin Abdullah, R., Abustan, I. and S. Eslamian, 2012, Comparison between capabilities of HEC-RAS and MIKE11 hydraulic models in river flood risk modeling (a case study of Sungai Kayu Ara River basin, Malaysia), International Journal of Environmental Science and Technology, Vol. 2, No. 3, 270-291.

[101] Galoie, M., Zenz, G., S. Eslamian and A. Motamedi., 2012, Numerical simulation of flood due to dam-break flow using an implicit method, International Journal of Environmental Science and Technology, Vol. 2, No. 2, 117-137.

[102] Ghazavi, R., A. B. Vali and S. Eslamian, 2012, Impact of Flood Spreading on Groundwater Level Variation and Groundwater Quality in an Arid Environment, Water Resource Management, Vol. 26, No. 6, 1651-1663.

[103] Fakhri, M., Farzaneh, M. R., Eslamian, S. and M. J. Khordadi, 2012, Uncertainty Assessment of Downscaled Rainfall: Impact of Climate Change on the Probability of Flood, Journal of Flood Engineering, Vol. 3, No. 1, 19-28.

[104] Gholami. A., Mahdavi, M. and S. Eslamian, 2012, Probability Distribution Choices for Minimum, Mean and Maximum Discharges, by L-Moments in Mazandaran Province, IRAN, Journal of Flood Engineering, Vol. 3, No. 1, 83-92.

[105] Shaeri karimi, S., Yasi, M. and S. S. Eslamian, 2012, Use of Hydrological Methods for Assessment of Environmental Flow in a River Reach, International Journal of Environmental Science and Technology, 9(3), pp 549-558.

[106] Eslamian, S. S., Hassanzadeh, H., Abedi-Koupai, J. and M. Gheysari, 2012, Application of L-moments for Regional Frequency Analysis of Monthly Drought Indices, Journal of Hydrologic Engineering, Vol. 17, No. 1, 32-42.

[107] Farzaneh, M. R., Eslamian, S. S., Samadi, Z. and A. Akbarpour, 2012, An appropriate general circulation model (GCM) to investigate climate change impact, International Journal of Hydrology Science and Technology, Vol. 2, No. 1, 34-47.

[108] Eslamian, S. S., Khordadi, M. J. and J. Abedi-Koupai, 2011, Effects of Variations In Climatic Parameters on Evapotranspiration In the Arid and Semi-Arid Regions, Global and Planetary Change, Vol. 78, 188–194.

[109] Eslamian, S. S. and M. J. Amiri, 2011, Estimation of daily pan evaporation using adaptive neural-based fuzzy inference system, International Journal of Hydrology Science and Technology, Vol. 1, Nos. 3/4, 164-175.

[110] Eslamian, S. S., Shaeri Karimi S. and F. Eslamian, 2011, A country case study comparison on Groundwater and Surface Water Interaction, International Journal of Water, Vol. 6, Nos. 1/2, 117-136.

[111] Eslamian, S. S., Gohari, A., Zareian M. J. and A. Firoozfar, 2012, Estimating Penman-Monteith Reference Evapotranspiration Using Artificial Neural Networks and Genetic Algorithm: A Case Study, The Arabian Journal for Science and Engineering, Vol. 37, No. 4, 935-944.

[112] Hassanzadeh, H., Eslamian, S. S., Abedi-Koupai, J. and M. Gheysari, 2011, Application of L-moment for evaluating drought indices of cumulative precipitation deficit (CPD) and maximum precipitation deficit (MPD) based on regional frequency analysis, International Journal of Hydrology Science and Technology, Vol. 1, Nos. 1/2, 88–104.

[113] Alipour, M. H., Shamsai, A., Eslamian, S. S. and R. Ghasemizadeh, 2011, A new fuzzy technique to find the optimal solution in flood management, Journal of Flood Engineering, Vol. 2, No. 1, 1-9.

[114] Ghasemizade, M., Mohammadi K., and S. S. Eslamian, 2011, Estimation of design flood hydrograph for an ungauged watershed, Journal of Flood Engineering, Vol. 2, No. 1/2, 27-36.

[115] Dhital, Y. P., Kayastha, R. B. and S. S. Eslamian, 2011, Precipitation and discharge pattern analysis: a case study of Bagmati River basin, Nepal, Journal of Flood Engineering, Vol. 2, No. 1, 49-60.

[116] Saatsaz, M., Sulaiman, W.N.A. and S. S. Eslamian, 2011, GIS DRASTIC model for groundwater vulnerability estimation of Astaneh-Kouchesfahan Plain, Northern Iran, International Journal of Water, Vol. 6, No. 1/2, 1-14.

[117] Saatsaz, M., Chitsazan, M., Eslamian, S. S. and W.N.A. Sulaiman, 2011, The application of groundwater modelling to simulate the behaviour of groundwater resources in the Ramhormooz Aquifer, Iran, International Journal of Water, Vol. 6, Nos. 1/2, 29-42.

[118]Kambona, O. O., Stadel, C. and S. S. Eslamian, 2011, Perceptions of tourists on trial use and management implications for Kakamega Forest, Western Kenya, Journal of Geography and Regional Planning Vol. 4, No. 4, 243-250.

[119]Malekian, R., Abedi-Koupai, J., Eslamian, S. S., Mousavi, S. F., Abbaspour, K. C. and M. Afyuni, 2011, Ion-exchange process for ammonium removal and release using natural Iranian zeolite, Applied Clay Science, Vol. 51, 323–329.

[120]Malekian, R., Abedi-Koupai, J. and S. S. Eslamian, 2011, Influences of clinoptilolite and surfactant-modified clinoptilolite zeolite on nitrate leaching and plant growth, Journal of Hazardous Materials, Vol. 185, 970–976.

[121]Malekian, R., Abedi-Koupai, J. and S. S. Eslamian, 2011, Use of Zeolite and Surfactant Modified Zeolite as Ion Exchangers to Control Nitrate Leaching, World Academy of Science, Engineering and Technology, Vol. 76, 657-661.

[122]Zaky, M. M. M., Salem, M. A. M., Persson, K. M. M. and S. S. Eslamian, 2011, Incidence of Aeromonas species isolated from water and fish sources of Lake Manzala in Egypt, International Journal of Hydrology Science and Technology, Vol. 1, Nos. 1/2, 47–62.

[123]Khorsandi, Z., Mahdavi, M., Salajeghe, A. and S. S. Eslamian, 2011, Neural Network Application for Monthly Precipitation Data Reconstruction, Journal of Environmental Hydrology, Vol. 19, Paper 5, 1-12.

[124]Eslamian, S. S., 2010, The Physically-Statistically Based Region of Influence Approach for Flood Regionalization, Journal of Flood Engineering, Vol. 1, No. 2, 149-158.

[125]Eslamian, S. S., 2010, Flood Regionalization Using a Modified Region of Influence Approach, Journal of Flood Engineering, Vol. 1, No. 1, 51-66.

[126]Eslamian, S. S., Ghasemizadeh, M., Biabanaki, M. and M. Talebizadeh, 2010, A principal component regression method for estimating low flow index, Water Resources Management, Vol. 24, No. 11, 2553-2566.

[127]Ghazavi, R., Vali, A. B. and S. S. Eslamian, 2010, Impact of flood spreading on infiltration rate and soil properties in an arid environment, Water Resources Management, Vol. 24, No. 11, 2781-2793.

[128]Rajabi, A., Sedghi, H., Eslamian, S. S. and H. Musavi, 2010, Comparison of Lars-WG and SDSM downscaling models in Kermanshah (Iran), Ecol. Env. & Cons., Vol. 16, No. 4, 1-7.

[129]Rahnamai Zekavat, P., Ghasemizadeh, R., Eslamian, S. S. and S. Tarkesh Isfahani, 2010, Journal of Flood Engineering, Vol. 1, No. 2, 175-184.

[130]Chavoshi Borujeni, *S., Sulaiman, W. N. A. and S. S.* Eslamian, 2010, Regional Flood Frequency Analysis Using L-Moments for North Karoon Basin Iran, Journal of Flood Engineering, Vol. 1, No. 1, 67-76.

[131]Kloub, N., Matouq, M., Krishan, M., Eslamian, S. S. and M. Abdelhadi, 2010, Monitoring of Water Resources Degradation at Al-Azraq Oasis, Jordan Using Remote Sensing and GIS Techniques, International Journal of Global Warming, Vol. 2, No. 1, 1-16.

[132]Akhavan S., Abedi-Koupai, J, Mousavi, S, F., Afyuni, M., Eslamian, S. S. and K. C. Abbaspour, 2010, Application of SWAT model to investigate nitrate leaching in Hamadan–Bahar Watershed, Iran, Agriculture, Ecosystems and Environment, Vol. 139, 675-688.

[133]Eslamian, S. S., Abedi-Koupai, J., Amiri, M, J., and A. R. Gohari, 2009, Estimation of Daily Reference Evapotranspiration Using Support Vector Machines and Artificial Neural Networks in Greenhouse, Research Journal of Environmental Sciences, Vol. 3, No. 4, 439-447.

[134]Eslamian, S. S. and N. Lavaei, 2009, Modelling Nitrate Pollution of Groundwater using Artificial Neural Network and Genetic Algorithm in an Arid Zone, International Journal of Water, Special Issue on Groundwater and Surface Water Interaction (GSWI), Vol. 5, No. 2, 194-203.

[135]Eslamian, S. S. and M. J. Khordadi, 2009, Comparing Rainfall and Discharge Trends in Karkhe Basin, Iran, International Journal of Ecological Economics & Statistics (IJEES), Vol. 15, No. F09, 114-122.

[136]Eslamian, S. S. and B. Nekoueineghad, 2009, A Review on Interaction of Groundwater and Surface Water, International Journal of Water, Special Issue on Groundwater and Surface Water Interaction (GSWI), Vol. 5, No. 2, 82-99.

[137]Eslamian, S. S. and N. Zamani, 2009, Innovations in Wind Modelling, International Journal of Global Energy Issues, Special Issue on Wind Modelling and Frequency Analysis (WMFA), Vol. 32, No. 3, 175-190.

[138]Eslamian, S. S. and H. Hasanzadeh, 2009, Detecting and Evaluating Climate Change Effect on Frequency Analysis of Wind Speed in Iran, International Journal of Global Energy Issues, Special Issue on Wind Modelling and Frequency Analysis (WMFA). Vol. 32, No. 3, 295 – 304.

[139]Eslamian, S. S., 2009, Editorial: Frontiers in Ecology and Environment, International Journal of Ecological Economic & Statistics, Special Issue on Basin Ecology and Environment (BEE), Vol. 13, No. W09, 1-6.

[140]Eslamian, S. S. and M. Biabanaki, 2009, Low Flow Regionalization Models, International Journal of Ecological Economic & Statistics, Special Issue on Stream Ecology and Low Flows (SELF), Vol. 12, No. F08, 82-97.

[141]Eslamian, S. S., 2009, Editorial: An Ecologically Based Low Flow Review, International Journal of Ecological Economic & Statistics, Special Issue on Stream Ecology and Low Flows (SELF), Vol. 12, No. F08, 1-6.

[142]Nosrati, K., Eslamian, S. S., Shahbazi, A., Malekian, A. and M. M. Saravi, 2009, Application of Daily Water Resources Assessment Model for Monitoring Water Resources Indices, International Journal of Ecological Economic & Statistics, Special Issue on Basin Ecology and Environment (BEE), Vol. 13, No. W09, 88-99.

[143]Abedi-Koupai, J., Amiri, M. J., and S. S. Eslamian, 2009, Comparison of Artificial Neural Network and Physically Based Models for Estimating of Reference Evapotranspiration in Greenhouse, Australian Journal of Basic and Applied Sciences, Vol. 3, No. 3, 2528-2535,

[144]Ebrahimizadeh, M. A., Amiri, M. J., Eslamian, S. S., Abedi-Koupai, J. and M. Khozaei, 2009, The Effects of Different Water Qualities and Irrigation Methods on Soil Chemical Properties, Research Journal of Environmental Sciences, Vol. 3, No. 4, 497-503.

[145]Matouq, M., Amarneh, I. A., Kloub, N., Badran, O., Al-Duheisat, S. A. and S. S. Eslamian, 2009, Investigating the Effect of Combustion of Blending Jordanian Diesel Oil with Kerosene on Reducing the Environmental Impacts by Diesel Engine, International Journal of Ecological Economic & Statistics, Special Issue on Basin Ecology and Environment (BEE), Vol. 13, No. W09, 79-87.

[146]Eslamian S. S., Gohari, A., Biabanaki, M. and R. Malekian, 2008, Estimation of Monthly Pan Evaporation Using Artificial Neural Networks and Support Vector Machines, Journal of Applied Sciences, Vol. 7, No. 19, 2900-2903.

[147]Abedi-Koupai J., Eslamian S. S. and J. Asad Kazemi, 2008, Enhancing the available Water Content in Unsaturated Soil Zone using Hydrogel, to Improve Plant Growth Indices, Ecohydrology and Hydrobiology, Vol. 8, No. 1, 3-11.

[148]Bazgeer, S., Kamali, G. A., Eslamian, S. S., Sedaghatkerdar, A. and I. Moradi, 2008, Pre-Harvest Wheat Yield Prediction Using Agrometeorological Indices for Different Regions of Kordestan Province, Iran, Research Journal of Environmental Sciences, Vol. 2, No. 4, 275-280.

[149]Eslamian, S. S. and H. Feizi, 2007, Maximum Monthly Rainfall Analysis Using L-moments for an Arid Region in Isfahan Province, Iran, Journal of Applied Meteorology and Climatology, Vol. 46, No. 4, 494–503.

[150]Modarres, R., Soltani, S. and S. S. Eslamian, 2007, The Use of Time Series Modeling for the Determination of Rainfall Climates of Iran, International Journal of Climatology, Vol. 27, No. 6, 819–829.

[151]Moradi, I., Nosrati, K. and S. S. Eslamian, 2007, Evaluation of the RadEst and ClimGen Stochastic Weather Generators for Low-Medium Rainfall Regions, Journal of Applied Sciences, Vol. 7, No. 19, 2900-2903.

[152]Modarres R. and S. S. Eslamian, 2006, Streamflow Time Series Modeling of Zayandehrud River, Iranian Journal of Science and Technology, Vol. 30, No. B4, 567-570.

[153]Mostafazadeh-fard, B., Osroosh, Y. and S. S. Eslamian, 2006, Development and Evaluation of an Automatic Surge Flow Irrigation System, Journal of Agriculture and Social Sciences, Vol. 2, No. 3, 129-132.

[154]Coles, N. A. and Eslamian, S., 2017, Definition of Drought, Ch. 1 in Handbook of Drought and Water Scarcity, Vol. 1: Principles of Drought and Water Scarcity, Ed. by Eslamian S. and Eslamian F., Francis and Taylor, CRC Press, USA, 1-12.

[155]Dalezios, N. R., Dunkel, Z., Eslamian, S., 2017, Meteorological Drought Indices: Definitions, Ch. 3 in Handbook of Drought and Water Scarcity, Vol. 1: Principles of Drought and Water Scarcity, Ed. by Eslamian S. and Eslamian F., Francis and Taylor, CRC Press, USA, 24-44.

[156]Goyal, M. K. Gupta, V., Eslamian, S., 2017, Hydrological Drought: Water Surface and Duration Curve Indices, Ch. 4 in Handbook of Drought and Water Scarcity, Vol. 1: Principles of Drought and Water Scarcity, Ed. by Eslamian S. and Eslamian F., Francis and Taylor, CRC Press, USA, 45-72.

[157]Dalezios, N. R., Gobin, A., Tarquis Alfonso, A. M., and Eslamian, S., 2017, Agricultural Drought Indices: Combining Crop, Climate, and Soil Factors, Ch. 5 in Handbook of Drought and Water Scarcity, Vol. 1: Principles of Drought and Water Scarcity, Ed. by Eslamian S. and Eslamian F., Francis and Taylor, CRC Press, USA, 73-90.

[158]TishehZan, P. and Eslamian, S., 2017, Agricultural Drought: Organizational Perspectives, Ch. 6 in Handbook of Drought and Water Scarcity, Vol. 1: Principles of Drought and Water Scarcity, Ed. by Eslamian S. and Eslamian F., Francis and Taylor, CRC Press, USA, 91-108.

[159]Bazrkar, M. H., Eslamian, S., 2017, Ocean Oscillation and Drought Indices: Application, Ch. 8 in Handbook of Drought and Water Scarcity, Vol. 1: Principles of Drought and Water Scarcity, Ed. by Eslamian S. and Eslamian F., Francis and Taylor, CRC Press, USA, 127-136.

[160]Basu, R., Singh, C. K., Eslamian, S., 2017, Cause and Occurrence of Drought, Ch. 9 in Handbook of Drought and Water Scarcity, Vol. 1: Principles of Drought and Water Scarcity, Ed. by Eslamian S. and Eslamian F., Francis and Taylor, CRC Press, USA, 137-148.

[161]Bazrafshan, J., Hejabi, S., Eslamian, S., 2017, Drought Modeling Examples, Ch. 11 in Handbook of Drought and Water Scarcity, Vol. 1: Principles of Drought and Water Scarcity, Ed. by Eslamian S. and Eslamian F., Francis and Taylor, CRC Press, USA, 167-188.

[162]Jonathan Peter Cox, Sara Shaeri Karimi, Eslamian, S., 2017, Real-Time Drought Management, Ch. 13 in Handbook of Drought and Water Scarcity, Vol. 1: Principles of Drought and Water Scarcity, Ed. by Eslamian S. and Eslamian F., Francis and Taylor, CRC Press, USA, 209-216.

[163]Garg, V. and Eslamian, S., 2017, Monitoring, Assessment, and Forecasting of Drought Using Remote Sensing and the Geographical Information System. Ch. 14 in Handbook of Drought and Water Scarcity, Vol. 1: Principles of Drought and Water Scarcity, Ed. by Eslamian S. and Eslamian F., Francis and Taylor, CRC Press, USA, 217-252.

[164]Dalezios, N. R., Tarquis Alfonso, A. M., and Eslamian, S., 2017, Drought Assessment and Risk Analysis, Ch. 18 in Handbook of Drought and Water Scarcity, Vol. 1: Principles of Drought and Water Scarcity, Ed. by Eslamian S. and Eslamian F., Francis and Taylor, CRC Press, USA, 323-344.

[165]Dalezios, N. R., Spyropoulosand, N. V., Eslamian, S., 2017, Remote Sensing in Drought Quantification and Assessment, Ch. 21 in Handbook of Drought and Water Scarcity, Vol. 1: Principles of Drought and Water Scarcity, Ed. by Eslamian S. and Eslamian F., Francis and Taylor, CRC Press, USA, 377-396.

[166]Araghinejad, S., Hosseini-Moghari, S. M., Eslamian, S., 2017, Application of Data-Driven Models in Drought Forecasting, Ch. 23 in Handbook of Drought and Water Scarcity, Vol. 1: Principles of Drought and Water Scarcity, Ed. by Eslamian S. and Eslamian F., Francis and Taylor, CRC Press, USA, 423-440.

[167]Vafakhah, M., and Eslamian, S., 2017, Application of Intelligent Technology in Rainfall Analysis, Ch. 24 in Handbook of Drought and Water Scarcity, Vol. 1: Principles of Drought and Water Scarcity, Ed. by Eslamian S. and Eslamian F., Francis and Taylor, CRC Press, USA, 441-460.

[168]Vafakhah, M., Akbari Majdar, H. and Eslamian, S., 2017, Rainfall Prediction Using Time Series Analysis, Ch. 28 in Handbook of Drought and Water Scarcity, Vol. 1: Principles of Drought and Water Scarcity, Ed. by Eslamian S. and Eslamian F., Francis and Taylor, CRC Press, USA, 517-540.

[169]González, M. H., Garbarini, E. M., Rolla, A. L., and Eslamian, S., 2017, Meteorological Drought Indices: Rainfall Prediction in Argentina, Ch. 29 in Handbook of Drought and Water Scarcity, Vol. 1: Principles of Drought and Water Scarcity, Ed. by Eslamian S. and Eslamian F., Francis and Taylor, CRC Press, USA, 541-570.

[170]Hadizadeh, R. and Eslamian, S., 2017, Modeling Hydrological Process by ARIMA–GARCH Time Series, Ch. 30 in Handbook of Drought and Water Scarcity, Vol. 1: Principles of Drought and Water Scarcity, Ed. by Eslamian S. and Eslamian F., Francis and Taylor, CRC Press, USA, 571-590.

[171]Mujere, N., Yang, X. and Eslamian, S., 2017, Gradation of Drought-Prone Area, Ch. 31 in Handbook of Drought and Water Scarcity, Vol. 1: Principles of Drought and Water Scarcity, Ed. by Eslamian S. and Eslamian F., Francis and Taylor, CRC Press, USA, 591-606.

[172]Mahmudul Haque, M., Amir Ahmed, A., Rahman, A., Eslamian, S., 2017, Drought Losses to Local Economy, Ch. 33 in Handbook of Drought and Water Scarcity, Vol. 1: Principles of Drought and Water Scarcity, Ed. by Eslamian S. and Eslamian F., Francis and Taylor, CRC Press, USA, 627-642.

[173]Fakhruddin, B. S. H. M., Eslamian, S., 2017, Analysis of Drought Factors Affecting the Economy, Ch. 34 in Handbook of Drought and Water Scarcity, Vol. 1: Principles of Drought and Water Scarcity, Ed. by Eslamian S. and Eslamian F., Francis and Taylor, CRC Press, USA, 643-656.

[174]Dalezios, N. R., Eslamian, S., 2017, Environmental Impacts of Drought on Desertification Classification, Ch. 3 in Handbook of Drought and Water Scarcity, Vol. 2: Environmental Impacts and Analysis of Drought and Water Scarcity, Ed. by Eslamian S. and Eslamian F., Francis and Taylor, CRC Press, USA, 45-64.

[175]Nazif, S. and Tavakolifar, H., Eslamian, S., 2017, Climate Change Impact on Urban Water Deficit, Ch. 5 in Handbook of Drought and Water Scarcity, Vol. 2: Environmental Impacts and Analysis of Drought and Water Scarcity, Ed. by Eslamian S. and Eslamian F., Francis and Taylor, CRC Press, USA, 81-106.

[176]Shahid, S., Alamgir, M., Wang, X.-J., Eslamian, S., 2017, Climate Change Impacts on and Adaptation to Groundwater, Ch. 6 in Handbook of Drought and Water Scarcity, Vol. 2: Environmental Impacts and Analysis of Drought and Water Scarcity, Ed. by Eslamian S. and Eslamian F., Francis and Taylor, CRC Press, USA, 107-124.

[177]Orimoogunje, O. O. I., Eslamian, S., 2017, Minimizing the Impacts of Drought, Ch. 8 in Handbook of Drought and Water Scarcity, Vol. 2: Environmental Impacts and Analysis of Drought and Water Scarcity, Ed. by Eslamian S. and Eslamian F., Francis and Taylor, CRC Press, USA, 143-162.

[178]Maleksaeidi, H., Keshavarz, M., Karami, E., Eslamian, S., 2017, Climate Change and Drought: Building Resilience for an Unpredictable Future, Ch. 9 in Handbook of Drought and Water Scarcity, Vol. 2: Environmental Impacts and Analysis of Drought and Water Scarcity, Ed. by Eslamian S. and Eslamian F., Francis and Taylor, CRC Press, USA, 163-186.

[179]Reyhani, M. N., Eslamian, S., Davari, A., 2017, Sustainable Agriculture: Building Social-Ecological Resilience, Ch. 10 in Handbook of Drought and Water Scarcity, Vol. 2: Environmental Impacts and Analysis of Drought and Water Scarcity, Ed. by Eslamian S. and Eslamian F., Francis and Taylor, CRC Press, USA, 187 -204.

[180]Crusberg, T. C., Eslamian, S., 2017, Drought and Water Quality, Ch. 11 in Handbook of Drought and Water Scarcity, Vol. 2: Environmental Impacts and Analysis of Drought and Water Scarcity, Ed. by Eslamian S. and Eslamian F., Francis and Taylor, CRC Press, USA, 205-218.

[181]Gaaloul, N., Eslamian, S., and Laignel, B., 2017, Contamination of Groundwater in Arid and Semiarid Lands, Ch. 16 in Handbook of Drought and Water Scarcity, Vol. 2: Environmental Impacts and Analysis of Drought and Water Scarcity, Ed. by Eslamian S. and Eslamian F., Francis and Taylor, CRC Press, USA, 291-314.

[182]Banjoko, B., Eslamian, S., 2017, Sanitation in Drought, Ch. 17 in Handbook of Drought and Water Scarcity, Vol. 2: Environmental Impacts and Analysis of Drought and Water Scarcity, Ed. by Eslamian S. and Eslamian F., Francis and Taylor, CRC Press, USA, 315-330.

[183]Davari, A., Bagheri, A., Reyhani, M. N., Eslamian, S., 2017, Environmental Flows Assessment in Scarce Water Resources, Ch. 18 in Handbook of Drought and Water Scarcity, Vol. 2: Environmental Impacts and Analysis of Drought and Water Scarcity, Ed. by Eslamian S. and Eslamian F., Francis and Taylor, CRC Press, USA, 331-352.

[184]Qian, Q., Eslamian, S., 2017, Streamflow Quality in Low-Flow Conditions, Ch. 20 in Handbook of Drought and Water Scarcity, Vol. 2: Environmental Impacts and Analysis of Drought and Water Scarcity, Ed. by Eslamian S. and Eslamian F., Francis and Taylor, CRC Press, USA, 375-386.

[185]Mohammadzade Miyab, N., Eslamian, S., Dalezios, N. R., 2017, River Sediment in Low Flow Condition, Ch. 21 in Handbook of Drought and Water Scarcity, Vol. 2: Environmental Impacts and Analysis of Drought and Water Scarcity, Ed. by Eslamian S. and Eslamian F., Francis and Taylor, CRC Press, USA, 387-408.

[186]Pérez-Blanco, C. D., Delacámara., G., Gómez., C. M., Eslamian, S., 2017, Crop Insurance in Drought Conditions, Ch. 23 in Handbook of Drought and Water Scarcity, Vol. 2: Environmental Impacts and Analysis of Drought and Water Scarcity, Ed. by Eslamian S. and Eslamian F., Francis and Taylor, CRC Press, USA, 423-444.

[187]Kahrizi, D., Esfahani, K., Ashraf Mehrabi, A., Ghaheri, M., Azizi Aram, Z., Khosravi, S., Eslamian, S., 2017, Biotechnology for Drought Improvement, Ch. 24 in Handbook of Drought and Water Scarcity, Vol. 2: Environmental Impacts and Analysis of Drought and Water Scarcity, Ed. by Eslamian S. and Eslamian F., Francis and Taylor, CRC Press, USA, 445-460.

[188]Wade, P., Eslamian, S., 2017, Water Issues from a System Dynamics Perspective, Ch. 25 in Handbook of Drought and Water Scarcity, Vol. 2: Environmental Impacts and Analysis of Drought and Water Scarcity, Ed. by Eslamian S. and Eslamian F., Francis and Taylor, CRC Press, USA, 461-488.

[189]Rahman, A., Hajani, E., Eslamian, S., 2017, Rainwater Harvesting in Arid Regions of Australia, Ch. 26 in Handbook of Drought and Water Scarcity, Vol. 2: Environmental Impacts and Analysis of Drought and Water Scarcity, Ed. by Eslamian S. and Eslamian F., Francis and Taylor, CRC Press, USA, 489-500.

[190]Dayani, S., Sabzalian, M. R., Hadipour, M. Eslamian, S., 2017, Water Scarcity and Sustainable Urban Green Landscape, Ch. 30 in Handbook of Drought and Water Scarcity, Vol. 2: Environmental Impacts and Analysis of Drought and Water Scarcity, Ed. by Eslamian S. and Eslamian F., Francis and Taylor, CRC Press, USA, 557-604.

[191]Gohari, A., Zareian, M. J., Eslamian, S., Nazari, R. 2017, Interbasin Transfers of Water: Zayandeh-Rud River Basin, Ch. 32 in Handbook of Drought and Water Scarcity, Vol. 2: Environmental Impacts and Analysis of Drought and Water Scarcity, Ed. by Eslamian S. and Eslamian F., Francis and Taylor, CRC Press, USA, 619-630.

[192] Banjoko, B., Eslamian, S., 2017, Environmental Evaluation: Lessons Learned from Case Studies, Ch. 33 in Handbook of Drought and Water Scarcity, Vol. 2: Environmental Impacts and Analysis of Drought and Water Scarcity, Ed. by Eslamian S. and Eslamian F., Francis and Taylor, CRC Press, USA, 631-664.

Citation: *Dr. Kaveh Ostad-Ali-Askari et.al. (2017) A Study on the Effects of Earth Surface and Metrological Parameters on River Discharge Modeling Using SWAT Model, Case Study: Kasillian Basin, Mazandaran Province, Iran, International Journal of Constructive Research in Civil Engineering, 3(4), pp.99-120. DOI: http://dx.doi. org/10.20431/2454-8693.0304010*