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Determination of Influence Levels of Natural Factors Affecting Infiltration and Runoff: A Case Goksu Basin

Fatih Karaosmanoglu

Ministry of National Education, Adana, Turkey

Abstract. Water is an indispensable element for human and other living life to live. Therefore, in any river basin, it is very important to calculate the hydrological cycle parameters such as evaporation, infiltration, and runoff, and to determine the level of influence of natural factors affecting this process. In this study, In Goksu Basin, it is aimed to determine the effect levels of natural criteria such as lithology, soil, land use/cover, soil cover (ndvı), slope, aspect, on infiltration and runoff. In the hydrological model developed for this purpose, natural criteria, digitization formula, ArcGIS based analytical hierarchy (AHP) model program were processed and their effect levels were revealed. According to this result, infiltration and runoff values are close to each other; Lithology 57.1%, soil 12.9%, land use/soil cover 18.4%, slope and aspect between 5.1% and 6.4% were determined. As a result of the model application, the total infiltration and flow amounts of 407.1 mm calculated with the converted real infiltration and runoff coefficients were correlated with the current height of 429.2 mm. It was found to be quite successful at 0.95.

Keywords: Goksu Basin, hydrologic model, infiltration, influence levels, runoff

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1. Introduction

Water, which is a limited natural resource in the world, is very important for human and living life. With the increasing world population and the consequences of global climate change, significant changes occur in the spatial distribution and temporal amount of water on the earth's surface. This situation, while it causes negative environmental problems such as drought, flood and landslide, it also threatens the sustainability of dirinking, irrigation, energy production and other water usage areas. Therefore, issues such as the sustainability and management of water are discussed in the agenda of the relevant states. From the past to the present, researchers in the hydrology and other disciplines related water have carried out studies on water budget such as groundwater, runoff, current, precitipation, evaporation. Below some important studies on infiltration and factors affecting runoff are mentioned.

*Corresponding author at: Ministry of National Education, Devlet, Atatürk Blv No:98, 06420 Çankaya/Ankara, Adana, Turkey

E-mail address: fatihkaraosmanoglu46@gmail.com

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Soil and vegetation are important parametres in hydrological models when determining runoff produced by given rainfall event. Gravel and rock plus gravel showed a significant negative correlation with infiltration, whereas rock alone was not significant. Infiltration decreased significantly with bare soil [1]. On hillslopes of natural length and roughness, vegetation play an important role in decreasing the average velocity of flow, increasing its residence time, and allowing significant poststorm infiltration to decrease runoff volumes [2].

Soil water infiltration is a key process in the water cycle since it controls, inter alia, the surface water–groundwater relationship [3]. Infiltration is strongly affected by many variables which control the hydraulic conductivity and moisture characteristic curve of the soil [4]. As occurs with other types of soil, the loss of forest cover produces important modifications in the properties of Andisols, impacting on the infiltration process [5], [6]. The results of the present forest soil study corroborate the findings obtained by a majority of authors for Andisols, particularly their high steady-state infiltration rate [7]–[9], which is usually attributed primarily to the high structural stability of the soil aggregates and its influence on pore-space distribution [6], [7], [10].

The soil properties play a crucial role in this process and soils are the interface through which water infiltration occurs [11]. Modifications to ecosystems produce changes in infiltration that can propitiate erosive processes [12]. As a number of authors have shown, the type of vegetation and its degree of coverage also plays an influential role in the water infiltration process [13]–[15]. Canopies play a role in shielding the soil from radiation and rainfall. The first causes a milder thermal regime with less temperature oscillation in the soil beneath [16]. The sensitivity of runoff response to land surface variability depends on the prevailing runoff mechanism [17]. The dynamics of vegetation-driven spatial heterogeneity (VDSH) and its function in structuring runoff and sediment fluxes have received increased attention from both geomorphological and ecological perspectives, particularly in arid regions with sparse vegetation cover . The latter involves partition of rainfall into three components, interception, throughfall and stemflow, the proportions of which vary depending on canopy structure, pattern of rainfall intensity and atmospheric conditions [18].

The interaction between vegetation and hydrologic processes is particularly tight in water-limited environments where a positive-feedback links soil moisture and vegetation. and play an important role in controlling erosion [19]. Vegetation cover plays a major role in the restoration and stabilization of disturbed systems [20]. In particular, runoff occurs only for saturation excess, the probability distribution function (PDF) of which is well represented by a simple expression, but the model does not consider the limited infiltration capacity of soil [21]. Andisols are soils with high structural development and aggregate stability, characteristics that play a major role in their high infiltration rate. The results of the present study show that cropping is not the only type of use capable of affecting infiltration in Andisols [22]. In short, when these studies are evaluated together; The role of factors such as soil, soil structure and high permeability of andisols, vegetation, different vegatation dynamics, the hydrological processes of vegetation at mining area, landuse, vegetation closure, changing surface conditions and ecosystem characteristics on infiltration and runoff were investigated.

However, in general studies, one or few natural factors as soil, vegetation were evaluated, and natural factors effective in water production were not used in a holistic way. In this study; ın the Goksu Basin; natural factors such as precipitation, geology (lithology), soil, landuse/cover, soil cover (ndvı), slope, aspect were evaluated in holistic manner in physical geography perpective and their effects on infiltration and runoff were analyzed.

2. Research Methods

2.1. Research Location and Sample

Goksu Basin (Adana-Seyhan) is an important sub-basin of the Seyhan Basin, most of which is located in the eastern part of the Middle Taurus Orogenic belt within the borders of the Mediterranean Region, Adana part. The basin extends in the northeast-southwest direction and is located between 37° 33'- 38° 40' North Latitudes and 35° 35 -36° 41 East Longitudes (Figure 1). Surrounded by a mountainous area in the northeast-southwest direction, the basin covers an area of 4392 km².

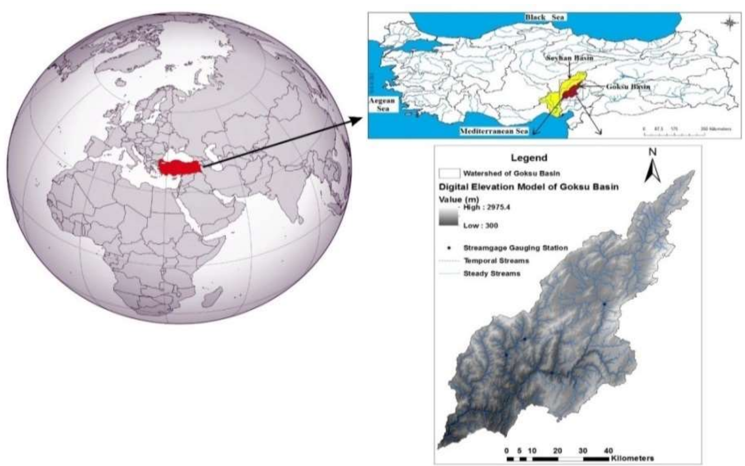

Figure 1. Location of Goksu Basin

2.2. Material and Methods

The material and methods mentioned below have been used in order to determine the effect levels of natural factors on infiltration and runoff in the Goksu Basin. A hydrological model was developed to determine the effect levels of these natural factors (Figure 2).

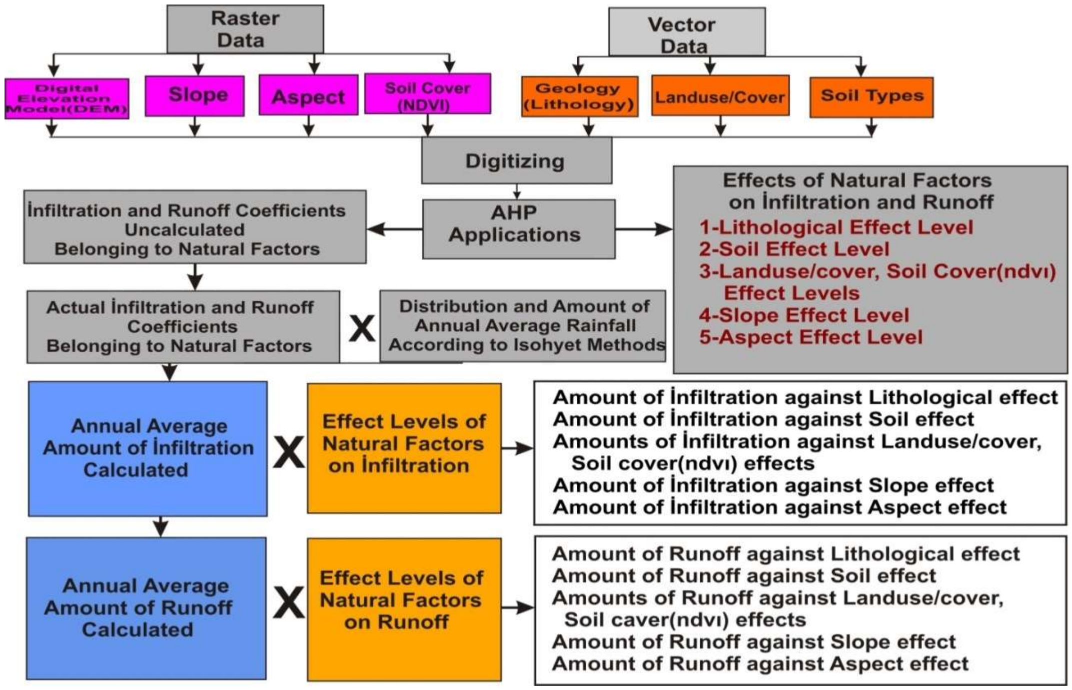

Figure 2. Model Flow on the Effect Levels of Natural Factors that Have an effect on Infiltration and Runoff in Goksu Basin

In this study, Aster-Gdem digital elevation model with 30 × 30 m resolution, climate date such as precipitation and current height obtained from stations belonging to the basin and geology, soil, land use, USGS Lansat-8 satellite images obtained from relevant institutions and organizations (Data such as ndvı) ground cover constitute the materials of the research area.

In the study, in the processing of materials belonging to the research field mentioned above and reaching the intended results: GeographyInformation Systems (GIS), digitization formula, Analytical Hierarchy Model Program (AHP), Remote Sensing techniques (RS), izohyet (co-precipitation) formula, and simple mathematical formulas created in the revision of digitization coefficients are the methods used. All these methods are expressed in the developed hydrological model flow (Figure 2). The fuction of these methods used in the study can be breifly explained as follows.

2.2.1. Digitization formula

$$N_f = \sum_{i=1}^{n} Ii = 1 \tag{1}$$

N_f = natural factor; I_i = weighted average; $\sum I_i$ = sum of the alternatives. In this formula; digitization of natural factors affecting the water cycle such as lithology, soil, land use/cover, soil cover (ndvı), slope and aspect has been made. In this digitization process, numerical values were created in order to determine the positive, negative and average effects of the sub-alternatives of each natural criterion on infiltration and runoff. At the same time, the total numerical values of alternatives belonging to each natural criterion created were equal to one (1) number. For each alternative that belongs to the criteria, the numerical value is high if it contributes positively to the infiltration and runoff processes; if it makes a negative contribution, the numerical value is low, and if it makes an average contribution, an average numerical value is given (Table 1).

Table1. Infiltration (A) and Runoff (B) Coefficients Formed Regarding the Digitization Process of Alternatives Belonging to the Natural Criteria of the Goksu Basin

Natural Factors	Alternatives and Coefficients	Total of Weighted Average
(A) Infiltration Coefficients Created for Digitization of Alternatives Belonging to Natural Factors		
Lithology	Limestone, Dolomite, Pebblestone, Brownstone, Conglomerate, Aluvion(**0.563**), Mudstone, Conglomerate, Schist, Brownstone, Arenite (**0.312**), Marl, Schist, Argilleceous, Shale (**0.125**)	1
Soil	Chesnut, Aluvial and Coluvial soils (**0.560**), Red Mediterreanean soils, naked and rocky and talus (**0.190**), Brown forest and non-calcareous brown soils(**0.250**)	1
Landuse/Cover	Forest, chaparral bushland areas (**0.170**), pasture areas (**0.130**), vinyard and garden (**0.230**), plantation areas (**0.270**), naked soil and rocy surfaces (**0.110**), centre of population (**0.090**)	1
Soil Cover(ndvı)	Naked surfaces and massive rocky (**0.110**), vegetation weakness and pasture areeas (**0.130**), chaparral, brushland, garden, plantation areas (**0.240**), complex forestry areas (**0.250**), densely forestry areas (**0.270**)	1
Slope	% 0-5 (**0.400**), %5-10 (**0.300**), %10-30 (**0.200**), %30 + (**0.100**)	1
Aspect	Flout areas (**0.280**), north, northeast, northwest (**0.200**), south, southeast, southwest (**0.150**), East (**0.170**), West (**0.200**)	1
(B) Runoff Coefficients Created for Digitization of Alternatives Belonging to Natural Factors		
Lithology	Limestone, Dolomite, Pebblestone, Brownstone, Conglomerate, Aluvion(**0.125**),Mudstone, Conglomerate, Schist, Brownstone, Arenite (**0.312**),Marl, Schist, Argilleceous, Shale (**0.563)**	1
Soil	Chesnut, Aluvial and Coluvial soils (**0.300**), Red Mediterreanean soils (**0.140**) naked and rocky and talus (**0.200**), Brown forest and non-calcareous brown soils(**0.250**), non-calcareaous soil (**0.110**)	1
Landuse/Cover	Forest, chaparral, bushland areas (**0.070**), pasture areas (0.**130**), vinyard and garden (**0.230**), plantation areas (**0.090**), naked soil and rocy surfaces(**0.230**), centre of population (**0.250**)	1
Soil Coever(ndvı)	Naked surfaces and massive rocky (**0.320**), vegetation weakness and pasture areeas (**0.300**), chaparral, brushland, garden, plantation areas (**0.150**), complex forestry areas (**0.120**), densely forestry areas (**0.110**)	1
Slope	% 0-5 (0.**100**), %5-10 (**0.200**), %10-30 (**0.300**), %30 + (**0.400**)	1
Aspoect	Flout areas (**0.100**), north, northeast, northwest (**0.250**), south, southeast, southwest (**0.190**), East (**0.180**), West (**0.280**)	1

2.2.2. Geography Information System (GIS)

Geographical İnformation System (GIS) is an information system created for entering, collecting, storing, quering, spatial analysis, displaying and printing in different formats of spatial origin information (graphics and attributes) [23]. Here; It is aimed to process the numerical data sets created regarding the natural criteria of the Goksu Basin in the analytical hierarchy (AHP) model program integrated into geographic information systems (GIS).

2.2.3. Analytical Hierarchy Process (AHP) Model

The Analytical Hierarchy Process (AHP) technique was first introduced in the 1970s by Thomas L. and Saaty, and is one of the multi-criteria decision-making techniques used in the solution of the decision problem [23]. AHP is an objective and subjective decision-making with multidimensional and multi-criteria. It is widely used in complex environmental analysis and across disciplines because it offers the opportunity to combine factors. AHP is a decision-making process based on managerial decision-making by giving relative importance values to decision-makers, decisions, options and criteria[24]–[28]. Here, the date sets of natural criteria, digitized above have been successfully implementation in the AHP model program integrated with (GIS). As a result of this application, the coefficients and percentage rates of the natural criteria of the Goksu Basin were determined on the effect levels on infiltration and runoff.

2.2.4. Izohyet (Co-Precipitation) Method

In the Isohiyet method, isohymes (Congruent precipitation height curves) are drawn that connect points with the same precipitation height. The calculation is made by assuming that the height of precipitation in two consecutive areas is equal to the average of the values of the isolates [29].

Table2. Application A case of Isohyet Method and Formula Applied to Determine the Distribution of Precipitation in Goksu Basin

Isohetes	Annual Precipitation Height (mm) Pi	Ai (Area =Km²)	Pi Ai
900-1100	1000	146	146000
1100-1200	1100	474.5	521950
1100-1000	1050	1277.4	1341270
850-510	650	1790.1	1163565
850-900	875	618.4	541100
900-660	780	85.8	66924
	Total	4392 km²	3780809 mm

$$P_a = \frac{\sum_{i=\imath}^{n} P_i A_i}{\sum_{i=\imath}^{n} A_i} = \frac{3780809mm}{4392km^2} = 860.8mm \tag{2}$$

P_a = annual average precipitation; P_i = annual average rainfall rates; A_i = basin areas to corresponding to the annual average rainfall;$\sum P_i A_i$= annual average total precipitation amount corresponding to the grouped basin areas; $\sum A_i$= sum of grouped basin areas.This isohyet formula has been successfully applied in the Goksu Basin and annual average rainfall of 860.6 mm has been calculated in the basin (Table 2). Here, It is aimed to correlate the total infiltration and runoff amounts to be obtained after this process with the current height obtained from the streamgage gauging station 1805 downstream of the basin.

2.2.5. Some Mathematical Formulas Used in Converting Uncalculated Coefficients as a Result of Anayltical Hierarchy Model (Ahp) Program Application to Actual İnfiltration and Runoff Coefficients

In this part of study, it is aimed to test whether the results of application of the Analytical Hierarchy Model (AHP) and the digitization of natural criteria on the infiltration and runoff of the basin are successful or not. The infiltration and runoff coefficients resulting from the AHP model application are not real coefficients since they correspond to 100%. These coefficients were converted into actual coefficients with the help of simple mathematical formulas (formulas 1,2,3,4). Because hydrological processes such as infiltration and runoff that occur in any river basin are elements that complement each other[30]. In formula 1, the ratio of the annual average rainfall amount of 860.6 mm in the basin was made with 429.2 mm current height data obtained from the stramgage gauging station (SGS) numbered 1805.

$$R_{(P_a/Q_h)} = \frac{p_a}{Q_h} = \frac{860.6mm}{429.2mm} = 0.50 \tag{3}$$

P_a = annual average precitipation;Q_h = annual average current height, $R_{(P_a/Q_h)}$ = ratio of the annual average precipitation amount to the annual average current height. In formula 2, on the other hand, in the temporal course of these hydrological processes, there is a balance with mutually complementary processes such as the infiltrating groundwater flowing back to discharge with the springs, and the inclusion of re-infiltration processes at the local level under changing surface conditions due to lithology, slope, vegetation, etc. constitute. For this reason, the actual infiltration and runoff coefficints based on current height data were mathematically proportioned [30].

$$R_{(Q/I)} = \frac{\sum(Q+I)}{2} = \frac{0.50}{2} = 0.25 \tag{4}$$

$R_{(Q/I)}$ = rations of current height to infiltration and runoff; Q = annual average runoff rate; I = annual average infiltration rate. $\sum(Q+I)$= annual average total infiltration and runoff.In formulas 3 and 4, the infiltration and runoff coeficients thet were not calculated based on the proportions in formula 2 were converted into actual infiltration and runoff coefficeints [30].

$$I_{(ac)} = \frac{I_{(cc)}}{4} \tag{5}$$

$I_{(ac)}$ = actual infiltration coefficient;$I_{(cc)}$= uncalculated infiltration coefficient.

$$Q_{(ac)} = \frac{Q_{(cc)}}{4} \tag{6}$$

$Q_{(ac)}$ = actual runoff coefficient; $Q_{(cc)}$ = uncalculated runoff coefficient. As a result, the actual infiltration and runoff coefficients obtained in the above mentioned mathematical operations and calculations made it possible to calculate the infiltration and runoff in the Goksu Basin [30].The calculated infiltration and surface flow amounts obtained from all these applications will be compared and evaluated with the flow height data in the findings and discussion section.

3. Results and Discussion

In this study, using the materials and methods mentioned above, the results and analyzes regarding the effect levels of natural criteria on hydrological processes such as infiltration and runoff in the Goksu Basin are as follows.

3.1. Digitization Processes of Lithology Criteria in Goksu Basin and the Effect Levels on İnfiltration and Runoff

In the Goksu basin, leaching coefficients corresponding to high densities in the range of 0.030 to 0.049 and 0.563 in total were given to rocks such as alluvium, limestone, conglomerate, conglomerate, dolomite belonging to various ages and formations. On the other hand, infiltration coefficients ranging from 0.005 to 0.010 and as low as 0.125 in total were given.Similarly, it was digitized with moderate infiltration and runoff coefficients in the range of 0.029 to 0.015 and a total of 0.312 [30].

In these digitization processes in the field of research; The permeable, semi-permeable and impermeable properties of the rocks and the intercalation of the layers are also considered. It was supported by field trips and observations. Accordingly, as a result of the application of the model program; lithology criteria were found to be effective at 57.298% infiltration and 57.045% runoff.

3.2. Digitization Processes of Soil Criteria in Goksu Basin and the Effect Levels on İnfiltration and Runoff

In the formation and distribution of basic soil groups in the research area; The effects of lithology, vegetation and morphological structure, especially climate, are clearly observed. In the Goksu basin; infiltration coefficients such as 0.14 are given for the areas where colluvial and alluvial soils are distributed, 0.10 for alluvial, colluvial and maroon soilsand 0.09 for bare rock and massive surfaces. For surface runoff, coefficients such as 0.12, 0.13, 0.14 were given for brown forest, lime-free brown forest, red Mediterranean soils, respectively, while coefficients such as 0.20 were given for rubble and bare surfaces [30]. In all these digitization processes; The negative, positive and average effects of vegetation cover on the soil and underlying lithological features on infiltration and runoff processes have always been considered. According to the results of the model implementation, it was determined that the soil criterion was effective on 12.936% infiltration and 12.968% runoff.

3.3. Digitization Processes of Landuse/Vegetation Criteria in Goksu Basin and the Effect Levels on Infiltration and Runoff

It is possible to say that land use/cover in the basin has an effect on seepage and surface flow. The digitization of the field has been made by considering it together with other natural criteria. In the infiltration processes; Coefficients were given for forest areas, shrubs and shrubs 0.17, pastures (pastures) 0.13, vineyards and orchards 0.23, cultivated-planted areas 0.27, bare soil and massive surfaces 0.11, and settlement areas 0.09.For surface runoff, coefficients were given for forest areas, shrubs and shrubs 0.07, pastures (pastures) 0.21, vineyard-garden areas 0.13, cultivated-planted areas 0.09, bare soil and massive surfaces 0.24, and settlement areas 0.26 [30]. In all these digitization processes; The positive, negative, and average effects of the aforementioned alternatives, together with other natural criteria for infiltration and runoff processes, have been considered. According to the model application results, it was revealed that the land use criterion was effective in 10.26% infiltration and 10.26% runoff processes.

3.4. Digitization Processes of Soil Cover (NDVI) Criteria and the Effect Levels on İnfiltration and Runoff in Goksu Basin

The ground cover (ndvi) characteristics in the basin are largely similar to the land use/cover characteristics. For this reason, similar coefficient values are given in digitization.For the infiltration level, bare and massive surfaces are given 0.11, vegetation cover weak step or pasture areas 0.13, shrub, vineyard-garden, cultivated-planted areas 0.24, shrub, scrub, scrub mixed forest 0.25, dense forest areas 0.27, while superficial For flow, coefficients such as step or pasture area 0.30, bare surface and massive rocky surfaces 0.32, shrub, scrub, bag-garden, cultivated-planted areas 0.15, shrub, scrub mixed forest 012, and densely forested areas 0.11 were given [30].In all these digitization processes; existing land use/cover and other natural criteria have been taken into account. According to the model application result, it was determined that it was effective in 8.138% infiltration and 8.149% runoff processes.

3.5. Digitization Processes of Slope Criteria and the Effect Levels on İnfiltration and Runoff in Goksu Basin

Four (4) classifications were made to determine the effects of slope factor on seepage and runoff in the basin. Accordingly, coefficients such as 0.10, 0.20, 0.30, 0.40 are given for slope values of 0-5%, 5-10%, 10-30%, 30% and more for surface flow, respectively, while 0-5%,% for leakage are given. It has been digitized with coefficient values such as 0.40, 0.30, 0.20, 0.10 for slope values of 5-10, 10-30%, 30% and more [30].According to the model application results, it was found that it had 6.468% surface flow and 5.662% infiltration levels.

3.6. Digitization Processes of Aspect Criteria and the Effect Levels on İnfiltration and Runoff in Goksu Basin

The basin extends in the northeast-southwest direction and is located between 37° 33´-38° 40´ north latitudes and 35° 35 – 36° 41´ east longitudes (Figure 1). In the digitization processes of the aspect criterion in the basin, the hemisphere where the basin is located, the degree of latitude and especially the angle of incidence of the sun's rays are taken into consideration.Due to the highly rugged topographic structure of the field, it has not played an important role in the frequent change of view positions.

Table3. Effects Levels of Natural Effective on Infiltration (A) and Runoff (B) in Goksu Basin

Rainfall (860.6 mm)	Effect Levels of Natural Factors on İnfiltration (İnfiltration Rates/Amounts)
Aspect Affect	%5.662/50966067.4 m³
Slope Affect	%5.662/50966067.4 m³
Landuse/Soil cover (ndvı) Affects	%18.411/165579013.3 m³
Soil Affect	%12.936/116339694.5 m³
Lithologic Affect	%57.298/515308582.0 m³
Amount of Total İnfiltration: 89934288.0 m³/4392 Km²=202.4 mm	
Rainfall (860.6 mm)	**Effect Levels of Natural Factors on Runoff (Runoff Rates/Amounts)**
Aspect Affect	%5.134/45637641.5 m³
Slope Affect	%6.437/57495961.3 m³
Landuse/Soil cover (ndvı) Affects	%18.416/163705260.4 m³
Soil Affect	%12.938/115009701.2 m³
Lithologic Affect	%57.045/507098884.6 m³
Amount of Total Runoff: 888929520.0 m³/4392 Km²=204.7 mm	

$$\sum (Q_{ct} I_{ct}) = Q_{ct} + I_{ct} = 202.4 + 204.7 = 407.1mm \tag{7}$$

Accordingly, for the infiltration level, coefficients such as flat areas 0.28, north-northeast, northwest facing face 0.20, south-southeast, southwest facing surfaces 0.15, east 0.17, west 0.20 are given, while for surface flow, flat areas are 0.10, north-northeast, southwest It was digitized by giving coefficients such as 0.25 for facing surfaces, 0.20 for south-southeast and southwest facing surfaces, 0.17 for east, 028 for west [30]. In digitization processes, the surfaces where the sun rays come at vertical and near vertical angles create negative effects on infiltration and surface flow as a result of increasing evaporation by heating more. On the other hand, the surfaces where the sun's rays come at oblique angles get warmer less, humidity conditions last longer and they create positive effects on infiltration and surface flow processes as the evaporation level decreases. According to the model application result, it can be said that the aspect factor is effective on 5.134% runoff and 5.662% infiltration levels.

Q_{ct} = annual average calculated total runoff; I_{ct} = annual average calculated total infiltration; $\sum(Q_{ct} + I_{ct})$ = annual average calculated amount of total infiltration and runoff. These calculated total infiltration and runoff values (formula 5) were compared with the actual current height data obtained from the streamgage gauging station no: 1805 located downstream of the basin (Table 4).

Table4. Current Height Data of Goksu Basin (1966-2017) (mm)

Months	O	N	D	J	F	A	M	M	J	J	A	S	Annual Average
The Current Height	13.64	16.51	30.59	38.74	43.00	74.92	87.29	53.80	26.61	17.47	13.98	12.65	429.23 mm

The purpose of this comparison is whether the calculated total infiltration and runoff amount meet the actual current height. For this purpose, the sum of the calculated infiltration and runoff amounts and the actual current height were correlated (Equation 8).

$$C_r = \frac{Q_{ch}}{Q_{ah}} = \frac{407.1mm}{429.2mm} = 0.95 \tag{8}$$

C_r = correlation rate; Q_{ch} = calculated annual average current height; Q_{ah} = actual annual average current height.

4. Conclusions

After all; the effect levels of natural criteria belonging to the Goksu basin on infiltration and runoff were determined by the successful application of the developed hydrological model. Accordingly, it can be argued that the lithology criterion has the greatest effect on infiltration and runoff, then the soil criterion comes second, but land use/cover and soil cover criteria are evaluated as a whole, it as a ratio of around 21.074%, so the soil criterion is considered more important. It has been observed that the slope and aspect criteria in the basin are the natural criteria with the least impact since they present values close to each other (Table 3). In addition, the validity of the level of influence of natural factors that affect infiltration and runoff has also been tested. İnfiltration and runoff amounts (Table 3) in the basin were calculated as 407.1 mm in total (Formula 5).

According to Formula 6, it has been determined to be quite successful with a correlation rate of 0.95 with the total infiltration and runoff amounts and the actual current height (Table 4).

Basing the study on actual data and supporting it with field studies played an important role in the digitization processes in the basin, such as determining the impact levels of natural criteria, and in hydrological processes such as determining the impact levels of natural criteria, and in hydrological processes such as infiltration and runoff. In addition, the Goksu Basin generally has a mountainous, rugged, karstic and fractured tectonic structure. It has been observed that these proportation of infiltration and runoff are quite consistent when compared to actual field observation.

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