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النمذجة المكانية لمخاطر السيول في حوض وادي الرطكة في الهضبة الغربية من العراق

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الكلمات المفتاحية

النمذجة

مخاطر

سيول

الملخص:

تناول البحث الخصائص الهايدرولوجية لمخاطر السيول في حوض وادي الرطكة في الهضبة الغربية في محافظة الانبار غرب العراق، وتم الاعتماد على المرئيات الفضائية وبرامج نظم المعلومات الجغرافية (G I S) وقد تم تحديد درجة مخاطر السيول لحوض وادي الرطكة واحواضة الثانوية من خلال تطبيق المعادلات الخاصة في تقدير مخاطر السيول.

Spatial modelling of flood risk in the Wadi Al-Ratka basin in the western plateau of Iraq

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Abstract:
The research addressed the biological characteristics of flood risk in the Wadi Al-Tarka basin in the western plateau in Anbar province in western Iraq, and was based on satellite visuals and G I S programs and the degree of flood risk for the Wadi Al-Tarka basin and secondary basins was determined by applying special equations in estimating flood risk

Keywords:
Modeling
Danger
flood.

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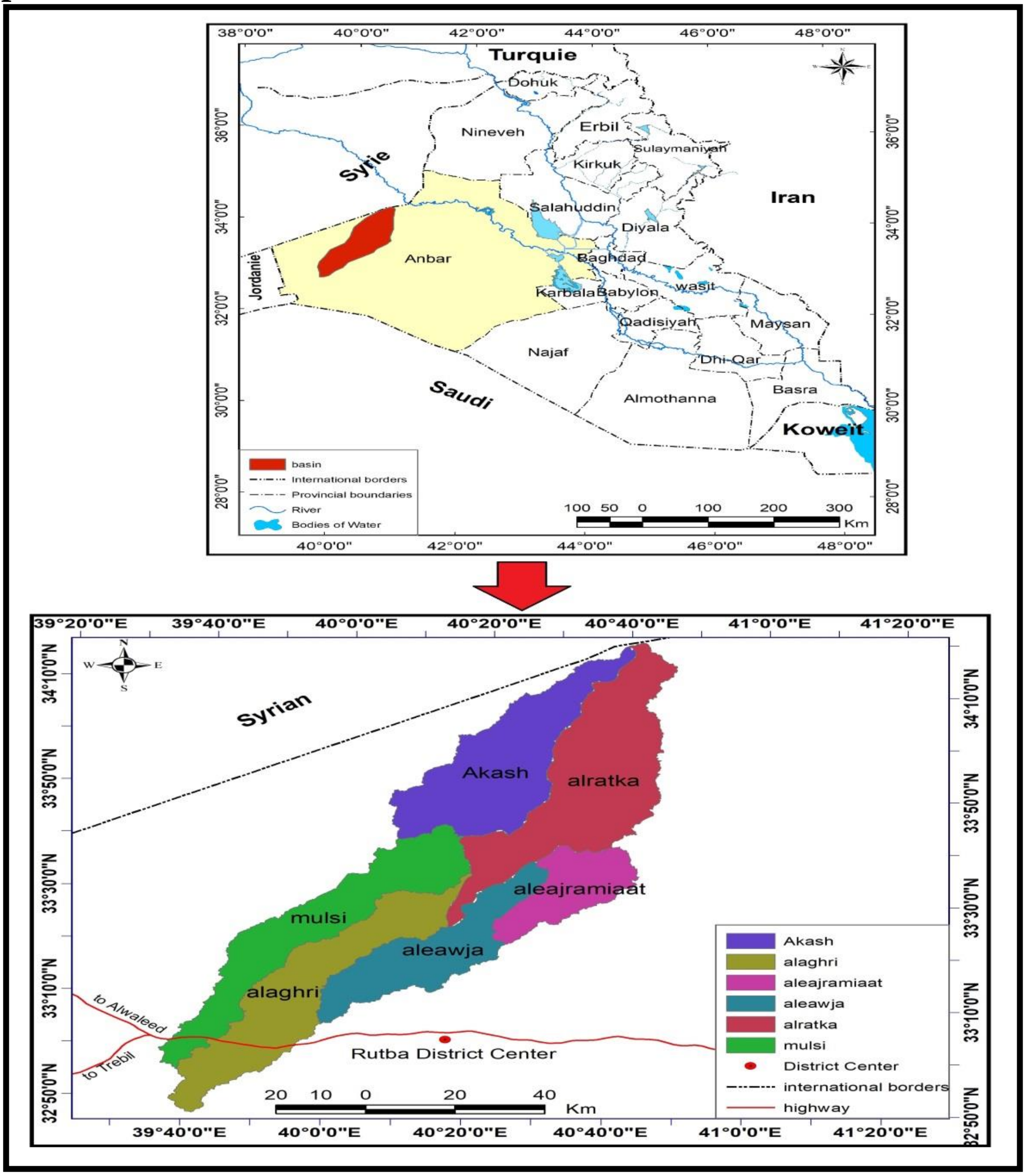
Introduction

Hydrological studies are interested in the study of aquariums because they are of great importance in dry and semi-dry regions, because they are full of amounts of water in those areas and suffer from a shortage of water resources, that the need for additional efforts in this area is mainly to commission studies to solve the problems of aquariums, especially the problem of flooding that the problem of predicting surface water flow resulting from a rainstorm on a particular basin still constitutes a great interest in hydrological studies, This problem is all the more important in seasonal and temporal flow basins, which are often unscathed basins.

Research problem: Is it possible to estimate the risk of floods in wadi al-Tarka's main basin and secondary basins. Research hypothesis: Flood risk can be estimated by relying on space visuals and GIS programs. Research objective: The research aims to identify the risk of floods according to the spatial variability of the Wadi Al-Tarta basin and secondary basins and divide it into mattresses according to the degree of risk by analyzing a range of hydrological transactions directly related to runoff and flood risk occurrences in the basin. Location of the study area: Wadi Al-Tartaa Basin location: Astronomical location: The basin is located between lines 39 30 00-45 00 east and two galleries 32 45 00 - 34 15 000 south. As for the natural location of the basin: the basin is located naturally within the western Iraqi plateau and the administrative site: the Adarria basin in western Iraq is located within Anbar province in al-Rutbah district.

The hydrological factor is the size of water available on the surfaces of the basins, as the amount of water is affected by several factors that help to increase or decrease significantly, namely the amount of rain distance in the basins and other factors such as regression, geological installation and natural plant the basins in the study area are part of the western desert region of Iraq, i.e. within the dry range, resulting in a decrease in rainfall, as well as the absence of rivers and lakes permanently flowing in the area, The rains fall suddenly and in large quantities and for a short period, part of which seeps into the soil and the other section is spilled into the valleys so that torrents are sweeping to have a significant impact on the changing features of the surface of the earth, these floods extend the main valleys

Map (1) Location of Wadi Al-Tarka basin from Iraq and Anbar province



Source: Ministry of Water Resources, General Authority for Space, Iraq Administrative Map, Scale 1:1000,000 for 2010

such as Wadi Okashat, Wadi Al-Awja, Wadi Al-Ghari, Wadi Al-Ajramiat, Wadi Al-Tarta, and in turn pose risks, and these rains increase the concentration of sediment, as the rains increase the processes of soil erosion and exposure of rocks directly from the weather factors During erosion, hydrological factors are a reflection of climatic conditions and the characteristics of drainage basins, as they are the main indicators for determining the hydrological budget ...

1. *Concentration timeTC,*

the time period after which the rate of runoff is equal to any increase in the rate of precipitation, and the higher the focus time, the greater the runoff uses the concentration time equation to calculate the duration of the rainstorm and to know the time covered by the water to reach the infected, as well as to classify the risk of runoff in the aquariums depending on the speed of water reaching its estuaries, thus determining the degree of risk on its surfaces adopted in calculating the concentration time in the basins of the study area. Stephen's equation is:

TC= (0.00013)*(L1.15)*(H0.38)

TC =Focus time

L = The length of the main stream

H = The head difference between the highest points in the basin

= ٠.٣٨ ، ٠.٠٠٠١٣ Constants

The results showed a variation in Tc values at the basin level, noting that the overall rate (7.5), while the "slurry, al-Agri, tartan" values, which reached concentration time values (2.2,2.5, 2.9), respectively, were within the low-risk degree, while the Awaja basin, Okashat (1.5,1.9) respectively within the degree of "high risk", while the basins (Ajramiat) which reached (0.5) within the high risk, as these values reflect the time difference between the speed of water access between the Valley of Tarka and the criminals is evident By classifying the risk scores of drainage basins of flood fans in the study area according to the focus time factor. N There are a combination of factors affecting the strength and speed of the arrival of torrential waves from upstream to downstream, which cause a variation in their concentration time, including the morphological characteristics of the basins, the degree of decline, geological structure, vegetation and the narrow width of the valley, as the speed of flow increases in the narrow valleys, as a result of their failure to absorb the volume of running water.

Table (1) Hourly and precise focus time for study area basins

Focus time per hour	Focus time per minute	height difference m	duct length	basin name

1.9	115.0	355	95	Eakash
2.2	131.7	342	113	Mulsi
2.5	147.2	357	121	Alaghri
0.5	29.5	234	37	Aleajramiaat
1.5	92.7	320	85	aleawja
٢.٩	١٧٦.٤	٤١٤	١٢٥	Alratka
7.5	448.8	580	227	Main Valley

Source: Dem Digital Height Model Blindness using Arc Map 10.5

2. idle time

Lag Time is the time when basins respond to precipitation (hours) to reach the highest discharge levels (peak), called the first response time, which is the time between the beginning of the rainfall and the beginning of the jars, this factor is an important factor strongly affecting the amount of loss, as large amounts of water seep into the soil during this period. LT (hr) = CT (Lb Lca) 0.3 Lb=main course length (km) Lca = distance between the estuary of the basin and its center of gravity (km) CT = peak flow time coefficient which is specific to the nature of the basin and its degree of slope and its value ranges from (1.8 - 2.2 By applying the previous equation to the study area basins, and through table (2) and map (3), we note that the overall rate of slowdown time (24.0) hours, and tp values ranged from the highest value (16.8) hours in the Wadi Al-Ratka basin While the values (7,7) hours were recorded in the Wadi Al-Ajramiat basin, we note the variation in the slowdown time in the study area basins, due to the variation in the area of the basins, the decline and the density of discharge.

Table (2) Slowdown Time (TP) per hour for study area basins

idle time/ hour	duct length	The distance between the mouth of the basin and its center of gravity /	basin name
14.5	95	42.4	Eakash
16.2	113	51.7	Mulsi
16.7	121	53.8	Alaghri
7.7	37	13	Aleajra miaat

12.4	85	28.5	aleawja
١٦.٨	١٢٥	٥٣	Alratka
24.0	227	95.5	Main Valley

Source: Dem Digital Height Model Blindness using Arc Map 10.5

3. Base time for torrents

The base duration of the torrent is defined as (the duration of the flow remaining in the aquarium from its source to its mouth and the base duration of the torrent is calculated (day) (days) Time base:

$$Tb\ (days) = 3 + \frac{tb(hr)}{8}$$

Tb (days) =: Base time for torrent (day) Tp = water basin response period for rainfall/hours (deceleration time)

By applying the previous equation to the study area basins, and through table (3) and map (4), we note that the overall base time rate of the torrent (00,6), tb values ranged from the highest value (10.5 (Yum) in the Basin of Wadi Al-Tarka, while the lowest values (96, 3) were recorded in the Basin of Wadi Al-Ajramiat, we notice the variation of the base time of the torrent in the basins of the study area but by a very small margin, and the reason is the similarity in geological and climatic conditions And the rainfall rates

Table 3, tb day base time for study area basins.

Base time for torrents/day	basin name
4.81	Eakash
5.02	Mulsi
5.09	Alaghri
3.96	Aleajramiaat
4.55	aleawja
٥.١٠	Alratka
6.00	Main Valley

Source: Dem Digital Height Model Blindness using Arc Map 10.5

4. Duration of gradual rise in flood flow Tm (hr) :

Is the time required for the gradual rise of rainwater at the bottom of the valleys after the occurrence of the accurate tracking of surface deposits and seepage through leakage, and some evaporation the end of the rain storm, assuming the continuity of precipitation so that the falling quantities allow this rise to occur until the floods flow from the upper and central valleys to the lower sectors towards their estuary, this period is calculated according to the following equationTm (hr) =$\frac{1}{3}$Tb(hr)

= Tm period of gradual rise of flow (hours), which represents on the hydrograph the duration of the period from the beginning of the flow flow to the duration of its peak on the curve. = Tb (hr) base time for calculated torrent (hour). By applying this equation, the results are evident in table 4 and map (5), showing that the overall rate of gradually rising flood flow in study area basins was 2.00 hours, and tm values ranged from the highest value (70). 1) An hour in the Valley of Al-Agri basin, while the lowest values (1.32) per hour were recorded, there are many factors affecting the determination of the time of gradual rise of the flow of floods in the basins, including the type of surface sediments, and the nature of the rocks characterized by porous and run-out few, resulting in rapid running despite the lack of precipitation.

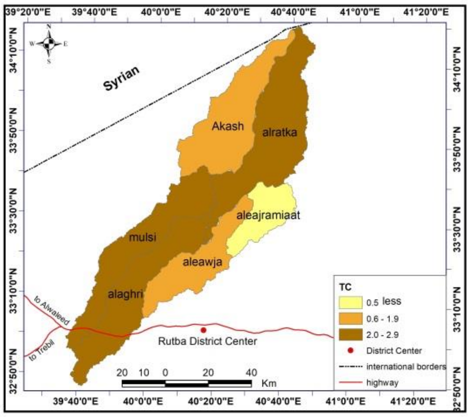
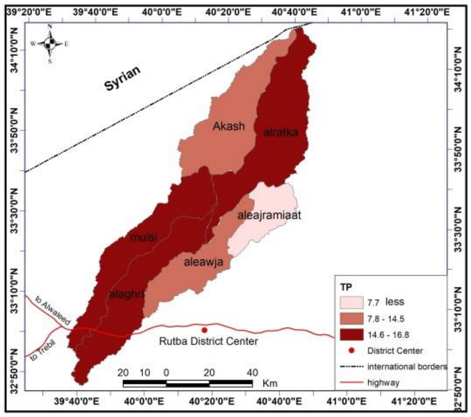
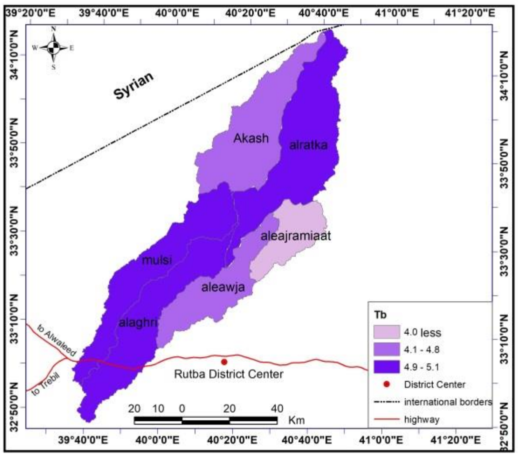
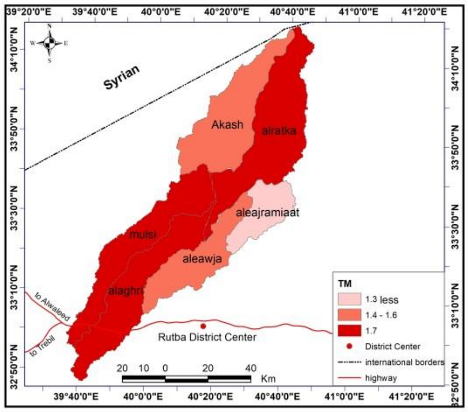
Table (4) Gradually rising flood flow time/hr for study area basins

Flood flow gradual rise time/hour Tm(hr)	basin name
1.60	Eakash
1.67	Mulsi
1.70	Alaghri
1.32	Aleajramiaat
1.52	aleawja
١.٧٠	Alratka
2.00	Main Valley

Source: Dem Digital Height Model Blindness using Arc Map 10.5

5. Duration of the gradual decrease in torrential flow (Td):

Is the duration of the peak flow to the end, i.e. the time needed to start the decline of the torrential flow, in which the water begins to decrease its levels and the small sizes of its expenses and the decrease in the speed of its flows with the beginning of the decrease of rainfall and calculated by applying the following equation:

Map (2) hourly focus time for study area basins	Map (3) slowdown time (TP) per hour for study area basins
	
Map (4) Base time of torrents (Tb day) for study area basins	Map (5) Time of gradual rise of the flow of floods an hour for study area basins
	

Source: Based on table(2) and using Arc Map 10.5.

$Td\ (hr) = \frac{2}{3} Tb\ (hr)$ The gradual decline time of the flow of torrent calculated in hours = ((Td (hr base time of the stream calculated (hr)=) the results of the application of the equation are evident in table (5) and map (6), where the overall rate of gradual decline of drainage basins in the region (4.0) 0) Hourly values (TD) at the level of the basins of the region ranged from (3.4) hours in the basin of both al-Agri and Tarka, and between (2.6) hours in the basin of the ajramiat .

table (5) the duration of the gradual decline of the flow of floods to the basins of the study area

Duration of the gradual decrease in torrential flow (Td):	basin name
3.2	Eakash
3.3	Mulsi
3.4	Alaghri
2.6	Aleajramiaat
3.0	aleawja
٣.٤	Alratka
4.0	Main Valley

Source: Dem Digital Height Model Blindness using Arc Map 10.5

6. Duration of torrential flow/hour

Estimate the duration of runoff: the time it takes for water to reach the basin's streams and tributaries to reach the estuary, measured by measuring the width of the hydrograph curve (peak of the disposition curve), and by applying the following mathematical relationship: T= N*hr as it represents: T= The time it takes to complete the run-up to the end (hour) N= fixed value (5) Hr = deceleration time (hour) the results of applying the equation in table (6) and map (7) are clear, as the overall rate of the duration of the run Td values at the level of the region's basins ranged from (16.8) hours in the Tarka basin, and wyn (7.7) hours in the Ajirami basin

table (6) the duration of run-off of the study area basins.

Duration of torrential flow/hour	idle time/hour	basin name
72.4	14.5	Eakash
80.9	16.2	Mulsi
83.6	16.7	Alaghri
38.3	7.7	Aleajramiaat
62.1	12.4	aleawja
٨٤	١٦.٨	Alratka

119.9	24.0	Main Valley

Source: Dem Digital Height Model Blindness using Arc Map 10.5

7. The speed of runoff: -

Is the volume of water through the river section during the unit of time, the promise of measuring the speed of flow indicator to know the danger of the drainage basin during runoff, there are several ways to measure the speed of flow such as calculating the speed of movement of water from one place to another, as well as calculating the distance it travels through its section distance over time, which is the most expensive method that is very expensive so it can be measured by the equation: (Imran, Abdul Rahman, 2018) V= L/Tc in the valley streams, the speed of flow can be calculated and estimated according to the following equation: V= L/tc: V=Flow Speed L = Length of drainage basin (km) Tc = focus time (hour) of table (7) and map (8), The speed values of runoff are evident in the study area basins, with a total rate of basins (67,25 km/h), and the Wadi Al-Tarka basin represented the largest capacity at 37.59 km/h while the lowest speed of the gonorrhea in the basin Jams reached (96, 58) km hours, the degree of risk of floods on the surface of the basins can be determined according to the speed of the jars, that the more the speed of flow the basins are more dangerous and on the contrary, the reason is the large area of the basins as well as the low slope of the surface and the length of the ...

Flow speed km/h	Focus time per hour	Maximum pelvis length/km	basin name
43.84	1.92	84	Eakash
43.27	2.20	95	Mulsi
42.79	2.45	105	Alaghri
58.96	0.49	29	Aleajramiaat
47.89	1.55	74	aleawja
٣٧.٥٩	٢.٩	١٩٢	Alratka
25.67	7.48	192	Main Valley

Source: Dem Digital Height Model Blindness using Arc Map 10.5

rainfall time

The ideal time for rainfall on drainage basins and symbolized by the symbol (Tr), which is the volume of water across the river section during the unit of time, the speed of run-off in the valley streams is one of the most important morphometers of drainage basins because it determines the degree of gravity of the valleys, as well as their ability to sculpt and transport sediments, and measure the speed of flow in rivers and waterways in multiple ways and using different devices, the speed of flow can be calculated and estimated by applying the following equation (Zubeidi),

$$Tr\ (hr) = \frac{tp(hr)}{5.5}$$

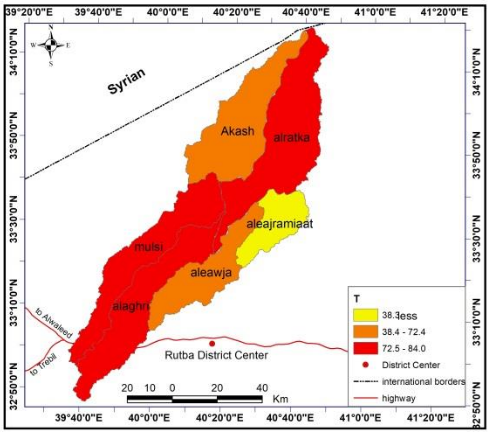
Tr (hr) = ideal rainfall time calculated by Tp (hr) = water basin response period for rainfall calculated (hourly) Tr (hr) = tp (hr) / 5.5 Tr (hr) = ideal time for fall Rainfall calculated by the hour Tp (hr) = the period of response of the aquarium to the rainfall calculated (hourly) and by applying the previous equation to the basins of the study area, and through table (8) and map (9), we note that the overall rate of rainfall (36, 4), Mr. values ranged from the highest value (3.5) in the Wadi Al-Tarka basin, while the lowest values (39,1) were recorded in the Wadi Al-Ajramiat basin, we notice a variation in the ideal period of time for rainfall in the basins of the study area but by a small margin, due to similarities in geological and climatic conditions and falling rainfall rates.

Table (8) Ideal rainfall time for study area basins

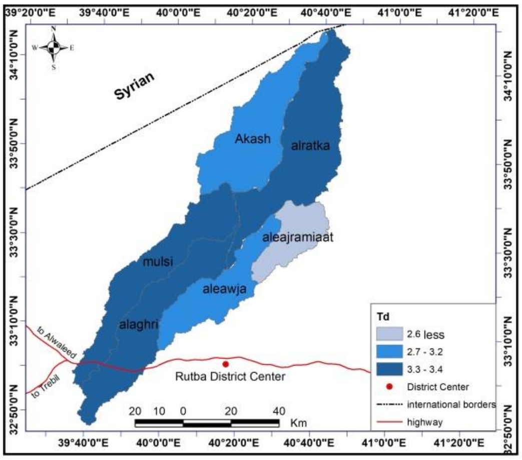
Tr	basin name
2.63	Eakash
2.94	Mulsi
3.04	Alaghri
1.39	Aleajramiaat
2.26	aleawja
٣.٠٥	Alratka
4.36	Main Valley

Source: Dem Digital Height Model Blindness using Arc Map 10.5

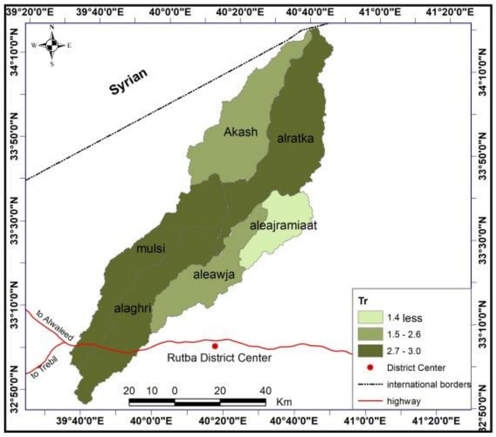
Map (6) Duration of gradual decline in flood flow to study area basins



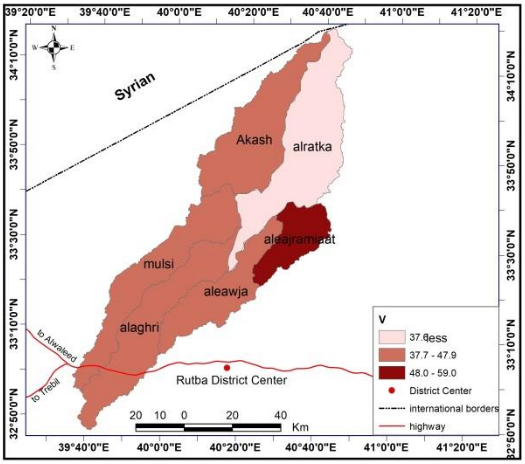
Map (7) duration of runoff of study area basins



Map (8) The speed of runoff of study area basins



Map (9) Ideal rainfall time for study area basins



Source: Based on table(7) and using Arc Map 10.5.

9. Flow volume

The volume of flow is an increase in the amount of rain from the amount of water loss by leakage, it refers to all the water flowing in the dry basin drainage system, and occurs when the intensity of the rain exceeds the capacity of the basin to absorb it, as large amounts of water are concentrated in the basin or in part and the speed of running water becomes high causing flooding, and the volume of flow indicates the volume of discharge that the river network can contain and measured in thousand cubic meters can extract the size of the water Flow using the following equation: Qt (m3/s)=∑ (km)0.85: Qt (m3/s) = flow volume (1,000 m3) ∑L (km) = total pelvic duct lengths (km) 0.85 = fixed foundations reflecting pelvic conditions By applying the equation above, the results are evident in table 9 and map (10), where the overall rate of runoff in the region's basins (902) ranged from (277) to the Wadi Al-Tarka basin, where it represents the highest volume of run-off in the study area basins, and between (104) basins Ajramiat represents the lowest rate in drainage basins in the region.

Table (9) Flow volume of study area basins

Flow volume (thousand cubic meters)	Total lengths of sink ducts km	basin name
216	559	Eakash
215	554	Mulsi
207	529	Alaghri
104	235	Aleajramiaat
161	396	aleawja
٢٧٧	٧٤٨	Alratka
908	3019	Main Valley

Source: Dem Digital Height Model Blindness using Arc Map 10.5

10. Maximum flow value of floods (Qp):

This value is used to determine the maximum flow of water torrents that can reach valley streams in the event of strong torrential activity, maximum flow values can be calculated in fan basins. Maximum flow values in basins can be calculated by the following equation:

Qp (m^3/s) $= \frac{CPA}{tp(hr)}$Qp (m3/s) = maximum flow amount of flow in drainage basin (M3/tha) A= basin area (km2) Tp (hr) the duration of the discharge basin's response to precipitation (hour)= Cp=(2.0-6.5) coefficient associated with susceptibleity Water storage drainage basin, ranging in value from the results of the use of maximum flow value factors in the region's basins as in table (10) and map (11), showed that the maximum flow rate in the region's basins reached (865.07) m3/tha, while flow values ranged Floods at the level of basins build (36. 206) m3/tha for the Awaja basin and (21.303) m3/tha basin wadi al-Tarta.

Table (10) Maximum flow value of flows to study area basins

Qp(m3/s)	basin name
277.46	Eakash
224.26	Mulsi
229.30	Alaghri
210.51	Aleajramiaat
206.36	aleawja
303.21	Alratka
865.07	Main Valley

Source: Dem Digital Height Model Blindness using Arc Map 10.5

11. The fixed leakage value,

which is the maximum rate at which water can penetrate into the soil, and the rate of leakage in wet soils is initially lower during all times of the storm, and then decreases in all soils during the duration of the storm, i.e. the leaching speed varies for a particular rainstorm over time, and is calculated according to the following equation: Carson and others, 1979) and the leak value is extracted according to the following equation (Fp = A*Td*0.0158 as it indicates: fixed leak value Fp: Area A: Td disposal time: by applying the previous equation to the study area basins, and through the table (11) And map (12), we note that the overall rate of fixed leakage value (0, 437), the values (Fp) ranged from the highest value (91.2) in the Basin of Wadi Al-Tarka, while the lowest values (4, 22) In the permations, we note that the value of leakage in the study area basins varies significantly, and the reason for the different geological and climatic conditions and rainfall rates.

Table (11) Fixed leakage value of study area basins

Fp قيمة التسرب	basin name
67.8	Eakash
64.0	Mulsi
68.5	Alaghri
22.4	Aleajramiaat
41.0	aleawja
٩١.٢	Alratka

437.0	Main Valley

Source: Dem Digital Height Model Blindness using Arc Map 10.5

12. **Classification congratulations grades dangerous floods on** basins in the area determine the degree of risk of floods in the basins of the study area was integrated the group of hydrological transactions of basins represented by the size of runoff (3m) QT concentration time Tc, deceleration timeTp speed of runoff V time The basis of the Tb torrent, the time of the gradual rise of the flow of torrents (Tmhr), the time of the gradual decline of the calm of the floodwaters (Idhr), the value of the maximum flow of torrentqp, for the purpose of extracting the degree of risk of floods on the basins, has been the work of a final classification of the degree of gravity Basins, having collected previous variables of (11) variables, have given each basin (3) degrees of gravity, and the number of variables (33) has become variable, the results of the final classification have appeared in table (12), and map (13).

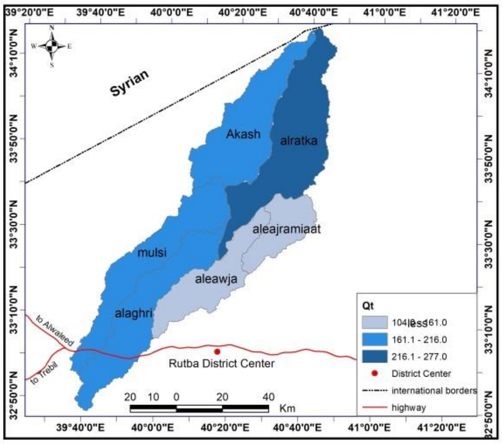
table (12) results of the final classification of the risk grades of the study area basins

The degree of danger	المجموع	Tc	Tp	Tb	Tm	Td	T	V	Tr	Qt	Qp(m3/s)	Ep	basin name
Low Danger	21	2	2	2	2	2	2	2	2	2	1	2	Eakash
high Danger	28	3	3	1	3	3	3	3	3	2	2	2	Mulsi
high Danger	28	3	3	1	3	3	3	3	3	2	2	2	Alaghri
Low Danger	17	1	1	3	1	1	1	1	1	3	3	1	Aleajra miaat
Low Danger	23	2	2	2	2	2	2	2	2	3	3	1	aleawja
middle Danger	27	3	3	1	3	3	3	3	3	1	1	3	Alratka
middle Danger	27	3	3	1	3	3	3	3	3	1	1	3	Main Valley

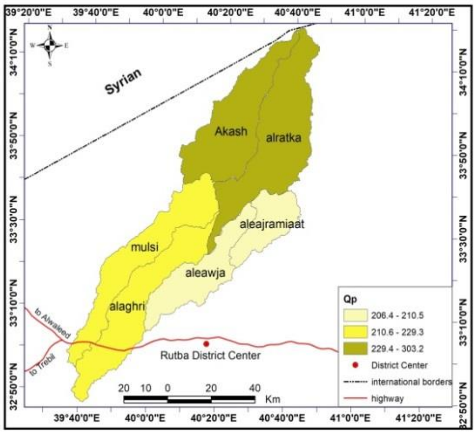
Source: From the researcher's work based on the results tables of previous equations.

From the previous table, we can estimate the severity of runoff of basins in the study area as follows: - low-risk basins (1-11) there are no - medium-risk basins (12-23 degrees: includes (okasat, warp and permome) - high-risk basins. 24-33 degrees: Includes (Malasi, Al-Agri and Tarka) *

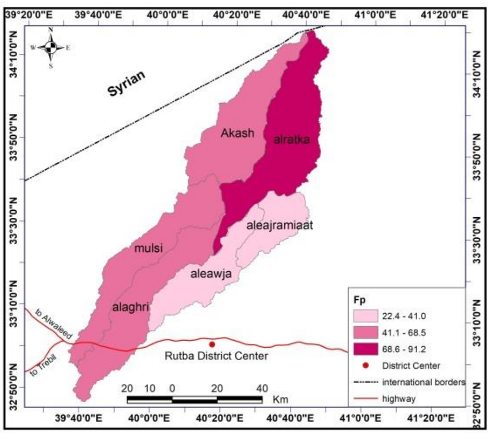
Map (11) Maximum flow value of flows to study area basins



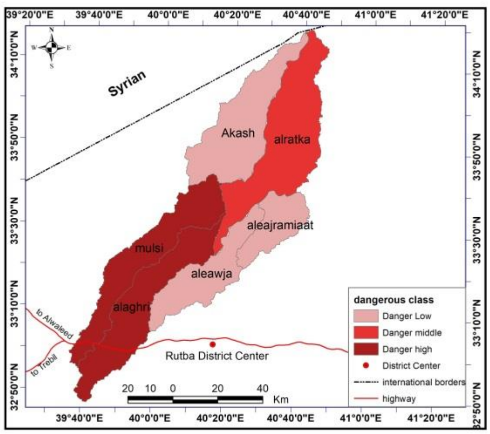
Map (10) flow size of study area basins



Map (13) Classification of flood risk in study area basins



Map (12) fixed gear value of study area basins



Source: Based on table(9) and using Arc Map 10.5.

Conclusions: 1- The fall of rain suddenly and in large quantities and for a short period, part of it leaks into the soil and the other section flows into the valleys so that the torrents will be as sweeping as in the Valley of Tarka, Wadi Okashat The Valley of Ajramiat, Awaja, Wadi

Malasi, Wadi Al-Agri, which in turn leads to dangers in the streams of those valleys. 2- Through research, the most important hydrological characteristics of the basins were highlighted by applying a range of hydrological transactions, thus determining the severity of the floods on the surfaces of those basins. 3- Through the research, two basins (al-Malasi and Al-Agri) fell below the high-risk level of torrents (24-33) and the basins (Tartaka are located below the level of medium-risk torrents (12-23) and basins (Okashat, aghrat, Awaja) are low-risk between (1-11).

Proposals: 1- Establishing an accredited network of monitoring stations and measuring the amount of rain and wind trends for the purpose of obtaining data on climatic elements in general and rainfall in particular for the purpose of adopting them to study any future project on the surfaces of the basins. 2- To create and develop a database within the GIS environment for flood risk on the roofs of the study area basins, where it contributes to early prediction, reduction or reduction of losses in various decision-making, and use it when planning the construction of various engineering projects in the future on the roofs of the basins, and the development of controls and restrictions on land use and various activities. 3. The construction of several dams in Wadi Al-Tarka and other secondary valleys that are branching from it, and the dams contribute to reducing the risk of floods on land uses.

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