Research Article

Modeling of the Terrain features of Zliten water basins (Kaam-mager) using GIS

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Abstract

Modern technologies have provided great possibilities in studies of the surface of the earth, especially the study of water basins in terms of analyzing the characteristics of those basins in terms of slopes, heights, levels, and others. The research dealt with the detection and analysis of the topographic characteristics of the basins of the Gamaam Majer valley within the administrative boundaries of the Zliten region. The research concluded a number of conclusions, the most prominent of which is the preference of GIS in geomorphological studies, as it provides the easiest and easiest ways to deal with maps.

Keywords: Terrain features of Zliten ,water basins, GIS

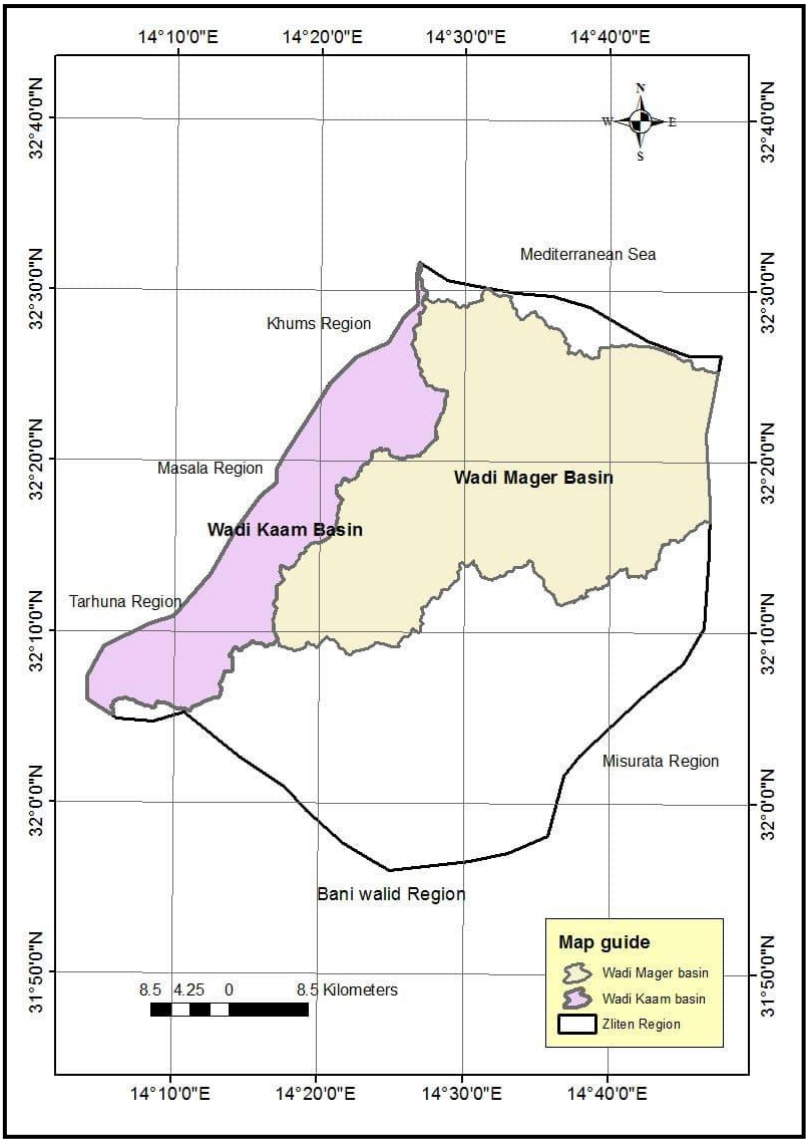
Introduction

The use of modern techniques in natural studies is an important matter, especially geomorphological studies. Information systems have been involved in a large number of geomorphological studies in developed countries since the second half of the twentieth century, and have developed greatly in the other two decades (Khattab, 2003, p. There are great possibilities in terrain studies, especially the study of water basins, in terms of analyzing and interpreting the characteristics of these basins. Machine modeling is one of the most important means to address several problems, so the model is a simplification of a complex reality, and each model has a pictorial role that is based on a mathematical language, and the model is a construction and discovery of reality, that is, it does not represent the given reality, rather it is a creation of it (Hady et al., 2017, p. 59) .

The aim of study to use geographic information systems in the study of modeling the terrain features of the basins of the Wadi Gama Majer as part of the Zliten region, where it is modeled in digital form by providing automatic methods, and analyzing spatial reference data, i.e. measuring the terrain features of the basin automatically.

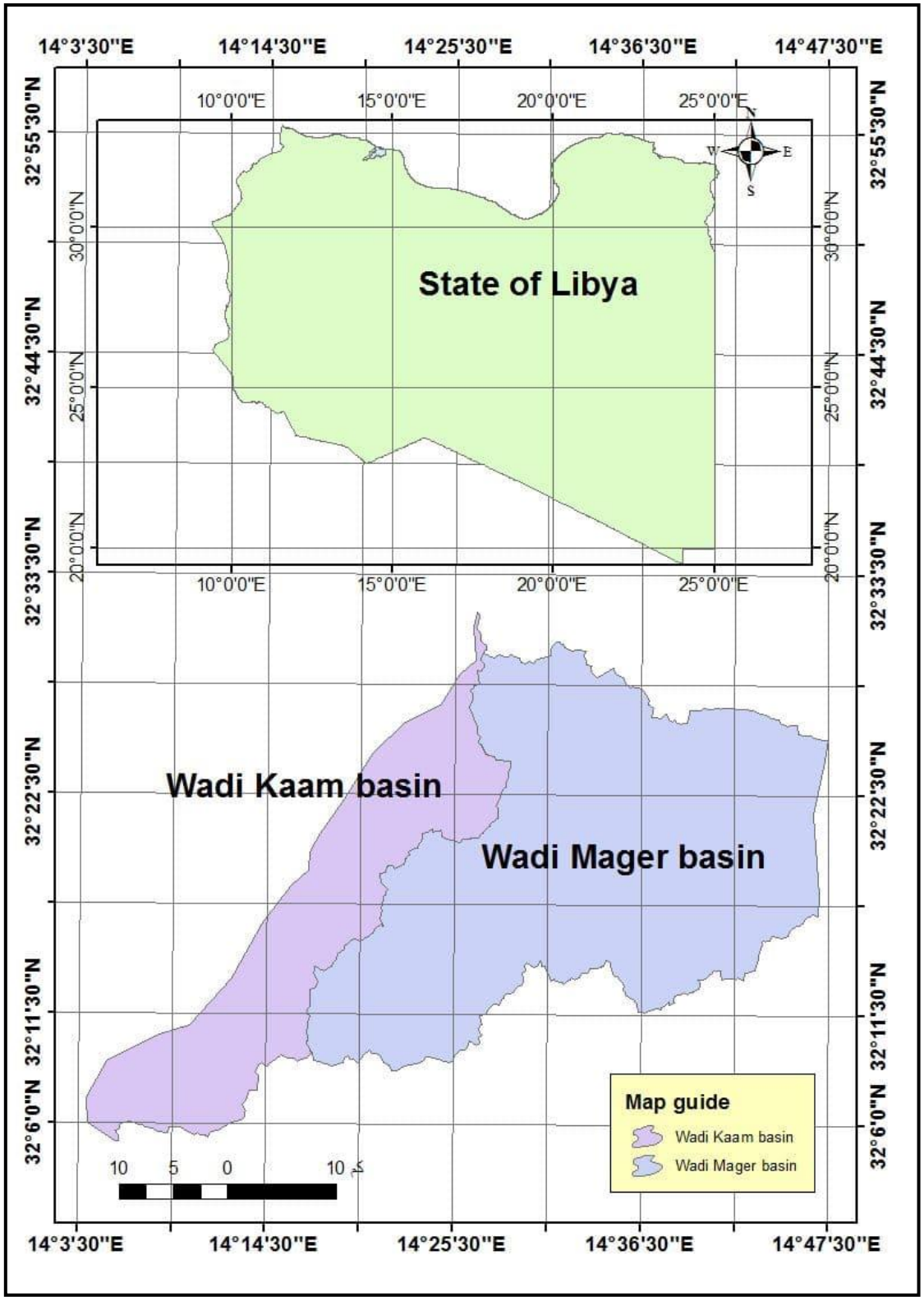
Geographical location: the study area is represented in the basins of Wadi Kaam and Majer, within the administrative boundaries of the Zliten region, the basins of the area are located between the latitude 55 31 and 30 32 north, and between longitudes 10 14 and 14 45 east, Map (1)

Map (1) of the location of the study area



Source / researcher's work based on the digital elevation model (DEM) and using a program

Map (2) of the location of the study area in Libya



Source / researcher's work based on the digital elevation model (DEM) and using a program. ARC GIS 10.3

Study problem: The study will try to answer the following questions:

1.Can information systems technologies produce databases that model the topographic characteristics of valleys?

2. What are the topographic characteristics of the study area?

Study hypotheses:

.1.There is a relationship between geographic techniques, speed and topographic analysis

2. The techniques of geographic information systems are an ideal tool for spatial analysis.

the importance of studying

.1.Highlight the importance of geographic information systems in analyzing terrain characteristics

2. Design thematic maps using contemporary technologies.

Terminology of study

1.Terrain sector: a line that represents the general shape of the Earth's surface, and its proportions along the M line. The .(line may be straight and in a horizontal, vertical or sloping position on the map. (Jad Allah, 1984, p.65

2.Modeling: It is one of the means of understanding what is happening on the surface of the Earth, and spatial .(relationships can be understood from models, manipulated and simulated reality (Jafar, 2018, p.10

3.: DEM Digital Elevation Models A digital representation and simulation of the Earth's surface.

Geological construction

The study of the geological structure of the basins contributes to the understanding of many facts about the geomorphological development of the basins, as the patterns of water drainage of the basins differ according to the different rocks and their types. Tectonics caused a decrease in the level of the base (Mustafa, 1989, p. 170), the nature of the geological structures in the region, like other regions located within North Africa, where it was subjected during its long life to tectonic movements and climatic changes accompanied by the tyranny of the sea and its decline through the times, especially the third and fourth times Where a downward movement occurred as a result of the tyranny of the sea that engulfed the whole region, then turned into dry land with the beginning of the Pleistocene with a new uplift movement. Most of the formations that unfold the surface of the region go back to the Pleistocene and Holocene eras, where they are found in the form of modern formations and sediments. The geological sequence of the region is related to the geological events that occurred in the north of Libya as well as in the northwest, more precisely, considering the region is part of the northwestern parts of Libya, so it is natural that its effects are reflected in the geomorphological nature of the region.

Geological formations

The geological formation of the region's basins is characterized by lack of complexity, as there is a general prevalence of geological formations dating back to the fourth time, these formations appear on the surface in most parts of the region, and the system of their construction is the basis for the formation of the basins 'manifestations and then comes the role of climatic conditions at intervals of time in showing the geomorphological features of the basins The study area, and looking at the geological maps of basins, it becomes clear that it includes many geological formations that were formed over different times, the oldest of which belongs to the second time, which appears in several formations in most parts of the basins, and the third time formations are represented by the khums formation, which appears in all basins, while The fourth time formations cover different parts of the basins with different configurations.

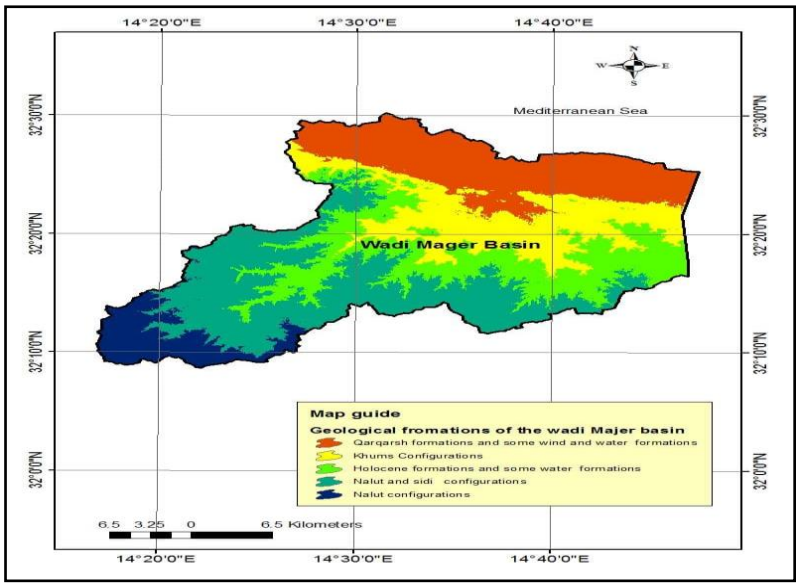
The classification of these geological formations spread over the basins can be summarized based on the geological map as follows, from oldest to newest

Second time configs

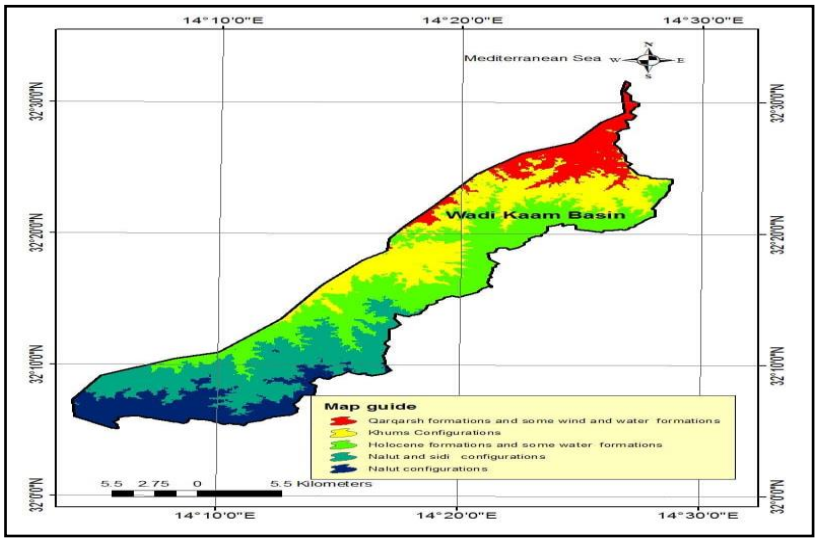
It is represented by the formation of Nalut and the Master of Hunting. The first formation is located above the second formation in different areas of the basins of the region, but it is less identical in the formation of hunting at times. With

high permeability and between limestone and marmalade hunting formation stones, The fishing formation below the Nalut Formation is one of the oldest formations in the region consisting of the highly depleted Dolomitic limestone with quartz intrusions. These two formations are spread in the central, eastern and western parts of the Wadi Majir basin, while the Nalut formation is less mixed in the southern parts of the basin (Map 2). As for the Wadi Kaam basin, the formations in the south-eastern and southwestern parts appear more widespread than the rest of the parts.

Map (2) Geological formations of Wadi Majer Basin Map



(3) Geological formations of Wadi Majer basin



Source / Researcher based on the geological map of Libya, previous source.

Third time configurations

This formation is confined to the middle Miocene rocks, and among the most important formations of this time are clay, limestone, clay, and calcanite. These formations are locally known as the Khums formation. This formation appears in the basins of the region. The fossil deposits in this formation indicate that the region's terrain was formed by erosion factors, as it became in the form of highlands and depressions in the Miocene stage. The formation of the fifth is evident in some northern and central parts of the Kaam Basin Map (3), while it is evident in the Wadi Majer basin that it extends in some The central parts of the basin, as well as the case in some eastern and western parts.

The formations of this time cover large areas in the basins of the study area, which can be divided as follows

1. Pleistocene Age configurations

Belongs to the Pleistocene era, the Gergaresh formation in the study area, which is a beach sand coherent with clay materials, sometimes exchanging lenses of silt, and these sandy sediments in intermittent places contain granular crystals with small proportions of calcium carbonate that help to hold it together. Noticeable in the northern basins of the valley.

2. Modern Holocene configurations

The formations of this time are among the most widespread sediments in the study area, and they consist of sections that arose according to the conditions that formed them

1.Valley deposits

They are found along the valleys and are mostly composed of inconsistent sand with some gravel deposited by the torrents that extended over successive periods of time and which are still forming and accumulating to our present time, as well as containing varying amounts of calcium carbonate and gypsum. These formations can be observed in all valley streams In the study area

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2.Wind water deposits

They are fine sands, gravel and silt that were transported by running water or torrents in the modern era, their formation due to re-sedimentation resulting from the erosion of various rocks by wind and water from high places, they appear in all basins of the study area, they can be seen in the central parts of the Wadi Basin Majer, while in the basin of Wadi Kaam, it covers most of the central and eastern parts.

First: General features of pond topography

Most of the basins of a region are characterized by little grouse and slope due to the lack of large elevations, in addition to the low difference in the height level of the basins, the topography of the basins is only an interaction between several factors, the most important of which are the geological and climatic characteristics. And height and others. Not to mention the hydrological indications such as the direction of flow, accordingly the most important general features of basin topography can be summarized as follows:

Elevations: The values of elevation levels in the basins of the study area vary from one basin to another, as it is confined between (0-308) meters above sea level. The height difference is divided into eight categories, which can be summarized as follows Wadi Majer Basin: It is considered one of the largest basins in the region and through the map (4) it is possible to observe the diversity of the levels of the basin surface, which shows that the Wadi Majer basin ranges between (0-206) meters above sea level, and as a general average of 89.43 meters, it is found that the basin is gradual It decreases downstream towards the sea to be the lowest point in the Al Baza area near desalination (0).

The first category: its height ranges between (0-32) meters above sea level, the area of this class reached 164.64 km2, with a rate of 15.59% of the total area of the basin, which are areas with very light slopes that extend over a large area north of the basin that overlooks the sea.

The second category: the height of this category ranges between (32-56) meters above sea level, the area of this class reached 103.93 km2, with a rate of 10.5% of the basin area, extending in some areas overlooking the sea, while most of it extends in the north of the basin south of the previous category.

The third category: the height of this category ranges between (56-79) meters above sea level. The area of this class reached 136.61 km2, with a rate of 12.93% of the basin area.

The fourth category: Its height ranges between (79-100) meters above sea level, its area is estimated at 152.25 km2, and by 14.41% of the basin area. This category ranks fourth in the ranking of categories and fourth in area.

Fifth Category: The height of this category ranges between (100-118) meters above sea level. The area of this class reached 164.12 km2, with a rate of 15.54% of the basin area.

The sixth category: ranging from (118-135) meters above sea level, the area of this category amounted to 200.20 km2 with a rate of 18.96% of the basin area, this category tops the rest of the categories in area, extending in some southern parts, the eastern central eastern edges of the valley, and some western parts .

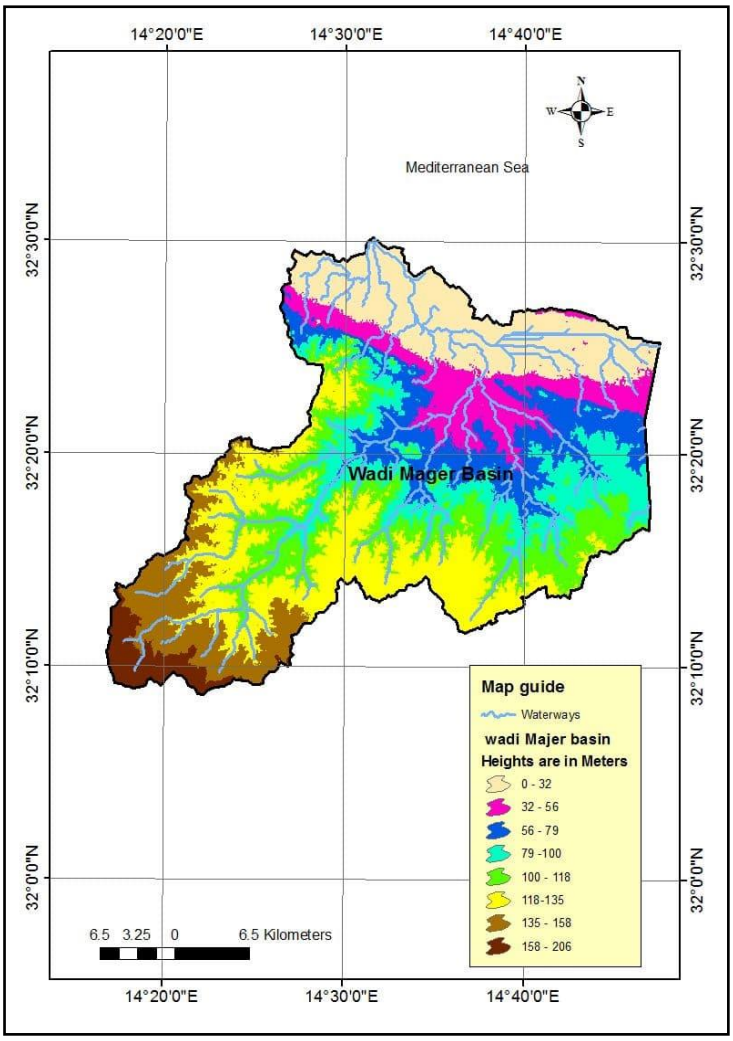
Fifth Category: The height of this category ranges between (100-118) meters above sea level. The area of this class reached 164.12 km2, with a rate of 15.54% of the basin area.

The sixth category: ranging from (118-135) meters above sea level, the area of this category amounted to 200.20 km2 and by 18.96% of the area of the basin, this category tops the rest of the categories in area, extending in some southern parts, the eastern central eastern edges of the valley, and some western parts .

The seventh category: Its height ranges between (135-158) meters above sea level, with an area of 92.02 km2 and 8.71% of the basin area, extending in the southern as well as eastern and western parts of the basin.

The eighth category: The height of this category ranges between (206-158) meters above sea level, its area is estimated at 35.12 km2 and by 3.82% of the basin area, it is spread out in the southern parts only.

Map (4) elevation classes of the Wadi Majer basin



Source / researcher's work based on the digital elevation model (DEM) and using a program. ARC GIS :

Table (1) Altitude classes for Wadi Majer basin

No.	Categories of height in meters	The area is km^2	percentage
1	0-32	164.64	15.59
2	23-56	110.34	10.50
3	56-79	136.61	12.93
4	79-100	152.25	14.41
5	100-118	164.12	15.54
6	118-135	200.20	18.96
7	135-158	92.2	8.71
8	158-206	35.12	3.32
Average height		89.43	

Source / researcher's work based on the digital elevation model (DEM) and using a program ARC GIS 10.3

Wadi Kaam basin: According to table (2) and map (5), the distribution of the height categories in the basin is confined between the two heights (0-308) meters above sea level, with a general average of 137.27 meters, while the height difference was 308 meters**.**

The first category: its height ranges between (0-60) meters above sea level. This category is only found in the lower basin, in the north of the basin, in the form of a narrow strip that occupies an area of 24.2 km2, which represents 5.37% of the total area of the basin.

The second category: the height of this category ranges between (60-94) meters above sea level, the area of this class is 55.94 km2 and by 12.41% of the basin area, this height is found in the northern parts more than others.

The third category: confined between (94-120) meters above sea level, its area is estimated at 92.32 km2 and by 20.49% of the basin area. This category is found in the eastern and central parts of the basin.

The fourth category: It is found between (120-146) meters above sea level, with an area of 105.66 km2 and by 23.48% of the basin area, and it is the dominant or most present category in the eastern parts, especially in the northern and central part of the basin.

Fifth Category: The height of this category ranges between (146-174) meters above sea level, extending as a narrow strip south of the basin from the northeast to the southwest. The area of this category is 59.39 km2, with a rate of 13.18% of the basin area.

The sixth category: ranging from (173-198) meters above sea level, the area of this category reached 59.7 km2 and by 13.25% of the basin area, this category is close in terms of area to the previous category, and it also extends to the south of it.

The seventh category: its height ranges between (198-229) meters above sea level. It is found in the eastern parts of the basin with an area of 40.97 km2, with a rate of 9.09% of the basin area.

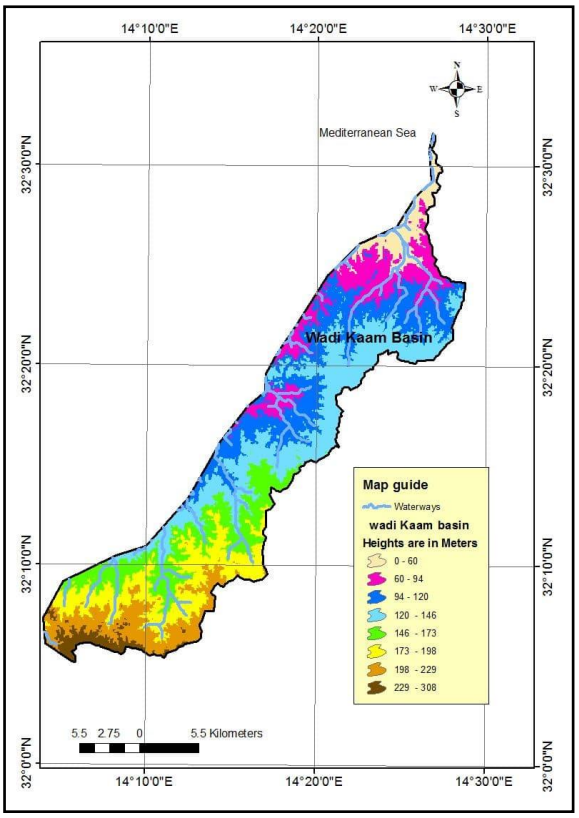
The eighth category: The height of this category ranges between (229-208) meters above sea level, representing a small percentage of the basin, confined to the regions of the southern parts, under an area of 12.53 km2, or 2.73% of the basin area.

Table (2) elevation classes for the Wadi Kaam basin

No.	Categories of height in meters	The area is km^2	percentage
1	0-60	24.2	5.37
2	60-94	55.94	12.41
3	94-120	92.32	20.49
4	120-164	105.66	23.48
5	146-173	59.39	13.18
6	173-198	59.7	13.25
7	198-229	40.97	9.09
8	229-308	12.33	2.73
Average height		137.27	

Source / the researcher's work based on the DEM digital elevation model and using the ARC GIS 10.3 program

Map (5) elevation categories for the Wadi Kaam basin



Source / researcher's work based on the digital elevation model (DEM) and using a program. ARC GIS 10.3

Regression characteristics analysis

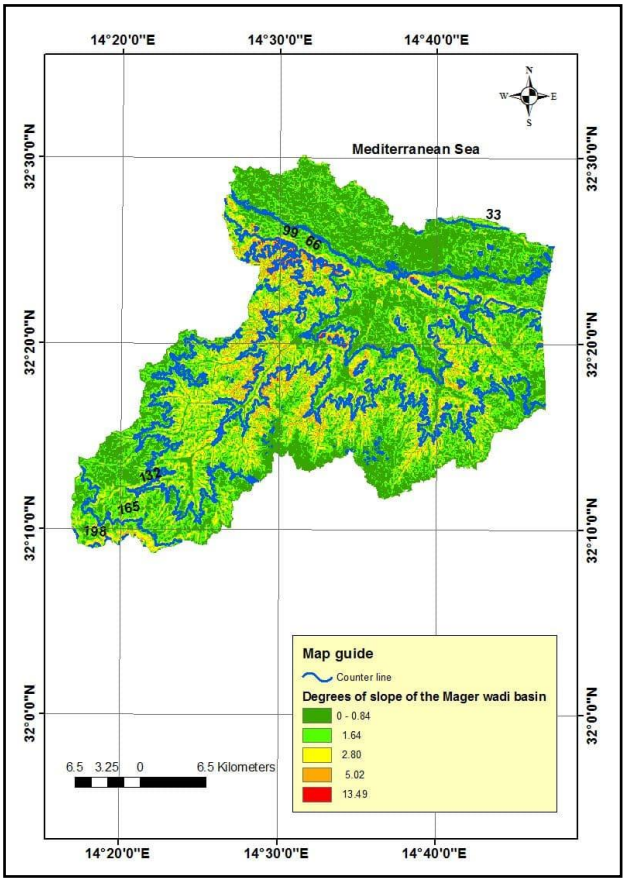
Regression is a term that refers to the vertical change of the earth's surface from the horizontal level at the height and fall of the earth's surface (Al-Jabri, 2012, p. 84). It is one of the important measures that give a comprehensive idea about the nature of the region, in terms of its surface variation, and to facilitate the identification of degrees of slope and terrain phenomena. Merging contour lines with regression maps to find basins surface shapes, slope shapes and river drainage patterns, which also show the vertical and horizontal dimensions through the values of contour lines levels shown as follows:

1. Wadi Majer basin: the lowest slope of the basin was swallowed 0 degrees, while the highest slope was 13.49 degrees and the general average was 1.27 degrees. It is indicated from Table (3) and Map (6) that the slight and semi-flat slopes amounted to 90% of the area of the basin, and the remaining area is It has moderate and above average slopes according to Young's classification, while the contour lines are confined between (33-198) meters above sea level, and some convergence is noted between the contour lines.

Table (3) The grades of slope of the Wadi Majer basin

No.	Regression classes	The area is km^2	percentage	Regression description
	0-0.84	**408.85**	**38.78**	**Quasi-flat regression**
	1-0.64	**359.82**	**37.07**	**Quasi-flat regression**
	2-0.8	**217.85**	**20.63**	**Slight regression**
	5-0.2	**60.86**	**5.76**	**Slight regression**
	13-.49	**8.66**	**0.82**	**regression above average**
1.27				**Average regression**

Map (6) of the gradients of the Wadi Majer basin



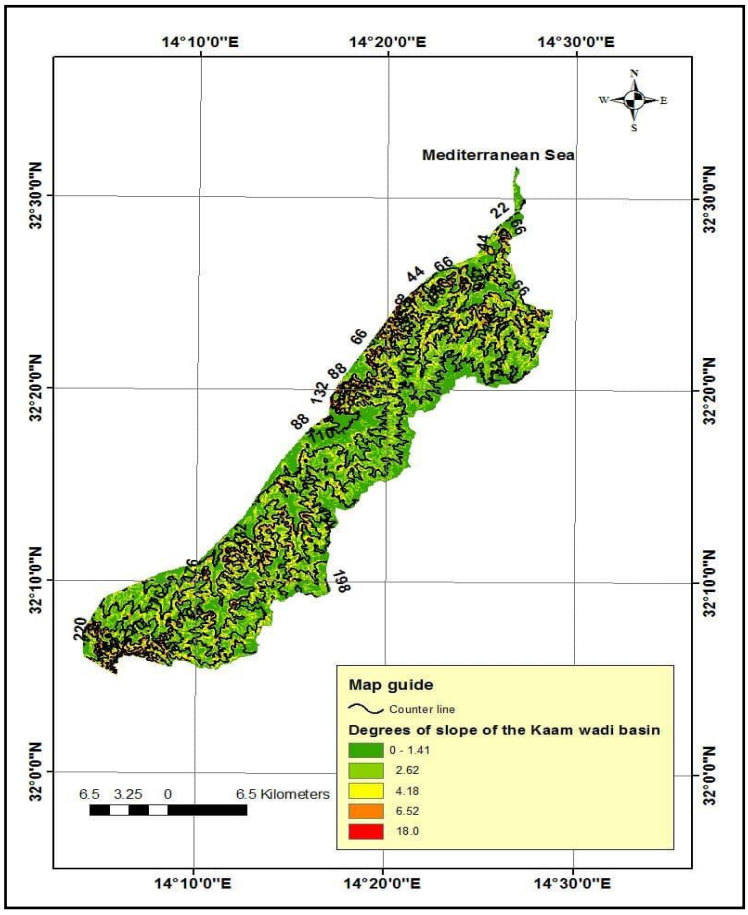
Source / researcher's work based on the digital elevation model (DEM) and using a program. ARC GIS10. 3

2. Wadi Kaam basin: The gradients of the basin are limited to (0-18) degrees. It was found that the surface area whose slope ranges between (0-1.41) degrees is 144.26 km2, with 32% of the total area of the basin, while the surfaces whose slope is greater than 7 degrees It reached 10.4 km2 with a rate of 2.31 degrees, which is described as medium and above-average gradients. As for the contour lines, it is clear from the map (7) that there is a convergence between the contour lines that were confined between (22-220) meters above sea level, which indicates the existence of a difference in the slopes of the basin and the absence of lack of levelness.

Table (4) gradations of the Wadi Kaam basin

No.	Regression classes	The area is km^2	percentage	Regression description
	0-1.41	**144.26**	**32**	**Quasi-flat regression**
	2-0.62	**161.69**	**35.9**	**Quasi-flat regression**
	4.18-	**94.91**	**21.06**	**Slight regression**
	6.52-	**39.37**	**8.73**	**Slight regression**
	18-	**10.42**	**2.31**	**regression above average**
2.27				**Average regression**

Map (7) of the slopes of the Wadi Kaam basin



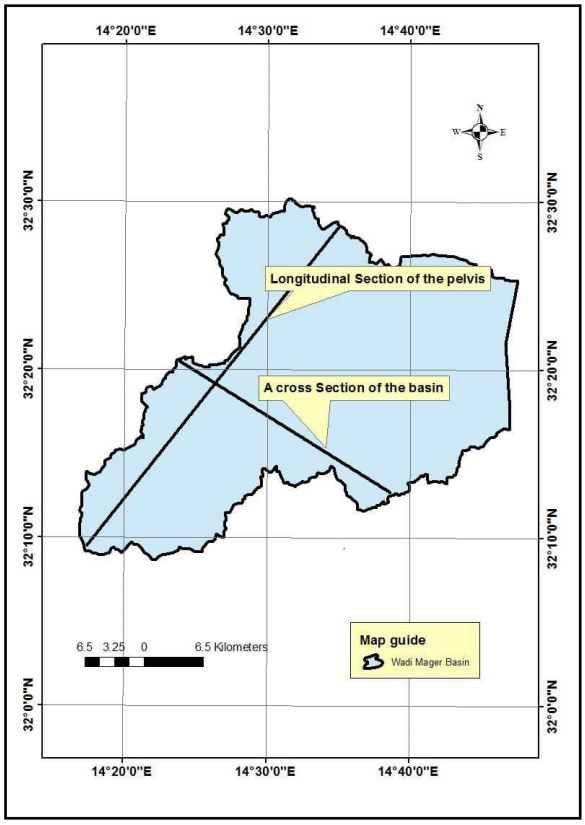
Source / researcher's work based on the digital elevation model (DEM) and using a program ARC GIS 10.3

- The relief sectors of the basins (longitudinal and transverse).

The study of longitudinal terrain sections is one of the important studies that clarifies the processes that led to the formation of waterways, and made it take the prevailing shape at the present time, and helps explain the topographic characteristics of valleys, as the cross sections are considered complementary to the study of longitudinal sections of the basins, as they help to draw a clear picture of them from During the general morphology of the selected sections, longitudinal and cross sections have been drawn using geographic information systems as follows:

Wadi Majer Basin: The longitudinal section of the basin heads in a direction from the source to the mouth, and extends for a length of 45 km, and its height exceeds 180 meters. A kind of regularity takes the form (1). As for the cross section, its length is more than 26 km and its height is 135 meters. The sector extends from the west to the east of the basin. (2). Then it rises again.

Map (8) of the two slope sectors of the Wadi Majer basin



Source / from the researcher's work based on the DEM digital elevation model and using a program. ARC GIS10. 3

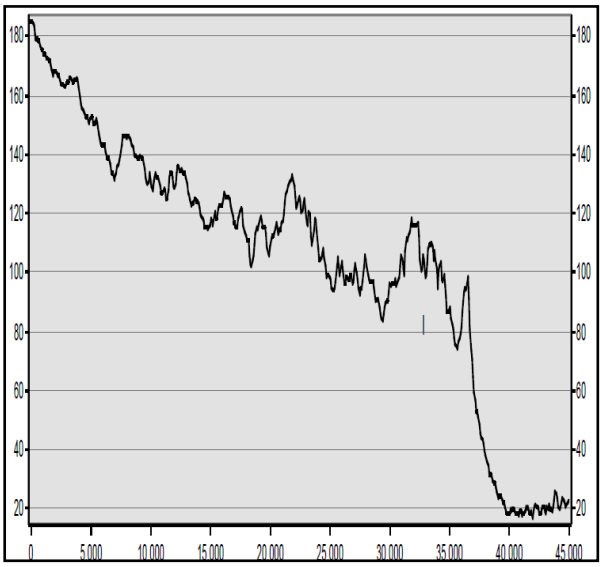


figure 1

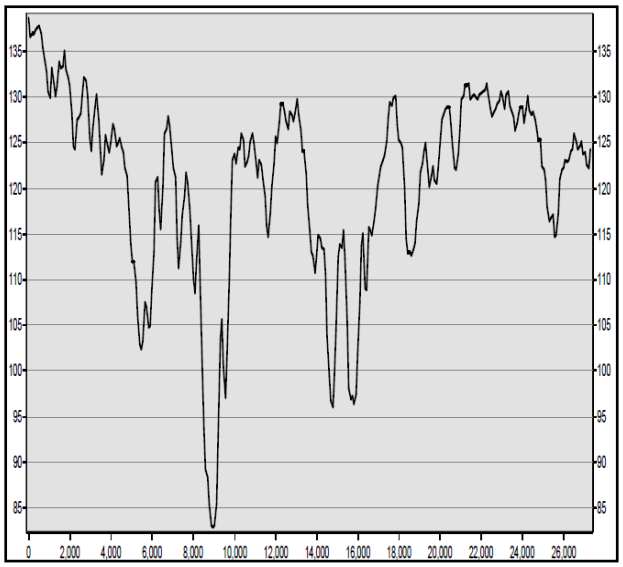
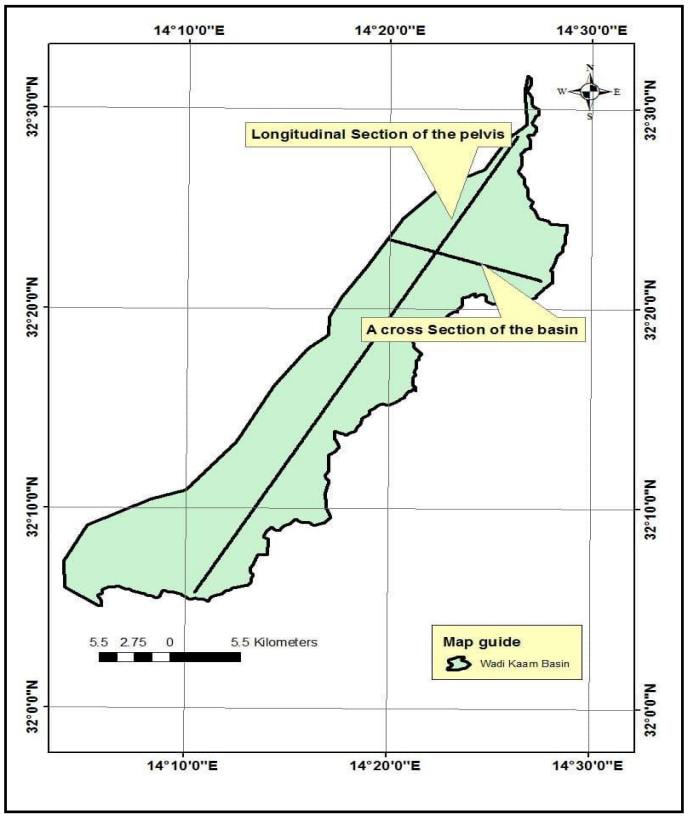


figure 2

Source / Researcher, depending on the program. Arc GIS a

- Wadi Kaam Basin: The longitudinal section of the basin is clearly gradient from the point of source to the mouth, and extends for a length of 50 km, while its maximum height reached 240 meters, characterized by a steep slope in the first distance up to a distance of 7.5 km, then convex slopes appear and a few concave slopes The length of the terrain sector up to the downstream area, while the cross section was characterized by a length of 13 km, with a maximum height of 130 meters and the lowest point of decline of 70 meters, which represents the course of the valley. The sector heads from west to east Figure (4).

Map (9) of the two regression sectors of the Wadi Kaam basin



The source is the researcher's work based on the DEM digital elevation model and using a program. ARC GIS 10.3

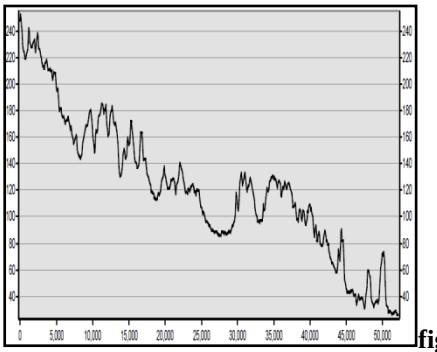


figure 3

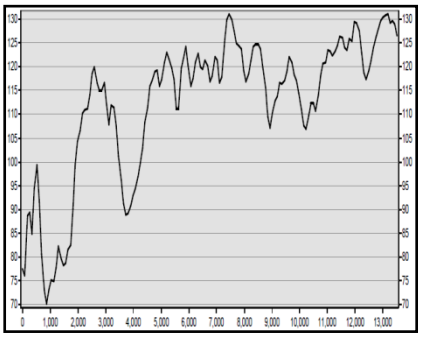
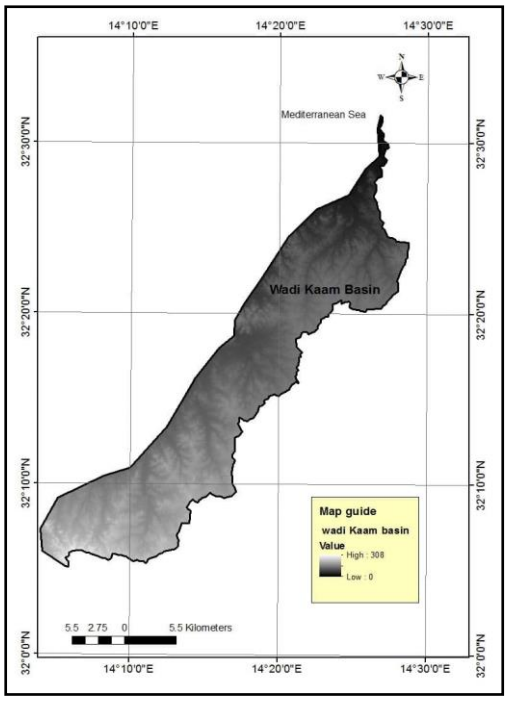


figure 4

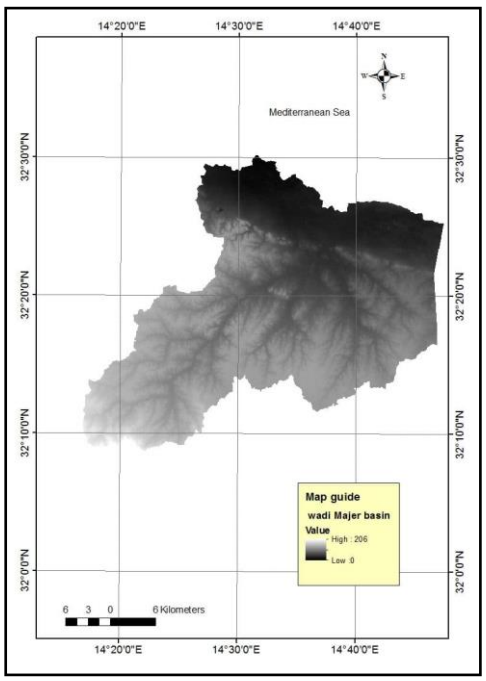
Second: Analyzing the topographic characteristics: The study of the topographic characteristics of river drainage basins is of extremely important geomorphological value, as it is a reflection of a set of variables, the most important of which are the geological formation and climate, and through these variables it is possible to know the geomorphological stage that the basins are going through, and to know the topography of the area and the nature of the shapes. The ground located in these basins through the following transactions:

Maximum and minimum height: the levels of basins in the region vary from one basin to another, and the maximum height of the basins often represents their sources on the water division line, and the highest level in the basins of the study area in the Wadi Kaam basin is about 308 meters (10) map, and it represents the lowest level in Ponds in the basin itself 0 m, usually represented by outfall ponds. While the maximum height of the Wadi Majer basin was 206 meters. The lowest level is 0 meters on the map (11).

Map (10) Wadi Kaam basin



Map (11) Wadi Majer basin



Sprocket ratio: The molar ratio is an important parameter in measuring the severity of pond pinching, because it indirectly indicates the degree of slope of the surface of the drainage ponds. It also indicates the early erosion geomorphological stage that it passes through and vice versa, and the values of the gear ratio are inversely proportional to the area of the drainage basins and then with the amount of drainage, and it is mathematically expressed by dividing the difference between the highest and lowest levels in the basin along the basin (Al-Razzouq, 2016, p. 212). From this, it

becomes clear that the molar ratio in wadi basins ranged between 5.48 m / km represented in the Wadi Kaam basin, which is the highest degree of grouse and 5.02 m / km, which is the lowest

The degree of grip ratio for the Wadi Majer basin, with a general average of 2.26 m / km, which are low slope ratios. The gradient ratios of the cleaned ponds are close due to the small height difference in the basins due to their entry into the .lowland areas

Relative topography: This parameter shows the relationship between pelvic terrain and pelvic surroundings. The low values indicate the weak resistance of rocks and the activity of the erosion factors, while the higher values indicate the resistance of rocks and the weakness of the erosion factors, and it is extracted according to the following mathematical formula (Jaber, 2019, p.526): -

Relative terrain coefficient= Basin relief (m) / Perimeter of the basin (km)

The value of the relative terrain coefficient in the basins of the area was 1.52 meters / km, while at the level of each basin it reached 1.98 meters / km in the Wadi Kaam basin, while the Wadi Majer basin was recorded at 1.07 meters / km Table (5), and it is noticed that all the values of this parameter Low is also due to the lack of the vertical difference between the highest and lowest elevation of the basins, which contributes to the superiority of lateral sculpture over the head of the basins, in addition to the geological convergence of the area's basins represented by sedimentary formations. Roughness value: The ruggedness value refers to knowing the relationship between the basin topography and the longitudinal drainage density of the basin, and it is measured according to the following equation. The ruggedness value = the drainage basin topography (m) x the drainage density in km 2/1000, and when applying the equation to the basins, it became clear that the ruggedness value in them indicates The decrease in this value, which amounted to a general average of 0.09, which is a low value in general indicating that the basins are still performing their corrosive cycle and have plenty of time to complete their cycle, as well as the low drainage density and the lack of terrain range in them, in addition to the small area of the basins.

Hypometric integration: It is one of the most accurate morphometric parameters that represents the time interrupted by the erosion cycle of the drainage basins, and is calculated by dividing the pelvic area by the terrain, and the increase of this parameter indicates the large pelvic area, which is confined to (0-100), while the lower values indicate the small area The pelvis and that it is still at the beginning of its regenerative cycle (Abu Radi, 2004, p. 129). The value of the Hesometric integration coefficient in the area basins was between 5.10 meters / km represented in the Wadi Majer basin, which is the highest degree and 1.45 meters / km, which is the lowest degree for the Wadi Kama basin, and with a general average of 3.27 meters / km, all the values indicate that the values of the HPS are low. This is due to the small area of the basins and their recent origin. In addition to the prevailing drought conditions.

Table (5) Terrain characteristics of the study area basins

The name of the aquarium	aquarium topography			Terrain ratio	Terrain ratio (m / km)	Ruggedness value	Hypometric form (M / km)
	Highest height (m)	Minimum height (m)	Difference height (m)				
Mager Valley	206	0	206	5.02	1.07	0.08	5.1
Kaam Valley	308	0	308	5.48	1.98	0.10	1.54
The overall average	257	-	-	2.26	1.52	0.09	3.27

The source is the work of the researcher, based on the digital elevation model (DEM) and mathematical equations for morphometric properties.

Conclusion:

:The most important findings of the research can be summarized as follows

Geographic information systems are considered one of the best tools used in analyzing terrain characteristics in terms of slope, altitude, and terrain sectors The study showed that geographic information systems open a new field that contributes to the construction of dams and urban and agricultural expansion The study showed the importance of geographic information systems in obtaining accurate data and information that are difficult to access by traditional study methods The area is characterized by a lack of marshes in general, as it ranged between 5.48 m / km represented in the Wadi Kaam basin and 5.02 M / km for the Mager Valley Basin The program used has proven efficiency, accuracy and high speed in drawing various terrain maps The valleys of the region begin from the southern and southwestern sides, following the general slope of the region towards the sea DEM digital elevation models are one of the main sources for geomorphological studies- It was found by analyzing the slopes of the two basins that it ranged between (0-18) degrees in Wadi Kaam, while it reached in Wadi Majer basin between (0-13.49) degrees. - The longitudinal section showed that the Wadi Kaam basin is characterized by a steep slope in the first distance up to a distance of 7.5 km, while the Wadi Majer basin is characterized by clear slopes in its upper southern parts, and then the slope decreases as we head towards the downstream. The natural geological factors affected the different slopes between the two basins, the basin and the one The information systems techniques used revealed the difference in convergence and divergence of the contour lines due to the difference in the ground structure The elevation level in the Wadi Kaam basin ranges from (0-308) meters, while in the Wadi Majer basin it is between (0-206) meters above sea level.

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