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Hydrological Characteristics of the Region of the Sea of Najaf Using (RS) and (GIS)

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Abstract : Hydrology is abroad science that includes all water in the earth ball , the general trend of modern hydrology is the study of water above and below the surface of the earthThe aim of this study is to know the hydrological characteristics of the Najaf Sea region based on the digital elevation model of the area using geographical information systems and remote sensing technology. In this study, a number of hydrological properties were used for the area of the Najaf Sea these characteristic are (Fill, Flow Direction, Flow Accumulation, Stream Definition).In the result we obtained the highest value of the fill is (19.9983) and the lowest value is (11.9932), while the highest value for the flow direction of the water value it was (128) to the northeast direction and the lowest value is (1) to the east, the highest value of the flow accumulation is (90110657) and the lowest is (0), and the highest value of stream definition is (1), the lowest value is (0).
Key Words : Hydrology, DEM (Digital Elevation Model), Remote Sensing, GIS (Geographic Information System).

Introduction

Flooding, as a major natural disaster, affects many kinds of the world including developed countries, [1]. Flooding is one of the great environmental crises one has to contend of within the century. Flood can simply be defined as a flow of water above the carrying ability of a channel, [2].

Geographic information systems (GIS) supply a digital representation of watershed applied in hydrology modeling. There methods of geographic information storage are discussed: raster or grid, triangular irregular network, and contour-based line network, the computational, geographic, and hydrologic aspects of all data-storage method are analyzed. The applied of remotely sensed data in GIS and hydrologic modeling is reviewed, [3].

Remote Sensing are not only used for observation of hydrological state variables, but also as the basis for parameter appraisement of hydrological models. Remote Sensing, especially from different satellites in different spectral bands, can provide information on catchment basin characteristics (e.g. land cover, land use, slope, and vegetation), from which the parameters of hydrological exemplars can be assembled, [4].

Digital Elevation Model (DEM)

Digital Elevation Model (DEM) defined as a digital representation of the ground surface topography or terrain. It is expansively known as a Digital Terrain Model (DTM), [5]. DEM is one of the important means and modern applications which in (GIS) program, which allows a three-dimensional terrain which save it from particle formidable potential in many science fields, including use as a tool for geographical research, specially in the field of geomorphology as the digital elevation model pictures space and air system of global autograph, etc.And until topographic maps supplies the fettling measurements and analysis and accurate results when extracting a digital elevation model like it can figure out the slopes and aspects of any acquaintance of the effect of wind and rain, solar radiation and then determine the range of the development of erosion of the soil and the operation of land. Distribution of natural vegetation, definition of the main recharge basin and sub-basins the length, length and dimensions of the flow network and the appraisal of the best locations for the construction of the dams and determination of the places designated for flooding, [6].

This model uses either geographic coordinates of the network, longitudes and latitude specially in the case of data changing and uncoupling due to arcing of the earth or using the (UTM) network in the case of a common data set. If the scale of DEM is little, it uses geographical coordinates, but if it is large, any locale is used, [7].

The digital elevation model appears the height of the terrain (the elevation values of the bare earth) bare from the natural plant and the man-made phenomena as opposed to the exemplar of digital surfaces (DSM) which represent the height of trees, roofs of houses, towers and another features that stand aboveground the surface of the earth, [8].

It is one of the necessary inputs is modeling or emulating landscape as well as dynamic natural phenomena like flooding, soil erosion and landslides. Due to the important role of DEMs in terrain-related research and application, it is essential to create high quality DEMs at different levels of minutiae. DEM can be generated using photogrammetry interferometry, ground and laser surveying and other techniques. Normally, aerial photos, high-resolution satellite data or domain- surveyed spot height and light detection and ranging (LIDAR) data are used as inputs to generate high-resolution / high-quality DEMs, [9].

Hydrological Model

Hydrologic modeling has extremely benefited from observation of land surface water, energy, and carbon conditions which are of critical importance owing to their profound effects on real world water resources applications like flood control, weather and climate forecast, agricultural production and water resources administration which collectively control the behavior of the climate system. Many studies have pretend that initial and boundary conditions of state variables such as soil wetness, soil temperature or vegetation water content at various temporal ad spatial scales exercise strong controls on climate, water and hydrologic operations.

Remote sensing has shown in troth promise for providing a multitude of data and information that were lacking with the in-situ monitoring. It has also been a valuable tool in many hydrologic modeling applications due to its ability of providing absolute collection of information with wide spatial coverage and temporal repeat, [10, 11, 12, 13].

The Techniques Used in the Study

1-Remote sensing:

Because it observers the phenomena of the earth without effective it, this is one of the methods presently depend in the literature of similar studies, [14]. It can also be which to identify the locations most at hazard of flooding, [15].

2- Geographic Information System (GIS):

Information systems help as to organize the method of extrapolation of information from remote sensing data to their capability provide adjectival information as well as spatial information (coordinates) for each point studies on the map and so will be available the two most important elements in which study are the place ad prescribe of the phenomena and useful in calculating the sites of regions affecting any locale under study, [16].

3-Digital Simulation for DEM:

Are gainly for emulating the surface of the earth as it is in fact because these data included the coordinate of each point (X, Y) and at the same time contain the (Z), which represents height of every point also and consequently become data represent a topographic emulation of the topography of any locale under study. This method is advantageous in the work of three-dimensional of the surface of the earth, [17]. It is also useful in drawing the ambit of the lake and its region, and the network of drains of the surrounding channels from the encompassing caves. The surface- drainage network is explained and its morphometric characteristics are defined as the lengths of glens, slope, gradient, etc, [18].

The Study Region

The geographical location of the Sea of Najaf confined between the longitudes 44° 14' 18" E, as well as between latitudes 32° 00' 50" N, and extends low longitudinally for a distance of (40) kilometers from the north-west of the city of Najaf to the south-west of the city of bewilderment. The Sea of Najaf between (6-60) km away from the Euphrates (14) km in the northern parts of Western and in the South East of its parts is just one kilometer from the river. Also, in the lower area of the sea up to six meters above sea level and it is thus a decrease forty meters from the level of the city of Najaf, as shown in figure (1).

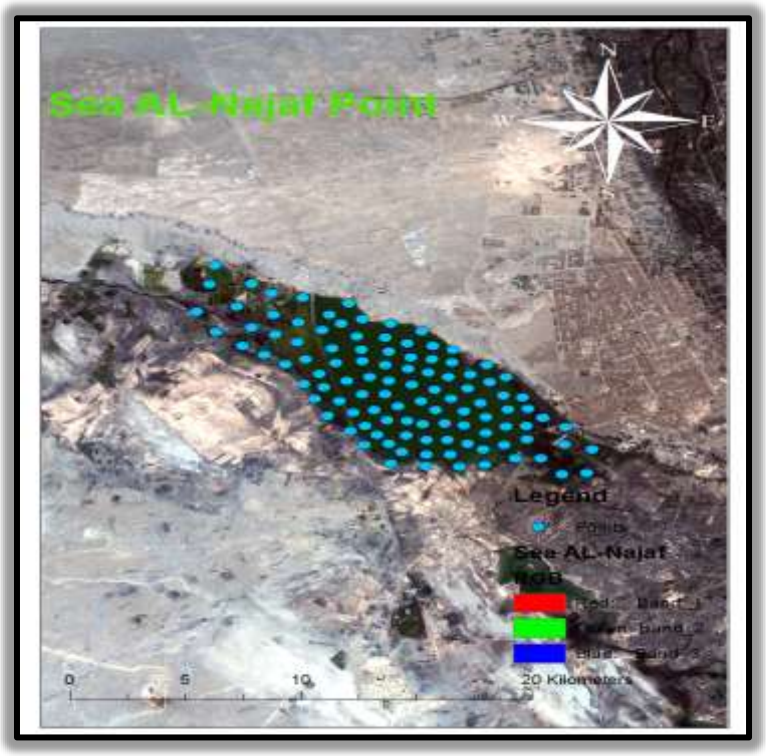

Figure 1:Satellite image of the Najaf sea region with coordinate (E,N) from Landsat 8.

The Experimental work

Hydrology Properties

The study of the hydrological characteristics (hydrological analysis) requires:

1-Digital Elevation Model (DEM)

2-ArcHydro

• Generation digital elevation model by using TIN method of the Najaf sea region

Digital elevation model (DEM) can be generated from TIN method, the accuracy of TIN method was extremely high, but it was really particle and economical to be applied over relativity small areas of terrain. Elevation values were in meters and the coordinate system was UTM 38N WGS84. We can create TIN from raster data (DEM).This kind of analysis depends accuracy of the results primly on the accuracy of digital elevation model data user that is created.

• Hydrology properties:

1-Fill

This tool is used to fill the curves of the digital height model through the program (ArcGIS). This tool is used to identify the values of all the drilling and the same climates that the program will find in order for the water to be able to slope over the heights from one cell to another within the model.

2-Flow Direction

This tool represents the analysis of water flow. This tool was used to determine the direction of the water and the direction in in which the water will be carried from one cell to another on the basis of heights. It also determines the path that water takes when passing through the topography of cell. As shown in figure (2)

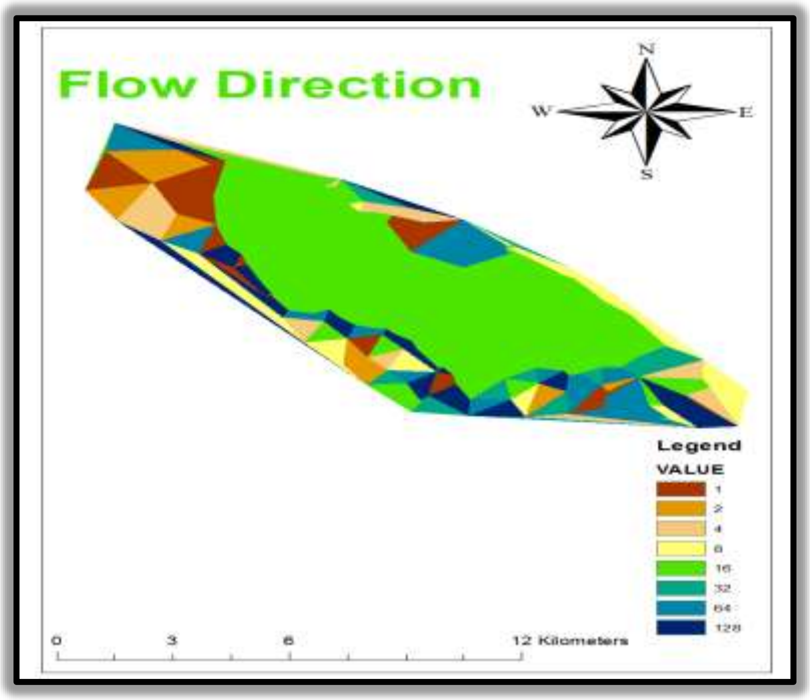

Figure 2: The flow direction of DEM of the Najaf sea region.

The above figure represents the determination of the water flow of the study area (the Najaf Sea) as we note from figure above we have shown values and both of these values corresponding to their specific direction. This tool determines the cell that is more steep and compares with the eight neighbor cells. Therefore, it determines the cell with the minimum which has the lowest value relative to the neighboring. After, the flow direction of each cell will be determined by the direction of the cell with the lowest value and compared with the corresponding value of the direction. For example if the direction of the cell with the lowest value is north, note that the value corresponding to the water flow is (1). This process is continuous relative to the other cells, and thus we obtained a layer containing specific values for each cell to be known as coordinates. The following table illustrates these values with their direction.

Table 1: Cell value with direction of the Najaf Sea.

Cell value	Direction
1	East
2	South East
4	South
8	South West
16	West
32	North West
64	North
128	North East

The table above shows that each off these cells is a value and its values are composed of eight numbers (1, 2, 4, 8, 16, 32, 6,128). Each of these numbers incretin direction of the water flow of the Najaf searegion. We also note from the table (1) that the highest value of the water flow was (128) in the north east, and the lowest value obtained is (1) to the east.

3-Flow Accumulation

This tool is the determine the water collection areas at each cell and this is done by calculating the number of cells in which the water will be placed. This mean that each cell of the network file cells will contain the number of cells from which the water will flow to this.

4- Stream Definition

This tool represents a threshold value. This tool determines the value through which we can show the water drainage network after the water pool has been identified (water accumulation). This depends on the number of cells that determine the accuracy of the image. The smaller the number of cells, the more accurate the appearance of the tributaries. Note from the figure above that the line that appeared in the dark -colored map represent the main tributaries, while the light-colored line represents the branches outside them.

Conclusions

1-(Fill):

This tool was used to fill all spaces, concavities and drilling in the digital elevation model using the program (ArcGIS). This tool appoints the values of the all the drilling and concavities so that the water can descend across the heights from one cell to another within the model in line with topographic terrain. The highest values were obtained (19.9932) and the lowest values are (11.9983).

2- Flow Direction:

This tool has been used to determine the direction of the water and the direction in which the water will be transferred from one cell to another on the basis a neighboring height, either work is done on the level of the cell and not at the level of tributary. The path that water takes when takes is also determined the when passing through the topography of the cell. For example if the direction of the lowest cell value is northward, then the value that the corresponds to the water flow is (1). The values that we have shown are (1, 2, 4, 8, 16, 32, 64,128). Each of these values means a particular direction and each of its values has its own color. For example the values (1, 2, 4, 8, 16, 32, 64, 128) represent trends respectively (East, Southeast, South, Southwest, West, Northwest, North, Northeast).

3- Flow Accumulation:

The water compiles areas in each cell were determined by counting the number of cells in which the water would be congregates. This means that every cell of the network file will contain the number of cells in which the water will flow. The values we obtained were the highest values (90110657) and the lowest value (0).

4- Stream Defintion:

From this tool we were able to obtain a network of waterways from the previously determined tracks that represent the direction of the water flow and its assemblies. This depends on the number of cells that determine the accuracy of the image, so we note that the smaller the number of cells, the more accurate the appearance of the tributaries. The highest value obtained was (1) and the lowest value was (0).

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