The use of Digital Elevation Models (DEM) and Geographic Information System (GIS) to Produce Some of Topographic Maps in Mesopotamian Plain, Baghdad- Iraq

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Abstract: There are three types of the topographic maps are used to study apart of Mesopotamian plain, Iraq, contour lines, slop map and Aspect map under Geographic information system (GIS), the study area located in between latitudes 33° N and longitudes 33° E, Digital Elevation Model (DEM) is used to produce these maps, The results of contour map referred to there are five classes for elevations were represented in contour lines, Elevations values were <=10, 11-20, 21-30m, 31-40, and 31-90. All the elevation in the study area begins to decrease as we move for the South, east and west. There are three types of slop, Low-type of slop covers a large part of the study area then medium-slop and Higher-slop. That means most the study area is flat. The Entisol soil order, sub soil order Fluvent and Torrifluvents great group covered the study area.

Keyword: DEM, Contour lines, Slop map, Aspect map, GIS

1. Introduction

Digital Elevation Model (DEM) is produced by Photogrammetric techniques from stereo-photo pairs, stereo satellite images or interpolation of elevation data (Hilmi 2014). The DEM is a computer representation of the earth's surface and provides a base data set from which topographic parameters can be digitally generated. The routing of water over a surface is closely tied to surface form (Wood, 1996). The Digital Elevation Model is regular gridded matrix representation of the continuous variation of relief over space (Burrough1986). Elevation can be defined as “the height above the horizon”, The term horizon refers to the sea level. The Term Digital Terrain Analysis (DTM) is attributed to two American Engineers namely Miller & Laflamme at the Massachusetts Institute of Technology during the late 1950s (Naser El Shelmy2005). DTM refers to the altitude of ground itself while DEM refers to the maximum altitude everywhere (Pratibha et al.2013). A contour line (also isoline, isopleth, or isarithm) of a function of two variables is a curve along which the function has a constant value (Courant etal.1996). The contour interval of a contour map is the difference in elevation between successive contour lines.

Aspect is measured counterclockwise in degrees from 0 (due north) to 360 (again due north, coming full circle). The value of each cell in an aspect grid indicates the direction in which the cell's slope faces. Flat slopes have no direction and are given a value of -1 (Esri 2009) fig.1.

Figure 1: ‘General Aspect map’

Figure 2: Aspect Key

Volume 6 Issue 2, February 2017
www.ijsr.net
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Using the legend you can determine the appropriate aspect for each hillside in the area, allowing you to identify North (~ 0 or 360 degrees), South (~ 180 degrees), East (~270 degrees) or West (~90 degrees) facing hillsides. Values found in between these ranges assume a mixture of cardinal direction; ex. 225 degrees would represent a hillside with a South-East facing aspect (http://www.gistutor.com/).

2. Material and Methods

Description of the Study Area/Location and area
The study area (Fig.3) called Baghdad located in between latitudes 33° N and longitudes 33 E °. Its part of Mesopotamian Plain, Iraqi. It is a geological depression filled with river sediments which covers the central and southern parts of Iraq. Mesopotamian Plain, Iraqi is a plain of the Tigris and Euphrates rivers. The northern part extending between Samarra and Delta consists of three distinct river terraces which are about 5 to 15 meters higher than the present river level. These old river terraces thus form high plains which are never flooded by the river. The lowest of these terraces is the most important for irrigated agriculture. It extends on both sides of Adhaim River. In central Iraq, the plains are nearly level. Large parts of it were flooded almost every year during spring and new soil material was deposited till 1956 when the first flood control project was completed. Deposition of material by the rivers is in a levee basin pattern giving a distinct meso relief in the nearly level landscape. In addition, the old irrigation canals have deposited irrigation silt to form narrow high strips along them (Omer, 2011).

Remote sensed dataset
The Digital Elevation Model (DEM) was used to investigate topographic maps of the Baghdad. Image processing and transformation for raster data set were applied under GIS program (Arc map v.9.3), Fig 2 by the following steps:
- The Digital Elevation Model (DEM) downloads for the Mesopotamian Plain Iraqi.
- Transforms the raster dataset from decimal degree to UTM projection in gis environment.
- Surface analysis was applied to produce the following maps.
  - Contour maps, Slope maps, Aspect maps, Hill shade maps.

3. Results and Discussion

Contour map
The results of contour map referred to there are five classes for elevations (fig.2)
Were represented in contour lines, Elevations values were <=10, 11-20, 21-30m, 31-40, and 31-90 respectively fig.4.

Figure 3: Digital Elevation Model (DEM) for Mesopotamian Plain Iraqi
Each of the elevations values from 21-30 and 31-40 covered most of the study area fig.5, 6.
All the elevation in the study area begins to decrease as we move for the South, east and west fig.7, 8, 9 and 10.
The greatest drop was when heading towards the southern and eastern and western parts. Compared to the northern part, the greatest drop represents the southeast and east in the study area.

**Slop map**

There are three types of slope in the study area: low, medium, and high slope, with values ranging from 0-20, 20.01-30, and more than 30.01 respectively. Low-type covers a large part of the study area, followed by medium-type and then the higher type (Jason McGilloway 2011) fig. 11, 12. This means that the study area is flat except for some places that make up a small percentage and mostly of water bodies such as the Tigris River.

![Figure 10: Digital Elevation Model (DEM) to the East](image)

![Figure 11: Slope map in study area](image)
Aspect map
The results referred to the Lands of study area is moving clockwise at different angles towards the north (0-22.5), northeast (22.5-67.5), east (67.5-112.5), southeast (112.5-157.5), south (157.5-202.5), south west (202.5-247.5), west (247.5-292.5), north west (292.5-337.5) and back again to the north (337.5-360). The gray color referred to the flat lands.

Soil classification
The Entisol soil order, Fluvent sub soil order and Torrifluvents great group covered the study area (Muhaimeed et.al 2014).

4. Conclusion
Most of the study area elevations values from 21 -30 and 31-40 covered, the elevations values begin decrease when heading towards the southern and eastern and western part, but the greatest decrease represents the southeast and east in
the study area. There are three types of slop, Low-type of slop covers a large part of the study area then medium and Higher. That means that the study area is flat except for some places that make up a small percentage and mostly of water bodies such as the Tigris River. The Entisol soil order and sub soil order Fluvent covered the study area.

References