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Generation Contour Lines from Digital Elevation Model (1m) for AL-khamisah, Thi-Qar Government

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Abstract

The DEM (Digital elevation model) means that the topography of the earth's surface (such as; Terrain relief and ocean floors), can be described mathematically by elevations as functions of three positions either in geographical coordinates, (Lat. Long. System) or in rectangular coordinates systems (X, Y, Z). Therefore, a DEM is an array number that represents spatial distributions of terrain characteristics. In this paper, the contour lines with different interval of high-resolution digital elevation model (1m) for AL-khamisah, The Qar Government was obtained. The altitudes ranging is between 1 m – 8.5 m, so characterized by varying heights within a small spatial region because it represents in multiple spots with flat surfaces.

Keywords: DEM (Digital Elevation Model), DGPS (Differential Global Position System), TIN (Triangulated Irregular Network).

انتاج خطوط الكنتور من نموذج الارتفاع الرقمي (1متر) لمنطقة الخميسية، محافظة ذي قار

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الخلاصة

نموذج الارتفاع الرقمي (DEM) هو نموذج يمثل طبوغرافية سطح الأرض (مثل ارتفاع التضاريس وقاع المحيطات)، والذي يمكن وصفه رياضيا كدالة للموضع بالإبعاد الثلاثية إما عن طريق الإحداثيات الجغرافية (خطوط الطول و العرض) أو عن طريق الإحداثيات المستطيلة (X، Y، Z). بالتالي فان نموذج الارتفاع الرقمي هو مصفوفة رقمية تمثل التوزيعات المكانية لخصائص التضاريس الأرضية. في هذا البحث ، تم إنشاء خطوط الكنتورية بفترات مختلفة لمنطقة الخميسية، محافظة ذي قار من نموذج الارتفاع الرقمي عالية الدقة (1متر) ومن النتائج التي تم الحصول عليها إن ارتفاعات المنطقة تتراوح بين (1 – 8.5) م تميزت ذلك بواسطة ارتفاعات متفاوتة داخل المنطقة المكانية لأنها تمثل في مناطق متعددة مع الأسطح المسطحة .

Introduction

Digital elevation models (DEM) are key for many commercial and scientific activities, e.g. for analyzing and predicting environmental and geophysical processes or events for crisis intervention planning, like flood and risk mapping, for applications in hydrology, forestry, ortho-rectification of multi-source Geo-data and mapping, infrastructure planning and navigation, [1]. Digital Elevation Model data files consist of only the elevation or height values of the terrain, covering a specified area in a discrete grid-like 3-D space of the particular surface in consideration. DEMs can be useful for extracting and visualization of terrain parameters, cartographic map generation and updating, modeling water flow or mass movement amongst others, [2].

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A DEM is a digital representation of land topography representing elevations on the earth's surface. A DEM can be represented by one of three data structures: (1) gridded models, where elevation is estimated for each point on a regular grid; (2) triangulated irregular networks (TIN), where terrain elevation is represented by a network of no overlapping irregular triangles; and (3) contour-based networks, where the landscape is divided into small, irregularly shaped polygons based on natural contour lines and their orthogonal. The square-grid (gridded) model is the most common form of DEM because of its simplicity and ease of computer implementation, [3]. The contours represent points having equal height/ elevations with respect to a particular datum such as Mean Sea Level (MSL). In the contour-based structure, the contour lines are traced from the topographic maps and are stored with their location (x, y) and elevation information, [4].

The Study Region and Elevation Data Collection Process

Study Region

The region is called **(AL-khamisah, Thi Qar govermnmet)**, which covers about (12.137683 Square Kilometers). The survey for this area were accomplished using Differential Global Position System (DGPS), type Topcon Hyper-II. The coordinate system of this data set is defined using the following values which have the following projection data:

Projection	Units	Zone
UTM	Meter	38

The study region located in the South of Iraqi country, Latitude (34º 01' 93.9") to (34º 04' 22.2") N, Longitude (63 º 70' 42.3") to (63 º 84' 94.6") E. Shown in Figure-1.

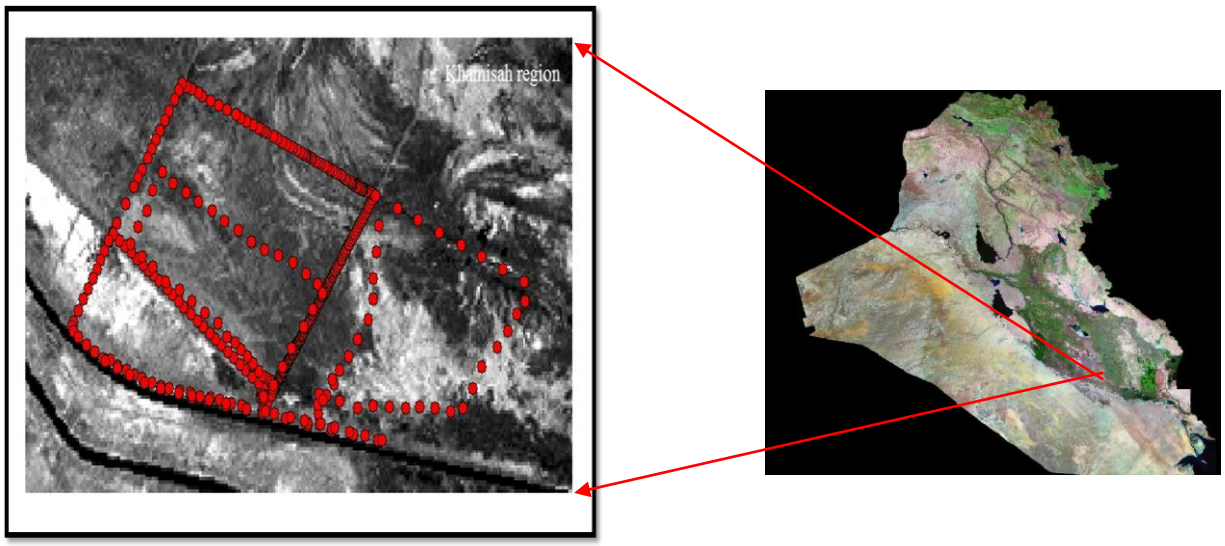

Figure 1- Studied region AL-khamisah captured by Landsat ETM+7 28.5m sensors

Elevation Data Collection

The data of terrain elevation from RTK (Real Time Kinematic)-DGPS Field Surveys for a part of AL-khamisah region,. The field survey is depending on the 2 GCPs (Ground Control Points) as Base points, which have been defined using the DGPS Static mode. These points are considered as reference points in all RTK gathering mode and later correction process, shown in Table-1.

Table 1- The Measured GCPs Base points by Static mode, DGPS

GCP_s	E (m)	N (m)	Duration	Method
B1	639701.511	3401328.789	04:23:00	Static
B2	639701.095	3401329.013	02:29:25	Static

Results and Discussion

After applying the RTK-DGPS navigation mode, the collected RTK points values were investigate using the GIS facilities. The works includes two methods of computer software evaluation by GIS, such as;

Generation digital elevation model Using TIN Method

The Digital Elevation Models can either be stored as a vector or raster format. DEMs in vector format are often in the form of Triangulated Irregular Networks (TIN), which can be seen as a set of polygons in the form of triangles where the 3 corners of each triangle are known height values. Each triangle has a uniform slope steepness and slope direction. When the terrain is more complex, the number of triangles needed to represent the terrain increases, [5].

Figure (-2a & -2b) represent, respectively, the DEM and the 3D view for the DEM of the ground level by using the TIN method.

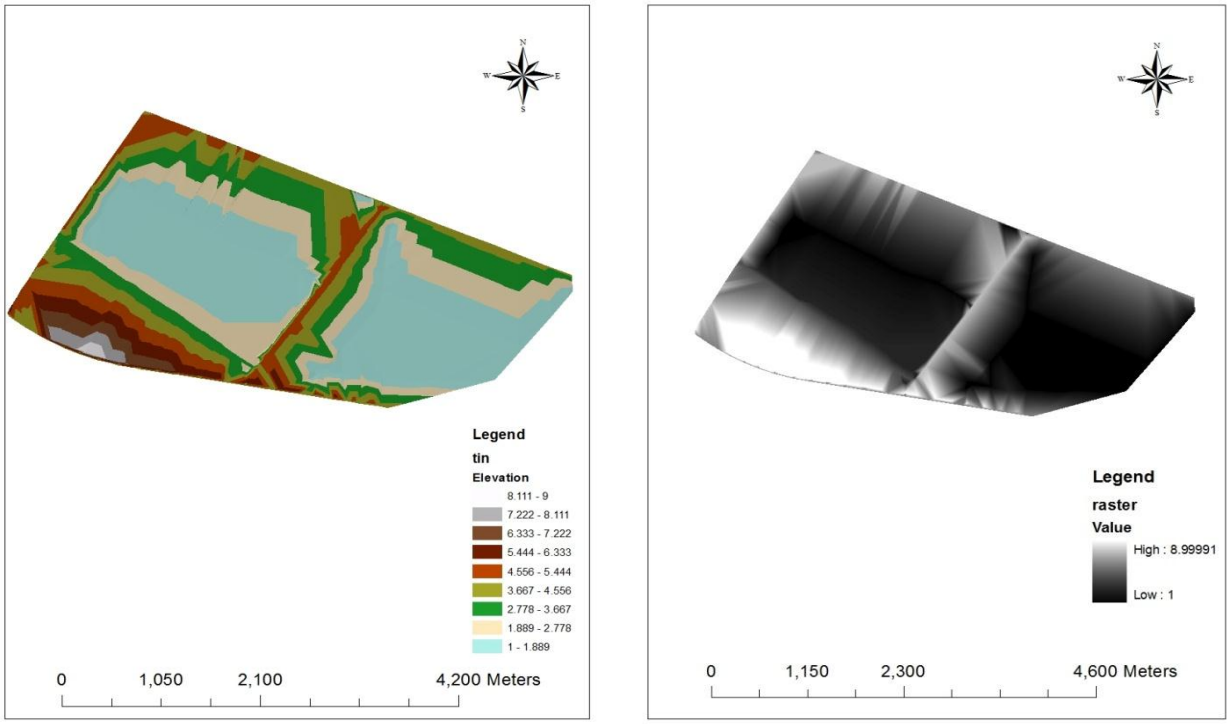

Figure-2a The DEM for field survey data of ground by (TIN) method

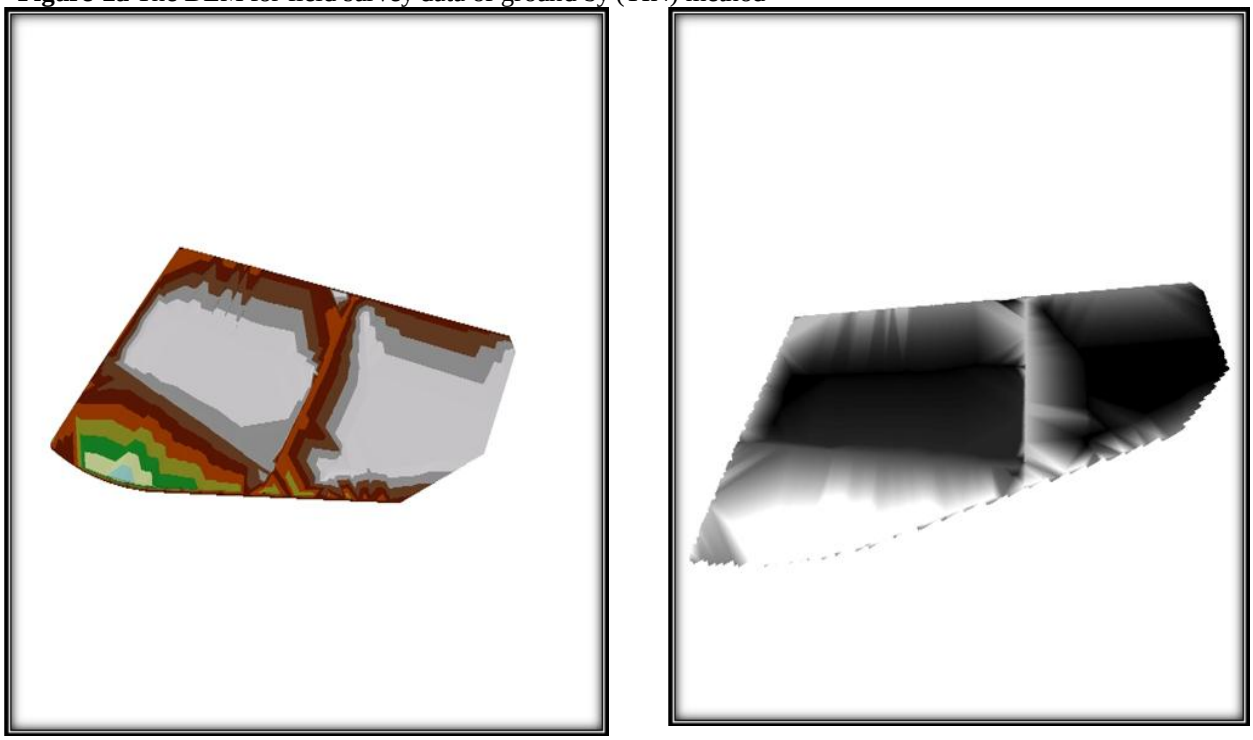

Figure 2b- The 3D view for the DEM for field survey data of ground by (TIN) method

From the Figures -2a and for the overall DEM results, the highest elevation is 9 m and the lowest elevation is 1, this values agree with the area general elevations.

Generation contour lines from high resolution DEM (1m)

The production of this type of contour map can be evaluated using the Spatial analyst for the 3D surface GIS facility. This method is and DEM application depending on the first step. The TIN necessarily produces images, contour images as the basis of images that can Relied upon to draw all geomorphologic characteristics. AL-khamisah region altitudes ranging between 1 m – 8.5 m so characterized by varying heights within a small spatial region because it represents in multiple spots with flat surfaces.

Figure -3a, the contour with contour interval (0.25) m, Figure -3b, the contour with contour interval (0.50) m, Figure -3c, the contour with contour interval (0.75) m, and Figure -3d, the contour with contour interval (1) m.

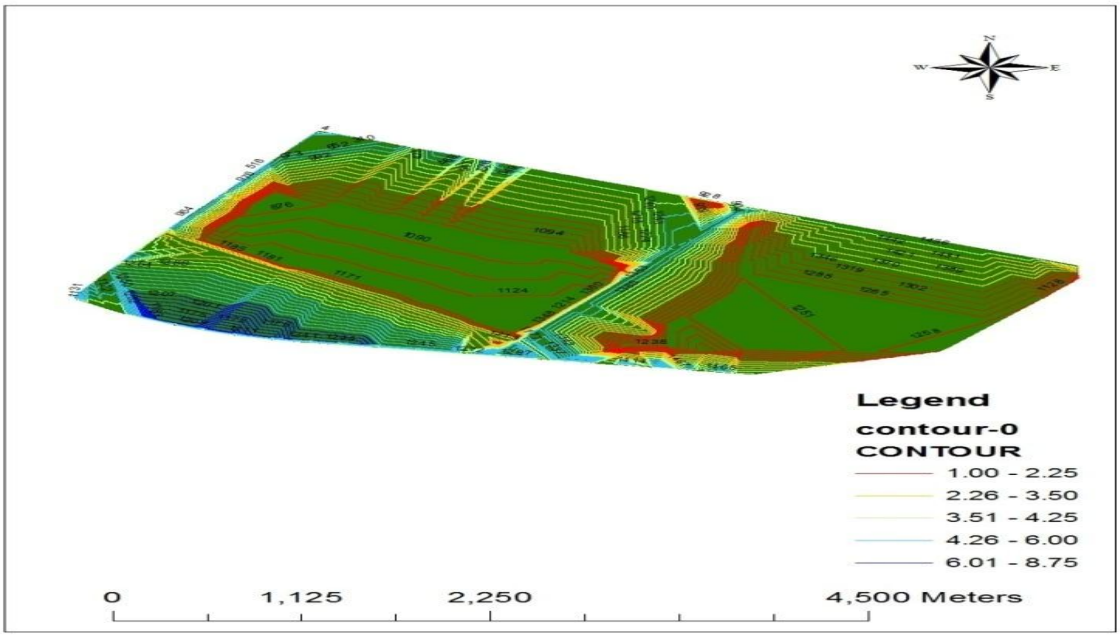

Figure 3a-The contour lines with interval (0.25) m

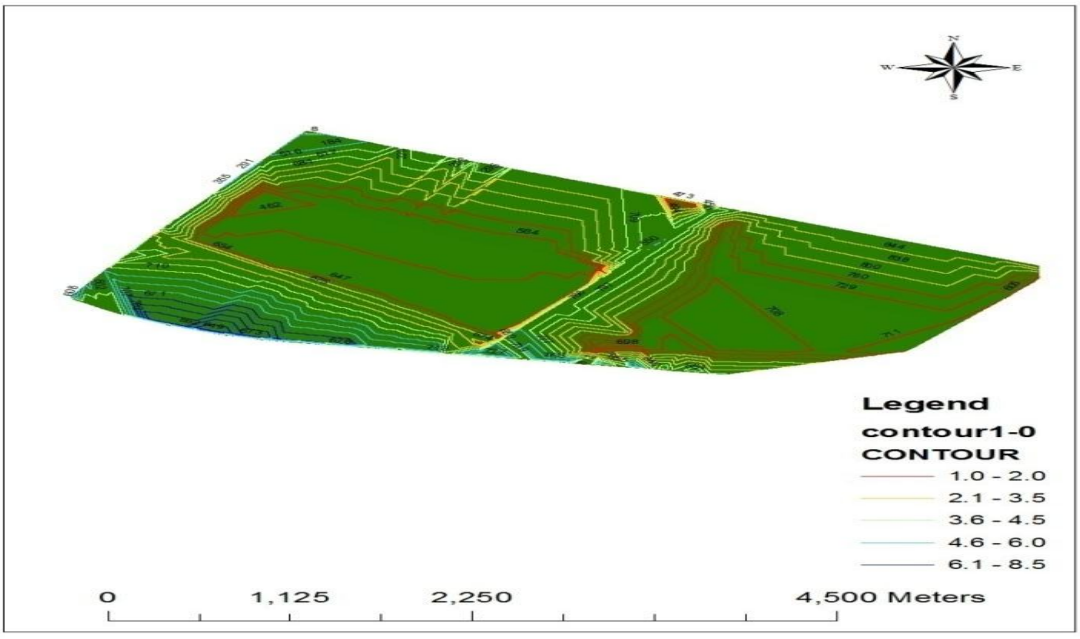

Figure 3b-The contour lines with interval (0.50) m

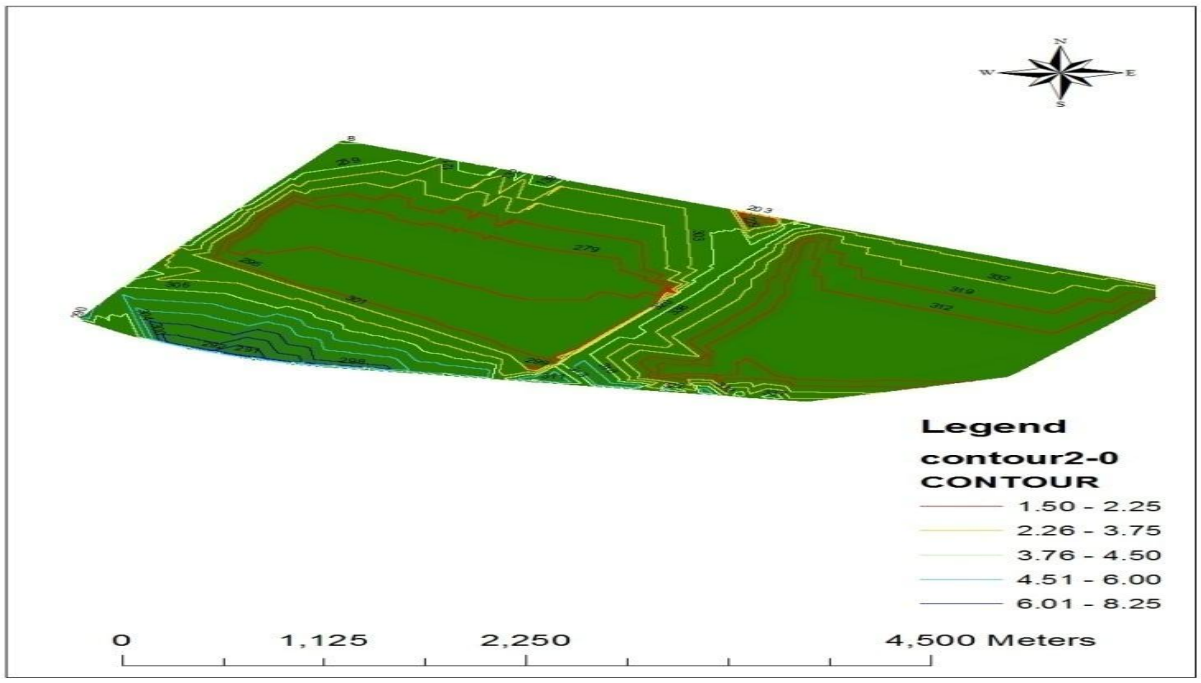

Figure 3c- The contour lines with interval (0.75) m

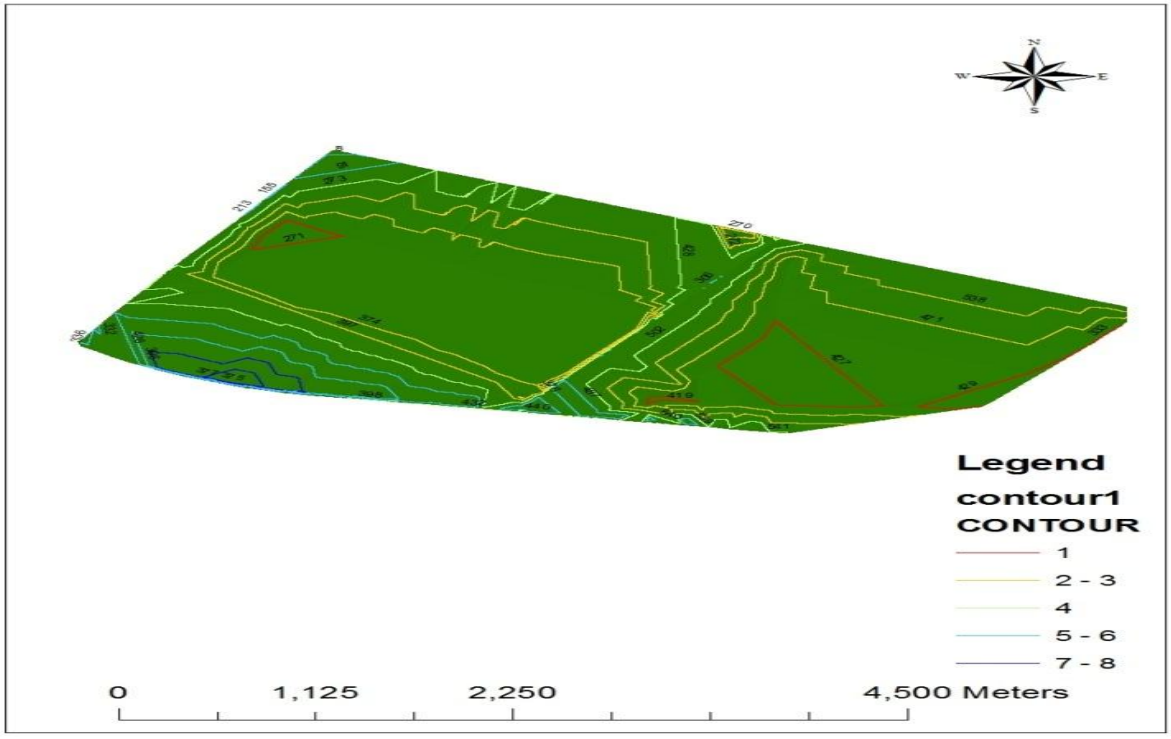

Figure 3d- The contour lines with interval (1) m

Result Discussion

Form the calculation results, the values of DEM for the region of interest is agree with the general elevation of the The-Qar Government aspect slope. In the field work, the real RTK mode of the Hiper-II DGPS navigation was stopped from time to time. In order to overcome the stooped problem, the DGPS unit must be restarted; this was due to the Navstar and Glonass satellites coverage. From the contour lines, the user can see that the lines are coinciding with the DEM values.

5. Conclusions

1. The DEM model for AL-khamisah region was created using the RTK DGPS data and GIS evaluations. This is the first study about this region for DEM generation.
2. The digital elevation model values can be summarized as, the highest elevation is 9 m and the lowest elevation is 1 m.
3. AL-khamisah region the contour line with different interval (0.25 , 0.50, 0.75 , 1) m altitudes ranging between 1 m – 8.5 m so characterized by varying heights within a small spatial region because it represents in multiple spots with flat surfaces.

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