ISSN: 2776-0960 Volume 3, Issue 5 May, 2022

THE USE OF THE DIGITAL ELEVATION MODEL (DEM) IN THE PRODUCTION OF TOPOGRAPHIC MAPS A REVIEW

Mahdi Hadi Mohsen
University of Kirkuk – Forestry Department
mahdibayaty@uokirkuk.edu.iq

Abstract

This study was conducted in northern Iraq / Dohuk governorate, which represents the border strip between Iraq and Turkey, which is bordered by Erbil and Mosul governorates, and lies astronomically between longitude (43°20'0" - 44°20'0"E) and latitude (36°20'0"-37°20'0"N). The study area is considered a very wide area with a varied topographic nature that is interspersed with many topographical features. For the purpose of producing digital topographic maps, the data of the digital elevation model (DEM) was used using (ArcGIS), and the DEM visualization of the Japanese satellite (Alos Palsar) with high spatial accuracy (12.5M) was used, which we will rely on in Topographical analysis of the study area and (contour map, slope map, aspect map and elevation map from sea level were produced).

Keywords: DEM , Aspect , Slope , Hill shade , Contour Line.

Introduction

Radar data is one of the most important sources for obtaining digital elevation data that shows the topography of the Earth's surface, which is above ground level. Through this data, it is possible to draw contour lines (of equal heights) with high accuracy and efficiency, and through this data, maps can be drawn Three-dimensional (D3) in order to give a clear picture of the shapes of the surface of the study area.

A digital elevation model is a quantitative representation of terrain and hydrological applications, and DEM can be generated using photogrammetry, interferometry, ground survey, laser and other technologies. Some DEMs such as ASTER, SRTM, and GTOPO 30 are open source products that are freely available (Mukherjee et al. 2013).

The digital elevation model provides basic information about the terrain the floor The digital elevation model consists of a series of points on the surface of the earth that are connected vertically with sea level and horizontally with a grid of longitude and latitude coordinates. The great progress in the sciences of

ResearchJet Journal of Analysis and Inventions
https://reserchjet.academiascience.org

topographic engineering through the development of aerial and space imaging technology, the emergence of digital survey devices and the development of geographic information systems created an imperative need to take advantage of the availability of spatial data that are compatible with modern digital methods so that they can be saved, distributed, analyzed and processed simultaneously (Guth, 2006).

The DEM data is very necessary because the digital model (DEM) is an important data source in both remote sensing and spatial information systems and in spatial databases. The production of these models has become faster and easier thanks to computers and the flexibility of the environment of information systems and software that deals with digital elevation models, Attempts have been made to examine the vertical accuracy of DEM ((Wu et al., 2008; Vaze et al., 2010; Zhou et al., 2012; Hirano et al., 2003; Bourgine and Baghdadi, 2005; Kornus et al., 2006; Tarekegn et al., 2010; Frey and Paul, 2012).

The widespread use of integrated space technologies has made geographical sciences more dynamic and flexible among other sciences, and made the average person know the importance of spatial signatures and care about the geographical reference of landmarks and the various components of the earth's surface, whether they are natural, human or economic. The integrated component of the material elements and the events taking place on the surface of the earth.

Production of Topographic Maps

Digital Elevation Model Map:

Map of the digital elevation model for the study area, which ranges in height between (237-2597) meters above sea level (Fig 1)

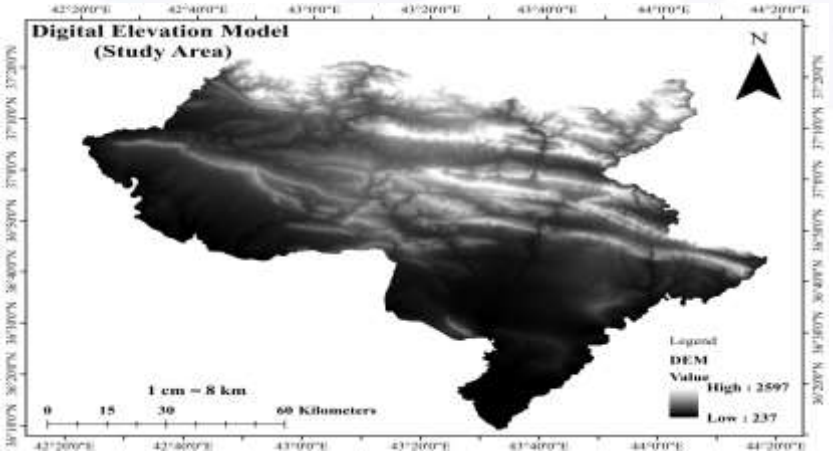

Fig.1 digital elevation model map

ResearchJet Journal of Analysis and Inventions
https://reserchjet.academiascience.org

The digital elevation model was used for the purpose of producing elevation maps from sea level, Aspect maps, hill shadow maps, and slope maps.

1- **Aspect Map:** this maps show the fronts of mountain ranges in the four directions , The aspect of the inclination means whether the inclination is to the north, south, northwest or southeast, and the faces are measured clockwise in degrees, where the north starts at zero degrees and then ends again towards the north to complete 360 degrees, as negative values refer to flat land. Fig.2

Arc Map--DEM--Spatial analyst Tools--Surface--Aspect--Ok

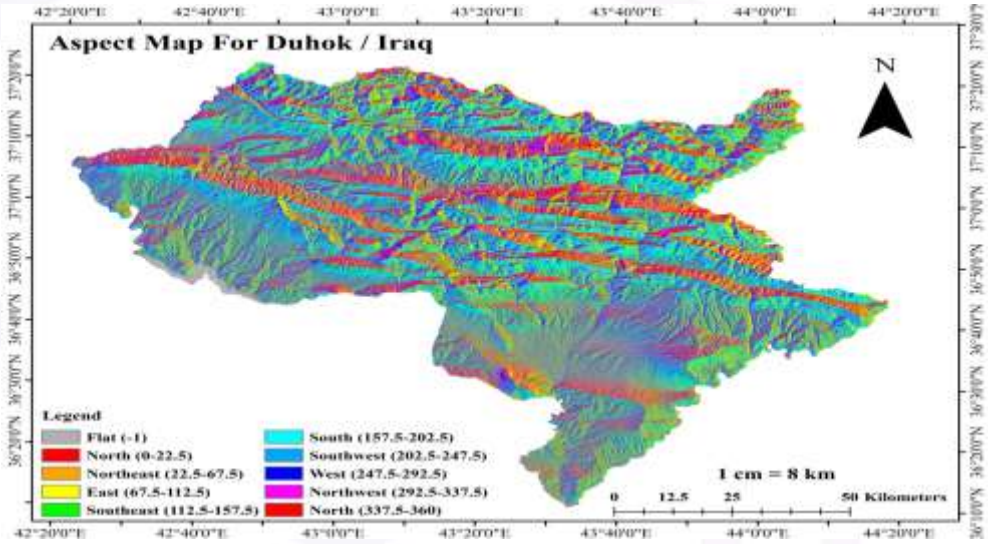

Fig.2: Aspect map

2- Derivation of the slope map:

Means the inclination of the Earth's surface from the horizon line, and the degree of inclination was calculated at each of the points Fig.3

Arc Map--DEM--Spatial analyst Tools--Surface--Slope--Ok

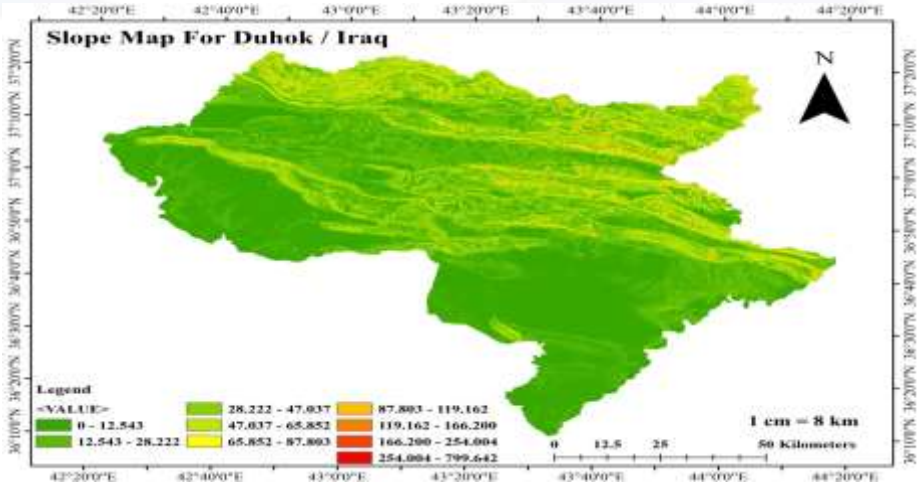

Fig.3 Slope map

ISSN: 2776-0960 Volume 3, Issue 5 May, 2022

ResearchJet Journal of Analysis and Inventions
https://reserchjet.academiascience.org

3- Derivation of the Hill shade:

Through this map, the lighting values for each cell are identified, and the map is prepared under the hills through a program Arc Gis , according to the steps Fig.4

Arc Map--DEM--Spatial analyst Tools--Surface--Hill shade--Ok

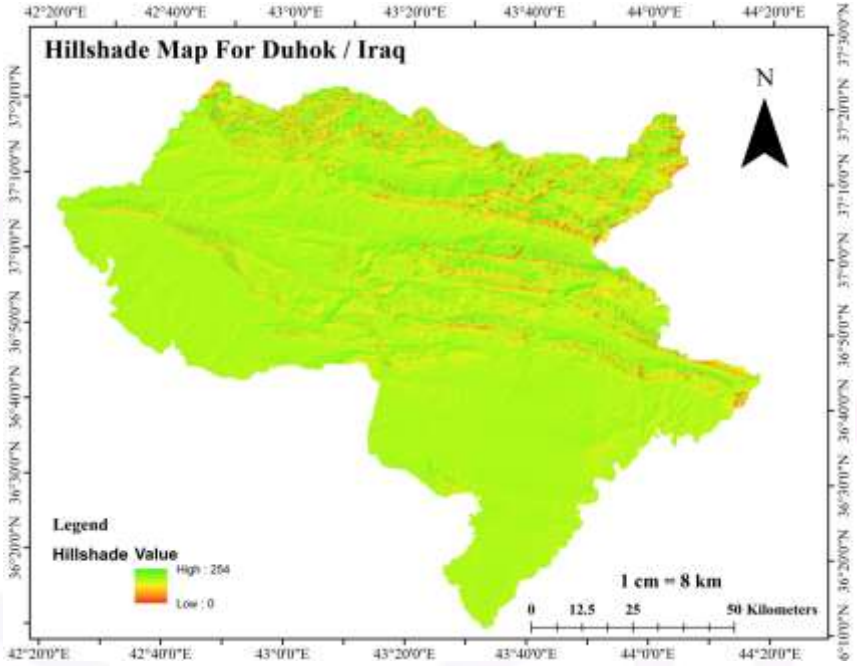

Fig.4 Hill shade map

4- Contour map:

It is a map showing the topography of the earth's surface through a number of drawn contour lines, which are known as contour Line , they are imaginary lines that pass through areas of equal sea level Fig.5

Arc Map--DEM--Spatial analyst Tools--Surface--Contour--Ok

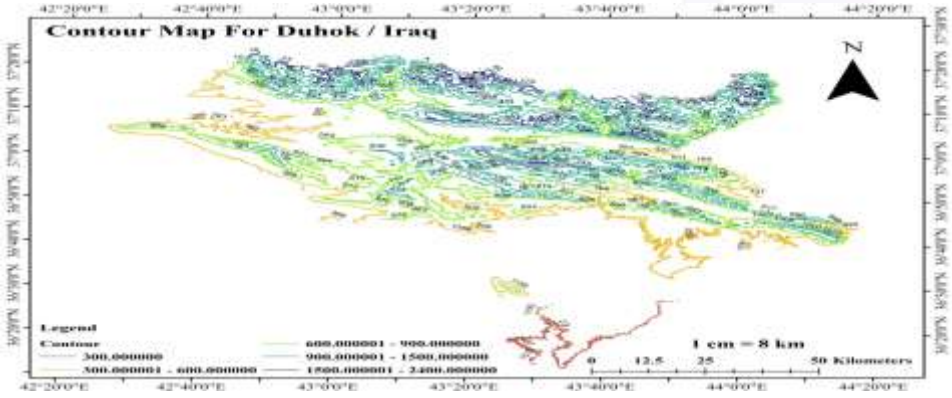

Fig.5 contour map

Conclusions

The study concluded that the use of the digital elevation model is very important to know the terrain, and the topographical nature of any region in the world, through mapping (Aspect map , Slope map , Hill shade and Contour map)

ResearchJet Journal of Analysis and Inventions
https://reserchjet.academiascience.org

References

1. Sandip Mukherjeea, P.K. Joshi, Samadrita Mukherjee, Aniruddh Ghosh, R.D. Garg, Anirban Mukhopadhyay.2013. Evaluation of vertical accuracy of open source Digital Elevation Model (DEM).international Journal of Applied Earth Observation and Geoinformation 21 (2013) 205–217.
2. Guth, P.L., 2006. Geomorphometry from SRTM – comparison to NED. Photogrammetric Engineering & Remote Sensing 72 (3), 269–277.
3. Wu, S., Li, J., Huang, G.H., 2008. A study on DEM-derived primary topographic attributes for hydrological applications: sensitivity to elevation data resolution. Applied Geography 28, 210–223.
4. Vaze, J., Teng, J., Spencer, G., 2010. Impact of DEM accuracy and resolution on topographic indices. Environmental Modelling and Software 25 (10), 1086–1098.
5. Zhou, H., Zhang, J., Gong, L., Shang, X., 2012. Comparison and validation of different DEM data derived from InSAR. Procedia Environmental Sciences 12, 590–597.
6. Tarekegn, T.H., Haile, A., Rientjes, T., Reggiani, P., Alkema, D., 2010. Assessment of an ASTER-generated DEM for 2D hydrodynamic flood modeling. International Journal of Applied Earth Observation and Geoinformation 12 (6), 457–465.
7. Frey, H., Paul, F., 2012. On the suitability of the SRTM DEM and ASTER GDEM for the compilation of topographic parameters in glacier inventories. International Journal of Applied Earth Observation and Geoinformation 18, 480–490.
8. Bourgine, B., Baghdadi, N., 2005. Assessment of C-band SRTM DEM in a dense equatorial forest zone. Computers and Geoscience 337 (14), 1225–1234.
9. Hirano, A., Welch, R., Lang, H., 2003. Mapping from ASTER stereo image data: DEM validation and accuracy assessment. ISPRS Journal of Photogrammetry and Remote Sensing 57 (5–6), 356–370
10. Kornus, W., Alamús, A., Ruiz, A., Talaya, J., 2006. DEM generation from SPOT-5 3- fold along track stereoscopic imagery using autocalibration. ISPRS Journal of Photogrammetry and Remote Sensing 60 (3), 147–159.