Digital Elevation Model of Green Mountain ,Abha,KSA

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***Abstract*— Analysis of the Earth's surface using 3-D models provides a wealth of new interpretation opportunities to geologists and Surveyors. Three-dimensional visualization of the Earth's surface and its examination at different angles and differently orientated is helpful for Surveyors. The tool is, however, relatively seldom used due to either limited access to digital data bases or time-consuming procedures of individual construction of such bases from the existing cartographic data. However, Topographic maps are most common source of terrain and elevation information for a given region. With the advancement of technology, other source of terrain and elevation data are now available at public domain. In this project work, elevation data points for Green Mountain of Abha City of Saudi Arabia extracted from the Google earth and a digital elevation model (DEM) was prepared.**

***Keywords*—Digital Data, DEM, Google Earth, Contouring**

I. Introduction

Digital Elevation Model is the continuous representation of elevation values over a topographic surface by a regular array of z-values, referenced to a common datum. Digital Elevation Models (DEMs) are helpful in many geoscience applications, namely topographic mapping, earth's deformation, hydrological and biological studies. It is of great significance to differentiate between DEMs and other form of terrain representation; the two most closely used and confused with DEMs are Digital Terrain Model (DTM) and Digital Surface Model (DSM). DTM is considered as a continuous usually smooth surface which, in addition to height values (as DEMs) also contains other element that describes a topographic surface; slope, aspect, curvature, gradient, and others. Like Digital Terrain Models, Digital Surface Models contain the spatial elevation data of the terrain in digital format which is presented as a grid with natural and artificial features such as vegetation, buildings etc. A filtered DSM result to DTM and a DEM is considered the most important component of DTM (Li, 1994; Maume et al., 2001; Li et al., 2005; Jobin, 2010).

A large variety of application is now drilling the requirement for increased details in Digital Elevation Models (DEMs). Details in this instance are defined by the horizontal sample spacing and vertical accuracy of the measurement. DEM is also an important utility of Geographic Information System (GIS). Using DEM/3D modelling, landscape can be visualized leading to a better understanding of certain relation in the landscape. Many relevant calculations, such as lakes and water volumes, Soil Erosion Volumes, quantities of earth to be moved for channels, dams, roads, embankments etc (ESRI, 2009).

The derivation of topographic attributes relies on digital elevation data sets that may be acquired from satellite imagery, digitizing the contour lines on topographic maps, or conducting ground surveys (Wilson and Gallant, 2000). Digital elevation data are typically compiled and stored in one of three data structures: (1) point elevation data on a regular grid, (2) point elevation data in triangulated irregular networks, and (3) digitized contour line data. The popularity of square grid DEMs is owed to their visual simplicity and ease of computer implementation (Moore et al., 1991; Wilson and Gallant, 2000). These square grids are arranged in rows and columns and each grid point represents the elevation at that location. Square grids have been criticized because they contain superfluous data in flat areas and they are unable to handle abrupt changes in elevation easily. The choice of a smaller grid size would increase the first and reduce the second problem. Another undesirable result of using square grids is that the computed upslope flow paths will frequently zigzag across the landscape in unrealistic ways (Wilson and Gallant, 2000). The second structure used to store digital elevation data is triangulated irregular networks (TINs). These networks are based on triangular elements or facets with vertices at the sample points (Moore et al., 1991; Wilson and Gallant, 2000). Three adjacent points on a plane are connected to form triangular elements. TINs can easily model sharp features such as peaks and ridges, and they can also incorporate discontinuities (Wilson and Gallant, 2000).

TINs are more efficient from the point of view that the number of sample points and triangles can be varied to match the surface roughness. Computer storage space is less using TINs compared to regular grids. Calculating topographic attributes is sometimes more difficult than with square grids due to the irregularity of the TIN structure; for example, it may be more difficult to trace the upslope connections of a facet and therefore more difficult to estimate the upslope contributing area at different points in the landscape (Moore et al. 1993).

The final structure is the contour-based network consisting of small, irregularly shaped polygons bounded by adjacent contour lines and streamlines (lines drawn orthogonal to the contour lines). This type of structure is difficult to implement but is nevertheless popular in hydrological applications because it can reduce complex three-dimensional flow equations into a series of coupled one-dimensional equations in areas of complex terrain (Moore and Foster, 1990).

The provision of gridded elevation data sets by many national mapping agencies (e.g. United States Geological Survey (USGS) at http://www.usgs.gov) coupled with the development and wide distribution of methods for converting contour elevation data to square grids (see Hutchinson 1989 for one such method) have contributed to the popularity of gridded elevation data sets and grid-based topographic attributes . Table (1) presents a list of grid-based topographic attributes and their connotations. Most of the algorithms for calculating topographic attributes have been proposed have

been implemented inside a GIS and are well documented in different literatures (e.g., Florinsky, 1998; Dunn and Hickey, 1998; Qiming and Xuejun, 2004; Zhou and Liu, 2004; Shi et al., 2007). This state of affairs introduces two new challenges in particular, the need to learn more about the performance of these different algorithms in different settings to maximize the likelihood that the algorithm best suited to the application and landscape at hand. And also, the need to ascertain the performances or reliability of the different data sources for generation of grid based DEMs in view of increasing number of global data set and the demand for such products. The former challenge is left for other studies while this paper ponders discussion on the latter.

This paper presents the result of an experiment to test the accuracy of DEMs that are generated from two global data sets sources (Shuttle Radar Topography Mission(SRTM 30),

and Google Earth Pro), digitized topographic map and the reference DEM generated by ground surveys for the study area

II. PROBLEM STATEMENT

It is Proposed to create Digital Elevation Model for Green hill mountain Abha, Kingdom of Saudi Arabia. To accomplish the task firstly the digital data has been taken from Google imagery by digitizing the points on Green hill mountain and saved in excel file. Secondly excel has been imported in surfer software which helps in creating digital elevation model.Digital Elevation has been created by three methods and for each method surface map and wiremap has been created. Moreover the contour map for getting elevation information has been created.

III. STUDY AREA

Green Mountain restaurants & cafés are located at Abha City on the highest point of Jebal Thera, with dramatic views over Abha City & the surrounding regions. Abha City is located in the southern region of Asir at an elevation of 2270 meters (7448 feet) above sea level. The climate of Abha is cold and semi-arid and it is influenced by city's high elevation. The city's weather is generally mild throughout the year, becoming noticeably cooler during the “low-sun” season. Abha seldom sees temperatures rise above 35 °C (95 °F) during the course of the year. The city averages 278 mm of rainfall annually, with the bulk of the precipitation occurring between February and April, with a secondary minor wet season in July and August.The highest recorded temperature was 40 °C (104 °F) on August 25, 1983, while the lowest recorded temperature was −2 °C (28 °F) on December 29, 1983

Fig.1 Study Area

IV. METHODOLOGY.

To create Digital elevation model,3D-Data has been taken from Google earth map of Abha city. Now this data act as input parameter for surfer software. Digital elevation model and Wire map has been creates using three interpolation function Kriging Method, Minimum Curvature Method and Modified Sheferd Method

Kriging Method

This method produces visually appealing maps from irregularly spaced data.

Kriging is a very flexible gridding method. You can accept the kriging defaults to produce an accurate grid of your data, or kriging can be custom-fit to a data set by specifying the appropriate variogram model. Within Surfer, kriging can be either an exact or a smoothing interpolator depending on the user-specified parameters.

Minimum Curvature

Minimum Curvature is widely used in the earth sciences. The interpolated surface generated by minimum curvature is analogous to a thin, linearly elastic plate passing through each of the data values with a minimum amount of bending. Minimum curvature generates the smoothest possible surface while attempting to honor your data as closely as possible.

Modified Shepard's Method

Modified Shepard's Method uses an inverse distance weighted least squares method. As such, modified Shepard’s method is similar to the inverse distance to a power interpolator, but the use of local least squares eliminates or reduces the "bull’s-eye" appearance of the generated contours. The modified Shepard’s method can be either an exact or a smoothing interpolator.

V. RESULTS

The result obtained by surfer software is shown in figure

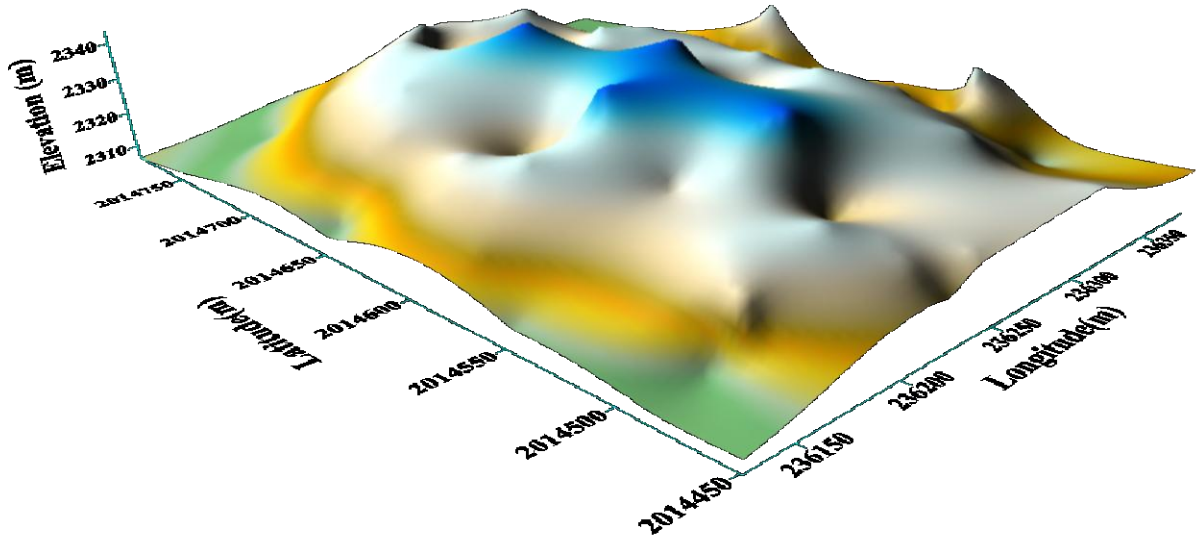

Fig 2. Digital Elevation Model Using Kriging Method

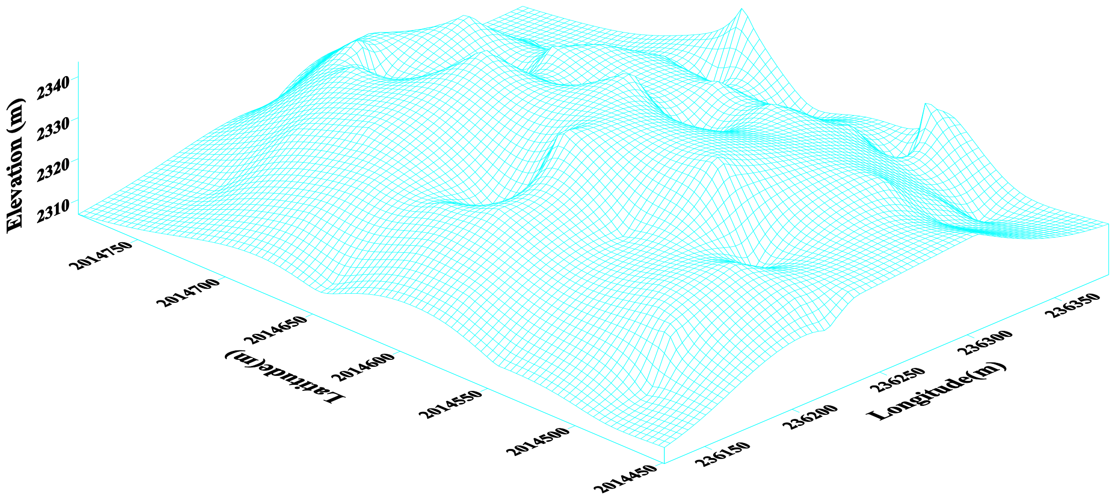

Fig 3.Wiremap Using Kriging Method

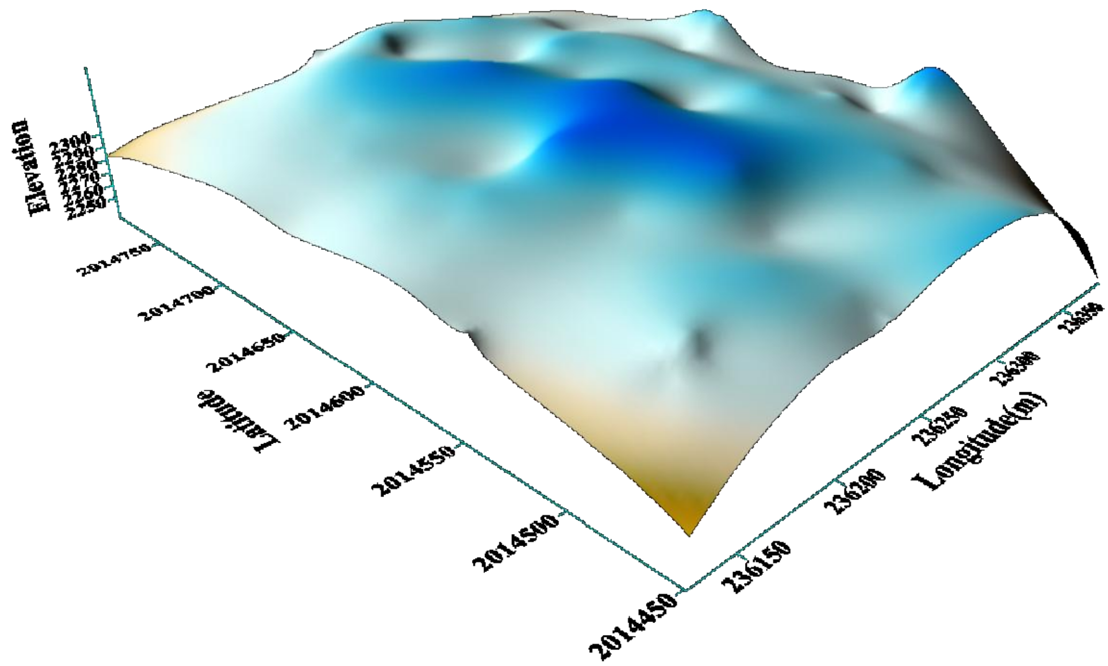

Fig 4. Digital Elevation Model Using Minimum Curvature Method

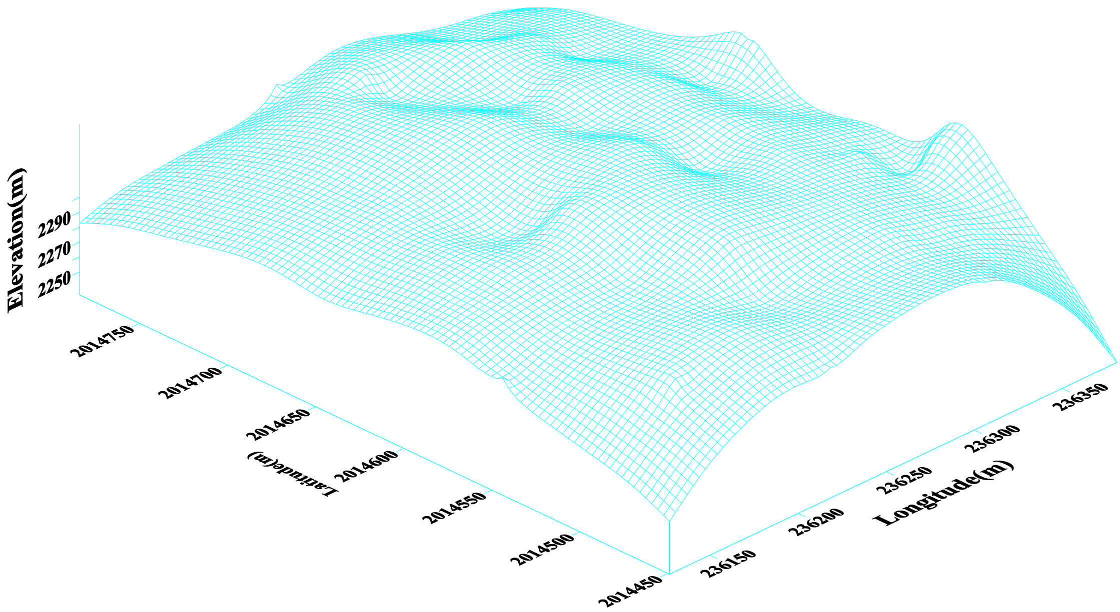

Fig 5. Wire Map Using Minimum Curvature Method

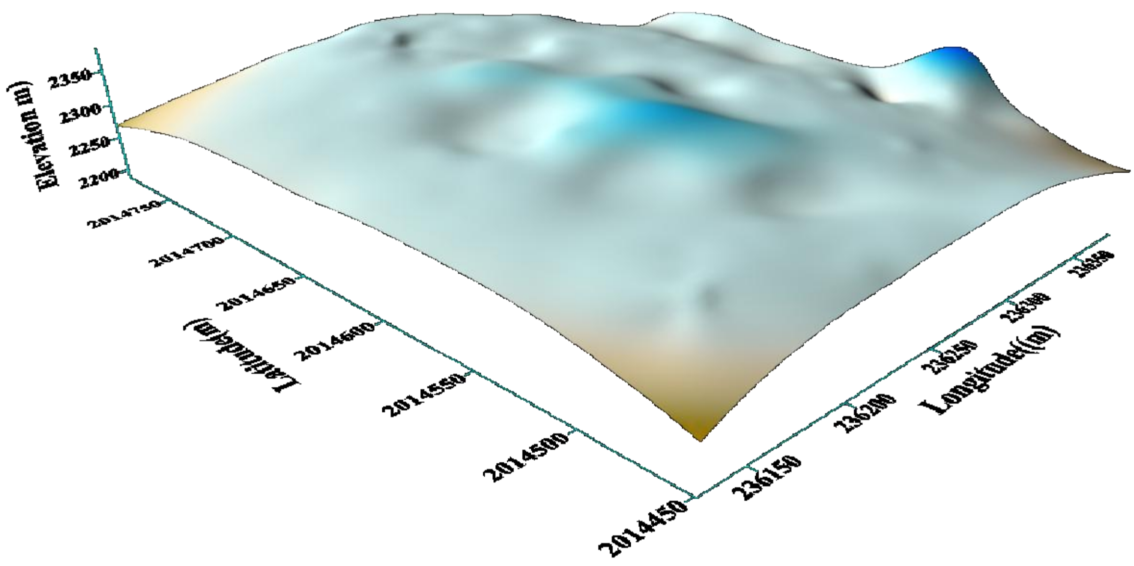

Fig 6. Digital Elevation Model Using Modified Shephard Method

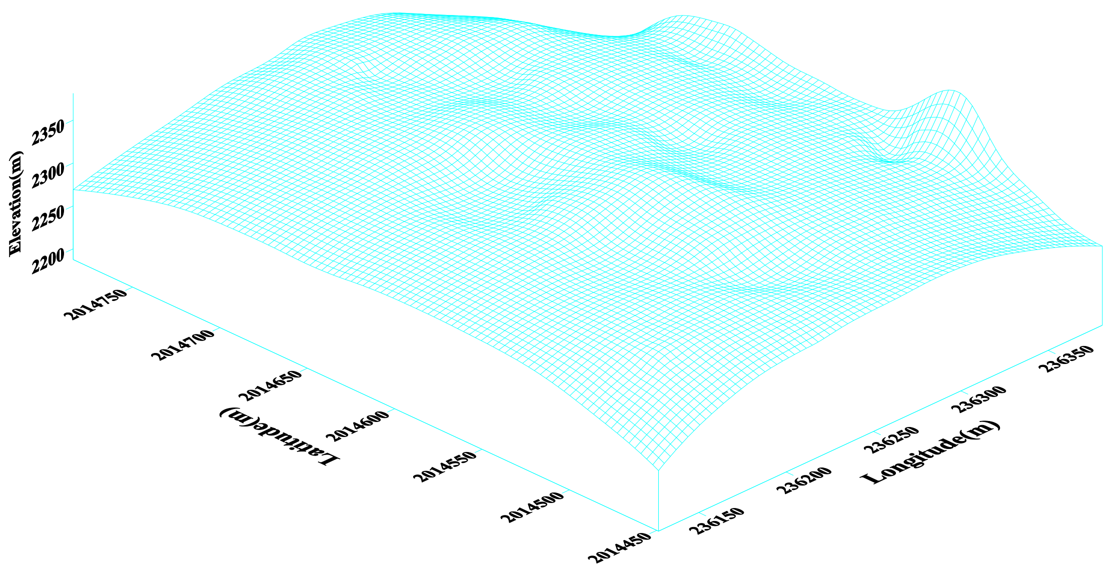

Fig 7. Digital Elevation Model Using Modified Shephard Method

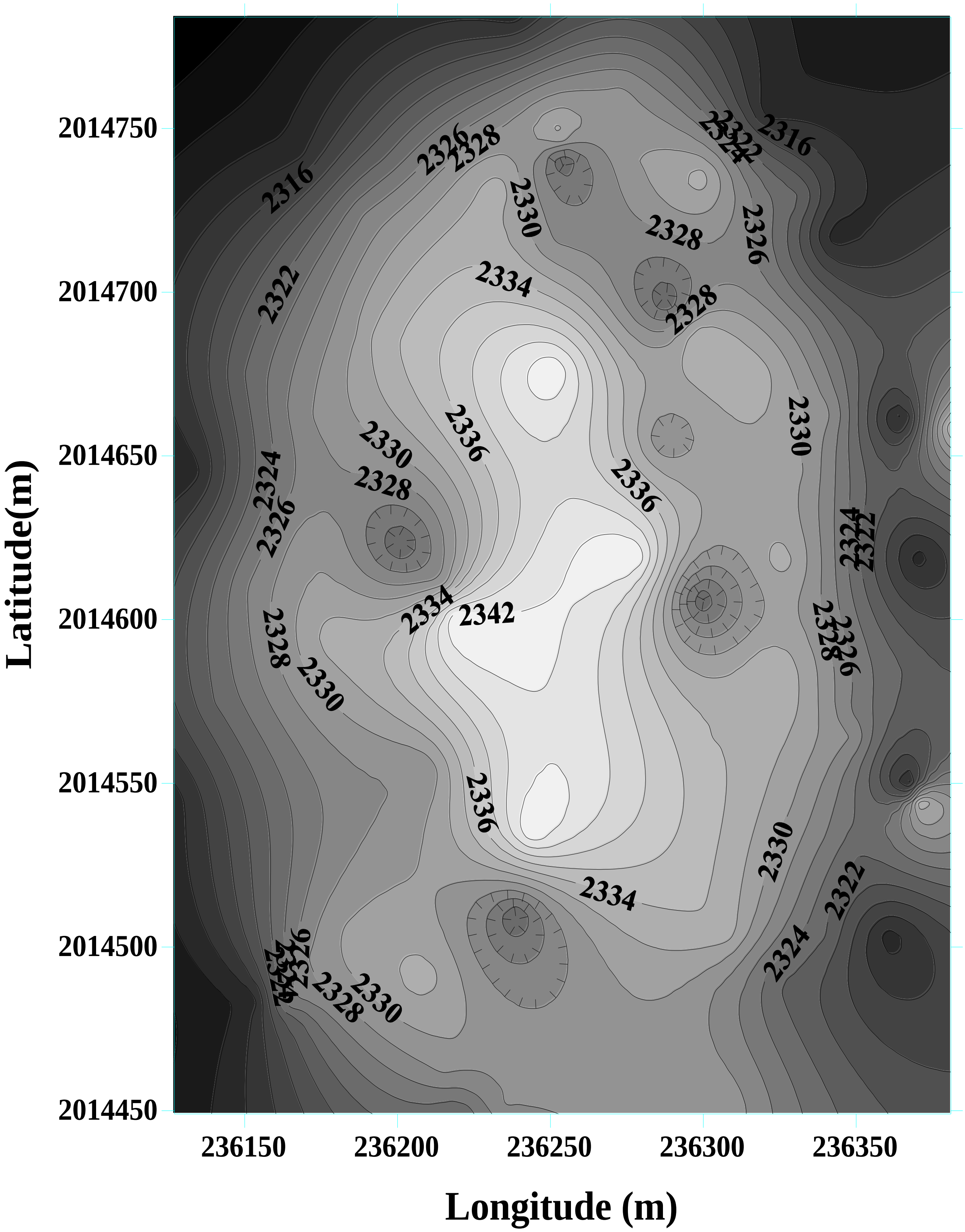

Fig 8. Contour Map

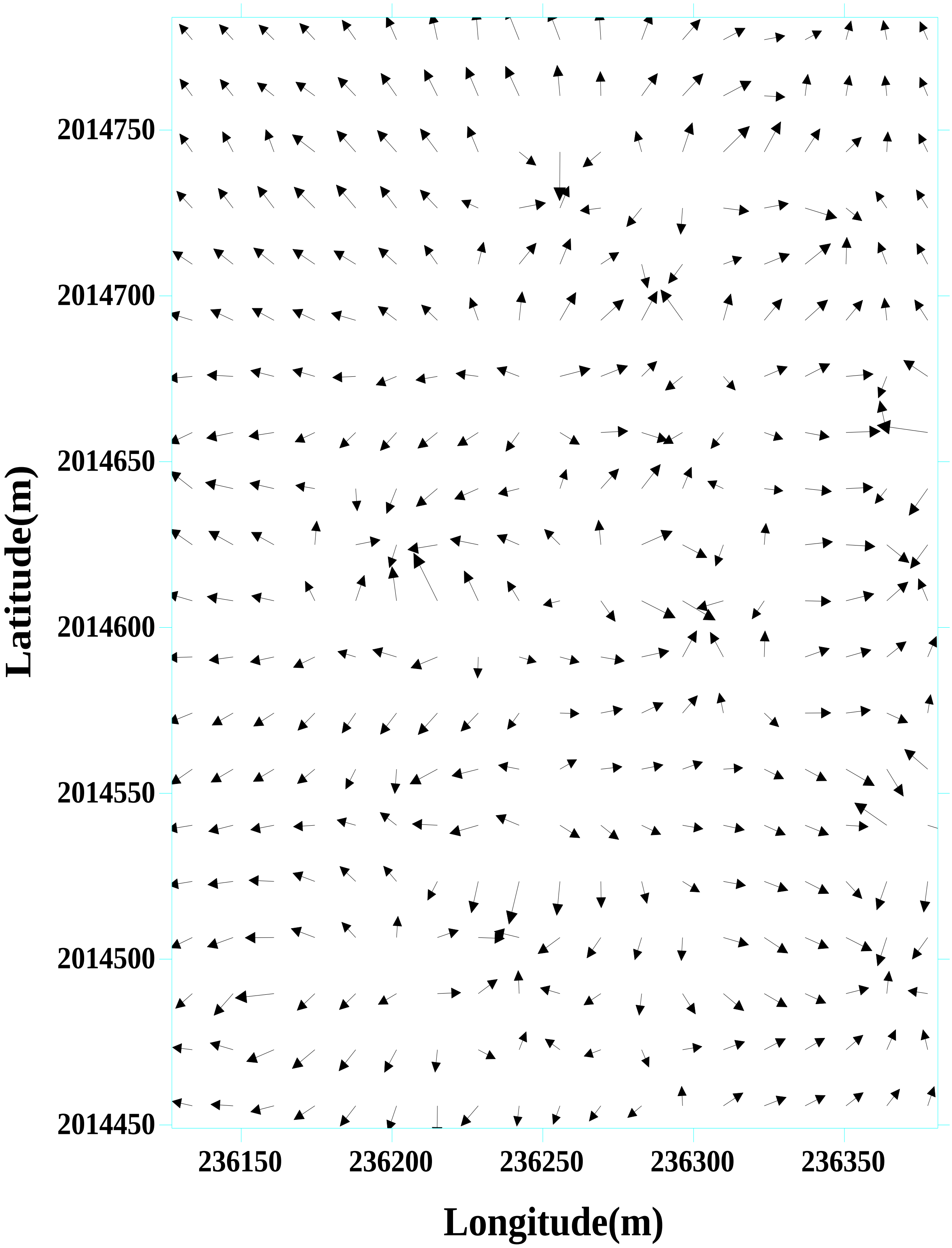

Fig 9. Vector Map

VI. CONCLUSIONS

We found this study is really interesting as this study provides a procedural improvement in the accuracy statistics calculation and the results shows that

- Google earth can be a potential source of terrain information for many civil engineering projects.
- The result is related to location of the study area. If it is located in United States, the results may be different and the quality of Google Earth DEM even better**.**
- Google Earth's DEM, is applicable to be used as a data source for conducting Digital Elevation modeling process.
- Free source of elevation data are really useful to assist researchers/students minimizing their time collecting elevation data which are normally tedious, time consuming and costly.
- Digital elevation models have proved to be increasingly more important in geological and geomorphological studies.
- DEMs and their software can be used as a tool in a complex analysis of the Earth's topography and legible data visualization.
- Quick construction of colour contour maps or shaded relief maps represents only basic application of digital elevation data.
- Digital models are also helpful in fast construction of a number of derivative maps, like those of slope, gradient.etc
- The optimal selection of digital elevation data formats for better calculations plays very important role in the analysis and contour generation of a particular projected area. Because the pure output readings always depend upon the captured input data only.

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BIOGRAPHY

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