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A STUDY ON GRAVIMETERIC SITUATION IN EAST OF UROMIEH LAKE REGION WITH DETERMINATION OF SUITABLE BOUGUER DENSITY

Maryam Bayat[1] --- Asghar Teymoorian[2]
[1,2]*Department of Geophysics Hamedan Branch, Islamic Azad University, Hamedan, Iran*

ABSTRACT
In this paper, the optimal density determined using fractal geometry to Urmia region in this way trying to minimize the topography of the region. Using this method, we can obtain the Bouguer anomaly optimum density east of Uromieh Lake and turn to the regional gravitation.

Keywords: Optimal density, Bouguer anomaly, Fractal analysis, , Topography, East of Uromieh lake.

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1. INTRODUCTION

According to Fig (1), the region of east of Uromieh is located at longitude of $45^{\circ}27', 46^{\circ}15'$ and latitude of $37^{\circ}40', 38^{\circ}18'$. This region is a part of oil field of Caspian sea in the zone 38 north in east Azarbayjan. The region of study consists of about 1400 stations of measuring gravitation in the direction of 34 profiles. Due to thick evaporate deposits from Oligocene and Miocene era has the capacity of hydrocarbon reserves in carbonated host rocks. The sample of determining points in the region stretches to Tabriz, Marand, Shabestar, oskou, and Azar SAHR. The region susceptiple in the area consist of limestone Facials attributed to Qum formation. This formation is of great importance due to the presence of thick layers of rocks and vapored deposits which constitute different parts of oil fields and hydrocarbonate Reservoir coating rocks of Middle East. Specific environments are susceptible to contitute vaporites such as permanrntly salty lakes of Urumieh and deud sea.

The island in Urumieh lake are among the areas in which the stacks of Qum structure have a representation and these stacks data back to the early miocene. There is the probability of hydrocarbonat ereservoirs due to limestone structure and porosity.

As one of the steps to attain Bouguer anomaly is to determine Bouguer density to do the corrections and the measurement of gravitational change in host rock and evaporate rock coating is a criterion to follow construction traps and determination of reservoir (Goodchild, 1982) the application of wrong values of Bouguer density leads to the increase of error in determining the situation subsurface facials making it impossible to attain the reservoirs (Mandelbrot, 1975). Therefore, the modification of anomalies and proper estimation of density from rock tablet changes are necessary to follow rudimentary of oil fields in gravitational method. Fournier and Fussell (1982). In the regions of high tectonic and number of construction contours, the Netelton pattern is not suitable to modify the effects of rock tablets (Aronson Peter and David, 1984). In Iran, due to use of this pattern, there is the possibility of error from topographic considerations.

Therefore, in this paper, a new fractal method has been used to reduce error.

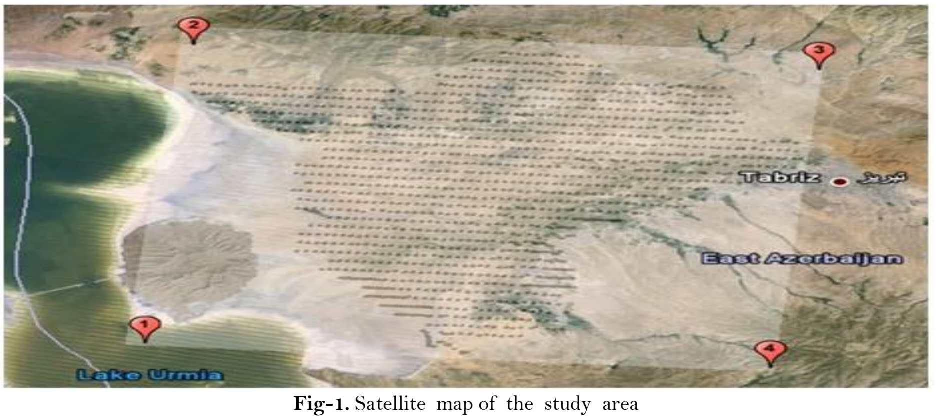


Fig-1. Satellite map of the study area

1.1. Fractal Analysis of Free Air Anomaly

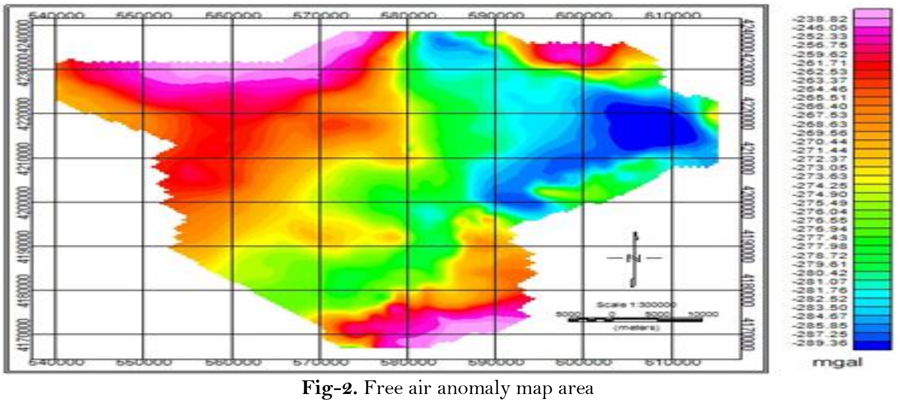


Fig-2. Free air anomaly map area

Fig 2 shows the free-air anomaly of east region of Urumieh lake. The first stage, the gravitational data having been processed, is to use free-air anomaly under the skew relationship of distance to get the variables independent of costatic phenomenon of mantle.

To obtain this goal, the algorithmic procedure can be expressed as follow:

1) Geographical coordinates of measurement stations are turned in to Cartesian coordinates.
2) The center and radius of the great circle are determined.
3) The circle is drawn.

4) The drawn circle is divided into definite numbers of parts.
5) The data located in this circle are sorted in certain distance.
6) Variance of data in each set is calculated.
7) The logarithmic graph of variance versus distance is depicted.
8) The logarithmic graph of variance versus distance is depicted.
9) The line of least squares is fitted to a part of curve having fractal property.
10) the tangent line slope is Determined
11) the fractal dimension is obtained the slope.

Data interpolation was carried out in kriging method at960 m distance(fig3). Due to concentration of data in the central region, the great circle was drawn in this part using most crop points. The circle diameter was divided in to 50 equal parts. The variogram of square mean of value difference (variance) versus distance was depicted. Based on Fig (4), the free air variance of region shows a dual behavior; to 3 km, a fractal behavior with the dimension 2,24 showing the topography is supported by crust and the other part is influenced by region contours.

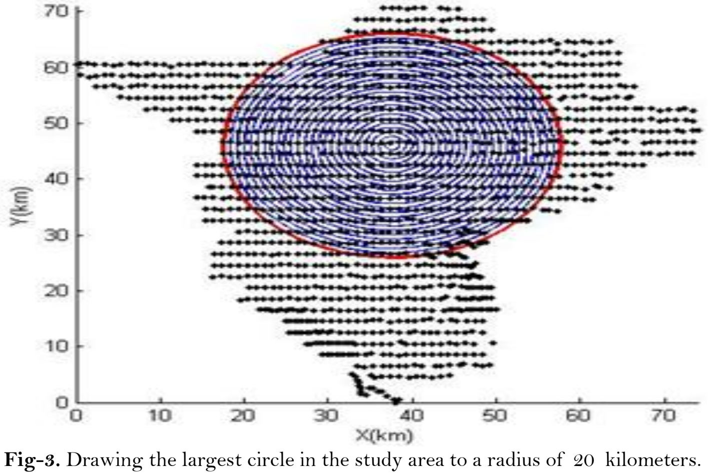


Fig-3. Drawing the largest circle in the study area to a radius of 20 kilometers.

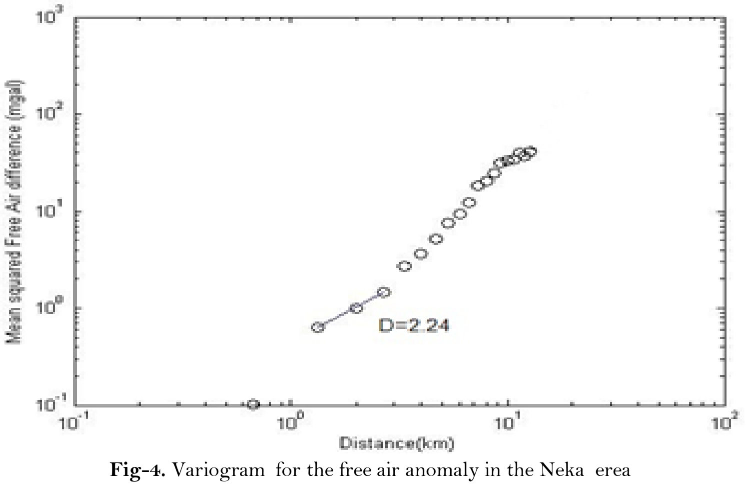


Fig-4. Variogram for the free air anomaly in the Neka erea

The linear relationship out to 5km indicates a fractal. Surface and is interpreted as crustally supported topography . The nonfractal character at larger distances is interpreted as isostatically compensated topography.

1.2. Optimum Mean Density of Region Using Fractal Method

Having surveyed the free air anomaly and recognized the gravitational changes independent of altitude effects of stations, we consider the relationship of distance-diffusion for Bouguer anomaly for different values of density.

The density used ranged from 1.7 to 2.7 g/cm^3. Fig 5 shows the greatest circle covering most data points in the region. The circle is divided into 25 equal parts and variance-distance graph is depicted for different densities (Samadi, 2013). The least dimension of density is calculated to be 1.9 g/cm^3

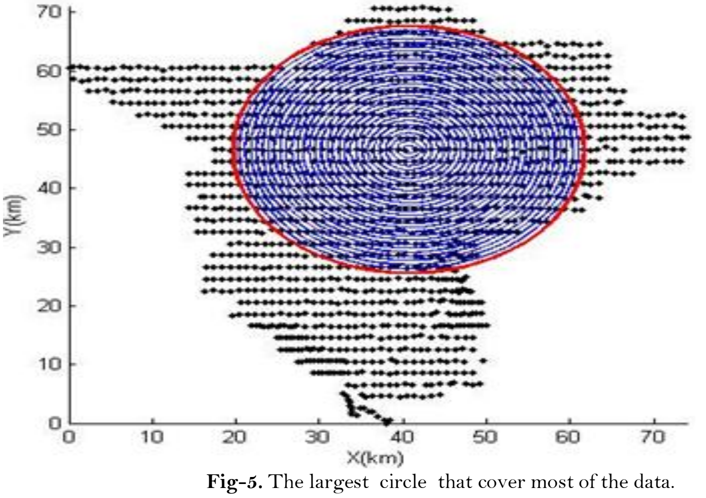


Fig-5. The largest circle that cover most of the data.

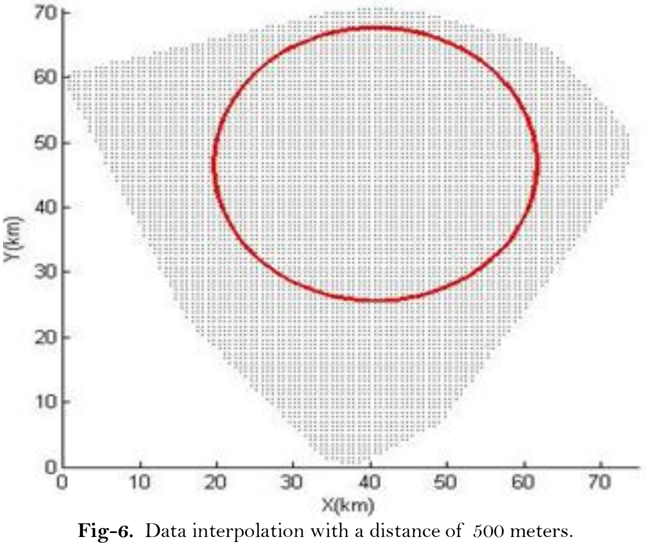


Fig-6. Data interpolation with a distance of 500 meters.

From the curve, the fractal dimension in the region for the density of lowest dimension is 1.9 g/cm^3.

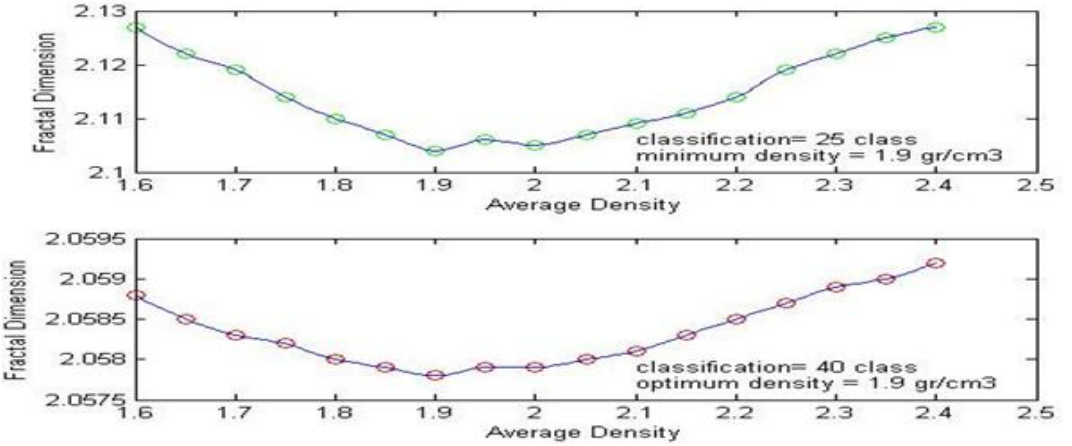


Fig-7. Curves obtained for the fractal dimension.

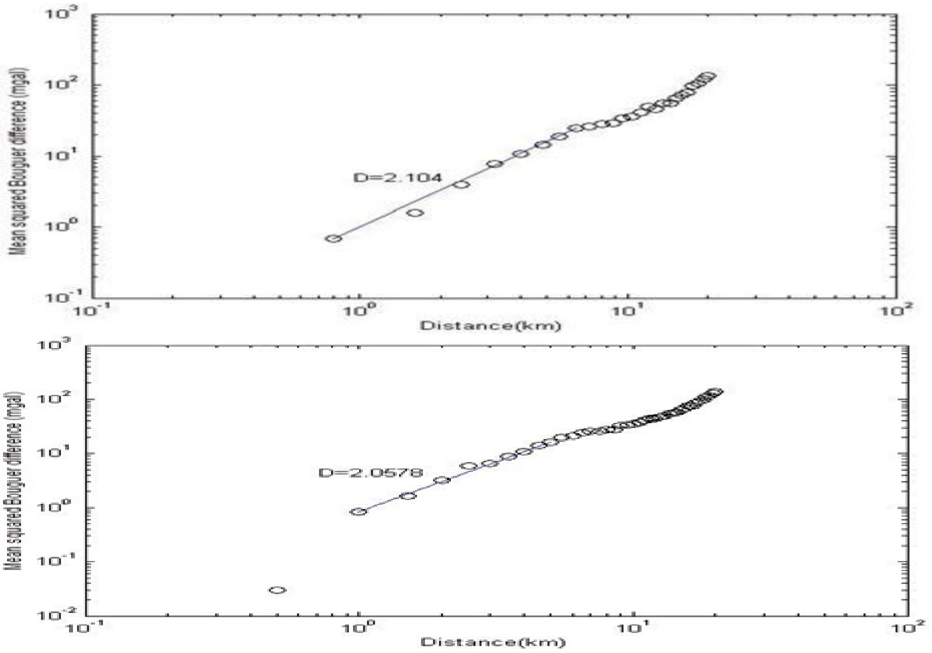


Fig-8 . Variogram for the Bouguer anomaly in the erea density of 1.9 $\frac{gr}{cm3}$ $and\ with\ 25\ and\ 40\ topclass$.

1.3. Region Mean Density Using Netelton Method

To obtain the region mean density, we used the gravitational data by NIOC as we did not have the Netelton's data of region and the calculation method by NIOC was Netelton method.

The mean density was obtained to be 2.01 g/cm^3.

$\delta g_{B=0.04188\rho h}$

1.4. The Comparison of Bouguer Anomaly Correlation Made By Region Profile

The comparison of Bouguer anomaly correlation made by region profiles with four profiles on Bouguer anomaly map from optimum density, mean and topography map, the following results were obtained (Thorarinsson and Magnusson, 1988).

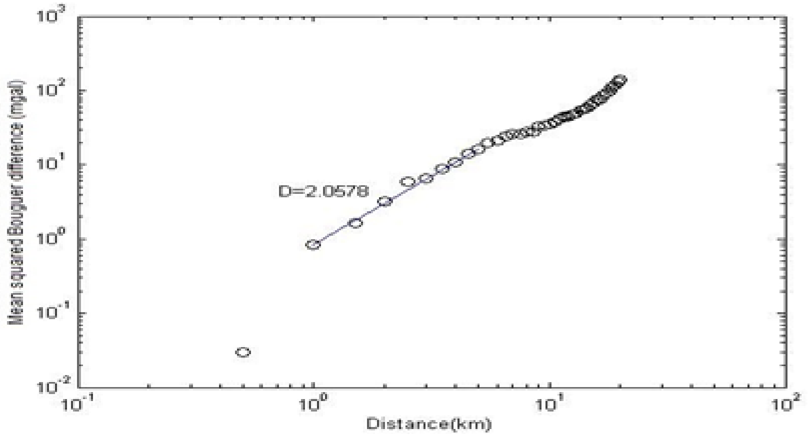


Fig-9. Variogram for the Bouguer anomaly in the erea density of 1.9 and with 40 topclass.

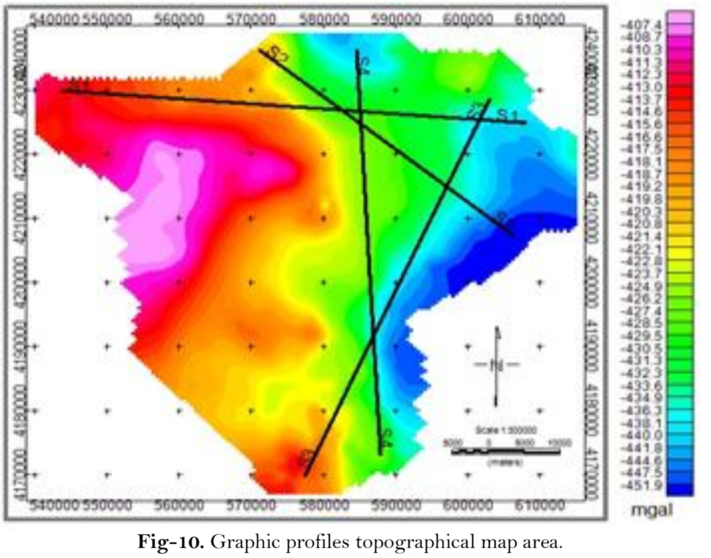


Fig-10. Graphic profiles topographical map area.

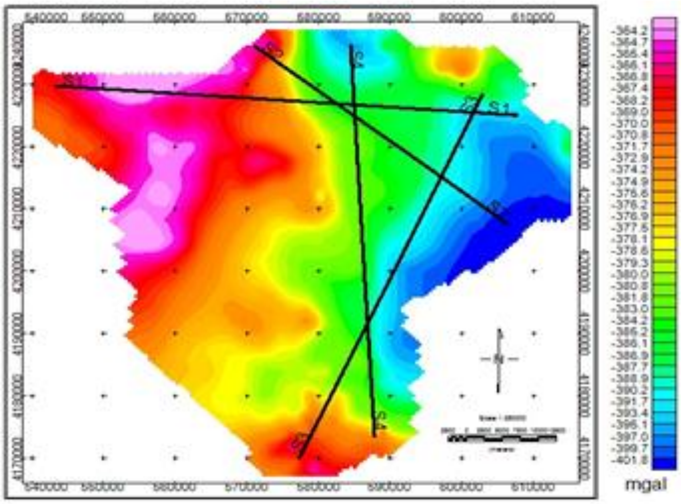


Fig-11. The graphical profiles that is creat on the Bouguer anomaly map whit optimal density.

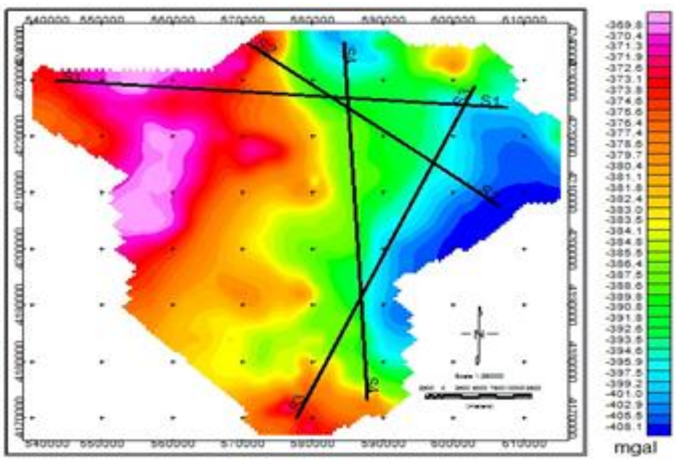
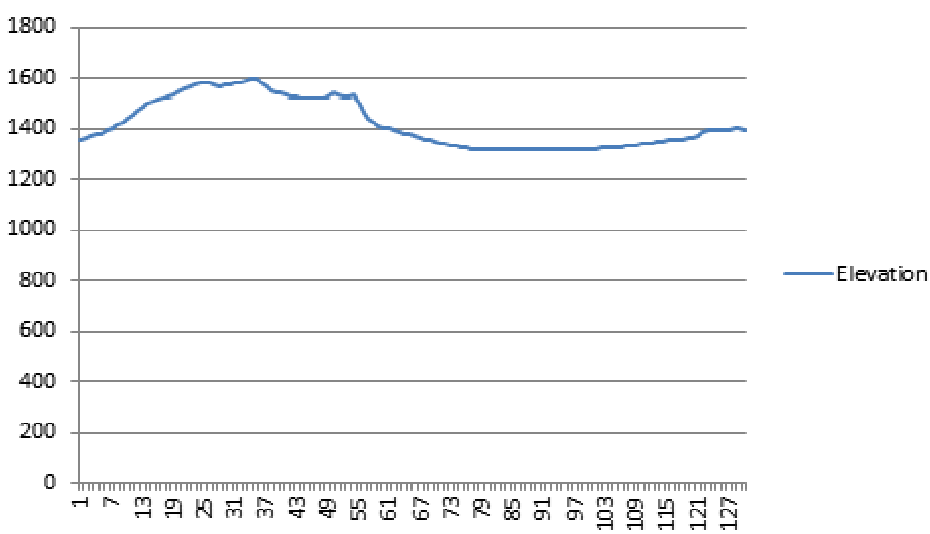


Fig-12. The graphical profiles that is creat on the Bouguer anomaly map whit optimal density.



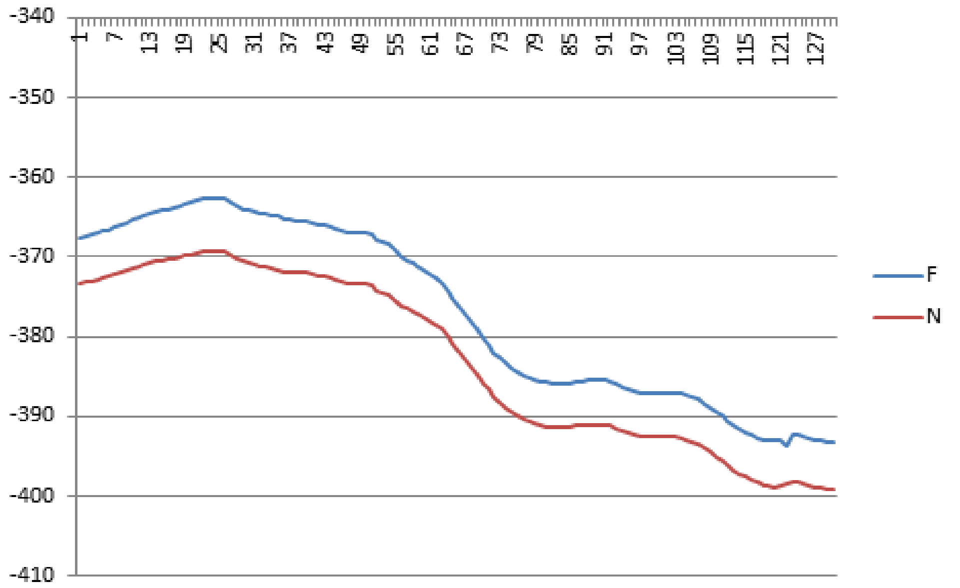


Fig-13. A.Section topographic profiles s1. B.Section Bouguer anomaly optimal density and mean density.

Table-1. Table section of optimal density and mean density .

Bouguer anomaly correlation of fractal density and topography	Bouguer anomaly correlation of netleton density and topography	Profile
0/805	0/817	S_1
0/252	0/255	S_2
0/204	0/222	S_3
0/044	0/0441	S_4

The numbers in table and the procedure profile curves s_1, confirm the principles of fractal analysis.

1.5. Survey and Comparison of Bouguer Anomaly Correlation and Topography of All Region Data by Pearson Method Using Correlation Statistical Method.

In this section, using pearson correlation method, we compared the Bouguer anomaly data from both densities with topography as shown in table 2.

Table-2. Pearson correlation table.

Full bouguer correlation between topography and the optimal density of the fractal	0/23952
Full bouguer correlation between topography and the regional average density	0/26951

2. INTERPRETATION OF RESULTS

1. The results show that fractal distribution of gravitational data aiming at assessing Bouguer anomaly change in the region provides better results due to use of corresponding quantities focusing on fractal properties which make it possible to

estimate density in a situation independent of topography compared with modification pattern of Netelton.

2. Using fractal method, we obtained the optimum density to be 1.9 g/cm^{3}and Bouguer density was obtained from Netelton method at 2.01 g/cm^3 showing that Bouguer density from fractal method in vast region is of greater accuracy and lower error the Netelton method.
3. From this research, making gravitational profiles on Bougeur anomaly map from optimum and Netelton density(mean), and topography, we concluded that profile obtained from fractal density is smoother, confirming the fractal analysis because the optimum density is obtained for the lowest fractal dimension.
4. Variogram of free air change shows a limited linear relationship for short distance which is vanished for greater distances.
5. The data of this region are fractal to 5 km and topography is under the support of crust expressing the dependence of free-air anomaly and topography in these distances.
6. The values of pearson correlation show that anomaly of fractal density had less dependence on topography and this density is obtained by minimizing anomaly Bouguer anomaly roughness, because applying density values mistakenly in modifying roughness of Bouguer anomaly is influential.

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Contributors/Acknowledgement: All authors contributed equally to the conception and design of the study.

REFERENCES

Aronson Peter, B.M. and M. David, 1984. Scale-dependent fractal, dimensions of topographic surfaces. Math. Geol, 16(2): 671-683.

Fournier, A. and D. Fussell, 1982. Computer bendering of stochastic models. Comm. Acm, 25(6): 371-384.

Goodchild, M.F., 1982. The fractional brownian process as a terrain simulationmodel proccedings. Thirteenth Annual Pittsburg Conference on Modeling and Bimulation. pp: 1133-1137.

Mandelbrot, B.B., 1975. How long is the coast of Biritain? Statistical self similarity and fractional dimention. Science, 156(4): 636-638.

Samadi, H.R., 2013. Optimal density determination of bouguer anomaly using fractal analysis (Case of Study: Charak Area, Iran). International Journal of Geography and Geology, 2(7): 80-85.

Thorarinsson, F. and S.G. Magnusson, 1988. Directional specteral analysis and filtering of geophysical maps. Geophysics, 53(5): 1587-1591.