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RESEARCH ARTICLE

THE INVERSION OF THE DATA IN THE MODELING (SOUTH WEST OF KUHPAYEH)

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ABSTRACT

Geometry and topography of the bedrock of the area can be recognized by the difference between optimal density and the density of the bedrock, in which all of the calculation for determining the topography of the bedrock are performed in the Fourier area. In fact, all of the obtained results are approximately good in geology and the drilled exploratory in determining topography of the area's bedrock.

INTRODUCTION

Explain natural complex and apparently irregular shapes. In Euclidean geometry dimension is an integer such as one, two and three. As a consequence, Euclidean geometry is able to explain one, two, three and higher dimensional phenomena According to Chotia's theorem (Chotia, 2001), for determining the geometry of the bedrock, first, we should extract the remaining gravity that is representing of the signal of the topography of the bedrock, and then the remaining gravity is used to invert the topography of the bedrock and its density. The upward continuation formula (Jacobson, 1987) is chosen to extract the remaining field. For inverting the topography of the bedrock according to (Parker, 1973 and Oldenburg,1974) equations in Fourier domain, the bedrock is modeled like an infinite flat plan with the even bottom and upper wavy surface. This algorithm supposesthe constant density difference between bedrock and the materials that are on their surface based onthe geological information, which is able to identify the three dimensional topography of the bedrock in the whole of the region. For inverting the density according to equations (Last and kubik, 1983) and equations (Bulenger and chotia, 2001), the sub-surfaces are divided into n cells in which every cell has constant density.

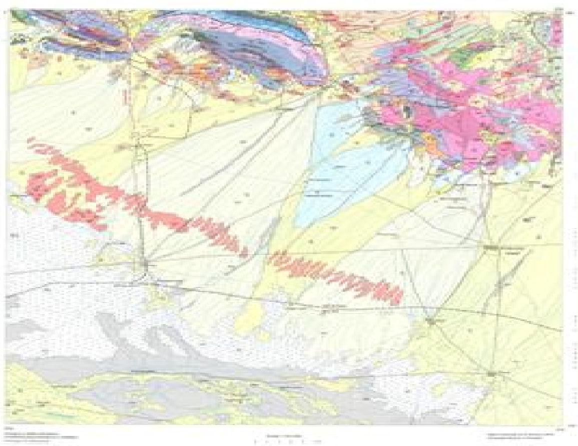

Fig1geology of area

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Inversion considersadensity for each of cells and finally presents us the three-dimensional picture of the density.

Determining the topography of the bedrock of the region

Applying upward continuation to separate local field from regional

For several decades, it has been a vital subject in gravity and magnet to separate the regional and remaining fields. A proven process for separating the regional and remaining fields is by convolving with the so-called separation filter. In other words, for the observed field (f_0) equals the addition of regional field (f_{reg}), remaining (f_{rem}), and noisy (f_{noise}) together i.e.

$$F_0(r) = f_{reg}(r) + f_{res}(r) + f_{noise}(r) \quad (1)$$

Sandwich source distribution structure

We consider a sandwich constituting of N narrow layers with a small vertical space Δzin which all of the layers have the energetic spectral *s(k).* Since we do not consider any correlation among the density distribution in distinct layers, external energy among them will tends to zero, so we conclude that the spectral energy of the whole of the sandwich source will be as bellow:

$$P(k) = \sum s(k) \exp\left[-2k(z_t + n\Delta z)\right] \quad (2)$$

Where z_t shows the depth to top of the sandwich, also $z_b = z_t + n\Delta z$ shows the depth to bottom. The sum of the third equation is calculated as the sum of quotient and is about to$-\exp(-2k\Delta z)$or $2k\Delta z$, so:

$$P(k) = s_0(k)[\exp(-2k\Delta z) - \exp(-2kz_b)] \quad (3)$$

$$s_0(k) = s(k)/(2k\Delta z) \quad (4)$$

This model in any depthz_0, betweenz_t $and z_b$, can be dividedinto two uncorrelated models, both of whichhave the spectral energy as the third equation.

Separating filters with optimized dispersal for sandwich source

Suppose that a dispersal of a sandwich source consists of half of the total land space according to $z_t = 0$ and $z_b \to \infty$ in the fourth equation. Consider the remainingfield as a field which is originated from an upper level of a position z_0 andthe regional field is considered in a way that is derived from the under of the position z_0 (kubik, 1938), so:

$$P_{reg} = S_0(k) \exp(-2kz_0)$$

$$P_{res}(k) = S_0(k)[1 - \exp(-2kz_0)] \quad (5)$$

And the optimal filter for extracting the regional field is as follow:

$$H_{reg}(k) = \exp(-2kz_0) \quad (6)$$

It shows that the value of wave for upward continuation to a height of $2z_0$ in the above of measurement level is independent from$S_0(k)$. In all filter for extracting field from a layer or an interval between$z_0$and z_0' has the form as follows: (Jacobson, 1937)

$$H_{slab}(k) = \exp(-2kz_0) - \exp(-2kz_0') \quad (7)$$

This is the answer of wave number for evaluating the difference between upward continuation fields.

It is necessary to be mentioned that an optimal filter for estimating a field which is originated under the position $z_0$and is measured in the depthz_0 is presented as bellow: (Jacobson, 1987).

$$H_{reg.z_0}(k) = \exp(kz_0) H_{reg}(k) = \exp(-kz_0) \quad (8)$$

In fact, it is an upward continuation and the result is completely constant.

At first, the regional buge anomaly which, in fact, represents the regional field is obtained, thenby using the upward continuation, the rest anomaly that denotes the local field is extracted (Figure (2)) with respect to the fifth relation.

Where,$S_0(k)$ is the buge anomaly, k is the wave number, and $z_0 is$the extended distance to the upward continuation (parker, 1973 and arnaud, 1989). The most significant character in upward continuation is identifying the extended distance, in which how distance should be used until the rest anomaly completely represents the topography of the bedrock.

For do this, take a profile of the region, and then apply all of the distinct extended distances on it, and compare the two dimensional picture of each of the rest anomaly with the buge anomaly of that profile. Each of the extended distances which makes the most similarities to the buge anomaly is our suitable extended distances and should be used to evaluate the rest anomaly in all of the other points.

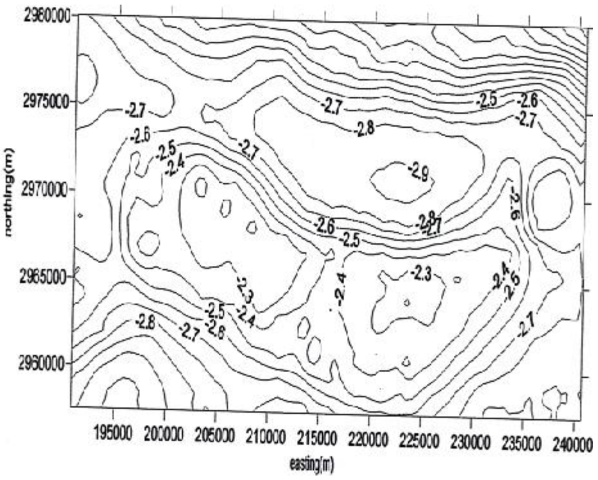

Figure2 The contour map of the rest anomaly of the picked area

Inverting the three dimensional topography of the bedrock

First, we consider the Parker's method for evaluating the gravitational of an uneven two-dimensional layer of material with a constant density. In a Cartesian coordinatex-z, the gravitational anomaly is represented by $\Delta g(x)$, and the upper and lower ranges of the chaotic layer is represented by z=0 and z=h(x) respectively. The total mass of the chaotic layer should lie under the horizontal line on which observation will be done. Since our profile has a limited length and fr omconvergent problems, we suppose that the layers out of the range and limited to d tends to zero. For instance, if $x \not\subset c$, then h(x)=0. In practical, h(x) is measured with respect to some of the balanced reference layers with a distance $z_0$under the level. We define the one-dimensional Fourier transformation of a function h(x) as follow:

$$F[h(x)] = \int h(x)\, e^{ikt} dx \qquad (10)$$

Where, k is the wave number of the transformed function. Here, we obtain the Fourier transformation of the gravitational anomaly by converting the Parker's two dimensional formula into an one –dimensional formula (Parker's, 1973)

$$F[\Delta g(x)] = -2g\pi\rho e^{-kz_0} \sum \frac{k^{n-1}}{n!F[h^n(x)]} \qquad (11)$$

Where,ρ is the density difference between the bedrock and its upper material, and G is the universal constant of gravitation. We are able to obtain following formula by converting n=1 from infinite summation and by rearranging (Oldenburg, 1974):

$$F[h(x)] = F[\Delta g(x)]e^{kz}/2g\pi\rho - \sum \frac{k^{n-1}}{n!F[h^n(x)]} \qquad (12)$$

When,ρ and $z_0$are known (or are supposed). This approach can repeatedly be used for evaluating the H(x) as follows: The newest h(x) (for the first step, h(x)=0 or choosing a suitable random value will satisfy) will be used for calculating the right side of the equation (12). Then the inverse of the Fourier transformation gives a new value for the topography. Pursue this repetition procedure until we face to a kind of convergence value, or we reach to the maximum repetition number. Note that evaluating h(x) in the equation (12) consists of almost the same calculations' steps relative to the straight solution algorithm, so every repeat can rapidly be done.

For inverting the data of the study area, the first necessary parameter that should be studied is the density difference between the bedrock and its upper sediments. Based on the geological mapping and drilling, the bedrock's and its upper sediment's density is estimated3.5 $\frac{gr}{cm^3}$,2.7 $\frac{gr}{cm^3}$respectively, so the density difference which is used in calculations is $0.8 \frac{gr}{cm^3}$.

In this procedure, we, first, depict the three-dimensional map of the rest anomaly of the study area based on the distance in a square net, then the quick Fourier transformation will be used for evaluating a matrix with a given amplitude spectrum. The first approximation of the topography of the bedrock is used for calculating the second sentence of equation (12).

Where,ρ is the density difference between the bedrock and its upper material, and G is the universal constant of gravitation. The second sentence will be filtered again, and after using the quick inverse Fourier transformation, the standard deviation between the new and the old topography will be calculated. With starting the repetition process that is applied for evaluating the right side of the equation (12), the first sentence of the series will be obtained by the equation (11), and the acquired topography will be filtered by a low-pass filter, then by using the quick inverse Fourier transformation, the topography is calculated in the time domain(Figure(3)).

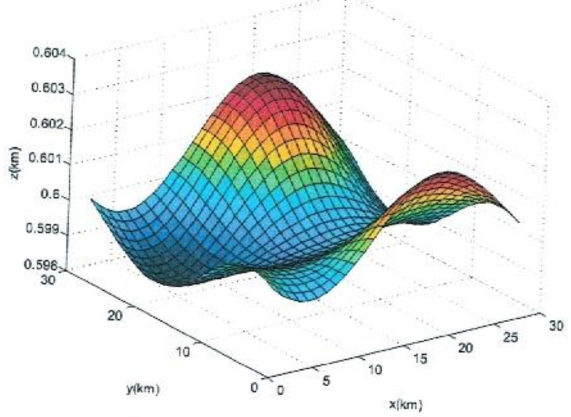

Figure3 The three dimensional map of topography of bedrock in the picked area.

RESULTS AND DISCUSSION

Nowadays, determining both the geometry of the bedrock and the layers with the density contrast in different depths is one of the crucial aims in much work. Since there always exists a density contrast between the bedrock and the upper layers, the gravity survey method which examines the changes in density will help to determine the bedrock. The written program by the real data of gravity survey in the south west of kuhpayeh has been shown a good agreement with the local geology, thus this procedure for determining the three-dimensional topography of the bedrock is an appropriate method.

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