



The Interpretation of Gravity Measurements Based on Local and Regional Map Contours

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ABSTRACT

The gravity method can be used to determine subsurface structures in an area. The data is data longitude, latitude, and CBA in mgal. Data processing begins with a 2D and 3D contour using the software Surfer 9. In making this contour, the coordinates in UTM coordinates. The results of two-dimensional contours, which have been obtained, then we make separation of local and regional anomalies using MagPick software. After that, both of them reprocessed using the software Surfer 9 to be "slice" or "cross-section" at the local and regional anomalies. The results of the cross section then processed to create a model in the form of layers so that the resulting curves cross section close to the results that have been observed previously.

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1. INTRODUCTION

The several geophysical methods can be used to identify subsurface structures due to these events (Setyawan et al., 2020). Geophysical methods that are often used to investigate subsurface structures include the geoelectric method, the gravity method, the seismic method, and the geomagnetic or magnetic method (Reswara & Sehad, 2014), (Hibatullah et al., 2019). The changes in the structure below the earth's surface occur due to changes in the load of soil and rock masses both on the earth's surface and inside the earth (Rahman et al., 2014). This research will use the gravity method because it has been widely used in mineral and rock exploration (Pinehas & Warsa, 2019), (Adha & Sapiie, 2017). The gravity method is a geophysical investigation method based on differences in the gravitational field due to differences in the density of the rocks that make up the subsurface of the earth (Aji et al., 2018). The physical quantity measured in the gravitational method is the acceleration due to gravity on the earth (Siringoringo et al., 2021). The gravitational acceleration data obtained during the measurement is processed into an anomaly of the earth's gravitational acceleration (Arisbaya et al., 2018). From the results of data processing, it can be seen the difference in mass density or contrast of rock density, so that the data can be used to determine the geological structure below (Margiono et al., 2021), (Aziz et al., 2020).

In geophysical surveys, the value of the gravitational field measured is given in gal units, where $1 \text{ gal} = 10^{-5} \text{ m/s}^2$. However, the gravity field anomaly data measured in the field are generally very small, in the milligal range (Hafidah et al., 2019), (Nurwidyanto et al., 2019). The difference in the density of the subsurface rock mass results in differences in the value of the gravitational field between one point and another on the earth's surface, which is called the gravitational field anomaly (Anggraeni, 2021). Gravitational field anomaly data is the difference or difference between the observed gravitational field data measured in the field and the theoretical gravitational field anomaly data (Hanif et al., 2021). Factors that affect the value of the gravitational field anomaly include latitude (λ), longitude (ϑ), and altitude (h) so that mathematically (Purnomo et al., 2013)

2. RESEARCH METHOD

The equipment commonly used in measuring using the gravity method is the La Coste-Romberg Gravimeter, Trimble GPS, GPS Navigation, altimeter, camera, meter, geological compass, timer, and topographic maps. Before taking measurements, first determine and make a tie point in the field. This binding point is needed as a looping point in the measurement, which starts from the tie point, continues to other measuring points and returns to the tie point. This looping measurement method is intended to reduce the field effect (drift) of the gravimeter. This correction is considered to be linear with time for a relatively short period of time (several hours).

Based on the gravity data that has been obtained, then data processing is carried out starting with creating 2D and 3D contours using Surfer 9 software. In making these contours, the coordinates used are in UTM. The results of the 2-dimensional contours that have been obtained are then separated from local anomalies and regional anomalies using MagPick software. After that, the two anomalous contour results are reprocessed using Surfer 9 software to do a "slice" or "cross section" on local and regional anomalies.

3. RESULTS AND DISCUSSIONS

Based on the K-regional Gravity Measurement Result Data, by utilizing the Surfer 9 software, 3 Dimensional contours and 2 Dimensional contours are obtained as follows:

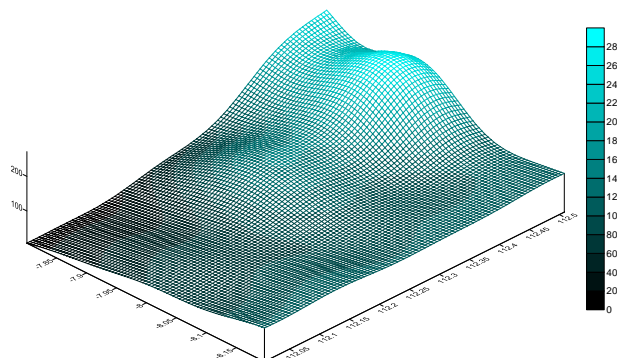


Figure 1. 3D Contour

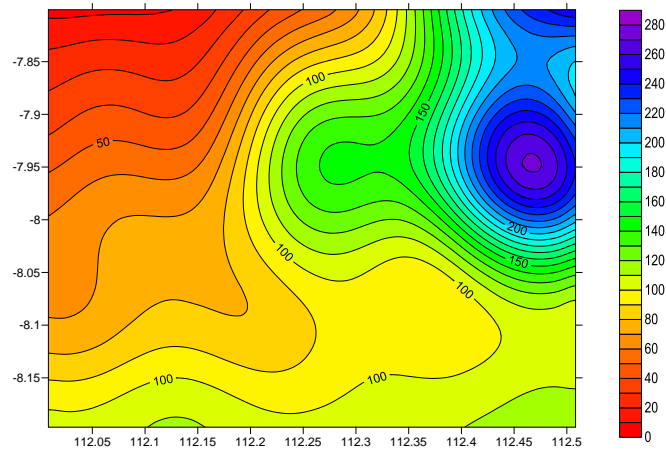


Figure 2. 2D Contour

The results of the 2-dimensional contour obtained earlier, then separated local anomalies and regional anomalies using MagPick software. After that, the two anomalous contour results are reprocessed using Surfer 9 software to do a “slice” or “cross section” on local and regional anomalies.

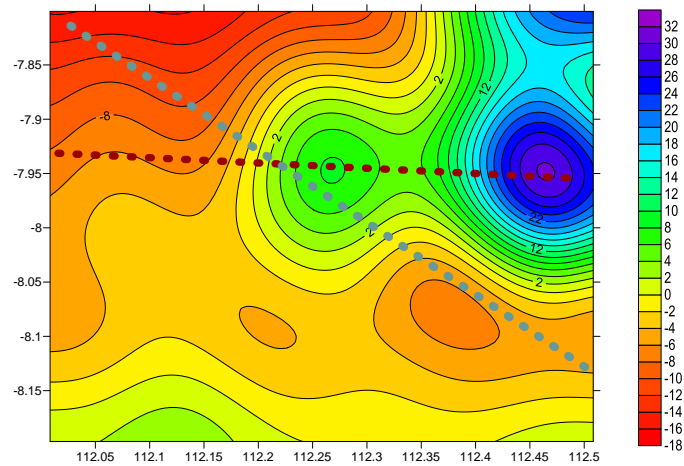


Figure 3. Local Map Contour

Cross Section 1 (Local)

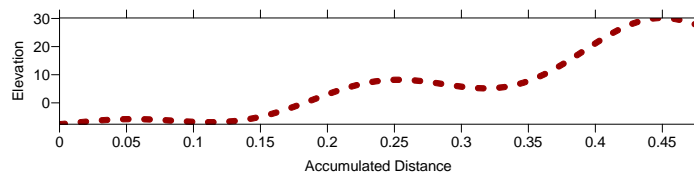


Figure 4. Cross Section 1 on Local Anomaly

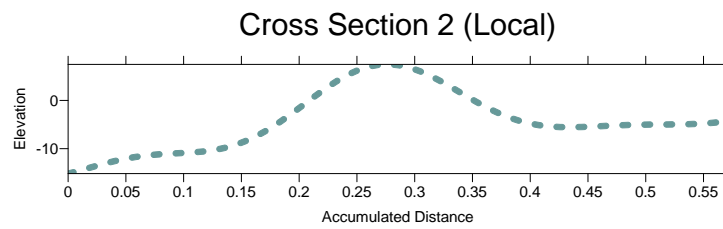


Figure 5. Cross Section 2 on Local Anomaly

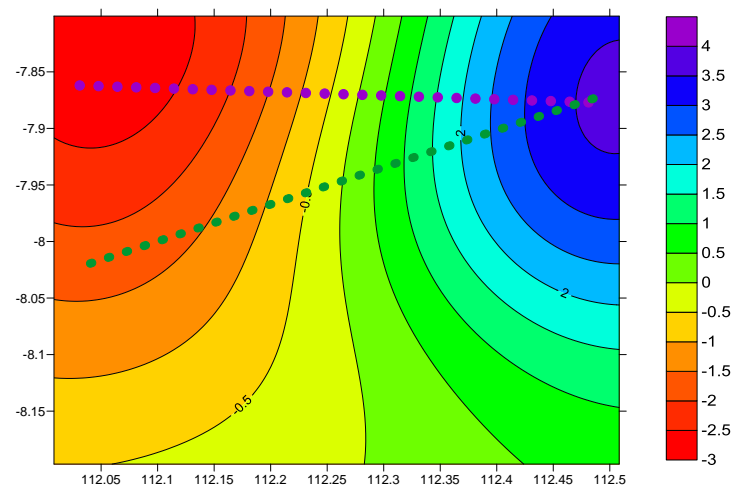


Figure 6. Regional Map Contour

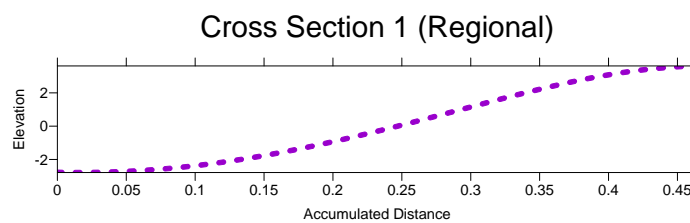


Figure 7. Cross Section 1 on Regional Anomaly

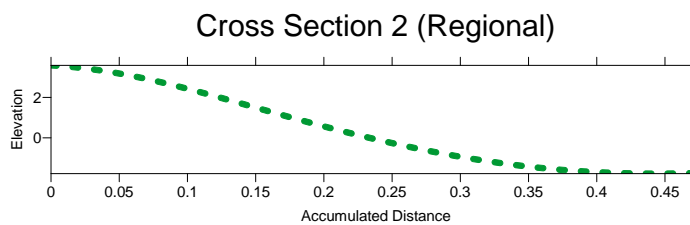


Figure 8. Cross Section 2 on Regional Anomaly

4. CONCLUSION

Based on the results of research and data analysis, it can be concluded that (1) the value of the earth's gravitational field is influenced by the position of latitude, longitude, and altitude as well as the distribution of mass below the surface, (2) the separation of local

and regional anomalies can be used as a reference in determining the location of the mass distribution below the surface.

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