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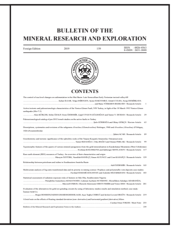

A brief note on the effects of floating standard deviation (non- derivative) and horizontal gradient (derivative) filters

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Short Note

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ABSTRACT

When processing gravity data, the filters are used in space and frequency environments. The filters allow more selectable parameter estimations than raw data about the structure being examined. Filtering in a broad sense means monitoring the data under the constraints we want. While the filters allow some information to become more noticeable, they allow some information to be lost or become less noticeable from data. In this case, the losses in the data make the interpretation difficult and can cause errors. Derivative and phase filters provide quantitative information about the variation of data in different directions. The display of the change results in a positive or negative manner proportional to derivative sensitivity and phase sharpness, and this may be observed in this data. In the structural boundary analysis, since the sudden changes in the derivative cause oscillations, the boundaries become questionable. Limiting the data neighborhoods with a window by controlling the deviation without using derivative and the filters that allow boundary analysis non-derivative by floating this limitation are used to illuminate the boundary relationships.

1. Introduction

In this paper, the boundary relations in regional scale and plate dimensions will be visualized on gravity data with a filter in which the changes in boundaries of the structure in gravity data are put forward using non-derivative. The computer program, written by the author, has been modified from D'errico 2016. The filter used was introduced in the article in which the Naşa intrusion was clarified (Toker et al., 2018). The floating standard deviation filter of which its sensitivity can be adjusted has been applied here for the first time on a regional scale with long wavelength structures. The data set is a network data generated by the satellite data from a sampling point at each 7 km (http://bgi.omp.obs-mip.fr/links).

2. Purpose

The aim of the study is to form a filter that does not contain derivative elements and that long-wave structures can be interpreted more easily. The network data obtained from the Bouguer gravity data was filtered to ease the interpretation and provide the structural boundary continuity by reconstructing the network with the values obtained from the program after the selection of index for the floating standard deviation window (by taking k=1, in 3x3 size window). It is intended to display the effects of the filter on a large-scale data.

3. Findings

The main tectonic elements are marked as locations in the double-layer figure. The floating standard deviation filter shows similarity when compared with

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the horizontal gradient (Cordell and Grauch 1985). However, they were obtained without calculating the derivative elements. The horizontal gradient values vary between 0-300 mgal/km, while the floating standard deviation varies from 0-80 mgal. It is possible to say that the standard deviation filter shows less oscillation. In addition to this, it is observed that the stable frequencies with less oscillation are observed in the display of long wavelength structures (Toker et al., 2014). It is possible to produce more clear and interpretable results from the image obtained using the derivative. Figures 1 and 2 show the Bouguer gravity data and the horizontal gradient, respectively. In figure 3, the floating standard deviation is observed. There, it can be observed that the oscillation is less. In figure 4, the main tectonic elements appear to match with the filtered gravity data.

The findings obtained will be examined geologically and geophysically in the continuous studies.

Formulas:

Horizontal gradient amplitude (Cordell and Grauch 1985):

$$HG\ (x,y) = \left[\left(\frac{\delta g}{\delta x} \right)^2 + \left(\frac{\delta g}{\delta y} \right)^2 \right]^{1/2} \quad (1)$$

$$HG\ (x,y) = \left[\left(\frac{\delta H}{\delta x} \right)^2 + \left(\frac{\delta H}{\delta y} \right)^2 \right]^{1/2} \quad (2)$$

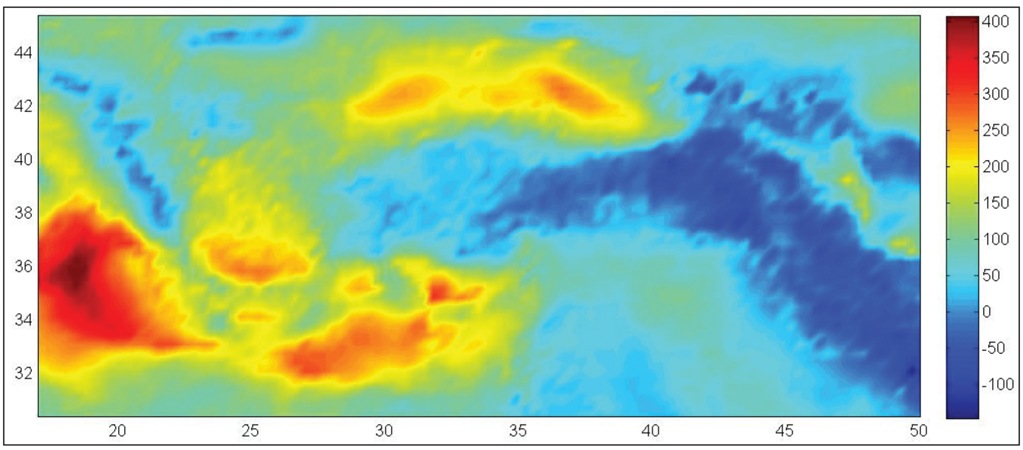

Figure 1- Bouguer gravity data.

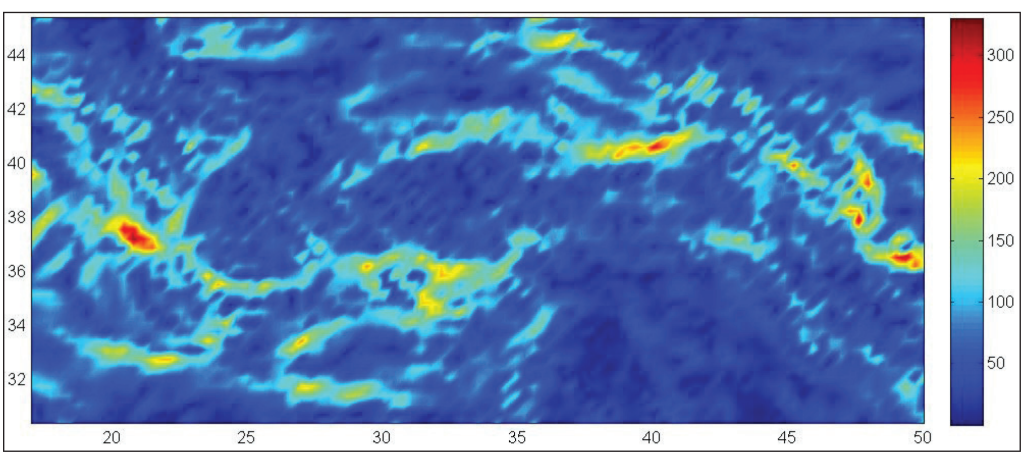

Figure 2- Horizontal gradient.

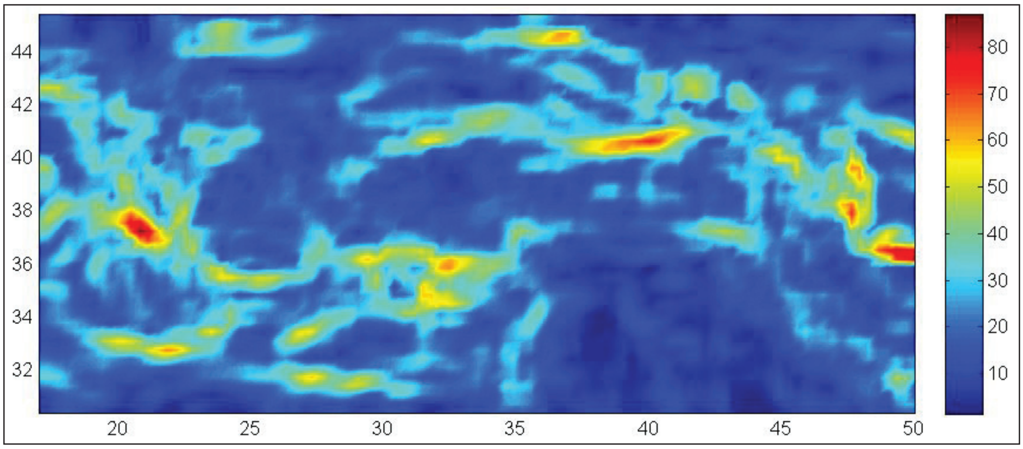

Figure 3- Floating standard deviation.

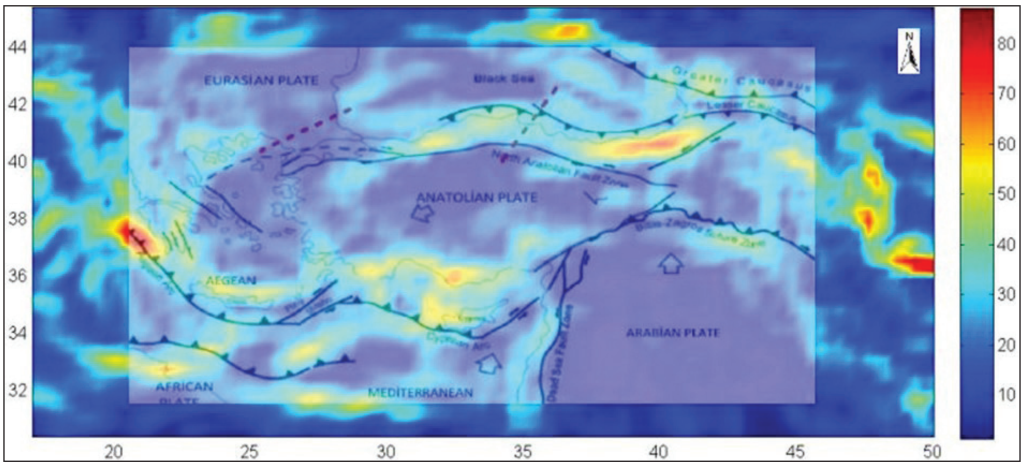

Figure 4- Main tectonic elements.

In formulas (1) and (2); (∂g/∂x) is the derivative in x direction and (∂g/∂y) is the derivative in y direction. H is the gravity function.

Standard deviation: $\sigma = ((\sum(X^2) - X^2 n^*)/(n-1))^{1/2}$

References

Cordell, L., Grauch, V.J.S. 1985. Mapping basement magnetization zones from aeromagnetic data in the San Juan Basin, New Mexico, in Hinze, William J. (ed), The utility of regional gravity and magnetic anomaly maps: Society of Exploration Geophysicists, Tulsa, Oklahoma, (1985). Pp:181-197.

D'errico, J. 2016. Personel Web Page https://www.mathworks.com/matlabcentral/.../869215-john

Gravity Data from: Bureau Gravimetrique International (BGI). DOI:10.18168/BGI.

Toker, C. E., Çiftçi, Y., Ayva, A., Kürçer, A. 2014. Two examples for imaging buried geological boundaries: Sinkhole structure and Seyit Hacı fault, Karapınar, Konya. Bulletin of the Mineral Research and Exploration. 149, 189-199, Ankara.

Toker, C. E., Ulugergerli Emin. U., Kılıç, A.R. 2018. Naşa Sokulumu (Batı Anadolu) ve tektonik anlamı: gravite ve deprem verilerinin birlikte analizi. Maden Tetkik ve Arama Dergisi. 156:251-262