



Application of derivative-based filters to enhance potential field features

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Abstract: Gravity and magnetic surveys are inexpensive and routinely carried out over vast stretches of land and sea. Maps data that are obtained from potential field are like a picture. The data are assumed to be sum of the signal and noise which in sedimentary environments, where the rocks are only weakly magnetized, major structures (fault, dyke) have weak magnetic response too, and there are not sharp contrast between noise and signal. In these cases in order to enhance, their anomalies filtering techniques are used. One of the most applicable filters are conventional derivative-based filters including Vertical derivative, Total horizontal derivative and directional derivative. The directional derivatives (horizontal derivatives) are applied for enhancing linear features in potential field images. Computation the directional derivative in a given direction enhances linear features (fault, dyke, and trend) which trend normal to that direction, while diminishing those that parallel to that direction.

Each of the conventional derivative filters has disadvantage in practice which in this work such new replacement derivative filters have been defined. In higher orders of vertical derivatives, the geophysical features are more enhanced but such derivatives are high pass filters and they also have an undesirable property of enhancing noise similarity. For overcome this problem vertical derivative with fractional order or weighted vertical derivative is used. If the datasets possesses anomalies with a large variation in amplitude then the horizontal derivatives datasets will also have large variation in amplitude and the smaller amplitude anomalies may be hard to discern. In this regard the new filters such as normalized total horizontal derivative (TDX) and derivative ratio are used which are not require to calculate vertical derivative and much faster to compute than other filters.

In this work these filters have been applied on magnetic and gravity data from southwest England. The geology of southwest England is dominated by late Palaeozoic rocks that have been intensely deformed (faulted) during Variscan progeny. The late Palaeozoic rocks are intruded by five granite plutons. The intent of this work is determination of these granite plutons and their faults. For this reason, derivative filters have been divided into two groups, conventional derivative filters and new derivative filters and their results comprised to each other. By application of these filters the five granite outcrops and variety of faults are enhanced accurately that are in agreement with field observations.

Keywords: Signal, Conventional derivative filters, Total horizontal derivative, Weighted vertical derivative, Normalized total horizontal, Southwest England.