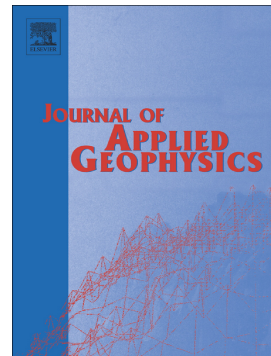


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Locating magnetic sources by Empirical Mode Decomposition

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Abstract:

The detection and correct location of magnetic bodies is crucial in geomagnetic explorations. However, the interpretation of magnetic anomalies is usually complicated, mostly because of their dipolar nature. In previous studies, many methods had been introduced to locate the edges of magnetic bodies. On the other hand, some of such methods are based on derivative algorithms which are theoretically sensitive to noise in the data. In this paper, “Empirical Mode Decomposition method (EMD)” is investigated as a novel tool to locate magnetic bodies by extracting intrinsic mode functions of the magnetic data. The introduced method is a source location detector while it cannot be considered as an exact edge detection filter. Empirical Mode Decomposition is a very powerful and well-known algorithm in time-frequency analysis of nonlinear and non-stationary signals. Since it is not a derivative-based method, it is able to handle the noise involved in data. Although the method has already been applied to the potential field to separate regional and local anomalies, in this study, for the first time it is used to detect the location of the subsurface magnetic bodies.

Several noisy and noise free synthetic models have been used to verify the efficiency of Empirical Mode Decomposition. Besides, for a real test, magnetic data from Sourk mining area in Central Iran have been utilized. Some other location detector and edge detector methods, including Horizontal Derivative, Total Gradient, Tilt Angle and Enhanced Horizontal Derivative methods, have been applied to synthetic and real magnetic data to compare with results of CEEMD. The results show that, in the existence of relatively high level of noise (usually more than 3%), the improved version of Empirical Mode Decomposition, i.e., Complete Ensemble Empirical Mode Decomposition method (CEEMD) has an acceptable resolution in locating magnetic sources. Generally, comparing with some other methods, applying Empirical Mode Decomposition may lead to more reliable locating adjacent magnetic sources with fewer artifacts especially in noisy magnetic data.

Keywords: magnetic body, location determination, Empirical Mode Decomposition, Sourk mining area

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