Combining edge enhancement images for more reliable detection of magnetic features

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The most common use of aeromagnetic data is the identification of magnetic bodies and geological contacts. To enhance an anomaly of interest, signal processing techniques are usually applied. This process is essential in areas where outcrop is limited, or the targeted anomaly is undercover. Nevertheless, the absence of geological information can make the interpretation of potential field data difficult since these methods have an inherent ambiguity. In order to improve the lateral detection of a source, it is recommended that one combines the output of several source edges detection algorithms. Since most enhancement filters use directional derivatives of different orders, it can amplify the high-frequency noise and compromise the noise-to-signal ratio. The workflow presented here allows the user to choose any combination of seventeen different filters and statistically stack the obtained results. The central point of this procedure is that locations with multiple solutions have a great confidence of representing a true edge while false peaks or mathematical artefacts will have fewer solutions and therefore can be easily disregarded. The algorithm was tested on both synthetic and real cases. The algorithm was able to correctly locate the lateral limits of the magnetic sources considered in all synthetic cases, regardless of the multiple sources' presence in the same area and the intense remanent component associated with them. The results obtained for the data contaminated by high frequency noise show an important characteristic: some individual filters present a better resolution than the combination them all. However, in real cases, it is not possible to know for sure the real shape of the magnetic source and, therefore, the statistical combination of different methods can lead to a safest interpretation. The algorithm is limited by the resolution of the data and the necessity of significative contrast on magnetic susceptibility along the geological features.

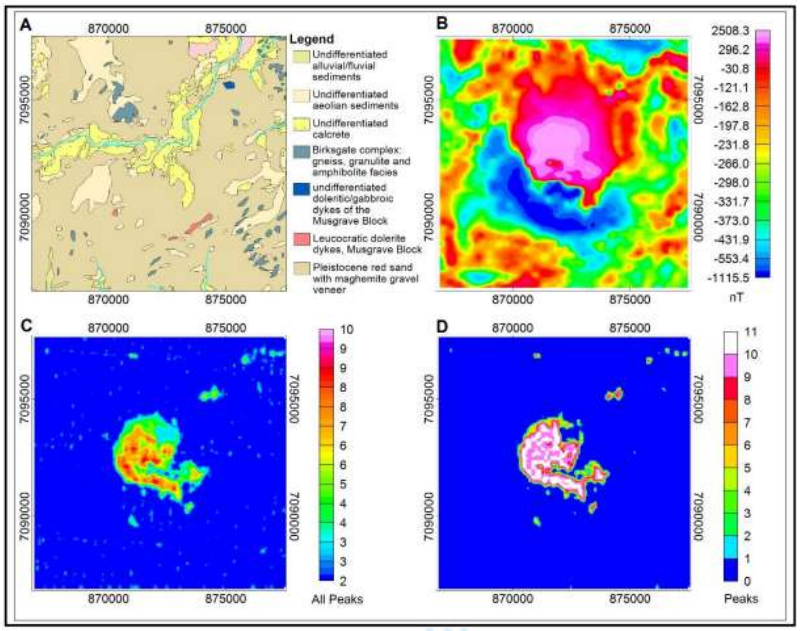

Figure 1. A – Geological map of the study area. B – Total magnetic intensity (TMI) field of Pukatja anomaly, Australia, C – sum of all peaks and D – selected peaks.

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