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Multiridge analysis of potential field data at satellite altitude

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Multiscale methods have been of great utility in applied geophysics to interpret potential field data and to retrieve the source position and shape. The Multiridge method allows obtaining the source location without specifying any a-priori information about the source, by searching the maxima of the potential field and the zeros of its vertical and horizontal derivatives, which represent the so called 'ridges'. The depth solutions are obtained by the intersection of the ridges prolonged down to the source region. However, multiscale methods have been mostly employed to datasets with limited areal extension, expressed in a Cartesian coordinate system. In this work the multiscale approach is extended for the analysis of potential field data at satellite altitude with regional and global extension. The Multiridge formulas have been transformed to a spherical coordinate system and the efficiency was tested firstly on potential field models produced by synthetic sources. The results show high precision in retrieving the right location of the edges and the center of the sources determined by the intersections of the ridges of the field, and of its radial and horizontal derivatives. We then analyzed satellite-derived lithospheric magnetic model (e.g. CHAOS-6) and core magnetic field model (IGRF). The spherical Multiridge method is applied to profiles representing great circle lines above the Earth's surface, by which radial slices of the multiscale dataset are produced. The Multiridge analysis yielded interesting results especially for the core magnetic field sources.