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Regularization of the aeromagnetic data using eigen-function expansion in Cartesian coordinate system

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The dominant upward- and downward-continuation technique used in the potential-field is the fast Fourier transform (FFT) technique. However, this technique is, in principle, only applicable to the regularized data obtained on a flat plane. So, for the data on irregular grid on an uneven surface, the inversion technique based on the equivalent sources is commonly used.

For the equivalent sources, dipole source is often used. In this case, the computational cost of inversion becomes large because the observation equation is represented by a dense matrix.

In this study, we design a continuation operator used for the direct continuation of the geomagnetic field data on irregular and uneven surface and developed an algorithm for calculating upward- or downward-continuation using the eigen function expansion based on the basic solutions of the Laplace equation defined on the Cartesian-coordinates. We apply the eigen function expansion to each rows of the coefficient matrix of the observation equation and subsequently threshold the matrix to generate a sparse representation in the wave number domain.

Keywords: aeromagnetic observation, upward continuation, downward continuation, regularization