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Qingmou Li, Sonya A. Dehler

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Inverse spatial principal component analysis for geophysical survey data interpolation

Qingmou Li and Sonya A. Dehler

*Natural Resources Canada, Geological Survey of Canada, Dartmouth, Nova Scotia, Canada
qli@NRCan.gc.ca, sdehler@NRCan.gc.ca*

ABSTRACT

The starting point for data processing, visualization, and overlay with other data sources in geological applications often involves building a regular grid by interpolation of geophysical measurements. Typically, the sampling interval along survey lines is much higher than the spacing between survey lines because the geophysical recording system is able to operate with a high sampling rate, while the costs and slower speeds associated with operational platforms limit line spacing. However, currently available interpolating methods often smooth data observed with higher sampling rate along a survey line to accommodate the lower spacing across lines, and much of the higher resolution information is not captured in the interpolation process. In this approach, a method termed as the inverse spatial principal component analysis (isPCA) is developed to address this problem. In the isPCA method, a whole profile observation as well as its line position is handled as an entity and a survey collection of line entities is analyzed for interpolation. To test its performance, the developed isPCA method is used to process a simulated airborne magnetic survey from an existing magnetic grid offshore the Atlantic coast of Canada. The interpolation results using the isPCA method and other methods are compared with the original survey grid. It is demonstrated that the isPCA method outperforms the Inverse Distance Weighting (IDW), Kriging (Geostatistical), and MINimum Curvature (MINC) interpolation methods in retaining detailed anomaly

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