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# Practical implementation of radial basis functions in sparse datasets in resource estimation

**Goncalves, Rui**

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## ABSTRACT

The choice of an estimation method in resource estimation is often constrained by the availability of data and the experience of the modeller. Moreover, insufficient data coverage or a highly variable deposit may hinder the application of kriging methods. The radial basis function has widely been applied to generate three-dimensional surfaces and volumes for geological modelling purposes. However, it also has application as an estimator, as the methodology is mathematically equivalent to dual kriging.

Using a vein-hosted copper deposit, the focus of this research study report is to investigate the application of the radial basis function as a resource estimation technique. A single vein from the dataset was targeted and, after analysis, spatially subdivided into a high-grade and a low-grade domain. A stochastic simulation was used to generate a representation of “reality” for each domain, with validations made against these. A single simulation was selected randomly and sampled at a 15 m x 15 m x 1.5 m spacing to emulate a grade control drilling grid. These samples constitute the database and were used as input for the estimation of the two domains identified. For each domain, a three-dimensional block model was generated using three estimation methods – the radial basis function, ordinary kriging, and inverse distance weighting. To ascertain which method was superior at predicting grades locally, the estimates were compared against input data and individually against each other using statistics and visual validations, such as grade distribution and swath plots.

The findings demonstrate that the radial basis function performs equally to ordinary kriging and inverse distance weighting when supported by sufficient sample coverage. In areas with poor coverage, the radial basis function outputs resulted in closely comparable estimates. As the radial basis function is a global estimator, unlike ordinary kriging, confidence in the estimates cannot be quantified easily. Therefore, the radial basis function was evaluated against the 99% confidence intervals of the ordinary kriging estimates. The radial basis function estimates were well within these confidence limits and similar to the ordinary kriging and inverse distance methods.

The conclusions drawn from this report suggest that radial basis function can provide robust estimates, even when sample coverage is inferior. For grade control purposes, where data coverage is abundant, it can be considered as an alternative estimation method. However, due to the lack of metrics that quantify the confidence in the radial basis function estimates, it is unlikely that this method will displace kriging methods in the statement of Mineral Resources.