

A study on kriging small blocks

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ABSTRACT

In order to define the ore/waste boundaries as finely as possible, mine planners often insist on kriging very small blocks (relative to the spacing of the available sample grades). These kriged estimates for very small blocks are over-smoothed. For several simple sampling patterns the relation between the block size and the variogram range, and the kriging results were studied. Meaningful estimates of individual blocks are obtained when the variogram range is large compared to the block size and the sample spacing. For a variogram range less than half the sample spacing, the kriged block estimates were found to be uncorrelated with the actual grades. The over-smoothed estimates should not be used for calculating recoverable reserves.

Introduction

Nowadays most mining companies know that the geostatistical estimation method, kriging, gives the best estimates of individual block grades. As most mining engineers and geologists are now familiar with the basics of geostatistics, the definitions of the variogram and of kriging will not be repeated here. An appendix containing definitions and mathematical formulae is given at the end of the article for the sake of completeness.

Even though it is well known that the kriged estimates for very small blocks are over-smoothed, mine planners who want to define the ore/waste limits as finely as possible (especially for selective underground mines), are often tempted to kriging very small blocks. So we ask how small is "too small"?

Comments

Kriging Variance

The kriging variance rises up to a maximum and then drops off. This behaviour has been described by Brooker (1986).

REFERENCES

BROOKER, P.I., 1986, A Parametric Study of Robustness of the Kriging Variance as a Function of the range and the Relative Nugget Effect for a Spherical Semivariogram; *J. Maths. Geol.*, Vol. 18, No. 5, pp. 477-488.

QUESTIONS

- Why does the kriging variance drop off?
- Why was the geostatistical model for Hecla's Grouse Creek gold mine an abysmal failure?
- Why are kriging variances and covariances aberrations in classical statistics?

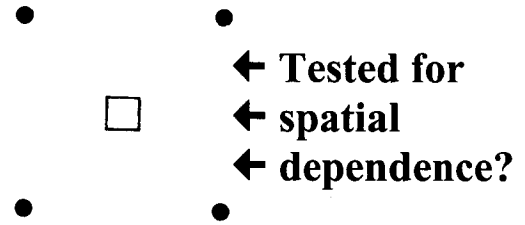


FIGURE 1. Location of the block to be kriged.

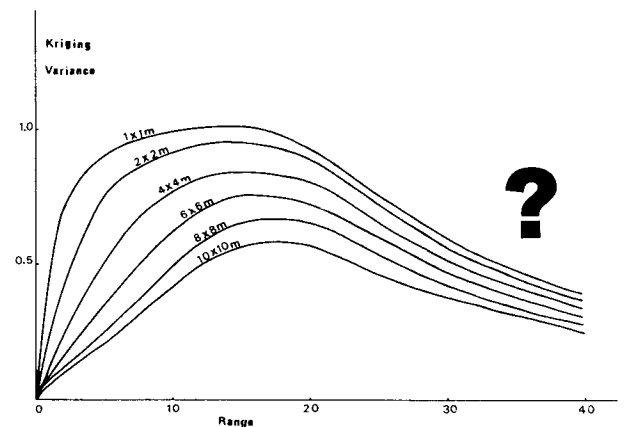


FIGURE 2. Kriging variance as a function of the variogram range.

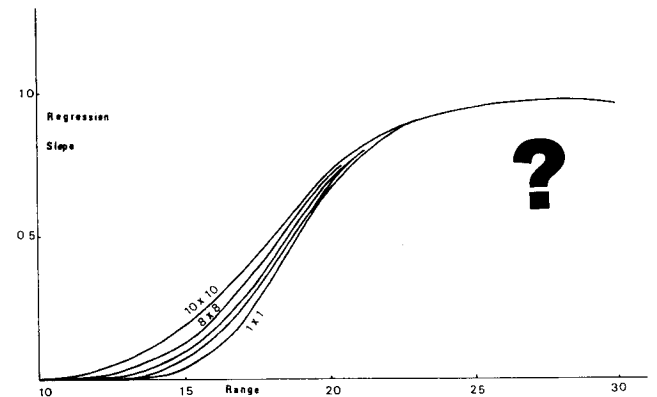


FIGURE 4. Slope of the linear regression of the actual grade Z on the estimated grade Z_K .