

ABSTRACT

Traditional grade estimation techniques produce single versions of grade distribution of a Mineral Resource. These approaches do not sufficiently provide a means to quantify the uncertainty around the estimates. Furthermore, the application of these methods when the sampling density is low such as in mine/pit extension areas results in the underrepresentation of spatial variation and generates unsatisfactory results. The research project aims to test and provide a proof of concept about the applicability of direct sampling simulation (DeeSse) in grade estimations and related uncertainty quantification, particularly in areas with sparsely spaced drill holes. The area with scarce data at Tarkwa mine is in the pit extension area (EA) where diamond drill holes are at 200 m x 100 m x 3 m spacing. However, there is sufficient closely spaced grade control data in the nearby Akontansi pit at a grid spacing of 25 m x 25 m x 3 m. These closely spaced samples were used to create a training image (TI) on 10 m x 10 m x 3 m blocks using simple kriging. All subsequent simulations were run on the same support. The TI was validated by comparing it to the etype estimate of 50 Sequential Gaussian Simulations (SGSIM) which were conditioned to the same data as the TI. Fifty DeeSse simulations were then run in the TI area using data spaced on a 50 m x 50 m x 3 grid. The DeeSse etype estimate was then validated by comparing it to a SGSIM etype estimate of 50 SGSIM simulations conditioned to the same data as DeeSse. DeeSse was found to be generally comparable with SGSIM with some minor bias. DeeSse reproduced a larger range of grade values while SGSIM showed more local variability. Several opportunities for possible improvement of the TI and simulations were identified. Nonetheless, the TI and the application of DeeSse were deemed valid for the purpose of the study.

Following the application of DeeSse within the TI area, it was then implemented and validated using SGSIM in the EA. The subsequent DeeSse simulations from the EA were then used to quantify the uncertainty around the grades, tonnages, metal, and revenue estimates. DeeSse was found to provide a more robust approach that offered more confidence in the estimates. It was therefore concluded that DeeSse can be successfully applied in areas with sparse data to generate resource models with more confidence. However, its success largely dependent on the ability to produce a representative TI.