Geomodeling in Non-Stationary Reservoirs: What is Locally Varying Anisotropy and When Should We Consider It

Jeff B. Boisvert[1]

[1]University of Alberta, Edmonton, AB, Canada

Abstract

Locally varying anisotropy is an important consideration for some deposits. Locally varying anisotropy can be thought of as non-second-order-stationary (anisotropy is not the same everywhere in the deposit); it is similar to trend modeling being required for deposits that violate first order stationarity (the mean is not the same everywhere in the deposit). When thinking of two point geostatistics, locally varying anisotropy can be interpreted as modeling the variogram for every cell in the model when second order stationarity is violated (much like the mean is modeled for every cell in a trend model when first order stationarity is violated). The very practical question of 'how do I get the local orientations and ranges for second order stationary considerations?' is important and addressed in this authors' other researches; this is not the focus of the work presented here. Rather, more fundamental questions such as 'what is locally varying anisotropy?' and 'when should I explicitly model LVA?' will be addressed. Much like trend modeling, the simple answer for considering locally varying anisotropy is 'when it exists in a deposit'; but more practical rules of thumb are the goal here.

This work will clearly outline (1) what anisotropy is (with minimal reliance on equations), (2) when it should be used (with practical considerations) and (3) briefly cover what techniques are available for modeling with locally varying anisotropy. The focus is largely on two point statistics (sequential Gaussian simulation, sequential indicator simulation, kriging etc), but there is some application to multiple point statistics with locally varying training images. Practical examples of locally varying anisotropy improving modeling will be given and suggestions for situations when it (1) must be considered or (2) should be considered or (3) can probably be ignored, will be the focus.