Dealing with unfittable variograms

Application of the GeoLime Sensitivity Analysis Module

In books and class room variograms are easy to fit ...

… While things get more complex in real life

One can fit the same data with different variogram models depending on:

What do we usually do ?

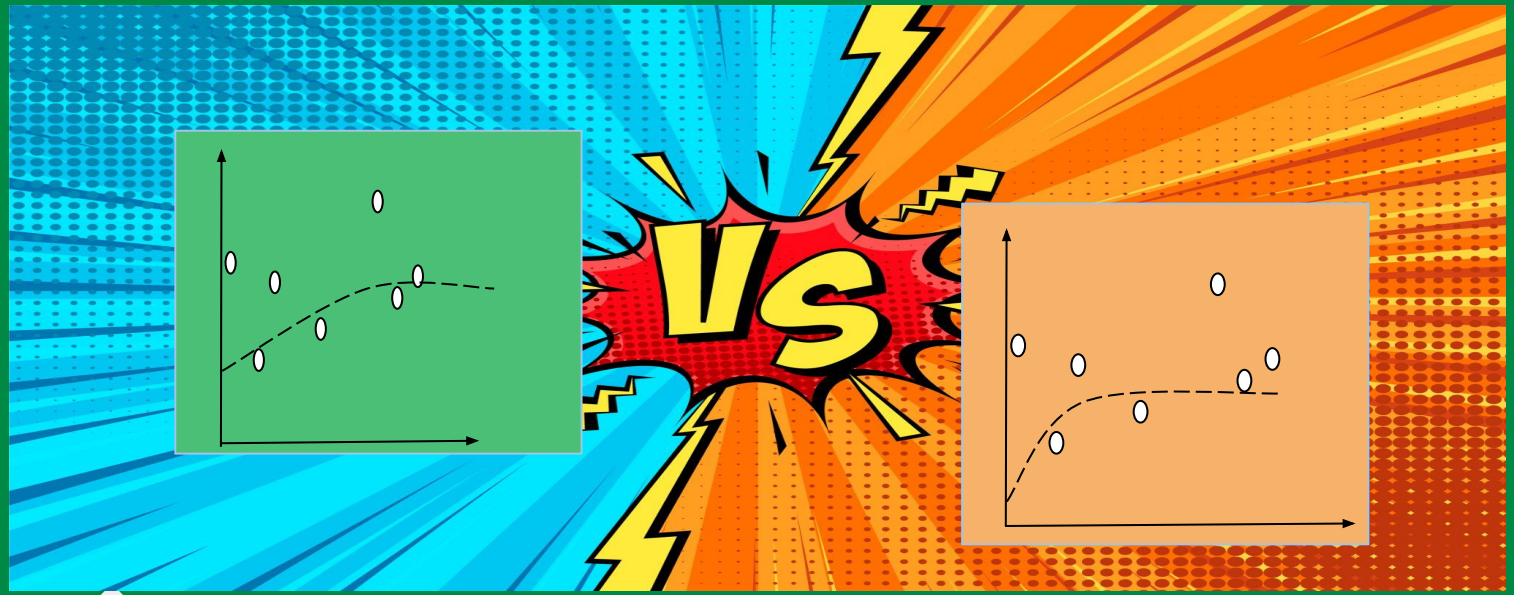
* Which we all have done

* Which is valid to some point

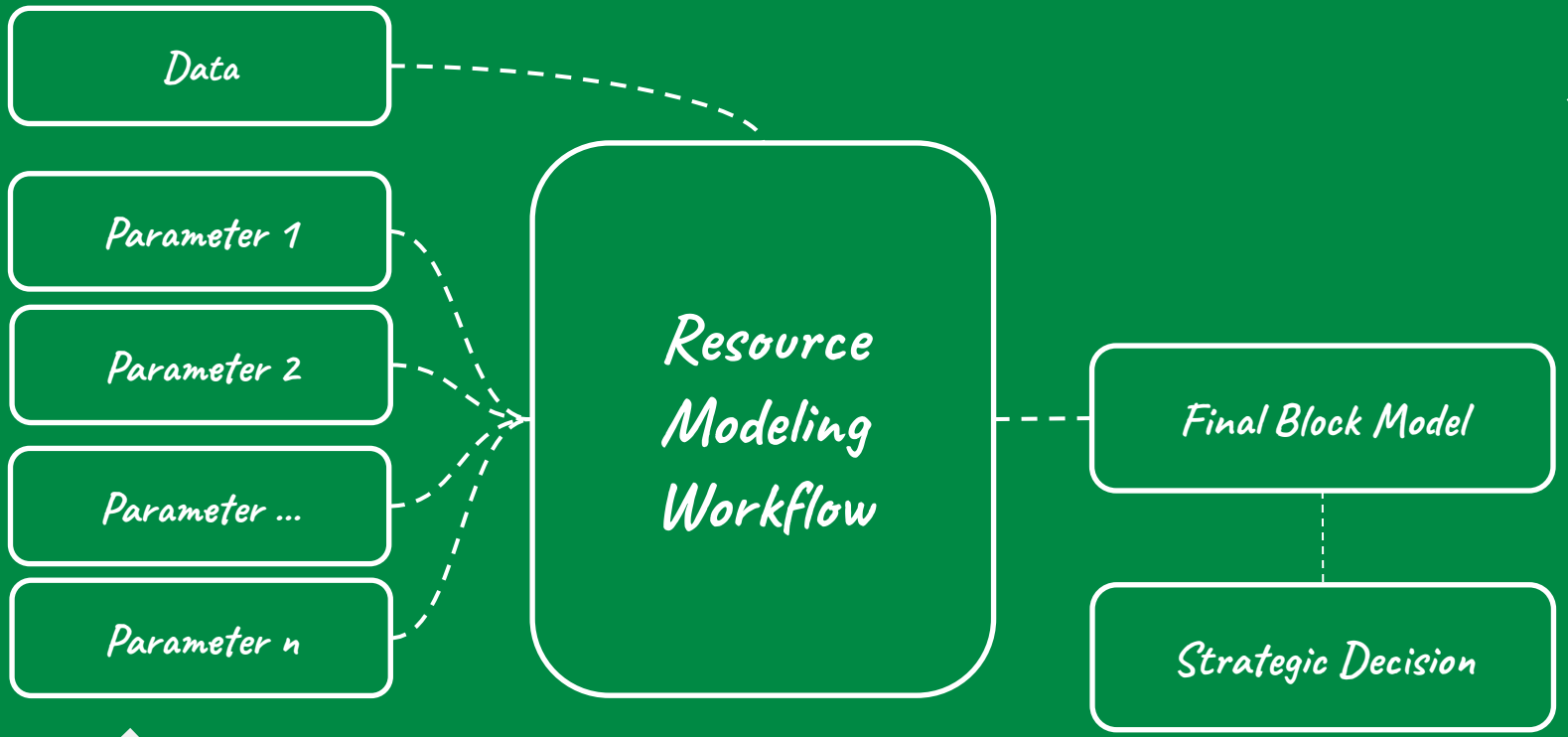
Why is it a problem ?

Block model will be used for strategic decision based on the economic valuation of the deposit

Two differents, but similar, variogram models might leads to two economical decisions



Deterministic modeling

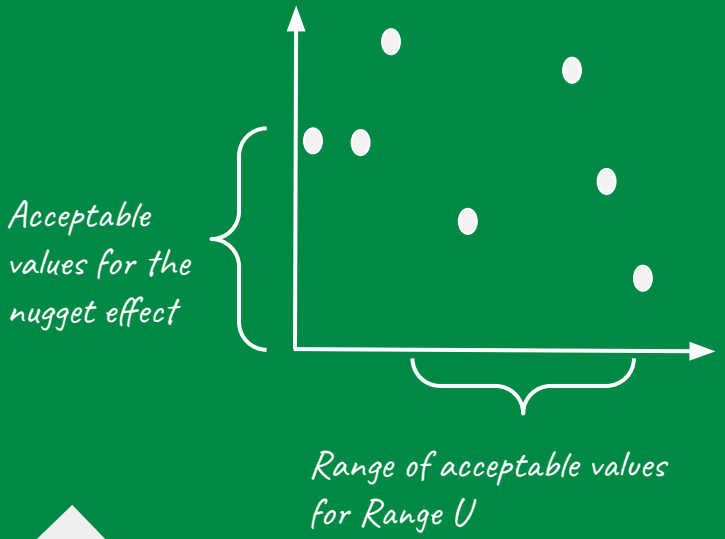


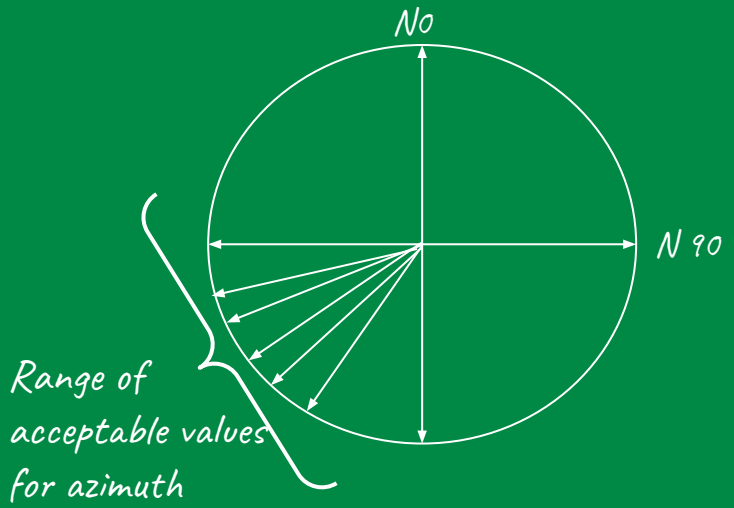
The variogram dilemma

- If the variogram is uncertain, is the block model acceptable?
- Should one use the model with the highest spatial variability?
- So lower mining selectivity, and usually smallest economical value?
- Who knows what would happens if we used another nugget effect?

The variogram dilemma

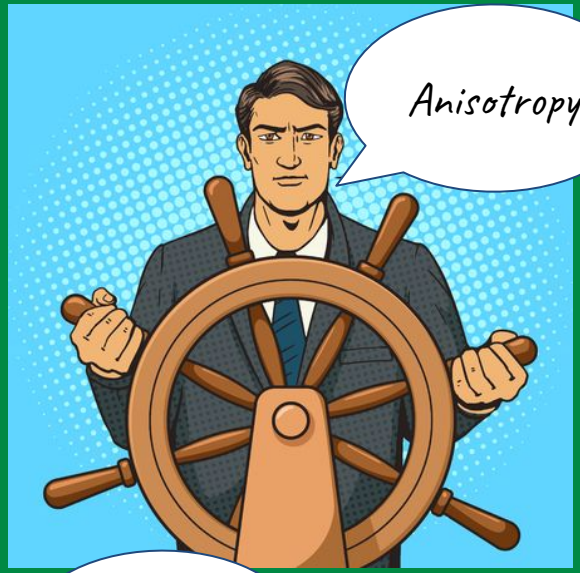
One cannot always be sure of the model to use





How to solve the variogram dilemma ?

First, identify the uncertain parameters


Anisotropy


Nugget Effect


Total Sill


Range U


Range V


Range W

Define a response

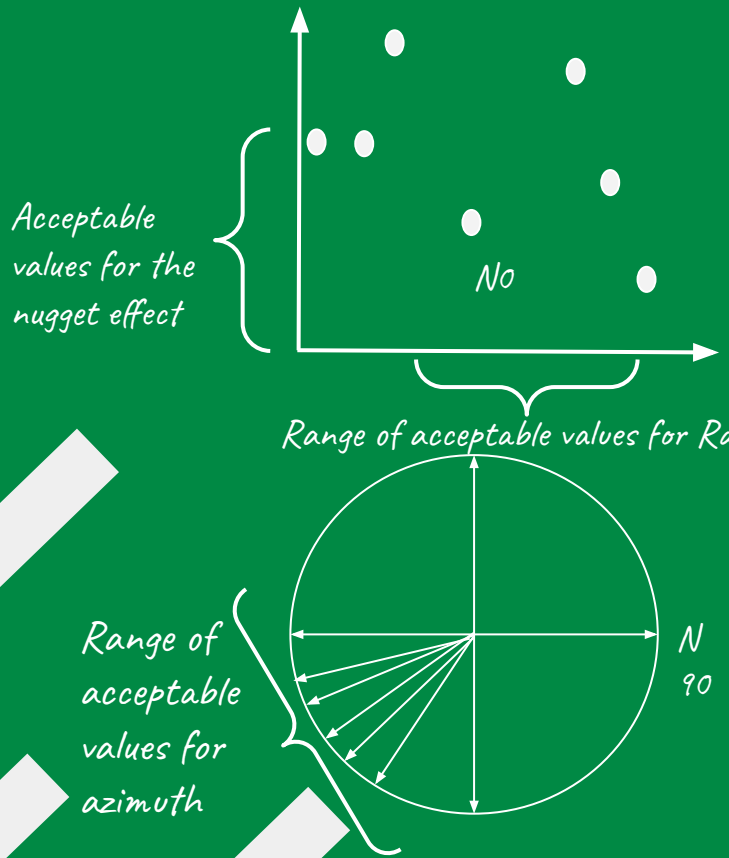
Define a metric to evaluate the difference between the models:

Ex: Total Tonne of ore at a specific cutoff

And understand the impact of the parameters on the response:

- How much each parameter impacts on the response?
- What would be the distribution of the response if we could test all possible variogram models?

Define a response

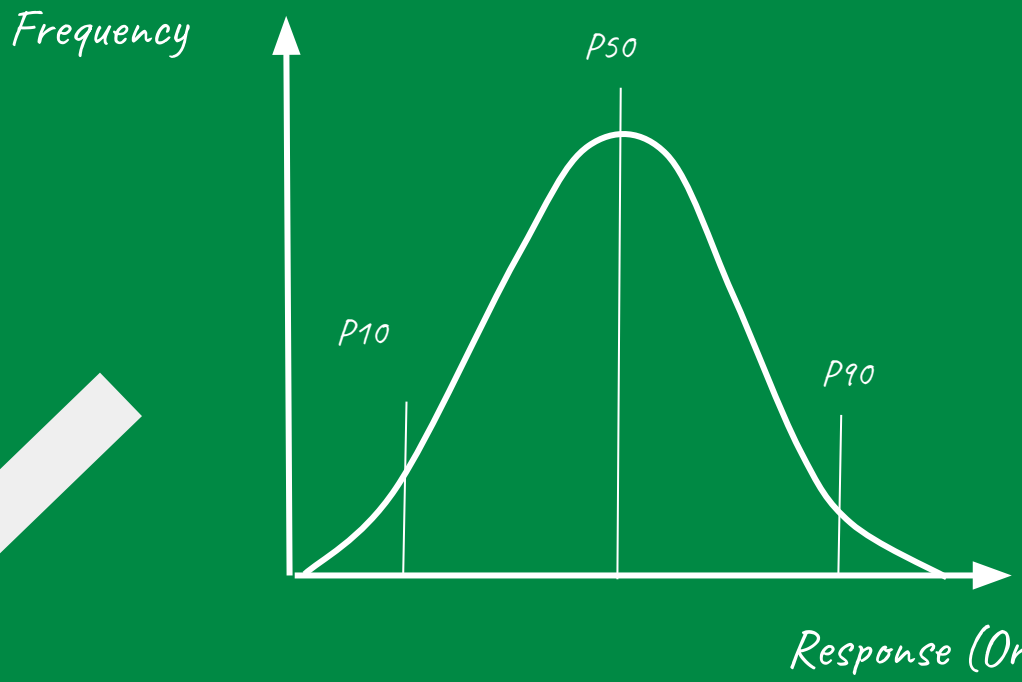


Resource Modeling Workflow

Distribution of Responses

Strategic Decision

Distribution of Responses



Getting the distribution of the Ore Tonnage given the uncertainty over the variogram model, allow to analyze the risk on the strategic decision

The not-so-bad, but naive, solutions

With 6 parameters and 20 possibles value for each parameters there would be 64 millions models to test ! If the estimation procedure (kriging, mik, etc.) takes 20 min it would be 2500 years of computation

Testing one variable at a time (OVAT) means the co-effect of parameters will be missed

Teasing on GeoLime Solution

A better Approach: Sensitivity Analysis

Designing a test plan to reduce the 64 millions of model to 100 model s. As we want to get a distribution, we cannot just select a 100 models and apply the estimation workflow

A better Approach: Sensitivity Analysis

Model the surface response
F(p1,p2,p3,...) = Total_ore

GeoLime library get has a dedicated function to test sensitivity on the ore volume from the variogram parameters

Specialists behind GeoLime Sensitivity Analysis

Sebastien Strebelle, PhD:
+ World-renowned geostatistician
+ Former leader geoscientist R&D at Chevron for 20 years

Claude Cavelius:
+ Former R&D engineer at Chevron for 10 years
+ Former Lead Developer at Belmont Technology
+ Currently CTO at DeepLime

Christelle Lusso, PhD:
+ R&D in academia for 6 years
+ Former data engineer at Capgemini
+ Currently R&D in AI and mathematical R&D at DeepLime

Contact us to get a demo of the sensibility analysis with GeoLime

Contact@deeplime.io