KRIGING AND THE SCREENING EFFECT

In Figures 1 and 2 below, the circles show the location of the samples, the circle size being proportional to the kriging weight. Block size and sample spacing are identical in Fig 1 and Fig 2. The spherical variogram has NO nugget component: the only difference is that the variogram range is larger than the sample spacing in Fig 1 and smaller in Fig 2.

Intuition may be proven wrong!

Intuition suggests that, the closer the sample is to the block being kriged, the larger the weight that Ordinary Kriging (OK) should assign to this particular sample. In Fig 1, this intuition is proven right. In contrast, Fig 2 shows the most distant samples assigned a larger weight than the closer samples in rings 1 and 2 surrounding the block. Why?

These results conform to the geostatistical theory

It all revolves around the weight of the mean ($\lambda_m$) as determined by Simple Kriging (SK). In Fig 1, SK has determined that $\lambda_m$ is small (if not equal to 0), hence the screening effect of rings 1 and 2 is strong: the most distant samples have minimal influence on the estimate.

In Fig 2, consistent with the variogram change, SK has determined that $\lambda_m$ is large. This means that OK is markedly influenced by the kriging of the mean (MK) using the samples in the neighbourhood. Recall that MK is implicit in OK. So, it is MK that is behind the counter-intuitive spatial distribution of the kriging weights in Fig 2. Expanding the neighbourhood further would show that the furthest samples still retain a significant influence in the OK estimate. This is why this kriging peculiarity is often referred to as the “inverse” screening effect as opposed to the “direct” screening effect in Fig 1.

Significance

The kriging peculiarity shown in Fig 2 can easily go undetected. If so, a search limited to a few samples around the block can lead to very poor results.

Whether a nugget is present or not, it is good practice to perform some kriging tests to assess the effects of the range / sample spacing ratio on the kriging weights and, ultimately, on the quality of the estimates.

This testing step should provide a meaningful basis for the optimisation of the kriging neighbourhood. It may also indicate that the block size needs to be changed.