AN OVERVIEW OF TENSORS, GRADIENT AND INVARIANT PRODUCTS IN IMAGING AND QUALITATIVE INTERPRETATION

*Matthew Zengerer**

Gondwana Geoscience, matt@gondwanageo.com

.

Potential Field Gradient Tensors are a multichannel dataset combining 5 independent components in a matrix array. As such, the data can be used and combined in many ways. A very common problem right across the world of geoscience is that even standard potential field transforms are not actually well understood by users. How does one expand grid transform concepts into the realm of tensors, where so many new combinations and concepts such as Invariants and Phase exist, and create lasting basis for industry interpretation?

It is important that all images used in potential field analysis carry some sort of physical meaning which is understood by the interpreter. True understanding arises from geophysically modelling a known 3D geological model, creating the grid transforms from the forward response of the model, and comparing these to the geology.

3D forward gravitational responses of a 3D model of a simple two-body basin-basement system with conjugate faulting and a dome-basin shape are used to generate the examples. Depths to the Basin-Basement interface were computed from the model and are presented as grids and contours draped on the gravity gradient imaging products to illustrate their responsiveness to the basement architecture.

Various combinations of traditional gravity and its gradient transforms, as well as tensor invariants and phase products, are assessed against the model. It is shown that certain imaging products show more responsiveness to physical property variations, whilst others are more sensitive to geometry, but combining these in novel ways can approach understanding of subsurface mapping possibly not explored previously using potential fields.