Inverse problems in geophysics are mathematically ill-posed when no unique solution exists. Nevertheless, the true source of the measured signal (e.g. a distribution of physical parameters in the subsurface) exists and is unique. Conversely, the information contained in the measurements about the true source is insufficient to discriminate it mathematically from other ‘data-equivalent’ Earth models.

Ideally, the mathematical tools yield a neutral and objective transformation between the measurements and the Earth model. In the literature a unique (optimal) solution to the inverse problem is often obtained by imposing mathematical assumptions which geophysical interpretation is unclear. The resulting optimal model can be biased with respect to the existing true source.

Since the ambiguity of a solution to the inverse problems cannot be avoided it should be exposed. The assumptions should be explicit and geophysically meaningful. Furthermore, the geophysical inverse models are often constructed sequentially, hierarchically and are based on series of ‘fixed assumptions’ that are not easy to change afterwards. A good method should be able to relax these fixed assumptions.

We illustrate the above general methodological principles by a geological stripping in the Faroe Islands area. The bathymetry and surface gravity are obtained from the global marine gravity model, DNSC08. The sediment thicknesses from the global models are also included. The average mass density values for different geological units are estimated including a modification option both vertically and horizontally. Also, a separation of the gravity signal generated by deep sources using horizontal gravity gradients transformed from gravity anomalies is discussed.