Geophysical Research Abstracts
Vol. 16, EGU2014-11174, 2014
EGU General Assembly 2014

Towards the geometric optimization of potential field models – A new spatial operator tool and applications

Claudia Haase (1) and Hans-Jürgen Götze (2)

(1) Geological Survey of Norway, Trondheim, Norway (claudia.haase@ngu.no), (2) Christian-Albrechts-Universität zu Kiel, Germany

We present a new method for automated geometric modifications of potential field models. Computational developments and the increasing amount of available potential field data, especially gradient data from the satellite missions, lead to increasingly complex models and integrated modelling tools. Editing of these models becomes more difficult. Our approach presents an optimization tool that is designed to modify vertex-based model geometries (e.g. polygons, polyhedrons, triangulated surfaces) by applying spatial operators to the model that use an adaptive, on-the-fly model discretization. These operators deform the existing model via vertex-dragging, aiming at a minimized misfit between measured and modelled potential field anomaly. The parameters that define the operators are subject to an optimization process. This kind of parametrization provides a means for the reduction of unknowns (dimensionality of the search space), allows a variety of possible modifications and ensures that geometries are not destroyed by crossing polygon lines or punctured planes. We implemented a particle swarm optimization as a global searcher with restart option for the task of finding optimal operator parameters. This approach provides us with an ensemble of model solutions that allows a selection and geologically reasonable interpretations.

The applicability of the tool is demonstrated in two 2D case studies that provide models of different extent and with different objectives. The first model is a synthetic salt structure in a horizontally layered background model. Expected geometry modifications are considerably small and localized and the initial models contain rather little information on the intended salt structure.
A large scale example is given in the second study. Here, the optimization is applied to a sedimentary basin model that is based on seismic interpretation. With the aim to evaluate the seismically derived model, large scale operators are applied that mainly cause depth adjustments to the model horizons.