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Inversion of gravity data: new techniques, new possibilities.

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Two popular methods of interpretation of gravity data are manual modeling and linear inversion. In the case of complicated three-dimensional structures both methods can be very time intensive tasks. However, in the era of fast computers and new programming techniques new software solutions can be developed to make the interpretation process fast and user friendly. Methods of linear inversion can be replaced by modern techniques of global optimization which deal with the non-uniqueness of the gravity interpretation.

A new program for 3D interactive gravity modeling is presented. The program uses a rectangular prisms approach to calculate the gravity effect of a modeled structure. Compressing techniques are applied to decrease memory usage and speed up the calculations. The program can be used as a standalone modeling application. However, best results are obtained by combination of the manual modeling with an automatic inversion program. The inversion algorithm employs the idea of Evolution Strategies. A new parameterization is applied to reduce the number of parameters of an inverted structure. A modeled subspace built of a set of rectangular prisms is divided into vertical columns. The new parameterization allows to significantly reduce the amount of computer memory and time needed to process the calculations. The inversion program can be run in a parallel mode on computer clusters.

The new software was applied in two field cases. The first one was the microgravity interpretation of glacial sediments of a buried valley. The second one was the inversion of regional gravity observations from the Hellenic subduction zone. A brief description of the interpreted structures is given and the results are presented.