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Optimized calculation of the crustal geoid

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Knowledge of 3D density distribution in the Earth crust and upper mantle is the necessary condition for proper geodynamic modelling. It can be estimated using forward modelling and inversion of the gravity data. As the gravity modelling is generally ambiguous, it should be constrained by existing seismic velocity models. In addition, we need a fast and precise algorithm to calculate gravity field that could be use in iterative calculations. We decided to focus on the geoid calculations because it gives more information about deeper structures than the Bouguer anomaly. We present a code based on point mass algorithm as well as prisms algorithm that uses some easy to implement optimizations. The code works in regularly parameterized models used in local scale interpretations, but it's second version works also in geographical coordinates allows a large scale interpretations. We used this code for calculation of the synthetic crustal geoid for the territory of Poland. Our 3D velocity P-wave velocity model was based on 2D interpretations along 18 deep seismic profiles from experiments LT, TTZ, POLONAISE'97, CELEBRATION 2000 and SUDETES 2003. The model was recalculated to densities using relationships between density and P-wave velocity. Using different density-velocity relationships for sedimentary and crystalline crustal rocks, we calculated the gravity effect of the topography, sediments and mantle separately. After calculation of the final geoid we found out that the observed geoid cannot be explained by our model reaching only 50 km and the remaining residuals are due to the effect of inhomogeneities in the mantle.