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Modeling of dynamic geoid with lateral viscosity variations

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The main objective of this work is to throw light on the effect of lateral viscosity variations (LVV) on geoid and dynamic topography modeling. This problem has been investigated for about 10 years but is not yet completely solved. A kernel technique, which is based on decomposition into spherical harmonics (SH), is normally used to model dynamic topography and geoid, however it doesn't provide a possibility to account for LVV directly. A direct simulating of the dynamic topography and geoid, based on FE/FD (Finite Element/Finite Difference) methods, provides such a possibility, but needs unacceptable computer time and doesn't guarantee necessary accuracy for the computed geoid, which usually represents a small difference of two opposite signals. It is intended to create a combined method, which resolves these problems and incorporates LVV in the SH method. As a basis we use a perturbation method suggested by Zhang and Christensen, 1993 to incorporate LVV in the model. We improved this method by incorporating of the effect of mantle compressibility into it. Instead of the prevalent kernel technique we use a direct method for solution of differential equation system with arbitrary changes of density and radial viscosity variations. The first tests of this method show that convergence of the solution is achieved for at least three orders of LVV magnitude. This method also provides a possibility for modeling of toroidal mantle flow. In the next step we plan to use this method to determine both vertical and lateral variations of the mantle viscosity, which are consistent with seismic velocities inferred from seismic tomography.