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First steps toward a comprehensive snap-shot model of the dynamic solid Earth.

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We present the initial results obtained during the first stage of the project “Modelling of the dynamic Earth from an integrative analysis of potential fields, seismic tomography and other geophysical data” within the SPP program (DFG) "Mass Transport and Mass Distribution in the Earth System". Two related problems have been analysed: (1) construction of a new global model of the crust and upper mantle and determination of its impact to the observed gravity; (2) developing of a new approaches to evaluate a global dynamic model of the mantle.
Several principal problems have been solved:
A new global digital model of the lithosphere has been constructed (principal improvements for Europe and South/Central Asia). The model provides variations of the main boundaries (the most important – depth to basement, Moho and lithosphere-asthenosphere boundary), density of the sedimentary layer and seismic velocity within the crust.
Gravity effect of the crust has been removed from the observed fields, which gives the residual mantle anomalies and residual topography. A new density model of the crust and upper mantle has been produced. The obtained residual non-isostatic geoid demonstrates the effect of deep mantle structure and dynamics.
A new method has been developed that provides a possibility to model the dynamic topography and geoid as well as surface plate velocities induced by global mantle flow with the effect of strong lateral viscosity variations in the mantle.
The existing plate velocity models have been analysed, the toroidal and polloidal components have been determined to use in the next modelling stage.
A preliminary global dynamic model of the mantle has been constructed. We have demonstrated that considering the effects of the transition zone and LVV could principally affect the results.
These results provide a comprehensive basis for the next stage of the project.