Geophysical Research Abstracts
Vol. 17, EGU2015-3905-1, 2015
EGU General Assembly 2015

Elastic thickness of the lithosphere and tectonic evolution: implications for GIA models

Aleksey Amantov (1) and Willy Fjeldskaar (2)
(1) VSEGEI, St.Petersburg, Russia, (2) Tectonor, Stavanger, Norway (wf@tectonor.com)

Rheological properties used in GIA models require independent verifications and possible modifications. To estimate the flexural rigidity of the lithosphere in simple platform areas we use peneplain distortion, which enable us to compute isostatic response from sediment load and compare the results with observed changes in geometry.

This was done for several different platform regions:
- Baltic (Fennoscandian) Shield, including structural elements of the Russian Platform
- Barents Sea platform areas
- Kara and Western Siberian domain
- Eastern Siberian Platform

In the East European and East Siberian old cratons we modeled isostatic distortion of Neoproterozoic Ediacaran peneplain and some other relevant surfaces. For the Arctic we used Mid-Late Jurassic surface (JP) as a distinct unconformity and well-traced (by seismic and well data) surface in the Arctic region.

The isostatic distortion of peneplains under sediment load / erosion for the old Archean - Proterozoic cratons in general confirms earlier rheology model with the flexural rigidity of the lithosphere around 5x10**23 Nm (effective elastic thickness of 30-40 km), but could be slightly lower in the Barents basins. Deviations are generally relatively small and could be explained by e.g. by averaging over fault-zones, tectonic events, compaction structures and density variations.

However, the situation for the Kara-Western Siberian domain is very different, with large deviations between observations and calculations. With a slight reduction of the effective elastic thickness in the Kara Sea to 10-20 km the fit is much better.

Based on the results we suggest two different major types of lithosphere rigidity in the area. This seems reasonable because they typify domains with different crustal age. Western Siberian platform, with Kara continuation has much younger basement, in addition to significant magmatic activity and Early Mesosoic extension. The lithosphere rigidity is a function of age and temperature; as the lithosphere cools, it becomes more rigid in responds to surface loads.

Differences in lithosphere rigidity would affect the vertical movements, caused by erosion and isostasy on both sides of the marginal Novaya Zemlya-Polar Ural belt. The rigidity variations could, at least partly, explain the asymmetry of the belt uplift. Possible differences in elastic properties could be important for glacial isostatic modeling, which involves Arctic region.