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A new thermal model for Northern and Central Asia

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Central and Northern Asia is a key natural laboratory for the study of active intra-continental deformation in response to the ongoing far-field collision of India and Eurasia. The induced tectonic processes strongly depend on the thermo-mechanical and compositional (density and thickness) structure of the lithosphere. Density heterogeneities within the crust and upper mantle are important factors in the control of the dynamics of Earth deformation at shallow and deep levels. The main aim of this research project is to construct new high-resolution 3D models of the compositional, thermal and rheological structure of the intra-continental lithosphere of the study area. The 3D models will be constructed by combining and jointly analysing satellite gravity data with terrestrial data (seismic velocity distributions, seismic tomography, GPS derived surface deformations, heat flow measurements and terrestrial gravity).

Here we present a first new 3D thermal and lithospheric thickness model for Central and Northern Asia. This new thermal model is constructed using an improved version of the methodology presented by Goes et al (2000) and Tesauro et al (2009), and is based on a recent seismic tomographic model of Central Asia (Koulakov, personal communication) and a global Moho model. We also present a new estimate for the lithospheric thickness in the study area, based on the analysis of the spatial distribution of the 1100, 1200, and 1300C isotherms. The new higher resolution models show significant lateral variations in thermal structure across the study area, in particular across main structural boundaries. Central Asia is characterized by more heterogeneous thermal structure of the lithosphere compared to the adjacent cratonic areas in Northern and Western Asia. The observed thermal heterogeneity of Central Asia will result in an anomalous thermo-mechanical structure of the continental lithosphere, which in turn may control the development of the contemporary compressional intra-plate deformation caused by the ongoing far-field collision of India into Eurasia. The new thermal and lithospheric thickness models are compared with the most recent available work in Central Asia. Furthermore possible relationships between the temperature distribution at different depth and the intra-plate deformation are discussed.

References

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