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Chinese Lithosphere Rheology and Geodynamic Modeling

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Rock rheology is of critical importance to affect lithosphere deformation. Laboratory experiments show that viscosity of rocks strongly depends on temperature. Therefore, reliable estimation of geotherm is the first step for understanding lithospheric rheology. Deduction of geotherm from surface heat flow and thermal conductivity has been applied widely. However, error in temperature estimated this way increases with depth. In our study, we use seismic tomographic data to estimate mantle temperature ranges 50 to 200 km depth, and get a better constraint of temperature at depth. We use new petrology data to construct the crustal structure and viscosity model of China. To test the validity of extrapolation of flow law of rock from laboratory sample size and higher strain rate to large field scale and much lower strain rate, we use post seismic GPS deformation observation to invert lower crust viscosity for comparison. We then apply the viscosity model to simulate a number of tectonic problems in China, such as GPS velocity clockwise rotation around the eastern syntax of the Himalaya and uplift of the Tibetan plateau, decoupling of stress indicated by compression in the upper crust and extensional normal fault earthquake in the upper mantle in Taiwan southwest coast, and different stress accumulation rate in the upper and lower crust in Longmenshan area, Sichuan Province to estimate the reccurence time of large earthquakes.