The Influence of Dynamically Supported Topography on Estimates of Te

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Abstract:
The effective elastic thickness, T_e, of continental lithosphere can be estimated from the relationship between gravity and topography in the spectral domain. Two methods have been used, one of which depends on the coherence between Bouguer gravity anomalies and topography, whereas the other uses the transfer function, commonly known as the admittance, between the free air gravity and topography. The two methods give estimates of T_e which differ by as much as an order of magnitude in areas where variations in elevation are small.

This problem has lead to much controversy. An important concern is the extent to which estimates of T_e are affected by dynamically maintained gravity and topography, arising from mantle convection and postglacial recovery. Such dynamical processes produce long wavelength anomalies, especially in Northern Canada and Fennoscandia. Unlike elastically supported anomalies, these processes can generate gravity and topographic anomalies with wavelengths as large as 20,000 km. If such anomalies are modeled as being supported by elastic forces, the resulting values of T_e are overestimated, often by a large amount, irrespective of which method is used.