EGU22-3561
https://doi.org/10.5194/egusphere-egu22-3561
EGU General Assembly 2022

Mechanical Strength of Southern African's Lithosphere from a Joint Inversion of Bouguer Gravity and Topography and its Uncertainty

Mohamed Sobh[1], Christian Gerhards[1], and Islam Fadel[2]
[1]TU Bergakademie Freiberg, Institute of Geophysics and Geoinformatics, Geomathematics and Geoinformatics, Freiberg, Germany
[2]Faculty of Geo-Information Science and Earth Observation, University of Twente, Enschede, The Netherlands

South African lithosphere is a mosaic of the best-preserved and exposed crustal blocks, assembled in the early to late Archean and then modified by a series of major tectono-thermal events, both of Precambrian and Phanerozoic age. Understanding the thermal and compositional structure of the South African lithosphere provides crucial information for the causes and processes of lithospheric stability and modification.

The lithosphere's effective elastic thickness (T_e) is a proxy for mechanical strength that can be used to constrain lithospheric rheology and better understand how surface deformation affects deep Earth processes.

In this study, we calculate the admittance and coherence for southern Africa using topography and Bouguer gravity data from the GOCE satellite dataset. The admittance and coherence are then jointly inverted to estimate the spatial variations in southern African elastic thickness, by applying a wavelet transform in a probabilistic Bayesian framework.

Unlike other Cratonic regions, the low effective elastic thickness values and the shallow Curie depth estimated along the Kaapvaal Craton, demonstrate that lithospheric strength is influenced by regional thermo-chemical mantle upwelling dominated by composition, rather than just the continental geothermal state.

The lateral heterogeneity of T_e across the Kaapvaal craton indicates that the Kaapvaal may not be a uniformly rigid craton and the modification is related to metasomatism and plume activity.