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Exploring Parameter Space of Rift Induced Delamination Hypothesis with Application to Rwenzori Mountains

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The extreme elevation of Rwenzori Mountains, a horst situated inside a rift zone, motivates our search for their geodynamic driving mechanism. Testing several hypotheses favours RID due to some first successful numerical models. RID is the hypothesis of rift induced delamination of mantle lithosphere and uplift of crust. It is based on the propagation of the rift tips feeded by upwelling asthenosphere, surrounding stiff old lithosphere, thereby triggering the delamination of cold and dense mantle lithosphere root by reducing viscosity and strength of the undermost lower crust. This unloading induces pop-up of the less dense crustal block along steep inclining faults.
Viscous flow of 2D models is approximated by Finite Difference Method in an Eulerian formulation. Equations of conservation of mass, momentum and energy are solved for a multi component and two phase system. Based on laboratory data of appropriate samples a temperature, pressure and stress dependent rheology is assumed.
We try to establish RID and learn about the process by exploring the parameter space with model families. Aim is to identify relvant factors controlling the delamination. Investigation candidates are parameters describing the initial pertubation such as excess temperature and geometry and its distance between bounding rifts. Further candidates include rheological properties such as the power laws of mantle, upper and lower crust and the limiting yield stress and its depth dependence. The range of variation and sensitivity of the individual quantities are presented. Because some values are highly sensitive physical and numerical system answers must be distinguished carefully.
The actually used model is 2D and simple as possible to test under which conditions the hypothesis is basically working. Earth naturally is more complex as new observations around Rwenzoris suggest. A first step would be an asymmetric model leading to 3D. If RID is true for the very special situation of the Rwenzoris, one ought to generalize it and check wether similar situations are detectable.