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Thermo-mechanical numerical modelling of lateral propagation of continental lithosphere delamination.

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One of the most intriguing problems of geodynamics is the presence of extension in continental zones within a regional context of compression. Previous works have shown that continental lithosphere delamination and convective removal of lithospheric material can be plausible mechanisms for the origin of extension. In this research we focus on the quantitative study of the delamination process, paying special attention to the lateral migration of the delamination point. We model the evolution of a thickened orogenic lithosphere which brings about a Rayleigh-Taylor gravitational instability. We introduce an asthenospheric conduit across the lithosphere that enables the ascent of asthenospheric material and its propagation along the base of the crust.

We apply new algorithms of thermo-mechanical modelling, developed in MATLAB code, able to study the temporal evolution of delamination. The motion equation and the coupled thermal equation are solved by applying finite difference techniques.

Differently from previous studies, we reproduce the lateral propagation of continental lithosphere delamination. We study the influence of initial geometry and stratification of density and viscosity in order to investigate the conditions needed for the lateral propagation to occur. Our results indicate that this propagation causes significant uplift, crustal extension and thinning, in contrast to symmetric convective removal.