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# Impact of elasticity on lithospheric shortening and strain localization

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The initiation of subduction is not well understood and also the mechanisms of localization in a compressive domain are incompletely understood. In order to better understand what controls strain localization during compression, we perform two dimensional numerical simulations with a finite element code using the MILAMIN solver with the Triangle mesh generator. Our model configuration consists of a lithosphere composed of an upper crust, a lower crust and a mantle with each layer having its own non-Newtonian rheology. We add a thermal perturbation (+100°C) to the right bottom side of the model. The model is then shortened with a fixed strain rate ($5*10^{-15}s^{-1}$) and we vary both the bottom temperature and the shear modulus. The latter allows variations between two extreme rheological models: visco-elasto-plastic and visco-plastic.
The results show that (1) the lithosphere is subjected to buckling, (2) localization caused by shear heating can occur in one of the folds during ongoing buckling, and (3) a lower basal temperature favors higher stresses so that localization is facilitated. The visco-elasto-plastic model shows faster and more intense localization than the visco-plastic model. Moreover, as soon as strain localization initiates, strain rates suddenly increase by several orders of magnitude (>2) during a short period of time (<200 ky). This stage presumably corresponds to the release of the elastic energy stored during the stress build up. According to these observations, we conclude that the role of elasticity on shear localization should not be neglected.