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Numerical modelling of strain localization by anisotropy generation during viscous deformation

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Localization and softening mechanisms in a deforming lithosphere are important for subduction initiation or the generation of tectonic nappes during orogeny. Many localization mechanisms have been proposed as being important during the viscous, creeping, deformation of the lithosphere, such as thermal softening, grain size reduction, reaction-induced softening or anisotropy development. However, which localization mechanism is the controlling one and under which deformation conditions is still contentious. In this contribution, we focus on strain localization in viscous material due to the generation of anisotropy, for example due to the development of a foliation. We numerically model the generation and evolution of anisotropy during two-dimensional viscous deformation in order to quantify the impact of anisotropy development on strain localization and on the effective softening. We use a pseudo-transient finite difference (PTFD) method for the numerical solution. We calculate the finite strain ellipse during viscous deformation. The aspect ratio of the finite strain ellipse serves as proxy for the magnitude of anisotropy, which determines the ratio of normal to tangential viscosity. To track the orientation of the anisotropy during deformation, we apply the so-called director method. We will present first results of our numerical simulations and discuss their application to natural shear zones.