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Deformation of the upper plate in subduction zones as a function of trench retreat dynamics

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Subduction zones around the world show mobile trenches, which have different directions and rates of motion. Retreating trenches often cause extension in the upper plate, however, the effect of the different rates of retreat on the surface deformation pattern is not yet clear.
Our numerical study aims at quantifying the effect of increasing the trench retreat velocity on deformation in the upper plate. We present 2D numerical results obtained using the finite-element code Fluidity, which simulates the dynamics and thermal evolution of lithosphere and asthenophere rocks as viscous materials. We simulate the subduction of a slab under an upper plate, and we control the rate of trench retreat by imposing density anomalies in the incoming subducting plate. We observe the resulting deformation through the spatial extent and magnitude of high strain rate regions in the upper plate. Results show that trench retreat is only partly accommodated by lateral translation of the upper plate, and can induce significant deformation up to 1000 km from the trench in addition to the localized back-arc region next to the trench.