Scale effects and mesh dependency in simple models for the dynamics of faults

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Although the evidence for complexity is overwhelming the dynamics of faulting is still poorly understood. As shown in earlier works we demonstrate that complexity and narrow rupture pulses are closely coupled and both depend on the presence of strongly weakening friction. However we add further fuel to these arguments and show that nonlinear, scale-dependent processes may also be a significant factor in the generation of slip complexity and pulse-like rupture. Whilst it has long been known that discreteness in numerical earthquake models produces complexity, the source of this complexity has never been fully established. Using a simple 1D nonlinear model we show how complexity can arise in discrete models through the presence of nonlinear, mesh-dependent (or scale-dependent) terms.