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Precursor evolution in recent dry friction experiments explained by 2D simulation

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We describe a 2D spring-block model for the transition from static to kinetic friction at an elastic slider/rigid substrate interface obeying a minimalistic friction law. Including the vertical dimension enables us to include the experimental boundary conditions directly, allowing a realistic evolution of the local shear and normal loading forces. We argue that these geometric properties of the system are of fundamental importance when modelling its frictional behaviour. We present simulation results showing that our model accounts for recent experimental findings on the arrest of the crack-like precursors at the onset of frictional sliding. We find that the stress build-up due to both elastic loading and micro-slip-related relaxations depend only weakly on the underlying shear crack propagation dynamics. Conversely, crack speed depends strongly on both the instantaneous stresses and the friction coefficients, through a non-trivial scaling parameter.