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A new mechanism for scaling in runout distances of landslides: the role of frictional heating and hydraulic diffusivity

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Natural landslides often exhibit surprisingly large travel distances and an unexplained decrease in apparent friction coefficient H/L (where H is the drop height and L the travel distance) with increasing slide volume, V. We present a thermo-poro-elastic mechanism operating at the base of landslides that may explain this behavior. Numerical simulation results indicate that frictional heating at the base of landslides elevates fluid pore pressure and reduces friction, resulting in large sliding velocities and distances. Depth-dependent permeability controls pore pressure diffusion rates from the shear zone, allowing larger slides to maintain high pore pressure for longer times, thus resulting in lower H/L. The numerically obtained relation between V and H/L agrees with field data of subaerial landslides.