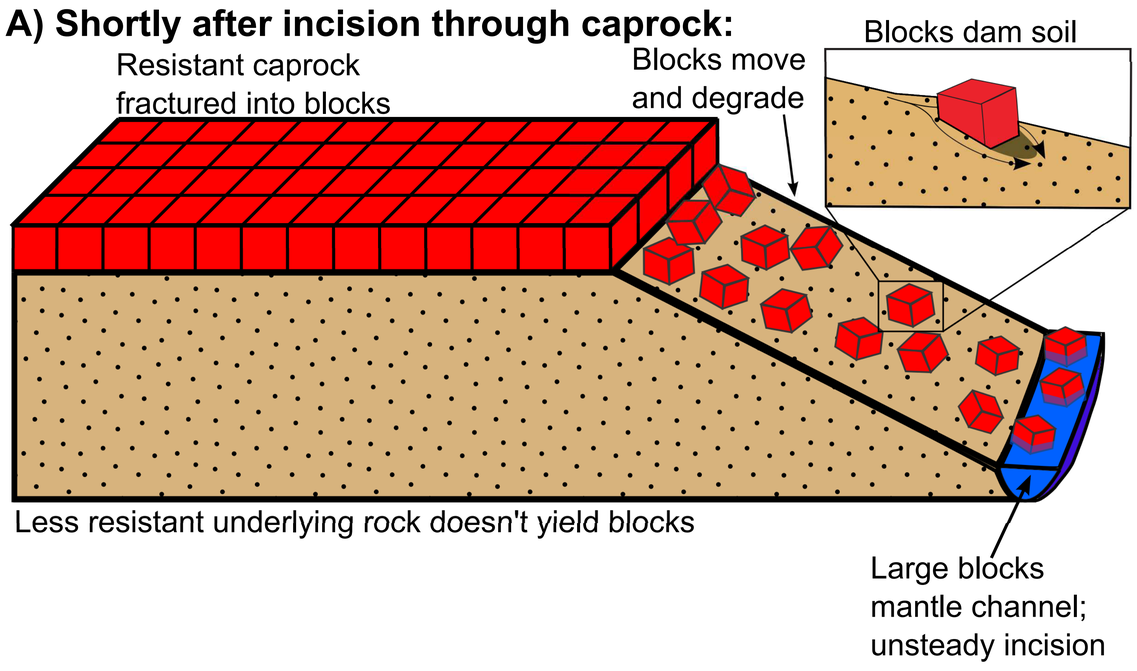
Modeling the 2-D evolution of blocky landscapes: Hillslope-channel interactions

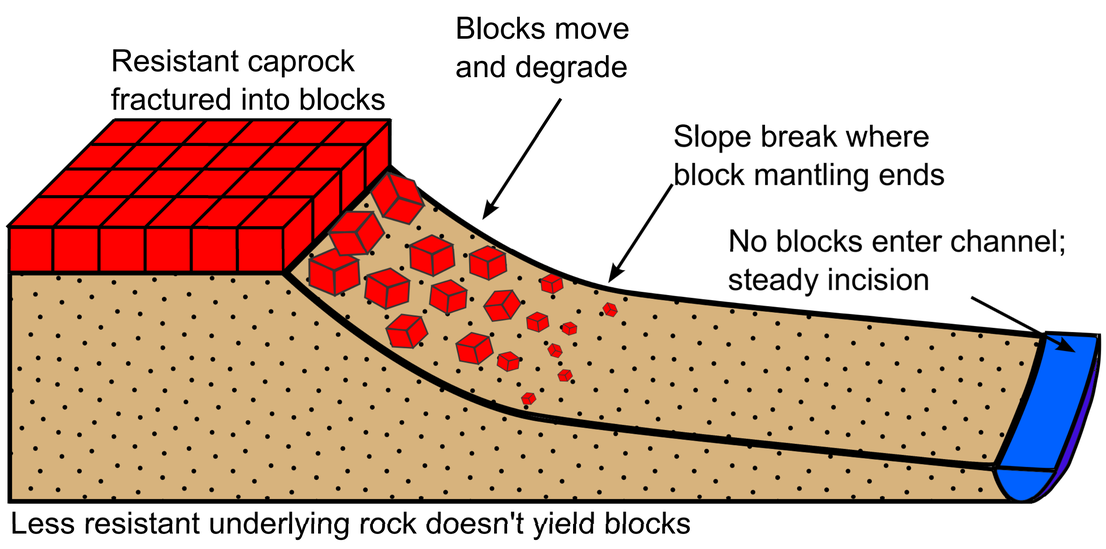
Charlie Shobe and Rachel Glade, University of Colorado Boulder
charles.shobe@colorado.edu | rachel.glade@colorado.edu

Conceptual model of canyon development

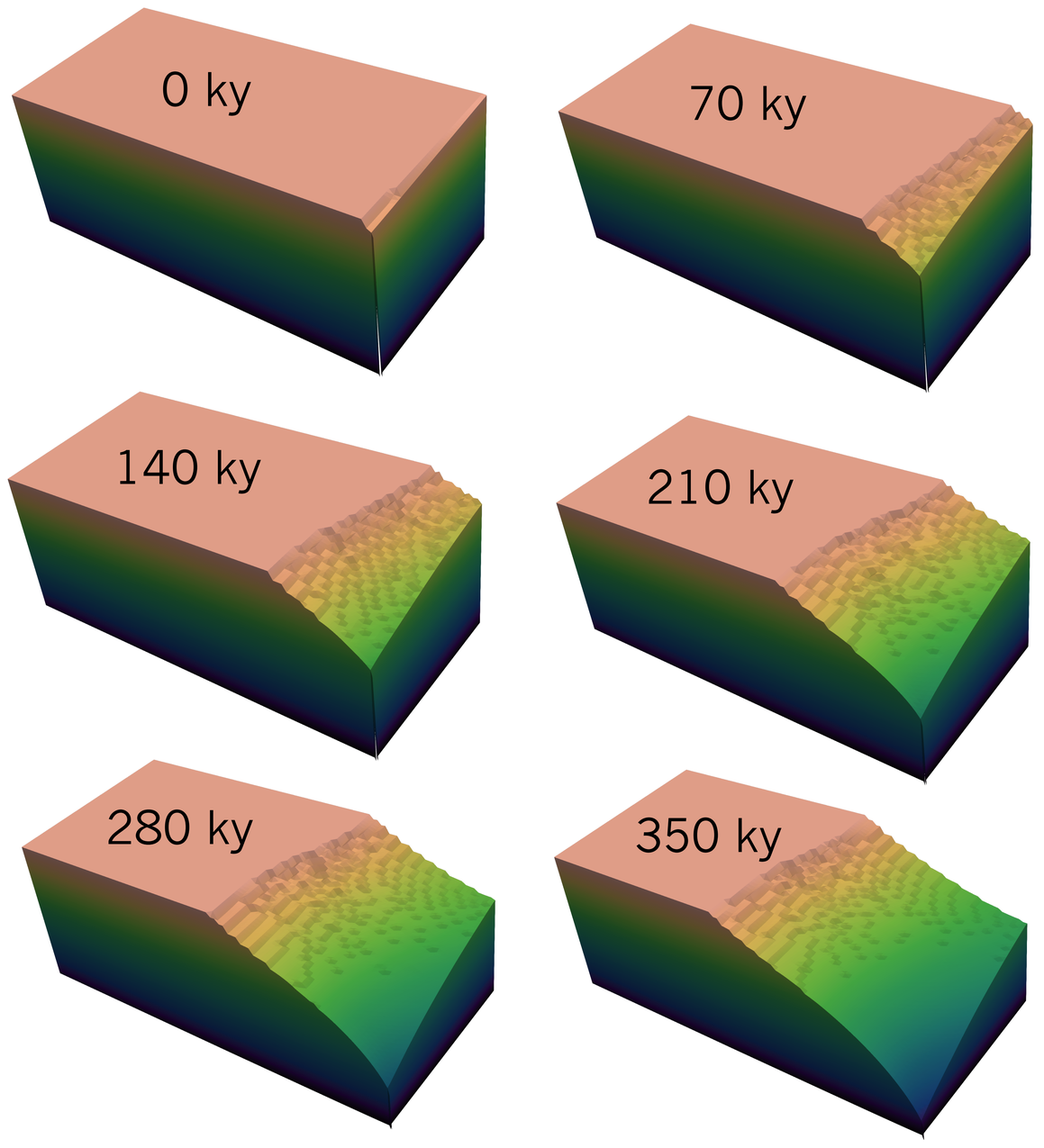
A) Shortly after incision through caprock:



B) Long after incision through caprock:

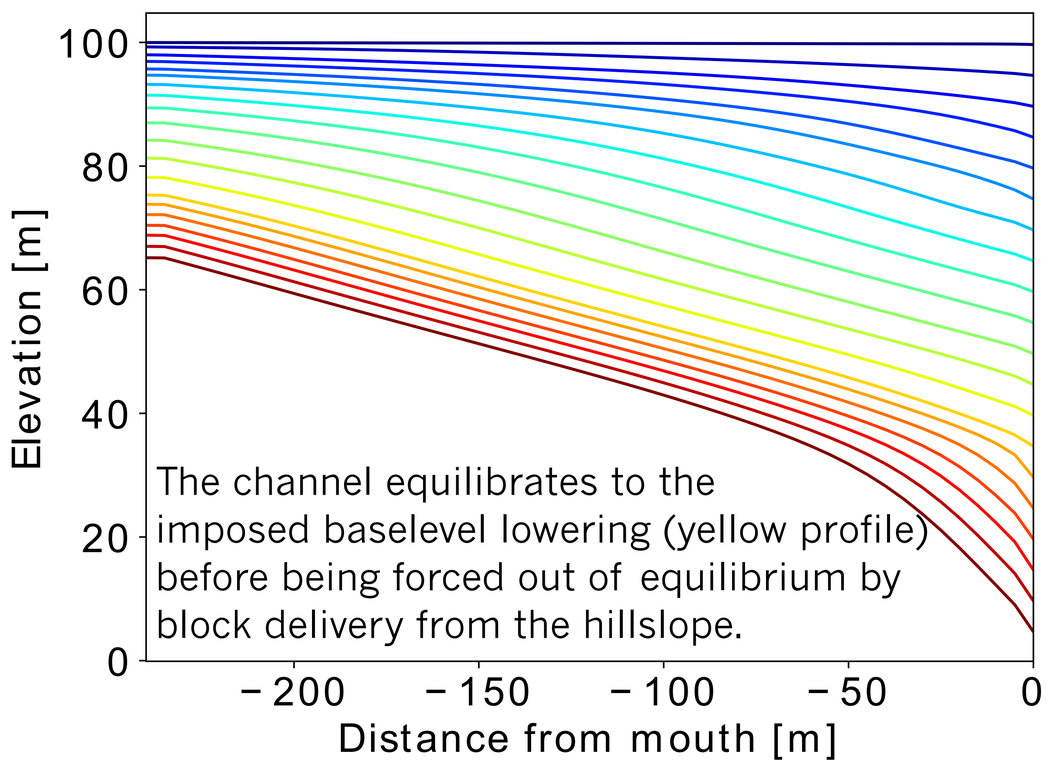


Time series of blocky landscape evolution

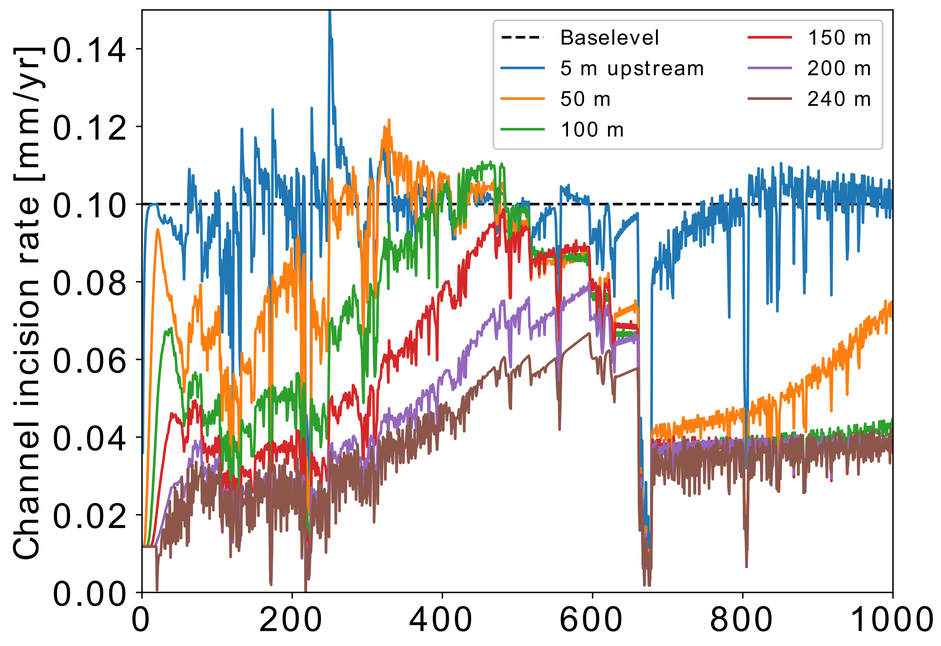


Unsteadiness in landscape form and erosion rates

Channel form and evolution



Baselevel lowering at a steady rate over 1,000,000 years



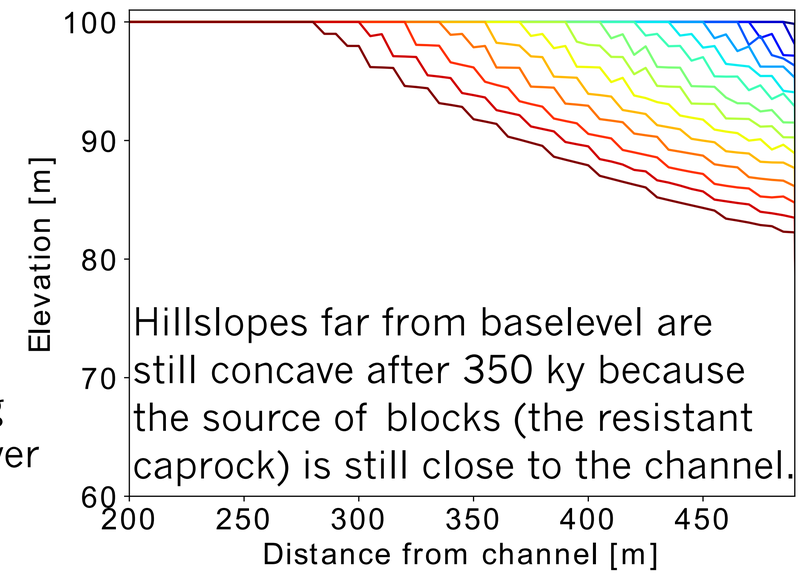
-Channel erosion rates approach imposed baselevel lowering rates, but are highly variable in time.

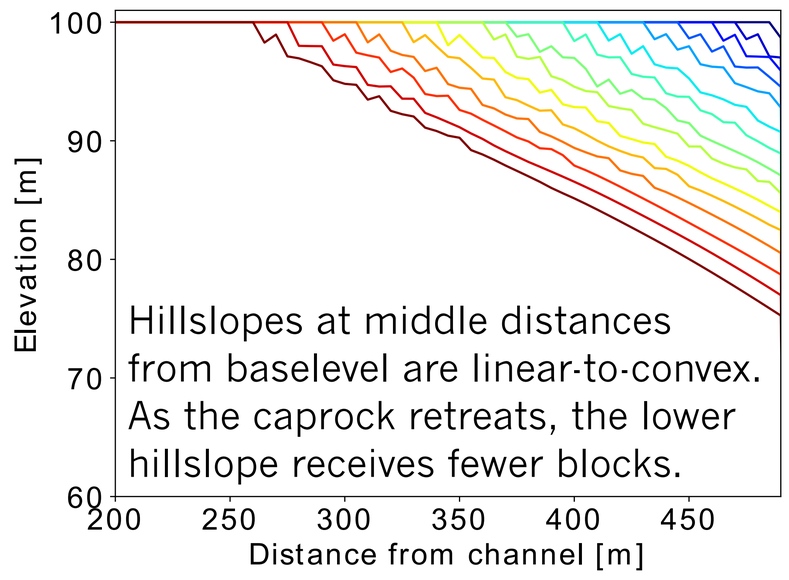
-Time to equilibrium increases with distance from baselevel

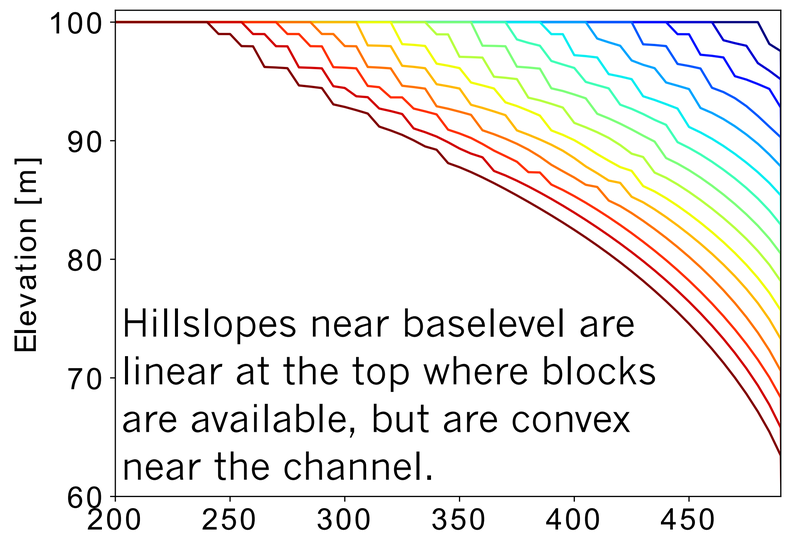
-Erosion rate variability is greatest near baselevel

-The channel was autogenically kicked out of equilibrium just after 600 ky (how??)

Hillslope form and evolution







References and acknowledgements

Glade, R.C., R.S. Anderson, and G.E. Tucker (2017) Block-controlled hillslope form and persistence of topography in rocky landscapes, *Geology.*
Glade, R.C. and R.S. Anderson (2018) Quasi-steady evolution of hillslopes in layered landscapes: An analytic approach, *JGR-ES.*
Shobe, C.M., G.E. Tucker, and R.S. Anderson (2016) Hillslope-derived blocks retard river incision, *GRL.*
Shobe, C.M., G.E. Tucker, and M.W. Rossi (in review) Variable-threshold behavior in rivers arising from hillslope-derived blocks, *JGR-ES.*

Thanks to NSF EAR-1331828, EAR-1323137, EAR-1529284, and CU. Thanks to G. Tucker, R. Anderson, M. Rossi, G. Bennett, K. Barnhart, H. Gray, A. Hurst, and K. Kochanski for helpful discussions.