Modelling Feedback Loops in Soil Erosion

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The Hairsine-Rose soil erosion model is a physically-based model capable of capturing the dynamics of erosion and sediment transport arising from differential deposition of soil particles with different settling velocities. Coupled with the St. Venant equations and a morphological component in a finite volume framework, the model can be applied to investigate spatial and temporal scale effects in soil erosion. We verify the numerical implementation against solutions obtained using the method of lines. To validate the model, we use published data from various experimental investigations. Finally, we present long-timescale simulations of soil erosion on a compound hillslope, demonstrating the feedback loop that exists between erosion processes, sediment delivery, and morphological changes.