Abstract Submitted
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Channelization and avalanche dynamics of sediments in a fracture driven by fluid flow[1] ARSHAD KUDROLLI, XAVIER CLOTET, Clark Univ — We investigate the evolution of porosity in a sediment bed induced by fluid flow which is important to understanding the structure of aquifers, dam-breaks, and extraction and sequestration of hydrocarbons in the subsurface. We demonstrate that a porous medium composed of granular matter in a thin model fracture becomes heterogeneous and develops channels due to growth of fluid flow coupled with increase in porosity. Erosion is observed to progress through stick-slip events with larger avalanches following longer wait times. Self-clogging is also observed where eroded particles collectively redeposit and jam within the channels, which are then stable to higher fluid fluxes. We model the spatial distribution of the flow within the medium using measured maps of the porosity and Darcy's law, and show that the channels grow on average at points where the perpendicular component of the fluid flux at the interface is the greatest. Adding a stochastic component to the model for the local erosion and deposition thresholds, we find the statistical features of the spatial development of heterogeneity to be consistent with those observed in the experiments.

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