MICHIGAN STATE UNIVERSITY
Department of Statistics and Probability

A Workshop on Future Directions in Fractional Calculus Research and Applications

Rina Schumer
Desert Research Institute, Reno, Nevada

Anomalous Transport, Rough Landscapes, And Preservation of Stratigraphy

Abstract

Although landscapes are considered far from equilibrium, the fact that topography exhibits self-affine scaling over a range of length scales has led to the use of surface evolution models originally derived for thermodynamic systems. Fractional Langevin equations representing fluctuating surface evolution link time averaged noisy transport with statistical patterns that emerge in the geomorphic and stratigraphic record. Specifically, anomalous transport leads to long range horizontal correlation of surface elevation across a landscape. This in turn, translates into vertical time correlations (ala a fractional Brownian motion) in erosion and deposition at a point, explaining statistics observed in geologic cores. Linking changes in deposition rates with climatic or tectonically driven changes in earth surface kinematics requires an appropriate null hypothesis.