Title: Simulations of Fluvial Landscapes and Optimal Transport

Abstract: The Smith-Bretherton-Birnir (SBB) model for fluvial landsurfaces consists of a pair of partial differential equations, one governing water flow and one governing the sediment flow. Numerical solutions of these equations have been shown to provide realistic models in the evolution of fluvial landscapes. Further analysis of these equations shows that they possess scaling laws (Hack's Law) that are known to exist in nature. However, the simulations are highly dependent on the numerical methods used; with implicit methods exhibiting the correct scaling laws, but the explicit methods fail to do so. These equations, and the resulting models, help to bridge the gap between the deterministic and the stochastic theories of landscape evolution.

The original optimal transport problem was formulated in terms of moving dirt from one place to another. A natural question then is to ask if erosion is an optimal transport of sediment. In general the answer in negative, but optimal transport turns out to play an important role in shaping what is generally called “the landscape”.