Spatially Random Processes in One-Dimensional Maps

Abstract:

In this talk, I explore the characteristics of two spatially perturbed one-dimensional maps: the logistic map and the Arnold circle map. The aim of this work is understanding in situ remediation of contaminated groundwater. Groundwater is vital to providing drinking water, irrigation, and makes up a large component in many industrial processes. Contaminant degredation reactions are more efficient when the solutions are thoroughly mixed together, so the onset of chaos in this system is a positive sign because it indicates the interface length between the two reactants is maximal, or at least large. One of the primary agents of mixing is the extent to which solutions move underground (transmissivity). Therefore, the spatial distribution of rocks and sediment plays an important role in the dynamics of the system. Observations of transmissivity in the field suggest these spatial distributions are log-normal. Two one-dimensional systems known to exhibit chaotic behavior are the logistic map and the Arnold circle map. Applying spatial perturbations to these maps and observing the subsequent dynamics may give an indication of what occurs in higher-dimensional systems, like the groundwater model.