Abstract

Modern urban systems contain intricate interconnected networks whose components depend on each other to operate, provide value, and sustain a functional society. However, this interconnectedness increases the fragility of these systems by allowing the propagation of disruptions through their interdependencies, which may result in large cascades of failures that can cause severe loss of functionality and recovery capability. Furthermore, the resilience of these systems does not only depend on the individual components, but on their combined ability to recover promptly. With the aim of quantifying the interdependence between these systems, this work introduces a new statistical model for evaluating and simulating the restoration of complex interdependent systems, while modeling their restoration as interdependent processes. The statistical model is introduced along with a custom calibration algorithm that fits the model to observed time series data of infrastructure restoration of functionality. Data from six iconic earthquakes are used to fit and test the model against a suite of service restoration curves associated with different infrastructures. It is concluded that the model may be used to simultaneously estimate the restoration and resilience of an infrastructure system after the disruptions caused by a mainshock. Limitations, possible extensions, and improvements of the model are discussed.