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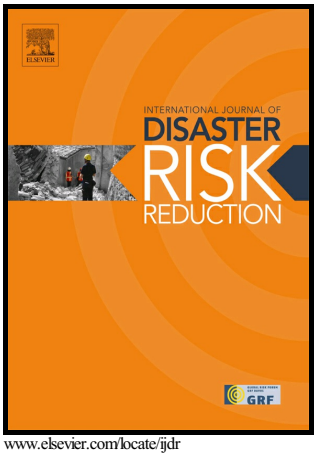

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Abstract

The paper connects two interrelated discourses: criticality assessments and cascading effects. During crises, crisis managers have to constantly assess and reassess the criticality of systems and elements in order to identify potential triggers for cascading effects and to distribute efficiently available resources for mitigation. To help practitioners to make the right decisions, models are needed for the preparation phase that extend their knowledge about dependency relations and critical system elements. To do so, the paper proposes a concept of dynamic interdependencies and criticality. It is argued that dependency relations and their impact on system elements are changing over time. We maintain that when elements and system either fail or become involved, or when resources become scarce and then regain availability, then the criticality of the individual element, the system, the resource, and finally the overall situation changes as well, either positively or negatively. This article also presents a software tool which models the dynamics of cascading crisis scenarios. Finally, this software is used to reconstruct an example of a cascading power failure to demonstrate how criticality evolves dynamically.

Key words: Cascade effects and disasters, criticality assessments, non-knowledge, interdependency, resilience, social network analysis

1. Introduction

It is widely stated that the current era is a time of increasing complexity. If this is true, our perspective is guided not only by a number of themes but also by a number of concepts with which the increasingly complex present can be understood. Today, mutual linkages and dependencies between infrastructures belong to the relevant themes which arise from this assumption of complexity. These dependencies go along with the danger of cascades that escalate beyond the individual infrastructural system (Rinaldi et al. 2001, Little 2003). Some concepts which have been applied in recent research to address these themes are vulnerability, resilience and criticality.

Although infrastructure operators are aware of system dependencies to some degree, they have little knowledge of possible interactions and cascading effects which like outside their own systems and consequently beyond their communicative horizon. In order to increase dependency awareness and decision-making ability, criticality would appear to be a useful concept. Criticality initially refers to a condition that an element of a system (such as a gas turbine in a combined heat and power plant) could achieve, often with unforeseeable consequences. This term is often used to emphasise the importance of a system or system element. If a certain threshold is exceeded, an element becomes critical. This impacts the