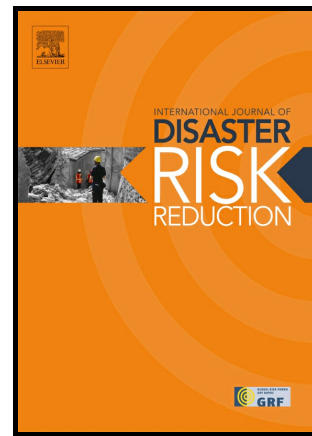


# Author's Accepted Manuscript

Theoretical model for cascading effects analyses

Giulio Zuccaro, Daniela De Gregorio, Mattia Leone



[www.elsevier.com/locate/ijdr](http://www.elsevier.com/locate/ijdr)

PII: S2212-4209(18)30504-1  
DOI: <https://doi.org/10.1016/j.ijdr.2018.04.019>  
Reference: IJDRR875

To appear in: *International Journal of Disaster Risk Reduction*

Received date: 16 October 2017  
Revised date: 18 April 2018  
Accepted date: 19 April 2018

Cite this article as: Giulio Zuccaro, Daniela De Gregorio and Mattia Leone, Theoretical model for cascading effects analyses, *International Journal of Disaster Risk Reduction*, <https://doi.org/10.1016/j.ijdr.2018.04.019>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting galley proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

## Theoretical model for cascading effects analyses

Giulio Zuccaro<sup>a,b</sup>, Daniela De Gregorio<sup>a</sup>, Mattia Leone<sup>a</sup>

<sup>a</sup> PLINIVS Study Centre, L.U.P.T. Interdepartmental Centre, University of Naples Federico II

<sup>b</sup> Department of Structures for Engineering and Architecture, University of Naples Federico II

### Abstract

In case of exceptional events of natural or anthropogenic type, the elements at risk (people, buildings, infrastructures, economy, etc.) are often hit by sequences of ‘cascading events’, function of time and space, caused by the triggering event (earthquake, landslide, volcanic eruption, fire, electric failure, etc.).

Generally, sequences of events can involve the same element at risk, and the combined effects of cascading phenomena can strongly amplify the impact caused by single events in terms of extension of the affected area and damage level. The final impact on the territory can be significant and require to be carefully assessed in terms of emergency planning and management.

This paper discusses from a theoretical point of view the modelling needs and the main issues to be taken into account in the development of simulation tools aiming to include cascading effects analyses to effectively support decision-makers in their preparedness and disaster mitigation strategies in the framework of emergency planning at local, national and international level.

The model aims at developing cascading effects scenarios at different level of detail, depending on the availability of inventory/exposure data for the different categories of elements at risk and hazard/impact models for the various hazard sources.

It has been developed within EU-FP7 SNOWBALL project (Lower the impact of aggravating factors in crisis situations thanks to adaptive foresight and decision-support tools, 2015-2017).

**KEYWORDS:** Cascading events, interconnected risk, impact assessment, vulnerability assessment, emergency planning.

### 1. Introduction

Recent significant disasters, such as Hurricane Katrina (2005), Haiti earthquake (2010) Ejaflajökull Volcano eruption (2010) and Fukushima Daiichi nuclear disaster (2011), have highlighted that natural or anthropogenic events can generate cascading events/effects, leading to a significant increase of fatalities and damages (Alexander, 2000; Kadri et al., 2014), because of the existence of interdependencies among the different sectors of the territorial and infrastructure system.

The assessment of the aggravation of systemic failure due to cascading effects, in terms of direct and indirect damage, assumes an essential role in the framework of disaster preparedness and management. The decision-makers are faced with the challenge of not only mitigating against the single hazards and related risks, but also against chain of events, which must include the consideration of the systemic interrelations. Since the cascading effects concept is a relatively new area of investigation in the field of natural risks’ governance, specific methodologies and field experience are so far limited (Aubrecht et al., 2013; Gasparini and Garcia-Aristizabal, 2014; Garcia-Aristizabal et al., 2014, 2015; Gill and Malamud, 2014; Marzocchi and Woo, 2009; Marzocchi et al., 2009, 2012; Komendantova et al., 2010; Zuccaro et al., 2008 and 2015).

The influence of events’ chains evaluation requires suitable approaches able to assess the probability of occurrence of different possible paths triggered by a specific event (earthquake, landslide, volcanic eruption, fire, electric failure, etc.) and the cumulative damage of different

Download English Version:

<https://daneshyari.com/en/article/7471237>

Download Persian Version:

<https://daneshyari.com/article/7471237>

[Daneshyari.com](https://daneshyari.com)