Geophysical Research Abstracts
Vol. 18, EGU2016-8736, 2016
EGU General Assembly 2016

System Dynamics Model to develop resilience management strategies for lifelines exposed to natural hazards

Alessandro Pagano, Irene Pluchinotta, Raffaele Giordano, and Michele Vurro
(alessandro.pagano@ba.irsa.cnr.it)

Resilience has recently become a key concept, and a crucial paradigm in the analysis of the impacts of natural disasters, mainly concerning Lifeline Systems (LS). Indeed, the traditional risk management approaches require a precise knowledge of all potential hazards and a full understanding of the interconnections among different infrastructures, based on past events and trends analysis. Nevertheless, due to the inner complexity of LS, their interconnectedness and the dynamic context in which they operate (i.e. technology, economy and society), it is difficult to gain a complete comprehension of the processes influencing vulnerabilities and threats. Therefore, resilience thinking addresses the complexities of large integrated systems and the uncertainty of future threats, emphasizing the absorbing, adapting and responsive behavior of the system. Resilience thinking approaches are focused on the capability of the system to deal with the unforeseeable.
The increasing awareness of the role played by LS, has led governmental agencies and institutions to develop resilience management strategies. Risk prone areas, such as cities, are highly dependent on infrastructures providing essential services that support societal functions, safety, economic prosperity and quality of life. Among the LS, drinking water supply is critical for supporting citizens during emergency and recovery, since a disruption could have a range of serious societal impacts.
A very well-known method to assess LS resilience is the TOSE approach. The most interesting feature of this approach is the integration of four dimensions: Technical, Organizational, Social and Economic. Such issues are all concurrent to the resilience level of an infrastructural system, and should be therefore quantitatively assessed. Several researches underlined that the lack of integration among the different dimensions, composing the resilience concept, may contribute to a mismanagement of LS in case of natural disasters.
Moving in such direction, System Dynamics Modeling (SDM) is a suitable operative approach. The SDM allows taking into account all resilience dimensions in an integrated and dynamic way. Furthermore, it allows to combine predictive and learning functionality through feedback mechanisms, and to foster active involvement of stakeholders in the modelling process.
The present paper show some results of ongoing research activities. The main aim of the work is to describe using SDM, the relationships and interdependencies between drinking water supply infrastructures and societies in building the resilience of urban communities in case of natural disasters. Reflections are carried out on the comparison between two major earthquakes in Italy: L'Aquila in 2009 and Emilia Romagna in 2012. The model aims at defining a quantitative tool to assess the evolution of resilience of drinking water supply system. Specifically, it has been used to evaluate the impact of actions and strategies for resilience improvement on the dynamic evolution of the system, thus suggesting the most suitable ones.