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## Assessment of the resilience to flood of a complex system: the case of densely populated city

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In the last decades, resilience officially become the worldwide cornerstone around which reducing the risk of disasters and improving preparedness, response and recovery capacities. The theoretical framework developed in this work is based on the resilience definition adopted in 2016 by United Nations General Assembly: *"the ability of a system, community or society exposed to hazards to resist, absorb, accommodate, adapt to, transform and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions through risk management"*. This definition implies 2 main concepts that are the foundation of this work: 1) resilience is a property of a system and 2) a system is resilient when is able to dynamically react to a perturbation in order to maintain or resume its functionalities.

In order to reproduce the complex system of an urban environment, the proposed framework shows the assumptions and operational procedure to construct a weighted and redundant graph. The built graph has the ambition, under the constrains due to the data availability, to represent the interdependencies among the exposed elements, both in ordinary conditions and under perturbations such as disasters. The weight of the graph is represented by the population served by each single service. Furthermore, each element in case of an external perturbation, has the possibility to dynamically adapt and switch to a new graph configuration based on the redundancy and backup capacity of its providers.

The feasibility of the proposed approach is illustrated by an application to a case study in the densely populated urban environment of the city of Monza that is exposed to river and pluvial floods. The case study consists in a directed and weighted graph with 6000+ nodes and almost 1.3 million links. By means of the graph an estimation of the impacted and adapted nodes is made along with a measure of resilience to different flood scenarios for the city of Monza

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