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Collaborative data collection to assess physical vulnerability of residential buildings in the flash flood-prone city of La Spezia, northern Italy

Giuseppe Esposito[1], Daniela Molinari[2], Simone Sterlacchini[3], Marco Zazzeri[3], Ginevra Chelli[3], Rosa Maria Cavalli[1], Marco Milella[4], and Paola Salvati[1]

[1]CNR-IRPI, Perugia, Italy (giuseppe.esposito@cnr.it)
[2]Politecnico di Milano, Milano, Italy
[3]CNR-IGAG, Milano, Italy
[4]Università di Perugia, Perugia, Italy

Mediterranean storms generating flash floods in small urbanized watersheds are leading to worsening socio-economic impacts, and challenges in terms of disaster risk management. One of the main issues affecting risk reduction in these settings is the occurrence of rough topography coupled with high density of buildings and infrastructures. This can limit structural interventions aimed at hazard mitigation, and only allow countermeasures that focus on reducing vulnerability and exposure of people and properties.

Damage models are useful tools for addressing some of the criticalities affecting flash flood risk reduction. These models aim to predict the extent of monetary loss associated with exposed assets by relating the expected physical damage to the recovery or reconstruction costs. The input data of the damage models consist of different types of variables that define the physical vulnerability of edifices. With reference to residential buildings, a series of characteristics including building type, structure, and number of floors need to be collected in the field. Damage models based on innovative machine learning algorithms can also support disaster managers during the response phase to flash flood events, by providing rapid damage scenarios that are useful for organizing relief operations.

Besides the physical vulnerability, it is also important to assess and reduce the social vulnerability of communities at risk. Informing the population on how to prepare for flash flood scenarios is crucial for mitigating the impact of future disasters. Generally, public involvement in the geo-hydrological disaster management cycle, supported by information and communication technologies, and training exercises, represent useful strategies to enhance the risk awareness and self-protection behaviors of citizens.

In this framework, the Hyrma (Hydrogeological Risk Assessment through Collaborative Mapping) project aims to implement collaborative data collection to acquire, store, analyze, and share geo-localized data about hazard, exposure, and physical vulnerability of buildings in flash flood-prone areas. Information on damage and costs related to past events are also collected. Trained volunteers can submit geo-localized data about selected residential buildings directly in the field, in pre-structured forms, via dropdown menus, single and multiple choices menus including images and videos. For this purpose, low-cost and user-centered web applications are properly designed and made available free of charge on smartphones and tablets. Data collected at the pilot sites are used to: i) develop or update existing damage models; ii) inform involved citizens about the risk they are exposed to, increasing their awareness and self-protection capabilities that may be transferred to

other people according to a cascading effect.

The current contribution presents preliminary outcomes of the Hyrma project, such as the implemented web application form along with examples of the first datasets collected by students, Civil Protection volunteers, and technicians in the coastal city of La Spezia (northern Italy). Here, the local municipality has just released an updated hydraulic model providing the expected water depths and velocities for twelve inhabited watersheds with thousands of people and buildings at risk.

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