A NEW APPROACH FOR THE EVALUATION OF PEOPLE'S STABILITY IN A FLOOD

Flood risk assessment is an important task that should take advantage of rational vulnerability models to increase its effectiveness. Focusing the attention on rapidly evolving flood processes, the issue of people's vulnerability is the most relevant target to be addressed. In this direction, Milanesi et al. (2015) proposed a conceptual model that provides the stability thresholds of a person impacted by a flow. As usual in this field, stability models are calibrated and validated through experimental data from tests on the resistance of people impacted by a flow. However, there is growing evidence that such tests are not fully representative of the variety of conditions that characterize real flood situations. For instance, the presence of safety equipment, the acquaintance with dynamic forces due to repeated tests, the absence of external factors (e.g. debris, temperature, lighting) might influence the psychological attitude of the tested subjects and bias the results.

In order to provide a solution to this problem, Milanesi et al. (2016) suggested a citizen science based approach to obtain information from web resources and complement the experimental literature data and conceptual models.

A comprehensive study employing commonly-used web engines allowed the collection of more than 300 videos showing real risk situations of people impacted by a flow, classified according to the stability of the involved subjects. From such database, 125 events were extracted for the quantification of local flow depth (h) and velocity (U) by a properly devised procedure. Scaling lengths were computed by relating the quantities measured on the screen and objects of known size. In most cases they were derived considering the ratio between the body segments and the total height of a man, available from the medical literature, and the statistical distribution of human height in different geographic areas. Velocity was usually computed considering a complete conversion of the kinetic head into piezometric head through the energy conservation principle and measuring the run-up height upstream the impacted body. Finally, a direct propagation method was adopted to assess the uncertainty related to each estimate (Fig. 1a). The reliability of the overall procedure was positively assessed by applying the procedure to videos where both U and h were known.

The computed U-h couples and the related uncertainty intervals were statistically treated to reconstruct a vulnerability surface (Fig. 1b) for the identification of stability thresholds associated to different percentiles. This approach provides a further validation of the conceptual model by Milanesi et al. (2015) since the adult stability threshold has a very satisfactory agreement with the tentative computed pattern of the 50th percentile curve (Fig. 1c).

[1] Università degli Studi di Brescia – Department of Civil, Environmental and Architectural Engineering, Brescia, Italy

Milanesi, L. [1]

Pilotti, M. [1]

Bacchi, B. [1]