NH42B-0412 A Flood Damage Model Accounting for Time-Evolving Hazard, Exposure, and Vulnerability

Thursday, 15 December 2022

16:00 - 19:30

Poster Hall, Hall A (South, Level 3, McCormick Place)

Abstract

Available flood damage models typically use some summary indicators, such as the maximum flooded area, the envelop of maximum water depths, the maximum presence of people in the area, etc., to estimate the flood damage. These models, either physics- or data-based, uni- or multi-variate, deterministic or probabilistic, generally neglect the time-evolution of the damage determinants (i.e., hazard, exposure, and vulnerability), and of the damaging processes as well. This is an important limitation, because damage is the results of a complex interplay of different processes, possibly characterized by marked unsteadiness.

We propose a new perspective to flood damage assessment, in which the time evolution of damage, as well as of its determinants, are explicitly accounted for. At each point within the flooded area, the flood damage is computed by integrating over time the rate at which damage progresses. This is provided by a logistic-type equation that depends on the time-varying hydraulic conditions and exposure. The model accounts for the fractions of damaged, exposed, vulnerable, and possibly rescued items, which obey to a sort of conservation principle. The total damage is finally obtained through spatial integration over the flooded area.

We claim that estimating the damage accounting for time evolution explicitly is more adherent to reality and, expectedly, more appropriate and effective than the standard approach. The increased number of model parameters, with associated uncertainties, is counterbalanced by the chance of new promising applications. The effectiveness of the method, as well as its potential in flood risk assessment and management, are shown by some relevant application to schematic, yet realistic, examples.

First Author

L

Tommaso Lazzarin
University of Padova

Authors

V

Daniele P. Viero
University of Padova

M

Daniela Molinari
Politecnico di Milano

B

Francesco Ballio
Politecnico di Milano

D

Andrea Defina
University of Padova

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