Geophysical Research Abstracts
Vol. 21, EGU2019-10175, 2019
EGU General Assembly 2019

A risk-based framework for assessing the levee effect

Claudia D'Angelo, Elena Volpi, and Aldo Fiori
Università degli studi Roma Tre, Dipartimento di Ingegneria, Rome, Italy (claudia.dangelo@uniroma3.it)

The presence of flood control structures, such as levees, often reduces the perception of risk by the population, triggering the development of human settlements in floodplain areas. This circumstance, often denoted as levee effect, exposes the population to a residual risk, for instance when a breach occurs in the levee during a significant flood; the quantification of such risk is often difficult and prone to uncertainty. Starting from the definition proposed by Varnes, where the risk R is defined by the product of the hazard H, the elements at risk E and their vulnerability V, we develop a risk-based framework in order to define the above residual risk. The framework builds over the risk pertaining to two scenarios: (i) before, and (ii) after the building of control structures; it is made up of three main components: (i) a structural term, linked to the probabilistic nature of the phenomenon, (ii) a dynamic term, which expresses the hydraulic component of risk, and (iii) an anthropic term, that represents the change of the elements at risk before and after the flood control measures. The framework is exemplified through an application to the Arrone river near Rome (Italy) for the analysis of the residual risk after the formation of a breach for piping in the levee. We performed extensive numerical simulations of flood propagation, modelling the occurrence of random breaches in the river reach of interest, along a Monte Carlo approach. The dynamic and the characteristics of the breach caused by piping was studied considering empirical analyses based on regression equations. Results are presented in terms of frequencies of significant quantities, comparing risk for the two scenarios of reference. The application example shows that the proposed risk analysis can be a relatively simple and valuable tool for analyzing the residual risk, along a rational and sound framework.