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Editorial

Editorial for the Special Issue "Water-Induced Landslides: Prediction and Control"

Antonello Troncone * and **Enrico Conte**

Department of Civil Engineering, University of Calabria, Rende, 87036 Cosenza, Italy; enrico.conte@unical.it
* Correspondence: antonello.troncone@unical.it

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The Special Issue "Water-Induced Landslides: Prediction and Control" [1] was planned with the main purpose of presenting advanced researches concerning the effects of water on slope stability. Indeed, water is a primary cause of landslides, playing a paramount role in the deformation processes leading the slopes to failure, and in the subsequent post-failure stage. It is well known that prolonged and intense rainfall may cause catastrophic and fast movement of rock and soil masses. In these circumstances, the drainage systems are widely used for the landslide control, because they are generally less expensive and more effective than other measures commonly designed for slope stabilization [2,3].

This Special Issue originally attracted twenty-seven papers, eighteen of which were accepted for publication in *Water* after a rigorous review process. Among these latter, six papers focused on the rainfall-induced landslides. Two papers dealt with rain infiltration into the slope. Particularly, Yeh and Tsai [4] analyzed the effects of the hydraulic conductivity anisotropy on slope stability using a coupled hydro-mechanical approach. Hsu and Liu [5] used the TRIGRS and DEBRIS-2D codes to predict the soil volume in a rainfall-induced shallow landslide. The remaining four papers presented different approaches for mapping the susceptibility of large areas to rainfall-induced landslides. In this context, Kok et al. [6] proposed a methodology to establish the most vulnerable regions in the Cameron Highlands, and Long and De Smedt [7] performed an analysis of the rainfall-induced landslide susceptibility in a district of Vietnam. Finally, Rong et al. [8,9] used a Bayesian model for mapping the rainfall-induced landslides in China. These studies showed that the landslide mapping may be a useful tool for disaster prevention and hazard mitigation.

Wang et al. [10,11] submitted two papers concerning the effects of the dry–wet cycles due to climate conditions on the stability of artificial slopes. In the first paper, Wang et al. [10] analyzed these effects referring to a tailing dam located in China. Several laboratory tests were carried out to characterize the involved soils from a geotechnical viewpoint. The results of these tests were used in a finite element analysis to investigate the dam stability. In another paper [11], the results from triaxial creep tests under different dry-wet cycles were used to develop a nonlinear Burgers-type viscoelastic-plastic constitutive model accounting for the effects of saturation–dehydration cycles on the response of reservoir bank slopes.

Slope stability is usually performed under the assumption of plane strain conditions (i.e., two-dimensional conditions). However, this assumption may not completely account for the slope behavior due to the influence of three-dimensional effects. In this connection, two papers dealing with the slope stability under three-dimensional conditions were published in this Special Issue. Specifically, Chen et al. [12] presented a three-dimensional analysis based on the limit equilibrium method to assess the stability condition of a slope located in Taiwan. This analysis provided results in close agreement with what observed, and was able to predict successfully the volume of the unstable soil mass, unlike some empirical equations commonly used in Taiwan. Zhou et al. [13] carried out a parametric study aimed to show the influence of the water level fluctuations on slope stability using a finite element formulation along with the well-known strength reduction approach.

Three papers highlighted the role of water combined with that of the soil properties for slope stability. Castro et al. [14] focused the attention on slopes whose stability is affected by the presence of thin clayey layers characterized by poor mechanical properties. In particular, the authors investigated a complex landslide triggered by water infiltration from a karstic aquifer. On the other hand, Xue et al. [15] documented the influence of soaking time and salt concentration on the behavior of some samples taken from a soil subjected to water irrigation. The problem of the soluble salt loss and its effect on irrigation-induced landslides was also studied by Zhang et al. [16].

Deformation and failure mechanisms of slopes are generally schematized in four different stages: pre-failure, failure, post-failure, and reactivation stages. Simplified approaches or finite element methods based on the assumption of small strains are generally employed to analyze the processes occurring in the pre-failure and failure stages as well as in the eventual reactivation stage. On the contrary, more advanced numerical methods, such as the Material Point Method (MPM), are required to analyze the post-failure stage of landslides [17]. Two papers are included in this Special Issue, where MPM is applied to unstable slopes. Specifically, Troncone et al. [18] studied the deformation process occurring in an ideal slope (from the pre-failure stage to the post-failure one) due to an increase in pore water pressure. In the second paper, the same authors analyzed the post-failure stage of a landslide that occurred in the state of Wyoming (USA) after a long rainy period that caused a significant increase in the groundwater level within the slope [19].

Manenti et al. [20] used a different numerical method (SPH) to evaluate the landslide hazard at the basin scale. This method was also used to simulate the Vajont landslide, included the generation of the consequent water wave in the reservoir located at the slope toe. In addition, Jamalinia et al. [21] proposed a data-driven surrogate approach to forecast the stability of dikes under different climatic conditions. Finally, Lucas et al. [22] documented three years of monitoring of a steep slope in the Swiss Alps, in order to understand whether a possible failure due to rainfall may cause damage to a village located near the slope.

In conclusion, the papers published in this Special Issue provide a valuable contribution that can support both practitioners and researchers to deal with effectively the important problem of water-induced landslides. Considering the value of the papers and the variety of the topics, the Guest Editors believe that the content of the published papers may arouse the reader's interest, and, at the same time, contribute to a better understanding of the slope deformation processes due to water effects. However, future researches are still needed to further investigate the influence of water on the complex deformation and failure mechanisms of slopes, from the pre-failure stage to the post-failure one.

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