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Topsoil Moisture Content Depends on Relaxed Penalties and Wet/Dry Cycles

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Introduction

Rain is widely recognised as one of the most common causes of landslides. Rainfall infiltration often raises pore water pressure or decreases matric suction, lowering shear strength and increasing the likelihood of slope failure. Numerous scholars have undertaken substantial research on the processes of rainfall-induced slope failure. Because of their high permeability, coarse-grained soil slopes are more prone to fail during rapid and strong rainfalls, whereas fine-grained slopes are more likely to break during extended rainfalls. The strong weathering and tropical environment of Malaysia have resulted in an abundance of residual soils. The result of substantial in-situ weathering of parent rocks, residual soils cover more than three-quarters of Peninsular Malaysia's geographical area.

Description

Rain is widely recognised as one of the most common causes of landslides. Rainfall infiltration often raises pore water pressure or decreases matric suction, lowering shear strength and increasing the likelihood of slope failure. Numerous scholars have undertaken substantial research on the processes of rainfall-induced slope failure. Because of their high permeability, coarse-grained soil slopes are more prone to fail during rapid and strong rainfalls, whereas fine-grained slopes are more likely to break during extended rainfalls. The strong weathering and tropical environment of Malaysia have resulted in an abundance of residual soils [1,2]. The result of substantial in-situ weathering of parent rocks, residual soils cover more than three-quarters of Peninsular Malaysia's geographical area.

The moisture content of all soil samples declined faster during the second drying cycle than it did during the first. However, repeated soaking and drying cycles had less of an effect on soil moisture recovery during wetness. The particles content has a substantial influence on soil moisture loss during drying. The particles concentration had minimal effect on the responsiveness of soil moisture after soaking. The findings of the numerical seepage investigations show that the wetting soil moisture responses can be simulated with reasonable precision.

Local laboratory tests are the only approach to determine the threshold rainfall for a probable slope failure while investigating the engineering properties of totally decomposed granite with fines contents ranging from 0 to 20%. SEEP/W and SLOPE/W were then utilised to investigate the seepage and stability of slopes with varying fines contents. The researchers discovered that slopes with low fines concentration saw a higher decline in the factor of safety after strong rainfall infiltration than slopes with high fines content. This is owing to low-fines soils' susceptibility to suction loss and the rapid progress of a wetting front during heavy rainfall. The findings were supported by a series of laboratory-scaled slope model experiments [3].

They claimed that as the volumetric water content increased, the coarse soil's soil matric suction decreased significantly, resulting in a failure. The soaking and drying cycles have the potential to drastically impact soil moisture and, as a result, slope stability. From the existing literature, only a few studies have investigated the direct effect of recurrent wetting and drying cycles on slope stability. Numerous research have been conducted to investigate the impact of wetting and drying cycles on the hydraulic characteristics of soil. A series of laboratory tests were carried out to investigate the permeability of clay throughout successive wetting and drying cycles. They evaluated the unsaturated hydraulic characteristics of residual soil using a pressure plate test and nuclear magnetic resonance (NMR) spectroscopy and discovered that after seven cycles of wetting and drying, the clay's permeability increased to a particular limiting value. They noticed that the residual soil's capacity to hold water reduced as the number of wetting-drying cycles increased. They noticed that the residual soil's capacity to hold water reduced as the number of wetting-drying cycles increased [4]. This shows that the recurrent wetting-drying processes have increased the soil's pore structure, porosity, and internal water content as well as others. To characterise the microstructure of soil during wetting and drying cycles, X-ray micro-computed tomography (micro-CT) was used. They discovered that during the wetting and drying processes, the dirt pore structures would generally extend and associate with one another. The soil's porosity and connectedness increased as the number of wetting-drying cycles increased [5,6].

Rainfall infiltration impacts surface soil moisture, and soil grains have a substantial impact on reactions, according to the prior literature. The weathering process and the parent rock composition impact how soil moisture responds to rainfall penetration in residual soils. The weathering process involved in soil formation provides variable permeabilities and other physical qualities to the soil. Because of this inhomogeneity, soils have a more difficult time responding hydraulically to rainwater infiltration. Furthermore, there has been little research on how soil moisture responds to repeated cycles of raining and drying. It is yet unclear how different soil types react to the same wetting and drying cycles, which may occur [7].

Conclusion

The problem, for example, is what motivates the on-going review to be completed. It is hypothesised that the repeating climate will cause dry fissures to form, complicating the soil's hydraulic responses. The goal of this study is to see how the particles content of residual soil affects soil moisture responses to repeated soaking and drying cycles. Small-scale research centre trials are undertaken to test the level of immersion of soils with varying fines contents under two wetting and drying patterns. Limited component drainage experiments are carried out in order to have a better understanding of the system of soil dampness variations throughout penetration and dissipation processes.

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Conflict of Interest

There is no conflict of interest by author.

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