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Soil suction monitoring for landslides

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Rainfall is the most frequent triggering factor for landslides in many regions of the world (Corominas, 2000) and researchers have long attempted to determine the amount of precipitation needed to trigger slope failures. However, it is not rainfall *per se* that causes a slope to fail; rather it is a change in pore-water pressure in the soil resulting from rainfall infiltration. Pore-water pressure is a more reliable predictor of failure, and hence a more useful parameter to monitor and use as a trigger value for early warning systems.

In many slopes, particularly in the tropical and more arid regions of the world, pore-water pressures exist at negative values relative to atmospheric pressure (suctions). The suctions (or negative pore-water pressures) contribute to increasing the strength of the soil and help to stabilise the slope. When rainfall infiltrates, the suction reduces leading to a strength reduction that can initiate a failure.

A range of devices exist for measuring soil suction in the field, many of them using indirect techniques (Tarantino et al, in press). The most widely used device for direct measurement of suction is the tensiometer. Conventional tensiometers are limited by cavitation (when water breaks down under negative pressure producing bubbles of vapour) and cannot measure suctions greater than 100 kPa. However, a new range of high capacity tensiometers has now become available that allows measurement to several hundred kilopascals of suction, in some cases to 2 MPa.

The paper describes the use of high capacity tensiometers for measuring suctions in slopes as used by the MUSE team. MUSE is an EU funded research training network

on Mechanics of Unsaturated Soils for Engineering (http://muse.dur.ac.uk). Examples are given of field installations in (1) an instrumented embankment being used to investigate the effects of climate change on slope stability in UK; (2) a site at Boissy-le-Châtel, France; (3) river embankments of the Adige River, Italy. The use of tensiometers in a large-scale slope model is also described.

Finally, the implications of using suction monitoring devices as part of early-warning systems for landslides are considered.

References

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