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Hydrological monitoring of a natural slope covered with loose granular pyroclastic deposits

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Mountainous areas of Northern Campania, Southern Italy, are characterised by steep slopes covered with loose volcanic ashes, with very high porosity (ranging between 0.70 and 0.75), laying above a calcareous bedrock. Slope inclination is often larger than internal friction angle of such ashes (around 38°), thus equilibrium is assured by the contribution of apparent cohesion due to soil suction in unsaturated conditions. That is why, during intense and persistent rainfall events, when soil approaches saturation and consequently suction decreases, shallow landslides are frequently triggered. The physical characteristics of involved soils are such that landslides often evolve in form of debris flows, which cause huge damages to buildings and infrastructures and, in some cases, even casualties.
Field hydrological monitoring is essential to develop reliable models of slope response to rainfall infiltration, allowing to define triggering conditions of landslides.
An automatic monitoring station has been recently installed at the slope of Cervinara, 30 km East of Naples, where a catastrophic landslide occurred in December 1999. The station consists of a tipping bucket rain gauge, with a sensitivity to rainfall height of 0.2mm; four jet fill tensiometers, for the measurement of soil suction at the depths of 10cm, 40cm, 120cm and 160cm below ground surface; four time domain reflectometry probes of various lengths, connected through a multiplexer to a reflectometer, for the measurement of water content profile from ground surface up to a depth of 160cm.
All the sensors are connected to a datalogger for the automatic acquisition at hourly frequency of experimental data. Acquired data are then stored into a magnetic memory which is periodically downloaded into a PC. The entire station is operated by a lithium battery connected to a solar panel.
The first collected experimental data confirm the usefulness of simultaneous monitoring, at high temporal resolution, of rainfall height, soil suction and soil water content for a better understanding of slope infiltration processes.