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Soil discontinuities as potential factors of shallow landslides: a case study from Calabria, southern Italy

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Effects of chemical and physical weathering processes on different rock types as predisposing factors of a number of landslides are often investigated in detail. Conversely, very few research studies on triggering mechanisms of shallow landslides and related risk assessment are focused on evaluation of morphological and physical discontinuities caused by pedogenetic processes affecting parent materials. Also sampling strategies for geotechnical or hydrological laboratory analyses can be biased by the lack of detailed information about the soil spatial variability and of a consequent horizon-wise selection of samples from soil profiles.
In this work we summarize the main results on the assessment of shallow landslide susceptibility along the A3 highway section between Cosenza Sud and Altilia in northern Calabria (southern Italy). This research is part of a wider project (PON01-01503: “Integrated systems for hydrogeological risk monitoring, early warning and mitigation along the main lifelines”), aimed at hydro-geological risk mitigation and early warning along three highway sections of southern Italy. Based on a detailed geological and geomorphological survey, the main lithological, structural and relief features of the landscape were mapped, with a special emphasis on active, dormant and inactive landslides and their geo-lithological control factors. A soil survey was also carried out in the field, showing a dominance of Entisols and Inceptisols on steep slopes, and Mollisols and Alfisols on gentle landforms. Soil observations were focused on the identification of pedological discontinuities as potential factors that might trigger shallow landslides. A number of soil profiles, often close to landslide scarps, evidenced significant morphological changes of the parent materials, such as texture, pedogenic structure, dry consistence and moisture, or hydromorphic features caused by transient water-logging conditions, and clay-illuviated horizons. Buried soils were recognized, often truncated by erosion, and overlain by younger soils developed on colluvia, debris flows and detrital slope deposits. Five representative soil profiles were selected and sampled for pedological, geotechnical and hydrological laboratory analyses. Bulk and undisturbed samples were collected for chemical and physical soil analyses (particle size distribution, organic and inorganic carbon, pH, electrical conductivity, soluble salts), for determining bulk density, Atterberg limits, cohesive strength, angle of internal friction, water retention and for thin sections to be observed under an optical polarizing microscope, respectively. Preliminary results of laboratory analyses showed irregular patterns of pedological (particle size distribution, organic matter content, bulk density), geotechnical (Atterberg limits) and hydrological data (water content, pore distribution) along the soil profiles, coherently with field observations.