"***CLIMATE CHANGE ADAPTATION OF TRANSPORT AND FLOOD DEFENCE INFRASTRUCTURE: IS THERE A FUTURE FOR NATURE-BASED SOLUTIONS?***".

Alessandro Tarantino (Strathclyde University di Glasgow)

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Accademia Pontaniana, Via Mezzocannone 8, 80134, Napoli

ABSTRACT: Climate change will affect our aging transportation and flood defence earth infrastructure (embankments, cuttings, slopes adjacent to transport corridors). Infiltrating rainwater/floodwater increases pore-water pressure leading to a reduction in soil shear strength eventually triggering slope instability. Dry/wet periods cause shrink/swell behaviour of clayey geostructures and may contribute towards these geostructures reaching the serviceability limit state. Ground-atmosphere hydraulic interaction is almost always mediated by a vegetated interface. If adequately 'engineered', it can be transformed into a valuable climate change adaptation measure for long linear infrastructure subjected to climatic hazard. Vegetation-based solutions are relatively easy to implement over long distances, are 'climate-smart' due to plant phenotypic plasticity in a changing climate, and are carbon neutral/negative. The lecture will first review the mechanisms of deformation and strength loss in soils induced by climate interactions (rainfall and evapotranspiration) and the processes that occur in the Soil-Plant-Atmosphere Continuum (SPAC). It then examines possible biotic and abiotic manipulation of the SPAC to amplify or attenuate the vegetation-mediated soil water fluxes. These are approaches commonly adopted in agriculture and forest management and the lecture discusses the lessons we can learn from plant science to develop geotechnical solutions.

BIO: Alessandro Tarantino joined the University of Strathclyde in 2010 as Professor of Experimental Geomechanics to establish a research group in geomechanics and geohydraulics specialised in laboratory and field investigation of multiphase geomaterials. He obtained an MEng degree in Civil Engineering from the Università di Napoli Federico II in Italy (1993) and a PhD in Geotecnical Engineering from the Politecnico di Torino in Italy (1998). He was awarded the title of Professional Engineer in Italy in 1993. The common denominator of his research is the presence of at least two fluid phases (liquid and gas) in the medium pore space. Under these conditions, different physical processes with high level of coupling (liquid flow, vapour flow, heat transfer, and solid matrix deformation) control the hydraulic and mechanical behaviour of the porous medium, which is therefore relatively complex to investigate and model. In Civil and Environmental Engineering, multiphase (unsaturated) porous media are typically encountered in the upper portion of the soil profile, between the ground surface and the ground water table/phreatic surface. Processes occurring in this zone are therefore the focus of my research, and includes rainwater infiltration, groundwater recharge, pollutant transport, soil shrinkage and heave, surface cracking, soil subsidence, and subsurface water flow and runoff (i.e. flood formation), and shallow landslides. Most of these processes have an interaction with the atmosphere and are therefore strongly affected by climate changes. Multiphase (unsaturated) porous media are also encountered in several geo-infrastructures, including road, railway and flood embankments, dams, and tunnels where mechanical and hydraulic response (stability, deformation, hydraulic conductivity) is controlled by the interaction of the ground with the atmosphere.